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ENERGY REORGANIZATION ACT OF 1973

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HEARINGS

BEFORE A

SUBCOMMITTEE OF THE COMMITTEE ON GOVERNMENT OPERATIONS HOUSE OF REPRESENTATIVES

NINETY-THIRD CONGRESS

FIRST SESSION

ON

H.R. 11510

TO REORGANIZE AND CONSOLIDATE CERTAIN FUNCTIONS OF THE FEDERAL GOVERNMENT IN A NEW ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION AND IN A NUCLEAR ENERGY COMMISSION IN ORDER TO PROMOTE MORE EFFICIENT MANAGEMENT OF SUCH FUNCTIONS

NOVEMBER 27, 28, AND 29, 1973

Printed for the use of the Committee on Government Operations

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ENERGY REORGANIZATION ACT OF 1973

TUESDAY, NOVEMBER 27, 1973

HOUSE OF REPRESENTATIVES,
LEGISLATION AND MILITARY OPERATIONS SUBCOMMITTEE
OF THE COMMITTEE ON GOVERNMENT OPERATIONS,
Washington, D.C.

The subcommittee met, pursuant to notice, at 9:40 a.m., in room 2154, Rayburn House Office Building, Hon. Chet Holifield (chairman of the subcommittee) presiding.

Present: Representatives Chet Holifield, Benjamin S. Rosenthal, Don Fuqua, William S. Moorhead, Frank Horton, John N. Erlenborn, John W. Wydler, Clarence J. Brown, and Richard W. Mallary.

Also present: Herbert Roback, staff director; Charles Goodwin, counsel; Michael T. McGinn, defense analyst; Elmer W. Henderson, general counsel; Miles Q. Romney, counsel-administrator; Douglas Dahlin, associate counsel; James Lanigan and John Reich, consultants; and Warren Buhler, minority professional staff, Committee on Government Operations.

OPENING STATEMENT OF CHAIRMAN CHET HOLIFIELD

Chairman HOLIFIELD. The committee will be in order.

The hearings this week by the Subcommittee on Legislation and Military Operations are directed to H.R. 11510, a bill to reorganize and consolidate major energy research and development functions in the Federal Government. The bill proposes:

(1) The creation of an independent Energy Research and Development Administration (ERDA), which would encompass all functions of the Atomic Energy Commission except licensing and regulation, and designated energy research and development functions transferred from other agencies.

(2) Renaming the Atomic Energy Commission as the Nuclear Energy Commission (NEC), which would continue with the same membership and would administer the AEC's licensing and regulatory functions.

For background purposes, I may recall that in June 1973, President Nixon submitted draft legislation, which Mr. Horton and I introduced as H.R. 9090. This bill has two parts, one providing for a Department of Energy and Natural Resources; and the other for an independent Energy Research and Development Administration. Our subcommittee held hearings on H.R. 9090 in July and August, and we planned to hold further hearings.

However, the increasing public and congressional concern about the energy crisis caused us to change our legislative plans. We have taken part B (titles XI through XIX) of H.R. 9090, made a number of improving or perfecting changes, and introduced it as a new bill, H.R. 11510, which is the subject of hearings today.

[The bill, H.R. 11510, follows:]

93D CONGRESS
1ST SESSION

H. R. 11510

IN THE HOUSE OF REPRESENTATIVES

NOVEMBER 15, 1973

Mr. HOLIFIELD (for himself, Mr. HORTON, Mr. PRICE of Illinois, and Mr. HOSMER) introduced the following bill; which was referred to the Committee on Government Operations

A BILL

To reorganize and consolidate certain functions of the Federal Government in a new Energy Research and Development Administration and in a Nuclear Energy Commission in order to promote more efficient management of such functions.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SHORT TITLE

SECTION 1. This Act may be cited as the "Energy Reorganization Act of 1973".

DECLARATION OF PURPOSE

SEC. 2. The Congress hereby declares that the general welfare and the common defense and security require

effective action to develop, and increase the efficiency and reliability of use of all energy sources to meet the needs of present and future generations, to increase the productivity of the national economy and strengthen its position in regard to international trade, to make the Nation self-sufficient in energy, and to advance the goals of restoring, protecting, and enhancing environmental quality.

(b) The Congress finds that, to best achieve these objectives, improve Government operations, and assure the coordinated and effective development of all energy sources, it is necessary to establish an Energy Research and Development Administration to bring together and direct Federal activities relating to research and development on the various sources of energy, to increase the efficiency and reliability in the use of energy, and to carry out the performance of other functions, including military and production activities.

(c) The Congress further declares and finds that it is in the public interest that the licensing and related regulatory functions of the Atomic Energy Commission be separated from the performance of the other functions of the Commission transferred pursuant to this Act, and that this separation be effected in an orderly manner assuring adequacy of technical and other resources necessary for the performance of each.

TITLE I—ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

ESTABLISHMENT

SEC. 101. There is hereby established an independent executive agency to be known as the Energy Research and Development Administration (hereinafter in this Act referred to as the "Administration").

OFFICERS

SEC. 102. (a) There shall be at the head of the Administration an Administrator of Energy Research and Development (hereinafter in this Act referred to as the "Administrator"), who shall be appointed by the President, by and with the advice and consent of the Senate. The Administrator shall receive compensation at the rate now or hereafter prescribed for offices and positions at level II of the Executive Schedule (5 U.S.C. 5313). The Administration shall be administered under the supervision and direction of the Administrator, who shall be responsible for the efficient and coordinated management of the Administration.

(b) There shall be in the Administration a Deputy Administrator who shall be appointed by the President, by and with the advice and consent of the Senate, and who shall receive compensation at the rate now or hereafter prescribed for offices and positions at level III of the Executive Schedule (5 U.S.C. 5314).

(c) There shall be in the Administration five Assistant Administrators, one of whom shall be responsible for fossil energy, another for nuclear energy, another for environment, safety, and conservation, another for research and advanced energy, and another for national security. The Assistant Administrators shall be appointed by the President, by and with the advice and consent of the Senate, and shall receive compensation at the rate now or hereafter prescribed for offices and positions at level IV of the Executive Schedule (5 U.S.C. 5315).

(d) There shall be in the Administration a General Counsel who shall be appointed by the Administrator and who shall serve at the pleasure of and be removable by the Administrator. The General Counsel shall receive compensation at the rate now or hereafter prescribed for offices and positions at level V of the Executive Schedule (5 U.S.C. 5316).

(e) There shall be in the Administration not more than seven additional officers appointed by the Administrator who shall receive compensation at the rate now or hereafter prescribed for offices and positions at level V of the Executive Schedule (5 U.S.C. 5316). The positions of such officers shall be considered career positions and be subject to subsection 161d of the Atomic Energy Act.

(f) The Division of Military Application transferred to and established in the Administration by section 104 (a) of this Act shall be under the direction of a Director of Military Application, who shall be appointed by the Administrator and who shall serve at the pleasure of and be removable by the Administrator and shall be an active commissioned officer of the Armed Forces serving in general or flag officer rank or grade. The functions, qualifications, and compensation of the Director of Military Application shall be the same as those provided under the Atomic Energy Act of 1954, as amended, for the Assistant General Manager for Military Application.

(g) Officers appointed pursuant to this section shall perform such functions as the Administrator shall specify from time to time.

(h) The Deputy Administrator (or in the absence or disability of the Deputy Administrator, or in the event of a vacancy in the office of the Deputy Administrator, an Assistant Administrator, the General Counsel or such other official, determined according to such order as the Administrator shall prescribe) shall act for and perform the functions of the Administrator during any absence or disability of the Administrator or in the event of a vacancy in the office of the Administrator.

FUNCTIONS

SEC. 103. The functions of the Administrator shall include, but not be limited to—

(1) exercising central responsibility for policy planning, coordination, support, and management of research and development programs respecting all energy sources, including assessing the requirements for research and development in regard to various energy sources in relation to near-term and long-range needs, policy planning in regard to meeting those requirements, undertaking programs for the optimal development of the various forms of energy sources, managing such programs, and disseminating information resulting therefrom;

(2) encouraging and conducting research and development to demonstrate the commercial feasibility of energy sources and utilization technologies;

(3) undertaking research and development in the extraction, conversion, transmission, and utilization phases related to the development and use of energy from fossil, nuclear, solar, geothermal, and other energy sources;

(4) engaging in and supporting environmental, biomedical, physical, and safety research related to the development of energy sources and utilization technologies;

(5) ascertaining the existence, progress, and results of other public and private research and development activities relevant to the Administration's mission and correlating its own research and development programs with such public and private activities;

(6) participating in and supporting cooperative research and development projects which may involve contributions by public or private persons or agencies, of financial or other resources to the performance of the work; and

(7) developing, collecting, distributing, and making available for distribution, scientific and technical information concerning the manufacture or development of energy and its efficient extraction, conversion, transmission, and utilization.

TRANSFER OF FUNCTIONS

SEC. 104. (a) There are hereby transferred to and vested in the Administrator all functions of the Atomic Energy Commission, the Chairman and members of the Commission, and the officers and components of the Commission, except as otherwise provided in this Act. The General Advisory Committee established pursuant to section 26 of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2036), the Military Liaison Committee established by section 27 of the Atomic Energy Act of 1954, as amended (42 U.S.C.

2037), the Patent Compensation Board established pursuant to section 157 of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2187), and the Division of Military Application established by section 25 of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2035), are transferred to the Energy Research and Development Administration and the functions of the Commission with respect thereto are transferred to the Administrator.

(b) There are hereby transferred to and vested in the Administrator such functions of the Secretary of the Interior, the Department of the Interior, and officers and components of such department—

(1) as relate to or are utilized by the Office of Coal Research established pursuant to the Act of July 1, 1960 (74 Stat. 336; 30 U.S.C. 661–668);

(2) as relate to or are utilized in connection with fossil fuel energy research and development programs and related activities conducted by the Bureau of Mines "energy centers" and synthane plant to provide greater efficiency in the extraction, processing, and utilization of energy resources for the purpose of conserving those resources, developing alternative energy resources such as oil and gas secondary and tertiary recovery, oil shale and synthetic fuels, improving methods of managing energy-related wastes and pollutants, and providing technical

guidance needed to establish and administer national energy policies; and

(3) as relate to or are utilized for underground electric power transmission research.

(c) There are hereby transferred to and vested in the Administrator such functions of the National Science Foundation as relate to or are utilized in connection with—

(1) solar heating and cooling development; and

(2) geothermal power development.

(d) There are hereby transferred to and vested in the Administrator such functions of the Environmental Protection Agency and the officers and components thereof as relate to or are utilized in connection with—

(1) the development and demonstration of alternative automotive power systems; and

(2) the development and demonstration of precombustion, combustion, and postcombustion technologies to control emissions of pollutants from stationary sources using fossil fuels.

(e) To the extent necessary or appropriate to perform functions and carry out programs transferred by this Act, the Administrator may exercise, in relation to the functions so transferred, any authority or part thereof available by law, including appropriation Acts, to the official or agency from which such functions were transferred.

TRANSFER OF PERSONNEL AND OTHER MATTERS

SEC. 105. (a) Except as provided in the next sentence, the personnel employed in connection with, and the personnel, positions, assets, liabilities, contracts, property, records, and unexpended balances of appropriations, allocations, and other funds employed, held, used, arising from, available to or to be made available in connection with the functions and programs transferred by this Act, are, subject to section 202 of the Budget and Accounting Procedures Act of 1950 (31 U.S.C. 581c), correspondingly transferred for appropriate allocation. Personnel positions expressly created by law, personnel occupying those positions on the effective date of this Act, and personnel authorized to receive compensation at the rate prescribed for offices and positions at levels II, III, IV, or V of the Executive Schedule (5 U.S.C. 5313–5316) on the effective date of this Act shall be subject to the provisions of subsection (c) of this section and section 301 of this Act.

(b) Except as provided in subsection (c), transfer of nontemporary personnel pursuant to this Act shall not cause any such employee to be separated or reduced in grade or compensation for one year after such transfer.

(c) Any person who, on the effective date of this Act, held a position compensated in accordance with the Executive Schedule prescribed in chapter 53 of title 5 of the

United States Code, and who, without a break in service, is appointed in the Administration to a position having duties comparable to those performed immediately preceding his appointment shall continue to be compensated in his new position at not less than the rate provided for his previous position.

ADMINISTRATIVE PROVISIONS

SEC. 106. (a) The Administrator is authorized to prescribe such policies, standards, criteria, procedures, rules, and regulations as he may deem to be necessary or appropriate to perform functions now or hereafter vested in him.

(b) The Administrator shall engage in such policy planning, and perform such program evaluation analyses and other studies, as may be necessary to promote the efficient and coordinated administration of the Administration and properly assess progress toward the achievement of its missions.

(c) Except as otherwise expressly provided by law, the Administrator may delegate any of his functions to such officers and employees of the Administration as he may designate, and may authorize such successive redelegations of such functions as he may deem to be necessary or appropriate.

(d) Except as provided in section 102, the Adminis-

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trator may organize the Administration as he may deem to be necessary or appropriate.

(e) The Administrator is authorized to establish, maintain, alter, or discontinue such State, regional, district, local, or other field offices as he may deem to be necessary or appropriate to perform functions now or hereafter vested in him.

(f) The Administrator shall cause a seal of office to be made for the Administration of such device as he shall approve, and judicial notice shall be taken of such seal.

(g) The Administrator is authorized to establish a working capital fund, to be available without fiscal year limitation, for expenses necessary for the maintenance and operation of such common administrative services as he shall find to be desirable in the interests of economy and efficiency. There shall be transferred to the fund the stocks of supplies, equipment, other assets, liabilities, and unpaid obligations relating to the services which he determines will be performed through the fund. Appropriations to the fund, in such amounts as may be necessary to provide additional working capital, are authorized. The working capital fund shall recover, from the appropriations and funds for which services are performed, either in advance or by way of reimbursement, amounts which will approximate the costs incurred, including the accrual of annual leave and the depreciation of

equipment. The fund shall also be credited with receipts from the sale or exchange of its property, and receipts in payment for loss or damage to property owned by the fund.

PERSONNEL

SEC. 107. (a) The Administrator is authorized to select, appoint, employ, and fix the compensation of such officers and employees, including attorneys, pursuant to section 161d of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2201 (d)) as are necessary to perform the functions now or hereafter vested in him and to prescribe their functions.

(b) The Administrator is authorized to obtain services as provided by section 3109 of title 5 of the United States Code.

(c) The Administrator is authorized to provide for participation of military personnel in the performance of his functions. Members of the Army, the Navy, the Air Force, or the Marine Corps may be detailed for service in the Administration by the appropriate military Secretary, pursuant to cooperative agreements with the Secretary, for service in the Administration in positions other than a position the occupant of which must be approved by and with the advice and consent of the Senate.

(d) Appointment, detail, or assignment to, acceptance of, and service in, any appointive or other position in the Administration under this section shall in no way affect the

status, office, rank, or grade which such officers or enlisted men may occupy or hold, or any emolument, perquisite, right, privilege, or benefit incident to or arising out of any such status, office, rank, or grade. A member so appointed, detailed, or assigned shall not be subject to direction or control by his armed force, or any officer thereof, directly or indirectly, with respect to the responsibilities exercised in the position to which appointed, detailed, or assigned.

(c) The Administrator is authorized to pay transportation expenses, and per diem in lieu of subsistence expenses, in accordance with chapter 57 of title 5 of the United States Code for travel between places of recruitment and duty, and while at places of duty, of persons appointed for emergency, temporary, or seasonal services in the field service of the Administration.

POWERS

SEC. 108. (a) The Administrator is authorized to exercise his powers in such manner as to insure the continued conduct of research and development and related activities in areas or fields deemed by the Administrator to be pertinent to the acquisition of an expanded fund of scientific, technical, and practical knowledge in energy matters. To this end, the Administrator is authorized to make arrangements (including contracts, agreements, and loans) for the conduct of research and development activities with private or public

institutions or persons, including participation in joint or cooperative projects of a research, developmental, or experimental nature; to make payments (in lump sum or installments, and in advance or by way of reimbursement, with necessary adjustments on account of overpayments or underpayments); and generally to take such steps as he may deem necessary or appropriate to perform functions now or hereafter vested in him. Such functions of the Administrator under this Act as are applicable to the nuclear activities transferred pursuant to this title shall be subject to the provisions of the Atomic Energy Act of 1954, as amended, and to other authority applicable to such nuclear activities. The nonnuclear functions of the Administrator referred to in sections 103 and 104 of this Act shall be carried out pursuant to the provisions of this Act, applicable authority existing immediately before the effective date of this Act, or on in accordance with the provisions of chapter 4 of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2051–2053).

(b) Except for public buildings as defined in the Public Buildings Act of 1959, as amended, and with respect to leased space subject to the provisions of Reorganization Plan Numbered 18 of 1950, the Administrator is authorized to acquire (by purchase, lease, condemnation, or otherwise), construct, improve, repair, operate, and maintain facilities and real property as the Administrator deems to be nec-

essary in and outside of the District of Columbia. Such authority shall apply only to facilities required for the maintenance and operation of laboratories, research and testing sites and facilities, quarters, and related accommodations for employees and dependents of employees of the Administration, and such other special-purpose real property as the Administrator deems to be necessary in and outside the District of Columbia. Title to any property or interest therein, real, personal, or mixed, acquired pursuant to this section, shall be in the United States.

(c) (1) The Administrator is authorized to provide, construct, or maintain, as necessary and when not otherwise available, the following for employees and their dependents stationed at remote locations:

(A) emergency medical services and supplies;

(B) food and other subsistence supplies;

(C) messing facilities;

(D) audiovisual equipment, accessories, and supplies for recreation and training;

(E) reimbursement for food, clothing, medicine, and other supplies furnished by such employees in emergencies for the temporary relief of distressed persons;

(F) living and working quarters and facilities; and

(G) transportation for school-age dependents of

employees to the nearest appropriate educational facilities.

(2) The furnishing of medical treatment under subparagraph (A) of paragraph (1) and the furnishing of services and supplies under paragraphs (B) and (C) of paragraph (1) shall be at prices reflecting reasonable value as determined by the Administrator.

(3) Proceeds from reimbursements under this section shall be deposited in the Treasury and may be withdrawn by the Administrator to pay directly the cost of such work or services, to repay or make advances to appropriations or funds which do or will bear all or a part of such cost, or to refund excess sums when necessary; except that such payments may be credited to a service or working capital fund otherwise established by law, and used under the law governing such funds, if the fund is available for use by the Administrator for performing the work or services for which payment is received.

(d) The Administrator is authorized to acquire any of the following described rights if the property acquired thereby is for use in, or is useful to, the performance of functions vested in him:

(1) copyrights, patents, and applications for patents, designs, processes, and manufacturing data;

(2) licenses under copyrights, patents, and applications for patents; and

(3) releases, before suit is brought, for past infringement of patents or copyrights.

(e) With respect to all nonnuclear research and development, including demonstration projects, contracted for, sponsored, or cosponsored by the Administration pursuant to this Act, the applicable arrangement shall provide that the disposition of patent rights in inventions or discoveries arising out of the work under the arrangement shall be governed by the President's Statement of Government Patent Policy issued on August 23, 1971 (36 F.R. 16887, August 26, 1971) and amended in September 1973 (38 F.R. 23782, September 4, 1973): *Provided*, That the Administrator in administering such patents shall make a determination, on a case-by-case basis, as to whether a requested license shall be granted on a royalty-free basis or upon a basis of charges designed to recover part or all of the costs of the research and development.

(f) Subject to the provisions of chapter 12 of the Atomic Energy Act (42 U.S.C. 2161–2166), and other applicable law, the Administrator shall disseminate scientific, technical, and practical information acquired pursuant to this title through information programs and other appropriate means, and shall encourage the dissemination of scientific, technical, and prac-

tical information relating to energy so as to enlarge the fund of such information and to provide that free interchange of ideas and criticism which is essential to scientific and industrial progress and public understanding.

(g) The Administrator is authorized to accept, hold, administer, and utilize gifts, and bequests of property, both real and personal, for the purpose of aiding or facilitating the work of the Administration. Gifts and bequests of money and proceeds from sales of other property received as gifts or bequests shall be deposited in the Treasury and shall be disbursed upon the order of the Administrator. For the purposes of Federal income, estate, and gift taxes, property accepted under this section shall be considered as a gift or bequest to the United States.

TITLE II—NUCLEAR ENERGY COMMISSION

CHANGE IN NAME

SEC. 201. The Atomic Energy Commission is hereby renamed the Nuclear Energy Commission and shall continue to perform the licensing and related regulatory functions of the Chairman and members of the Commission, the general counsel, and other officers and components of the Commission, which functions, officers, components, and personnel are excepted from the transfer to the Administrator by section 104(a) of this Act.

LICENSING OF SELECTED ADMINISTRATION FACILITIES

SEC. 202. Notwithstanding the exclusions provided for in section 110a or any other provisions of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2140(a)), the Nuclear Energy Commission shall, except as otherwise specifically provided by section 110b of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2140(b)), or other law, have licensing authority pursuant to chapters 6, 7, 8, 10, and section 185, of the Atomic Energy Act of 1954, as amended, as to the following facilities of the Administration:

(1) demonstration liquid metal fast breeder reactors when operated as part of the power generation facilities of an electric utility system;

(2) other demonstration nuclear reactors when operated as part of the power generation facilities of an electric utility system, except those in existence, under construction or authorized or appropriated for by the Congress on the date this part becomes effective; or

(3) facilities used primarily for the receipt and storage of high level radioactive wastes resulting from activities licensed under such Act, except those in existence, under construction, or authorized or appropriated for by the Congress, on the date this Act becomes effective.

RESEARCH

SEC. 203. (a) The Nuclear Energy Commission may engage in or contract for research which the Commission deems necessary for the discharge of its licensing and regulatory functions.

(b) In order to achieve the objectives and carry out the purposes of subsection (a), the Energy Research and Development Administration and all other Federal agencies shall, to the extent practicable—

(1) cooperate with respect to the establishment of priorities for the furnishing of such research services requested by the Nuclear Energy Commission as the Commission deems necessary for the conduct of its functions; and

(2) furnish to the Nuclear Energy Commission, when requested, on a reimbursable basis, through its own facilities or by contract or other arrangement, such research services as the Commission deems necessary for the conduct of its functions.

TITLE III—MISCELLANEOUS AND TRANSITIONAL PROVISIONS

TRANSITIONAL PROVISIONS

SEC. 301. (a) Except as otherwise provided in this Act, whenever all of the functions or programs of an agency, or other body, or any component thereof, affected by this Act, have been transferred from that agency, or other body,

or any component thereof by title I of this Act, the agency, or other body, or component thereof shall lapse. If an agency, or other body, or any component thereof, lapses pursuant to the preceding sentence, each position and office therein which was expressly authorized by law, or the incumbent of which was authorized to receive compensation at the rate prescribed for an office or position at level II, III, IV, or V of the Executive Schedule (5 U.S.C. 5313–5316), shall lapse.

(b) All orders, determinations, rules, regulations, permits, contracts, certificates, licenses, and privileges—

(1) which have been issued, made, granted, or allowed to become effective by the President, any Federal department or agency or official thereof, or by a court of competent jurisdiction, in the performance of functions which are transferred under this Act, and

(2) which are in effect at the time this Act takes effect,

shall continue in effect according to their terms until modified, terminated, superseded, set aside, or revoked by the President, the Administrator, or other authorized officials, a court of competent jurisdiction, or by operation of law.

(c) The provisions of this Act shall not affect any proceeding pending, at the time this section takes effect, before any department or agency (or component thereof) func-

tions of which are transferred by this Act; but such proceedings, to the extent that they relate to functions so transferred, shall be continued. Orders shall be issued in such proceedings, appeals shall be taken therefrom, and payments shall be made pursuant to such orders, as if this Act had not been enacted; and orders issued in any such proceedings shall continue in effect until modified, terminated, superseded, or revoked by a duly authorized official, by a court of competent jurisdiction, or by operation of law. Nothing in this subsection shall be deemed to prohibit the discontinuance or modification of any such proceeding under the same terms and conditions and to the same extent that such proceeding could have been discontinued if this Act had not been enacted.

(d) Except as provided in subsection (f)—

(1) the provisions of this Act shall not affect suits commenced prior to the date this Act takes effect, and,

(2) in all such suits proceedings shall be had, appeals taken, and judgments rendered, in the same manner and effect as if this Act had not been enacted.

(e) No suit, action, or other proceeding commenced by or against any officer in his official capacity as an officer of any department or agency, functions of which are transferred by this Act, shall abate by reason of the enactment of this Act. No cause of action by or against any department or

agency, functions of which are transferred by this Act, or by or against any officer thereof in his official capacity shall abate by reason of the enactment of this Act. Causes of actions, suits, actions, or other proceedings may be asserted by or against the United States or such official as may be appropriate and, in any litigation pending when this section takes effect, the court may at any time, on its own motion or that of any party, enter any order which will give effect to the provisions of this section.

(f) If, before the date on which this Act takes effect, any department or agency, or officer thereof in his official capacity, is a party to a suit, and under this Act any function of such department, agency, or officer is transferred to the Administrator, or any other official, then such suit shall be continued as if this Act had not been enacted, with the Administrator, or other official, as the case may be, substituted.

(g) Final orders and actions of any official or component in the performance of functions transferred by this Act shall be subject to judicial review to the same extent and in the same manner as if such orders or actions had been made or taken by the officer, department, agency, or instrumentality in the performance of such functions immediately preceding the effective date of this Act. Any statutory requirements relating to notices, hearings, action upon the record, or

administrative review that apply to any function transferred by this Act shall apply to the performance of those functions by the Administrator, or any officer or component.

(h) With respect to any function transferred by this Act and performed after the effective date of this Act, reference in any other law to any department or agency, or any officer or office, the functions of which are so transferred, shall be deemed to refer to the Administrator, or other officials in which this Act vests such functions.

(i) Nothing contained in this Act shall be construed to limit, curtail, abolish, or terminate any function of the President which he had immediately before the effective date of this Act; or to limit, curtail, abolish, or terminate his authority to perform such function; or to limit, curtail, abolish, or terminate his authority to delegate, redelegate, or terminate any delegation of functions.

(j) Any reference in this Act to any provision of law shall be deemed to include, as appropriate, references thereto as now or hereafter amended or supplemented.

(k) Except as may be otherwise expressly provided in this Act, all functions expressly conferred by this Act shall be in addition to and not in substitution for functions existing immediately before the effective date of this Act and transferred by this Act.

INCIDENTAL DISPOSITIONS

SEC. 302. The Director of the Office of Management and Budget is authorized to make such additional incidental dispositions of personnel, personnel positions, assets, liabilities, contracts, property, records, and unexpended balances of appropriations, authorizations, allocations, and other funds held, used, arising from, available to or to be made available in connection with functions transferred by this Act, as he may deem necessary or appropriate to accomplish the intent and purpose of this Act.

DEFINITIONS

SEC. 303. As used in this Act—

(1) any reference to "function" or "functions" shall be deemed to include references to duty, obligation, power, authority, responsibility, right, privilege, and activity, or the plural thereof, as the case may be; and

(2) any reference to "perform" or "performance", when used in relation to functions, shall be deemed to include the exercise of power, authority, rights, and privileges.

AUTHORIZATION FOR APPROPRIATIONS

SEC. 304. Except as otherwise provided by law, appropriations made under this Act shall be subject to annual authorization.

COMPTROLLER GENERAL AUDIT

SEC. 305. Section 166 "Comptroller General Audit" of the Atomic Energy Act of 1954, as amended, shall be deemed to be applicable, respectively, to the nuclear and nonnuclear activities under title I and to the activities under title II.

SEPARABILITY

SEC. 306. If any provision of this Act, or the application thereof to any person or circumstance, is held invalid, the remainder of this Act, and the application of such provision to other persons or circumstances, shall not be affected thereby.

EFFECTIVE DATE AND INTERIM APPOINTMENT

SEC. 307. (a) The provisions of this Act shall take effect one hundred and twenty days after the Administrator first takes office, or on such earlier date as the President may prescribe and publish in the Federal Register; except that any of the officers provided for in title II of this Act may be nominated and appointed, as provided in that title, at any time after the date of enactment of this Act. Funds available to any department or agency (or any official or component thereof), any functions of which are transferred to the Administrator by this Act, may, with the approval of the President, be used to pay the compensation and expenses of any

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officer appointed pursuant to this subsection until such time as funds for that purpose are otherwise available.

(b) In the event that any officer required by this Act to be appointed by and with the advice and consent of the Senate shall not have entered upon office on the effective date of this Act, the President may designate any officer, whose appointment was required to be made by and with the advice and consent of the Senate and who was such an officer immediately prior to the effective date of this Act, to act in such office until the office is filled as provided in this Act. While so acting, such persons shall receive compensation at the rates provided by this Act for the respective offices in which they act.

Chairman HOLIFIELD. The advantages of proceeding at this time with a separate bill to create an independent Energy Research and Development Administration are as follows:

(1) Action can be expedited because we will not have to consider the broader range of issues posed by H.R. 9090. Some of those issues, involving various transfers to the proposed new department, are quite controversial and not directly related to energy research and development. By considering H.R. 11510, we can concentrate on the energy R. & D.

(2) The new bill has administration support. In his energy message to the Congress of November 8, 1973, the President recommended action along this line, recognizing that it would avoid delays. He still wants a new department, but is willing to have the Congress give priority to ERDA.

(3) The bill has bipartisan sponsorship in our committee, and will get support in some other committees. You will note that Representatives Melvin Price and Craig Hosmer, the chairman and ranking minority member, respectively, of the Joint Committee on Atomic Energy, have joined Mr. Horton and me in sponsoring H.R. 11510. In the Senate, we understand that there will be a bill dropped in today that will be sponsored by Senators Ribicoff and Percy, the chairman and the ranking Republican member on the Ribicoff subcommittee. Also, they will be joined by the chairman and ranking Republican member of the Joint Committee on Atomic Energy, Senator Pastore and Senator Aiken. So the bills will go forward concurrently.

We plan to introduce another identical bill so that additional names can be added. There are many Members who want to sponsor this bill. I am sure that most of the members of this committee and of the Joint Committee will want to sponsor it, as well as other Members of the House and Senate.

(4) The bill provides an organizational base for the large expenditures to be committed to energy research and development. The President has announced a $10 billion program, at the rate of $2 billion a year for 5 years, beginning in fiscal year 1975. Planning for these expenditures is underway. In his November 8 message the President said that ERDA is needed to direct the $10 billion program.

(5) ERDA, which encompasses the nonregulatory functions of the Atomic Energy Commission, would start with an experienced organization. The Commission and its laboratories now employ about 25,000 scientists and engineers and have unique facilities for mounting energy research and development programs on a broad front. It makes good sense, in my opinion, to bring together the AEC's technical resources and facilities with those from other research units for a consolidated attack on the future energy crisis.

(6) ERDA, with a single Administrator in charge, will offer more effective management than a multimember commission, or a lead-agency arrangement, to supervise the energy research and development activities of various agencies. As noted above, a number of energy research and development activities will be transferred to ERDA from the Department of the Interior, the National Science Foundation, and the Environmental Protection Agency, along with the developmental and other nonregulatory functions of the AEC.

(7) ERDA will conduct a broad program of energy research and development, giving full attention and appropriate emphasis to all forms of energy research and development, not only nuclear. The internal organization of ERDA will reflect the broadscale approach. For example, an assistant administrator for Fossil Energy Research is provided in the bill.

(8) NEC will administer the licensing and regulatory functions now in AEC. This will satisfy a longstanding demand to separate the development and regulatory activities in the nuclear energy field, and thus avoid an organizational conflict of interest.

I would like to see H.R. 11510 reported to the House before this session ends. For this reason, the subcommittee has compressed its hearing program. We will try to accommodate witnesses who have asked to be heard, and we will take statements for the record from all informed sources who may wish to prepare and submit such statements. I want to point out that we have already had a series of hearings on the same subject matter, which was partly involved in H.R. 9090 and carried into H.R. 11510. I will ask the witnesses to present their prepared statements for the record and to highlight their remarks in a 10-minute presentation if possible. If not possible, I will give them some extra time. We may have to move the hearing over to the public hearing room of the Joint Committee on Atomic Energy in order to have it close to the floor, so the Members can go to the floor and vote whenever it is necessary and get back to the committee with minimum time and trouble.

I now yield to my associate on the committee, Mr. Horton.

Mr. HORTON. Thank you, Mr. Chairman. When we started our hearings in July on H.R. 9090, the predecessor to this legislation, I said, "there are very few legislative initiatives in this Congress as significant as this bill we are beginning hearings on today." Certainly this is even more true today. The Library of Congress report on the severity of the energy shortage states that we could have a shortfall of as much as 35 percent of our energy supplies; and even if we were able to resolve our immediate problems with the Arab States, we should still expect a shortfall of some 20 percent. With energy demands rising, there is no way we can guarantee our continued development without somehow providing self-sufficiency in our energy supply. That is what this bill, H.R. 11510, is all about.

Chairman Holifield and I were among the group of congressional leaders who met with the President on November 7 to discuss ways the Nation could cope with the present energy shortage and assure that we never again are susceptible to blackmail by energy-producing nations. We talked about immediate measures and longer term measures. That evening, the President in his address to the Nation specifically and strongly urged the creation of an Energy Research and Development Administration, which would direct the $10 billion program aimed at achieving self-sufficiency in energy by 1980. Chairman Holifield, as many of you know, was one of the first to propose such an agency.

The chairman has briefly outlined the revised legislation. He and I have worked with the administration, the executive departments involved, and several Members of the Congress in developing H.R.

11510. It is a bill which I believe we can move quickly, and I hope we will.

I look forward to the testimony of our witnesses on the adequacy of this legislation, and any improvements we ought to consider.

Chairman HOLIFIELD. At this time, I will yield to Mr. Rosenthal.

Mr. ROSENTHAL. I have no comments, thank you, Mr. Chairman.

Chairman HOLIFIELD. I will ask Mr. Moorhead, if he has any statements to make at this time.

Mr. MOORHEAD. I have no statement.

Chairman HOLIFIELD. Mr. Mallary.

Mr. MALLARY. No.

Chairman HOLIFIELD. Then we will proceed with the witness list.

We have a distinguished list this morning. Many of them I have known for many years and they occupy tremendously important positions in our Nation.

Our first witness is Dr. Chauncey Starr, who is now the president of the Electric Power Research Institute.

Dr. Starr, will you please come to the witness table?

STATEMENT OF DR. CHAUNCEY STARR, PRESIDENT, ELECTRIC POWER RESEARCH INSTITUTE

Dr. STARR. Mr. Chairman, members of the committee, I am very glad to have this opportunity to speak to you today on what is obviously an issue of great importance to the Nation. Let me say at the outset that I support H.R. 11510. I believe the Energy Research and Development Administration that is proposed therein is both timely and important. I have appended to the testimony my biography and I think I have given each of you a history of the Electric Power Research Institute, a new institution about a year old. It is an institute supported by both investor and publicly owned utilities to foster the application of advanced technologies for improved delivery of electrical services to the public. I will submit my testimony for the record and try to summarize the key points, as you have suggested.

Chairman HOLIFIELD. The entire testimony will be included in the record, Dr. Starr.

Dr. STARR. Thank you.

I want to make it clear that I am speaking as an individual rather than on behalf of the institute. The institute does not, as a matter of policy, take positions on legislation. That is not its function. It is a technical and scientific organization, but many of our members have been in the energy business for many, many years, and as you can tell from my own biography, it is a field in which I have spent most of my lifetime. I hope that my perception of the issues our Nation faces in the field of energy supply and utilization may be of use to the committee in its deliberations.

Obviously, those of us in the energy business, and particularly my institute and its sponsors, are deeply concerned with the issues raised by the President and by many Members of the Congress, for reaching the objective of self-sufficiency in energy operations. We hope that we will be able to operate as part of the team necessary to achieve that objective for the country.

I would like to make some major points about self-sufficiency which may be of interest to the committee. I do not think that this is an objective that is going to be achieved just through the discovery of new energy sources. It is going to require also the development of more efficient and environmentally acceptable means to use energy sources already available to us. Continued development of nuclear power, both through conventional and fast breeder reactors, and research to develop improved use of our vast coal and shale oil reserves, for example, will play an important role in achieving energy self-sufficiency in the coming decades. The development of the new conversion systems which the newspapers are always discussing, such as thermonuclear fusion, solar power, and other energy sources is also very important. Because of the time required for such development, however, these cannot be considered as solutions for our near-term problems. They are obviously very important for the long range.

I would like to point out to the committee that for the very near-term issues raised by the President in his recent talk, that non-technical actions of Government may be predominantly important. Immediate steps should be taken to conserve our available energy supply by reducing the nonessential usage which developed in our affluent energy past. I believe the Federal Government has to continuously study its administrative policies which influence the operating boundaries of our energy systems to determine if, in the light of new national needs, adjustment of these policies could enhance and speed up our national capability to achieve self-sufficiency objectives. There has been much recent discussion on these matters and I will not discuss these myself.

I think the most important thing we should recognize is that for the foreseeable future, and certainly beyond the year 2000, the demand for energy in the United States will grow no matter what is done to conserve or constrain such energy consumption. I believe this has to be a basic premise of any legislation or of any policy decisions made in the Federal Government. Every study indicates that even if we reduce our reproduction rate to 2 per family, we are going to have a population increase by the year 2000. And if we provide for any kind of economic and social growth for the most deprived elements of our population, the per capita energy consumption in the United States will also increase.

It is evident from this kind of a study, regardless of how it is made, that by the year 2000 we will have increased our total consumption in this country of all forms of energy by at least two times our present consumption; we will increase our consumption of electricity by five to six times our present consumption. I believe these projections are conservative rather than extravagant. The fact that the use of electricity will increase at a greater rate than the total use of energy is simply a result of the evident fact that electricity is a most convenient energy source. It is thus apparent that the issues associated with the national objectives of energy self-sufficiency are likely to be with us permanently, and certainly, an agency such as the proposed Energy Research and Development Administration suggested in this bill will fulfill a growing and permanent need.

Now, there are three approaches to managing a future increase in energy demand. One would be to place a ceiling on the total energy

availability in the United States and thus to administratively limit such growth. The effect of any such action, even if it were accomplished with great wisdom, would be to seriously limit the improvement in the quality of life of the great mass in the population that now does not have all the material goods and recreational options which the upper economic sector of our country enjoys. And even if we do this all very wisely, I think it ought to be done really as an emergency or last-resort operation. There is an additional difficulty with such administration limitations on energy consumption; that is, the very act of doing this distorts a rational approach to a permanent solution.

A second approach is not to undertake long-range national plans for energy supply at all, but hope that the good fortune that has been the historical blessing of our country will continue to find opportunistic solutions to our problems as they develop. Our country has had a long history of being lucky. Those of us who have studied this problem in great detail do not believe that the kind of exponential factors that are focusing on this problem can be handled by treating the situation as one in which a lucky break will solve the problem for us. I do not have any faith in the luck of the country getting us out of this particular problem.

The third approach, and to me the only rational approach, is to undertake a series of national planned programs which, first, try to develop all the various means of supplying energy; second, undertake to use such energy effectively and not wastefully; and third, moderate and accommodate our lifestyles in a reasonable fashion to a somewhat restricted energy diet. I do not believe that we have a choice among these three steps. I believe that even though we may develop every conceivable method of supplementing our energy resources, we will barely be able to meet foreseeable demands. It is inevitable that we will have to live with a very tight energy supply from here on out; hopefully not so tight as to seriously impede an improvement in the average quality of life, but nevertheless one which will not permit wasteful use.

I would like to make it clear that the historical and perhaps publicized battles between, say, the coal interests, the nuclear interests, and the oil interests have to be a thing of the past. We are not competitive in the economic or commercial markets. Every one of these has to be supported to the greatest possible extent.

Chairman HOLIFIELD. I am glad you made that statement, Dr. Starr, because I have been emphasizing that point for many years, that we cannot ignore the tremendous value of the coal deposits or any other fuel source in our Nation. We are going to need every kilowatt, every unit of energy, that we can get out of all sources that we have, and still we are going to be short.

Dr. STARR. Yes.

Chairman HOLIFIELD. That is, when we use all of those sources, at least for the foreseeable future.

Dr. STARR. I agree, Mr. Chairman. I might also point out that the foreseeable future is at least 30 years ahead in terms of new things coming in and that is a long time in a nation's history.

I would like to talk a little bit about technology and how the various institutions, both private and public, such as the ones being pro-

posed in this bill, might relate. Unlike most resources, technology is a manmade resource. Its abundance and variety can be continuously increased. It is the one resource we have which plays a major role in the development of the Nation and which really does not have an upper limit.

This particular challenge that we face now is a major challenge for the scientists and engineers of the country and I think it is one to which they will steadily rise. The particular institute which I now head, the Electric Power Research Institute, represented a fairly unusual approach of the normally conservative element of our private sector, the national utility industry, to undertake a comprehensive and massive program to develop energy technologies. We have been, in effect, in operation for less than a year but we are moving rapidly to institute many, many programs. As you know, our future programs, while not comparable to those of the Federal Government, are being developed at the level of $100 million or more.

Now, the utility industry foresaw the energy problem for their particular operations during the past decade. I might also point out that some members of this committee, including the chairman, have foreseen this problem for many years and have led earlier programs to solve it. We have had plenty of foresight in terms of warning statements concerning the energy crunch. None of us, of course, could foresee the particular pressure that the recent Arab-Israeli war has created. But the pressures would have occurred anyway. What the war has done is to give us a cataclysmic situation which has brought the problem to our attention on an immediacy basis.

Chairman HOLIFIELD. Dr. Starr, your experience suggests, and your testimony indicates, that you are a realist in assessing the energy problem. How realistic and feasible do you think that this proposal is or will be in meeting the President's goal of energy self-sufficiency?

Dr. STARR. Well, Mr. Chairman, I think that this kind of coordination of Federal efforts is absolutely essential, in one form or another, to bring the great resources of the Federal Government to focus on a problem which I believe is as essential to our Nation as, for example, the food supply of the country. Because I do not have the reaction of the business community to the pending energy shortage I cannot respond for them. It might be somewhat exaggerated, but, nevertheless, energy plays as key a role to the functions of society as food and water supply. We have not had in the Nation a coordinated program which treated energy as an essential commodity to be husbanded and carefully managed. We have lived under a situation of energy affluence. In a sense, one could even describe our situation as being one of energy addiction and we are now facing a situation where, with very tightened supply, we are discovering what has been known to the students of the subject for many years—that this is a very key commodity and a change in its availability, even more than a change in its price will be a key element in determining the economic and social welfare of the country.

Chairman HOLIFIELD. Do you look upon this reorganization of the Atomic Energy Commission for an overall energy research and development effort as being a sound proposal, considering that we have some $4 billion or $5 billion invested in laboratories and some 25,000

scientists and engineers involved in the work that they are doing now? Do you look upon that as a sound approach?

Dr. STARR. The answer to that question, in short, is yes.

Chairman HOLIFIELD. Do you know of any other group of laboratories and scientists of a commensurate size and commensurate number of facilities?

Dr. STARR. Well, there are other organizations of the U.S. Government which do have resources of a similar nature, but they are presently heavily committed to other activities. I am thinking specifically of the laboratories of the Department of Defense and the laboratories of NASA, both of which are very technically competent, and have resources similar to the resources of the Atomic Energy Commission but are hardly in a position of being flexibly available to move into the energy sector on short notice.

Chairman HOLIFIELD. You mentioned NASA, and I know that your work in the past particularly has been very close to the space nuclear applications program.

Dr. STARR. Yes.

Chairman HOLIFIELD. Since you have worked in the SNA program which NASA now has jurisdiction over, what is your opinion of the feasibility of utilizing such technology in the more mundane sphere of creating electrical energy resources?

Dr. STARR. Well, it is clear that in any area of advanced technology there is a long and historical interaction between those developments which come out of the more far-reaching efforts of the Department of Defense or of NASA and those of commercial use in energy development. For example, solid state electronics is one such development. As you may know, this was directly stimulated as an outgrowth of Department of Defense activities. There are many research activities of NASA which will have a direct result in the ability to handle, say, environmental pollution, because NASA has been concerned with closed-system environments, and, in effect, our biosphere is such a closed system. The particular problems of NASA relative to making high-reliability components under very difficult situations will pay off. So I think there are many things that can be done with these technologies.

The virtue of the particular bill you are now considering is that it takes the ongoing energy activities of the Federal Government and brings them together in as expeditious a manner as one could conceive without necessarily putting in the huge time delays that bringing in other agencies, such as NASA, or a new agency into the energy sector would have.

Our problem, I believe, is not that we do not have enough laboratories, either in the Federal Government or in the private sector or in other areas. We have ample facilities in the United States for undertaking major programs in the energy field. Except for a few operations such as represented by our particular institute, there have been very few attempts to bring these together. The bill that is now being considered by this committee does that and, in that sense, I believe it is an important short-term as well as a long-term step in bringing together the resources we already have.

[Dr. Starr's prepared statement follows:]

PREPARED STATEMENT OF DR. CHAUNCEY STARR, PRESIDENT, ELECTRIC POWER RESEARCH INSTITUTE

Mr. Chairman and members of the committee, I am very honored to have this opportunity to talk to you today on this important issue of the Federal organization for advancing technology in the energy field. I believe the Energy Research and Development Administration proposed in H.R. 11510 is both timely and important.

I am president of the Electric Power Research Institute, a nonprofit organization recently established by the electric utility industry—both investor owned and publicly funded—to foster the application of advanced technologies for improved delivery of electrical services to the public. A brochure describing EPRI is attached. As is evident from my biography appended to this testimony, I have been actively involved in research and development in scientific and engineering areas, and particularly in those relating to the energy industry, most of my lifetime. I hope that my perception of the issues that our Nation faces in the field of energy supply and utilization may be of use to the committee in its deliberations.

I wish to make it clear that I speak as an individual rather than on behalf of the Electric Power Research Institute. By its very nature the Institute is not postured to take advocacy positions on national legislation. The Institute is intended to provide a technological resource for the Nation and to analyze and develop technical options in the electrical energy field. In the particular area to which the committee is addressing itself, the history of the Institute is much too short to have developed an organizational insight. For this reason the comments I provide you represent those distilled from my own experience and background.

The concern expressed by the President and by many Members of the Congress for the discovery and development of energy to make our Nation self-sufficient is a concern that is shared by the Electric Power Research Institute, EPRI's staffing is well underway. Both the President and the Congress will find that EPRI is ready and capable to work as an eager teammate toward making the United States more independent of outside energy sources.

Self-sufficiency is an objective that will be reached not only through the discovery of new energy sources, but also by development of more efficient and environmentally acceptable means to make use of energy sources already available to us. Continued development of nuclear power—both through conventional and fast breeder reactors—and research to develop improved uses of our vast coal and shale oil reserves, for example, will play an important role in achieving energy self-sufficiency in the coming decades. The development of new conversion systems to make use of thermonuclear fusion, solar power, and other energy sources are, of course, important for the long-range.

Although our very near-term national technical efforts to improve the supply-demand relation will aid the approach to self-sufficiency in the next decade, I believe that nontechnical actions may be predominantly important. Immediate steps should be taken to conserve our available energy supply by reducing nonessential uses which developed in our energy affluent past. I believe the Federal Government must continuously study its administrative policies which influence the operating boundaries of our energy systems, to determine if, in the light of new national needs, adjustment of these policies could enhance and speed up our national capability to achieve the self-sufficiency objective. There has been much recent discussion of such matters, and I will therefore not pursue this subject further here.

PREMISES AND ALTERNATIVES

The most important premise for national energy planning is that the energy demands of the United States for the foreseeable future and certainly beyond the year 2000 will inevitably grow no matter what actions are taken to constrain such energy growth. All studies indicate that even though we reduce our reproduction rate to 2 per family, the inevitable resulting population increase from now to the year 2000, and the apparently inevitable growth in the per capita use of energy, will also inevitably result in a total annual energy consumption in the United

States that increases steadily. It is quite clear from all such studies that by the year 2000 we will have increased our total consumption in this country by at least two times our present consumption and we will increase our consumptions of electricity by five to six times our present annual consumption. I believe these projections into the future are conservative. The fact that the use of electricity will increase at a greater rate than the total use of energy is simply a result of the relative convenience of electricity as an energy source. It is thus apparent that the issues associated with the national objective of energy self-sufficiency are likely to be with us permanently, and certainly an agency such as the proposed Energy Research and Development Administration will fulfill a growing and permanent need.

There are three approaches to managing such a future increase in energy demands. One would be to place a ceiling on the total energy availability in the United States and thus, to administratively limit such growth. The effect of any such action, even if it were accomplished with great wisdom, would be to seriously limit the improvement in the quality of life of the great mass of the population that now does not have all the material goods and recreational options which the upper economic sector of our country enjoys. Such a policy of planned energy malnutrition would have the same social consequences on the life style of our population as if one were to limit the abundance of any other form of essential supplies in our society such as food or water. Regardless of whether such actions are taken by placing a very high price upon energy or by rationing energy or by allocating it administratively, the net effect will be very much the same. In general, these would be regressive sociological steps for the future welfare of the country and regardless of their political feasibility, should represent a last resort in our national planning. Furthermore, any such actions would distort the rational approaches to a permanent problem.

A second approach is not to undertake long-range national plans for the energy supply of the Nation, but to hope that the good fortune that has been the historical blessing of our country will continue to find opportunistic solutions to our problems as they develop. This optimistic pioneering tradition has often been supported by our national run of luck, and perhaps it might again. Unfortunately, for those of us who analyze the current trends, the possibility of finding an adequate solution through such happenstance appears to be very remote. As you know, the combination of exponential events which are gradually bringing the demands of our Nation into conflict with our resources do not indicate that we can rely on good fortune to save us from our present improvident behavior pattern.

The third, and to me the only rational approach, is to undertake a series of nationally planned programs which first, try to develop all the various means of supplying energy; second, undertake to use such energy effectively and not wastefully; and third, moderate and accommodate our lifestyles in a reasonable fashion to a somewhat restricted energy diet. I do not believe that we have a choice among these three steps. I believe that even though we may develop every conceivable method of supplementing our energy resources we will barely be able to meet foreseeable demands. It is inevitable that we will have to live with a very tight energy supply, hopefully not so tight as to seriously impede an improvement in the average quality of life, but nevertheless one which will not permit wasteful use.

TECHNOLOGY AND INSTITUTIONAL ROLES

Unlike the mineral resources found in nature, technology is a manmade resource whose abundance and variety can be continuously increased. For this reason the tightening energy supply represents a most exciting challenge to the scientists and engineers of today. There is every reason to expect that an intensive application of scientific research and engineering development to the problem of supplying and using energy effectively could result in technological developments of substantial magnitude; sufficient perhaps to relieve the energy constraints we foresee. Nature occasionally provides breakthroughs and gifts to compensate for its more numerous pitfalls and blockades. The history of technological development is encouraging in this regard and for this reason research and development in the field must receive a significant portion of our Nation's resources.

As a means of focusing our technological strength on the specific task of delivering electricity to the public, the recently formed Electric Power Research Institute is an unusual and dramatic initiative by our national utility industry to undertake a comprehensive and massive program for the development and application of advanced energy technologies. The Institute has its foundation in the formation of the Electric Research Council in 1965 when the utility industry foresaw the magnitude of the impending energy problem. The urgent need for such a large national program in all of our various energy systems has now been widely recognized by the public and by the Federal Government. The Electric Power Research Institute is supported by all segments of the electric utlity industry including investor-owned companies through the Edison Electric Institute, and public entities through the American Public Power Association, the Tennessee Valley Authority, and the U.S. Department of Interior, and the National Rural Electric Cooperative Association. Representatives of these groups form the EPRI Board of Directors. In addition, an advisory council of 25 individuals, of whom seven are from the National Association of Regulatory Utility Commissioners, is intended to effectively represent the interests of the public.

In considering the formation of the Electric Power Research Institute, the electric utilities of the United States faced the same problem to which this committee is addressing itself on a much broader scale. The production of electricity involves the use of every fuel resource known to man. The fossil fuels (coal, oil, and gas), nuclear fuels, the Sun, the wind, the tides, the heat of the Earth—all of these are energy sources which can be converted into electricity. Thus the industry was faced with creating an organization that could coordinate all the research appropriate to converting these basic energy sources into electricity. The problem that our Nation faces with regard to all energy systems is, in a broader framework, similar to the mission of EPRI, namely, to focus our national resources on providing the technological options needed to meet our future energy demands in a manner which optimizes the overall public good. Such a large mission requires indepth technological assessments of near-term and long-term possibilities, their arrangement in some orderly strategic plan, the assignment of priorities and funds, and finally, implementation and management of individual projects. Further it is not sufficient to explore and develop new technology unless the results of this research can be evaluated in a practical demonstration stage so that the most promising processes can be developed commercially for the public good.

It is of interest that the basic philosophy which has led to EPRI's formation and its organizational structure is similar to the pattern suggested for ERDA in H.R. 11510. The principal technical groupings of EPRI are: (1) Nuclear power, (2) fossil fuels, (3) advanced systems, (4) transmission and distribution, and (5) energy systems, environment and conservation. This may be compared with the ERDA grouping of (1) fossil, (2) nuclear, (3) environment, safety, and conservation, (4) research and advanced systems, (5) national security. The similarities and differences indicate areas of common interest as well as differences in responsibility. Because the utilities carry the responsibilities for delivery of electricity to the end consumer, transmission and distribution is a major technical area for them, but not for the Federal Government. This example illustrates the complementary nature of EPRI and the proposed ERDA, a subject which I will discuss more fully later.

FEDERAL AND PRIVATE ROLES IN ENERGY R. & D.

It has been estimated that of our total gross national product, roughly 10 percent represents the cost of delivering energy services to the end users. Thus, at the present time the energy sector represents a $120 billion annual industry. It is customary in advanced technological industrial areas to devote roughly 8 percent of the total gross sales to R. & D. for improving performance. One might thus expect that nationally we should be spending about $10 billion a year for research and development among the various sectors of the national energy system. Although exact figures are not available, I estimate we are actually spending less than one-fifth of this total sum now including government, utility, and manufacturing expenditures. If we are seriously concerned with taking the necessary steps to improve the future energy situation, we must rapidly move to substantially increase our level of R. & D. investment for all energy

sources. I recognize the impracticality of sudden increases on a scale which involves both our private and public sectors. Further, both the pricing and the economic structures of our energy industry are such that one could not expect to implement sudden fiscal changes to accommodate huge investments in research. Nevertheless, the pattern of increased R. & D. in the energy field must be established.

The most serious issue we face in the Federal management of the proposed new agency is that of effectively maximizing the overall public interest by the best use of Federal and private sector resources. I believe that the principle that ought to be followed in resolving these national management problems is to place the responsibility for performance of the various subtasks in the national energy problems with those groups that have the maximum incentive for achieving success in their missions. It is my belief, based on observation of both the private and governmental sectors, that success in achieving an end result is clearly associated with the existence of strong motivation and incentives for the groups involved. The sheer assignment of responsibility without such motivation and incentives does not generally result in a successful contribution to the total end purpose. It therefore may be of value to present to this committee my view of the areas of responsibility and motivation which may be most effective in the mix of government and public sectors.

There appears to be little doubt that the Federal Government has ultimate responsibility and major concern with establishing the operational boundaries in which the energy systems of the country have to function. Such boundaries may include: (1) Fuel resource policies, both indigenous and off-shore; (2) foreign policy considerations; (3) fiscal policies, such as the uses of surtaxes, economic incentives, or trade and pricing regulations; (4) the national objectives with regard to the trade-off among the quality of life, population growth, economic growth, resources allocation, and ecological options; and (5) most importantly the establishment of environmental criteria, with due regard for the overall public interest in the balance between achieving a desirable environment and energy availability. There seems little doubt that these, and similar areas of national concern, are a Federal responsibility and that the research and studies associated with these areas should be managed by the Federal Government regardless of whether the work is done directly by Federal agencies or by contractual relationships with the private sector. At the other end of the management spectrum, I have already indicated the direct responsibility of the private sector for the end-point delivery of energy services to the public. It would therefore appear that the management of any research and development programs associated with improving such energy delivery should be the responsibility of the private sector, even though there might be Federal participation in funding such research and development. Between these two extremes of the management spectrum is a very complex mixture of participation by the Federal Government, national laboratories, research organization (nonprofit and profit), manufacturers, and the operators of energy delivery systems (such as investor-owned and publicly financed electrical utilities), and the various energy companies. It is evident that in such a complex mixture each particular technical project requires a management system analysis to tailor the optimal mix. Such an analysis would include a comprehensive program plan, the distribution of performance responsibilities among the participants, and the selection of the most appropriate management structure.

The role of the Federal Government in this complex of energy research activities might generally be separated into two distinct areas: those concerned with the management of the R. & D. programs, and those concerned with financial participation.

It is evident from my previous comments that there are many areas where the major financial burden can only be borne by the Federal Government. These include those areas where the uncertainties of the program involves extremely high financial risks, or where the time required for successful achievement of the end mission may be so distant that the private sector could not justify the present use of its resources for such developments, or where the benefits of the development are so widespread and the financial return to the private sector is so narrow that only a public investment is justified. It is certainly clear that the Federal Government has a major responsibility for the continued survival of our society, so that such research programs as nuclear fusion can certainly be justified as a long-range, high pay-off development which may be important

to the welfare of future generations. In the same vein, research on environmental matters may be of direct concern and benefit to the public at large, but the outcome of such research may carry with it very little incentive for private investment in these areas.

Even areas where the private sector has already invested heavily in a developing technology, may occasionally justify a Federal infusion of funds to accelerate the success of such technologies. As a specific example, the acceleration on a short-term basis of alternative energy supplies in order to insure the continuous meeting of energy demands may have a social priority which far exceeds on a short-term basis, the gradual improvement in our total environment or the gradual development of energy resources. Because of the crisis aspects associated with this issue of continuity of energy supply, such Federal investments would certainly be justified even if the management responsibility for the development were predominantly in the private sector. I do not consider this to be in contradiction with a long-term Federal investment in improving the environment, even if this means some reduction in energy availability or increase in energy cost spread out over the future years. I present these examples as illustrations of cases where the short-term public interest goals and the long-term public interest goals may not be completely the same, but where the Federal role is similar both in stimulating and supporting the activities of the private sector and in meeting national objectives which are beyond the responsibility and capability of the individual elements of the private sector. It is necessary to keep in mind that the final implementation of any development of a technological nature applied to the energy systems rests in the hands of the private sector and utilities, and the management approach in all cases should accelerate their participation as early as possible.

The role of the Federal Government in managing research and development programs as distinct from financial support for such programs should really depend on the case-by-case analysis of the state of the art of the particular program under consideration, with reference to its position in the sequence of the development from the earlier stages of scientific feasibility through engineering development, small-scale demonstration, large-scale demonstration, and commercial prototype demonstration. It is clear that in the very large programs which require more extensive Federal financial support the role of Government in integrating and overviewing the total sequence is a continuous one. The Federal Government will always have the responsibility for assuring that the major technical contributions to the national energy systems are being expeditiously developed. However, the detailed management of the various phases of the program should shift from the Federal agencies concerned with the scientific feasibility of research and the early stages of development to the private industrial sector and eventually to the service industry as the approach to the commercial hardware and end use availability becomes clear.

Thus, the degree of Government participation in the management of a technical program with a specific mission should depend on the relative percentage of the total program which has already been accomplished. For example, in a program such as fusion, where the time required for eventual commercial development is very far ahead and the scientific feasibility stage is still the predominant issue, the Government should certainly maintain maximum management responsibility. However, in areas such as coal gasification and liquefaction, the technologies are very close to the pilot plant demonstration phases and the issues are not those of scientific feasibility or even of engineering feasibility, but rather of adequate demonstration of their reliability, economics, and commercial potential. In such areas the management responsibility should clearly be in the hands of the private sector, even though Federal participation in the funding of such programs may be a national need in order to accelerate the accomplishment of the end purpose.

Thus, in such program categories as nuclear reactor development, coal utilization, the transmission and distribution of electrical energy, one would expect the primary management responsibility for the R. & D. programs to be in the hands of the private sector, even though many of these programs may involve substantial financial contributions from the Federal Government. In such programs, the role of the Federal Government would be to insure, through an overview and continuous assessment of these programs, that the private sector is indeed achieving successfully the end purposes which are essential for the national good.

In such categories of programs as development of advanced conversion systems, such as high-temperature gas cycles, fuel cells, MHD, and solar energy

conversion, the technologies are a mixture of both scientific and demonstration experiments which require a balanced mixture of both Federal and private sector management. These advanced technologies must represent true collaborative efforts, although individual cases may result in various ratios of Federal and private management.

The role of the Federal Government as R. & D. managers will increase in certain areas of environmental research as described previously and certainly in such areas as represented by nuclear fusion. In many of these areas, the private sector may be performing the detailed tasks under Federal contracts, but the management planning and assessment of the overall program is likely to be the predominant responsibility of the Federal Government.

The first principal point of these illustrations is that the Federal Government management responsibility increases the closer the research program is to the early stages of scientific feasibility and initial demonstration. The second principal point is that the participation of the Federal Government in the financial aspects of the R. & D. programs should really be measured against the remaining risk involved in investment in such programs. The more such financial risks exceed the capabilities of the private sector to absorb, the greater should be the Federal financial participation. Because these two relationships are not always parallel, the management responsibility for specific R. & D. programs may not necessarily be in relation to the funding of such programs. Again, the basic criterion should be the overall social benefit in relation to the total national investment—both in consideration of success for eventual achievement of the end mission and the reduction in time to achieve such success.

It is interesting that without any detailed joint planning, the distribution of funds of the Electric Power Research Institute as representative of the primary concerns of the utility industry and the distribution of funds proposed in the various governmental R. & D. plans illustrate many of these points which I have just discussed. The following table gives this comparison in terms of the percentage of distribution of the annual funds tentatively planned by the Government and by EPRI.

ESTIMATED DISTRIBUTION OF EPRI AND FEDERAL FUNDS FOR ENERGY R. & D.

[In percent]

	EPRI, 1973–76	Federal 1975–79
Nuclear	27	45.0
Fossil fuel	27	11.0
Advanced technology	11	3.0
Fusion	4	27.0
Transmission and distribution	21	.3
Environment and conservation	3	10.0
System analysis and miscellaneous	7	3.7

Note: All areas have environmental goals.

It is of particular interest that in the area of transmission and distribution which is directly the responsibility of the utility industry, the percentage allocation by the industry of its research funds exceeds the percentage allocation of the Government. On the other hand, in an area such as fusion, the Government allocation of funds far exceeds on a percentage basis that considered appropriate by the utility industry. Without attempting to draw too fine a series of conclusions from such a gross comparison, it is of interest that the intuitive allocations of the Government and EPRI indicate a pragmatic application of the management and funding philosophies which I have discussed.

SUMMARY

I have attempted in this presentation to present some basic ideas on the rationale for relating Federal and private activity in energy R. & D. It is clear that the respective partnerships of these two groups will have to be custom tailored on a case-by-case basis so that the most effective use of our national resources is undertaken in each case. It is also clear that for the Federal Govern-

ment to have a knowledgeable overview of the activities in the energy field, such an agency as ERDA will require a minimum critical group in each of the major energy areas so as to competently assess the technological areas and to act as a knowledgeable liaison group with the private sector. In a similar fashion, the various centralized agencies of the private sector, such as the Electric Power Research Institute, should be knowledgeable and aware of those activities predominantly under Federal Government detailed management which relate to the responsibilities of the utility industry. In any event, the Federal Government, through its appropriately designated agency, in this specific proposed case ERDA, should be in a position to integrate the overall activities of the nation, evaluate the state of the art, and to review and comment on the national missions established for energy R. & D.

I am in complete agreement with the objectives of H.R. 11510, to establish an agency such as the proposed Energy Research and Development Administration. I feel it very important, however, that national planning include the already existent complex infrastructure of national capabilities in this field. Our problem is not that we don't have enough institutions for conducting research or enough hardware or laboratories for doing research, but rather that we have lacked coordinated programs supported on a continuous basis which would lead to the development of productive new devices and processes for energy production and utilization. I therefore believe that new Federal efforts to enhance the stature of the energy programs of the Nation should not be confined solely to the creation of new institutions. I urge that the program plan utilize all existing Government and private organizations which already have successful patterns of operation, and to encourage these with new substantial support. In this way we may avoid "reinventing the wheel."

As a recently organized agency of the utility industry, the Electric Power Research Institute and its staff recognizes the complexity and enormity of the national energy problems and welcomes the participation on an extended basis of the Federal Government in helping to solve these problems. We look forward to the opportunity to work in partnership with the proposed new Federal agency, as we are now planning to work with the existent energy groups in the various departments of our Federal Government. As I have indicated in this presentation, it appears to me that there is a balanced set of roles which an agency such as ERDA can fulfill in the national interest and which EPRI will complement in helping the electric utility industry deliver energy to the consumer. The energy research needs of our Nation are so vast and so important that I can only look forward with enthusiasm to the enhanced efforts which would be represented by the proposed new agency.

Biographical Sketch of Dr. Chauncey Starr

Dr. Chauncey Starr was appointed president of the Electric Power Research Institute on January 1, 1973. Starting in January 1967, and until his new appointment, he was the dean of the UCLA School of Engineering and Applied Science, following a 20-year industrial career, during which he served as vice-president of Rockwell International and as president of its Atomic International Division.

He received an electrical engineering degree in 1932 and a Ph. D. in physics in 1935, both from Rensselaer Polytechnic Institute in Troy, N.Y. He then became a research fellow in physics at Harvard University and worked with Nobelist P. W. Bridgman in the field of high pressures. From 1938 to 1941 Dr. Starr was a research associate at Massachusetts Institute of Technology in cryogenics.

He became associated with the Manhattan district in its early days at the radiation laboratory of the University of California at Berkeley, and subsequently at Oak Ridge. Following World War II, he pioneered in the development of nuclear propulsion for rockets and ramjets, in miniaturizing nuclear reactors for space and in developing atomic power electricity plants.

Dr. Starr is vice president of the National Academy of Engineering, a member of its committee on public engineering policy, and member of the Environmental Studies Board of the National Academy of Sciences—National Academy of Engineering. He is a founder and past president of the atomic industrial forum. He is also a member of the board of trustees of the Institute for Defense Analyses, and a member of the President's Task Force on Science Policy, U.S. Government, and is a member of the President's Energy R. & D. Advisory Council. He is a foreign member of the Royal Swedish Academy of Engineering Sciences.

ELECTRIC POWER RESEARCH INSTITUTE



"One of the great challenges of our time is that of matching energy production and utilization with progress . . . in harmony with nature."

The Electric Power Research Institute (EPRI) was formed in 1972, for the purpose of expanding electric energy research and development under the voluntary sponsorship of the nation's utility industry, public, private, and cooperative. Its goal is to develop a broad, coordinated, advanced technology program for improved electric power production, transmission, distribution, and utilization in an environmentally acceptable manner.

EPRI represents a major milestone in utility industry R and D cooperation and response to the electric energy problems we face today.

The primary areas of EPRI's research are nuclear power; fossil fuels and advanced systems; power transmission and distribution; and energy systems, environment, and conservation.

Headquarters are at 3412 Hillview Avenue in Palo Alto, California, near Stanford University.

HISTORY

The beginning of the EPRI concept can be traced to 1965, when the Electric Research Council (ERC) was organized to encourage all sectors of the utility industry to join in cooperative sponsorship of electric energy research. ERC brought together representatives of the Edison Electric Institute, the Tennessee Valley Authority, the American Public Power Association, the National Rural Electric Cooperative Association, and the U.S. Department of the Interior.

By the late 1960's the utility industry found itself caught between meeting increasing energy demands on the one hand and rapidly growing environmental concerns on the other. Diminishing gas and oil reserves and production and increasingly stringent environmental standards turned a potential energy problem into a reality. It became evident that a tremendous R and D challenge lay ahead for the rest of the century.

In the fall of 1969, ERC set up a special R and D Goals Task Force to establish a blueprint for utility industry research and development through the year 2000. The Task Force report, issued in 1971, was the most comprehensive study ever developed on electric utility R and D requirements. It called for total R and D expenditures by the utility industry, federal government, and electric equipment manufacturers averaging $1.12 billion annually for the balance of the century.

Concurrent with the study, ERC worked out details for an industry-wide organization to provide direction and support for this ambitious undertaking. The result was the Electric Power Research Institute which has

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succeeded the Electric Research Council, and absorbed the R and D programs of the Edison Electric Institute.

The ERC did an outstanding job of bringing all segments of the industry together to support research work. But its most important contribution was to lay the foundation for a strong national utility industry organization with authority, technical and administrative expertise, and greatly increased funding, to develop and coordinate industry-wide research.

The Electric Power Research Institute was incorporated in March, 1972. Its by-laws were approved by the Board of Directors in June, 1972, and Dr. Chauncey Starr became its president on January 1, 1973. Formerly dean of the School of Engineering and Applied Science, University of California at Los Angeles, Dr. Starr is one of the country's most distinguished and experienced leaders in energy development. He served as vice president for Rockwell International and president of its Atomic International Division during his 25-year industrial career prior to joining the UCLA faculty.

EPRI moved into its headquarters in Palo Alto in September, 1973. An office has also been established in Washington, D.C. to insure close coordination of EPRI research programs with parallel efforts of federal agencies such as the Office of Coal Research, the National Science Foundation, and the Atomic Energy Commission.

OBJECTIVES OF EPRI

Major objectives of the Electric Power Research Institute, as set forth in the Articles of Incorporation, include the following:

- To promote, engage in, conduct, and sponsor research and development for electricity production, transmission, distribution, and utilization and all activities directly or indirectly related thereto.
- To provide a medium through which investor-owned, government-owned, and cooperative-owned power producers and all other persons interested in the production, transmission, distribution, or utilization of electricity can sponsor electricity research and development for the public benefit.
- To discover, through study and research, ways to improve the production, transmission, distribution, and utilization of electric power, in order to insure the adequate power supply vital to the progress of the nation and the world community.
- To seek, through scientific research and development, solutions to the environmental problems related to the production, transmission, distribution, and utilization of electric power.
- To provide a medium for coordination and cooperation and for the exchange of information, among all organizations, public or private, concerned with electric power research and development.
- To develop, prepare, and disseminate information and data on scientific research and development activities in the field of electric power.

EPRI will not make operating decisions for the utility industry or for government bodies. Its mission is to focus our national utility R and D resources on continuously providing the technological options needed for ensuring that future electricity demands are met in a manner which best serves the overall public good.

FUNDING

EPRI is supported by all segments of the electric utility industry including investor-owned companies, publicly-owned agencies, rural cooperatives, the Tennessee Valley Authority, and the U.S. Department of the Interior. In most cases, investor-owned companies participate through the Edison Electric Institute, public-owned organizations through the American Public Power Association, and rural cooperatives through the National Rural Electric Cooperative Association.

As of October 1973, there were nearly 400 member organizations in the EPRI program. The formula for members' R and D contributions is equivalent to .5% of revenues in 1973, rising to 1% in several years. Over $60 million has been pledged for 1973 and $96 million for 1974. Included in this amount are funds for support of EPRI sponsored research projects, funds for the Liquid Metal Fast Breeder Reactor (LMFBR) Project, and local support funds. Approximately one-fifth of each member's funds may be earmarked locally for projects specially important to the individual member utility.

STAFF STRUCTURE

To carry out its mission, EPRI will require an in-house technical staff of approximately 200. About one-half of these people will be full-time EPRI employees, working on a permanent basis, and the other half will be on sabbatical leave, on post-Doctorate assignments, or on loan from outside organizations.

The supporting administrative organization will bring the total staff at EPRI headquarters to about 300.

The EPRI technical staff is composed of four divisions.

THE NUCLEAR POWER DIVISION is responsible for research projects in the areas of nuclear safety and analysis, engineering and operations, and nuclear materials.

THE FOSSIL FUEL AND ADVANCED SYSTEMS DIVISION promotes the development of new technology for using fossil fuels—particularly coal—in environmentally acceptable ways. This division is also in charge of developments related to conversion and storage systems and new energy sources, including fusion, solar, geothermal, magnetohydrodynamics, fuel cells, and other advanced systems.

THE ENERGY SYSTEMS, ENVIRONMENT AND CONSERVATION DIVISION is concerned with energy supply and demand studies, environmental considerations, energy conservation, and system planning and simulation.

THE TRANSMISSION AND DISTRIBUTION DIVISION handles projects including underground transmission, AC overhead and DC transmission system reliability, and development of better distribution systems.

The major responsibilities of these divisions are 1) to assist in determining the relative emphasis to be placed on research in the various fields over the short and long term, 2) to make recommendations on R and D projects under consideration for EPRI funding, 3) to closely monitor EPRI-sponsored research projects, and 4) to promote continuing coordination and communications with other research activities in their fields.

Initially, hardware research will take place where it can best be performed—in universities, manufacturers' facilities, or government laboratories—with close project management by EPRI staff. EPRI may also operate (and own) one-of-a-kind facilities that either exist now or may be built in the future. These will be located wherever both talent and existing facilities make the work most productive. EPRI facilities may develop into regional centers—each specializing in some nationally significant area of research. The Board of Directors has already authorized preliminary site studies in the eastern coal producing region for a programmatic center for fossil fuel research.

In addition to the technical divisions, there are also an administrative division and other functions such as planning and information services at EPRI headquarters.

As this unique and critical research effort gets underway, EPRI is seeking those highly qualified individuals essential to the success of the program.

Typical of the senior staff members already aboard, in addition to Dr. Starr, EPRI president, are:

Dr. Richard Balzhiser, *Director*, Fossil Fuels and Advanced Systems—formerly Assistant Director, White House Office of Science and Technology.

Mr. Milton Levenson, *Director*, Nuclear Power—previously Associate Director, Energy and Environment, Argonne National Laboratory.

Mr. David Saxe, *Director of Administration*—formerly Vice President—Business Management, Atomics International Division of Rockwell International Corporation.

Mr. Sam H. Schurr, *Director*, Energy Systems, Environment and Conservation—formerly Director of Energy and Mineral Resources, Resources for the Future, Inc.

Dr. George Hill, *Assistant Director*, Fossil Fuels—previously Director, Office of Coal Research, U.S. Department of the Interior.

Dr. Walter Loewenstein, *Assistant Director*, Nuclear Power—formerly Director of Applied Physics, Argonne National Laboratory.

Dr. Robert Loftness, *Director*, Washington, D.C. Office—previously Deputy Director for Technology, Office of Atomic Energy Affairs, U.S. Department of State.

RESEARCH PRIORITIES

The principal factor in determining R and D priorities is the very long lead time required for any new technology to have a significant impact on the ability of utility systems to provide electricity. Only near-term technologies, now in the demonstration phase, are likely to have much impact prior to 1985. Intermediate-term technologies that are of proven scientific feasibility but require further engineering development may be important between 1985 and 2000. Finally, there are the long-term projects whose scientific feasibility is still uncertain and which may not be significant until after 2000, if ever.

On this basis, the major near-term high priority technologies are those related to fossil fuel use, nuclear power, and transmission and distribution. Geothermal power is a developing technology, but with lesser near-term potential.

HIGHEST PRIORITY

Fossil fuel R and D which would lead to extensive use of all grades of coal and oil, under conditions which meet our national environmental objectives, are of the highest priority. Clarification of safety issues, particularly for light water (conventional) reactors, appears to be the most pressing near-term concern in the nuclear power field. Development of the fast breeder reactor, which would extend our uranium resources for hundreds of years, and development of the gas-cooled reactor are also of high importance.

Improvements in the transmission of electricity are also of near-term importance. The carrying capacity, efficiency, and esthetics of our transmission systems must be improved. EPRI and the manufacturers will closely coordinate their efforts in this area. Superconducting transmission lines appear to have exciting possibilities for the 1985 to 2000 period. EPRI will work closely with federal agencies in sponsoring this research.

POTENTIAL JUSTIFIES FUNDING

Intermediate-term R and D will have lesser priority than pressing near-term developments. However, because of their payoff possibilities, such technologies as fuel cells, high capacity storage batteries, solar energy conversion, magnetohydrodynamics, and novel topping and bottoming cycles all justify allocation of EPRI funds.

The classic example of long-term R and D, post-year 2000 payoff, is fusion—both the magnetic confinement and the laser-pellet concepts. These still have significant scientific uncertainties which make their feasibility difficult to assess at the present time. However, the eventual payoff for success is large and the national effort in fusion is justified because of the possibility of providing the post-2000 era with a near limitless energy option. Because of its complexity, fusion research may require a substantial and continuing investment for several decades before a tangible public benefit becomes evident.

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BOARD OF DIRECTORS

The 15-man EPRI Board of Directors is composed of representatives of the former Electric Research Council organizations.

Chairman of the Board is James E. Watson, *Manager of Power* for the Tennessee Valley Authority.

Vice Chairman is Shearon Harris, *President* and *Chairman of the Board* of Carolina Power and Light Company.

Other members of the Board are:

Robert F. Gilkeson, *Chairman of the Board*, Philadelphia Electric Company.

Robert W. Gillette, *Manager*, Public Utility District of Grant County, Washington.

Jack K. Horton, *Chairman of the Board*, Southern California Edison Company.

Charles F. Luce, *Chairman of the Board*, Consolidated Edison Company of New York, Inc.

William G. Meese, *President* and *Chief Executive Officer*, The Detroit Edison Company.

John N. McGurn, *Chairman of the Board*, Virginia Electric and Power Company.

Robert V. Phillips, *General Manager* and *Chief Engineer*, Los Angeles Department of Water and Power.

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Thomas C. Shirley, *Chairman*, Research and Technological Development Committee, National Rural Electric Cooperative Association.

Shermer L. Sibley, *Chairman of the Board* and *Chief Executive Officer*, Pacific Gas and Electric Company.

Lelan F. Sillin, Jr., *Chairman* and *President*, Northeast Utilities.

Stephen A. Wakefield, *Assistant Secretary for Energy and Minerals*, the U.S. Department of the Interior.

Frank M. Warren, *President*, Portland General Electric Company.

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Chairman HOLIFIELD. Thank you very much. I regret that we are under such forced time that we cannot go into great detail on some of the matters contained in your testimony, Dr. Starr, but knowing of your background and your work for so many years in full scale, large research and development projects of different kinds, we consider that your testimony before us is very valuable and we want to thank you for your appearance.

Mr. ROSENTHAL. Mr. Chairman, I have some questions.

Dr. Starr, I assume what you said is we are at an electrical energy crisis situation as of today. Is that correct?

Dr. STARR. Depending on how you define crisis, but in the sense of your question, the answer is, "Yes."

Mr. ROSENTHAL. I think you also stated that we had forewarnings of this sometime earlier, I think you said almost a decade ago, is that correct?

Dr. STARR. Yes.

Mr. ROSENTHAL. What has anybody done about the situation?

Dr. STARR. Well, there has been a lot of talking by people like myself and others in the energy field who have been analyzing the problem and pointing out that the pressures of growth in demand and shortages of supply, required long-range development and long-range planning. I guess the best and quickest answer to your question is that nobody was listening. Or that those who were listening, certainly were not in a position to take effective action.

Now, I might point out that the Joint Committee on Atomic Energy has been aware of this for some time and has, in many of its own position papers, indicated the fact that nuclear power was an essential addition to our energy resources, but I believe that as a public matter, this has not been generally recognized.

Mr. ROSENTHAL. In other words, no responsible governmental official took any action sufficient to the need?

Dr. STARR. No; I consider that statement an exaggeration.

Mr. ROSENTHAL. Well, even if it is an exaggeration, did anybody take any action?

Dr. STARR. Yes, many governmental agencies pushed hard to accelerate the development of nuclear power. Many Government agencies pushed hard to accelerate research in coal and oil and gas. But there is also much opposition to this. Some of the opposition is well-founded, some of the opposition is not so well-founded.

We have, in our Nation, a technical tradeoff, and I want to say technical, between a situation of energy affluence and a desire to make sure that in the affluent use of energy, we do not impose environmental damage on our society as a whole. Now, it is customary in our country for such tradeoffs not to be made on a technical basis but to be made in a public forum with much debate of a nontechnical kind.

Mr. ROSENTHAL. I think I understand that. During the past 10 years, were you aware of the fact that electrical utilities were still soliciting their customers to buy more appliances and use more electricity? And as of the last year or two, I know I saw in New York City where everybody was urged to get more toasters and washing machines. Why did they continue?

Dr. STARR. I am not going to defend the electric utilities for those particular advertisements, but I must point out that the electric utility

industry is very much like the Congress of the United States. It has a long time-constant for change. At a time when energy resources were not being limited by fuel supply; when, in fact, it appeared that there were ample resources to be had by everybody for any purpose; when, in fact, there was even an economic reason why the electric utilities would want to push for such things, they felt it appropriate. Among others, they also did not put a high priority on the kind of long-range warnings that were coming from people like myself and others.

Let me point out, however, that it is not a simple matter. Electric utilities also have a scale function, that is, the larger the electric utility system, the lower the unit cost, and given the motivations of any individual sector of the energy industry, it attempts to increase the scale of its services. In addition, the electrical industry faces a unique problem—you cannot, at present, store electricity. Because you cannot store it, you have huge electrical generating plants that are used fully only under peak demand circumstances. This means that when demand is off-peak, a portion of the capital investment, which is a consumer capital investment because he pays for it, is sitting idle with interest costs continuing. The electric utilities were trying to even out their loads and they were looking for such loads. If you get into the complexity of the problem, you find that the electrical utility industry was no worse nor better than most of the other major energy supply sectors of the country.

Mr. ROSENTHAL. Do you think that maybe we should consider nationalizing some of these resources if the Federal Government is going to spend billions of dollars in research?

Dr. STARR. Well, a good part of my paper, if you have occasion to read it, addresses itself to that specific question, because I think the one question not raised in this bill—but not appropriate for the bill—is the question of the relationship between the Federal Government and the huge infrastructure of the energy system in the country. Unlike NASA or the DOD, we are not creating something new. There is an enormous energy system in the country, most of it in private or utility hands—things like TVA and so forth. This infrastructure is already supplying the energy needs of the country and is now facing some major problems. The intervention of the Federal Government, I believe, is desirable, particularly in the sense of coordinating research and development and those actions necessary to bring together a consolidated national program in this field. We do not have that. I think it is essential for that purpose.

But to assume that centralizing the authority for operations of such energy systems in the Federal Government is going to improve anything is naive and incorrect, in my opinion. The fact is that we know from management studies of operations in the United States, that the more you decentralize responsibility under a plan that you understand, the more you are apt to get efficient service. And I think you know utility systems of the country are already regulated; they are already administered.

Mr. ROSENTHAL. Your answer to my question is what?

Dr. STARR. My answer to your question is, I do not think we ought to nationalize the energy industry of the United States.

Chairman HOLIFIELD. Mr. Horton?

Mr. HORTON. Mr. Chairman, I just want to thank Dr. Starr for coming.

I have read over your biography. You bring to the committee outstanding experience in and knowledge of this field. I think it is important to point out that the Electric Power Institute was established, according to this information you furnished, in 1972, and that you have been on board since the first of this year. This would indicate, at least as far as the research institute is concerned, that there was some advanced planning for research and development on a private level. In other words, you have not waited for the immediate crisis. The institute was established in an attempt to plan ahead.

I am also struck with the similarity between the staff structure of your institute and that contemplated under the ERDA bill. You do comment on that in your testimony. I want to acknowledge that that does indicate a sameness of direction for the ERDA and your institute, even though you developed your staff structure independently. Do you want to say anything specific about that?

Dr. STARR. Yes, I think the problem that the utility industry faced is somewhat similar to the problem the Nation faced and the problem to which this committee is addressing itself. As in the Nation, the utility industry is interested in every energy resource, because every energy resource can be converted into electricity. So it is important for the utility industry to be interested in all energy resources. The utility industry, I might say, recognized a long-range problem about a decade ago and started early steps to sponsor national programs on a joint basis. In 1965, they formed the Electric Research Council, which recruited all the private and publicly owned utilities in the country to stimulate this interest. The institute I now head is really a major expansion during the last year of this undertaking. But the utility industry was, like everyone else in the country, anticipating a long-range problem rather than the immediate crisis that we face as a result of the Near East situation.

The only difference in emphasis between our program and that being suggested by the legislation of this committee is that the utility industry is responsible for the delivery of electricity to the customer and the Federal Government is not. The Federal Government has an overview of this, but the Federal Government's primary interest and responsibility has been on the development of energy resources. So if you look at the mix of activities which are covered in this bill and the mix of activities covered in the program of our institute, you will find that our emphasis is on the conversion to electricity and the delivery of electricity from all energy sources, and the emphasis in this bill and in the Federal Government programs that actually exist is on the development of energy resources to make such conversion possible.

Mr. HORTON. One short question. What is the amount of funding that you have for the institute?

Dr. STARR. We are on a calendar year basis and for calendar year 1973, we have had pledges for $64 million. In 1974, our pledges are roughly going to be up to $100 million and they will probably increase

at about $25 million a year up to a level, I would guess, of between $200 and $300 million a year.

I might point out that this is a very small amount considering the national problem. I point out in the paper that the energy business of the United States is now 10 percent of our gross national product, $120 billion. If this were an advanced technology industry run by a major company, for example, which had advanced technology in mind, it would put in about $10 billion a year on research and development. That is 8 percent of the total gross sales. That is the average in the United States for the R. & D. component of advanced technology companies. We are not spending $10 billion a year in the United States, even if you add up everything that everybody is spending in the energy business. We are spending probably one-fifth that much. We are far from putting in the kind of effort that is needed.

The contribution that utilities are making to my institute is just a portion of what is needed nationally. We hope to use this as seed money and for starting things and getting things moving, simply because, as a small and private institution, we probably can move more flexibly and establish certain lead activities which might otherwise take a long time.

Mr. HORTON. Thank you very much.

Chairman HOLIFIELD. Mr. Fuqua?

EXTENT OF COORDINATION

Mr. FUQUA. Thank you, Mr. Chairman.

Dr. Starr, you have made a very fine statement. I think you get at the crux of the problem with which we are confronted.

In reviewing the bill that we have before us, H.R. 11510, do you think we go far enough in coordinating our research capability? I am thinking of the National Science Foundation now, the Bureau of Standards, NASA, and other agencies which are engaged in energy research. Could you elaborate on that?

Dr. STARR. Yes. I would like to make two comments about this, one political, in which I am not an expert—all the experts are sitting in front of me at the moment.

Mr. FUQUA. I am not sure about that.

Dr. STARR. To get a bill through Congress, it really ought to be one which does not have so many appendages that everybody starts shooting at it. This bill is a clean bill from my point of view, having watched Congress operate for 25 years. It has a clean message and a clean objective. I think it is more important to get something done initially than to have the perfect bill that never gets passed. With that sort of contributed thought, I would say that, basically, the other point you raise is easy to achieve. Nationally we miss a centralized planning and analytic function in the energy sector. We do not have it. And this bill provides that.

You are talking now, from my point of view, about operations—how do you get work done? It has been the experience, I think, of those people who watch the Federal Government work, that Federal agencies can be made to work together very effectively. I happen to know the

NASA operation rather intimately and I know there would be absolutely no difficulty in getting NASA to put its resources to work—just by request to such an agency.

The same holds true for the Department of Commerce's National Bureau of Standards. These people are as concerned with the national welfare as any other agency which has a specific responsibility. I think that the coordination of resources is an easier task administratively than it is to come out with an intelligent plan of what to do with the Nation's money. I think that is really what we need, and this bill provides a mechanism for that.

Mr. FUQUA. I appreciate your comment. I think it is very good. I hope that we will see interagency cooperation so that we can utilize the talents of the various agencies.

Dr. STARR. It is my understanding, sir, from a reading of the bill, that it does provide that.

Mr. FUQUA. Thank you, Mr. Chairman.

Chairman HOLIFIELD. May I comment on that?

Every resource, in my opinion, in every laboratory that is available should be channeled into this energy problem that is before the Nation. I think there is enough research and development work to be done that we will need every Government laboratory and there is adequate provision in this bill for the contracting of work to any laboratory, private or federally owned, that we have the money to use. The pace of research and development will, of course, be measured by the amount of funds available. But, certainly, the Atomic Energy Commission has over the 27 years of its existence probably done, I would say, 80 percent of its work, maybe more, by contracting with private industry. So there is adequate provision in the bill now for the utilization of any resource that is available.

Dr. STARR. I might point out parenthetically, Mr. Chairman, that the Government agencies that have been mentioned have all volunteered and are, in fact, actively cooperating with my institute in joint research and development programs. If they will work with me, I do not see why they would not work with a new Government agency.

Chairman HOLIFIELD. Thank you.

Mr. Mallary?

Mr. MALLARY. I have no questions.

Chairman HOLIFIELD. Mr. Moorhead?

Mr. MOORHEAD. Thank you, Mr. Chairman.

Thank you, Dr. Starr, for an excellent statement.

I would like to ask you, sir, on page 14 of your statement, where you refer to high temperature gas cycles, is that the same as high temperature gas reactors?

Dr. STARR. There is a great variety of high temperature gas cycles. One of these has to do with being able to use the combustion products in coal at a much higher temperature than we are now in a position to do technically. This raises the thermal efficiency of a powerplant. Another has to do with a high temperature gas cycle in nuclear reactors. The problems in all of these are very similar in that they require gas turbines and engineering equipment that can operate at these very high temperatures. I might point out to you that going from a 30-percent efficient powerplant to one of 40-percent or 50-percent ef-

ficiency makes an enormous change in the fuel required to produce the same amount of electricity. This is a point well recognized by the industry. These are not easy developments, however, and they do have many things in common. That is what is meant by this term.

ENERGY-ENVIRONMENT TRADEOFFS

Mr. MOORHEAD. So in a sense, though they keep producing electricity, they are not as far along as coal and oil?

Dr. STARR. No, sir; I think we have to recognize, and I have discussed that in the paper too, the time constant of development for getting any new concept into commercial use. Things start off by being a back-of-the-envelope idea by a group of scientists, then they become a laboratory bench-scale type of experiment. Then they become a pilot operation. Then they become a semiworks operation of partial scale to find out whether all the engineering problems have been considered. Then they become a full-scale demonstration.

When a utility builds powerplants in large numbers, it has to have some confidence in 20- to 30-year reliability of the plants. So this takes a long time—10, 20 years—depending on the state of the art. The only things we have now which can be expanded rapidly for meeting short-time energy use are nuclear and fossil fuels—coal, oil, and gas. Our problem is how to make that expansion and maintain the kind of environmental criteria or environmental objectives which, as a nation, we need to have.

I would like to point out, however, that in terms of priorities, it is much more drastic to be energy short than it is to have a less-than-perfect environment, and I know that this is a subject of great contention amongst the environmentalists.

If I may give you an analogy, it is much better to be alive and living on a bad diet than it is to have a balanced diet if that balanced diet, although perfect for your health, does not provide enough food to keep you alive. Your priorities are wrong. And I think that this is a situation we face right now.

The short-term goals of the Nation for the next 10 years are somewhat different than the long-term goals for the next 30 years in the energy field.

Mr. MOORHEAD. We will just be either freezing to death or choking to death?

Dr. STARR. I do not think it is a choice between choking to death or freezing to death. I hope in either case, we do not have to do either, but I think there is a difference between completely destroying the economy of the country on a short-term basis, having a real catastrophe, of which the best example I would consider is the depression of the 1930's, versus an impaired environment and an impaired atmosphere, which we also had in the 1930's and which was hardly a desirable long-term thing, but which, in fact, you could live with.

Now, I am not suggesting that we go whole hog and destroy the environment just to get more energy, but I think that in the tradeoff—and it is a tradeoff—between achieving a better environmental quality and achieving energy supply, one has to look very carefully to make sure that the priorities are weighted on preventing short-term crises in the economy and in the society.

POSITION OF MILITARY NUCLEAR RESEARCH

Mr. MOORHEAD. Now, please turn to page 8 of your statement. You discuss there the principal technical groupings of ERDA, the fifth of these being national security. Is it, in your opinion, important for the future success of ERDA that this fifth component of national security be included?

Dr. STARR. Well, I think that is an historical issue if, by national security, you are referring to the weapons program. I think I would leave this question with the committee. The Atomic Energy Commission has this under its jurisdiction now. It has worked very effectively. I guess in a perfect management chart, you would say this is a responsibility of the Department of Defense. Operationally, this program has done well so far under the AEC; one of the reasons having to do with the nature of the national laboratories concerned with this kind of research—Los Alamos and Livermore and the like—which by their nature are civilian rather than military in their format and have been successful in incorporating some of the best scientific and technical minds of the country. I think this is a happenstance which has worked out. I would leave it up to the committee whether they would want to disturb that.

Chairman HOLIFIELD. If my colleague would yield, I might say that we had a real battle in 1945 and 1946 as to whether the development of atomic energy should be in military hands over in the Defense Department or whether it should be in civilian hands. The outcome of that fight was that we put it in the hands of civilians. We drew heavily upon universities for scientific personnel, and we functioned as the Atomic Energy Act intended. Today, as a result, over half of the atomic energy budget goes to peacetime applications. There is very little left in the atomic energy laboratories that is classified. In the Joint Committee we have encouraged, as you know, Dr. Starr, the publication of all types of information except in a very narrow circle, and that would be how to make an atomic weapon, where they are stored, what they would do, the sizes, and things like that.

Dr. STARR. Yes.

Chairman HOLIFIELD. It has worked out very well. And we have now, as I said, over half of the budget going to peacetime applications as a result of civilian control.

Mr. HORTON. If the gentleman would yield, I also would point out that it has also worked well for the military. The Navy has, over the years, converted to nuclear energy. Many of the ships and submarines that are sailing today are nuclear powered. They are not depending on fossil fuel. So there has been an application for military purposes which is also to the good, it seems to me.

Dr. STARR. I think if one assumes that the military aspects of national security are of prime importance, and I make that assumption, I may say, I would also indicate that as a professional manager, one does not normally disturb a function which is doing very well. In this particular area and from a technical point of view, that particular function is doing very well. As I say, from an idealized organization chart, an idealized set of missions, there is no question that the Department of Defense has this responsibility.

Mr. MOORHEAD. Let me say to the chairman that I did not by my question mean to indicate any criticism of the past, but just, in view of the proposed changes, continue to explore.

Chairman HOLIFIELD. I realize that and by my comment I did not mean to criticize your question, because in that same division, we have international security considerations which involve international agreements for cooperation. They have all worked, as the gentleman knows, very well. The international aspects involve, of course, the inventory of nuclear materials which could be converted, if there was not adequate security, into weapons. We are dealing with international organizations like Euratom and other international groups in the field of peacetime production and utilization of material which, as I say, can be used for civilian purposes or, with certain changes, could be used for military purposes. So it is very vital that that type of security remain under the control of the people who have done a darn good job in handling it.

The gentleman would agree with that observation, would he not?

Dr. STARR. Yes; I would, sir. And the thought comes to mind that there is no hard line between technical development, the international relationships of these technical developments, and military security. There is a gray area and where the gray area is cut is really, I think, an administrative matter and a political matter within the Federal Government. As I said before, I would leave it up to the committee to decide what they do with this one. My only comment is that in my knowledge of the operations of Livermore and Los Alamos specifically, and the operations of the military in the nuclear weapons field, that this has gone very well. My first reaction, again as a professional technical manager, is keep hands off if it is doing all right.

Chairman HOLIFIELD. Thank you very much, Dr. Starr. I think the questions that have been asked are indicative of the members' interest and their appreciation of your presence here. Thank you very much.

Our next distinguished witness is Mr. John Simpson, who is appearing here today as vice chairman of Atomic Industrial Forum, Inc., which is a composite of all the people in the atomic energy business, you might say, both military and civilian.

Mr. Simpson, your title with Westinghouse is that of senior——

STATEMENT OF JOHN W. SIMPSON, VICE CHAIRMAN, ATOMIC INDUSTRIAL FORUM, INC.; ACCOMPANIED BY GEORGE L. GLEASON, VICE PRESIDENT

Mr. SIMPSON. President of the Westinghouse Power Systems Company.

Chairman HOLIFIELD. I had forgotten the exact title. I know that you are in charge of the power facilities of Westinghouse in all the States.

Proceed, please, with your summary.

Mr. SIMPSON. I am also president of the American Nuclear Society, but today I am speaking on behalf of the executive committee of the Atomic Industrial Forum, as vice chairman of the Atomic Industrial Forum.

Chairman HOLIFIELD. How many members do you have in that forum?

Mr. SIMPSON. There are about 600 corporate and institutional members. With me today is Mr. Gleason, vice president of the Atomic Industrial Forum.

Chairman HOLIFIELD. Will you furnish to the committee a background summary of your own experience?

Mr. SIMPSON. I will, indeed, sir. I am here to discuss the issues relevant to H.R. 11510, a bill introduced by the chairman and others to establish a new Energy Research and Development Administration (ERDA) and a Nuclear Energy Commission (NEC).

The Atomic Industrial Forum is a not-for-profit membership corporation organized in the State of New York. Its members comprise nearly 600 corporate and institutional members in the United States as well as in some 25 other countries, all of which share a common interest in the development and application of atomic energy for peaceful purposes.

H.R. 11510 contains a declaration that it is in the public interest that the licensing and regulatory functions of the Atomic Energy Commission should be separated from its other functions, which would be transferred to ERDA. These activities would be reconstituted in a Nuclear Energy Commission.

As AEC Director of Regulation, L. Manning Muntzing, stated before this committee when testifying on H.R. 9090 on July 31, there has been almost uniform agreement among those who have studied the problem that a separate regulatory commission for nuclear matters should be established at an appropriate time. We agree with this consensus and believe that the time for separating the Commission's regulatory and promotional functions is now at hand. Our conclusion in no way constitutes a reproof of the AEC for the manner in which it has carried out either its regulatory or promotional functions. As the chairman is well aware, during the early days of nuclear energy, the Commission was essentially the exclusive source of expertise for nuclear technology. It was quite logical and indeed necessary that as the technology was developed, the Commission should perform the research and establish the regulatory provisions required to insure its safety. The record has been an exemplary one.

As the nuclear industry has grown, the Commission has adjusted its internal organization to separate its regulatory and promotional functions and as Mr. Muntzing pointed out, they are now virtually the responsibilities of two separate agencies brought together at the level of the Commissioners.

Nevertheless, the Commission has been subjected to criticism for an organizational structure that is said to lend itself to a conflict of interest in nuclear plant licensing cases. We believe that this criticism is unjustified and would not of itself warrant sufficient ground for separating the principal functions now under the jurisdiction of the AEC.

We are mindful that there is a need for balanced decisionmaking in developing the regulatory framework for licensing nuclear power facilities. There is a danger that a separate Nuclear Energy Commission could become unduly conservative in establishing safety standards and require measures that are neither necessary nor desirable and that could impede the development of nuclear power as a principal energy source for the country. Forum groups have been critical in certain in-

stances in the past of what were considered to be overly conservative positions taken by the AEC's regulatory staff and we have had our share of complaints of what we have called ratcheting. Separation of the licensing and promotional functions could tend to exacerbate this situation. We wish to emphasize, therefore, the necessity that a balanced approach to regulatory decisionmaking be taken within and by the NEC.

The relationship of the Nuclear Energy Commission to ERDA will be an extremely important one. It is essential that the exchange of technical information between the two agencies be facilitated. It is also essential that new developments in reactor safety that come to light through the regulatory process be transmitted to ERDA so as to incorporate the best safety features into advanced reactor designs. While ERDA will bear the primary nuclear safety, research, and development responsibilities for advanced systems, as a minimum NEC should have a sufficient research and development capability under its own control so as to be able to discharge its responsibilities for independently validating safety margins where practicable. I might add at this point that the manufacturers and the utilities also bear a major responsibility for the safety of reactors. I do not believe that this independent NEC should have a major research and development facility but should temper it with only those that are really required.

Going on with the statement. There will undoubtedly be a need for continuous interaction among ERDA, NEC, private industry, and other Government agencies in the continuous ongoing evaluation of safety mechanisms being built into plants today and designed for those to be built in the future.

With respect to consolidating all energy research and development into a single administration and the prospect of significantly increasing the commitment to Federal research and development over present levels, we wish to underscore the importance we ascribe to maintaining a strong commitment to nuclear energy even while upgrading Federal research and development support for other energy technologies. We agree that increased research and development is needed for nonnuclear energy applications, but it should not be achieved at the expense of a reduction in nuclear energy research and development.

While we agree that the time is ripe to separate the Commission's regulatory functions, its impact on the ongoing licensing program must be carefully considered, particularly with respect to potential transitional problems, including the provision of adequate manpower. This is particularly urgent in view of the current energy crisis facing our Nation. Moreover, as the committee knows, the President, recognizing the substantial contribution which nuclear power can play in closing the gap between supply and demand, recently called on the AEC to reduce the long leadtimes for the licensing of nuclear powerplants. This will not be accomplished through mere reorganization, but the creation of the new Nuclear Energy Commission provides an appropriate occasion for instituting licensing reforms which would help to simplify licensing procedures and reduce delays in bringing these badly needed facilities on the line.

Chairman HOLIFIELD. Mr. Simpson, could I interrupt your statement at this moment to ask you this question.

Mr. SIMPSON. Certainly.

Chairman HOLIFIELD. Your company is engaged in building nuclear reactors in this country, and you are also building a number of them in Japan and other countries?

Mr. SIMPSON. That is right.

Chairman HOLIFIELD. Could you give us an idea of the time it takes to build a reactor in this country and in Japan?

Mr. SIMPSON. The reactors in Japan are built in less than 5 years. We built the reactors in Switzerland in between 4 and 5 years, we built the reactor in Spain in approximately 4 years. In the early days in the United States—that is, plants going on the line as recently as 1971, for example—the Robinson 2 plant of Carolina Power and Light at Hartsville, S.C., from order to on-line operation, was less than 5 years. So it is only within the last few years that the time has stretched out to such a long time in the United States.

Chairman HOLIFIELD. Well, how much time is it now taking you to build the same kind of plant you were building?

Mr. SIMPSON. It is now 9 years plus or minus a few years time depending on the given circumstances.

Chairman HOLIFIELD. In other words, from 5 to 8 or 9 years in order to build the same kind of plant in the United States as you are building in many other countries?

Mr. SIMPSON. That is correct, sir.

Chairman HOLIFIELD. And what is the reason for that?

Mr. SIMPSON. Well, there are many reasons. One, of course, is the regulatory problem where such things as permitting of the site clearing and site development work to be done in advance of a construction permit. There were fewer intervenors in the regulatory process in the early days.

Also, the manpower shortage in the construction trades has had a significantly—has been a difficulty that we have had to overcome and has not always been overcome. So it is a case of the labor problems and the regulatory problems and in facing the regulatory problems, the need for additional things for safety. We have had to do, sometimes, research and development or redesigns and backfit them into the plants, which took an inordinate amount of time. It would not take that long if we had rules that, if we followed, the plants could be built, almost no matter how restrictive they might be.

Chairman HOLIFIELD. You have been tied up in court by intervenor actions, injunctions, and that sort of thing many, many months?

Mr. SIMPSON. Many months.

Chairman HOLIFIELD. In fact, you have been tied up for years.

Mr. SIMPSON. Frequently it ends up that in the last analysis, it is a technical problem that holds the plant up. The technical problem that always, of the debugging variety that comes to light in the final phases of getting started. Had the licensing been done earlier, we would have faced that problem earlier and you would have had the plant on the

line sooner. So when you look back, it is very difficult to separate out the specific reasons why a plant has been late.

Chairman HOLIFIELD. But you do believe now that we are approaching a standard for reactors of a capacity of, let us say, between 1,000 and 1,200 megawatts—that we will now start standardizing these plants to the point where we can get them on the line quicker?

Mr. SIMPSON. I believe that standardization is essential, it is being done. Most of the major manufacturers have submitted to the Atomic Energy Commission standardized designs under various names. We see in the case of the standardized nuclear plants, so-called, that they intend to apply for licenses for six plants at one time. There are many other varieties of this. With the number of plants currently on the line and with the number of construction permits, it would seem to me that the time is ripe to reassess the regulatory process and in fact, probably have an impact statement of changes that are required for safety to show that the added safety is worth the cost in delay and in money.

Chairman HOLIFIELD. Of course, you are just as much interested in safety as anyone.

Mr. SIMPSON. Absolutely.

Chairman HOLIFIELD. As we all know who have been in this field of endeavor, we just cannot afford to have an unsafe nuclear plant. One unsafe nuclear plant would jeopardize hundreds of plants for the future. The general estimate is that by the year 2000, we will get at least 40 to 50 percent of our power from nuclear plants. Is that not a fair statement?

Mr. SIMPSON. I would put it somewhat higher, but that is a fair statement.

Chairman HOLIFIELD. That is a conservative estimate on my part.

Mr. SIMPSON. Yes.

Mr. FUQUA. Will the chairman yield at that point?

Chairman HOLIFIELD. Yes, I will.

Mr. FUQUA. Is that possible?

Mr. SIMPSON. Yes sir, that is possible. The first thing that is required is that it become a matter of national importance, a national purpose that we become self-sufficient, and the main way that this can be done is through nuclear power supplemented by coal. We can build essentially any number of plants to be on the line by 1985 or 1990 that this Nation requires. The manufacturing capability can be increased in the leadtimes that are required for the design and construction of the plants. So that we can get essentially any amount that is desired.

Mr. FUQUA. So it is an achievable goal?

Mr. SIMPSON. It is an achievable goal, yes, sir.

Chairman HOLIFIELD. And I might say that Westinghouse Co., is the lead contractor in the liquid metal fast breeder reactor, which has already been authorized, and the initial appropriations passed by the Congress. The construction of the LMFBR is now imminent on the TVA property close to Oak Ridge; and your company, along with General Electric and other companies, is going to share in building it. If we are successful, as we confidently believe we will be, we will get from a given amount of uranium anywhere from 75 to 100 times the heat that we now get out in the present water reactor plants.

Mr. SIMPSON. That is correct, sir, and that permits you to mine uranium in the less desirable ore bodies at a higher price or a higher cost and therefore extends considerably our quantity of uranium that can be used to produce energy, and the breeder is even more needed if we fill the gap in the interim with more of the light water reactors.

Chairman HOLIFIELD. Thank you very much.

Mr. SIMPSON. Incidentally, sir, I would like to point out that necessarily, speaking for the executive committee of the Atomic Industrial Forum in my prepared statement, when I answer questions outside of the prepared statement, I am speaking as an individual, not as the vice chairman of the Atomic Industrial Forum.

Chairman HOLIFIELD. We understand.

Mr. SIMPSON. The Nuclear Energy Commission must be provided adequate staffing and technical assistance in order to reduce the long license application processing time that the industry has been and continues to be experiencing. In this connection we have noted the statements of both Mr. Muntzing and Commissioner Doub that recent cuts by the Office of Management and Budget in the proposed regulatory staff budget could jeopardize plans for reducing the license processing time. This would be extremely unfortunate. Specifically, we are very much concerned that current efforts to implement faster reviews of standardized plants and systems could be curtailed due to inadequate manpower at the staff level.

We must also voice our concern over the possibility that the salutary move to identify generic issues and then hold rulemaking hearings on those issues separately from individual licensing hearings might also have to be curtailed by lack of manpower. Standardized plant reviews and hearings on generic issues are both essential to shortening licensing time. We strongly urge, therefore, that during the transition to the NEC the new Commission be given all the authority and all the support it requires to attract and retain the technical manpower necessary to carry out and to accelerate the existing initiatives for speeding up the licensing process.

As the chairman knows, the time required to obtain a license to construct or operate a nuclear powerplant has increased drastically over the last several years. If this time is to be reduced as the President has requested, substantial changes will need to be made in the licensing procedures. Important among these are restriction of the public hearing at the operating license stage as proposed by the AEC last year; elimination of mandatory review by the Advisory Committee on Reactor Safety of each application as proposed by the AEC several times in the past; and modification of the section 105(c) prelicensing antitrust review to permit issuance of a construction permit or operating license subject to completion of the antitrust review.

Consideration also needs to be given to the establishment of siting procedures which will provide for final approval of sites at an early stage and which will coordinate and consolidate the interests of Federal, State, and local agencies. Several bills are now pending before the Congress which seek to accomplish these objectives.

In addition, at the agency level, steps need to be taken to use existing authority to streamline staff review and simplify hearing and appeal

procedures. Commissioner Doub recently indicated that he favored reestablishment of procedures which, in certain circumstances, would permit construction to begin in advance of issuance of the construction permit. This would be a step in the right direction. Consideration should also be given to eliminating the Atomic Safety and Licensing Appeal Board in favor of appeal directly to the Commission. The Appeal Board was established by the Commission 2 years ago in an effort to insulate the Commissioners from potential charges of conflict of interest resulting from their dual responsibilities of regulating and promoting. Since NEC will only have the licensing function, it is appropriate to put the Commission back into the decisionmaking process. The licensing of nuclear powerplants involves important matters of public policy as well as technical considerations and the final licensing decision should be made by officials who have been appointed to administer the nuclear power program and who are sensitive to the broad public policy considerations which are involved.

While we believe it is important to consider licensing reforms such as those just mentioned as part of the reorganization of AEC, we are not suggesting that H.R. 11510 should be revised to cover them. However, these are clearly matters which require the immediate attention of the Congress, the Commission, and the industry. Accordingly, the chairman of the forum, on behalf of its entire board of directors, recently requested the Joint Committee on Atomic Energy to schedule hearings at the earliest possible date to review the whole licensing process, including new measures as well as the current process.

Chairman HOLIFIELD. I understand that these hearings will be held. This is a matter that will undoubtedly involve some changes in the Atomic Energy Act. In this particular bill, we are interested in the organizational aspect. We are divorcing the regulatory and licensing functions from what is now the present Atomic Energy Commission and setting them aside in a regulatory commission very much like the Federal Power Commission or the Federal Trade Commission, which has worked well over the years. Much as we may find occasions to criticize them, nevertheless, regulatory commissions are a functioning, recognized process in our Government, which we are going to make possible in this case by spinning off the regulatory and licensing functions in a completely independent commission.

Mr. SIMPSON. Fine.

We believe a record of testimony from expert industry and Government witnesses would help to pinpoint licensing pitfalls and thereby move rapidly toward meeting the President's goal.

We also are mindful of the President's charge to Commissioner Doub and his interagency study group to review the total regulatory structure for the energy industry in this country.

H.R. 11510 is similar to H.R. 9090, the administration-sponsored energy reorganization bill, insofar as it establishes ERDA and NEC. However, at least with respect to NEC, we believe H.R. 11510 embodies a preferable approach since it spells out more precisely the responsibilities of NEC in two important areas; namely, the provision of research services required to support its licensing and regulatory functions and the provision for NEC licensing of certain ERDA facili-

ties. The research provisions should help to assure that the Commission will have at its disposal the technical support which it needs to assess independently the design and safety features of nuclear facilities; however, this is an important enough matter that the committee's report should specifically encourage close liaison and cooperation between ERDA and NEC. The provision for NEC licensing of certain ERDA-sponsored demonstration projects will help to assure the licensability of these facilities when they become technically and commercially viable, as well as facilitate the exchange of technical information between the agencies.

There are two provisions of the bill upon which I would like to comment. Section 102(c) establishes five Assistant Administrators in ERDA and delineates the specific areas of their responsibility. While I agree that the bill should assure that each of the energy sources receives appropriate attention, it would be preferable to leave the organizational structure by which this is accomplished to the Administrator. Section 103(5) describes the functions of the Administrator to include assessing the state of both public and private research and development and correlating ERDA's research with them.

Chairman HOLIFIELD. Let me assure the witness that he is exactly right, that this does not intend to change the existing laws, and that this section is under study.

Mr. SIMPSON. Fine.

Chairman HOLIFIELD. It will be clarified, in my opinion, to the point that it will accomplish just exactly the goal that the committee wants and which you want, which is not to have someone interfering with existing laws in regard to security information and in regard to proprietary information and so-called trade secrets and that sort of thing. We are not trying to cover that field in this bill. This is an organization bill, and we have looked at (5) on page 7 and we are in agreement, I think, that it will have some clarification. We would welcome your submission of any thought that you may have before the final markup.

Mr. SIMPSON. Fine. I will omit the rest of that sentence then, Mr. Chairman.

In conclusion, the executive committee of the Atomic Industrial Forum supports the objectives of H.R. 11510. We endorse the establishment of the Energy Research and Development Administration and the Nuclear Energy Commission. The establishment of these organizations will help the nuclear power industry provide a larger share of our Nation's needed energy supplies more rapidly and so assist in alleviating the energy crisis we are now facing.

[Mr. Simpson's biographical sketch and prepared statement follow:]

BIOGRAPHICAL SKETCH OF JOHN W. SIMPSON

John W. Simpson, president of Westinghouse Electric Corp., power systems organization, holds a unique distinction in the development of the atom as a source of energy for mankind.

As one national magazine phrased it: "* * * for all his devotion to practicality, John Simpson has done much more than ordinary engineering. He has done as much as any single man to bring to birth the age of atomic power."

No other engineer or scientist is believed to have made as significant contributions as Mr. Simpson to all three pioneering applications of nuclear theory—to marine propulsion, to electric power generation, and to space propulsion.

Mr. Simpson was in charge for Westinghouse of the design and construction of the nuclear propulsion plant for the U.S.S. *Nautilus*, the world's first atomic submarine.

He headed the team that designed and built the pressurized water reactor for the Nation's first full scale nuclear powerplant, in operation at Shippingport, Pa.

And he launched the Westinghouse research and development work, which is still continuing, to develop a nuclear rocket engine for powering manned spaceships to other planets.

The extent to which he influenced the transition from scientific discovery to practical application in all three areas is to a substantial degree responsible for the eminence of the United States in the atomic energy field today.

Mr. Simpson was named president, power systems, in January 1969. He is in charge of the engineering, production, and marketing of a wide range of electrical equipment for the utility industry and other heavy industrial and construction applications.

He thus has witnessed firsthand the growth of nuclear power that was spurred by the pioneering efforts at Shippingport.

Born September 25, 1914, in Glenn Springs, S.C., Mr. Simpson was graduated from the U.S. Naval Academy with a bachelor of science degree in engineering. He joined Westinghouse in 1937 and, by studying during his free time, earned a master's degree in electrical engineering from the University of Pittsburgh in 1941.

He held various positions in the switchgear division at East Pittsburgh, Pa., between 1938 and 1949, and was instrumental in assuring that Westinghouse-supplied electrical switchboards and related equipment survived the extreme shocks and impacts aboard Navy vessels during World War II.

In 1946, he was granted a 2-year leave of absence by Westinghouse to work at Oak Ridge National Laboratory with a select group of engineers and scientists on a design concept that was the basis for the first attempt to apply nuclear energy to the controlled generation of power.

Returning to Westinghouse, Mr. Simpson, in 1949, was named assistant manager of engineering for the Bettis Atomic Power Laboratory, operated by the company for the Atomic Energy Commission.

It was at Bettis that the nuclear propulsion plants were designed and built under U.S. Government contracts for the U.S.S. *George Washington*, the first Polaris-carrying nuclear submarine, and the U.S.S. *Long Beach* and *Enterprise*, the first nuclear surface ships, as well as for the *Nautilus*.

Mr. Simpson became assistant general manager at Bettis in 1952.

Two years later, Westinghouse received a contract from the Atomic Energy Commission for the Shippingport nuclear reactor project, and Mr. Simpson was tapped as manager of the project. In 1955, with the Shippingport project well underway, he was named general manager of the Bettis Laboratory. He was elected a Westinghouse vice president in 1958.

Mr. Simpson was appointed general manager of the company's newly formed atomic power divisions a year later, with the assignment of developing the company's then modest commercial nuclear powerplant activities.

To get Westinghouse into the space reactor field, he also organized the company's astronuclear laboratory, which holds the first industrial contract for development of a reactor for nuclear rocket propulsion under the Government's NERVA program.

By 1962, the commercial nuclear power activities and the space reactor programs were proceeding smoothly, and Mr. Simpson was promoted to Westinghouse vice president for engineering and research.

He was named vice president, electric utility group, in 1963, and today is responsible for the activities of 18 major divisions that comprise the power systems organization, one of four companylike units that make up Westinghouse.

Mr. Simpson received the Westinghouse Order of Merit—the highest award the company makes to employees—for "his outstanding work in meeting the needs of the U.S. Navy for switchboards during World War II; for his talented contribution to the technical organization of the atomic power division; for his coordination and prosecution of the manifold technical details connected with the design and construction of the first submarine atomic powerplant."

Mr. Simpson was named Pittsburgh's "Man of the Year in Engineering" by the Pittsburgh Jaycees in January 1963, and was elected to the National Academy of Engineering in April 1966. A member of the board of governors of the Na-

tional Electric Manufacturers Association, he also serves as chairman of NEMA's power equipment division.

He is president of the American Nuclear Society and has served on its board of directors, on its executive committee, and as chairman of its finance committee. He is also vice chairman of the Atomic Industrial Forum and a member of its board of directors. He also is a fellow of the Institute of Electrical and Electronics Engineers and a member of the American Society of Mechanical Engineers and recipient of its Research Metal Award; and the Society of Naval Architects and Marine Engineering.

He married the former Esther Slattery in 1948. They reside in Upper St. Clair, Pa., a Pittsburgh suburb, and have four children.

PREPARED STATEMENT OF JOHN W. SIMPSON, VICE CHAIRMAN, ATOMIC INDUSTRIAL FORUM, INC.

Mr. Chairman, and members of the committee, I am pleased to be here today on behalf of the executive committee of the Atomic Industrial Forum, Inc., to discuss issues relevant to H.R. 11510, a bill introduced by the chairman and others to establish a new Energy Research and Development Administration (ERDA) and a Nuclear Energy Commission (NEC).

The Atomic Industrial Forum is a not-for-profit membership corporation organized in the State of New York. Its members comprise nearly 600 corporate and institutional members in the United States as well as in some 25 other countries, all of which share a common interest in the development and application of atomic energy for peaceful purposes. Because of the diversity of its members, which include utilities (both public and investor-owned), manufacturing companies, engineer-constructors, mining and milling companies, universities, labor unions, professional firms, financial institutions, government organizations, and other profit and nonprofit entities, the Forum, as a matter of policy, does not take positions on matters pending before the Congress. However, when possible, we do make an effort to identify relevant technical, legal and policy considerations and to provide a mechanism for determining and articulating the views of our various members.

H.R. 11510 contains a declaration that it is in the public interest that the licensing and regulatory functions of the Atomic Energy Commission should be separated from its other functions, which would be transferred to ERDA. These activities would be reconstituted in a Nuclear Energy Commission.

As AEC Director of Regulations, L. Manning Muntzing, stated before this committee when testifying on H.R. 9090 on July 31, there has been almost uniform agreement among those who have studied the problem that a separate regulatory commission for nuclear matters should be established at an appropriate time. We agree with this consensus and believe that the time for separating the Commission's regulatory and promotional functions is now at hand. Our conclusion in no way constitutes a reproof of the AEC for the manner in which it has carried out either its regulatory or promotional functions. As the chairman is well aware, during the early days of nuclear energy, the Commission was essentially the exclusive source of expertise for nuclear technology. It was quite logical and indeed necessary that as the technology was developed, the Commission should perform the research and establish the regulatory provisions required to insure its safety. The record has been an exemplary one.

As the nuclear industry has grown, the Commission has adjusted its internal organization to separate its regulatory and promotional functions and as Mr. Muntzing pointed out, they are now virtually the responsibilities of two separate agencies brought together at the level of the Commissioners.

Nevertheless, the Commission has been subjected to criticism for an organizational structure that is said to lend itself to a conflict of interest in nuclear plant licensing cases. We believe that this criticism is unjustified and would not of itself warrant sufficient ground for separating the principal functions now under the jurisdiction of the AEC.

We are mindful that there is a need for balanced decisionmaking in developing the regulatory framework for licensing nuclear power facilities. There is a danger that a separate Nuclear Energy Commission could become unduly conservative in establishing safety standards and require measures that are neither necessary

nor desirable and that could impede the development of nuclear power as a principal energy source for the country. Forum groups have been critical in certain instances in the past of what were considered to be overly conservative positions taken by the AEC's regulatory staff and we have had our share of complaints of what we have called ratcheting and the imposition of unnecessary and redundant safety features at each stage of the licensing and construction process. Separation of the licensing and promotional functions could tend to exacerbate this situation. We wish to emphasize, therefore, the necessity that a balanced approach to regulatory decisionmaking be taken within and by the NEC.

The relationship of the Nuclear Energy Commission to ERDA will be an extremely important one. It is essential that the exchange of technical information between the two agencies be facilitated. It is also essential that new developments in reactor safety that come to light through the regulatory process be transmitted to ERDA so as to incorporate the best safety features into advanced reactor designs. While ERDA will bear the primary nuclear safety, research, and development responsibilities for advanced systems, as a minimum NEC should have a sufficient research and development capability under its own control so as to be able to discharge its responsibilities for independently validating safety margins. There will undoubtedly be a need for continuous interaction among ERDA, NEC, private industry, and other Government agencies in the continuous ongoing evaluation of safety mechanisms being built into plants today and designed for those to be built in the future.

With respect to consolidating all energy research and development into a single administration and the prospect of significantly increasing the commitment to Federal research and development over present levels, we wish to underscore the importance we ascribe to maintaining a strong commitment to nuclear energy even while upgrading Federal research and development support for other energy technologies. We agree that increased research and development is needed for nonnuclear energy applications, but it should not be achieved at the expense of a reduction in nuclear energy research and development.

While we agree that the time is ripe to separate the Commission's regulatory functions, its impact on the ongoing licensing program must be carefully considered, particularly with respect to potential transitional problems, including the provision of adequate manpower. This is particularly urgent in view of the current energy crisis facing our Nation. Moreover, as the committee knows, the President, recognizing the substantial contribution which nuclear power can play in closing the gap between supply and demand, recently called on the AEC to reduce the long-lead-times for the licensing of nuclear powerplants. This will not be accomplished through mere reorganization, but the creation of the new Nuclear Energy Commission provides an appropriate occasion for instituting licensing reforms which would help to simplify licensing procedures and reduce delays in bringing these badly needed facilities on the line.

The Nuclear Energy Commission must be provided adequate staffing and technical assistance in order to reduce the long license application processing time that the industry has been and continues to be experiencing. In this connection we have noted the statements of both Mr. Muntzing and Commissioner Doub that recent cuts by the Office of Management and Budget in the proposed regulatory staff budget could jeopardize plans for reducing the license processing time. This would be extremely unfortunate. Specifically, we are very much concerned that current efforts to implement faster reviews of standardized plants and systems could be curtailed due to inadequate manpower at the staff level.

We must also voice our concern over the possibility that the salutary move to identify generic issues and then hold rulemaking hearings on those issues separately from individual licensing hearings might also have to be curtailed by lack of manpower. Standardized plant reviews and hearings on generic issues are both essential to shortening licensing time. We strongly urge, therefore, that during the transition to the Nuclear Energy Commission, the new Commission be given all the authority and all the support it requires to attract and retain the technical manpower necessary to carry out and to accelerate the existing initiatives for speeding up the licensing process.

As the chairman knows, the time required to obtain a license to construct or operate a nuclear powerplant has increased drastically over the last several years with current estimates running 9 to 10 years. If this time is to be reduced

as the President has requested, substantial changes will need to be made in the licensing procedures. Important among these are restriction of the public hearing at the operating license stage as proposed by the AEC last year; elimination of mandatory review by the Advisory Committee on Reactor Safety of each application as proposed by the AEC several times in the past; and modification of the section 105(c) prelicensing antitrust review to permit issuance of a construction permit or operating license subject to completion of the antitrust review.

Consideration also needs to be given to the establishment of siting procedures which will provide for final approval of sites at an early stage and which will coordinate and consolidate the interests of Federal, State, and local agencies. Several bills are now pending before the Congress which seek to accomplish these objectives.

In addition, at the agency level, steps need to be taken to use existing authority to streamline staff review and simplify hearing and appeal procedures. Commissioner Doub recently indicated that he favored reestablishment of procedures which, in certain circumstances, would permit construction to begin in advance of issuance of the construction permit. This would be a step in the right direction. Consideration should also be given to eliminating the Atomic Safety and Licensing Appeal Board in favor of appeal directly to the Commission. The Appeal Board was established by the Commission 2 years ago in an effort to insulate the Commissioners from potential charges of conflict of interest resulting from their dual responsibilities of regulating and promoting. Since NEC will only have the licensing function, it is appropriate to put the Commission back into the decisionmaking process. The licensing of nuclear powerplants involves important matters of public policy as well as technical considerations, and the final licensing decision should be made by officials who have been appointed to administer the nuclear power program and who are sensitive to the broad public policy considerations which are involved.

While we believe it is important to consider licensing reforms such as those just mentioned as part of the reorganization of AEC, we are not suggesting that H.R. 11510 should be revised to cover them. However, these are clearly matters which require the immediate attention of the Congress, the Commission, and the industry. Accordingly, the chairman of the forum, on behalf of its entire board of directors, recently requested the Joint Committee on Atomic Energy to schedule hearings at the earliest possible date to review the whole licensing process, including new measures as well as the current process. We believe a record of testimony from expert industry and Government witnesses would help to pinpoint licensing pitfalls and thereby move rapidly toward meeting the President's goal. We would urge this committee to encourage the holding of such hearings as a parallel to the reorganization initiative you have taken.

We also are mindful of the President's charge to Commissioner Doub and his interagency study group to review the total regulatory structure for the energy industry in this country with a view to improving energy regulation so as to assure that our energy needs will be reasonably, responsibly, and expeditiously met. While we do not believe that separation of the Commission's regulatory function need be deferred until the completion of Commissioner Doub's review, it is essential that the direction and preliminary results of this study be kept in constant view so that its effect on the establishment of NEC can be promptly taken into account and so that the transition from the present system to what is hopefully an improved and more responsive system can be managed with the least disruption and delay.

H.R. 11510 is similar to H.R. 9090, the administration-sponsored energy reorganization bill, insofar as it establishes ERDA and NEC. However, at least with respect to NEC, we believe H.R. 11510 embodies a preferable approach since it spells out more precisely the responsibilities of NEC in two important areas; namely, the provision of research services required to support its licensing and regulatory functions, and the provision for NEC licensing of certain ERDA facilities. The research provisions should help to assure that the Commission will have at its disposal the technical support which it needs to assess independently the design and safety features of nuclear facilities; however, this is an important enough matter that the committee's report should specifically encourage close liaison and cooperation between ERDA and NEC. The provision for NEC licensing of certain ERDA-sponsored demonstration projects will help to assure the

licensability of these facilities when they become technically and commercially viable, as well as facilitate the exchange of technical information between the agencies.

There are two provisions of the bill upon which I would like to comment. Section 102(c) establishes five Assistant Administrators in ERDA and delineates the specific areas of their responsibility. While I agree that the bill should assure that each of the energy sources receives appropriate attention, it would be preferable to leave the organizational structure by which this is accomplished to the Administrator. Section 103(5) describes the functions of the Administrator to include assessing the state of both public and private research and development, and correlating ERDA's research with them. It does not appear that this is intended to give the Administrator any jurisdiction over proprietary information in the private sector, but to avoid any doubts in this regard, an explanatory statement might be included in the committee report.

In conclusion, the executive committee of the Atomic Industrial Forum supports the objectives of H.R. 11510. We endorse the establishment of the Energy Research and Development Administration and the Nuclear Energy Commission. The establishment of these organizations will help the nuclear power industry provide a larger share of our Nation's needed energy supplies more rapidly and so assist in alleviating the energy crisis we are now facing.

Chairman HOLIFIELD. I want to thank you very much for your presentation here this morning.

Mr. Horton, do you have any questions?

Mr. HORTON. Mr. Chairman, I do not have any questions. I, too, want to thank Mr. Simpson for his testimony. It is very valuable testimony.

Chairman HOLIFIELD. Mr. Moorhead?

Mr. MOORHEAD. I do not have any questions. I just want to welcome Mr. Simpson from Westinghouse, which is in my congressional district.

Chairman HOLIFIELD. Mr. Mallary?

FUNCTIONS OF ERDA AND NEC

Mr. MALLARY. To what extent do you think there will have to be redundance of staff between ERDA and the Nuclear Energy Commission? Can the NEC licensing functions be properly performed without undue reliance upon personnel of other agencies if there is not some redundancy? Do you think there will be a major problem here?

Mr. SIMPSON. There is always a problem when an organization is separated because you have to carry on many things where court processes which were already started under the old organization may well have to be carried out under the old organization. Some people might have some time before they could transfer to the new organization. I believe it is a problem, but a manageable problem. I do not believe that it necessarily will involve a larger staff than this otherwise would be even in the transition.

Mr. MALLARY. Thank you.

Thank you very much.

Chairman HOLIFIELD. I might comment on that. As I understand it, there are about 600 or 700 people now working in the AEC licensing and regulatory division, and it is contemplated that those same people will continue in the NEC. We are going to do the best we can to have a continuity of service and function without the long leadtime which would be necessary in setting up a completely new organization. These people have been working for years and years in this function; they

are familiar with it and the transitional period will be worked out, I am sure, administratively. If there is anything in this bill that would preclude the working out of the transition from the one agency to the other, we can solve it, I am sure.

Mr. SIMPSON. I would hesitate to mention this except I have such a high regard for the expertise of some of the lawyers in the regulatory hearing process, but there is likely to be grounds found for a court challenge of things during the transition from one to the other that would not have otherwise occurred.

Chairman HOLIFIELD. We can take care of that by language in the bill which will continue to preserve the legal situation. Our attorneys tell us that this can be done and it will be done.

Mr. SIMPSON. Fine.

Chairman HOLIFIELD. My staff informs me that there are a number of provisions in the bill that go directly to preserve the status of ongoing litigation of all types.

Mr. SIMPSON. I have confidence in your staff lawyers as well as in the environmental lawyers.

Chairman HOLIFIELD. We have had lawyers working on this from the Atomic Energy Commission, the Joint Committee, the legal staff of this committee, the Interior Department, the Office of Management and Budget, and the Antitrust Division of the Department of Justice, all sitting around the table. And if you think it is fun to preside over about 12 or 13 lawyers and try to resolve something, try it sometime. But we did work it out.

Thank you very much for your testimony, Mr. Simpson.

Now we are going to have another distinguished gentleman as our next witness, Mr. Carl Bagge of the National Coal Association.

Mr. Bagge, we want to welcome you to the committee. Some of us have had a chance to read your statement, and we want you to summarize it without omitting important parts of it. I want to state, as I have stated many times in public, that the greatest source of energy that we have on this continent is coal. All of the studies indicate that it will be a most vital source of energy for the next 30 years and for decades and possibly generations to come, because nature has endowed us with such a plentiful supply of coal. Being aware of its vital necessity to support the standard of living and the industrial production of this Nation, this committee is going to give every consideration to that particular area of research and development. As our oil supplies go down and we have to import more oil, and our gas supplies go down, and all predictions are that they will go down, we will need to rely upon coal. Your testimony is going to be very valuable to this committee.

STATEMENT OF CARL E. BAGGE, PRESIDENT, NATIONAL COAL ASSOCIATION; ACCOMPANIED BY JOSEPH P. BRENNAN, VICE PRESIDENT, PLANNING; AND JOSEPH W. MULLAN, VICE PRESIDENT, GOVERNMENT RELATIONS

Mr. BAGGE. Mr. Chairman, thank you very much for those comments. I might say that the American coal industry welcomes this very fine statement that you have made regarding the role we can play.

I would like, if I may, Mr. Chairman, to say that I am accompanied here by Mr. Joe Brennan on my right, the vice president of economics and planning for the National Coal Association; and Mr. Joe Mullan, who is vice president of government relations and environmental affairs.

I will attempt to summarize my statement. Because this is such an important thing to the coal industry, as you know, Mr. Chairman——

Chairman HOLIFIELD. I do not want you to cut your testimony any shorter than is necessary. It is a good statement and it will all be in the record. But it is 30 pages.

Mr. BAGGE. I will attempt to highlight it. It is a long statement.

Research and development is one obvious key to the future of coal in the United States. It is obvious that the technological base for coal extraction, distribution, conversion, and consumption must be sound and expanding if America's energy needs are to be satisfied. It is also tragically apparent that the past neglect of research in coal is one major reason for our current technological inadequacies which compound the energy crisis.

Equally important over the long run, and perhaps more crucial in the short term, are those governmental restraints which now inhibit the coal industry's ability to produce and market its product efficiently. For example, price controls even now interfere with the rapid expansion of coal production. Air pollution regulations rule out the use of much available high-sulfur coal, coal which is sorely needed in an energy-short America and which must be mined and burned if we are to avoid an even greater crisis than we now have. Governmental policies relating to the coal leases in the West and exploration permits on western public lands have halted plans to expand the industry into some of the world's richest energy reserves.

In both the short run and the long run, therefore, we need governmental policies which help coal to meet the demands of a rapidly growing and energy-intensive society. We need a soundly conceived governmental framework within which the coal delivery system—the whole complex of coal mining, transportation and use—can operate effectively and efficiently. This is necessary if we are to produce the vast quantities of coal which America will require to achieve energy self-sufficiency.

Research and development are a part of that system. But they are by their very nature lengthy processes. Pressing ahead with coal R. & D. now is essential—it should have started long ago. However, it will have little immediate effect in terms of added production or energy supply.

On the other hand, much can be done now in such areas as environmental control, price regulation, surface mining legislation, and the tax structure to insure the orderly expansion of coal capacity so that the technologies which we are now beginning to develop at an accelerated pace will do the Nation the most good.

These comments are not intended to denigrate the place of research and development. They are intended, however, to place it in proper perspective. In short, we must not become mesmerized by the potential for coal R. & D. and neglect the urgent need of the American coal industry to survive and to grow. Today this is the real issue—the issue

which is central to our continuation as a major industrial power capable of maintaining our historic commitment to human dignity and to world peace.

It is in this context—the context of energy self-sufficiency for industrial America—that we wish to discuss the research and development needs of the coal industry over the remainder of this century. In my prepared text on page 3, we have a discussion there of the coal research record. I might say just very briefly that the Federal Government has had a sad record of support or nonsupport for coal research and development. Attached to our formal statement as an exhibit is a listing of the funding of the Office of Coal Research for the past 10 years. It is interesting to note that only in the past year or two has the OCR budget begun to reach effective levels. Prior to that time, moneys allocated to OCR were so minuscule that the program of the agency could never be pursued as logic and experimental results would dictate.

On pages 3, 4, 5, and 6, we go on and try to demonstrate how, because of lack of funding, very vital projects which were brought up to the point where they could have been demonstrated simply were not demonstrated because of the lack of such funding. What is needed, a need which is acutely felt by you, Mr. Chairman, and your colleagues and sponsors of H.R. 11510, is a sharp reversal of our past record on coal research and development. We must have a determined and accelerated program to provide a sound technological base for coal expansion. We must make up for the inaction of the past and move rapidly to meet the contingencies of the future.

This is a time for forging those institutions which will meet America's future energy needs. We regard ERDA as an organization which will do that forging of those institutions. To do so, we must learn from our past but more importantly, we must be prepared to forgo ingrained tradition in order to fashion those instruments which will be responsive to the future and not merely mirrors of the past. The challenges ahead will require new thinking, new institutions, and a new governmental response to the questions posed by research and development. We in the American coal industry, Mr. Chairman, believe that H.R. 11510 is one constructive approach toward fashioning a national research and development institution capable of meeting the challenges of the 1970's and 1980's and beyond.

At page 7, Mr. Chairman, going into pages 8 and 9 and 10, is a discussion of the research policy. Let me just say that the sponsors of H.R. 11510 have set forth a clearly defined goal for energy research and development. I won't read the words, they are set forth here. But let me say that we would only suggest that there should be added a timeframe within which energy self-sufficiency, or at least the capability for energy self-sufficiency, should be attained.

We would also suggest two other goals which should be incorporated into the legislation.

STATEMENT OF GOALS

Chairman HOLIFIELD. You are not suggesting that a timeframe be put into the statute but rather into the report?

Mr. BAGGE. We would suggest, at least we respectfully suggest, Mr. Chairman, that if our goal is indeed energy self-sufficiency, we try to

define that in order to say as a matter of national policy, we want to attain the capability for self-sufficiency within a defined timeframe. This, then, gives it an element of urgency and a kind of commitment that has been lacking up to now. We submit this, of course, for the committee's consideration.

Chairman HOLIFIELD. Of course, the President has done this, hasn't he?

Mr. BAGGE. He has; that is correct.

Chairman HOLIFIELD. And the committee is certainly in favor of setting a goal now. The question would be whether you would write that into a permanent statute or whether you would set that goal in your objectives. I have no strong feeling on this and would be glad to discuss with your lawyers as to how this can be obtained.

Mr. BAGGE. Thank you, Mr. Chairman.

We also respectfully suggest two other goals for the committee's consideration which we believe could be incorporated into this legislation. One is taken from legislation pending before the Senate. This legislation provides for a program which will:

* * * develop the technology and information base necessary to supplement development of the widest possible range of options available for future energy policy decisions by aggressively pursuing research and development programs in a wide variety of energy technologies.

The other goal of national policy we submit should aim to:

* * * develop the technology to use abundant resources where possible in place of scarce resources in order to insure the optimum utilization of the totality of our resource base.

In short, we suggest as the overall goal for research and development policy the following:

National energy research and development policy should attempt to achieve the optimum production and use of our vast coal base in an environmentally acceptable way in forms designed to maximize consumer value, extracted in the most efficient manner consistent with the health and safety of the workers involved, within the context of our free enterprise system.

Coal is an obvious choice for research and development on an expanded scale. It is our most abundant, Mr. Chairman, as you said in your comments, our most abundant fossil fuel reserve. It is located in quantity in or near practically every part of the Nation. We know how to mine it, move it, and consume it. Coal can be used in its original solid form to make heat and/or electric power. It can also be converted into liquid or gaseous forms for use in the modes most popular in today's society.

But most importantly, coal gives us an alternative to Mideast oil. The huge reserve of coal provides us with the muscle necessary to forgo the danger and the humiliation of foreign dependency and to retain our progress at home and our posture abroad.

SELF-SUFFICIENCY

Chairman HOLIFIELD. I believe you are striking the nail right on the head. This country cannot live on the whims of Middle East sheiks who have no regard for anything except getting all that the traffic will bear. Last year, 1972, we imported between $6 and $7 bil-

lion worth of oil from overseas. We predicted that, if delivered, it would run $9 billion at the prices of 1972, but you and I both know that those prices have doubled. Oil that was $3 a barrel is now around $6 or $7 a barrel. Therefore, the prediction that in 1980 we would have to import $22 billion worth of oil means, at today's prices, $44 billion annually. And this country cannot stand that type of outflow of the dollar. We are going to have to solve this energy problem standing on our own feet, and not on our knees with our arms raised in a plea for mercy, which will not be given us from the financial standpoint.

We have to make coal work, we have to make nuclear work, we have to exploit every available resource, indigenous or under our control, so we will not have the situation that we have today.

Mr. BAGGE. Yes.

On page 9, Mr. Chairman, in the third part of our paper, we have the research structure.

In attempting to analyze H.R. 11510 we measured it against what we consider to be the ideal research and development program. Below we have outlined conceptually what such a program should be:

As a research need is seen or anticipated, technical and economic assessments should be made of the various options to meet it. Where technical deficiencies exist, research and development should be undertaken on those options which have the best probability of success within the timeframe required. Research and development resources should be allocated on the basis of the intensity of the problem and on the effort needed to develop the required technology—again within the timeframes for such development. Careful control should be maintained so that the programs are directed at meaningful targets, their progress is satisfactory, and their transfer to the private sector expedited. A research concept such as this requires, it seems to us:

A central control agency capable of making informed, unbiased and farsighted decisions.

Sufficient support for the agency so its decisions can be translated into solid research programs.

An adequate funding level.

Close cooperation, and I would like to underscore this, if I may, Mr. Chairman, close cooperation with the industries involved as well as with other governmental agencies.

This analysis leads us to support the creation of a central energy research and development administration. We believe that this administration must be a separate governmental body which includes all of the present governmental agencies involved in energy research and development. This agency could be completely independent, or it could be a part of a Department of Energy and Natural Resources, as has been suggested by the administration. I want to say that our appearance here is based on a resolution adopted by the National Coal Association's board of directors at a meeting here in Washington about a month ago. Within this research agency, there should be separate but equal agencies for the major sources of energy. And may I underscore that, that within ERDA, there should be separate but equal agencies for the major sources of energy. I respectfully must dissent from the statement made by Mr. Simpson, which seems to

suggest that there should be no organizational structure as the bill now provides, but rather that the administrator should be free to adopt this himself. We respectfully dissent from Mr. Simpson's testimony in that regard, because we sincerely believe, Mr. Chairman, that the idea of separate but equal agencies within ERDA is necessary.

One such agency, as suggested in H.R. 11510, should focus on coal, with a funding level on a parity with nuclear power. Its staff should be charged with coal development much as the current AEC is charged with nuclear progress. The head of the coal agency should report directly to the Administrator of the overall energy research administration and not to a nuclear oriented subadministrator of ERDA, and through him to the President and the appropriate committees of the Congress.

The objective of this administration would be to carry on research and development in energy through all of the steps necessary to demonstrate commercial feasibility. Its various agencies would be both empowered to utilize in-house capabilities, such as those of the Bureau of Mines and the National Laboratories, and to contract—and may I underscore this because of its critical importance to the coal industry—and to contract on the outside with capable public and private research agencies, much as the present Office of Coal Research has been doing and operating as a contracting agency. We think that the flexibility that is provided in the current method by which the Office of Coal Research on its very minuscule budget is a very effective ingredient to our program under ERDA.

Chairman HOLIFIELD. That I believe is incorporated in the bill.

Mr. BAGGE. Yes, it is. The authority is there, but we believe that contracting, because the great success we have had, such success as we have had has come, we believe, from private contracting with private contractors and we hope this will be pursued vigorously under ERDA.

Beginning at page 12 and going on for three or four pages, we begin the analysis of H.R. 11510. We want to say only that in our opinion, the sponsors of H.R. 11510 deserve the commendation of the Congress and the American people. It provides the basic forward thrust for the type of centralized Government research and development program which, properly implemented, will make possible the type of quantum jump in technology which America so sorely needs.

The basic strength of this legislation is highlighted in the first charge to the Administrator of the new agency.

This charge makes possible a conceptual attack on America's energy research and development needs. It centralizes for the first time the R. & D. programs of the Federal Government relating to energy. It will allow available research resources to be balanced with national needs.

For too many years such centralization was missing. The various agencies of Government fought for the scant available funds. Moreover no single agency could assume research and development responsibility on a national scale in order to make truly meaningful decisions.

We are particularly pleased that H.R. 11510 designates an Assistant Administrator for Fossil Energy. To us this means the sponsors recognize that the fossil fuel resources of the United States—most particu-

larly the coal resource—are, and should be, on a par with nuclear energy as the twin pillars upon which energy self-sufficiency for our Nation must be built. Such a parity between the fossil and the nuclear resource is long overdue.

In the interest of time, I might just say the rest of the paper deals with a number of different topics. On page 19, we go into coal research and development priorities. Because of its singular importance, I would like to presume upon the time of the committee to take only one of those and discuss it with you if I may.

The establishment of ERDA will not, in a short time, remedy all of the shortcomings of past research and development policies. However, we can and must establish research goals, define priorities needed to achieve them, and allocate the necessary resources. H.R. 11510 vests this authority in the Administrator. For the guidance of the committee, and hopefully for the eventual guidance of the Administrator of ERDA, we suggest the following research priorities for the coal industry—priorities which are necessary to permit the maximum utilization of our vast coal resource base. Here we go into a number of priorities—liquefaction, gasification, increasing the power systems and so on. But if I may, because it is greatly misunderstood, on page 20 and 21, I will simply highlight the critical importance of mining research.

Productivity in coal mines has been in a period of substantial decline since 1969. In part, this was caused by the Coal Mine Health and Safety Act of that year, and in part, by the simple aging of coal mining technology which had remained relatively static since the 1950's. Whatever the cause, future coal demands cannot be met without a major new forward thrust in extraction technology. More importantly, health and safety are compelling forces behind research work on mining technology.

Most Federal mining research is now carried out by the U.S. Bureau of Mines and is directed at health and safety problems, with no programs—no programs, Mr. Chairman—designed specifically to improve efficiency. We believe this health and safety research is necessary, indeed it is vital; we have urged that it be expanded. By the same token, we also urge the initiation of research programs on production technology which would, within strict health and safety requirements, improve the efficiency of coal mining in the United States.

There are obvious areas where such activities would be fruitful. Automated mining systems are sorely needed. Transport of coal from the mine face must be made truly continuous. Our so-called continuous miner, Mr. Chairman, operates continuously for only 5, at the most, percent of the time. Advance roof support and dust suppression methods would improve both safety and efficiency. More rapid tunneling would shorten mine development time and reduce both capital and operating costs. Improved methane control, especially if done in advance of mining, would add to both safety and productivity of the coal mine. Relatively new mining systems, such as long-wall and short-wall, must be perfected and applied where safety, geology, and economics indicate. Finally, we must move to develop technology to recover deeper eastern coals and the thick underground seams of the West. It is evidenced that an increasing share of our future coal supplies will have to come from these two areas.

The National Coal Association has suggested to the Congress on a number of occasions several underground test coal mines. These mines would permit the testing of new or improved mining concepts without impeding current operations or subjecting research work to commercial pressures. The only real place to test mining technology is in a coal mine. The test mine permits that to be done in an environment of research, not commercial operations.

In summary, it is essential to understand that without significant mining technology breakthroughs it does not matter how many wonderful things can be done with coal. If we cannot get it out of the ground, coal can never fulfill its bright potential.

To the Congress it does not matter if we find the technology to the significant liquefaction——

Chairman HOLIFIELD. May I ask you if any technology being used anywhere in the world is superior to the American technology in the mining of coal?

Mr. BAGGE. The answer to that, I think, is no.

MINING TECHNOLOGY

Chairman HOLIFIELD. In other words, you are talking about a very vigorous program to develop a better mining machine, or technology, whatever you might call it?

Mr. BAGGE. It is an international problem, Mr. Chairman. We just recently hosted here some weeks ago in Washington a meeting, an international conference in coal research with all of the nations of Western Europe and Canada participating. This is a need that is not only unique to the United States but is true if indeed the Western world, the coal-producing nations of the Western world are indeed going to be able to provide, because they are blessed with most of the world's coal resource reserves, if we, the rest of the world, are in fact going to be able to provide the coal alternative to Middle Eastern oil, not only for the United States but for Western Europe as well. So this is a commitment that we are making together with our brethren in Western Europe and in Canada. But it is something that is ignored today. My fear is, Mr. Chairman, that as we talk of gasification and liquefaction, the public and perhaps even decisionmakers become so mesmerized by the exotic utilization of coal in different forms that we forget the basic problem of production technology. That is why I think and we respectfully submit that one of the indispensable elements of ERDA and ERDA's challenge simply has to be to involve itself in mining technology. Because without that as the essential predicate, we are not going to be able to produce the coal, Mr. Chairman, that we have to produce, the billion and a half tons that are called for by the National Petroleum Council study by 1985, even before the present crisis, to provide the coal as truly a mother fuel to be gasified and liquefied to supplant or to at least help in the current petroleum and gas shortages.

Chairman HOLIFIELD. I was amazed to hear you say that very little money had been spent in this field that you are talking about, that the function of the Bureau of Mines has been mostly in the health and safety area. Is that correct?

Mr. BAGGE. That is correct, Mr. Chairman.

Chairman HOLIFIELD. And what amount of money is available for this mining technology now in the Bureau of Mines?

Mr. BAGGE. In fiscal year 1974, I think we have a line item that is something like $7 million in fiscal year 1974. But this is the first breakthrough that we have had where the Bureau of Mines, in any meaningful way, is beginning to involve itself in mining technology. The Bureau has properly, because of the legitimate concerns of mine health and safety, been focusing on that area, not on getting more production or on making breakthroughs in what we regard today as an obsolete mining technology.

Mr. Chairman, all we have done is to automate the pick and shovel. The continuous mining machine is simply nothing more than an automated pick and shovel. We have to look to the new miners, creative people that will come to ERDA to be getting whole new applications to mining and tunneling.

Chairman HOLIFIELD. Are your research people in a position at this time to advocate specific lines of engineering and development which you feel would improve the production of coal?

Mr. BAGGE. Yes, we are. We are involved in some of that. You know, there is not a great deal of research done by our member companies because of the low level of profitability of the coal industry. But one or two of the larger companies in our association are involved now in this very area. But with more funding, with a commitment to do this, we think it can be done.

But the answer to your question is yes, we have a number of specific proposals that we have been operating with over a number of years with very modest funding which, with a new thrust, can bring this about. It has to be brought about. But my concern is that if ERDA does not concern itself with mining technology, then I fear that the great hopes we have for gasifying and liquefying coal in the next decade or two will come to naught.

Chairman HOLIFIELD. Well, as you have said, you cannot liquefy or gasify coal if you cannot get it out of the ground.

Mr. BAGGE. That is right, Mr. Chairman.

Chairman HOLIFIELD. I can see where production of coal is basic to the better utilization and transportation of coal, whether it be through pipelines in liquefied form or in gaseous form.

Mr. BAGGE. Yes sir.

Chairman HOLIFIELD. Thank you very much. Have you finished your statement?

Mr. BAGGE. I think I will just let it sit there, Mr. Chairman. I was going to read something from the conclusion.

Chairman HOLIFIELD. Go ahead.

Mr. BAGGE. May I just say in conclusion that the American coal industry supports enthusiastically, I might say, based on my conversations with you, Mr. Chairman, from time to time, as you have crystalized this proposal, H.R. 11510, with the suggested changes we have made. We have consistently supported the basic concepts of this legislation and with the reservations which we have set forth in this testimony we remain enthusiastic supporters. I might say in conclusion,

that we are very grateful to you, sir, for your leadership and we hope this bill will be reported out of committee and the greatest priority will be attached, with the new urgency that is needed, to this legislation.

[Mr. Bagge's prepared statement follows:]

PREPARED STATEMENT OF CARL E. BAGGE, PRESIDENT, NATIONAL COAL ASSOCIATION

My name is Carl E. Bagge. I am president of the National Coal Association, whose members include the major coal producing and coal sales companies of the Nation. We welcome this forum to present testimony on a vital national issue.

Research and development is one essential key to the future of coal in the United States. It is obvious that the technological base for coal extraction, distribution, conversion, and consumption must be sound and expanding if America's energy needs are to be satisfied. It is also tragically apparent that the past neglect of research in coal is one major reason for our current technological inadequacies which compound the energy crisis.

Equally important over the long run, and perhaps more crucial in the short term, are those governmental restraints which now inhibit the coal industry's ability to produce and market its product efficiently. For example, price controls even now interfere with the rapid expansion of coal production. Air pollution regulations rule out the use of much available high-sulfur coal, coal which is sorely needed in an energy-short America and which must be mined and burned if we are to avoid an even greater crisis than we now have. Governmental policies relating to the coal leases in the West and exploration permits on Western public lands have halted plans to expand the industry into some of the world's richest energy reserves.

In both the short and the long run, therefore, we need governmental policies which help coal to meet the demands of a rapidly growing and energy-intensive society. We need a soundly conceived governmental framework within which the coal delivery system—the whole complex of coal mining, transportation, and use—can operate effectively and efficiently. This is necessary if we are to produce the vast quantities of coal which America will require to achieve energy self-sufficiency.

Research and development are a part of that system. But they are by their very nature lengthy processes. Pressing ahead with coal R. & D. now is essential—it should have started long ago. However, it will have little immediate effect in terms of added production or energy supply.

On the other hand, much can be done now in such areas as environmental control, price regulation, surface mining legislation and the tax structure to insure the orderly expansion of coal capacity so that the technologies which we are now beginning to develop at an accelerated pace will do the Nation the most good.

These comments are not intended to denigrate the place of research and development. They are intended, however, to place it in proper perspective. In short, we must not become mesmerized by the potential for coal R. & D. and neglect the urgent need of the American coal industry to survive and to grow. Today this is the real issue—the issue which is central to our continuation as a major industrial power capable of maintaining our historic commitment to human dignity and to world peace.

It is in this context—the context of energy self-sufficiency for industrial America—that we wish to discuss the research and development needs of the coal industry over the remainder of this century.

I. THE COAL RESEARCH RECORD

The Federal Government has a sad record of support—or nonsupport—for coal research and development.

Attached as an exhibit is a listing of the funding of the Office of Coal Research for the past 10 years. It is interesting to note that only in the past year or two has the OCR budget begun to reach effective levels. Prior to that time, moneys allocated to OCR were so minuscule that the program of the agency could never be pursued as logic and experimental results would dictate.

There are several examples of this. In 1968, laboratory research on a promising liquefaction process developed by Hydrocarbon Research, Inc., and sponsored by OCR, was completed. Proposals were developed for the construction of a pilot plant, but for lack of funds OCR had to discontinue this plant. Had it been continued it is quite probable that we would now have the technological information necessary to construct a prototype plant that could produce fuel oil from coal. This would offset the major threat posed by the cutoff of oil exports of Arab nations because of U.S. international policy.

Further, because of a lack of funds, the solvent refined coal process, now in the pilot plant stage under a contract with the Pittsburgh and Midway Coal Mining Company, remained in a state of limbo for 5 years. In other words, a pilot plant was built and successfuly demonstrated. However, lack of proper Again, as in the case of the H-Coal process, for lack of a few million dollars a 5- or 6-year delay was incurred.

Finally, within the past several weeks, a vessel of the U.S. Navy actually operated on a liquid fuel oil made from coal. This fuel oil was developed under an OCR contract with the FMC Corporation in a pilot plant in Princeton, N.J. That pilot plant was built and successfully demonstrated. However, lack of proper funding prevented bringing that plant through the demonstration phase to the point of commercial viability, and so valuable years were lost. The Bureau of Mines' coal research record reveals the same unfortunate pattern. Years of neglect were followed by a spurt of crisis spending after the passage of the Coal Mine Health and Safety Act. This desirable spending is limited: It can only be used for health and safety, and not to improve the actual mining technology for coal, notwithstanding the dramatic drop in productivity in recent years.

An expanded research and development program on mining is an absolutely necessary technology. We will discuss this in more depth later, but let us note here that had the Bureau of Mines and the Office of Coal Research been given the mandate to develop new coal mining technology, the coal industry would be much more able to respond to today's crisis by producing greater amounts of coal. Our present coal mining technology is the technology of the 1950's. It is completely unequal to the demands which we foresee in the 1980's and beyond. The Congress and the American people must recognize that as we develop the technology to use coal to a much greater degree we must have a parallel technology to permit the more efficient and the safer mining of all the coal we will need.

The result of past apathy is clearly evident in our time of energy crisis. The coal industry today should be able to move to meet its greatly increased responsibilities not only to domestic consumers but also to those of our allies abroad, particularly Japan and those other nations hardest hit by the Arab oil embargo. Unfortunately, coal lacks, among other things, an adequate technological base to do so. Today at every stage of the coal system—mining, distribution, conversion, and ultimate consumption—great technological barriers impede coal growth. It is interesting to speculate what could have happened if a parallel and balanced research and development program on coal production, distribution, conversion, and consumption had been launched in 1954 when our massive national commitment to nuclear research and development was made. This is not in any way to denigrate the nuclear program. It is only to suggest that coal is one of the major reserves of energy to which we must look, a reserve with the potential to justify a research and development program on a scale comparable to the nuclear program.

Inadequate technology was tolerable in an America characterized by energy abundance. We could afford to permit our largest fossil fuel resource to stagnate in terms of technological capability. We could ignore the rewards which would flow from an expanded and successful research and development program. But we can no longer, in our present environment of scarcity—yes, of crisis—continue such a wasteful and shortsighted national policy. Nor can we in the decades ahead continue in the pattern of the past. Rather, we must now optimize all of our remaining energy resources in order to maintain both our domestic living standards and our present and potential international commitments.

What is needed—a need that is acutely felt by the sponsors of H.R. 11510—is a sharp reversal of our past record of coal research and development. We must have a determined and accelerated program to provide a sound technological base for coal expansion. We must make up for the inaction of the past and move rapidly to meet the contingencies of the future.

This is a time for forging those institutions which will meet America's future energy needs. To do so we must learn from our past but more importantly, we must be prepared to forgo ingrained tradition in order to fashion those instruments which will be responsive to the future and not merely mirrors of the past. The challenges ahead will require new thinking, new institutions, and a new governmental response to the questions posed by research and development. We believe that H.R. 11510 is one constructive approach toward fashioning a national research and development institution capable of meeting the challenges of the 1970's and 1980's and beyond.

II. RESEARCH POLICY

The sponsors of H.R. 11510 have set forth a clearly defined goal for energy research and development in these words:

> "The Congress hereby declares that the general welfare and the common defense and security require effective action to develop and increase the efficiency and reliability of use of all energy sources to meet the needs of present and future generations, to increase the productivity of the national economy and strengthen its position with regard to international trade, to make the nation *self-sufficient in energy* and to advance the goals of restoring, protecting and enhancing environmental quality." (Emphasis added.)

To that we would only suggest that there should be added a time frame within which energy self-sufficiency, or at least the capability for energy self-sufficiency, should be attained.

We would also suggest two other goals which should be incorporated into the legislation. One is taken from legislation pending before the Senate. This legislation provides for a program which will:

> "* * * develop the technology and information base necessary to supplement development of the widest possible range of options available for future energy policy decisions by aggressively pursuing research and development programs in *a wide variety of energy technologies*." (Emphasis added.)

The other goal of national policy should aim to:

> "* * * develop the technology to use abundant resources where possible in place of scarce resources in order to insure the optimum utilization of the totality of our resource base."

In short, we suggest as the overall goal for research and development policy the following:

> "National energy research and development policy should attempt to achieve the optimum production and use of our vast coal base in an environmentally acceptable way in forms designed to maximize consumer value, extracted in the most efficient manner consistent with the health and safety of the workers involved, within the context of our free enterprise system."

Coal is an obvious choice for research and development on an expanded scale. It is our most abundant fossil fuel reserve. It is located in quantity in or near practically every part of the nation. We know how to mine it, move it, and consume it. Coal can be used in its original solid form to make heat and/or electric power. It can also be converted into liquid or gaseous forms for use in the modes most popular in today's society.

But most importantly, coal gives us an alternative to Mideast oil. The huge reserve of coal provides us with the muscle necessary to forego the danger and the humiliation for foreign dependency and to retain our progress at home and our posture abroad. Properly developed, America's coal can become a guarantee to our allies that they need not fear the long-term threat of blackmail aimed at forcing them to adopt foreign policies not in their interest.

Thus, in providing a research and development program which will help to make the Nation self-sufficient in energy, H.R. 11510 provides a goal for those charged with energy research and development and starts the Nation toward secure energy abundance.

III. RESEARCH STRUCTURE

In attempting to analyze H.R. 11510 we measured it against what we consider to be the ideal research and development program. Below we have outlined conceptually what such a program should be:

As a research need is seen or anticipated, technical and economic assessments should be made of the various options to meet it. Where technical deficiencies exist, research and development should be undertaken on those options which

have the best probability of success within the timeframes required. Research and development resources should be allocated on the basis of the intensity of the problem and on the effort needed to develop the required technology—again within the timeframes for such development. Careful control should be maintained so that the programs are directed at meaningful targets, their progress is satisfactory, and their transfer to the private sector expedited. A research concept such as this requires:

A central control agency capable of making informed, unbiased and farsighted decisions;

Sufficient support for the agency so its decisions can be translated into solid research programs;

An adequate funding level; and

Close cooperation with the industries involved as well as with other governmental agencies.

This analysis leads us to support the creation of a central energy research and development administration. We believe that this administration must be a separate governmental body which includes all of the present governmental agencies involved in energy research and development. This agency could be completely independent or it could be a part of a Department of Energy and Natural Resources, as has been suggested by the administration. Within the research administration, however, there should be separate but equal agencies for the major sources of energy. One such agency, as suggested in H.R. 11510, should focus on coal, with a funding level on a parity with nuclear power. Its staff should be charged with coal development much as the current AEC is charged with nuclear progress. The head of the coal agency should report directly to the administrator of the overall energy research administration and through him to the President and the appropriate committees of the Congress.

The objective of this administration would be to carry on research and development in energy through all of the steps necessary to demonstrate commercial feasibility. Its various agencies would be both empowered to utilize inhouse capabilities, such as those of the Bureau of Mines and the National Laboratories, and to contract on the outside with capable public and private research agencies.

H.R. 11510 is a major move in this direction. It does, in fact, establish an Energy Research and Development Administration and sets up a special section in that administration for a head of a fossil fuel research group. We suggest, however, that as the agency gets under way those programs now conducted by the present coal research agencies; that is, the Office of Coal Research, the U.S. Bureau of Mines, and the Environmental Protection Agency, continue to function until they can be transplanted. These ongoing programs are of vital interest to the coal industry in such areas as gasification, liquefaction, mining, environmental control, et cetera. Any hiatus in these programs or delay in their funding could be fatal to their early success.

This analysis of the ideal Government agency dealing with energy research and development leads us to discuss specific provisions of H.R. 11510.

IV. H.R. 11510

In our opinion, the sponsors of H.R. 11510 deserve the commendation of the Congress and the American people. It provides the basic forward thrust for the type of centralized Government research and development program which, properly implemented, will make possible the type of quantum jump in technology which America so sorely needs.

The basic strength of this legislation is highlighted in the first charge to the administrator of the new agency, where he is directed to exercise:

> "* * * central responsibility for policy planning, coordination, support, and management of research and development programs respecting all energy sources, including assessing the requirements for research and development in regard to various energy sources in relation to near term and long range needs, policy planning in regard to meeting those requirements, undertaking programs for the optimum development of the various forms of energy sources, managing such programs and disseminating information resulting therefrom."

This charge makes possible a conceptual attack on America's energy research and development needs. It centralizes for the first time the R. & D. programs of

the Federal Government relating to energy. It will allow available research resources to be balanced with national needs.

For too many years such centralization was missing. The various agencies of Government fought for the scant available funds. Moreover no single agency could assume research and development responsibility on a national scale in order to make truly meaningful decisions.

We are particularly pleased that H.R. 11510 designates an assistant administrator for fossil energy. To us this means the sponsors recognize that the fossil fuel resources of the United States—most particularly the coal resource—are, and should be, on a par with nuclear energy as the twin pillars upon which energy self-sufficiency for our Nation must be built. Such a parity between the fossil and the nuclear resource is long overdue.

We also believe that it is desirable policy to separate nuclear regulation from atomic energy research and development. The regulatory function of the AEC does not really belong in an agency charged with research and development. It may have been necessary in the early days of the Atomic Energy Commission when there was a need for a very close relationship between those charged with regulation and those charged with development. But, no more. We think, therefore, that the division of the two functions is extremely desirable and will do much to enhance the credibility and the effectiveness of both the Energy Research and Development Administration and the Nuclear Energy Commission.

The legislation also wisely makes the Administrator responsible for:

> "* * * ascertaining the existence, progress and results of other public and private research and development activities relevant to the administration's mission and correlating its own research and development programs with such public and private activities."

Obviously there is a great deal of energy R. & D. going on in the private sector. If it can be correlated with the public R. & D., a great deal of redundancy can be avoided and maximum progress made toward the objectives of the research and development administration.

We also support the continuation of the contracting activities of the Office of Coal Research. This program has been extremely desirable in shortening the research and development lead times and bringing into Government service some of America's best nongovernmental research and development institutions. We believe this activity should be continued in the new agency. In fact, it should be strengthened in order to accelerate private research and development work under Government aegis and to provide for the shortest possible technology transfer time as the new technologies are developed.

We also support the transfer of the research functions of the Environmental Protection Agency to the new Research and Development Administration. We believe this to be extremely desirable because the R. & D. work of EPA is obviously essential to long term energy self-sufficiency. Just as in the case of AEC, an agency cannot effectively do both regulation and research for the same industry. The temptation will always exist to declare by regulation that the Agency's research is successful.

On the other hand, there are several deficiencies in the pending legislation which we believe should be called to the attention of the committee.

First, we believe that military R. & D. should not be a part of ERDA. We suggest the transfer of this function to the Department of Defense or to some other agency, perhaps even the Nuclear Energy Commission. We do not in any sense suggest curtailing military R. & D. in energy; in fact, we believe it should be expanded if necessary. However, a governmental agency charged with civilian research and development is inherently different from an agency charged with the development of weapons and other things for use by the military. For example, a civilian R. & D. program must operate as openly as possible, with maximum dissemination of the information developed. On the other hand, nuclear research and development for the military must operate within an atmosphere of great secrecy and limited access to desirable information. Further, the great need for civilian R. & D. must permit the Administrator an entirely free hand in seeking whatever funds are necessary without having to determine his priorities within the context of some overriding military need.

Moreover, we do not believe that the type of R. & D. carried on by the civilian agency is parallel to any great degree with the type of R. & D. involved in military applications.

Finally, the linking of the civilian and the military research and development programs would, we believe, have a detrimental effect on both. Of course, ERDA

should cooperate fully with whatever agency handles military research and development on particular energy research programs which the military might need.

H.R. 11510 provides for no effective dialog between the private and the public sector about research and development. We strongly recommend a top-level industry policy advisory committee to the agency. This committee should be made up of top executives from the various parts of the energy industry. It should also provide policy advice and industry input to the research and development program, and should develop methods for the orderly and quick transition of technology as it is developed, to the private sector. We believe that without such a mechanism, much of the work of ERDA will be misguided and, even if successful, will be transferred to the private sector more slowly than necessary.

We also strongly suggest that the advisory role of the industry committee be explicitly set forth in such a way that the Administrator has to rely upon the committee as trusted advisers. He should be required to consult prior to the development of general and specific research policies, as well as during the implementation phase of the programs which such policies dictate. To be truly meaningful, therefore, the advisory committee should be considered an integral part of the ERDA structure—a function which is essential to the carrying out of the ERDA responsibilities.

There should also be, at least initially, some type of cooperative program between industry and Government to bring into the new ERDA organization top-level scientists, engineers, and other professionals from outside the agency. This would permit the agency, especially in fossil fuel development, to receive a major forward impetus toward meeting the vastly expanded challenges which the present energy situation imposes.

Finally, we cannot leave the ERDA organization without suggesting to you the qualifications we think should be required of the people who will man the organization. These were spelled out to Chairman Holifield in our letter of August 24. For the record, I would like to submit the complete text of the letter, and I will summarize it here for the information of the committee.

We view the qualifications for top-level management of ERDA to be as follows:

First, the people should be intimately familiar with both the legislative appropriation process and with its parallels and adjuncts in the executive branch of Government.

Second, the top-level policymakers should be able to articulate the broad policy needs and objectives of energy research in our society to Government, to the research community, to the Nation at large, and especially to those people who are crucial to the production and distribution and utilization of energy and not intimately involved with research and development per se.

Third, the policymakers of the new energy organization should carry impeccable managerial backgrounds and the willingness to dedicate themselves to the future of ERDA.

Fourth, it would be desirable to bring to the new research effort top-level management with some capability in research and development projects, although we do not believe that this is an absolute necessity. It is more important, in our view, for top management to be people who possess vision, who can interact favorably with the various public and private institutions impinging on research, and who will be tough minded in establishing research priorities and in defending them articulately in both the public and private sectors.

At the next level of ERDA—that is, the level where the specific energy resources are dealt with—we believe that management should possess some of the following qualifications:

In coal, for example, we would recommend that the head of the coal or fossil fuel area should have the conceptual view of the coal industry as an entity. This does not mean that he must be an expert in coal research, necessarily, but rather someone who possesses a sufficient grasp on the intricacies of bringing that resource into public use that he can establish the necessary research and development priorities.

Second, we believe that he must have sufficient stature to attract professsional personnel who enthusiastically and with single-minded dedication will carry out the work of the coal research function.

Finally, he must be able to sell the coal research priority in competition with all of the other priorities which will bear upon the top leadership of the Federal research and development effort. He must articulate it within the institutional structure, to Congress, to the executive branch, and the public at large.

V. COAL RESEARCH AND DEVELOPMENTAL POLICY PRIORITIES

Establishing ERDA will not, in a short time, remedy all of the shortcomings of past research and development policies. However, we can and must establish research goals, define priorities needed to achieve them, and allocate the necessary resources. H.R. 11510 vests this authority in the Administrator. For the guidance of the committee, and hopefully for the eventual guidance of the Administrator of ERDA, we suggest the following research priorities for the coal industry—priorities which are necessary to permit the maximum utilization of our vast coal resources base. The specific allocation of effort in each one will vary with time and will have to be studied when the ERDA priorities are eventually determined.

The following, however, are research priorities which we feel at this time are essential to assure the maximum contribution of the coal industry to the well-being of the American public.

Mining Research

Productivity in coal mines has been in a period of substantial decline since 1969. In part, this was caused by the Coal Mine Health and Safety Act of that year, and in part, by the simple aging of coal mining technology which had remained relatively static since the 1950's. Whatever the cause, future coal demands cannot be met without a major new forward thrust in extraction technology. More importantly, health and safety are compelling forces behind research work on mining technology.

Most Federal mining research is now carried out by the U.S. Bureau of Mines and is directed at health and safety problems, with no programs designed specifically to improve efficiency. We believe this health and safety research is necessary; we have urged that it be expanded. By the same token, we also urge the initiation of research programs on production technology which would, within strict health and safety requirements, improve the efficiency of coal mining.

There are obvious areas where such activities would be fruitful. Automated mining systems are sorely needed. Transport of coal from the mine face must be made truly continuous. Advance roof support and dust suppression methods would improve both safety and efficiency. More rapid tunnelling would shorten mine development time and reduce both capital and operating costs. Improved methane control, especially if done in advance of mining, would add to both safety and productivity of the coal mine. Relatively new mining systems, such as long wall and short wall, must be perfected and applied where safety, geology, and economics indicate. Finally, we must move to develop technology to recover deeper Eastern coals and the thick underground seams of the West. It is evident that an increasing share of our future coal supplies will have to come from these two areas.

The National Coal Association has suggested to the Congress on a number of occasions the operation of several underground test coal mines. These mines would permit the testing of new or improved mining concepts without impeding current operations or subjecting research work to commercial pressures. The only real place to test mining technology is in a coal mine. The test mine permits that to be done in an environment of research, not commercial operations.

In summary, it is essential to understand that without significant mining technology breakthroughs, it doesn't matter how many wonderful things can be done with coal. If we can't get it out of the ground, coal can never fulfill its bright potential.

Liquefaction

Producing liquid fuels from coal has been seriously neglected in the coal research programs of the past. Several promising concepts have been stalled short of pilot plant construction, one pilot plant has been shut down, and another is only now being constructed after a delay of more than 5 years. This is both a national and an international tragedy.

We view coal liquefaction as needed for two major reasons:

First, liquefaction process such as solvent-refined coal, the work done at Cresap, W.Va., and the H-Coal process, can provide a low-sulfur alternative to imported residual oil for boiler purposes. The market potential for such a product is clear when we consider the 621 million barrels of residual oil imported last year.

Second, for the longer term, coal liquefaction in conjunction with oil shale development offers the United States a clear alternative to Mideast oil dependency. While the problems connected with this alternative are not all research oriented, we believe that a major program in this area would have beneficial results.

Pilot plant work has been going on in one liquefaction process; that is, solvent-refined coal. Other work could be done at the existing pilot plant at Cresap. An acceleration of the liquefaction program, leading to the construction of additional pilot plants as successful research programs indicate, and the earliest possible construction of demonstration stations, would be squarely within the national interest.

The coal industry, along with many concerned citizens, has watched with alarm our growing dependency upon Mideastern oil, which has grave implications for our economic well-being. Economics aside, the rapid concentration of oil supply capability in one small, unstable area of the world has frightening implications for world peace. Clearly, the dependency of the major industrial nations of the free world upon the Mideast has introduced a chronically unsettling condition in world affairs with far-reaching policy ramifications. When the energy demands of the emerging nations of the world—which must also turn to the Middle East—are added to this demand, the problem becomes almost hopeless, as we are now seeing demonstrated around the world.

This spring I addressed this question in a paper entitled "Coal—the Energy Key to World Stability" presented to the Council for the Association for Coal in Europe at St. Ives, England. At that time I suggested a coal research conference with representatives from Western Europe and the United States to begin to develop a global coal research strategy. That suggestion was adopted by the European coal-producing nations and, as a result, the National Coal Association, with the support of the U.S. Department of the Interior, was host at such a conference last October. This international cooperative effort is an extension of our new concern to rationally develop our own—and the world's—coal reserve base.

Our vast coal resources, and to a lesser degree, our oil shale reserves, give the United States an alternative to increasing dependence on the Mideast, both for our own use and for the free world. It is true that both technological progress and a favorable economic climate to translate that potential into actuality are needed. Fortunately, there seems to be a growing national and international consensus to do just that. I am convinced that the Nation will have to decide very soon whether to become overly dependent upon fuel imports or develop the full potential of its secure coal resources.

Gasification

A major effort is already underway in coal gasification. A jointly sponsored program between the American Gas Association and the Office of Coal Research has brought new processes to the pilot plant stage. In addition, several private companies have extensive research programs of their own underway. Meanwhile, for lack of a better commercially-proven process, several natural gas pipelines are planning to construct commercial gasification plants using limited and high-cost German technology developed several years ago. This, in itself, is a sad commentary upon American technological successes in energy research.

Within the past several years there has been a new initiative in another type of coal gasification, the use of low-Btu gas in conjunction with the combined cycle to generate electrical power. This program has an exciting potential. If it is successful, future new power stations will be more efficient and will be able to burn a clean fuel made from coal. We urge full Federal support of this effort and, if necessary, a crash program to make it an early success.

Power Systems

Today, power generation technology is obsolete. It has not changed fundamentally since Edison, for the steam cycle is still the mainstay of our electric

utility industry. Tragically, power generation from either fossil fuel or nuclear power sources wastes more energy than it uses. Equally tragic, our national demand for pollution abatement has far outstripped the technological means for satisfying that demand.

Research and development in power generation is both expensive and time consuming. We cannot look for early success nor for any rapid shift from our present methods to new ones. But neither can we afford the luxury of further apathy. We must begin now to develop the power systems of the future, systems which will burn coal more efficiently and with less pollution than present power plants. We must also serve notice to the producers of electrical power that coal is and will remain a vital part of the Nation's energy base for decades to come.

Several interesting research projects are already underway in the Office of Coal Research. They include fluidized bed combustion, now programed for pilot plant operation; magnetohydrodynamics, which seems to be a longer term project: and combined-cycle generation, to which we have already alluded. All of these new systems promise exciting prospects. All have potential, and all will be expensive to build and bring to commercial fruition.

We hope for both Federal and private support in all of the projects mentioned above and in all of the others deemed advisable. Such new power systems offer a nonnuclear alternative until the more esoteric power sources, such as the breeder and fusion reactor, can be brought into the marketplace. They can span the interim period between present technology and the ultimate solution to our supply problems. Finally, if successful, these new systems give America time, measured in terms of decades, that will be needed to do the necessary research, development, and demonstration on the advanced power systems.

Environmental Challenges to Coal

The biggest single impediment to coal growth at present is the unattainable pollution abatement standards which have been set by the Environmental Protection Agency and the various States. Such standards have placed energy supply and environmental concern on a collision course from which can only come a national disaster. Coal is a veteran of an aspect of the energy/ecology dispute—the problem of air pollution, which became public property before the Nation realized that its refined taste in fuels was an energy luxury it could not indefinitely afford. In a state of nature, coal is not a clean fuel—it carries a primeval burden of ash and sulfur and other impurities. Perhaps more would have been made of it if it had been caught young, like natural gas. Historically, the urge to improve coal has not been overwhelming.

The sure and lasting way out of this dilemma of clean air versus adequate energy is not to reject our huge reserves of higher sulfur coal, but to redeem them.

Clearly, research and development is the long term bridge between energy and the environment, a reconciliation of the heretofore unreconcilable dichotomy between these two vital national concerns. Much work has already been done to build that bridge, but a great deal more remains to be done.

The focus of attention to date has been on the problem of sulfur dioxide control technology. Several processes, both here and abroad have been brought through pilot stage and are now in various stages of demonstration work. This will require a large dollar investment and the fullest cooperation of industry and the State and Federal Governments involved. We hope that as the work proceeds no promising process will fail because of a lack of financial support at any stage of development. Rather, there should be support for any potentially successful SO_2 control technology until it is placed in commercial operation or it is no longer considered to be technically or economically feasible.

However, even if the problem of sulfur dioxide is solved, another combustion product, oxides of nitrogen, may loom large in the future of coal and, in fact, of all fuels. Research and development work must begin immediately and be carried forth expeditiously so that when the new standards for nitrogen oxides are designed and implemented, the technology will be available to permit coal to meet them.

It is evident that America desires both ample energy and a relatively pollution-free environment. The vast reserves of coal available to our Nation can supply both, given the time necessary to do it and a research and development program which will provide the technological base for meeting our energy requirements within acceptable environmental constraints.

VI. CONCLUSION

We support the passage of H.R. 11510 with the suggested changes we have made. We have consistently supported the basic concepts of this legislation and with the reservations which we have set forth in this testimony we remain enthusiastic supporters. We believe that H.R. 11510 recognizes that the coal research program is now a matter of major national concern and deserves the close attention of those charged with the making of national policy at the highest level.

In a sense, the current imbalances in the supply and demand of energy, and the crisis which such imbalances bring to our Nation, may well be a blessing in disguise. For the shock of scarcity after such a long period of abundance has forced us to focus upon the critical questions surrounding the supply and demand of energy. It has given our Nation a chance—a second chance—to put our energy house in order through sensible management and full use of its fuels inheritance. This reprieve, however, could be wasted unless the Nation reverses its historical attitude of something less than benign neglect toward coal. We may look ahead to the nuclear promise and to the even more remote hope of solar power. In the realistic meantime, however, we must live according to our present energy means and not draw blank checks against the future.

Research is one essential key to that future. Quite obviously the challenge of the present and the future has outstripped the capability of present governmental research organizations. Therefore, it is time to lay aside the past and to fashion the type of research and development institution capable of meeting the contingencies of the future. To do this we must move away from the biases of the past, from the narrowly construed centers of influence, as well as from tunnel vision in the matter of energy research and development. The demands before us clearly indicate the need for conceptually viewed and implemented R. & D. programs in energy. Those who administer those programs must view energy as a totality and must allocate resources on the basis of the potential and need and not from the standpoint of narrow self-interest. This will also mean that the major energy resources of the future, i.e., coal and nuclear, will have aggressive, dynamic, competent research leadership, men who can develop and articulate programs which will draw maximum value from our share of the Earth's bounty. H.R. 11510 gives us hope that the fragmented past can somehow be transformed into the unified future and that an energy research and development program truly responsive to the public need can be created, a research and development program in which all of America's energy resources can be developed according to their ability to meet the energy needs of the American people. More than this the coal industry cannot ask.

In conclusion, we pledge to you the complete cooperation of the National Coal Association and the members which it represents as you further refine and develop this legislation and as you move it through the various legislative steps and its eventual enactment into law.

Appropriations—Office of Coal Research, U.S. Department of the Interior

1964	$5,075,000
1965	6,836,000
1966	7,220,000
1967	8,220,000
1968	10,980,000
1969	13,700,000
1970	15,300,000
1971	17,160,000
1972	30,650,000
1973	44,280,000

NATIONAL COAL ASSOCIATION,
Washington, D.C., August 24, 1973.

Hon. CHET HOLIFIELD,
House of Representatives,
Washington, D.C.

DEAR CHET: Thank you for your letter of July 30, 1973, asking for my thoughts on the type of management capabilities which would be needed to provide the leadership for energy research and development in the years and decades which

lie ahead. Certainly, in view of our current energy crisis no question is of more topical importance, and no issue bears more heavily on the future of the United States as an industrial Nation.

We at the National Coal Association have obviously given this question a great deal of thought. In line with that, we are planning to testify before your committee on the proposed reorganization of the energy function and at that time will submit further answers to several of the questions you raised in your letter. However, I would like to take this opportunity to outline briefly what I believe to be the best management structure for ERDA and what type of management capability the new ERDA should have.

TOP-LEVEL MANAGEMENT

As we view the top-level management of the new research and development effort of the Federal Government we think in terms of those who will guide its policy and will interact with the policy in Government at both the executive and legislative branches at the highest level. Thus, these people should have several basic capabilities.

First, they should be intimately familiar with both the legislative appropriation process and with that process in the executive branch. As such, they should have wide experience in dealing with the leaders of Congress and with the various executive agencies which determine budget priorities and are ultimately responsible for the implementation of those priorities in the financial sense.

Second, the top-level policymakers should be able to articulate the broad policy needs and objectives of energy research in our society, both to Government and the research community, along with the Nation at large, and with those people who, though key in the production, distribution, and utilization of energy, are not intimately involved with research and development.

Third, the policymakers of the new energy organization should carry impeccable managerial background, both in terms of past history in managing large organizations and also in the willingness to dedicate themselves to the future of ERDA. As such, we believe it to be very important for the short term, at least, to bring into any new research and development effort a top-level management team, preferably from the private sector, who can establish the broad policy guidelines, secure the needed Government and private support, and draw to it the talent at the next lower rung of responsibility who can implement a program truly responsive to the national need.

Fourth, if at all possible, it would be desirable to bring to the new research effort top-level management with some capability in research and development projects, although I would hasten to point out that I do not feel that this is an absolute necessity. It is more important, in my view, for the top management in the new Federal research effort to be people who possess vision, who can interact favorably with the various public and private institutions impinging on research, and who will be tough-minded both in the establishment of research priorities and in the articulate defense of those priorities, both in the public and the private sectors.

At the next lower level, we believe that each of the priorities for research should be headed by an individual well versed in the particular aspects of the energy segment in which he will be conducting R. & D. In the coal case, for example, we believe that a top-level expert in the coal industry as an entity would be a prime prerequisite for consideration of that position. By that I do not mean an expert in one specific area of the coal research problem but, rather, someone who can view the coal resource conceptually and who possesses a sufficient grasp of the intricacies of the various aspects of bringing that resource to the public use so that he can, in fact, establish the necessary R. & D. priorities to do so. It is not essential that this individual have a technical background, although a technical background would be inherently desirable.

In addition, I believe that the individual must have sufficient stature that he can attract to him a body of professional personnel who will enthusiastically and with single-minded dedication, carry out the work of the coal research function of any new Federal R. & D. program. Thus, we are, of necessity, discussing a man of high stature and recognized standing in the coal research community. Given the very complex nature of the coal research problem, the individual must possess sufficient pull to attract people from various disciplines including the

technical, legal, and economic, and his stature must be such that they will, in fact, come into the program.

Finally, he must be able to "sell" the coal research priority in competition with all of the other priorities which will bear upon the top leadership of the Federal research and development effort, and articulate it both within the institutional structure finally established, as well as in the Congress, the Executive, and with the public at large.

As you know, the coal industry is a relatively technologically deficient industry. Erasing that deficiency is a number one challenge facing not only our industry but indeed the entire Federal and industrial structure surrounding our energy industry as we move to providing America with a stable, reliable and economically secure source of fuel. An independent coal research program with a staff of aggressive, knowledgeable, and dedicated people is a vital part of that effort and we hope that in establishment of any new energy research and development agency the independence and proper functioning of the coal research effort will be made a clear priority of your committee, the Congress, and the Executive.

I hope that, pending the formal hearings before your committee, these thoughts will be of benefit to you. I shall be pleased to discuss them with you at any time you should desire.

Sincerely,

CARL E. BAGGE.

COAL PRODUCTION AND CLEANING TECHNOLOGY

Chairman HOLIFIELD. Thank you very much for your statement.

I do not suppose anyone here has ever produced a bill just exactly like I want it. We have 41 members on this committee. But I think we are in pretty good shape to get agreement, considering our background of hearings on an earlier bill on this matter, as you know.

More than 3 years ago, I was speaking to the President and predicted what is now happening today. I was pleased about 2 weeks ago, when I was invited to a White House meeting with the leadership of the Congress, to hear the President say, in effect, "What I thought was an energy problem has now turned into an energy crisis." As you know, if you have read my speeches, you know that over the past 5, 6, or 7 years, I have been saying that in addition to every other form of energy, we had to take care of coal.

Would you say, then, that in this coal area, two important goals would be the increased production of coal and the solution of the environmental impact of sulfur, particularly sulfur dioxide and other things, that come from the burning of coal.

Mr. BAGGE. That is an excellent summary, Mr. Chairman, of our problem.

Chairman HOLIFIELD. If those two goals are vigorously attacked, it seems to me we could come out in a period of a few years with a tremendous increase in usable fossil resources. Every ton of coal that we can use will just mean that much less oil we have to buy in the Middle East.

Mr. BAGGE. Mr. Chairman, I would like to say that we regard increased coal utilization as the most decisive form of true energy conservation we can embark on as a nation. Putting coal back in the utility boilers, for example, and freeing up the gas and oil that is being flared in the utility boilers of the Nation has to be a national commitment. This is the way to achieve conservation of our scarce oil and gas reserves most efficiently.

Chairman HOLIFIELD. Mr. Horton?

Mr. HORTON. Mr. Chairman, I do not have any questions. I do want to thank you, Mr. Bagge, for testifying before this committee. I think you tell in one sense a very thrilling story about a great challenge; and at the same time, it is a tragic study, because we just have not developed our coal resources. I think you have made it very clear what the problem is. I certainly agree with you that we have to have a national commitment. I hope that through this organization, we can make that national commitment. I was thinking as you were talking about getting coal out of the ground, if we can devise a spaceship to take men to the Moon, I do not see why we cannot develop a systems approach for getting the coal out of the ground and still——

Mr. BAGGE. It should have been done years ago, I think.

Mr. HORTON. Right. As I say, that is the tragic part of the story that you tell. Let me conclude by saying, I think your support of this bill is very important to its ultimate success.

Mr. BAGGE. Our support of the bill is based on a series of conversations with Chairman Holifield and the personal assurances I have received from many and also the particular part of the bill that sets up fossil fuel on a parity with nuclear.

Chairman HOLIFIELD. You have received our organizational chart. You probably noted that we have recognized that.

Mr. BAGGE. Yes.

Chairman HOLIFIELD. I also want to express my appreciation for your testimony today and say that while I am only one of 435 Members, so far as I can put my powers into play, I will see that we do a good job on every resource that we have, because I know we will be short even then.

Mr. Moorhead, this is very vital to your State, I know.

Mr. MOORHEAD. Yes, Mr. Chairman. I am pleased that Mr. Bagge is supporting this legislation. I think we have the support of the chairman to have an assistant administrator of fossil fuels on a par with his nuclear counterpart.

Mr. BAGGE. That is our concern, I may say, Mr. Chairman. The legitimate concern of my principals is that, having been ignored all these years and having been told in the 1960's that we were going to be phased out by the nuclear power industry, there is a very real and, you can understand, genuine concern of our being an appendage to an organization which is going to be dominated by nuclear interests. Based on the assurances that I have received and based on the present text which provides specifically for a parity, to give us some visibility, we are enthusiastically supporting it.

LIQUEFIED AND GASIFIED COAL PROGRAMS

Mr. MOORHEAD. Good.

I understand your emphasis on research in extraction, but I was interested in the statement you made to the chairman about liquefaction and gasification. You said in the next decade or two. I thought it was closer to us than that, but I gather it is not.

Mr. BAGGE. Well, it is as close as—we were discussing the certificating problems of the nuclear power industry. My old colleagues at the

Federal Power Commission where I served for 5 or 6 years have pending two major gasification projects, El Paso Natural Gas and Texas Eastern Natural Gas Co., proposing to convert coal using the existing technology, not wait for new technology. That has been sitting there for 2 years as well. So we could have gas from coal today, two commercial plants that seek to be constructed today, so it is here and now, Congressman.

I did not mean to suggest that this is something that we have to wait for another decade or two to achieve. But with a commitment——

Chairman HOLIFIELD. With the technology we have, could we make coal into a gas competitive with the so-called LNG, liquid natural gas, being made in Algeria?

Mr. BAGGE. Based on the studies I have seen specifically of coal gasification, the answer to that is, "Yes." If you take into account all of the true costs of importing LNG, it is a resounding "Yes."

Chairman HOLIFIELD. Not only that, the precariousness of the supply from a political standpoint?

Mr. BAGGE. Exactly, even if you do not quantify militarily or in terms of our national interest that factor, it is still competitive. The answer is "yes." But we have plants that are proposed to be constructed today. We have an announcement thirdly from another major gas transmission company, the Panhandle Pipeline, which has an arrangement with Peabody Coal to do precisely this, although their petition is not pending before the Power Commission at the present time to my knowledge.

Mr. MOORHEAD. Mr. Bagge, were you here when Dr. Starr testified?

Mr. BAGGE. Yes, I was.

POSITION OF MILITARY PROGRAMS

Mr. MOORHEAD. I expressed a little concern about having military programs in that essentially energy agency. His argument against that was essentially: do not destroy it, we have a good thing going, do not change it. I notice on page 15 of your testimony that you suggest as a possible alternative the transferring of that function to the newly created or to be created Nuclear Energy Commission.

Mr. BAGGE. That is correct.

Mr. MOORHEAD. Would that accomplish, or would that meet, Dr. Starr's objection?

Mr. BAGGE. As I think as I interrupted his answer, he would leave things as they are—he said when you have a good thing going, leave it the way it is.

Mr. MOORHEAD. He was very persuasive about it.

Mr. BAGGE. If we had our druthers, we would prefer to have that function moved into, as an appendage either to the DOD—it could be under the DOD or with the newly constituted Nuclear Energy Commission.

Mr. MOORHEAD. Which would seem to meet his objections, because it would be the same people running it that have done a good job in the past?

Mr. BAGGE. Exactly. We are discussing here institutional frameworks and the institutional structure. We just suggest for your consideration

that this be left intact but be reporting, instead of to ERDA, so the ERDA Administrator's total commitment would be to solving what is our greatest crisis today, and that is the power crisis, the domestic power crisis, so that he could be totally committed to that goal. We are simply suggesting that you move out these other concerns and do not burden him, do not burden him with that responsibility when we are making this tremendous leap forward in energy.

Chairman HOLIFIELD. I might say that their laboratories have always worked on weapons and they have worked under civilian direction, and their work has both military and civilian purposes. The system of security we have, should not, in my opinion, be disrupted. I would go along with Dr. Starr on that point, that you had better let well enough alone, because without the security of this Nation you won't have any coal mines; somebody else will be operating the coal mines.

Mr. BAGGE. We obviously defer to your judgment on that, Mr. Chairman.

Chairman HOLIFIELD. Mr. Wydler?

INDUSTRY SELF-HELP

Mr. WYDLER. I just want to precede my question by saying I am a great admirer of American business. For getting action on problems, it is more effective than government. That is why I find it strange that your statement is full of endorsement for all the things that government is going to do. I do not find anything in it about what you are going to do. I just wonder, where does the coal industry itself fit into this whole picture? What are you doing about research and development? What are you doing about the energy crisis? How many shifts do you have working in the coal mines these days, and how many could you put on; things of that nature?

Just because the Government does not give you money to develop new mining equipment, there is no reason why you cannot go out and develop a little bit on your own. If the Government is going to develop all this research, how will we be paid for it? Are you going to be the beneficiaries of it? Are you going to pay for any part of it?

These are the questions that run through my mind. I understand why you endorse the programs and are not opposed to them. I want to know what you are going to do and how you are going to help.

Can you come up with anything?

Mr. BAGGE. That is a very complex question, Congressman. I would like to say that my board of directors has committed themselves totally within the capability of the resources of the coal industry. You have to remember that the coal industry, the thing we call the American coal industry is comprised of 4,000 separate economic entities that are involved in the extraction or the mining of coal. Now, with that kind of a segmented industry, of which 3,000, I might say, Congressman, 872 entities do not belong to the National Coal Association, for example. We have a laboratory. A third of my budget, for example, of the 150 members that I represent, a third of my entire budget goes to fund our own laboratory in Pittsburgh, the Bituminous Coal Re-

search Lab, which is our initial funding. There is research done by some of the larger coal companies. Those companies who have become affiliated with the larger oil companies now have access therefore to larger laboratories and these laboratories can involve themselves then in coal research. We have established a coal research committee in the last year which is focusing its attention on precisely how, what kind of a response we can make now that coal has come to center stage.

You have to understand, Congressman, that 10 years ago, we were told that we were going to be phased out. In Western Europe, they were what they call rationalizing their coal industries, literally phasing them out—this is true in England, France, Germany—for imported oil.

Mr. WYDLER. But you used all those Government figures to indicate that the Government had not supported research sufficiently. The Government could have used the same argument you are using, that they were going to phase out the industry and we did not have to use the public's money to support it. Now, maybe you can show that you have done something better than the Government, and acted with greater foresight. Is there any coal mine in the country that is working on a double shift right now?

Mr. BRENNAN. Oh, yes, some of them, working two shifts and usually what you have is a maintenance shift.

Mr. WYDLER. Do you have a percentage of those that are working on double shifts that you can give us?

Mr. BRENNAN. I cannot do that. We will try to get some idea. It will be difficult because there are 4,000 mines. But in your surface mines, there are three shifts around the clock. Your deep mines will work two with maintenance, because they have to maintain roof holes, and so forth. But we will try to get you some idea.

Chairman HOLIFIELD. Mr. Mallary?

TRANSFER OF BUREAU OF MINES AUTHORITY

Mr. MALLARY. Mr. Chairman, just one question, that relates to the specific bill before us, the transfer section.

You addressed yourself to the transfer of the functions from the Bureau of Mines. Do you feel that that section appropriately transfers all of the technological development activities of the Bureau of Mines?

Mr. BAGGE. No, Congressman. Without having my finger on the precise language of the bill, my impression is, as I read it the last time, that it contemplates only the transfer of the Bureau of Mines energy centers. This is section (b)(2). My understanding of the bill, and I am delighted that you brought it up, because it dovetails exactly with my plea to the committee in regard to mining technology because of its vital character and because it is the essential prerequisite to gasification and liquefaction, that in my opinion, it is absolutely essential that you expressly provide for the transfer of the mining technology functions of the Bureau of Mines. Now, I am not saying health and safety. I think with the health and safety functions, as Chauncey Starr says, when you have a good thing going, you might leave it there. We are not disrupting a thing, Congressman, when we urge you to provide

specifically for an entirely new role of the Bureau of Mines, that is, mining extraction technology, to bring that over to ERDA, so that if ERDA, when assessing its priorities, does have a breakthrough in some field, they know they have to put something in the mining technology to accommodate this new conversion technology. So I am grateful to you for asking the question. I would urge the committee to give serious consideration to expanding that provision which defines the functions of the Bureau which are to be transferred to ERDA.

Mr. MALLARY. You feel that the technological development of extraction processes would be better located within ERDA rather than retained within the Bureau of Mines, even assuming adequate funding in either place?

Mr. BAGGE. Well, if you say adequate funding in either place, Congressman, you throw me a curve. I personally believe that the only opportunity that the American coal industry is going to have for adequate funding for any visibility at all, assuming that you do not adopt Mr. Simpson's proposal that we eliminate an assistant administrator for fossil fuels and keep coal on a parity with nuclear, I think this is the only hope we have for any kind of funding.

Mr. MALLARY. So your preference then would be that this section be modified in order to make it clear that mining technology——

Mr. BAGGE. There is another reason, too, even assuming the same funding, I might say, that I think that the administrator of fossil fuel research has to conceptually, even if I assume in your question there is equal funding at the Bureau of Mines or with ERDA, I think conceptually, you have to think of all this as a total delivery system and the administrator of ERDA having concern for the gasification and liquefaction technology has to be able to manipulate the total system in such a way that he knows he has to turn on more in mining technology to accommodate new breakthroughs, new technological breakthroughs involving coal. So I think even if we have the same funding, which I doubt that we would have, based on past history, that I urge it be included as well, because conceptually, I think it belongs there together with the conversion technology research.

Mr. MALLARY. Thank you very much.

Chairman HOLIFIELD. Mr. Bagge, you know that, of course, this is a controversial matter within the Department of the Interior.

Mr. BAGGE. Well, I would hope that it would not be, Mr. Chairman, because the Department of the Interior has been our only hope in the past and even remains today the only hope that we have as an industry. I would hope that that proposal would not be regarded as controversial. It is my understanding that the administration and indeed, the Department of the Interior supports ERDA.

Mr. HORTON. What the chairman is talking about is the transfer from the Bureau of Mines in the Department of the Interior of this research and development function relating to the extraction of coal. That is what I think he was referring to.

Mr. BAGGE. I understand the question, but I would assume that conceptually, this is such an integral part of the whole coal delivery system that it simply, in my opinion, and in the opinion of my colleagues and our board of directors, who have given careful considera-

tion to this specific issue, we believe that is has to be an indispensable part of the whole R. & D. effort.

Chairman HOLIFIELD. Well, we will certainly take your testimony under consideration. I know the Secretary of the Interior is scheduled to come before us as well as other administration witnesses, and he will have something to say to us on it.

Mr. BROWN. May I just ask a question, Mr. Chairman?

Chairman HOLIFIELD. Mr. Brown.

COORDINATION OF PRIVATE R. & D.

Mr. BROWN. In my part of the country, we are very much interested in the development of liquefaction and gasification of coal, so much so that it is a major effort by the Battelle Memorial Institute, as I am sure you are aware. As a matter of fact, they are spending almost as much, I understand, as either private industry or the Federal Government spent last year on this matter. Now, could you clarify for me the method by which coordination of private industry efforts, public efforts, and not-for-profit efforts like the Batelle Memorial Institute, could be effected?

Mr. BAGGE. We believe, Congressman Brown, that the only way you can avoid redundancy and get the kind of true coordination of all these institutional interests to which you have referred is by writing into this bill a specific strong provision for an advisory committee comprised of these institutional interests apart from the governmental where they would, on a continuing basis, have an advisory role to play to the Administrator of ERDA and to the fossil fuel—I have forgotten how he is characterized, the subadministrator—the Assistant Administrator. We think that can only be accomplished by this committee providing precisely and expressly for that kind of a close and continuing coordination through the advisory committee, with all of the restraints that obtain with respect to such advisory committees to avoid the kinds of problems to which you are addressing yourself.

Mr. BROWN. I am not trying to entrap you in your own language, but I am concerned about the definition of the word "coordination." One man's coordination is another man's stultification. I do not want to spend a lot of Federal money or private money reinventing the wheel or wasting a lot of time duplicating efforts made by other agencies, or private organizations. On the other hand, I did not want to have only Federal direction of energy research.

For instance, in the National Institutes of Health there are waves of faddism that go through the study of cancer. This year, we all look at viral methods and that is where all the Federal grants go. And some poor guy out here who is working on another aspect of the solution, which may in fact be closer to the truth than all this Federal effort, gets cut off from the money. I had a long conversation once with Dr. Sabin, whose processes for solving the polio problem with the live virus polio vaccine, were not looked upon with favor. He said that if he had not had private money to go ahead with this, he would never have been able to come up with the solutions he came up with, which were ultimately better than the Salk solutions to the problem.

I want to be sure we do not duplicate efforts, but I also want to be sure that we do not, by coordination, get so much control that somebody with a good idea gets cut off simply because—do you understand what I am saying?

Mr. BAGGE. I understand and it is a legitimate concern. I think it may be intrinsic in any governmental mission such as this and one that I simply do not know quite how, other than through the advisory consultive process, which requires the Administrator to take into serious account these kinds of concerns, from a Battelle or from our own laboratory, for example, from a number of different laboratories that are cooriented throughout the country, so that they have a voice. We have to, I think—the problem to which you are addressing yourself is one that is almost inherent in the system.

Mr. BROWN. To get a little fresh air in it some way, how could we write legislation so that they, from time to time, would take into account not just currently popular ideas; or at least to make sure that you do not find projects following just one approach being funded?

Mr. BAGGE. This, of course, I might say, Congressman Brown, was one of our concerns initially if we are going to aline only the national laboratories. The Coal Institute has never been a beneficiary of the national laboratories and it was with some concern that we viewed a bill that would be viewing the national labs as the only source of this kind of research in coal. Now, therefore, I tried to make the point as explicitly and as dramatically as I could to your colleagues before you arrived that we believed that retaining the contracting technique which has been employed through the years by the Office of Coal Research will provide the kind of fresh air and ventilation so we do not get stultified in the national laboratories, without denigrating the national laboratories one iota. But we think that if there is not only a provision which permits the Administrator to make contracts with private industry but a mission to do so, that we can build into the system the kind of flexibility and the kind of creativity and what you characterize as fresh air which is needed.

Mr. BROWN. The staff has pointed out to me language on page 7, items 5, 6, and 7. Are you suggesting that you think this does take care of providing the necessary fresh air in the operation?

Mr. BAGGE. Let me ask our vice president of planning, who has been giving a great deal of thought to this very point you raised, Congressman Brown, if he would just respond.

Mr. BRENNAN. Congressman Brown, I am very familiar with the Battelle work. I think they have done a very good job inasmuch as they have gone to all of the people involved in coal research and all of the people involved in mining and liquefaction and gasification, and because of the great amount of public information, they have been able to look at where the gaps are, then comfort, hopefully with a place where they can contribute. I think there are several things that have to be done in order to maintain the maximum amount of participation and to get those ideas that are worthwhile into the program. Mr. Bagge has mentioned one, advisory committees.

I have been personally involved with the Office of Coal Research on advisory committees and true, an advisory committee representing

all segments does provide a maximum flow of dialog between the various outside interests.

Second, you can do things as provided for in the bill by participator programs, where private interest and Government in fact join together. And since you have competing private interests looking for better ways and since these interests have the expertise or can have the expertise to develop better ways, you have a type of competition for programs.

The third way is the way that really, Battelle has gone about it. That is looking at the thing independently and gone into.

And I think the most important thing that is provided in H.R. 11510, is that ERDA should provide for maximum information flow. Everything that ERDA is doing should be way out there in the public. So if there is a guy or an institution which has a better idea, if there is a gap in what ERDA is doing in the fossil fuel area or the nuclear area or any, it is highlighted and independent people or outside agencies, either the Government or the private sector, will have a mechanism through advisory committees or through hearings or whatnot to go and say, well, this is the gap or this is where we should be going.

Mr. BROWN. I would like to touch on that for just a minute if I may.

Chairman HOLIFIELD. Would the gentleman yield?

Mr. BROWN. Yes; but may I make my observation, or I will forget it?

In the State of Ohio, we now have law libraries set up by virtue of a State law which provides that in every county, you have a tax to provide for an extensive law library, even in some of the rural counties. Well, they decided that they had so much money left over from this tax that they ought to use the extra funds to computerize the law. Now any lawyer can go into a law library on a problem and get a computer printout of applicable citations of the law. For instance, he just taps out the words "statutory rape" and gets all the citations on that in current law.

We are doing some of that in NIH, where medical research information is generally available, again by computer reference. It seems to me that if we are going to accomplish by 1980 this energy independence that the President has suggested is important to our continued national existence, it would be helpful if we had that kind of computerized center where the gaps that you suggest in research show up. Then the guy who has a little grant from whatever source—private, public, or parochial—might be in a position to check and see whether the work that he is going to do has already been done by somebody else. Our committee report shall urge that such a system be established. Battelle is publishing a lot of journals. I once asked someone connected with Battelle how a guy, when he got into the field, knew about their journals. He said, well, they just ought to know about them.

There are a lot of things that get lost in the literature, and maybe we could set up a better mechanism by which we can keep track of research.

Mr. BAGGE. I might say, Congressman Brown, we had the responsibility of preparing a rather comprehensive paper which attempted to

send to the European coal producing nations of the world a comprehensive survey of all of the coal R. & D. that has been done in this country. That is a tremendous job, simply because there was no one single place we could go to identify the contracts, the kind of work that is being done. We attempted to do that. It purports to be comprehensive, but I am sure it is not.

Mr. BROWN. Thank you, sir.

Chairman HOLIFIELD. I want to say that on page 14 of the bill, at the bottom, section 108, it says,

> To this end, the Administrator is authorized to make arrangements, (including contracts, agreements and loans) for the conduct of research and development activities with private or public institutions or persons.

And so on.

Now, this language has been paraphrased from the Atomic Energy Act, which as you know, has contracted with Battelle, with Union Carbide, with General Electric, with Westinghouse, and with many other private companies for laboratory work as well as for operational instruction.

I visited the Ames Laboratory in Iowa, for instance, where they were under contract, and Battelle has been under contract for a long time until a court order was handed down requiring them to divest themselves of certain activities which had to do with a conflict of interest. So I am in accord with what the gentleman is saying. We talked about it and we very carefully had our legal staff, including lawyers from the Atomic Energy Commission and the Antitrust Division of Justice, around the board working out some of these changes in the language. I think we have this covered, I really do.

Mr. BROWN. If the gentleman will yield, I am not critical. I am just concerned that the legislation cover it, and that in meeting our committee's oversight responsibilities—or whatever committee is going to have ultimate jurisdiction over the operations of ERDA—that we accomplish what is a continual balancing act in the establishment of any Federal activity; that is, to draw the line between Federal dictation on the one hand and a lack of coordination on the other. I think we have both obligations.

Mr. HORTON. I think it is appropriate that we suggest to the staff that we include in the report this commentary. I think it is an important point and could be covered in the report.

Mr. BAGGE. I might say, if I may, because I think it is relevant to Congressman Brown, your colloquy with Congressman Brown, Mr. Chairman, that we are now attempting through the establishment of an international coal commission to try to integrate to avoid redundancy, jointly fund research efforts in mining technology—liquefaction, gasification, the whole spectrum of R. & D. efforts with respect to coal. We have for the first time provided and are now providing at the institution our own little ERDA, you might say, on an international basis where all the coal producing nations of the Western World and Canada and the United States are trying to do this very thing.

Chairman HOLIFIELD. This will put you in a position, then, to go before the committee of authorization and jurisdiction and present your case on this matter.

Mr. BAGGE. We intend to do that, yes.

Chairman HOLIFIELD. Yes, I think you would.

Thank you very much, Mr. Bagge. We will take into consideration your suggestions and try to work them out in a way that will give us a bill that will pass and get signed by the President.

QUALIFICATIONS OF ERDA ADMINISTRATOR

Mr. BAGGE. I have one other thing I would like to lob in. That is because we think the selection of the Director of ERDA is so important and I know you are concerned, I took the liberty of including in my statement the letter which I addressed to you in which we gave a great deal of thought to the kind of quality which the ERDA Director should have and because we think it is so vital, we would like to make it a matter of record by your leave.

Chairman HOLIFIELD. That is the letter by which you responded to my letter of some months ago?

Mr. BAGGE. Exactly.

Chairman HOLIFIELD. I received, I might say, about 40 or 50 from informed persons, and I would say there was a substantial amount of reasoning in those letters as to qualifications. We are not going to get involved in personalities, but qualifications that have been suggested by you and others certainly should be considered by the President or his people in making this appointment.

Mr. BAGGE. Yes.

Chairman HOLIFIELD. I believe we are on the right track, and I believe we are going to get a good person to head this organization.

Mr. BAGGE. Thank you very much.

Chairman HOLIFIELD. Thank you very much.

Now, we have Mr. John Partridge of the American Gas Association.

You may proceed. We are pushing against a probable call to the floor. So far we have had good luck, so you may proceed as swiftly as possible and give us a summary, and we will see that your full statement is put in the record.

STATEMENT OF JOHN PARTRIDGE, AMERICAN GAS ASSOCIATION AND COLUMBIA GAS SYSTEM

Mr. JOHN PARTRIDGE. Mr. Chairman, I plan to read my testimony, which should not take any longer than 10 minutes.

Chairman HOLIFIELD. All right.

Mr. JOHN PARTRIDGE. I am chairman of the board and chief executive officer of the Columbia Gas System, Inc., of Wilmington, Del., and past chairman of the American Gas Association's (AGA) Research and Development Executive Committee. I appear here today on behalf of the American Gas Association and the Columbia Gas System.

The American Gas Association is a national industry association composed of some 300 distribution and transmission companies which deliver about 92 percent of the utility natural gas consumed by 150 million people in this Nation. Natural gas provides about 31 percent of the Nation's total energy requirements and 42 percent of its sta-

tionary energy needs. The Columbia Gas System directly at retail and indirectly at wholesale provides gas service to 4 million customers in an area with a population of some 18 million people in the seven States of Kentucky, Maryland, Ohio, Pennsylvania, New York, Virgina, and West Virginia, as well as the District of Columbia.

Although natural gas is our prime interest, we assure you that we support meaningful and appropriate efforts to provide our Nation with adequate supplies of all forms of energy. I was pleased to have that in our testimony, Mr. Chairman, by reason of your earlier statement. There is need and room for all and our testimony today applies to all forms of energy.

The current critical energy situation should at long last convince Congress and the American public that the United States is in a deepening energy crisis with serious effects on our Nation's welfare. However, we are concerned as to how well it is understood that at best—which we are far from having—no appreciable relief can be obtained for 3 to 5 years and longer.

Further, that even with the necessary measures to provide partial and short-term help, there remains a tremendous undertaking to make the United States self-sufficient in adequate energy supplies. Until this is achieved, we will be increasingly dependent upon foreign supplies with increasingly perilous uncertainties. We face, in fact, a deepening long-term problem that is certain to escalate with critical impact on our economy for at least a decade.

While there are many other actions that have to be promptly taken, the basic solution is the earliest possible implementation of a massive, all-out, Federal energy research, development and demonstration program. This has to be done on a high urgency basis—such as took place with the successful Manhattan and Apollo programs.

The urgency and importance of this program mandates the following essential criteria:

1. It must be conducted by a fresh, new organization, independent of existing entities, priorities, and procedures, which pulls together the present fragmented Federal energy research efforts, and is charged with overall and specific accountability for meaningful results. It is essential that this program be subjected to the least restraints possible, including those partisan and political—it must involve an independent effort by our best talent to do the job that must be done. This should involve inclusion in the new independent agency of all pertinent, existing Federal nonmilitary energy research activities, such as those in AEC, Department of the Interior, NASA, National Science Foundation, et cetera.

2. It must be funded on a sustained basis—a trust fund which would provide a minimum of $2 billion per year for at least 10 years. This is essential so that needed funds can be utilized without any timelag and that long-range commitments can be readily made.

3. It must have maximum flexibility to function at its management's discretion within broad policy guidelines. It must operate on a sound businesslike basis with sole authority to initiate projects of its own, by others, or jointly, and most important must be able to timely terminate or cut back projects if lack of progress so dictates.

4. Its management and responsibility should be vested in a board

of governors consisting of key Government officials with primary responsibilities in areas related to energy and persons from the private sector with high qualifications and responsibilities in energy and relevant areas, appointed by the President with the advice and consent of the Senate. This Board should be responsible only to the Congress.

We submit these criteria are requisite if the United States is to become self-sufficient in adequate energy as soon as possible.

Although the objectives of H.R. 11510 are consistent with those required, its provisions meet only part of these essential criteria. However, a bill has been introduced in the Senate—S. 2694—which does meet them and it is hoped that a companion bill to it will shortly be introduced in the House. A copy of S. 2694 is attached as appendix A.

[The attachment referred to above is in the subcommittee files.]

Mr. JOHN PARTRIDGE. A brief comparison of the major provisions of the two bills will demonstrate the differences.

The Declaration of Purpose is quite similar, except that H.R. 11510 provides for inclusion of military in the new administration. S. 2694 provides for military nuclear research under the Department of Defense. And I might say here that we hold no particular belief for this, whether it should be under the Department of Defense or under a civilian authority. But we do feel very strongly that military should not be mixed up with energy research. Both provide for the licensing of regulatory functions of AEC to be vested in a Nuclear Energy Commission.

Both bills provide for the establishment of an independent executive agency. H.R. 11510 calls for its top management officers to be appointed by the President, by and with the advice and consent of the Senate, and they would be compensated in accordance with various levels of the executive schedule.

S. 2694 calls for management by a Board of Governors, consisting of eight key government officials concerned with energy—this would provide a great deal of the coordination which has been discussed here this morning—and seven from the private sector having to do with energy and related matters. The Government members would serve by reason of their office—the private members would be appointed by the President, by and with the consent of the Senate for specified staggered terms. The private members would make a vital contribution of talent and experience at the policy level. Each would be "a person with high qualifications and responsibilities" from each of the coal, nuclear power, natural gas, petroleum and electric industries as well as from environmental and consumer organizations. All would serve without compensation. The Board would elect the top agency officers and set their compensation. The latter is most important because it is believed that current Government executive pay schedules would not attract the best talent available, which is so sorely needed for this effort.

Functions in the two bills are generally similar, but S. 2694 provides more specificity and emphasis on demonstration projects, and its broader transfer provision would enable ERDA to coordinate, more comprehensively, all Federal energy research and development programs.

Thus, S. 2694, in addition to mandating certain transfers, provides for transfer of any Federal nonmilitary research function, as in the agency's judgment is required.

Funding provisions are quite different. H.R. 11510 provides for the usual year-to-year authorization and appropriation procedure, which could severely retard proper progress of the program. S. 2694 calls for the establishment of a $2 billion per year trust fund. It would be funded by Federal receipts from all eligible energy sources, such as lease sales, royalties, excess profit tax, et cetera, without disrupting existing commitments. If such receipts do not total $2 billion in any fiscal year, the balance would be made up from general funds. If Federal energy leasing programs continue to accelerate as they appear to be doing and as they must, it is doubtful that any help will be needed from general funds. This approach is equitable and appropriate because it earmarks funds generated by the sale of Federal energy development rights for the development of future energy sources.

We have covered above only the major differences between H.R. 11510 and S. 2694. The attached appendix B sets forth a more detailed comparison, together with our position on the differences.

[The attachment referred to above is in the subcommittee files.]

Mr. JOHN PARTRIDGE. In conclusion, we urge that you not take final action on H.R. 11510 until you have had an opportunity to study S. 2694, or much better, to have hearings on its companion House bill. We unequivocally believe that the S. 2694 approach is by far the right way to properly solve our Nation's most serious and critical energy problems. The real challenge on not only energy research, but on the entire energy problem, is whether we will continue to futilely attempt to meet it with traditional procedures, or if we face reality and do what has to be done the right way.

That concludes my presentation, sir.

Chairman HOLIFIELD. Thank you, Mr. Partridge. I am sorry we will not have time to question you. We have been called to the floor. We will try to get your statement and that of the other Mr. Partridge into the record at this time, as we will not be able to reconvene this afternoon.

Mr. HORTON. We do thank you, Mr. Partridge. We certainly will compare and study the bills, particularly the suggestions you have made. We will take under consideration your very valid points.

Mr. JOHN PARTRIDGE. I think in particular, I hope you will give grave attention to the funding. I think this is extremely essential.

Chairman HOLIFIELD. Thank you, sir.

Mr. Robert Partridge, National Rural Electric Cooperative Association.

How long is your statement, sir?

STATEMENT OF ROBERT D. PARTRIDGE, EXECUTIVE VICE PRESIDENT, NATIONAL RURAL ELECTRIC COOPERATIVE ASSOCIATION; ACCOMPANIED BY CHARLES A. ROBINSON, CORPORATE COUNSEL

Mr. ROBERT D. PARTRIDGE. Mr. Chairman, I have a prepared statement. If you will include that in the record, I will hit only the summary points.

Chairman HOLIFIELD. Thank you. We will let you continue until the next bell rings. That will just give us time to trot over to make the rollcall.

Mr. ROBERT D. PARTRIDGE. Very good, sir.

Mr. Chairman, members of the committee, I have with me Mr. Charles A. Robinson, Jr., the corporate counsel and director of our energy and environmental policy division. We appear in support of H.R. 11510. We think it does provide the organizational framework around which to martial and give direction and thrust to the Federal research effort, that it will enable the gathering together of the research efforts of the Federal Government which at present are rather badly scattered.

We do support the Electric Power Research Institute. The cooperatives are contributing about $8 million to the liquid metal fast breeder reactor and are gradually increasing their research commitment in other areas, including particularly the ERPRI currently being funded at about one and a quarter million dollars per year, and we expect that to go up to the range of about $8 million when the final commitments are made. At the same time, we are aware that much broader efforts are going to be required in the R. & D. field, probably in the range of billions of dollars per year rather than millions, and we agree that is probably not within the present capability of the private sector.

We additionally recognize that this country is shifting from its petroleum-based energy system to a system which will rely in making up the deficit and in meeting the expanding needs primarily on the nuclear field and on coal.

It is our view that it will be necessary to attain a synthetic liquid fuel capability as quickly as feasible. Liquid fuel is the real shortage area at the present time. We think this is so important that we believe there is justification for Government participation in full-scale production facilities, in informed price supports, or in the involvement by Government in the actual planning and construction to get synthetic fuel capability on line.

The need in the liquid fuel area is such that it will probably require essentially as large an effort as has been committed to nuclear development.

In summary, Mr. Chairman, members of the committee, we do support this bill as a vehicle that can strengthen the Federal energy research, coordinate Government research with the work of the EPRI, and quiet some fears which we do not share but which have been voiced about the combined research and regulatory functions of the Atomic Energy Commission.

We do caution that a reorganization of function will not in itself, we believe, produce the substantial additional R. & D. effort that will be required in solving the energy crunch unless companion to that, Congress gives the new agency greatly expanded and broadened authority and funding. We do urge consideration of the substantive research on a scale such as is contemplated by Senator Jackson's bill, S. 1283. We particularly emphasize the need for attention to the synthetic liquid fuel production capability as I have just mentioned.

We also suggest for the consideration of the committee that section

104(d) of H.R. 11510 be changed to include the transfer to ERDA of the EPA research used to develop powerplant environmental protection standards. This change would, in our view, constitute a major step toward reconciliation of the Government's divergent policy on energy development and environmental protection.

We continue to support the concept of a national power guide, with the added justification of moving toward coal and away from gas and oil for electric power generation. We believe such a nationwide guide would substantially assist in achieving that objective.

We very much appreciate the opportunity to present our views to this committee.

Chairman HOLIFIELD. We want to thank you, sir, for your support of the bill. We wish we were not pushed for time, but I think we are going to have to adjourn the committee. Your testimony will be published in the record in its entirety.

Mr. ROBERT D. PARTRIDGE. Thank you, Mr. Chairman, and members of the committee.

Chairman HOLIFIELD. And we will carefully consider the points you have made. Thank you very much.

We are recessed until tomorrow at 9:30.

[Mr. Robert D. Partridge's prepared statement follows:]

PREPARED STATEMENT OF ROBERT D. PARTRIDGE, EXECUTIVE VICE PRESIDENT, NATIONAL RURAL ELECTRIC COOPERATIVE ASSOCIATION

Mr. Chairman, and members of the subcommittee, my name is Robert D. Partridge. I am the executive vice president of the National Rural Electric Cooperative Association (NRECA). NRECA is the national service organization of consumer owned cooperatives which provide electric utility service to some 24 million consumers located largely in the sparsely populated agricultural areas of 46 States. I am accompanied by Mr. Charles Robinson our corporate counsel and director of our energy and environmental policy division.

The chairman of this subcommittee stated on July 25th, during Secretary Morton's testimony, that "This committee believes that the approaching deficit crunch—as they call it in the energy field—is our greatest domestic problem at this time." The chairman was obviously and eminently correct. The "energy crunch" is now upon us, and it is indeed our most serious domestic problem. Moreover, as matters have developed, it is also one of our most serious problems of foreign policy. We cannot tie our Nation's energy future to the vagaries of international politics.

For several years NRECA has advocated a sharply stepped up Federal role in energy research. Our membership has participated in the development of the Electric Power Research Institute (EPRI), and rural electric systems are now beginning to commit substantial funds to EPRI programs. However, we also believe that the magnitude of the energy research burden imposed on us by the present situation requires a truly massive effort; an effort which cannot succeed without strong and thoroughly coordinated Federal leadership. We offer our support of H.R. 11510, because it is clearly designed to improve the coordination of Federal research activity. It may not yet be perfect in every detail, but it is very soundly conceived legislation. It anticipates the need for increased Federal R. & D. activity and sets in motion the machinery to handle the work.

H.R. 11510, by divorcing the R. & D. activity of the Atomic Energy Commission from its regulatory function, should also help to allay the fears of persons who have felt that the combined research and regulatory functions of AEC might somehow downgrade nuclear safety or environmental standards. We do not share these fears, but we do not object to the separation proposed.

As we interpret sections 103(6) and 108(a) of H.R. 11510, they would permit ERDA to participate in and help fund EPRI projects, and thereby speed electric industry research. We feel that these provisions are excellent from the industry's standpoint.

As we understand, however, H.R. 11510 would not actually authorize any additional research programs, and we really believe that if the potential of this new agency (ERDA) is to be realized, H.R. 11510 must be followed by legislation which does strengthen and broaden the substance of Federal research activity. S. 1283, introduced by Senator Jackson and others, is one example of the kind of legislation which we feel is needed.

Actually, the U.S. energy crunch is primarily a shortage of petroleum based liquid and gaseous fuels upon which we depend for 78 percent of our energy. What we must do, in my opinion, is shift our energy base away from natural petroleum and toward coal and nuclear fuel, both of which we have in abundance, assuming we develop a successful breeder type nuclear reactor.

This changeover is, the way we see it, as much of a problem of business economics and development as it is one of pure research. Therefore, we feel strongly that it may be time for the Federal Government to set some quantitative and time certain objectives for synthetic liquid fuel production. Many utilities are now facing fuel oil prices of $7 per barrel; some prices are even higher. Scientists with whom we have recently discussed the process, advise us that synthetic liquid fuels can be produced from coal at about that price. They are of the opinion that it would require 10 years of construction and planning time to produce synthetic liquid fuel in quantities equal to about 10 percent of total U.S. liquid fuel demand. We feel that substantial synthetic liquid fuel capability is essential to the future economic strength and national security of the country; even to the extent of Government participation in actual construction and operation of full scale production facilities if necessary, or Government support of synthetic liquid fuel prices. Under even the most optimistic estimates, our natural petroleum reserves cannot last more than several decades. We cannot achieve energy "self-sufficiency" without immediate attention to developing substantial synthetic fuel capability.

NRECA has traditionally supported the concept of a national power grid; complete interconnection of all major electric generation and all major load centers in the country. This is one way to help shift our fuel consumption toward those areas where coal is predominant, and away from oil and gas. We suggest that ERDA is the vehicle through which to develop plans for a national grid system.

Subsection 104(d) of H.R. 11510 (page 9) transfers to ERDA certain research functions of the Environmental Protection Agency which relate to developing alternate automotive power systems and stationary power plant emission control technology. This is in our view an excellent concept, but we urge that subsection 104(d) be expanded to include the transfer to ERDA of EPA research activities which form the bases for that agency's powerplant performance standards.

It seems to us that at least on some occasions the policies of Government agencies responsible for energy availability work in opposition to the policies of those agencies responsible for environmental protection. We believe that combining in one agency the research base for both energy production, and the environmental protection standards which such production must satisfy, would be an enormous step toward a coordinated Federal policy on the seemingly opposed objectives of adequate energy and environmental protection.

In summary:

(1) We support H.R. 11510 as a vehicle which can strengthen Federal energy research, coordinate Government research with the work of the Electric Power Research Institute, and quiet fears which have been voiced against the combined research and regulatory functions of the Atomic Energy Commission.

(2) We caution, however, that a reorganization of functions will not of itself produce substantial additional R. & D. effort or make much progress in solving the energy "crunch" unless Congress gives the new agency greatly expanded and broadened authority and funding. We urge consideration of substantive research on a scale contemplated by Senator Jackson's bill (S. 1283). We suggest special emphasis on synthetic liquid fuel production capability even to the extent of Government support for product prices, or Government participation in construction and operation of full scale plant facilities.

(3) We suggest that section 104(d) of H.R. 11510 (page 9) be changed to include the transfer to ERDA of EPA research used to develop powerplant environmental protection standards. This change would, in our view, constitute

a major step toward reconciliation of the Government's divergent policies on energy development and environmental protection.

(4) We continue to support the concept of a national power grid, with the added justification of moving toward coal and away from gas and oil for electric power generation.

We very sincerely appreciate this opportunity to present our views to the subcommittee, and wish it much success in moving toward a solution of the energy shortage.

[Whereupon, at 12:40 p.m., the subcommittee adjourned, to reconvene at 9:30 a.m., Wednesday, November 28, 1973.]

ENERGY REORGANIZATION ACT OF 1973

WEDNESDAY, NOVEMBER 28, 1973

HOUSE OF REPRESENTATIVES,
LEGISLATION AND MILITARY OPERATIONS SUBCOMMITTEE
OF THE COMMITTEE ON GOVERNMENT OPERATIONS,
Washington, D.C.

The subcommittee met, pursuant to notice, at 9:35 a.m., in room 2154, Rayburn House Office Building, Hon. Chet Holifield (chairman of the subcommittee) presiding.

Present: Representatives Chet Holifield, Benjamin S. Rosenthal, Don Fuqua, William S. Moorhead, Frank Horton, John W. Wydler, Clarence J. Brown, and Richard W. Mallary.

Also present: Representatives Melvin Price and Craig Hosmer; Herbert Roback, staff director; Charles Goodwin, counsel; Michael T. McGinn, defense analyst; Miles Q. Romney, counsel-administrator; Douglas Dahlin, associate counsel; James Lanigan and John Reich, consultants; and Warren Buhler, minority professional staff, Committee on Government Operations.

Chairman HOLIFIELD. The committee will be in order. Our first witness this morning will be Mr. Mike McCormack of Washington.

Mr. McCormack, we will be delighted to hear from you.

STATEMENT OF HON. MIKE McCORMACK, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF WASHINGTON; ACCOMPANIED BY JOHN ANDELIN, ADMINISTRATIVE ASSISTANT; AND J. THOMAS RATCHFORD, SCIENCE CONSULTANT, HOUSE COMMITTEE ON SCIENCE AND ASTRONAUTICS

Mr. MCCORMACK. Thank you, Mr. Chairman. I would like to take this opportunity to introduce two of my aides, John Andelin, my administrative assistant, and Dr. Tom Ratchford, who is science consultant for the House Committee on Science and Astronautics, Subcommittee on Engineering.

Mr. Chairman, I appreciate being invited to testify before the Committee on Government Operations today on H.R. 11510. I want to congratulate you and the members of this committee on your efforts in this matter of an administrative organization to deal with energy research and development. I cannot help but take this opportunity to congratulate you, Chairman Holifield, for a lifetime of dedicated service to our Nation's nuclear energy program which has brought us to this point of preeminence in nuclear power, with a breeder reactor development program underway, and with fusion research now mov-

ing aggressively forward. The people of this country will forever honor you for your leadership in this accomplishment. Mr. Chairman, the basis for my comments this morning lies in my conviction that this Nation must have a systems approach to an integrated national energy policy. This is an absolutely essential minimum requirement if we really intend to do anything to help solve the energy crisis. Any research and development agency must be built on this principle if it is to accomplish anything that cannot be done just as well with existing agencies.

A systems approach to an integrated national energy policy must include, along with the administration of all energy research, development, and demonstration, assessment and management of all fuels, an understanding of the supply and demand for each type of energy and fuel for each region of the country, managerial determination of the conservation potential, and economic and environmental feasibility of any energy-related proposal. This is basic to any other action we may desire to take with respect to the energy crisis, and it is essential that we establish within the executive branch a single administrative agency with the authority to implement such an energy policy.

In this crisis situation we face, it is not acceptable to have any energy research and development administration working in some areas of energy R. & D. if other Federal agencies are independently doing the same thing, unless, of course, these efforts are actively coordinated through some single administrator to whom all report.

It does not serve the best interests of our society to attempt to direct any research and development separately from the assessment and management of our fuels. A system approach would demand that the two be integrated within a single authority. For instance, a research, development, and demonstration program for coal gasification and liquefaction should be related as much as is possible to accurate information concerning available resources of petroleum and natural gas, including the amount available at various prices, the dates available, and the logistics involved. It must also be coordinated with programs that determine with certainty how much coal can be made available at any given point in time in any region of the country. The sulfur content, the noncombustible content, and the caking characteristics of the coal must be known along with the availability of process water and the environmental impact of developing a specific process which would depend upon coal from a specific area.

It does not serve this Nation's best interest to undertake a nuclear development program, as the chairman well knows, including various types of breeder reactors and burners using different types of fuel, without a thorough understanding of our uranium and thorium reserves, their location, and the cost of extracting and refining them, as well as the cost and leadtime required to provide adequate enrichment. This is an area wherein the AEC, with oversight from the Joint Committee on Atomic Energy, has done an outstanding job, coordinating research, development, and demonstration with fuels assessment and management. However, this has been limited to nuclear energy. What this Nation needs now is the same integrated

management for all energy policy, including research and development.

The same applies to understanding supply and demand. Until we know how much electrical energy and how much fossil fuel will be required in each region of the country, we cannot possibly set out to manage our fuel programs or ultimately to determine policies for research and development.

Nor is this enough. We must understand the conservation potential, and the environmental and economic feasibility of any proposed program for energy conversion, transmission, or consumption. Let me cite an example. A recent study by my staff shows that if this Nation were to develop an economically viable system for the gasification of coal by the mid-1980's, and if we were to undertake to make up with synthetic gas the deficiency that is presently anticipated in our natural gas supply at that time, the anticipated cost for the coal gasification plants alone would amount to approximately $200 billion. This is, of course, a rough figure, but it is a good approximation. It applies only to the gasification plants, ignoring the cost of opening and developing more mines and of transporting coal to the gasification plants. It also completely ignores the availability of process water and the environmental considerations of such an undertaking.

This example can be multiplied many times as one considers such programs as the increase in the number of nuclear reactors, the breeder program, synthetic liquid fuels from coal, solar and geothermal energy development, transmission of electricity, human transportation, desulfurization technology, and the environmental impact of any of these.

The question logically then arises: Would the ERDA, as set forth in H.R. 11510, respond to, or fit into the need for a systems approach to an integrated national energy policy?

I respectfully submit that it would not respond to the need, and that if it would fit in at all, it would be so awkward and so inadequate that this committee might consider taking no action at all, lest the Congress mislead the people of this country into believing we are doing something new and constructive to help solve the energy crisis which could be done just as well with existing agencies.

Let me cite what I consider to be several specific weaknesses or inadequacies of H.R. 11510.

The ERDA would be headed by an Administrator, appointed by the President and confirmed by the Senate. However, the bill is silent with respect to whom the Administrator would report. On Monday of this week, the Science and Astronautics Committee met all day with its Research Management Advisory Panel to discuss the subject of "Executive Organization for Energy Research and Development." At that time, Mr. John Sawhill, Assistant Director of the Office of Management and Budget for Energy, Science, and Natural Resources, discussed this matter with us.

He suggested that the Office of Management and Budget, along with an expanded Energy Policy Office, would coordinate with, and give general policy guidance to the Administrator of ERDA. A similar relationship would prevail with the Department of Interior and DENR if it were created at a later date.

Thus, it would appear that fuels assessment and management, and energy data and information collection and retrieval would be carried out in DENR, or in the Department of Interior, while a "sort of" combination of EPO and OMB would "sort of" coordinate energy policy, and through the budget procedure determine what R. & D. programs would be carried out.

I regard such a loose approach to energy policymaking and supervision of our energy R. & D. as dangerously inadequate. I believe that we must have clearly defined channels of authority from the President to some person who has authority for overall energy policy and planning, and thence to directors of R. & D. agencies. I believe that the person responsible for energy policy and planning should come before the Congress each year with a well defined program for energy R. & D., and with a budget request for it.

Mr. Chairman, the second major weakness of H.R. 11510, as I see it, is that nuclear weapons research, development, and demonstration would be transfered from AEC, along with energy R. & D. to the ERDA. I believe this to be highly inadvisable, not only because the very large weapons budget would tend to blur the perspective of our energy effort, and not only because of the distorted attention that such a large block in the budget would cause in the mind of management, but also because I believe very strongly that we must, in every way that we can, help the average citizen distinguish between the safe, peaceful uses of nuclear energy on the one hand, and nuclear weapons on the other.

Mr. Chairman, I would like to turn now to other areas of energy related research and development. H.R. 11510 would transfer solar heating and cooling development, and geothermal power development from the National Science Foundation. It would also transfer alternative automobile power systems and emission research from EPA.

While this seems to be a start in the direction of integrating energy R. & D., I fail to perceive the logic in this particular delineation. If some energy R. & D. from NSF is to be included, why not all? Should not other solar related R. & D. be included? What about battery R. & D., and wind energy and fuel cells? Most important of all is materials research. This is the most important area of all energy research, as our task force of energy pointed out this spring. If some automotive research is to be included, why not that outstanding work being done by NASA? If we include some transportation R. & D., why not all, at least insofar as it is energy related? If solar heating and cooling is included, why not housing design and standards for energy efficiency as are being worked on by the National Bureau of Standards? These are all important areas of energy research, and I believe that any energy research and development agency must consider them all in an integrated manner.

Finally, Mr. Chairman, I want to emphasize that any energy R. & D. agency must be responsible to Congress, as much as to the administration, for developing and implementing energy policies and R. & D. programs. It is my impression that H.R. 11510 does not provide for such congressional involvement. This, Mr. Chairman, is the main thrust of my criticism of the ERDA proposal: That it is inadequate to do the job in the face of the energy crisis; that it does not have a

clearly defined chain of command to the President; that it includes nuclear weapons R. & D.; that it is not adequately responsive to Congress, and finally it would be very awkward to fit the ERDA into a systems approach to an integrated national energy policy unless the entire program and agency were actually run by EPO–OMB. I have asked myself—could H.R. 11510 be amended to make the ERDA meet the criticism I have offered. My judgment is that it would be a sounder approach to consider instead the concept of an interagency energy council, such as was included in S. 1283, which was marked up in Senator Jackon's subcommittee in the Senate yesterday. This agency would, as I understand it, be directed by an Administrator appointed by the President, and approved by the Senate. The agency would coordinate the energy research, development, and demonstration activities of NASA, NSF, AEC, Department of the Interior, FPC, NBS, and EPA. I do not know the details of this bill at the present time because it has not been completely written up or published, but it would seem to me that it may come closer to meeting our Nation's needs at this time than does H.R. 11510. However, even with such a council, I would include an automatic destruct provision, with a long range study for the creation of a Cabinet level agency to determine energy policy and manage all energy programs. Finally, Mr. Chairman, I want to assure you that my criticism of H.R. 11510 is meant to be constructive, and that it is offered in a spirit of good will as my attempt to make a meaningful contribution to this committee's very important deliberations.

Thank you, Mr. Chairman. I will, of course, be happy to try to answer questions.

Chairman Holifield. I want to thank the gentleman, who is a colleague of mine on the Joint Committee on Atomic Energy, for his testimony this morning and his suggestions. I assure him that his suggestions will be considered by this committee when we come to the markup session. However, I might say that a number of things which the gentleman has mentioned are, or will be in the bill, such as the one man Administrator and annual reports to the Congress through the Chief Executive, which is where the reports would go first, and then to the committees of jurisdiction. So those things are taken care of.

Now, in my 30 years in Congress, I have come to the conclusion that you cannot always climb the full ladder in one bound; you have to do those things which are possible and practical and which can be passed in the Congress, and which can be signed by the President, or else you are engaged in futility.

This is an interim, you might say an initial, step toward coordination of energy and resources. We have, within the bill, the capability of contracting with every other agency of Government, the capability of taking on any research and development program, by assignment or by contract, that is now in existence.

As to what the Administrator will do when the agency is established and the problems are analyzed—and of course, an analysis must be made before any research and development program can go forward—I cannot say. The President, in his message to the people and to the Congress, has asked for immediate steps. This committee is endeavor-

ing to respond, and we have good support from the Members both here and in the Senate. Senators Ervin, Pastore, Aiken, and Jackson—the latter three being on the Joint Committee—and several more Senators introduced this same bill yesterday. Senator Ribicoff is ready to proceed in parallel.

It is the hope of the chairman of this subcommittee that we can get this bill out of subcommittee by the end of this week and bring it before the full committee next week. We are proceeding in an expeditious manner, but not in a hasty manner, because we have had this under study for some time. Hearings were held earlier on H.R. 9090, of which part B is substantially the same as this bill—that is, the transformation of the Atomic Energy Commission into an overall energy agency, utilizing its some 80,000 in-house and contractual employees and its $4 billion to $5 billion worth of facilities that are the best facilities in the Nation. It would have access to all other agencies' research and development facilities through the contractual route, and to all private sources of assistance. This will be taken care of in the bill.

We believe we have a practical bill here. We believe we have a bill that can be passed on the floor of the House and Senate, and we believe that this bill will be signed by the President. The administration witnesses will be before us after we get through with the congressional witnesses this morning.

Mr. Fuqua, do you have any questions?

Mr. FUQUA. I have no questions.

Chairman HOLIFIELD. Mr. Horton?

ERDA ORGANIZATION

Mr. HORTON. Mr. Chairman.

Mike, I want to thank you for coming before the committee and testifying. As you know, I have a great deal of respect for your expertise and knowledge in this field. I think the points you have presented to this committee ought to be looked at and studied. I do not know whether you have seen a draft of the proposed organization; perhaps one of the staff could make sure that you have one in front of you.

Have you received one?

Mr. MCCORMACK. No, I have not.

Mr. HORTON. Mike, would you see that Mr. McCormack gets a copy of this?

One of the objections you had was with regard to some of the more advanced concepts. If you will look at the five boxes showing the Assistant Administrators.

Mr. MCCORMACK. Yes.

Mr. HORTON. The fourth box is for research and advanced energy systems. Included in there is transmission, storage, and then advanced concepts, MHD, tides, winds, and solar. You can see the lineup that is listed there. I do not think that that means to exclude any other concepts. I would expect that this would be a very wide based research and development administration.

You were also concerned about the reporting, the lines of authority. This would be very similar to NASA. As I see it, ERDA would be to the energy mission what NASA was to the space mission.

There is a line of authority directly to the President. This would be an independent agency that would report directly to the President.

The other point is that we did by inadvertence leave out of the bill the requirement that this agency report annually to the Congress. However, it will be put in the bill that will be reported to the floor. So your criticism was justified there; it was not in the bill. But this is an inadvertent error. The chairman and I thought it was in the bill, but apparently, in typing, it was left out. But it will be put in the bill. I would certainly agree with you.

I wanted to assure you that the very things you are concerned about, I think, are included in the bill. I would be most concerned about the line of authority matter if we had not provided for it. It is understood that it will report directly to the President and to the Congress.

Mr. McCormack. Mr. Horton, I appreciate this information very much. But I would respectfully suggest that putting on paper that the Administrator will report to the President does not mean that there would be a really meaningful dialog between the two except through the intermediary of the OMB–EPO. The working relationship would indeed be, as Mr. Sawhill said to us the other day, that ERDA would receive general policy direction from OMB and EPO. It strikes me that what we are doing is setting up OMB as the energy policy agency with EPO as its working entity.

Mr. Horton. We cannot eliminate in this bill the Office of Management and Budget.

Mr. McCormack. No, I do not suggest that.

Mr. Horton. That is not the purpose of this bill. That is an organization that is in existence in the Federal Government, and it has a role in the executive branch. To the extent that it is there, it will continue to have that type of role, just as it has with NASA, the Department of the Interior, other Federal agencies, departments, et cetera. So you cannot eliminate that.

Mr. McCormack. I certainly agree. I did not mean to infer that I would suggest abolishing OMB, or even an end-run around it. But the thrust of part of my presentation was that we ought to have a clearly delineated line of authority to the President. Perhaps the bill does provide that more than I have had the impression.

Mr. Horton. I think as a result of your testimony, Mike, we can surely make certain in the report that this is covered, because I would agree with you that that line of authority ought to be established.

Chairman Holifield. I think with Mr. Horton that it is in the bill, but we will certainly consider that point, because we intend that the reporting be both to the Congress and to the President, of course. It is a good point and we will look at that very carefully.

SINGLE AGENCY

Mr. Horton. I want to emphasize one other thing, Mr. Chairman. That is, on page 2 of your statement, Mike, you indicate, and you underline:

> This is basic to any other action we may desire to take with respect to the energy crisis, and it is essential that we establish within the executive branch a single administrative agency with the authority to implement such an energy policy.

I really think that this bill will do just exactly what you are asking to be done. I discussed this informally with you before this hearing today, and I think that you and the members of this committee are basically in accord. We have had experience in this committee, I might say parenthetically, with regard to trying to establish a Consumer Protection Agency. The fact is that we do not have one today because nobody can agree as to how it should be structured; and the result is that the agency has not been established, and I am not sure it can ever be established. I am not completely pessimistic, but I am more pessimistic now than I was optimistic in the last Congress.

I do think that this agency, ERDA, does have the capability of doing exactly what you want it to do. If there are other phases of research and development that ought to be put in here, there is no reason why this agency's umbrella cannot encompass them. I would hope we can move forward with this and I would hope we can get your support, not only on the floor, but your active support and even your cosponsorship of this bill. We ought to get this agency established. Later, if we have some problems, we can make adjustments.

But I do want to assure you that there is no intent to have this agency not report directly to the President or have it not report to the Congress. I think affirmatively it should report both to the President and to the Congress.

Mr. McCormack. Thank you.

Chairman Holifield. Thank you, Mike.

Mr. Moorhead?

EFFECT OF NEW AGENCY

Mr. Moorhead. Thank you, Mr. Chairman.

Let me say, Mr. Chairman, I think this is one of the finest presentations I have ever heard in the Congress. It is very thorough and thoughtful.

You have brought up some matters that concerns me, Mike. But I wonder if the question should not be, should we go ahead with this bill as best it is and then try to work out the imperfections, rather than to try from scratch to write a whole new bill? Do you have any thoughts on that?

Mr. McCormack. Yes; I do. And I must say I am very troubled, because this is obviously going through my mind, too. I have thought about it a great deal. Why not go ahead with the ERDA program? I think there is a very serious danger here and I think the committee should consider it. That is, ERDA will not be doing anything significant that would not be done anyway with existing agencies under the direction of EPO and OMB.

Now, we are going into a severe energy crisis that is going to last for a long time. The President has said that under Project Independence, we are going to establish energy independence and self-sufficiency. I think all of us who have studied this question know that we are not going to have energy self-sufficiency for a long period of time, at least not at the levels at which we are accustomed to using energy. The only way we will have energy self-sufficiency quickly is to drastically reduce our demands.

Mr. Moorhead. That is in the short term?

Mr. McCormack. In the intermediate term, too. If this is true, the people are going to be turning to us and saying, what did you do; I thought you created an agency to correct this problem.

Now research and development is not going to change anything significant in the next 5 years. The major impact will not fall until from 10 to 15 years. In that period, there are going to be many months of hardship, cold, unemployment and disarrangement of every sort. Is it good to be holding out what appears to be a solution to the problem to the people when it really is not? I believe this is a real danger.

If this bill is passed or if any bill creating an organization is passed, I hope that the message goes out to the people that energy research and development is not going to solve our problems for a long period of time. But just in the act of passing this bill, we may be building a trap for ourselves that it will be very difficult to live with.

Mr. Moorhead. I think that is a very good point. Obviously, with or without ERDA, we will have or we will not have gasoline rationing.

Mr. McCormack. That is right. You could not be more right, Congressman.

Mr. Moorhead. Thank you very much, Mr. McCormack.

Thank you, Mr. Chairman.

Chairman Holifield. Thank you very much, Mr. McCormack.

Mr. McCormack. Thank you.

Chairman Holifield. Mr. Coughlin.

I will say to my colleague that we are under quite a bit of time pressure. If the gentleman wishes to read his complete statement, it will be received in that manner. If the gentleman feels he can without doing violence to his testimony summarize it, why, we will accept it in that manner. But I will leave it up to the gentleman as to which course to pursue.

STATEMENT OF HON. LAWRENCE COUGHLIN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF PENNSYLVANIA; ACCOMPANIED BY DR. IRAJ ZANDI, PROFESSOR OF ENERGY AND ENVIRONMENT, UNIVERSITY OF PENNSYLVANIA

Mr. Coughlin. Thank you, Mr. Chairman, what I would like to do is submit my statement for the record and briefly summarize it for the record if I might.

I am Congressman Lawrence Coughlin from the 13th District of Pennsylvania. With me is Dr. Iraj Zandi, professor of energy and environment, at the University of Pennsylvania, who is on a sabbatical leave from that university with our office. He is in charge of their College of Thematic Energy Management. He holds a Ph. D. in environmental engineering. This testimony which we have submitted is a result of both my work on the task force in energy in the 92d Congress and the work of Dr. Zandi.

Let me say at the outset that I strongly support the legislation before your committee. This goal of transferring almost all of the existing energy-related research activities of the Federal Government from the Atomic Energy Commission, the Department of the Interior, the National Science Foundation, and the Environmental Protection

Agency is certainly a very important step to consolidate our energy research. While we do face a dilemma in energy, it is comforting to note that the problem is not one of exhaustion of resources but a problem that lies within the realm of management. This is a realm that is within our grasp.

In expressing support of the legislation, I would like to note in particular two potential dangers in the measure unless the necessary safeguards are taken. First, the analogy has been made frequently before this committee and in discussing this legislation of the energy crisis and the energy problem with the Manhattan project and with NASA. Now, while this is a valid analogy in one sense, in another sense it is not, because the goal of providing adequate cheap energy is a diverse goal.

Energy is a multifaceted, global yet local, economically sensitive, time variable, socio-technical problem. It touches without exception on all facets of our national, family, and individual life. So that unlike the Manhattan project or unlike NASA, it is not a singly-oriented kind of problem and in the broadness of the energy field lies the danger of a single all-powerful energy administration charged with the task of illuminating the pathway by doing research. If this agency attains considerable momentum in a specific direction and misinterprets the intent of the law by assuming that its mission is to develop a single sophisticated solution at the expense of other feasible and perhaps less effective and more exotic solutions, it might for instance allocate a disproportionate share of its resources to the advancement of nuclear energy while neglecting the development of coal. It might become so involved in massive technical solutions while neglecting social and financial tools of balancing supply and demand. Such a tendency, if allowed to proceed unchecked, might lead the Nation in a direction replete with difficulties.

I respectfully suggest that this committee consider the possibilities of mitigating against such an outcome. One of the possibilities I would offer is the inclusion of a program to create the position of Assistant Administrator-Comptroller who would be in charge of planning and budgeting for the various segments of the new agency. Under such a provision, the Assistant Administrator-Comptroller would be required to make public the tentative budget requests of the administration, say at least 2 months before the Administrator's final decision. This would give interested parties and the Congress the opportunity to review this and to present their views. The public would have the opportunity to judge the merits of the budget requests as well as the final decision by the Administrator.

I think that the Congress should be aware of the possibility that no single committee or group in the Congress would have the opportunity to examine fully the total budget of the Administrator as the bill is presently drawn. If this would be the outcome, then it is possible for a disproportionate budget distribution to take place despite the best intentions of this measure.

I am sure that some would contend that the new agency should not be saddled by a priori restrictions. It may also be said that research in one area may be more expensive than research in other areas. These are, of course, thoughtful observations and should be weighed care-

fully, but it is very important that this agency not go off in a single direction, that all directions be given adequate attention.

Another matter of concern in our review of the legislation is that in the creation of a catchall administration, there is the chance of stifling maverick or novel or out-of-line, unsolicited or far-out research, if you want to call it that. Many instances of maverick research have paid off handsomely in scientific discoveries and technological innovations. Whatever Congress does, it should not create a situation in which creativity is stifled, even if it is out of line with established policy.

The National Science Foundation has been successful because it is flexible enough to provide opportunities for the would-be inventor and the would-be contributor to contribute his or her share of innovation.

Once an energy research and development agency is established, it will be very difficult for a person with unconventional ideas to receive support if the agency does not consider the idea of interest.

The singularity of authority which will be created to support energy research will, no doubt, eliminate extensive interagency competition which would be detrimental to creative research. It is imperative that a certain level of competition be kept alive. If competition among governmental agencies is eliminated, the new agency should then be structured so to induce a healthy level of competition.

A possible method of achieving this goal would be to authorize the Assistant Administrator for Research and Advanced Energy to support unsolicited research in any area of energy in the same manner that the National Science Foundation presently undertakes. This mechanism would assure the possibility of support for scientifically sound ideas extraneous of established policy.

Mr. Chairman, I would like to stress one final point. This bill, as important as it is, must be considered by all concerned as a beginning, a first step. The development of reliable research strategy can only be effective in the context of a sound, equitable, and popularly supported national energy policy. As all of us know, no such policy exists. We should strive to develop one. We should resist temptations to content ourselves with this one approach.

At the present, we face a future that promises to bring crisis of the type and magnitude unknown to us except in time of war. Clearly, we will court disaster unless we act properly and quickly.

But, it also must be said that the energy challenge has provided an opportunity for the Nation. We should be thankful that international events have jarred us awake now rather than 5 years hence. We have been given the precious gift of time.

I applaud this committee for its swift action in this matter.

Thank you, Mr. Chairman.

[Representative Coughlin's prepared statement follows:]

PREPARED STATEMENT OF HON. LAWRENCE COUGHLIN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF PENNSYLVANIA

Mr. Chairman and members of the Committee on Government Operations: Thank you very much for giving me the opportunity to appear before you to express my support of and make related observations on H.R. 11510, the Energy Reorganization Act of 1973.

During the 92d Congress, I served on the Science and Astronautics Committee's Task Force on Energy. The experience on this task force was invaluable. From my work on the task force and my own studies of our energy dilemma, I offer what I hope is a practical view of the bill your committee is considering.

This measure would create an independent executive agency, the Energy Research and Development Administration, whose Administrator would be authorized but not limited to exercising central responsibility for "policy, planning, coordination, support, and management of research and development programs respecting all energy sources. * * *"

The establishment of this proposed agency would be accomplished by the transfer of almost all existing energy-related research activities of the Federal Government from the Atomic Energy Commission, the Department of the Interior, the National Science Foundation, and the Environmental Protection Agency. In reality, it would produce a super organization with a directive to develop national energy research policy and execute all research activity of the Federal Government.

In light of recent international events and in view of our predicament with oil and gas shortages, I find ample justification for the proposed legislation. I share with you, Mr. Chairman, the belief that this bill would enhance our chances to handle with more confidence the future energy needs of the country.

For whatever reasons—the insatiable appetite for energy of an affluent Nation; misguided Government policies often influenced by special interests; the absence of machinery to respond to an energy crisis, or the lack of foresight in mobilizing the vast scientific and engineering talent and technological resources of the Nation—the fact is that the status quo has not worked in an adequate and satisfactory manner.

It is all too obvious that the Nation faces the specter of energy deficiencies. We have reached a point where we need to alter our present course. This bill is a step in the right direction. It provides the machinery that will enable us to come to grips with many of our energy problems.

While we face a dilemma in energy, it is comforting to note that our problem is not one of the absence or exhaustion of physical resources, but rather a problem that lies within the realm of management. This is a realm that is fortunately within our grasp.

There are sufficient supplies of oil, natural gas, and coal—not considering other sources of energy—to last the country for many years. Various documents of the Department of the Interior indicate if the Nation utilizes only oil for its energy needs that it has a sufficient economical supply for the next 40 years. If the only source is natural gas, the supply is sufficient for 30 years. If the only source is coal, the supply is sufficient for 40 years. This is, I underscore, an economical supply at 1970 price and consumption levels.

If we are ready to pay more, so that the exploitation of what are now considered submarginal resources becomes economical, the figures change to 200 years for oil, 65 years for natural gas, and 360 years for coal. With more advanced technology, higher prices, and prudent conservation measures, the limits stretch into the millennium.

Attention to these statistics persuades one to conclude that the crisis confronting us is a crisis of shortsightedness, a crisis of sagacity, and a crisis created by institutional blunders. The bill this committee is considering attempts to address some of these problems. That is why I am supporting it.

In expressing my support, I also want to note briefly potential dangers inherent in the measure unless care is taken to include the necessary safeguards.

The merit in establishing so all-encompassing an organization as proposed in the bill is assumed a priori, because of the successful experience with the Manhattan Project and the National Aeronautics and Space Administration.

It has been observed that the energy problem is a colossus and therefore demands similar herculean effort. This is a strong argument and deserves attention. There is, however, another side to the coin.

The goal of providing an adequate supply of cheap energy, diverse in form and geographic source with minimum insult to the environment, has a number of attributes very different from developing the atomic bomb or going to the Moon. If these variances in attributes are not acknowledged and accommodated, they may prove to be so harmful as to damage the Nation's capability to respond to future problems.

Energy is a multifaceted, global yet local, economically sensitive, time-variable, sociotechnical problem. It touches, without exception, on all facets of our na-

tional, family, and individual life. It can be supplied through direct use or conversion of sun rays, hydrological cycle, geothermal, coal, natural gas, oil, nuclear, or any combination of these sources. The energy shortage can be eliminated by either increasing supply or reducing demand. In the demand sector, reduction can be accomplished by elimination of a given activity or increasing the efficiency of the utilization.

Energy, when used properly, enriches our lives but in its conversion, transmission, and utilization it has the potential of harming us and insulting our environment. Energy also is a big business having significant impact on the national economy and, as such, on the political arena. This is a partial list. There are many other characteristics of energy problems that for the sake of brevity are not enumerated here. However, even this partial list emphasizes and denotes the fundamental distinctiveness of the energy problem. It indeed is much broader and more complex than going to the Moon.

In the broadness of the energy field lies the danger of a single, all-powerful research administration charged with the task of illuminating the pathway of the future by doing research. It may attain insurmountable momentum in a specific direction and misinterpret the intent of the law by assuming that its mission is to develop a single sophisticated solution at the expense of other feasible and, perhaps, more effective but less exotic solutions.

It may, by the encouragement of powerful special interests, for instance, allocate a disproportionate share of its resources to the advancement of nuclear energy while neglecting the development of coal. It may become so involved in massive technical solutions while neglecting social and financial tools of balancing supply and demand. Such a tendency if allowed to proceed unchecked may lead the Nation in a direction replete with difficulties.

I respectfully suggest that this committee consider the possibilities of mitigating against any such outcome. I offer as one of the possibilities the inclusion of a provision to create the position of Assistant Administrator-Comptroller who would be in charge of planning and budgeting for the various segments of the new agency.

Under such a provision, the Assistant Administrator-Comptroller would be required to make public the tentative budget request of the Administration, say, at least 2 months before the Administrator's final decision. This would give interested parties the opportunity to present their views. The public would have the opportunity to judge the merits of the budget requests as well as the final decision by the Administrator.

I think that the Congress should be aware of the possibility that no single committee or group in the Congress would have the opportunity to examine fully the total budget of the Administrator as the bill is presently drawn. If this would be the outcome, then it is possible for disproportionate budget distribution to take place despite the best intentions of this measure.

One safeguard that might be considered, can be considered only by the Appropriations Committee, is that it can realine its duties or assign a specific subcommittee jurisdiction over the Administrator's total budget.

I am sure some will contend that the new agency should not be saddled by a *priori* restrictions. It may also be said that research in one area may be more expensive than research in other areas. These are, of course, thoughtful observations and should be weighed carefully. We must provide this minimal safeguard, because there is a timelag that exists between recognition, acknowledgment, and correction of mistakes, and because in energy matters we do not have very much leadtime.

Another matter of concern in the creation of a catchall Administration is the chance of stifling maverick, novel, out-of-line, unsolicited, and far-out research. Many incidents of maverick research have paid off handsomely in scientific discoveries and technical innovations. Whatever the Congress does, it should not create a situation in which creativity is stifled even if it is out of line with established policy.

The National Science Foundation has been successful because it has been flexible enough to provide opportunities for the would-be inventor and the would-be contributor to contribute his or her share of innovation.

Once an Energy Research and Development Agency is established, it will be very difficult for a person with unconventional ideas to receive support if the agency does not consider the idea of interest.

The singularity of authority which will be created to support energy research will, no doubt, eliminate extensive interagency competition which would be det-

rimental to creative research. It is imperative that a certain level of competition among government agencies is eliminated, the new agency should then be structured so as to induce a healthy level of competition.

A possible method of achieving this goal would be to authorize the Assistant Administrator for Research and Advanced Energy to support unsolicited research in *any* area of energy in the same manner that the National Science Foundation presently undertakes. This mechanism would assure the possibility of support for scientifically sound ideas extraneous of established policy.

I am sure arguments will surface deriding such a scheme. Those opposed will state that if the measure is adopted it will induce duplication and waste. In response, I would point out (1) that in scientific and engineering research a certain degree of duplication is not only useful but is necessary in keeping research honest, and (2) the possibility of research outside established policy becoming successful and dominating the approved research will keep decision-makers on their toes and produce sufficient competition to break unchanged medicrocity.

Mr. Chairman, I would like to stress one final point. This bill, as important as it is, must be considered by all concerned as a beginning, a first step. The development of reliable research strategy can only be effective in the context of a sound, equitable, and popularly supported national energy policy. As all of us know, no such policy exists. We should strive to develop one. We should resist temptations to content ourselves with one approach.

At present, we face a future that promises to bring crisis of the type and magnitude unknown to us except in time of war. Clearly, we will court disaster unless we act properly and quickly.

But, it also must be said that the energy challenge has provided an opportunity for the Nation. We should be thankful that international events have jarred us awake now rather than 5 years hence. We have been given the precious gift of time.

Chairman HOLIFIELD. The Chair wishes to compliment the gentleman on his statement. It is a very well-thought-out statement and I think the committee is in general accord with every principle you have enunciated. There are some principles you speak of which I believe are in the bill, and they will be called to your attention by members of the staff.

At this time, the Chair will yield to Mr. Rosenthal.

Mr. ROSENTHAL. I want to join with the committee in commending our colleague on a very incisive and thoughtful statement. I wonder if your associate would want to add anything?

Mr. COUGHLIN. Dr. Zandi?

Dr. ZANDI. I just want to add that I support the statement of Congressman Coughlin. I think two dangers which he mentioned which seem to be inherent in the present bill should be very carefully analyzed and should be mitigated against.

Mr. ROSENTHAL. Thank you very much, Mr. Chairman.

Chairman HOLIFIELD. Mr. Horton?

ERDA ORGANIZATION

Mr. HORTON. Mr. Chairman.

Larry, I want to thank you for appearing before the committee. I also agree with the chairman's statement and that of Mr. Rosenthal that you have given us a very incisive statement. I think it is right to the point and will be very helpful in this committee's consideration of this very important legislation.

On page 4, at the bottom of the page, you have a recommendation with regard to an assistant administrator-comptroller. If you will take a look at the chart—I am afraid you and Dr. Zandi probably have

not had an opportunity to read the organizational chart—you will see that we have provided for an assistant administrator for each one of the divisions within the agency.

I am informed that there will be an additional seven executive level officers, any one of whom could be involved in this very thing about which you are talking, and we can cover that in the report.

I think it might be helpful if a member of our staff would talk with members of your staff and Dr. Zandi about this. If you will notice the boxes at the top of the chart, you will see that there is a provision for planning and analysis. The idea is to make certain that the development of one energy source is not going to be sacrificed at the expense of the other. That has been the problem now where it has been in different agencies.

In another area that you have referred to, the problem of assuring adequate attention is given to novel ideas and we had some testimony yesterday about this very subject, that would be the responsibility of the Assistant Administrator for Research and Advanced Energy Systems. I think it is important that this agency not overlook the novel or unique idea just because it may sound like it is farfetched. I remember one time somebody talking about being able to move a wheelchair by just moving your eyes. That has actually been accomplished now in the space program. So there are some things that may sound far out, but under this particular section, the Assistant Administrator for Research and Advanced Energy Systems would be able to offer the developer an opportunity to test his idea. And I think we ought to encourage the agency to look at that type of suggestion, the novel, the unique proposal.

I do think it would be helpful if perhaps we had our staff work with your staff. I would hope we could resolve your problem so perhaps you could even cosponsor the bill. I think that would be very helpful to us.

But I do want to thank you for your support of the bill and for bringing up these points, which I think are very good. I think they will be covered and are covered in the proposal that has been presented.

Mr. Coughlin. I would like to make a comment on two points my colleague has made. Perhaps the setting for my fear of a momentum in one direction can be found in the figures, the best figures we have been able to get for energy research, taken from the President's message of October 11. These are broken down into five categories. At the present time, we have been budgeting for fossil fuel research about $125 million; for conservation of the environment, $94.2 million; for advanced research, $59.1 million; for civilian nuclear, $608.1 million; and for national security $1,014 million. The concern I guess we would have in this would be that if the agency goes off so much in one direction or becomes dominated by one kind of thinking, other types of research might be neglected. That is the reason for the suggestion of the comptroller and the budgeting and the review ahead of time.

EMPHASIS ON COAL

Chairman Holifield. Let the Chair say that, as you can see by the chart there, we have placed the Assistant Administrator for Fossil Energy Development on parity with the Nuclear and the other three Assistant Administrators. You speak of the present $600 million that

is allocated for nuclear research. This is the result of 27 years of programing in research and development. It is pointed toward what we think will be the eventual solution for a great deal of our energy problem, and that is the liquid metal fast breeder reactor. Without going into the intricacies of it, the principle has been proven in the laboratory. It will get out of a gram of uranium anywhere from zero to 100 times more heat than the present water reactors.

Now, in the coal, in the fossil fuel research areas, which have been in other committees and in other agencies, mostly in the Department of the Interior, we readily recognize that they, particularly coal, have not had the amount of attention that they should have had. Of course, that was not the responsibility of the Joint Committee on Atomic Energy. We went ahead with our jurisdictional response to this challenge, and thank God we have, because the best information we have is that by the year 2000, 50 percent of our electrical energy will come from nuclear sources.

But that still is going to make necessary the utilization of coal. It so happens that we have such a tremendous supply of coal that it may last for hundreds of years. Now, coal has not been given the prominence that it has to be given, because we have to have every kilowatt of energy and every useful pound of steam that we can get out of coal in order to fill this energy gap.

Now, I know it is a very interesting subject to the gentleman, as it is to Mr. Moorhead, who is also from the State of Pennsylvania, one of the great coal-bearing States in the Union. We have to proceed on a very wide field of research in coal. We have to think about the development of machinery to get the coal out of the ground more efficiently. We have to think about coal liquefaction. We have to think about gasification of coal, both from the standpoint of its utility and its convenience of transportation. We have to go into a lot of other matters, particularly environment.

For instance, a ton of coal throws 300 pounds of pollutants into the air. Actually, 300 out of the 2,000 pounds go into the air in the form of sulfur, ash, and that sort of thing. The great need right now is to solve that pollution problem, and it is also the same problem with oil, although to a lesser extent. Coal supplies are abundant. If we can dig the coal and get it in acceptable form, enough energy is there to offset this curtailment of supply from the Middle East.

So I assure you that this agency will have an administrator in the fossil energy field. He will be on a par with others—not necessarily in fund allotment. That does not depend exactly upon us, but the fossil energy component will be, I assure you, given far more funding than it has had in the past. It has only modest funding in the Department of the Interior. The Bureau of Mines has concentrated on health and safety research for years and years. And now we have to go into an intensive coal research and development program.

Now, I will assure you that this agency, with the proper scrutiny of the competent committees of the Congress, is going to look at every source of energy that is available in this country. We need it all, and we need it on an urgent basis, and the President has allotted $10 billion for research and development to this ERDA organization. Now that means there is going to be more money available for all these forms of energy.

Regarding some of the things that you mentioned in your paper, you will notice on the fourth box to the right, Assistant Administrator for Research and Advanced Energy Systems—we believe that we have in that area, and we will say it in the report, the capability of taking care of these concerns mentioned in your testimony. It will be looking at geothermal, which is already producing electricity in California. It will be looking at solar and will undoubtedly call upon NASA—ERDA would call upon NASA for their experience in the solar field.

Then there is the problem of transmission, underground transmission and overhead transmission, the search for more efficiency, the development of storage batteries and fuel cells, and that sort of thing. Much of this is already, by the way, being considered in the Atomic Energy Commission laboratories. I visited a laboratory and saw a room half as big as this full of experimental batteries that they are using, and they are storing energy in batteries for use in fusion. Big companies are now working on contract for fuel cells. So we are really taking care of these things. And we will push forward.

I join Mr. Horton in hoping that you will cosponsor this bill.

Mr. COUGHLIN. I thank the chairman. I certainly agree, particularly in coal research, which I think is vital.

Chairman HOLIFIELD. It is vital. We cannot get along without it.

Mr. Fuqua?

NEW IDEAS

Mr. FUQUA. Mr. Chairman, I do not have a question. I do want to commend my colleague and good friend from Pennsylvania for the points he makes. I think they are very valid.

As the chairman and Mr. Horton have pointed out, I, too, want to make sure in the report that we do not limit innovative energy research. I think the gentleman makes a very important point in this and I trust the committee report will clearly reflect this need.

Thank you, Mr. Chairman.

Chairman HOLIFIELD. The Chair wishes to note at this time that two other Members of Congress are here, the chairman of the Joint Committee on Atomic Energy, Mr. Price of Illinois, and the ranking minority member, Mr. Hosmer, both of whom cosponsor the bill. These gentlemen have been on the Atomic Energy Committee for many years dealing with energy problems. We are very honored to have them here today and to have them as cosponsors of this bill.

I will say that yesterday, in the Senate, this bill was dropped in by Senators Ribicoff and Percy, who will handle the bill in the Government Operations Committee over there. They were joined by eight other Senators, including Senator Jackson, Senator Ervin, Senator Pastore, and Senator Aiken, who are all senior Members in the Senate. I have been assured by Senator Ribicoff that they expect to move as expeditiously as possible on this legislation.

So we hope that both bodies can get the bill out before we recess for Christmas.

Mr. COUGHLIN. I know the amount of work that goes into a piece of legislation like this and I commend the chairman and the committee for the very diligent effort they have put in.

Thank you.

Chairman HOLIFIELD. Congressman Brown.

Mr. BROWN. I have no questions, Mr. Chairman.

Mr. HORTON. Thank you, Larry, for coming.

Chairman HOLIFIELD. The Chair will ask at this time if the ranking members of the Joint Atomic Energy Committee wish to join us on the podium. I have worked with one or another or both of them over a period of 18 years. If at any time they wish to seek recognition of the Chair for questioning of the witness, the Chair will be pleased to grant them that courtesy.

The next witness will be—is Mr. Rarick here? If not, Mr. Ash will be the lead witness for the administration today.

Mr. Ash, you have appeared before this committee before on many occasions, and we are pleased to have you here with us today. We will be pleased to hear from you.

STATEMENT OF ROY L. ASH, DIRECTOR, OFFICE OF MANAGEMENT AND BUDGET; ACCOMPANIED BY CHARLES F. BINGMAN, DEPUTY ASSISTANT DIRECTOR, ORGANIZATION AND SPECIAL PROJECTS; AND FRANK G. ZARB, ASSISTANT DIRECTOR FOR MANAGEMENT AND OPERATIONS

Mr. ASH. Thank you, Mr. Chairman.

I have on my right Mr. Frank Zarb, Assistant Director for Management and Operations, and Mr. Charles Bingman on my left.

Mr. Chairman, I am pleased to appear before this committee today to present the administration's views on H.R. 11510, a bill that would create a new Energy Research and Development Administration (ERDA) and an independent Nuclear Energy Commission (NEC).

As you remember, Mr. Chairman, on November 7, 1973, the President reported that the Nation is facing a serious energy emergency in the weeks and months ahead, and that energy shortages will persist unless bold steps are taken toward energy self-sufficiency. As part of his program for moving toward energy independence, he requested the Congress to give priority attention to his proposal for creating an Energy Research and Development Administration, so as to enact that legislation during this session of the 93d Congress. Since that time, Mr. Chairman, I know that you, Congressman Horton, Chairman Price of the Joint Atomic Energy Committee, and other members and staff of this and the Joint Committee have worked long hours in the preparation of H.R. 11510 to accomplish this purpose.

On behalf of the President, I want to express appreciation for the swift and expert manner in which you have responded to his request for priority attention to ERDA. The result of these endeavors is a bill that represents a sound and much-needed reorganization and which this administration vigorously supports.

Before discussing ERDA and NEC in detail, we should note that H.R. 11510 is based on an earlier Presidential proposal, transmitted on June 29, 1973, and subsequently introduced as H.R. 9090, a bill which you, Mr. Chairman, also worked on very diligently. In addition to establishing ERDA and NEC, H.R. 9090 would have also created a Cabinet-level Department of Energy and Natural Resources (DENR) designed to bring together related programs now scattered

in five departments and two agencies. As such, H.R. 9090 represented a comprehensive approach to dealing with problems facing the Nation in the critical energy and natural resources areas.

It became evident, however, that the comprehensive nature of the proposal was leading to prolonged consideration in both the House and the Senate—a prospect worthy of the bill's importance but unacceptable because of the urgency of its energy elements. For that reason, the President requested that ERDA and the closely allied NEC be acted on separately from DENR and ahead of any other organizational initiatives. We wish to emphasize, however, that the need for DENR has not diminished, and that DENR continues to be strongly supported by this administration. Therefore, we urge that legislation creating this soundly conceived department be enacted as soon as possible in the second session of the 93d Congress.

Let us now turn to the current business at hand—the creation of a strong energy R. & D. agency and how it will meet the national need for an expanded and upgraded R. & D. capability to achieve energy self-sufficiency; and, an independent nuclear energy regulatory commission to carry out the licensing and other regulatory functions now vested in the AEC.

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

Mr. Chairman, the current energy emergency is due primarily to the sudden curtailment of oil from the Mideast. It serves, however, as a painful reminder that the Nation has passed the point at which our energy needs can be met from reliable and readily available supplies, and that continuation of past trends toward growing dependence on other nations for energy supplies is unacceptable.

For that reason, the President has set a national goal for the end of the decade of developing the potential to meet our own energy needs without depending on foreign sources. This endeavor, aptly called "Project Independence," looks beyond the immediate energy emergency and focuses on the underlying problem of expanding and improving our domestic sources of energy while striving to achieve more realistic levels of energy demand. Essential to reaching this goal will be the achievement of significant advances in the state of our energy technology so that the Nation's abundant energy resources can be tapped to produce an adequate supply of clean energy at reasonable costs. The problem is not a lack of basic energy resources, for we have half the world's coal, huge resources of oil shale, vast amounts of oil, including resources in the continental shelf, and some of the finest technical and scientific minds on earth. The problem is "getting at" those resources in ways that are economically competitive and environmentally acceptable. At the same time, better techniques must be developed to reduce the amount of energy presently consumed by our automobiles, homes, powerplants, office buildings, and industrial processes. In short, we must advance the state of our energy technology. Accordingly, the President has proposed:

A 5-year, $10 billion Federal program to accelerate and expand the national research and development effort leading to new and improved energy technology; and

An independent Energy Research and Development Administration to provide unified leadership and strong direction for managing this massive energy R. & D. program.

The 5-year, $10 billion R. & D. program will provide strong impetus for exploring and developing many promising sources of energy in such areas as coal, oil shale, solar, geothermal, nuclear breeders, nuclear fusion, and others. The program will also strive to develop ways of improving the efficienc of automotive power systems, heating systems, and other energy cons ning mechanisms. The specifics of this program are now being devel ed and proposals for fiscal year 1975 will soon be presented to the Congress.

More than money, however, is needed to achieve prompt and productive results. Absolutely essential are unified direction, concentration of technical and scientific skills, and a strong management framework for carrying out this large-scale R. & D. effort on a priority basis. In short, we must bring together into a new agency the Federal resources and skills now scattered among several agencies and organize them in the best possible manner to assure vigorous pursuit of our energy goals. Toward that end, ERDA will be created by bringing together important energy programs now operating in the Atomic Energy Commission, Department of the Interior, Environmental Protection Agency, and the National Science Foundation. These resources will then be supplemented as the agency accelerates and expands its activities to fulfill its broad-based energy R. & D. mandate.

From AEC will come such programs as: Nuclear power reactor development; controlled thermonuclear research; nonnuclear R. & D.; nuclear materials production; physical, biomedical, and environmental research; national security programs; other nonregulatory activities.

From the Department of the Interior will come the Office of Coal Research; energy research centers and the synthane pilot plant of the Bureau of Mines; underground electrical power transmission R. & D.

From the Environmental Protection Agency: Development of stationary source emissions technology for fossil fuels; development of alternative automotive power systems.

And, from the National Science Foundation: Solar and geothermal energy development.

When these programs were first established, they were appropriately located in their present agencies. Now, however, with the creation of ERDA as a comprehensive energy R. & D. agency, these energy R. & D. programs clearly should be brought together in ERDA where they will operate under unified leadership, benefit from the concentration of ERDA's scientific and technical capabilities, and serve as the base for a swift expansion of Federal R. & D. efforts into all promising energy technologies.

On the basis of these transfers, ERDA will have a gross outlay level of approximately $3 billion with a complement of about 6,700 Government personnel in fiscal year 1974. Also transferred would be about 85,000 contractor personnel who operate the AEC's extensive and sophisticated research and production facilities valued at about $9 billion. Later, as the full extent of the expanded R. & D. program is reached, ERDA is expected to increase in size substantially.

ERDA's greatest single asset will be the scientific and technical personnel of the AEC, Interior, and other agencies who will accompany their functions to the new agency. Their proven technological skills, resourcefulness, and experience—combined in the same agency under integrated policy and direction—will enable ERDA to begin accomplishing its mission swiftly and effectively.

If ERDA is to put these impressive resources to prompt and productive use, it must have the best organizational and management framework we can devise. We propose that ERDA be headed by a single administrator and deputy administrator, both appointed by the President and confirmed by the Senate. These officials would be supported by a strong management team consisting of five assistant administrators, a general counsel, and several additional officers.

The five assistant administrators would also be appointed by the President and confirmed by the Senate. They will be responsible for line-program management and will provide strong leadership and clear-cut accountability for achievement of assigned objectives in the following areas: Fossil energy development; nuclear energy development; research and advanced energy systems; environment, safety and conservation; and national security.

Additional management flexibility and strength would be afforded by a pool of not more than seven management positions at Executive Level V. ERDA's Administrator will appoint career officials to these positions and assign responsibilities in such areas as heads of major staff offices or as deputy assistant administrators.

The Assistant Administrator for Fossil Energy Development would be responsible for projects such as coal liquefaction, coal gasification, gas and oil systems, and advanced research on combustion systems and mining technology. ERDA will place significant new emphasis on development of energy from fossil fuels, since that area offers particular promise for near-term relief for the energy shortage.

The Assistant Administrator for Nuclear Energy Development will assure continued emphasis on nuclear R. & D. and production activities such as fission reactors, nuclear breeders, controlled thermonuclear fusion research, naval reactors, space nuclear systems, reactor safety research, and uranium enrichment.

The Assistant Administrator for Research and Advanced Energy Systems would be responsible for research in the physical sciences, the development of geothermal and solar energy systems, various energy conservation techniques such as automotive power systems, energy transmission and storage capabilities, and other advanced energy systems such as magnetohydrodynamics.

The Assistant Administrator for Environment, Safety, and Conservation would carry out critically important programs of biomedical and environmental research; improvements in radiological waste management and transportation; energy-efficient systems research; and ERDA-wide safety oversight. These activities will be closely coordinated with those of the fossil, nuclear, and advanced energy areas, which will also have responsibilities for safety, environmental, and conservation matters as an integral part of developing their respective energy source technologies.

The Assistant Administrator for National Security would be responsible for ERDA's national security programs including nuclear

weapons development, testing, and production; international security affairs; and the production of reactor materials such as plutonium and tritium. These functions will be carried out by ERDA under the same conditions of security and in essentially the same manner as is now the case in the AEC.

A fundamental management concept of the ERDA approach is to provide flexibility for utilizing a variety of technical and management capabilities, such as industrial contractors, Government-operated laboratories, private research institutions, and universities. In this manner, ERDA's managers will have adequate freedom of action for getting the job done without building up excessive physical plant or Government staff. This approach also develops a close working relationship with industry which will later help insure a smooth and speedy transition of developed technology to broad commercial application.

The bill also contains a number of administrative provisions which are necessary for enabling the Administrator to manage the energy effectively and with a reasonable degree of flexibility. The basic structure of ERDA is designed to meet current needs as now perceived. Undoubtedly, adjustments will be needed as R. & D. problems change and as ERDA gains experience.

NUCLEAR ENERGY COMMISSION

The Nuclear Energy Commission will carry on the AEC's present licensing and other regulatory activities. The change in the Commission's title from "Atomic" to "Nuclear" will more accurately describe the technical matters of concern to the Commission.

After more than two decades of Federal nurturing, the nuclear power industry is reaching maturity. Currently, the 37 nuclear powerplants licensed for operation constitute about 5 percent of the electrical capacity of this Nation. By 1980, nuclear powerplants are forecast to be providing about 20 percent of our total electrical power capacity. By 1990, it is expected that nuclear power will be over 40 percent of the electrical capacity, and by the year 2000, as much as 60 percent. Moreover, the supporting nuclear fuel cycle activities, such as waste disposal, will expand and accelerate to keep pace with this growth. Medical and industrial uses of radioisotopes are increasing as well. All of these activities must be controlled by licensing and other regulatory procedures to insure the public safety.

The proposed Nuclear Energy Commission will provide the full-scale independent regulatory commission that is warranted and required for the adequate regulation of the rapidly growing nuclear industry. And, in view of the increasing impact of nuclear regulatory decisions on the energy supply and environmental quality of the Nation, it is more important than ever to remove even the appearance of a conflict in the AEC's regulatory decisions.

The Nuclear Energy Commission will assume the AEC's present licensing and related regulatory responsibilities for assuring that the civilian uses of nuclear materials are consistent with public health and safety, environmental protection, and the antitrust laws. These functions encompass standards setting, technical safety reviews, environ-

mental evaluations, public proceedings, licensing, inspections and enforcement, and materials safeguards—all of which have broad impact on the public as well as the regulated industries.

Under the President's proposal, AEC's five-member commission form of organization would be retained for the NEC as the best means of assuring continued fair and impartial regulation of commercial nuclear power. In addition to the five-member commission itself, NEC will include AEC's present regulatory staff, offices, and other resources that perform licensing, regulatory and related safety, and environmental activities.

Spared the burdensome demands of a large, complex energy R. & D. and production operation, NEC's commissioners and officers will be able to concentrate exclusively on regulatory tasks. A five-member commission with the sole function of regulating nuclear energy will also upgrade and help expedite the NEC's regulatory processes.

The Atomic Energy Commission's transition to an exclusively regulatory agency will be vastly simplified by the evolutionary steps which have already been taken over the past decade to organize its regulatory functions into a separate, integrated operation under a Director of Regulation. As a result, the NEC can be brought into existence with a minimum of change and disruption.

Functions to be performed in NEC include those now administered by the Director of Regulation, the General Counsel's staff for regulation, the Advisory Committee on Reactor Safeguards, and the Licensing and Appeal Boards. The Nuclear Energy Commission will also have overall planning, funding, and evaluation authority over the $51 million light water reactor safety program. In the areas of biomedical and environmental research and waste management and transportation, it is expected that NEC will be provided additional funding—up to $5 to $10 million in NEC's first budget—to undertake research for insuring the protection of public health and safety.

Resources now associated with the AEC's licensing and regulatory functions include approximately $98 million in 1974 Budget outlays and about 1,550 full-time permanent employees. In support of these functions, additional resources needed to create and maintain a high level of technical competence in NEC will be sought as soon as possible.

The line organization proposed for NEC would be comprised of four directorates reporting to an Executive Director of Operations. Each directorate would be responsible for a major regulatory function as follows: Standards setting for nuclear reactors; licensing of nuclear facilities and materials; inspection of nuclear facilities and activities and enforcement of NEC's regulation; and confirmatory assessment research on safety, safeguards, and environmental concerns.

The Directorates of Standards, Licensing, and Inspection and Enforcement—now Directorate of Regulatory Operations—currently exist in the AEC and will be transferred intact to NEC. The new Directorate of Confirmatory Assessment will provide NEC with an independent capability for developing and analyzing technical information related to reactor safety, safeguards, and environmental protection—a capability essential for assuring effective and objective decisionmaking.

In addition, NEC will have the authority and resources to have regulatory related research completed where it is deemed necessary by the Commission in determining the adequacy of safety factors related to nuclear reactor design and operation.

In order to insure the safety of future nuclear powerplant technologies, NEC will license ERDA's nuclear reactor demonstration facilities involving electric power generation components and thus require the same rigid regulations and procedures for ERDA as are currently established for commercial nuclear reactor powerplants. In addition, NEC would license new storage facilities for high level radioactive waste resulting from processing and utilization of nuclear materials.

Mr. Chairman, in conclusion, I must stress again that big energy problems lie ahead of us and we must organize our Federal resources in the best manner possible to maximize our ability to solve these problems swiftly. ERDA will bring to the accelerating and expanding energy R. & D. program the concentration of skills and resources, balanced R. & D. approach, and strong management structure that are essential to the successful conduct of an undertaking of this size and complexity.

At the same time, NEC will carry out the AEC's crucially important regulatory responsibility in a framework free of nuclear development responsibilities and with leadership able to focus exclusively on regulating the growing nuclear industry.

We believe these agencies are vitally needed and we pledge every assistance in working with this committee and its able staff to create ERDA and NEC without delay.

Thank you, Mr. Chairman.

Chairman HOLIFIELD. Thank you very much, Mr. Ash, for this statement. It is very clear and concise on the purposes and provisions of the legislation.

The gentleman from Florida, Mr. Fuqua.

Mr. FUQUA. Mr. Chairman, I have read the statement of Mr. Ash and I think his proposals are a step in the right direction. For the time, I do not have any questions.

Chairman HOLIFIELD. Thank you.

Mr. Horton.

ERDA REPORTS TO PRESIDENT

Mr. HORTON. Mr. Ash, there was some testimony this morning from Congressman Mike McCormack. I am sure you were not here at the time, so you did not hear his testimony, but he had a question about to whom this agency would report. I replied that this agency would report directly to the President, it would be an independent agency that would report directly to the President, and that it also would be required to report to the Congress annually with regard to its responsibilities. So it has a dual reporting function.

I will read you what he said. He said:

> On Monday of this week, the Science and Astronautics Committee met all day with the Research Management and Advisory Panel to discuss the subject of executive organization for energy research and development. At that time, Mr. John Sawhill, Assistant Director of the Office of Management and Budget for Energy, Science, and Natural Resources, discussed this matter with us.
>
> He suggested that the Office of Management and Budget, along with an expanded Energy Policy Office, would coordinate with, and give general policy

guidance to the Administrator of ERDA. Similar relationships would prevail with the Department of the Interior and DENR if it were created at a later date.

Then he went on to express some concern about this. He said:

I regard such a loose approach to the energy policymaking and supervision of our energy R. & D. as dangerously inadequate. I believe that we must have clearly defined channels of authority for overall energy policy and planning, and thence to directors of R. & D.

Would you like to comment on that subject?

Mr. ASH. Yes, I would, Mr. Horton.

As you know, and as I am sure the public knows, the President personally is concerning himself greatly with this subject; he is involving himself in much of the work going on, is giving direct leadership and direction to all aspects of dealing with the energy problem. As an independent energy research and development organization, ERDA would report directly to the President, and would get direct instructions and guidance from the President. Now, of course, as in many functions that serve the President's office, the President also has some help in doing his work. The Office of Management and Budget helps prepare the budgetary information across the whole Government that in turn goes before the President in terms of our recommendations to him. But I think the main answer here is that ERDA would report directly to the President, would be responsive to him and his leadership. The President would make use of his staff in helping him perform his job, but certainly not to take over his job. He has a strong involvement in this subject already and would continue to do so, I am sure.

EMPHASIS ON COAL

Mr. HORTON. Another subject that was brought up by Mr. Coughlin, of Pennsylvania, Congressman Coughlin: He suggested that the committee consider the possibility of mitigating against an instance in which coal would be subjected to the research in nuclear and other areas. He said:

I offer as one of the possibilities the inclusion of a provision to create the position of Assistant Administrator-Comptroller who would be in charge of planning and budgeting for the various segments of the new agency.

I indicated to him that according to the boxes that we had for the divisions within the agency, coal research, fossil energy development, would each have a separate Assistant Administrator, as would nuclear energy, and it would be given equal status and consideration.

Now, you might want to talk to that subject, too. Would this agency relegate coal to the back of the room and forget about it, or would it have a coequal status with nuclear research and the other more exotic types of research?

Mr. ASH. That is a very central question.

I would like to address it, and appreciate the opportunity to do so.

As you observed, the organizational status of research dealing with the fossil fuels is alongside rather than in any way subordinate to nuclear energy and it is so structured to have equal authority in the agency.

Furthermore, the allocation of resources, which, of course, determines to a great extent the distribution of emphasis in the organiza-

tion, is one that the President will take a direct role in as I was saying earlier. And certainly the plan and the expectation is to allocate a substantial portion of the total resources to deal with the many research and development opportunities in the coal area. So by the combination of organizational structure and resource allocation, we have the greatest confidence that research in the coal area will get full attention, and not in anyway be subordinated to the nuclear area. They must go on, of course, in parallel, but there will be no subordination.

NOVEL IDEAS FOR ENERGY

Mr. HORTON. I would like to point out one area in which there has been a breakthrough which I think has not been given sufficient headlines. This is the subject of liquified coal. As I understand it, the Navy did some research and lowered the flash point so that it could be used in regular oil boilers. They were able to use that fuel in an old destroyer without making any conversion in the boilers. The point is that it takes the place of fuel oil. This is a breakthrough, I think a major breakthrough, that has just been accomplished in the last couple of weeks. I think there are some real possibilities with regard to this.

I certainly do appreciate your emphasis on this and your explanation of it, because I think that will be very helpful to us in discussing this on the floor.

The other matter that I would like to ask about, which was brought up yesterday and also was brought out today in the testimony of Mr. Coughlin. Let me read it because he expresses it well:

> Another matter of concern in the creation of a catchall administration is the chance of stifling maverick, novel, out-of-line, unsolicited, and far-out research.

I assured him that under this arrangement for ERDA, the novel and the unique suggestions in research would certainly be welcome and ERDA is so constructed to properly handle them. Some of the areas, for example, under the research and advanced energy systems, might very well utilize some unique approaches. Would not the overall emphasis of the agency be to encourage this type of novel research? I thought perhaps you might like to comment on that.

Mr. ASH. I certainly agree with that statement. Not only would it not stifle novel and unique research, one of the basic objectives being sought by creating this organization at this time is to give special attention to novel and unique areas of research. I think we can look back and see that historically, particularly in the fossil fuel area, we probably have not done much novel and unique research. This is the time and the opportunity to do so, and we believe this organizational structure will give exactly the impetus needed to now get on with some of that novel and unique type of research that I think many people are convinced represents a great potential, particularly in the use of fossil fuels.

COAL EXTRACTION R. & D.

Mr. HORTON. Let me bring up another point, and I am sorry to take so much time, but these are points that were raised in the testimony yesterday and there will be questions asked about them again.

I think your testimony can be very helpful on this.

There was testimony yesterday raising a question with regard to transferring over the research and development on extracting coal. The question was whether or not this research and development program would be transferred over to ERDA from the Department of the Interior or whether it would remain in the Department of the Interior. Perhaps you might add some light to that subject, too.

Mr. ASH. I would like to.

We believe that there are among these opportunities that represent great potential at this time a number dealing with extraction technology and particularly dealing with novel and unique forms of extraction technology. That is, rather than just ways to dig coal faster, ways that might either burn it underground or otherwise extract it in other forms and by wholly different methods. We would charge ERDA with doing the kind of research that would develop those new advanced, unique means of extracting coal or any other of our natural resources for energy purposes, for that matter. We would still have in the Department of the Interior a basic core that primarily deals with extraction by present techniques and is not so much research as it is merely small increments of development, so that ERDA would have a charge of important responsibility for extraction, but not to the exclusion of the work that would continue in Interior, largely dealing with present technology and incremental gains to that.

Mr. HORTON. Thank you, Mr. Chairman.

Chairman HOLIFIELD. That last remark that you made, Mr. Ash, of course, is based on the fact that there are certain ongoing programs which are also related to health and safety?

Mr. ASH. Yes, there are.

Chairman HOLIFIELD. And the primary work of the Bureau of Mines has been in health and safety, which does require access to the mines by people who understand mining, and all that sort of thing?

Mr. ASH. Correct.

They relate closely to other functions of Interior, but I think the key point here is that ERDA in no way will be precluded from using the genius that we hope will be in it to find wholly new and different and better ways to extract our energy resources.

NEED FOR COAL USE

Chairman HOLIFIELD. Do you agree with me that after your assessment of the energy sources in our Nation, coal is one of the real priority items that we have, that we must learn to produce it safely and acceptably in environmental terms. Do you agree with that statement?

Mr. ASH. I certainly do, Mr. Chairman. I think this country should feel very fortunate that we have about one-half of the world's supply of coal. If we can now find ways to extract it better and use it better and protect the environment in the process, we have gone a long way toward achieving the objective of Project Independence—that is, to become independent of the rest of the world.

Chairman HOLIFIELD. I have looked at the charts, at all the predictions of the need for coal, and they become more urgent as our dependence upon oil from the Middle East becomes more precarious. I would want to believe that we are really going to develop the potential of coal

and use it, because we know that we have hundreds of years of supply of this form of fossil fuel. We can use it in the form of liquid fuel, and we can also have domestic gas for the use of our people, if we proceed and do it. I think it can be done economically quicker than any of us realize. When you start thinking about the oil from the Middle East being advanced from around $3 a barrel to around $6 or $7 a barrel, with no limit on what it can be in the future, you see how urgent it is that we do this.

Mr. Ash. Absolutely.

As a poker player would say it, and if I may make half a pun: Coal is our ace in the hole. There are the resources that this country will really be able to work from, not only in negotiating with the rest of the world, but in meeting our own domestic requirements.

Chairman Holifield. Do you agree with me that research and development in the coal area has been too little in the past, in relation to our present urgency?

Mr. Ash. I must say I agree with you, yes, Mr. Chairman.

Chairman Holifield. I would not want to give the impression that you could start in on a level with other forms such as nuclear energy, which has had 27 years of research and development behind it. There we have this very important fast breeder reactor project, which requires a substantial amount of money. But I would want to be assured by you and in behalf of the administration that adequate funds would be proposed by the administration to do everything that we can do and do wisely and prudently to develop this coal and utilize it as quickly as possible.

Mr. Ash. That is certainly the intention that I know the President has, the administration has, and I know that you, Mr. Chairman, have taken a considerable lead in pointing that out, not only over months but over years, even as we are now here talking about the subject.

POSITION OF MILITARY ATOMIC ENERGY

Mr. Horton. Mr. Chairman, I have one more question I neglected to ask.

On the organizational chart, the last box is Assistant Administrator for National Security. There were some questions raised yesterday as to whether or not the nuclear research and development that has to do with the national security should be transferred over to the Department of Defense.

Now, it has been in the AEC and it has worked well there. We had some favorable testimony from Dr. Starr yesterday on this subject. But perhaps you might like to comment on why it is left here and why it is important that it remain here.

Mr. Ash. I think there are two main reasons that support leaving it where it is.

First, research and development for defense purposes——

Mr. Brown. Would you clarify what you mean by leaving it where it is?

Mr. Ash. Leaving National Security in Research and Development—or, let's say, having it move along with the rest of Research

and Development from AEC to ERDA rather than having it go separately to Department of Defense.

The two main reasons are that so much of it, both as to capability and applicability, is commingled, done by the same people, using the same facility. Therefore, we think maintaining that structure is best suited to carrying out both kinds of nuclear research.

Secondly, as we have seen in so many other fields, and it is certainly applicable to this, so many times, some of the first breakthroughs come in defense-type applications and then later, find their way into more commercial and industrial applications. So that keeping these together provides the greater opportunity for that phenomenon to continue to operate. This is why we believe that such research and development should be in the same organization as other nuclear research and development, rather than being separated.

Mr. HORTON. Thank you.

Chairman HOLIFIELD. Mr. Moorhead.

Mr. MOORHEAD. Thank you, Mr. Chairman.

I was given, Mr. Ash, a paper marked "Exhibit A," "Agency Energy R. & D. Programs." I understand it was in connection with your testimony, sir.

Mr. ASH. I have no exhibits with mine—it is a part of our internal—yes, I didn't put it in the testimony, but certainly we can put it in the record at this point. It is part of the data I have in front of me.

Mr. MOORHEAD. Mr. Chairman, I think it would be appropriate to have it in the record.

Chairman HOLIFIELD. It has been distributed to us and it will go in the record. We will put the charts in the record along with this, too.

Mr. ASH. Perfect. It supports the general statements that I made in my testimony.

[The documents referred to follow:]

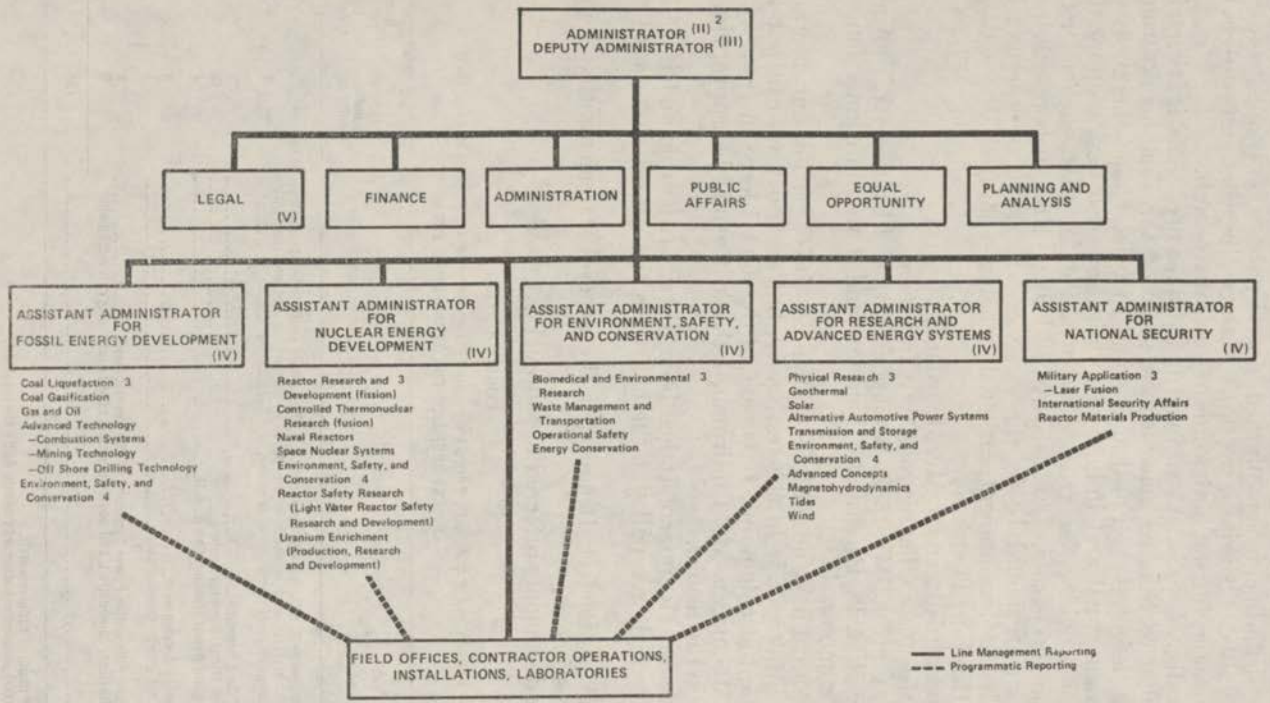
EXHIBIT A

AGENCY ENERGY R. & D. PROGRAMS AND ESTIMATED FISCAL YEAR 1974 RESOURCE LEVELS[1] PROPOSED FOR TRANSFER TO ERDA

	Estimated outlays (millions)	Number o permanent positions (year end)[2]
AEC: Nuclear energy R. & D., nonnuclear energy R. & D., military applications, production of nuclear materials, and research in the physical, biomedical and environmental sciences (program level, exclusive of revenues of —$773,000,000)	$3,018	5,885
Interior:		
Office of Coal Research	79	55
Bureau of Mines, 6 energy centers	16	715
Underground power transmission R. & D.	1	5
NSF:[3]		
Solar energy development	3	3
Geothermal energy development	1	2
EPA:		
Alternative Automotive Power Systems (AAPS) development	9	12
Precombustion, combustion, and postcombustion control technology development	6	18
Total	3,133	[4]6,695

[1] Excluding pending supplementals.
[2] About 85,000 contractor personnel (mainly AEC) are involved.
[3] Excludes trust fund.
[4] Some additional positions will be needed to provide administrative support for programs transferred from agencies other than AEC.

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION [1]



[1] The General Advisory Committee, Military Liaison Committee and the Patent Compensation Board of the AEC are proposed for transfer to the ERDA.

[2] Roman numerals indicate Executive Level of position

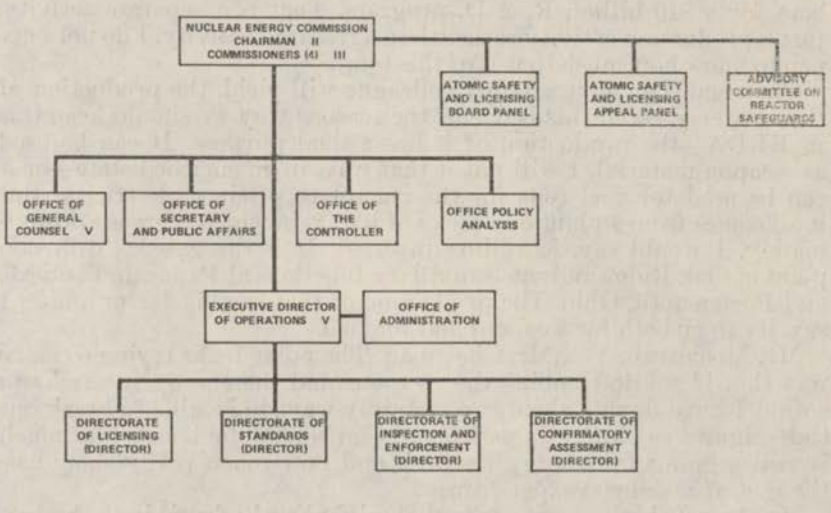
[3] Proposed areas of interest.

[4] Integral to development of energy technologies. Not duplicative of the Assistant Administrator for Environment, Safety and Conservation.

NOVEMBER 1973

PROPOSED

NUCLEAR ENERGY COMMISSION



NOVEMBER 1973

Mr. MOORHEAD. On the top line, where it is 3,018 million, in dollars, coming from AEC, and 5,800-odd personnel, can you break out of that figure the dollars and the positions applicable to military applications?

Mr. ASH. The best data that we have says that of $3 billion in outlays, $1.15 billion relates to defense R. & D. We do not have the number of people separated, but I think that is probably a fair approximation of the distribution by looking at it in terms of dollars.

Chairman HOLIFIELD. I believe we can get that information from the AEC. Either they will have it or they can furnish it.

The two laboratories primarily, though not exclusively, devoted to military work are the Los Alamos Laboratory and the Livermore Laboratory. There is some military work done at Oak Ridge, but those two are the main ones. But there is other work going on there as well, in peacetime applications, based on facilities at Los Alamos. There is a big linear accelerator, which is particularly adaptable to biomedical work.

AEC EXPENDITURES AND ENERGY R. & D.

Mr. MOORHEAD. Mr. Ash, taking that $1.15 billion that you mentioned and subtracting from that the total at the bottom of the page of $3.133 billion, we come out with approximately $2 billion. Is that the $2 billion that you referred to on page 5 on the 5-year, $10 billion Federal program? Is that the $2 billion?

Mr. ASH. No, sir.

Mr. MOORHEAD. Or is that an additional 2 on top of the 3?

Mr. ASH. It is more of a coincidence than the same number. For instance, under AEC, there are some activities that are really not research—production of nuclear materials for example.

Mr. MOORHEAD. Oh, you did not include production of nuclear materials?

Mr. ASH. That is in the number here, but not in the President's numbers for a $10 billion R. & D. program. That is a separate activity, just a production activity rather than a research activity. I do not happen to know how much that is of this total.

Chairman HOLIFIELD. If my colleague will yield, the production of that material—and this is one of the reasons why we should keep this in ERDA—the production of it has a dual purpose. It can be used as weapon material, I will put it that way, in an enriched state—or it can be used for fuel rods for the reactor to produce electricity. But it all comes from a plant or a series of plants in which there is approximately, I would say, $2 billion invested. It is the gaseous diffusion plant at Oak Ridge and some auxiliary functions at Paducah, I believe, and Portsmouth, Ohio. The production of that is a big factor and as I say, it can go both for weapons and for fuel.

Mr. MOORHEAD. Yes, Mr. Chairman. The point I was trying to make was that if we do combine the weapons and the energy research, an action I have doubts about, we certainly want to be able to break out those figures as clearly as possible so that the public knows how much is really going for energy research and how much really should be thought of as defense expenditures.

Mr. ASH. I think an answer to that might best be found in the budget of this last year. I do not have it in front of me, but I think I know the numbers, which showed that the annual rate of energy research and development being expended currently was $772 million, or maybe it was 779—something like that. The $2 billion a year for a 5-year period is more than doubling the annual rate of energy research and development as it is now going on.

Mr. MOORHEAD. Then, I come to the next question, which is where I was confused, For next year, we should be thinking about adding $2 billion onto the $3.133 billion, is that correct?

Mr. ASH. No, sir, for two reasons. That would not be the way to arrive at the number. First, the most effective way of employing that $10 billion over 5 years to do research and development is to move each program at a rate of growth that it can effectively move, because you would be wasting a big part of the money if you just throw money at it immediately when you do not have the organization in place.

Second, at $2 billion a year over a 5-year period, or $10 billion in toto, there would be a net increment to a level of about $3½ billion over 2 years—it is now about $700 million a year for 5 years at current levels. The President's proposal would more than double it by having the total be $10 billion over 5 years. We are already running at a number that would be about $3½ to $4 billion over 5 years if there were no incremental program. So what this does——

Mr. MOORHEAD. The $10 billion is the increment, is that right?

R. & D. PROGRAM: $10 BILLION

Mr. ASH. No; the $10 billion is not an increment over the 5 years. The $10 billion is the proposed energy R. & D. program over 5 years, of which about $6 or $6½ billion would be considered incremental to a rate that we are now operating.

Mr. MOORHEAD. I see. I was not sure whether we were just using already existing money already arranged or using——

Mr. ASH. It is more than doubling the present rate of energy R. & D.

Mr. HORTON. Just so I can get this point clarified, what you are talking about is new money now rather than incremental money? What Mr. Moorhead was talking about was $3½ billion already planned and you are talking now about an additional $6 or $6½ billion, which would be new money, in other words, in addition to what is there now?

Mr. ASH. That is right, almost all of which, or let us say the biggest part of which would go to nonnuclear R. & D.-type programs. There would be some increase in nuclear, but by far the new money would go to the nonnuclear R. & D. programs. And the increment would be, over the present rate, about $6½ billion or so over the present rate. We can put those precise numbers in the record if you like. I am drawing out of memory that present rate. I think it is $772 million.

[The information submitted follows:]

ENERGY R. & D. RECOMMENDED PROGRAM INCREASES

[In millions of dollars]

Energy R. & D. program area	Fiscal year 1973 level	President's fiscal year 1974 budget	Recommended fiscal year 1974 increment	Total fiscal year 1974 level
1. Coal	91.0	119.4	+49.5	168.9
(a) Liquefaction	11.5	24.1	+19.0	45.1
(b) Low Btu gasification	4.4	13.1	+8.0	21.1
(c) Improved combustion	1.9	9.9	+6.0	15.9
(d) High Btu gasification	27.1	27.4	+5.4	32.8
(e) Extraction technology (inc. reclamation, explosives, anthracite)	5.9	7.1	+5.0	12.1
(f) Supporting technology, systems studies and administration	5.5	7.5	+6.1	13.6
(g) Health and safety R. & D.		28.3	0	28.3
2. Geothermal	3.8	4.1	+7.0	11.1
(a) Resource appraisal and exploration	3.4	3.2	+2.2	5.4
(b) Extraction and power generation technology	.4	.7	+4.3	5.0
(c) Environmental and institutional effects	0	.2	+.5	.7
3. Environmental control	37.1	46.5	+12.0	58.5
(a) Near-term SO_x control (including TVA demo plant)	25.0	34.1	+5.7	39.8
(b) Advanced SO_x control	3.0	1.7	+2.3	4.0
(c) NO_x, particulates, trace elements from fossil fuels	4.4	3.5	+2.2	5.7
(d) Other control technology for fossil fuel treatment/conversion, etc	.1	.2	+1.8	2.0
(e) Thermal pollution control	4.6	7.0	0	7.0
4. Energy conversion (incl. solar)	8.9	18.9	+5.0	23.9
(a) Topping cycles (inc. MHD)	4.6	5.7	+1.2	6.9
(b) Bottoming cycles	.1	0.	+.4	.4
(c) Improved material	0	1.0	+.4	1.4
(d) Advanced power systems	0	0	+1.0	1.0
(e) Studies	0	0	+1.0	1.0
(f) Solar	4.2	12.2	+1.0	13.2
5. Conservation	6.8	9.2	+6.3	15.5
(a) Residential/commercial	2.8	3.2	+3.0	6.2
(b) Industrial	0	.1	+.9	1.0
(c) Transportation (not incl. automotive power systems)	2.5	3.3	+1.0	4.3
(d) General and policy studies	1.5	2.6	+1.4	4.0

Footnotes at end of article.

ENERGY R. & D. RECOMMENDED PROGRAM INCREASES—Continued

[In millions of dollars]

Energy R. & D. program area	Fiscal year 1973 level	President's fiscal year 1974 budget	Recommended fiscal year 1974 increment	Total fiscal year 1974 level
6. Gas-cooled nuclear reactors	8.3	9.1	+7.1	16.2
(a) HTGR base program (incl. equipment)	4.7	5.3	+3.4	8.7
(b) Thorium utilization	2.0	2.0	+2.5	4.5
(c) Gas-cooled fast breeder	1.0	1.0	0	1.0
(d) Nuclear safety	.6	.8	+1.2	2.0
7. Automotive energy R. & D	19.8	16.7	+6.0	22.7
(a) Management	2.8	3.0	+.5	3.5
(b) Basic and applied res	2.9	4.7	+1.5	6.2
(c) Exploratory development	.3	1.3	+1.0	2.3
(d) Engine development	13.8	7.7	+3.0	10.7
8. Environmental effects	37.8	38.5	+5.4	43.9
(a) Health effects research (inc. new pollutant ident.)	13.7	14.8	+4.3	19.1
(b) Ecological effects and transport research	18.2	18.0	+.9	18.9
(c) Measurement and monitoring technology development	5.9	5.7	+.2	5.9
9. Electric transmission, distribution, and energy storage	6.3	5.7	+3.2	8.9
(a) Transmission and distribution	4.4	3.0	+2.1	5.1
(b) Energy storage	1.9	2.7	+1.1	3.8
10. Nuclear fusion (magnetic confinement)	39.6	47.5	+7.3	54.8
(a) Magnetic confinement systems	25.1	30.1	+3.8	33.9
(b) Fusion technology and materials research	6.4	9.0	+1.8	10.8
(c) Magnet research	.9	.5	+.6	1.1
(d) Other (plasma research and computer simulation)	7.2	7.9	+1.1	9.0
11. Other program increases	35.8	23.0	+6.2	29.2
(a) Conversion of wastes	10.4	0	+1.0	1.0
(b) Oil and gas recovery	10.3	8.4	+1.8	10.2
(c) Resource assessment (not incl. geothermal)	7.3	7.3	+1.0	8.3
(d) Oil shale	2.5	2.0	+.3	2.3
(e) System studies	5.3	5.3	+1.5	6.8
(f) International programs	0	0	+.6	.6
12. Energy R. & D. programs not receiving further increases in fiscal year 1974:				
(a) Other nuclear fission R. & D. (incl. liquid metal fast breeder reactor) and nuclear materials process development	397.1	503.5	0	503.5
(b) Laser fusion	35.1	42.9	0	42.9
(c) Other	1.6	1.7	0	1.7
Total [1]	729.0	886.7	115.0	1,001.7

[1] The obligations now shown for fiscal year 1973 and for the 1974 budget are higher than earlier reported in the 1974 budget. The increase is attributable primarily to the inclusion of categories for R. & D. not previously reported under energy (e.g., automotive R. & D., conservation, resource assessment, and research on environmental effects) and recalculation of program costs.

ENERGY RESEARCH AND DEVELOPMENT—$115,000,000 INCREMENT TO ENERGY R. & D. BUDGET FOR FISCAL YEAR 1974

[Supplemental appropriation required is indicated in parentheses; dollar obligations in millions]

	AEC	NSF	DOI	EPA	Total
Total increase over 1974 budget	+20.2	+10.5	+62.0	+22.5	+115.2
Minus increases already appropriated	−20.2	−4.3	−23.6	−12.0	−60.1
Supplemental required	+0	+6.2	+38.4	+10.5	+55.1
Coal: Total increase over 1974			+49.5		+49.5
Supplemental required			(+26.6)		(+26.6)
Geothermal	+4.7	+2.3			+7.0
Supplemental	(+0)	(+0)			(+0)
Petroleum and natural gas			+2.1		+1.8
Supplemental			(+2.1)		(+1.8)
Solar		+1.0			+1.0
Supplemental		(+0)			(+0)
Nuclear fission	+7.1				+7.1
Supplemental	(+0)				(+0)
Nuclear fusion	+7.3				+7.3
Supplemental	(+0)				(+0)
Conversion		+2.2	+1.8		+4.0
Supplemental		(+2.2)	(+1.8)		(+4.0)
Transmission		+1.0	+1.1		+2.1
Supplemental		(+0)	(+1.3)		(+1.3)
Storage	+1.1				+1.1
Supplemental	(+0)				(+0)
Control technology				+11.7	+11.7
Supplemental				(+1.7)	(+1.7)
Auto. propulsion		+.9		+5.1	+6.0
Supplemental		(+.9)		(+3.1)	(+4.0)
Environmental effects				+5.7	+5.7
Supplemental				(+5.7)	(+5.7)
Resource assessment			+1.0		+1.0
Supplemental			(+1.0)		(+1.0)
Conversion of wastes			+1.0		+1.0
Supplemental			(+0)		(+0)
Systems studies		+2.0			+2.0
Supplemental		(+2.0)			(+2.0)
International programs		+.6			+.6
Supplemental		(+.6)			(+.6)
Conservation		+.5	+5.6		+6.4
Supplemental		(+.5)	(+5.6)		(+6.4)
Total increase	+20.2	+10.5	+62.0	+22.5	+115.2
Supplemental required	(+0)	(+6.2)	(+38.4)	(+10.5)	(+55.1)

Mr. MOORHEAD. I yield to my colleague from Florida.

Mr. FUQUA. Is nuclear weapons R. & D. included in the $10 billion figure?

Mr. ASH. No; it is not.

Mr. FUQUA. It is strictly for energy research?

Mr. ASH. That is correct and that is why it is a good idea to work from these two numbers. They are two different sets for different purposes.

Mr. FUQUA. That is what I wanted to be clear about.

Mr. ASH. You are absolutely right.

Chairman HOLIFIELD. And as you say, there would be an increase over a 5-year period of about $6.5 billion?

Mr. ASH. That is correct also, yes, sir.

ROLE OF NUCLEAR R. & D.

Mr. MOORHEAD. Finally, exhibit A does demonstrate what so many of us express concern about. It shows $3 billion coming out of the AEC and $79 million out of the Office of Coal Research. That is a tremen-

dously disproportionate thing. My hope in supporting this legislation would be that it would mean that instead of this $79 million, coal research would get a lot more than if we did not make this change.

Mr. ASH. It certainly would. That is the prime objective for the increment being added. There is plenty to be done and, as the chairman has said, we have been remiss and have not been doing what might have been done. Now is the time to concentrate all of the resources that can be effectively employed to get at the nonnuclear fuel potentials that this country has.

Mr. MOORHEAD. Did you give any consideration to transferring the military applications to production of nuclear materials, not to DOD but to the new NEC, to continue the same management that we have now that has done such a good job?

Mr. ASH. We did give some consideration to it, but what we really believe is important for the new NEC, given the increasing job that is going to have to be done in providing proper regulation for the increasing amount of nuclear plants being built, is that it have a full concentration on that. That is a very important job, to protect the public interest as these new nuclear plants get onsite and onstream. We felt that the best possible mission for NEC would be to have it highly concentrated and dealing only with protecting the public interest from a regulatory point of view, not in any way diluted by other kinds of activities.

Mr. MOORHEAD. You could almost use those same words as applied to ERDA. I realize it is a difficult problem.

Mr. ASH. Yes.

Mr. MOORHEAD. Thank you, Mr. Chairman.

Chairman HOLIFIELD. Mr. Wydler?

CRISIS-ORIENTED CONCERNS

Mr. WYDLER. I just want to point out, Mr. Ash, that the bill we have before us concerning ERDA, of course, is part of the long-range solution to some of our energy problems. I get a little nervous, to be honest with you, when I hear some of the testimony before our committee. It is all so crisis-oriented and also what I would consider one sided in the way it talks about developing energy, as if we do not have other serious problems. To put that in perspective, a few years ago, I was concerned, because whenever we talked about developing energy, we seemed to concentrate on nothing but the conservation problems and protecting the environment, to almost the exclusion of everything else. Now we seem to be going very much in the other direction and I wish we could have taken a more sensible course then. I hope we do not go completely overboard now.

Now, to try to put that into some relationship to the problem we have here today, Mr. McCormack's testimony—and I happen to serve on that subcommittee with him and I know the enormous work he has done on that Science and Astronautics Subcommittee on Energy in researching some of these problems—he states on page 4 of his statement that he has figures that show, for example, that coal gasification plants, building them—just building the plant; not producing any coal but just building the plant that would be needed to supply the coal gasification—would cost $200 million. I do not know anything

about his figure, but that raises the problem, in my judgment, about whether we should be doing any research at all in this field. I think somebody at the very top has to make some judgments on this, because if those figures are anywhere near right, that becomes so economically unviable that I think we should not get involved in it.

Now, how are we going to make judgments on that basis, that maybe instead of wasting money on developing coal gasification which will never be economically sensible, we get into something like building a good, sound, practical coal scrubber which can be used in some of our plants that will make it reasonable to use coal again for producing electricity? That to me, would seem to be a much better investment. Who in this management organization is going to be making decisions of that type? That is what I am wondering about.

Mr. ASH. I think this is one of the basic jobs that ERDA must be charged with. That is making sure that in undertaking research and development programs, or particularly as they get down to the development programs, or particularly as they get down to the development stage, that there is good cost-benefit analysis cranked into research. One of the basic problems that so often is the case, and I have managed research and development programs for the last 20 years, is that there is always a real need to do exactly what you have said; make sure that early in the development phase, or even before that, cost-benefits are analyzed as much as technology is analyzed. We so often run after the technology and run right away from any economical value from that technology.

COST-BENEFIT CONSIDERATIONS

The ERDA organization, as I see it, should be charged with strong cost-benefit considerations in everything that it does. The Administrator of ERDA, if I had my way, would not be somebody who might be the world's expert at technology but—might also have a balanced view of how technology, economics, the total public good, has to be brought into the work that it does.

I agree with you that it is a main problem. I do not know about that $200 million as a number, but I do know that the issue is there.

I must say in my own view, in dealing with the budget of many agencies where research and development is a part, I find that every time I work with their data, a question that I ask every last time is: "Is the research of a cost-benefit value that the public of this country should pay for, not just interesting research for the researchers?" It is a very important question and the whole of this Government should give attention to it, and particularly the management of ERDA itself.

Mr. WYDLER. I could not help noticing that in the last year and a half, coal has changed its character tremendously. A year or two ago, it was black goo. Now everybody is talking about it like black gold. It is amazing how we are depending upon it to solve all our problems and I just wonder if we possibly will ever be able to do that if we do not solve some of the pollution problems that go along with its use. I am really thinking that would be much more practical to think about using coal in a traditional way with proper environmental safe-

guards. I am not one of those who has ever been overboard on this issue one way or the other. But now I can begin to see us turning our backs completely on that aspect of it and just totally ignoring it. I just hope we do not do it as a Nation.

Mr. Ash. A significant part of the research and development money, particularly that to be given to the fossil fuels, is to deal with the energy potential aspects of extracting and using those fuels, because it is essential that we maintain the best possible balance between the very considerations that you have suggested. Certainly, my opening statement acknowledged that a big part of energy R. & D. is to attempt to do just that. I realize, as you do and like the people do, that the Government seems to swing way over this way and then swing way over that way and we only seem to be able to work on one thing at a time. But we will try to do the best we can do in finding balance, even though we all know that it does not really work that way in real life.

INDUSTRY CONTRIBUTION

Mr. Wydler. Just one last question. There is something that bothered me in testimony we received yesterday. It involves the extent to which the Government is going to pour money into research for this or that. At the end of all of these lines of research are industries. This is not like space; there was no customer. But in this field, there are lots of customers at the end of the line who stand to benefit very much from all the research that the Government does. I find nothing coming out of the industry on the question of what they are going to do, what part they are going to play, or, if they benefit from all this Government effort, what they are going to do to reimburse or pay back the Government for its effort. Is any thought being given to this?

Mr. Ash. Yes, but first, I agree with your assessment of what the potential problem areas might be. I am sure I would run to the same conclusion you would, that we should not hand to industry on a platter a lot of things that they convert to more profit than they otherwise would make. We have in some areas thought about ways where we can contract with industry where it has a strong financial incentive—first, to put up its own money to do a big part of the R. & D. job; and second, where the ultimate consequences are ones that do not result in unjust enrichment of industry for doing so.

There may be many contracts involved here. As you will notice, this is not necessarily a plan where we have Government employees and Government scientists doing all this research and development. We certainly found in the defense areas that we should not try to do everything in a Government munitions plant. We contract out with all kinds of experts to do our research and development. There is no reason that ERDA cannot adopt the same kind of approach, and do it on contracting arrangements, that first enlist the benefit of the tremendous amount of R. & D. capability that exists outside of Government, which happens to be more than is in Government; and second, do it under contracting arrangements that do not result in unjust enrichment of the private sector participating. I would hope that we can go that way.

I should answer also with another observation, drawing from my own past experience in dealing with scientists and research. One of the things we are doing in OMB is a "crosscut" of research across the Government in all kinds of R. & D. to retest cost-benefit judgments that are being made to make sure that where we do research, we do not just do research for research's sake and for the sake of those who are doing the research. That is a syndrome that one can get caught up in very easily, and we must be sure that we do keep our eye on the potential benefits.

Now, I realize that the further back you are toward pure research, the harder it is to measure potential benefits. Some people just have to be turned loose to see if you can discover something new and interesting and let that lead to a potential value later. But there is a lot of work, particularly in the development stage, that we ought to——

Mr. WYDLER. That certainly would not be the function of ERDA.

Mr. ASH. What we would hope to do would be not to depend just on OMB or even the President to make these judgments, but hope to bring into the structures of the organizations doing the research and the top management of those structures an awareness, a technique and a responsibility to do its own cost-benefit work as it presides over research going on over the whole of Government. Thus, we would like to build that approach into the management capability and responsibility of everybody that deals with research. It is so easy to be captivated by the scientist who takes you down a path at great expense and sometimes little benefit. I think Professor Conant once, at Harvard many years ago, in the early days of some of this advanced research and development—and he himself was in it as a physical scientist, at least—said you do not have to be buffaloed by the scientists. Just get them in a room, lock the door, and make them talk until you understand it. That is a way for a nonscientist to have an impact on a scientist.

Mr. WYDLER. Good luck.

Thank you, Mr. Chairman.

Chairman HOLIFIELD. Mr. Brown.

Mr. BROWN. Thank you, Mr. Chairman.

I am going to keep my questions short because I hope Director Ash will have the opportunity as he leaves to stop by the building superintendent's office and tell him to cut the heat down.

Chairman HOLIFIELD. And also we have Dr. Dixy Lee Ray, the Atomic Energy Commission Chairwoman.

Mr. BROWN. Yes, sir.

I would like just to comment on two subjects you have been discussing, both with Mr. Wydler and other members of the committee. You talked about the fashions or the fads of researchers versus the economics of effective research, and I would heartily concur. I think it might explain a little bit of the difference between the $3.6 billion in atomic energy versus the $79 million in coal, since atomic energy seems to be a much sexier item for researchers than coal.

Second, I would just like to point out that while undoubtedly, private industry and private citizens will benefit from the kind of research that springs from ERDA and what it produces, that all of us will pay taxes

back to the Government so maybe this is a contribution that the Government ought to make so that we can all pay taxes rather than perhaps be out of work, which may be the case this winter for some people who will be impacted by the fuel crisis. Wouldn't you agree with that?

Mr. ASH. I would surely agree with that.

ERDA ADMINISTRATOR

Mr. BROWN. Let me ask you one organizational question and one funding question.

Yesterday, Mr. Partridge of Columbia Gas said he preferred the language of S. 2694 with reference to the leadership of this agency. Now, your experience with the Ash Commission taught you a lot about the organization of independent agencies. Would it be better, as in S. 2694, to have a board of governors name an Administrator and pay him at a set rate of pay, which could be above the executive schedule, or to have, as H.R. 11510 provides, a Presidential appointee with Senate confirmation, whose salary would be set by the executive schedule as the head of an executive agency?

Mr. ASH. I feel strongly that the proposal to have a single executive appointed by the President and confirmed by the Senate will get us on with the task in a more effective way than if we superimposed a board of governors and committee-type structure of management. I think we have a task that requires very single-minded effort and energy and commitment, and I think it can by far be best done through the H.R. 11510 route.

Mr. BROWN. As I understand that, it is not a choice, really, between committee management and executive management, but it is for this board of governors to name an Administrator and set his pay. I do not mean to contend, either, for one method or the other, but I want to be sure that we are talking about the same thing here.

Mr. ASH. I would say that in evidence that there is an expectation that the board of governors would involve itself in management in that it is set up as a board of governors. If instead it were merely saying that instead of the President nominating a candidate and the Senate confirming it, we would have 15 people nominate and confirm that head, and then discharge themselves and go out of business, then that would indicate that its only role would be to nominate the person and the agency would thereafter proceed in an executive mode. But the fact that the board of governors would continue and would exist, would be there to involve itself in management of some sort, I would worry about that sort of management. A board of governors would feel called upon, feel almost compelled to get involved merely by virtue of its very existence. It is obvious that it was intended to have some role in subsequent management or it wouldn't continue to exist after it appointed an executive director.

Mr. BROWN. You think the pressures for different kinds of research and so forth would be adverse rather than beneficial to the Administrator?

Mr. ASH. I think it would. I think it would be very proper for the Administrator and very desirable for the Administrator to make use of advice where he could get it from some of the very kinds of people

that would be on this board of governors. But taking advice from them is quite different than having them design his program. He would really have a——

Mr. BROWN. Does H.R. 11510 provide for the input of that advice?

Mr. ASH. It doesn't specifically provide for it. It does not preclude it and I would hope that an Administrator would find it is in the best interest of such an agency to get that kind of advice.

Mr. BROWN. But you don't think language providing for it in some way would be desirable, or do you think it would be desirable?

Mr. ASH. It could be in. It needn't be in, but it certainly could be in. I would certainly encourage an Administrator to make use of all of the advice and information that he could get from some of the very same people that would make up a board.

Mr. BROWN. Perhaps, Mr. Chairman, it would be helpful if Director Ash, assuming he feels that some compromise could be reached which would encourage this kind of outside advice from industry or other agencies, would submit some language to modify H.R. 11510 in that regard.

Mr. ASH. Let us take a look at that.

TRUST FUND APPROACH

Mr. BROWN. Also, another difference between S. 2694 and H.R. 11510 was pointed out by Mr. Partridge, the difference between a trust fund approach and the other's appropriations approach.

Those of us aware of the problem are all passionately involved in the energy crisis. By the way, I have a colleague on the Interstate and Foreign Commerce Committee who said he polled his constituents recently and about half of them feel the energy crisis is a fake, and that there is no problem. I don't hold with that and certainly we will all recognize it much more clearly and severely as the winter progresses.

What I am saying, along the line of what Mr. Wydler questioned you about, is that our concern now is one of heated passion about the problems of energy. What happens when that perhaps cools off a little and suddenly, we continue our dependence on foreign oil imports or some such thing, and then we get into the same problem again in the future? Some of us felt that 6 months ago and maybe 12 months ago, this was more of a problem than was perceived by people in the administration. But now we are all facing the problem. How can you be sure that the Congress will continue to appropriate money at the rate you suggest, first, and how can you also be sure that it will not get tied up, as we now have the HEW budget tied up, in some kind of legislative bag or personal difference of opinion between the administration and Congress, and lose the whole initiative that we are trying to get started here?

Mr. ASH. Well, I think that if we were to operate according to the S. 2694 proposal and have a trust fund made up of offshore oil lease moneys, we would be premaking a decision, and probably the wrong one, because it would just be a formula as to how much should be spent in this area. Maybe some year, we will have no offshore oil lease money, and then what? I would think that the political processes that have served well over 196 years, by which the Congress and the Ex-

ecutive determine how much to spend for any program, can probably best come to the right answer as to how much should be spent for energy research and development. Sure, the pendulum will swing and it always has, but we are probably going to be closer to the mark that way than if we let some totally arbitrary and independent factor—that is, offshore oil leases—premake the decision for us as to how much we should spend on R. & D. That is probably going to be the worst number of all, a number arrived at independently by some other activity that is going on.

For example, it is possible that there are better ways to realize more money for the Federal Government from its offshore oil by other means of leasing.

Mr. BROWN. It would not necessarily have to be offshore oil. What you could do is impose a tax on electricity. I think somebody has even been radical enough to suggest a tax on gasoline that would raise the price on gasoline and would create a fund for research in this area. I really do not care about the source of the trust fund. What I am after is the concept of a trust fund.

Now, we had a crash program to develop the Interstate Highway System in this country and in order to assure that we kept it going until we got the solutions we wanted, we set up a trust fund arrangement. We have done this in airports and airways. We did not do it in space, I guess, because there was no way you could figure out how to finance it out of a trust fund. But does it have merit or does it not have merit?

Mr. ASH. My personal view, and I am sure that the administration supports this view in general, a way to make better decisions, is to use that tried and true political process of how much is enough each year, rather than the trust fund concept that lets the amount that is to be spent be determined by some other and independent factor, even if it were a tax on gasoline. The likelihood of that resulting in the right number is much less than the congressional consideration of all of the ramifications that are appropriate for consideration and form a sound basis of making a decision. I think that we have a good process for making these decisions, and while we can criticize it and complain about it and even argue over it, it is probably a lot better than letting some third independent formula determine what is available.

Mr. BROWN. So the answer to effective and efficient coal research is to get on the Appropriations Committee.

Thank you, Mr. Chairman.

Chairman HOLIFIELD. Mr. Mallary.

EXTRACTION TECHNOLOGY

Mr. MALLARY. Thank you, Mr. Chairman.

A couple of brief clarifications.

I would like to pursue the question Mr. Horton asked you with regard to the transfers of responsibility from the Department of the Interior to ERDA. I gather that your answer was that exotic and new sophisticated techniques of coal extraction would be transferred to ERDA, but any expansions or modifications of mechanical extraction techniques would still be the responsibility of Interior?

Mr. ASH. Not precisely, but it would come down to about that same end.

There would be nothing transferred from Interior to ERDA of the new and exotic technique, but the ERDA mission would be charged with developing new extraction techniques, even though at this moment, there is really nothing going on at all, and nothing to be transferred, but ERDA would certainly have the responsibility for doing it.

Mr. MALLARY. There is nothing in essence going on now in terms of new extraction techniques?

Mr. ASH. I think it has to do with the close mine safety relationship that the Department of the Interior otherwise has. But we want to do more than that and ERDA would be charged with doing more than that.

Mr. MALLARY. The concern that was expressed was that it might not be adequate if ERDA was given authority just for new extractive techniques. If we are going to rely on coal gasification and liquefaction, we must figure out how to get the coal out of the ground. Do you feel that a transfer of some of the mining or extractive techniques to ERDA would put a greater emphasis on them?

Mr. ASH. I see no reason why there would be any reduction. In fact, in parallel, there is a good possibility, assuming that the programs are effective, that the private sectors should give and the public should look at all of the ways that we can get more coal out of the ground. And if the bottleneck is what we are, or, are not doing in the Government, then we should eliminate that bottleneck in the Government, which certainly would not be by reducing the amount spent for it.

Mr. MALLARY. Could you, for my information, supply for the record the amount of funds and personnel now in Interior working on extractive techniques?

Mr. ASH. We will do that, yes, sir.

[See p. 170.]

NSF RESEARCH ROLE

Mr. MALLARY. One other question.

The testimony this morning of Mr. McCormack raised a question of why only two programs were taken out of NSF when such other programs as solar research, battery, wind energy, and fuel cell research were not transferred from NSF to ERDA. Would you want to comment on that?

Mr. ASH. NSF has a mandate to do basic-type research across a wide field. We do not think that NSF should be precluded from doing its basic research and those programs that were left in NSF were much more at the basic level rather than in their developmental stages, which we expect ERDA could more appropriately handle. I think as a matter of principle generally, there is no desire to always eliminate competition in basic research. In fact, quite the contrary. The more basic you are, the more you ought to have two or three or four people working on it. The more that is developmental, as were some of the space and other programs, the more effective you are when you can really concentrate attention on it. So the belief fundamentally is that basic research should not be denied those agencies that have the capa-

bility to effectively do it and yet development can and should be concentrated to achieve maximum effectiveness. That was the basis of the split.

Mr. MALLARY. Thank you very much.

Thank you, Mr. Chairman.

Chairman HOLIFIELD. Thank you very much, Mr. Ash, for your testimony and your responses to the questions. You have given us some invaluable testimony this morning.

Mr. ASH. Thank you, Mr. Chairman.

Chairman HOLIFIELD. Our next witness will be Dr. Ray, Chairman of the Atomic Energy Commission.

Dr. Ray, will you please come forward?

The Chair might announce that we will conclude the morning session with Dr. Ray's testimony, and I believe that Mr. Whitaker, Under Secretary of the Department of Interior, and Mr. Love will be here at 1 and 1:30 respectively.

We are glad to have you before us, Dr. Ray. Will you please proceed?

Do you wish to summarize your testimony, or do you wish to read it?

STATEMENT OF DIXY LEE RAY, CHAIRMAN, ATOMIC ENERGY COMMISSION; ACCOMPANIED BY MARCUS A. ROWDEN, GENERAL COUNSEL

Dr. RAY. Thank you, Mr. Chairman.

I will try to summarize it. It is broken out rather specifically.

Chairman HOLIFIELD. Would you prefer to read it?

Dr. RAY. I would, if there is time, sir.

Chairman HOLIFIELD. I think we will have time. I do not think we will be called to the floor for a while.

Go ahead.

Dr. RAY. Thank you very much.

Mr. Chairman, members of the committee, 4 months ago I had the privilege of testifying before this committee in support of the administration's original bill to reorganize Federal energy research and development efforts. Since then events have caused me to become even more convinced of the necessity for such action. You, Mr. Chairman, and your staff working closely with our agencies have molded the administration's reorganization proposals into a piece of legislation that can be acted upon quickly to provide the organizational arrangements that are needed. It is a pleasure for me to testify personally and for my fellow Commissioners in support of H.R. 11510—the Energy Reorganization Act of 1973.

The President in his November 7 message to the Nation stressed the need for immediate reorganization of Federal energy research and development into a single agency. That message caused me to reflect on my own experience during the past 4 months in developing recommendations to the President for a 5-year, $10 billion program of Federal energy research and development. I have been impressed by a fact that has become increasingly clear in recent weeks, that we will require further development of all of our fuel resources: Fossil, nu-

clear, solar, geothermal, hydro, and others yet to be discovered if we are to meet our energy needs. To realize the potential of our domestic fuels will require a balanced, vigorous, and imaginative use of all energy sources and improved efficiency in the uses of energy. I strongly support the concept of an Energy Research and Development Administration (ERDA) as essential to attaining such a balanced approach to the development of our energy future.

This organization is needed to integrate the efforts of diverse research groups which are presently competing for a variety of resources: Funds, skilled people, and facilities. If those resources are to be used in the best possible way, there must be central planning and coordination of all energy research and development efforts. The creation of ERDA will help to focus responsibility for the Government's diverse activities in energy research.

The Energy Reorganization Act of 1973, by creating ERDA, would provide for a unified and focused Federal research and development program. The creation of the Nuclear Energy Commission (NEC) would assure the AEC's important regulatory responsibilities are continued by an independent agency.

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

ERDA would be formed by bringing together some of our Nation's best talent in research and development. The Atomic Energy Commission would bring to the new agency its extensive experience in technical management, a resource that would help to launch ERDA quickly. The network of national laboratories created by AEC would provide a valuable technical base for the new agency. ERDA would likewise acquire professional talent in fossil fuel development from the Department of the Interior through the transfer of the Office of Coal Research and the Bureau of Mines Energy Research Centers to ERDA. The new agency would also be enhanced by transfer of solar and geothermal energy development from the National Science Foundation. From the Environmental Protection Agency, ERDA would acquire experts on the development of alternative automotive power systems and in developing technology for controlling emissions of air pollutants from stationary sources using fossil fuels.

To integrate these broad capabilities into an effective organization, ERDA has been instructed to:

Assure full recognition of all potential energy systems at the highest organization levels; and

Retain flexibility for adjustment to new opportunities and circumstances not now predictable.

The top levels of the ERDA organization would be served by:

The Administrator and Deputy Administrator. These two senior officials would be appointed by the President with the advice and consent of the Senate.

Five Assistant Administrators, each responsible for a major area. These Assistant Administrators would also be appointed by the President with the advice and consent of the Senate. They would be chosen for their technical and managerial ability in their respective areas.

Staff offices, reporting to the Administrator, are to supply staff services in such categories as legal services, finance, administration, external affairs, civil rights, and planning and analysis.

Field office managers, will be responsible for overseeing execution of ERDA programs performed at contractor or Government facilities.

Specific responsibilities will vary among the offices.

The Administrator would need the flexibility provided in this legislation to mold this organization in the way that would seem most effectively to accomplish ERDA's program responsibilities.

ERDA would adopt the merit personnel system of the Atomic Energy Commission. This system has proved successful in attracting and retaining highly qualified scientific, technical, and supporting personnel under merit principles.

The single Administrator approach focuses responsibility for management in one single office. The Administrator and his Deputy would establish policies and plans and they would coordinate, support, and manage (1) energy research and development programs, (2) production of special nuclear materials, and (3) research, development, testing and production of weapons in accordance with national defense responsibilities.

FOSSIL ENERGY PROGRAMS

A vital component of ERDA would be its programs to develop fossil energy. It is recognized that many of the most promising near-term solutions to energy shortages may be found in advancing fossil energy technologies. The personnel being provided by the Department of the Interior would form the core of talent upon which ERDA would draw. The Assistant Administrator for Fossil Energy would focus on developing new and improved technologies for the economical recovery of coal, oil, and natural gas. Another major concern would be the improved uses of fossil energy sources. Finally, inherent in all of these activities would be the continuing responsibility to protect the health and safety of the public and to improve the efficiency of processes.

Basic to all efforts would be the need to bring fossil fuel concepts to the point of commercial application. This Assistant Administrator would be responsible for facilitating transfer of new technology to industry through appropriate mechanisms.

Developing new and improved technology for the economic recovery of coal, oil, and natural gas, includes:

Research on advanced extraction technology relating to energy source materials;

Liquefaction and gasification of coal;

Production of coke from low-grade coals and lignite; and

Transformation of oil shale into petroleum products.

Advances in the technology of energy conservation through improved utilization of fossil energy sources would be pursued in areas such as:

Advanced combustion systems and emission control systems;

Basic research on the physics and chemistry of fossil fuels; and

Other advanced techniques for using fossil fuels and reducing environmental effects.

NUCLEAR ENERGY DEVELOPMENT

The responsibilities for nuclear energy development and operation of facilities for enriching uranium would be under the Assistant Administrator for nuclear energy. He would carry forward present AEC research on long-term solutions to energy needs. His responsibilities include studying new nuclear technologies, developing them, and working with industry to bring them to commercial demonstration. This effort involves a close working relationship with industry to insure technology transfer and effective, cooperative R. & D. efforts.

Responsibilities for R. & D. on systems for conversion of fission energy include:

Civilian power reactors, such as the liquid metal fast breeder reactor (LMFBR), light water breeder, and the gas-cooled concepts;

Safety research on nuclear reactors;

Supporting technology relating to components, fuel preparation and recycling and auxiliary systems;

Technology for providing on-board electric power for spacecraft;

Improved nuclear propulsion systems for submarines and surface vessels; and

A wide range of peaceful application of nuclear explosives.

Research and development of systems for the conversion of fusion energy would include:

Research on the fundamental laws of physics relevant to the magnetic confinement of thermonuclear plasma;

Experimental production of sustained thermonuclear reactors; and

Design and fabrication of devices to demonstrate the feasibility of controlled fusion.

This research would be closely coordinated with laser fusion efforts.

A significant responsibility would involve the operation of facilities for enriching uranium and performing research to develop and improve enriching techniques. AEC is now attempting to transfer technology to industry in this field with the intention of inducing industry to construct additional increments of uranium enrichment capacity. In the meantime, the sole source of the U.S. supply of uranium for commercial uses comes from these Government-operated production complexes.

A continuing responsibility would be exercised over health, safety, conservation, and environmental aspects of all nuclear systems being developed. Included in this work would be performance of nuclear waste management activities.

ENVIRONMENT, SAFETY, AND CONSERVATION

Protecting the environment, safeguarding public safety, and conserving resources must be considered in developing all energy systems. Such concerns inevitably have an effect on hardware development for any specific energy technology. These would be the responsibility of the Assistant Administrators for fossil energy, nuclear energy,

and advanced energy development. Many of the most critical problems in energy research and development are associated with energy demand or consumption questions or with more fundamental environmental or safety questions that are not necessarily directly related to the development of a fuel supply technology. These matters would be the responsibility of the Assistant Administrator for environment, safety, and conservation. He would also be able to provide the Administrator with a general assessment of the environmental, safety, and conservation aspects of the technologies under development.

This Assistant Administrator would have a charter to:

Carry out general R. & D. programs in the areas of environmental protection including waste management, transportation, health and operational safety, and alternative conservation technologies arising from energy sources or uses;

Provide a focal point for coordination of environmental, safety, and conservation issues with other agencies; and

Review ERDA programs and facilities for compliance with relevant environmental, safety, and conservation standards.

Examples of topics that might be the subject of research by this element include:

Basic biological and medical problems;

Environmental, health, and safety impacts on human populations and various ecosystems;

Effect of thermal discharges on aquatic life;

General waste management;

Safety, cost, and risk-benefit factors in various energy systems;

Conservation factors in alternative means of increasing system efficiencies; and

Fire and safety reviews of all ERDA facilities. Safety responsibilities exercised by this Assistant Administrator would extend to the oversight of Federal facilities under ERDA control to assure that they are operated in a safe manner.

ADVANCED ENERGY SYSTEMS

The Assistant Administrator for research and advanced energy systems would have important development responsibilities. We must recognize that there is need for energy research and development in areas that fall outside both the nuclear or fossil categories but which ERDA could profitably study. Work being performed by this Assistant Administrator would support both fossil and nuclear programs and also involve advanced energy source options.

This Assistant Administrator would have research responsibilities which broadly relate to current and future energy missions including:

High-energy physics to achieve better conceptual understanding of matter and energy;

Medium- and low-energy studies of nuclear structures and processes;

Fundamental studies of the properties of materials and phenomena related to their potential use in energy systems; and

Studies of processes and interactions on the molecular or atomic scale related to energy applications.

In addition, research and development work would be performed on new technologies which have long-range potential for generating energy. Efforts would include developing for commercial application:

Geothermal and solar energy;

Transmission and storage of energy;

Magnetohydrodynamics and other advanced cycles; and

Other advanced concepts such as conversion of tidal and wind energy, and advanced automotive systems.

NATIONAL SECURITY

The Assistant Administrator for national security would continue to exercise responsibilities for research and development of nuclear weapons, the production of weapons materials, and the testing, manufacture, and reliability assessment of weapon components and systems. His activities would be coordinated with the Department of Defense.

Responsibilities for research and development on nuclear weapons and related programs include:

Development of nuclear weapon components and systems; and

Laser fusion systems capable of providing specified energy units to a laser-fusion target.

The reactor products necessary for fabrication of weapons will be produced in Government-operated reactors and would be the responsibility of the Assistant Administrator for national security. He would also perform international security functions including export-import control of the goods, services, and information necessary to protect national security.

The Administrator would, of course, have the flexibility to run his agency as he saw fit. But if we were to project from present successful practices, we would assume that ERDA would probably be managed and operated along the following lines.

ASSIGNMENT OF RESPONSIBILITIES

The ERDA Administrator would be responsible for setting agency policy and program objectives and for allocating the agency's resources. The Administrator would draw upon a central staff to provide guidance and agency control in the financial, legal, personnel, and other administrative areas. A strong policy planning and analysis group would also be available. In the assignment of priorities and allocation of funds, each Assistant Administrator would propose requirements for his programs.

The principal staff of operating divisions, composed of individuals with strong technical-management backgrounds, would provide program direction and assessment. Principal responsibility for contract administration would be assigned to managers of field offices, who will report organizationally to the Administrator.

ERDA would operate to draw upon existing strengths. The agency would begin with plant and laboratory facilities and technical organizations in existence of outstanding capability, competence, and versatility. Clearly, the existence of a large-scale fossil fuel industry

with its own technical competence and resources makes possible a wide range of patterns and opportunities for Government-industry cooperation.

Each Assistant Administrator would have flexibility in selecting the best means for conducting research and development under his responsibility. Available options would include using the national laboratories, contractors, other agencies, universities, and nonprofit organizations.

NUCLEAR ENERGY COMMISSION

The spectacular growth of the nuclear power industry in recent years has greatly increased demands upon the AEC for regulating the peaceful uses of nuclear energy. As we have long anticipated, the time has now come when the scope and magnitude of the regulatory function requires the undivided attention of one agency. The proposal to provide for a separate Nuclear Energy Commission (NEC) is another step in the evolution of the Government's involvement in controlling nuclear development and use.

The Nuclear Energy Commission would consist of:

The five Commissioners;

An Executive Director of Operations;

A General Counsel to provide legal advice and assistance;

A Controller for financial management;

A Secretary and Public Affairs Officer to assist in the conduct of the Commission's business and its communications with the general public;

A Policy Analysis Office to conduct broad policy planning, assessment of resources, and operational planning and control functions; and

A regulatory line staff reporting through the Executive Director of Operations.

This staff will operate in the areas of:

STANDARDS

Setting standards for licensed nuclear activities involving nuclear reactors, other nuclear facilities in the reactor fuel cycle, and the possession, use, transportation, and disposal of nuclear materials in civilian activities.

LICENSING

Review and evaluation of license applications for nuclear facilities and materials.

INSPECTION AND ENFORCEMENT

Inspection of licensed nuclear activities to determine compliance with NEC's regulations and licensing provisions; and enforcement where necessary.

CONFIRMATORY ASSESSMENT

Independent assessment of research requirements relating to reactor safety and other regulatory responsibilities. This would include the

verification of research results for applicability to safety standards, design features for reactor safety, and safety and environmental aspects in other areas of nuclear application where NEC has responsibility.

Standards, licensing, and inspection and enforcement (regulatory operations) exist in the current organization under the AEC's Director of Regulation. Confirmatory assessment is a new organizational responsibility. It would give the NEC an independent capability for developing and analyzing technical information related to reactor safety, safeguards, and environmental protection in support of the licensing and regulatory process.

The Commission would continue to have the assistance of the licensing and advisory boards of the AEC including:

The Atomic Safety and Licensing Board Panel;

The Atomic Safety and Licensing Appeals Panel; and

The Advisory Committee on Reactor Safeguards.

NEC would be responsible for licensing and regulating the civilian applications of nuclear materials and facilities. NEC's responsibilities would embrace a comprehensive set of programs designed to insure that activities involving nuclear materials and facilities are conducted in a manner consistent with public health and safety, environmental quality, national security, and antitrust laws.

The Commission would carry out exclusively the regulatory functions of the present AEC, including:

The establishment of policy and oversight of the regulatory operations;

Rulemaking;

Adjudication of licensing and enforcement cases; and

Assessment and allocation of management resources.

The regulatory responsibilities would encompass the licensing and regulation of all nuclear utilization, production, and processing facilities for industrial, commercial, or other licensable purposes, including transportation, import or export of nuclear materials, and the disposal of radioactive wastes. This would involve diverse uses of nuclear materials and facilities, such as in electric power generation, nuclear research, and medical diagnostics and therapy, and industrial radiology.

NEC would have the statutory authority to engage in contracting for confirmatory research which the Commission deems necessary for the discharge of its licensing and regulatory functions. Furthermore, NEC would be able to obtain appropriate research and development data developed by ERDA and other Federal research agencies and to examine and analyze the data. ERDA and other Federal agencies, to the extent practicable, would be expected to: (1) Furnish NEC, on a reimbursable basis, such research services as the Commission deems necessary for the conduct of its functions, and (2) cooperate with respect to the establishment of priorities for the furnishing of research services requested by NEC.

NEC would have the responsibility for planning, budgeting, and evaluation of results of the light water reactor safety program. The loss-of-fluids test and power-burst facilities would be transferred to

ERDA, which would continue to perform the day-to-day management of these programs on a reimbursable basis under agreement with NEC. In the areas of biomedical and environmental research, waste management, and transportation, NEC would be provided additional funding to initiate research appropriate to the regulatory responsibilities for the protection of public health and safety.

At the request of the Administrator, the Advisory Committee on Reactor Safeguards would conduct safety reviews of ERDA nuclear activities and facilities. NEC would be authorized to license the following categories of future ERDA facilities: (1) Demonstration liquid metal fast breeder reactors when operated as part of power generation facilities of an electric utility system, (2) other demonstration nuclear reactors when operated as part of a power generation facility system, (3) facilities used primarily for the receipt and storage of high level radioactive wastes resulting from licensed activities.

To summarize, the proposed Nuclear Energy Commission is designed to assure protection of the public health and safety in civilian nuclear activities. The new organization would eliminate the appearance of regulatory and developmental conflicts in administering the nuclear energy program. The reorganization would maximize regulatory objectivity and impartiality, increase public confidence in nuclear regulation, permit the Commissioners to concentrate exclusively on regulatory issues, and create a fully independent regulatory agency which the rapidly maturing nuclear industry requires.

I believe we need these two new organizations now. Some may contend that we could move forward more quickly with our existing institutions by patching programs together. This approach, in my opinion, would be shortsighted and less effective. We, as a Nation, are confronted with a crisis that requires bold action. To do less is to risk the welfare of our Nation.

I commend this committee for taking the initiative on this vital matter, and I offer the full support of the Atomic Energy Commission in this endeavor.

I will be glad to answer any questions that you, Mr. Chairman, or any member of the committee may have.

Chairman HOLIFIELD. Thank you, Dr. Ray, for a very comprehensive and informative statement. I think your statement and Mr. Ash's statement, put together, will provide the basic information for our report.

Dr. RAY. Thank you, sir.

IMPROVEMENT OF REGULATORY PROCESS

Chairman HOLIFIELD. There is one question I would ask you.

Do you feel that this adaptation, you might say, of existing AEC laboratories, personnel, and so forth, can be effected without substantial delay?

I will be specific on one point: This group of licensing and regulatory people which now, I believe, represents close to 700 or 800, does it not——

Dr. RAY. About 1,200.

Chairman HOLIFIELD. About 1,200?

Dr. RAY. Yes, sir.

Chairman HOLIFIELD. They will continue to do the same work they are doing now, will they not?

Dr. RAY. With just this one addition, Mr. Chairman, that in the regulatory branch of AEC at the present time, we have a very thorough review going on of the procedures that have been developed for handling applications and reviewing license applications, and so on, to see whether the system which evolved over a time, beginning when only a very few reactors were making applications for construction and operation of nuclear powerplants, to the time now when we have, within the next 12 months, we figure, about 21 plants which should complete their reviews for operating licenses.

We are reviewing to see whether there can be some improvements in the licensing system and in the review system, which has turned out to be a rather lengthy procedure. This careful review is going on because we have no intention of sacrificing the quality of the review or the responsibility for very careful consideration of both health, safety, and environmental considerations before any kind of speedup. But we do believe the process can become more efficient, and with just that modification, that we intend to see if there are improvements possible in the processes, and the system, yes. It seems to me there is no reason why in a transition to becoming an independent agency, the regulatory branch could not continue its work almost without interruption.

Chairman HOLIFIELD. That really was the assurance that I wanted, because I was aware, of course, of the study that had been made to improve the existing processes. But this would not be a sharp break in functions by any means?

Dr. RAY. No.

Chairman HOLIFIELD. I mean the same people would go to work at the same desks, and they would go right ahead with their work, and we have provisions in the act for any kind of carryover functions that might be necessary during the transitional period.

Dr. RAY. In my opinion, sir, title III of the proposed legislation, which takes care of transitional problems, has been very thoughtfully and carefully drawn. And as far as AEC is concerned, I do not see any likely problem that would arise that has not been taken into consideration. We have studied what things would lapse, what things would transfer. The bill gives the authority for the carryover during the time of transition.

Chairman HOLIFIELD. Well, I assure you that both this committee and the Joint Committee on Atomic Energy will be watching this because it is of vital interest to both committees. If any adjustment is needed, as soon as you bring it to our attention, we will act expeditiously on it.

I think, the first report we put out on energy needs in the Joint Committee was in 1963. And we predicted pretty well what has been happening. We did not predict it would be quite as bad as it is, because certain factors have developed which caused it to be worse than we expected. I would say we hit it about 75 percent. It is about 25 percent worse than we thought. So we have been working at this a long time.

I consider this as probably one of the most important pieces of legislation that I have handled in my 31 years in the Congress. I think it

will have such a beneficial and lasting effect upon our whole economy that it is worth all the work that we are putting into it. We will keep looking at it, with your help and with the help of the other people that will be working in the NEC, to see that this job is done right and improved as it is needed to be improved. I know you will help.

Dr. RAY. I certainly will.

Chairman HOLIFIELD. This committee and the Joint Committee, as you know, have practiced vigorously the oversight function. We have practiced it not to be obstructive, but to be constructive and helpful.

Dr. RAY. That is correct. I certainly agree, sir.

Chairman HOLIFIELD. Mr. Horton.

Mr. HORTON. Mr. Chairman, I do not have any questions.

I do want to thank you, Dr. Ray, for your statement. I agree with everything the chairman said with regard to your statement, and Mr. Ash's statement. I think the two of them together do form the nucleus of the story. I think your statement will be very helpful to this committee because it does outline very succinctly what is involved in the creation of what Mr. Holifield says is one of the most important pieces of legislation that he has worked on in his 31 years in Congress. I think it is a most important piece of legislation.

As I said earlier, I look on ERDA with its energy challenge as though it were NASA with its space challenge. I think that this organization would have the possibility of providing the technology and the know-how to solve our energy problems. With the help of your staff and our staff in drafting this bill, I think we do have a very good bill that can set up an agency that can be very instrumental in the solution of this very serious problem.

Dr. RAY. Thank you very much.

Mr. HORTON. Thank you for your testimony.

Dr. RAY. Thank you, Mr. Horton.

I would just like to say that the statement as drawn represents a good deal of very hard thinking on the part of the staff. We have a group of key people within the organization that have been devoting a lot of thought to how a reorganization issue involving the AEC could be worked out. I can say that they have not only given a great deal of thought to it, but the staff is fully supportive of that effort.

Mr. HORTON. I want to tell you, it showed. It showed that they had given this many hours of thought in advance, because when they came, they were well prepared. They knew what they were talking about, and that saved us many hours.

Dr. RAY. Splendid.

Mr. HORTON. We spent about 5 days working on the language of this bill.

Dr. RAY. That is right.

Chairman HOLIFIELD. Dr. Ray, we will present you with a series of questions, many of them are technical in nature, and we hope that we can get a response back from you on them as quickly as possible. We are trying to get all of this in print as quickly as possible.

Dr. RAY. We have our reorganization unit still in existence, and I think we are prepared to respond quickly to any questions and will be happy to do so.

Chairman HOLIFIELD. Counsel will hand them to you.
Thank you very much.
[The information referred to follows:]

AEC SUBMISSIONS TO ADDITIONAL SUBCOMMITTEE QUESTIONS

1. With the separation between ERDA and NEC, do you see any problem in coordinating and achieving a proper balance between the safety standards of NEC and the production and technological objectives of ERDA?

Under H.R. 11510, ERDA will continue to operate facilities for producing special nuclear materials and to achieve the technical objectives of its research and development program much as AEC has done in the past. Furthermore, NEC would be authorized to license certain categories of new ERDA facilities, including demonstration nuclear powerplants and facilities used primarily for the receipt and storage of high-level radioactive wastes resulting from licensed activities. The Administrator would be able to call upon the ACRS for safety reviews of programs when he believes this to be necessary, in much the same way as AEC now operates. ERDA would be responsible to assure that safety is built into its own programs and products as they are developed and that its facilities are operated safely. This practice has been a strength of AEC operations and would continue.

We anticipate no significant problem in developing safety standards as a result of the separation between NEC and ERDA. H.R. 11510 would give NEC authority to engage in contracting for confirmatory research which the Commission deems necessary for the discharge of its licensing and regulatory functions. NEC could also obtain appropriate research and development data developed by ERDA and other Federal agencies would be expected to perform research services for NEC on a reimbursable basis. NEC would have important responsibilities for planning, budgeting, and evaluating results of the light water reactor safety program. NEC would be provided additional funding to initiate research in several areas appropriate to its regulatory responsibilities.

2. What is your reaction to the suggestion that ERDA be headed by a board of governors including seven part-time and public members?

A principal objective of moving to the single administrator system has been to focus responsibility in one individual. A board of governors would diffuse responsibility, and, with industry members, could bring some conflict-of-interest questions into being.

It will, of course, be desirable for ERDA to have access to diverse viewpoints in making its R. & D. decisions and mechanisms will be available for doing this.

ERDA will be able to obtain industry and other advice from the private sector as well as the expertise of other Federal agencies. One of the means for doing this is through advisory committees. Section 107(g) of this act provides the specific authority for the Administrator to establish advisory boards, a practice which the Atomic Energy Commission has successfully utilized in carrying out its nuclear programs. In addition, ERDA will be subject to the oversight of the President and the Congress, which will contribute to the perspective leading to balance in its programs.

3. What will be done under ERDA to assure a proper program balance between coal research and nuclear research?

The purpose of ERDA is to provide a balanced program in energy research which will adequately support projects on all promising energy systems. We are seeking to build this objective into ERDA by structuring the organization so that all energy projects have equal access to the Administrator.

A major program area has been recognized under H.R. 11510 and within ERDA for fossil energy. It is also the intent of the administration to provide a significantly increased level of support to the fossil programs. Transfers of personnel and facilities from the Department of the Interior will give these programs a strong base upon which to build. In addition, the personnel being transferred from the AEC have long recognized the need to increase fossil R. & D. The AEC has, in fact, sought budget program support for work in this area.

4. What is your reaction to the suggestion that ERDA be given a more comprehensive responsibility for coordinating Government energy research programs including, for example, those of NASA?

ERDA is being organized to provide central planning coordination for Federal energy R. & D. programs. It would have a broadened R. & D. charter to carry out research over a broad range of technologies. We do not think it would be either practicable or desirable to attempt to centralize all these energy R. & D. projects in ERDA. In some areas the R. & D. may be so closely interwoven with the major mission of another agency that it would be appropriate for another agency to perform it. We would expect that the agency would work closely with ERDA to exchange information and coordinate plans. To this extent ERDA would perform a coordinating role. ERDA would also be available to perform work for others on a reimbursable basis.

5. It has been suggested that ERDA should take over from the Bureau of Mines responsibility for developing coal mining production technology and power generation technology. What do you think?

ERDA will perform research and development on advanced extraction technologies for energy sources. The Department of the Interior will continue existing programs in the Bureau of Mines to improve current mining technologies. This work is closely associated with mine health and safety and is appropriately continued by Interior.

6. Would it be better to relieve ERDA of responsibility for nuclear military systems by transferring this to the Department of Defense?

The proposal to retain the weapons design, development, test, and production operation within ERDA is predicated on three important considerations. First, transfer would raise the fundamental issue of civilian control over nuclear weapons development and production. As it is, the separation affords a public check on these systems. We, of course, anticipate that ERDA will follow the AEC pattern of coordinating closely with DOD on requirements. There is, in fact, a military liaison committee through which the two organizations can work.

Separation would also not be desirable from an administrative and research point of view. The programs are carried out in multipurpose laboratories which perform both nuclear energy and nuclear weapons R. & D. A separation would disrupt a number of important programs such as controlled thermonuclear fusion and laser fusion. Furthermore, there is a healthy cross-fertilization in technology that benefits both peaceful and defense work.

The weapons R. & D. program has frequently formed the cutting edge for important energy R. & D. programs. In weapons work we are harnessing energy sources. There has been some significant advances made that have later been translated into peaceful uses—and not only in the nuclear area. A variety of scientific disciplines are represented in defense work. For instance, geologists used in testing are performing work in the geothermal and in situ coal gasification and oil shale recovery areas. To break up these resources would weaken both efforts—peaceful and defense.

7. What should be the role in ERDA decisionmaking of industry advisory committees or other industry consulting procedures? Should they be left discretionary or made mandatory?

The creation of industry advisory committees should be discretionary. The circumstances requiring committees change. If the committee is set up by statute, this can result in perpetuation of an outmoded group. ERDA will be better served if the Administrator can call committees as needed. It would, of course, be appropriate to legislate some "charge" to obtain advice from industry on matters of mutual interest.

8. What do you think of the suggestion that the NEC Commissioners should do away with the license appeals board and hear appeals themselves?

Our present thinking is that the Atomic Safety and Licensing Appeal Board should be retained. The present caseload is substantial and continuation of the Appeal Board would enable the Commissioners to devote more time to major matters of policy and development of rules and regulations with the Commission still maintaining an appropriate role in the adjudicatory process. This is consistent with the modern trend in regulatory agencies. The foregoing represents a present perspective. The role of an appeal board in the new regulatory Commission will, of course, be subject to future evaluation in the light of needs reflected by developing experience.

9. Will the requirement for licensing certain ERDA facilities by NEC delay such ERDA projects?

There should not be any undue delays in commercial demonstration and waste disposal projects as a result of licensing by NEC. In fact, the demonstration of licensability is an important objective at this stage of the development process. NEC will be provided the information it requires for licensing in time to budget for and schedule reviews of demonstration projects. It should be noted, in this regard, that commercial demonstration reactors are by present AEC regulations (10 CFR part 115) subject to a regulatory review and authorization process which parallels that of normal licensing.

10. Can the transfer of Office of Coal Research functions to ERDA be accomplished without disruption?

There should not be any significant disruption associated with the transfer of these functions. The Atomic Energy Commission and the Office of Coal Research staffs are working closely with OMB to assure that personnel, contracts, and on-going responsibilities are not disrupted. H.R. 11510 provides the Administrator with adequate authority to continue OCR contracted work.

Chairman HOLIFIELD. The committee will adjourn and we will come back into session at 1 o'clock when we will hear Mr. John Whitaker, Under Secretary of the Interior; and at 1:30, Mr. John Love, Director of the Energy Policy Office, will be our second witness. And that will be all for today.

The meeting is recessed.

[Whereupon, at 12:19 p.m., the subcommittee recessed, to reconvene at 1 p.m., the same day.]

AFTERNOON SESSION

Chairman HOLIFIELD. The committee will be in order.

We have as our first witness this afternoon Hon. John Whitaker, Under Secretary of the Interior.

We would be pleased to hear from you, sir. You may proceed.

STATEMENT OF JOHN WHITAKER, UNDER SECRETARY, DEPARTMENT OF THE INTERIOR; ACCOMPANIED BY WILLIAM GOUSE, DIRECTOR OF RESEARCH AND DEVELOPMENT

Mr. WHITAKER. Thank you very much, Mr. Chairman. It is a pleasure to be here.

First of all I would like to make an apology for Secretary Morton that he couldn't personally be here because this bill interests him a great deal. I would like to quickly explain why. He has been very busy. This morning he conditionally gave the permit for the Alaskan pipeline, subject to the judicial review in the old court case. He announced his decision to move and move fast on oil shale. These actions were taken in the interests of developing our energy supply. With his protection hat on he is just about finishing up a meeting with the President right now and they will be sending to the Congress today an additional wilderness bill.

Chairman HOLIFIELD. An additional what?

Mr. WHITAKER. Additional bills for more wilderness areas under the Wilderness Act. So that explains why he can't be here.

Chairman HOLIFIELD. The whole place is liable to be a wilderness soon if we don't solve this energy crisis a little better than we have.

Mr. WHITAKER. Well, I agree with that. I have with me Dr. William Gouse, the Director of Research and Development of the Department of Interior.

In Secretary Morton's July 25 testimony before this committee on H.R. 9090, he expressed the full support of the Department of the Interior for the creation of a Department of Energy and Natural Resources, in Energy Research and Development Administration, ERDA, and a Nuclear Energy Commission.

For many years we have lived in a land that has been generously endowed with fossil fuels and with sites for electric hydropower-plants, and at the same time we have had economic capability to acquire large amounts of low cost petroleum from foreign sources. But events of the last few weeks have made it clear that we must promptly take the necessary actions to achieve energy independence.

The old axiom that "necessity is the mother of invention" certainly applies to our current problems. With our usual form of energy no longer available we need to move fast on substitute sources as Project Independence indicated in the President's remarks on national television a few days ago.

A key aspect of this program is advancing the state of our energy technology. In this undertaking, we must be mindful of costs to our consumers, the impact on our environment, and the long range availability of the new sources of energy which we are able to develop.

The creation of the proposed Energy Research and Development Administration will enable us to approach these problems systematically with the urgency and concentration of resources that they warrant. ERDA is essential for more unified direction and leadership over the presently fragmented Federal energy research and development efforts. Several agencies now have parallel programs directed toward similar ends. For example, the Atomic Energy Commission and the National Science Foundation, as well as the Department of the Interior, are interested in geothermal and solar sources of energy and new fossil fuels sources such as oil shale. ERDA will minimize this inefficient diffusion of scarce R. & D. capabilities. Through consolidation of research in all energy fields, including nuclear, the new administration will be in a position to provide direction and a comprehensive approach to the swift development of new sources of energy. ERDA will be formed from energy functions of the Department of Interior, the Atomic Energy Commission, the Environmental Protection Agency, and the National Science Foundation.

TRANSFERS FROM INTERIOR

Specifically, Interior's contribution would include: the Office of Coal Research; the Bureau of Mines energy research centers and its synthane pilot plant; and underground electrical power transmission research and development. While good reasons existed in the past when these functions began for placing them in Interior, the creation of ERDA as a comprehensive energy R. & D. agency means that these programs should now be included in ERDA. The manner in which ERDA will be organized and managed will help to assure the aggressive pursuit of energy R. & D. in each of ERDA's principal areas, including fossil fuels.

H.R. 11510 permits the Administrator of ERDA to conduct its energy research either in-house or by contract.

However, it should be kept in mind that research and development programs can at best only provide technical alternatives for meeting

the needs of society. In order to allocate resources to energy needs effectively, R. & D. planning and evaluation must be closely coordinated with resource assessment functions currently underway in the Department of the Interior. The information Interior is developing on worldwide supply and demand trends for various minerals or other materials will be critical to determining the social and economic potential of the technical research and development options developed by ERDA.

In summary, Mr. Chairman and members of this committee, the Department of the Interior strongly endorses the establishment of ERDA. This organization will be free of the sometimes troublesome aspects associated with regulatory functions, and will become a focal point for R. & D. executive and legislative oversight. It will attract more scientific talent because of a closer relationship with the academic world and the scientific components of the industrial world and it will probably receive more adequate funding as a strong central R. & D. agency than would similar functions scattered throughout several agencies. We believe an R. & D. organization such as ERDA will play an essential role in meeting the national challenge of achieving energy independence.

Thank you, sir.

Chairman HOLIFIELD. Thank you, Mr. Whitaker, for your statement.

Mr. Horton?

COAL EXTRACTION TECHNOLOGY

Mr. HORTON. Mr. Chairman, thank you.

Mr. Whitaker, thank you for that statement and for the endorsement by the Secretary of the Interior and by the Interior Department of H.R. 11510. In the testimony yesterday some questions were asked with regard to the transfer of certain functions over to the ERDA dealing with extraction of coal from the ground. And today Mr. Ash testified and indicated that it was anticipated that the transfer would provide that a certain portion of those functions would still remain with the Department of Interior but basically the more exotic or the more technical aspects of new concepts of extracting coal would be turned over to ERDA and the remainder which would have to do with health and safety would remain with the Department of the Interior. Is this the way you still understand it?

Mr. WHITAKER. Yes, if I may elaborate, Mr. Horton?

Mr. HORTON. Yes.

Mr. WHITAKER. The six laboratories which we are talking about transferring, are largely energy functions or fossil fuel, coal, or oil and gas research or combustion research.

Mr. HORTON. Are those ongoing programs?

Mr. WHITAKER. Yes, sir, they are.

Chairman HOLIFIELD. And can you give us a breakdown on how they are funded and how these programs—you said 23 synthane plants?

Mr. WHITAKER. No sir, there are 23 plants in the U.S. Bureau of Mines. The following will be—maybe I should go back to this?

Chairman HOLIFIELD. Yes.

Mr. WHITAKER. The following plants or energy laboratories that are now in the U.S. Bureau of Mines will be transferred to ERDA. These are the Bartlesville Energy Research Center, the Grand Fork

Research Laboratory, the Laramie Research Laboratory, the Morgantown Research Center, the Pittsburgh Research Center, and the San Francisco Energy Research Center.

I will give you for the record a breakdown if you wish it. It is very long but——

Chairman HOLIFIELD. We would like to have a breakdown for the record on the functions and also the moneys allocated to each of the 23 different centers.

[See p. 170.]

Mr. WHITAKER. We will also give you the number of people in each one.

Chairman HOLIFIELD. Also on the others that are not being transferred, what their functions are, how many people they have, and what their allocation is.

Mr. WHITAKER. Correct.

Mr. HORTON. What are the others? You are going to transfer six over, right?

Mr. WHITAKER. I am sorry?

Mr. HORTON. You would transfer six over to ERDA?

Mr. WHITAKER. That is correct.

Mr. HORTON. And the remaining 17—is it 17?

Mr. WHITAKER. They would remain in the Department of the Interior or in the U.S. Bureau of Mines.

Let me, if I may, explain the basic philosophy within the split and then get to the coal extraction question.

The philosophy in the split is that the R. & D. functions of these six laboratories that move to ERDA are primarily in energy functions. Defining energy functions, primarily it is things like coal gasification, coal liquefaction, combustion, MHD, tertiary recovery of oil and gas, and things of that sort. They move to ERDA.

What stays in the Department of the Interior primarily are mineral, hard rock and extractive functions, including coal extractive functions.

Now let me zero in if I may on your first question, Mr. Horton. The Office of Coal Research carries with it authority to do extractive coal research. So that authority would go to ERDA. So I would agree completely with Mr. Ash's assumed statement that you were referring to this morning that there would be authority in ERDA to do extractive research for coal.

It will probably tend to be the more exotic research whereas the equipment for the nearer term hardware and the things that can be done best alined with mine development would remain in the Interior. But the authority to conduct this research would then reside in both agencies.

So frankly there is a possibility of duplicating there, but I think it is a healthy kind of duplication.

And in the normal budget process there will be good interchange between Interior and ERDA on that point.

Mr. HORTON. How much money is allocated now for research and development in the extraction field?

Mr. WHITAKER. For extraction in coal technology approximately, in the past, only $0.5 million. In the 1974 budget there is $7.5 million that is for coal extractive technology. For mineral extractive technology there is roughly I think—and don't hold me to this—but there is roughly somewhere between $10 million and $14 million.

We are now going through, and Dr. Gouse might wish to speak to this, the planning cycles for fiscal year 1975. I can assure you there will be considerably more money put into extractive technology. How much more I would not hazard a guess because that is all in this first cut of the $2 billion over a 5-year period energy R. & D. fund that we are talking about.

Mr. HORTON. Well, the problem arose yesterday when we were talking about the opportunities to liquify coal and use it as a fuel. But none of these developments will mean anything if we can't get the coal out of the ground. That is why the question came up.

Mr. WHITAKER. Yes.

Mr. HORTON. And what you are saying and what Mr. Ash said is that some of these functions will remain in Interior?

Mr. WHITAKER. Right.

Mr. HORTON. And you have defined the programs to be transferred rather carefully. ERDA will have jurisdiction with regard to exotic research in this area?

Mr. WHITAKER. Yes.

COAL LIQUEFACTION

Mr. HORTON. The other thing I wanted to ask you about is an Interior Department press release. I think it might be beneficial to put in the record a copy of the press release I received from the Department of the Interior, released Thursday, November 22 by the Office of Coal Research. It has to do with a U.S. Navy destroyer sailing out of Philadelphia, Thursday, November 15, and it was burning synthetic oil made from coal. This was the first time this has been done.

I have referred to it in the past and there have been some other comments made with regard to it. So I think it might be good for you to put it in the record. I don't know what the follow-on will be but I assume from what has been said in this release that it will be possible for us to utilize coal for fuel?

Mr. WHITAKER. Yes; we will be glad to do that.

Mr. HORTON. We will be able to use coal for some of our seagoing vessels?

Mr. WHITAKER. I think, yes; we can do that. And we of course are really at the stage here where we are starting to move from very small-scale work on coal gasification and liquefaction into much larger scale model demonstration plants.

So the kind of dollars we are getting into now are now beginning to approach the kinds of dollars that were involved in the breeder reactor as we go to demonstration scale. That press release refers to a practical application of this. And we will certainly submit it for the record.

[The document referred to follows:]

SYNTHETIC OIL FROM COAL MAKES SEAGOING HISTORY

A U.S. Navy destroyer sailed out of a Philadelphia port Thursday (November 15) and thereby added a page to seagoing history by burning synthetic oil from coal for the first time.

The U.S.S. *Johnston*'s 24-hour test voyage in the Delaware River was part of Project SEACOAL—the name given to the Navy's research for synthetic oil fuel to replace petroleum oils for propulsion of its ships and aircraft. It is an extensive program to evaluate and utilize synthetic fuels in naval boilers, gas turbines, and pumps the next 3 years.

Thus far, Project SEACOAL I has dealt with evaluation of synthetic crude oil obtained by the Department of the Interior's Office of Coal Research (OCR) in the latter's Project COED (Char-Oil-Energy-Development). COED is one of several processes being studied by OCR in its program for converting coal to clean energy during the 1970's.

The Acting Director of OCR, George Fumich, Jr., said: "We are happy to provide this service to the Navy free of charge. They will need the fuel from this source, and we need the experience of producing oil from coal as part of our pilot plant program to advance coal conversion technology for use in commercial plants of the future."

The concept for Project SEACOAL I originated with the Combat Systems Advisory Group of the Naval Materiel Command, which recommended testing of the COED synthetic crude oil produced in an OCR pilot plant at Princeton, N.J. The Naval Ship Engineering Center, Philadelphia Division (NAVSECPHILA), is conducting the testing under the direction of Rear Adm. Randolph W. King.

Originally conceived by the FMC Corp. and funded by OCR since 1962, COED has been proven out in the Princeton pilot plant during nearly 3 years of operation. COED crude oil is obtained by pyrolysis, or a "cracking process"; that is, the basic fuel, coal, is crushed and then decomposed by use of heat, pressure, and catalysts and produces a number of byproducts. Pyrolysis is followed by a hydrogen treatment, producing the synthetic oil like fuel.

The cost of producing COED synthetic oil is expected to be reduced by selling the other byproducts for commercial use. Based on this, the ultimate cost of production is estimated at $4.50 to $5 per barrel, as compared with $5.25 per barrel for oil now being used by the Navy.

Initial testing of COED fuel proved to be unsafe for Navy shipboard use because of a low flashpoint at 58° F. (the minimum allowable is 140° F.). Because the FMC Corp. was not equipped to further refine the raw fuel, the Navy selected Solvents Recovery Services, Linden, N.J., on a low-bid contract to raise the flashpoint.

The Navy burned the COED fuel in a boiler ashore and decided that the product was totally compatible with Navy boilers and recommended that shipboard tests proceed as planned. The Naval Reserve force destroyer, U.S.S. *Johnston*, was selected for shipboard tests because it is homeported in Philadelphia, near NAVSECPHILA, and near the fuel processors in New Jersey. Also, it was a logical selection because of the mission of Reserve force ships to relieve regular Navy ships when appropriate, the Navy said.

Shipboard testing will consist of boiler and machinery operation over the whole range of ship's power.

The Navy plans to evaluate each fuel product from OCR processes once it is developed to the point of being usable in Navy propulsion systems. Project SEACOAL II will designate the next phase of Navy testing of coal-derived liquid fuels.

Additional possibilities for Navy use are synthetic fuels derived from oil shale and tar sands, which are also being studied by the Department of the Interior.

R. & D. ON COAL MACHINERY

Chairman HOLIFIELD. How much actual research and development have you done on extractive machinery and that sort of thing?

Mr. WHITAKER. Bill, would you like to take a crack at that?

Mr. GOUSE. Well, over the years in the history of the Bureau of Mines a considerable amount. Of course priorities change with time.

In the very recent past, say the last 4 years or so the major focus of the research with respect to coal mining machinery has been on the health and safety aspects of it rather than production.

Chairman HOLIFIELD. Would you please explain that to me? You were talking about health and safety in the mines? What has that got to do with the machinery you use?

Mr. GOUSE. A great deal. The kinds of conditions that prevail where the machine is cutting the coal have a lot to do with safety and health

and environment in the mines, the kinds of dust generated, the kinds of fragments thrown, well, this leads to different kinds of ventilation requirements, different equipment for shielding personnel and so on.

In the recent past except for this year the focus has been on improving the health and safety environment perhaps somewhat at the expense of the productivity aspects of the machinery.

Chairman HOLIFIELD. Well, as a matter of fact you haven't spent very much on the research and development to produce better extractive machinery, have you?

Mr. GOUSE. Not in the last 4 years.

Chairman HOLIFIELD. Well over a period of more than 4 years?

Mr. WHITAKER. That is correct. There was only $0.5 million being spent and now $7.5 million this year——

Chairman HOLIFIELD. I understood from someone that there was $3 million in the 1974 budget. Does that sound reasonable?

Mr. GOUSE. $7.5 million.

Mr. WHITAKER. $7.5 million.

Chairman HOLIFIELD. Is that 1974 or is that both 1974 and 1975?

Mr. WHITAKER. No, that is for 1974.

Chairman HOLIFIELD. That is 1974? Now, you have already had that authorized and appropriated, have you?

Mr. WHITAKER. That is correct.

Chairman HOLIFIELD. And what do you plan to do with that $7.5 million?

Mr. GOUSE. Well, we are in a process of launching a fairly extensive program. Some of the elements are as follows: automatic long-wall mining machinery, development of a continuous transportation system from the working face of the mine to the surface, automating roof support systems to permit the operation of high productivity machinery and those sorts of problems.

And we expect those to grow rapidly.

Chairman HOLIFIELD. How much of that is in the design stage and how much of it is in the hardware devices stages that you are ready to test?

Mr. GOUSE. Well, I think we will be going into phase 1 hardware this year with some of our contract money. A good fraction of that money is for contract work outside of the Bureau with mining machinery manufacturers.

Chairman HOLIFIELD. Well, will it be for design work on their part or will it be for the actual production of designs already in existence?

Mr. GOUSE. Some of both. Some mining machinery manufacturers and several of the larger coal mining companies have been doing development work on their own and are now in the process of seeking help from the Government to carry it to the next more expensive stage. We are also taking a look at the whole problem to make sure that certain aspects haven't been overlooked.

So we will be doing some early phase design as well.

Chairman HOLIFIELD. How many people do you have working in the field of extractive machinery?

Mr. GOUSE. For coal mining? I can't give you an exact number. I can supply it for the record.

Chairman HOLIFIELD. Can you furnish it for the record?

Mr. GOUSE. Yes.

[The information referred to follows:]

NUMBER OF PEOPLE AND FUNDS USED FOR WORK IN RESEARCH ON EXTRACTIVE MACHINERY FOR COAL MINING

	Persons	Funds (million)
Fiscal year:		
1973	6–7	$0.5
1974	[1] 40	7.0

[1] Includes only Department of the Interior personnel. A substantial part of this work will be carried on by contractors.

COAL EXTRACTION TECHNOLOGY

The Department of the Interior conducts research and development to improve the technology for extraction of coal. In FY 1974, major research projects in the Bureau of Mines on coal extraction technology include automated longwall mining, surface mining methods, and underground gasification.

A total $7.5 million will be obligated in FY 1974 to cover both contract research ($6 million) and in-house research ($1.5 million; 225 full-time positions). Of this amount, $1 million is for underground gasification. Total FY 1974 outlays will be approximately $4 million.

Chairman HOLIFIELD. You spoke of the six energy centers that will be transferred over. Now will you also furnish us a list of those energy centers which will not be transferred, their mission, and their personnel accompaniment?

Mr. WHITAKER. Yes, sir, you mean of the 23 Bureau of Mines laboratories, 6 are called energy centers, and we will give you the list of all 23 laboratories, the 6 that go to ERDA, and also the personnel and budget and function of each of the 23.

[The information referred to follows:]

DEPARTMENT OF THE INTERIOR

BUREAU OF MINES FIELD RESEARCH AND RESOURCE INSTALLATIONS

[Dollar amounts in millions and tenths]

Research centers	Appropriation 1974	Number of employees	Functions
Energy research centers:			
Bartlesville, Okla.[1]	$4.7	143	Responsible for basic and applied research and technologic activities in the production, transportation, storage, processing, and utilization of crude oil, natural gas, related materials, and their products and byproducts. Conducts research on disposal of industrial wastes and on nonnuclear stimulation of oil and gas.
Grand Forks, N. Dak.	.6	48	Conducts research on the chemistry, preparation, storage, transportation, and utilization of lignite and western coals.
Laramie, Wyo.[1]	3.1	147	Responsible for basic and applied research and technological activities in the production, transportation, storage, processing, and utilization of crude oil, natural gas, oil shale, and shale oil.
Morgantown, W. Va.[2]	3.7	203	Conducts research and development on coal liquefaction and gasification, coal carbonization, air pollution abatement, underground gasification of coal, pneumatic transport of coal, and on the analysis and characterization and use of the minerals in coal and related materials.
Pittsburgh, Pa.[2,3]	9.8	262	Conducts research and development in coal liquefaction and gasification to produce nonpolluting synthetic fuels, coal combustion, and development of new power-generation cycles such as MHD, coal preparation and air pollution abatement, special uses of coal including coal carbonization, and coal science and analysis. The coal gasification program includes the development of a process, (synthane process) for making substitute natural gas.
San Francisco, Calif.	.2	7	The primary research is to increase the ultimate recoveries of oil and gas from California fields.

See footnotes at end of table.

DEPARTMENT OF THE INTERIOR

BUREAU OF MINES FIELD RESEARCH AND RESOURCE INSTALLATIONS—Continued

[Dollar amounts in millions and tenths]

Research centers	Appropriation 1974	Number of employees	Functions
Metallurgy research centers:			
Albany, Oreg.[3]	4.1	175	Research is oriented toward developing better methods of producing, purifying, and shaping high-melting point metals, and development of basic thermodynamic data on inorganic materials. Also, includes fund for construction of a pilot plant for conversion of wood wastes to oil.
Boulder City, Nev.[3]	1.0	23	Research is aimed at solving the problem of finding new uses and applications for sulfur. Also, information is being gathered on abundant geothermal brines as possible source of future mineral needs and on the development of alumina.
College Park, Md.	1.6	85	Research is conducted on recovery of metal and mineral values from urban waste, recovery of secondary metals, the basic phenomena behind froth flotation and corrosion, and process engineering.
Reno, Nev.	1.6	89	Research stresses improved electrometallurgical processing methods for primary metal production, hydrometallurgical and solvent extraction processes for recovering metals from ores, and improved technology for recovering and utilizing rare earths.
Rolla, Mo.	1.1	69	Research includes improved metals and recovery and utilization of base metals, investigating problems in the area of physical and extractive metallurgy.
Salt Lake City, Utah[1]	2.8	143	Conducts research to develop new, improved, and more economical methods for minimizing all forms of pollution from metallurgical operations; for extracting and refining base metals from ores; for extracting metals and metal compounds from brines, mine wastes and mill tailings and for recycling scrap materials.
Tuscaloosa, Ala.	.9	59	Research focuses on the problems of both processing and utilizing nonmetallic minerals. All ceramics-related projects are concentrated at Tuscaloosa.
Twin Cities, Minn.[3]	1.6	118	Research effort involves the development of improved iron and steel technology with particular attention to the production of high-grade iron and copper concentrates from low-grade ores.
Mining research centers:			
Denver, Colo.[2 3]	2.9	101	The center conducts field and laboratory research on ground control problems with emphasis on rock mass behavior, mine structure design, systems for locating oil and gas well ahead of the working face in a coal mine, development of roof-failure warning systems, and radiation hazards research.
Pittsburgh, Pa.[2 3]	7.5	272	Has responsibilities for research, development, and engineering studies on fires and explosions, improving coal mining technology, control of respirable dust, roof support system, explosives, and related health and safety problems.
Spokane, Wash.[3]	2.2	106	Research is conducted on the artificial stabilization of underground openings, on the disposal of mine waste, on improved methods of materials handling and develop new and improved technology for mining of coal and noncoal with emphasis on health and safety problems.
Twin Cities, Minn.[3]	2.3	110	Research is undertaken on mine excavation and rock breakage problems to develop new and improved rock disintegration techniques as part of advanced mining systems which will achieve national goals for conservation and use of mineral, environmental, and human resources.
Field operations centers for resource studies:			
Spokane, Wash.[3]	.8	48	Performs engineering and technological investigations of mineral related problems, evaluates mineral resource availabilities, and collects, analyzes, and interprets data on technical, economic, environmental and social factors that affect mineral supply. Emphasis is placed on the wilderness program.
Denver, Colo.[2 3]	1.1	61	Performs engineering and technological investigations, evaluates mineral resource availabilities, collects and interprets mineral data, wilderness studies, and makes studies on water utilization and pollution problems.
Pittsburgh, Pa.[2 3]	.7	37	Performs engineering and technological investigations on minerals, evaluates mineral availabilities, collects and interprets mineral data on technical, economic, environmental and social factors that affect mineral supply, and collects data on individual mineral deposits, with emphasis on copper and fluorine.
Juneau, Alaska	.6	18	Performs engineering and technological investigations on minerals, evaluates mineral availabilities, and collects and interprets mineral data. Emphasis is given to the unique geographic, geologic, climatic and economic characteristics of Alaska. Mineral resource investigations for native claims, land appraisal, and wilderness areas are conducted.

[1] Includes pending supplemental.
[2] Includes more than 1 Bureau function.
[3] MESA also operates at this location.

Chairman HOLIFIELD. We were furnished this morning a paper, exhibit A, which said the Interior's Office of Coal Research would spend an estimated $79 million in fiscal 1974. The Bureau of Mines and the six energy centers, a total of $16 million, and underground transmission R. & D., $1 million. Is that approximately correct?

Mr. WHITAKER. That is exactly correct. And the personnel on those are 5 people in the Office of Coal Research, 728 in the Bureau in the 6 energy centers, including the synthane plant, and 5 in underground transmission research and development.

Chairman HOLIFIELD. You said five people? That is a very modest number.

Mr. WHITAKER. Yes; it is a very modest program.

Chairman HOLIFIELD. It certainly is.

Mr. WHITAKER. Well, it is contracted out. It is $1 million but still it is a modest program.

Chairman HOLIFIELD. Contracted with private industry?

Mr. WHITAKER. Yes, sir.

Chairman HOLIFIELD. Any further questions? Mr. Fuqua?

Mr. FUQUA. I don't have any questions. I read the statement of Mr. Whitaker and appreciate his support of the bill.

Mr. WHITAKER. Thank you very much.

Chairman HOLIFIELD. Mr. Wydler?

UNDERGROUND POWER TRANSMISSION

Mr. WYDLER. Can you tell me what underground power transmission R. & D. means?

Mr. WHITAKER. I will ask Mr. Gouse to give a specific answer to that. One of the big problems of this country is we have the esthetics of so many powerlines all over the country. We estimate for example that by the year 2000 with our plant requirements and there is some question about the demand we could use 3 million more acres just for powerlines. That is the size of Connecticut. So there is a great deal, well not a great deal but a very modest amount at this point of research going on to learn how to inexpensively transmit power underground.

Mr. WYDLER. You use land for power transmission whether you build the lines up in the air or under the ground. You still have to have an easement or something to put it in don't you?

Mr. WHITAKER. I am not sure, that is perhaps true. You would need an easement to start with. Let's hear from Mr. Gouse.

Mr. GOUSE. You need an easement but generally speaking it would be like pipelines. Like the land above the underground transmission would still be useful for grazing or would be esthetically pleasing whereas the overhead transmission lines no longer are so.

One of the other problems is as our total energy needs are growing the kinds of transmission lines one has to build overhead to carry the loads have to get higher and wider in order to avoid undesirable effects on the ground under them and they are going to be visible for longer and longer distances.

Mr. WYDLER. Well, maybe I don't understand but it seems to me what you are saying is that in effect this is an esthetic consideration. Is that right?

Mr. GOUSE. Only partly. The new higher voltage overhead transmission lines are now generating electric fields on the surface of such a nature that they are causing metallic objects to charge themselves and for people to get shocked if they live in the neighborhood of these.

What it is telling us is we have reached about the technological limit for overhead transmission where we are now in terms of the people being able to use the land close by them on the ground.

So there is another important driving force for us to understand how to put these lines below the ground at a reasonable cost. Now most of these research moneys that are involved in the Department of the Interior is cost shared by industry. In fact, we get 60 cents for every 40 cents we put in. So that when we put in $400,000 there is another $600,000 implied on jointly supported activities. And that program is growing fairly rapidly.

Mr. WYDLER. I yield to the chairman.

Chairman HOLIFIELD. A few years ago we had the problem of a high-voltage line, I believe it was 275 kilovolts from P.G. & E. to the Stanford linear accelerator. This line had to go through this little city nearby, Woodside, and it gave us quite a bit of opposition. The overhead lines, as I remember, were very much cheaper than the underground lines. It seems that to place that same voltage underground you had to put it in a pipe and have the transmitting wire inside the pipe and oil all around it at 275 pounds per square inch pressure to take the heat off of that line. And, as I remember, it cost something like $1 million, or maybe more, a mile. The overhead transmission cost was maybe one-fifth of that for the distance involved. Does that sound about right?

Mr. Gouse. Yes, it is, and that is why the research effort on the underground transmission cables is going on to see what can be done to bring that cost down.

Chairman HOLIFIELD. The cost is almost prohibitive underground, when you compute the cost. Also, if the pressure of that oil goes off for even a short time, the transmission lines will melt inside of the pipe. So you've got the hazard of melting and the disruption of supply by melting lines, as well as the tremendous cost to go underground. Most of the subdivisions now are putting the low-voltage lines underground. When it comes to this heavy voltage line, you've got a real problem from the standpoint of reliability and from the standpoint of the cost, as I understand it.

Mr. GOUSE. Right.

Chairman HOLIFIELD. Is that about right?

Mr. GOUSE. That is right. That is why we need to find out more about how to do it better.

Mr. WYDLER. Thank you.

Chairman HOLIFIELD. Mr. Mallary?

COAL EXTRACTION TECHNOLOGY

Mr. MALLARY. Just let me pursue one question a little further. We were talking earlier about the split between the Department of the Interior and the ERDA with regard to coal extractive technology. I know you defined this somewhat more for Mr. Horton this morning

and we discussed this with Mr. Ash this morning also. Mr. Ash said that he thought a little duplication was desirable in basic scientific research but that when we get to applications, duplication was undesirable. And I gather your statement was that a little duplication in extractive technology research would not be undesirable either?

Mr. WHITAKER. Yes. I think my statement and Roy Ash's are compatible. Is that your question?

Mr. MALLARY. Well, do you feel that what you are doing is basic research in the sense that Mr. Ash was referring to it this morning?

Mr. WHITAKER. Yes. The more exotic hardware—the far-out future type of R. & D. and extraction—would go to ERDA. And the more near-term hardware would go to Interior because Interior is more tied into the what are we going to do tomorrow type problems than the what are we going to do in the year 2000 problem.

Mr. MALLARY. The basic problem that I think we have had expressed to us about this is that if extractive technology research remains in the Interior, it will not be emphasized quite as much; there would not be quite the same allocation of resources to that kind of research that there may be with ERDA. And certainly the history of the past has indicated that there has not been very much priority given.

Mr. WHITAKER. I think, shall we say, we have put our money where our mouth is.

We have gone from $0.5 million in fiscal year 1973 to $7.5 million in fiscal year 1974 for research. And, as I indicated, I speculate that we will go much further than that depending on decisions made in the fiscal year 1975 cycle, which begins the $2 billion-a-year cycle.

Mr. MALLARY. You don't see any problem here, any lack of emphasis or what?

Mr. WHITAKER. Oh, yes, I think we do need a lot more knowledge in extractive technology for coal. I mean it is the obvious thing in front of us, a fact that coal is a resource, it is here, it is here now and we do have the technology problem of getting the sulfur out of it and cleaning it up for the air. And we have the social and scientific problem of deep mining. It has become an unattractive thing to do in an increasingly affluent society.

SHALE OIL DEVELOPMENT

Mr. MALLARY. One other related question and that is you have a pilot shale oil plant that has been under the Department of the Interior. Will that research in shale oil development be transferred to ERDA?

Mr. WHITAKER. Shale oil R. & D. will be transferred to ERDA. This is primarily in the technology area as opposed to the management of the public lands and the mining plan related to this prototype shale oil releasing program which will remain in the Interior. That is the one the Secretary announced this morning that I referred to in my testimony.

Mr. MALLARY. Thank you very much. That is all, Mr. Chairman.

Chairman HOLIFIELD. Mr. Bagley testified that there was some cooperative work going on between industry and the Department of the

Interior in certain kinds of research and development. Could you give us an illustration of the programs involved?

Mr. WHITAKER. Well, I will ask Mr. Gouse to amplify on our remarks. For example there is research between the American Gas Association and the Department of the Interior on cost sharing for coal gasification programs. That has been going on for several years. There is a whole field of these kinds of programs.

Bill?

Mr. GOUSE. Yes.

Chairman HOLIFIELD. Was that a demonstration plant?

Mr. GOUSE. No, I would say it is at the pilot plant stage.

Chairman HOLIFIELD. The what?

Mr. GOUSE. The pilot plant. That is somewhere between one-tenth to one-hundredth the size of a commercial installation. It is bigger than what a laboratory device is, but it is not really a commercial operation.

Most of our larger-scale operations involve pilot plants. Those entered into, say, in the last 2 years or so require the order of one-third participation by private interests.

We put up two-thirds of the dollars and they put up one-third.

Chairman HOLIFIELD. But judging from the number of dollars you attained, there hasn't been any enthusiastic participation on the part of private industry?

Mr. GOUSE. I think this year you will find that will change because now it is no longer a secret that we have a problem whereas 2 years ago we had some people convincing people.

Chairman HOLIFIELD. You think the urgency will push them forward?

Mr. GOUSE. Oh, yes. It is absolutely unbelievable as to who is coming in to talk with us.

Chairman HOLIFIELD. Can you give me an example of just exactly what kind of research and development work these six energy centers that will be transferred over, will do?

Mr. WHITAKER. Making gas out of coal, coal gasification; making oil products out of coal, coal liquefaction; various kinds of combustion research. This would be their primary functions of these six energy centers and also one additional thing, developing better methods to recover oil and gas from existing fields in an economical way. That for example is what the Bartlesville, Okla., laboratory primarily does.

Chairman HOLIFIELD. At what point would these six energy centers move into practical application?

Mr. WHITAKER. Well, I don't think I understand your question.

Chairman HOLIFIELD. Let's assume that they develop a new method of making synthetic gas?

Mr. WHITAKER. If we do it, we will go right from ERDA then to industry and out of the Government forever, I hope. I didn't mean that to be a coy answer but that is my belief.

Chairman HOLIFIELD. Now with your other 17 centers, what kind of work are they doing? I am still not clear.

Mr. WHITAKER. Primarily hard rock mining research, mining excavation research.

Chairman HOLIFIELD. That is actually using mechanical devices?

Mr. WHITAKER. That is right.

Chairman HOLIFIELD. Devices that you have developed into the test stage, is that right?

Mr. WHITAKER. That is correct. That is right.

Chairman HOLIFIELD. And you are doing some of that now?

Mr. WHITAKER. Oh, yes, a great deal of it. That is what the 17 remaining laboratories are doing.

Chairman HOLIFIELD. And is that all related to health and safety?

Mr. WHITAKER. Oh, no.

Chairman HOLIFIELD. Is the work they are doing all related to health or safety, or is it for improving the extractive process?

Mr. WHITAKER. Yes. The bulk of those, as I said, it is approximately $14 million of which $10 million or $11 million you could call generally lumped under extractive research either for coal mining research or hard rock mining research.

Chairman HOLIFIELD. Give us a memorandum that would lay this out on a center-by-center basis, as to what they are doing and whether they are actually testing pilot machinery or pilot devices or processes, and so forth, it would be helpful to us.

Mr. WHITAKER. Yes, we will. As I briefly referred to it, we will give you a description. If there is a judgment factor as to how descriptive it should be we will make it reasonably complete but you could go on and on forever——

Chairman HOLIFIELD. Oh, no, I want it small enough to be read and understandable, so that we can have it for our records. [See p. 170.]

Mr. WHITAKER. Well, we will try to limit it to three or four pages.

OFFSHORE OIL TECHNOLOGY

Mr. WYDLER. Mr. Chairman, there is some research I am interested in. What are you doing in the Interior Department or any other department to your knowledge on the techniques of offshore oil drilling? What research is being done in that field at the present time?

I don't mean from the point of view of exploitation so much as from the point of view of safety to the environment.

Mr. WHITAKER. Yes. Well, first of all we have two strategies. One is research and the other is enforcement of offshore drilling requirements.

With regard to research, I can't give you a detailed breakdown. I can supply that for the record. Off the top of my head I do recall, for example, that we have a study contracted with NASA going on right now on safety in the more hostile environment's area where NASA is very expert. The safety report has improved rather dramatically over the last several years.

I can also give you the figures on that. There are more programs. Perhaps Bill can recall them.

Mr. GOUSE. No: but we can get them.

Mr. WHITAKER. We will submit a more detailed report for the record.

Mr. WYDLER. I would like that, particularly as to what NASA would have to do with offshore drilling.

[The information referred to follows:]

The Department is not engaged in research on offshore oil and gas drilling relating to safety or protection of the environment. It monitors safety activities and may, from time to time, make research recommendations to others. The Department has no contract in this area with NASA.

Mr. WHITAKER. They generally have a very good capability in working in hostile environments, that is, fallout from their space program. And we actually have a contract with NASA that we think as good or better than any contract we could get with private industry to help us on safety in oil wells. For example, we got a very small program admittedly going on, on completing wells subsurface, subocean surface. Industry, of course, has a very large program going on in that respect. I can foresee the day, for example, that we could get away from the problem of just an esthetic problem of having oil fields sticking up in near shore environments where you can see them, but when we could go through that stage, for example, to another. And when we go through that stage, there will probably be some risk because as you get used to that technology, there will probably be greater environmental risks.

Mr. WYDLER. But what I am talking about, of course, is why we don't or couldn't have a workable method of just stopping the flow of oil in these pipes at a low enough level so that if there really was a problem of some sort in the equipment, that there would be a turnoff valve. That is what we are really talking about, a turnoff valve that would really work. We know they have them, but they don't work, apparently.

Mr. WHITAKER. Well, there was a celebrated case, and I don't recall the oil company, but rather heavy fines were slapped on them by the Department of Justice in the gulf coast because they did not have their existing storm chokes in.

Mr. WYDLER. They did not have what?

Mr. WHITAKER. Storm chokes. This is a pressure valve which automatically turns on if you have any drastic change in pressure which is the first signal of trouble in the hydraulic system of drilling any well. It is properly referred to as a blowout. That stops it.

Mr. WYDLER. I would like, for the record, an answer. Do I understand that Interior, then, is the Department that is doing whatever is being done in this field?

Mr. WHITAKER. Yes; on safety and environment.

Mr. WYDLER. Well, by safety I am talking about safety to the environment. I don't know what you mean by safety, though. You are not talking about safety to the workers, are you?

Mr. WHITAKER. No; I am talking about research on safer ways to drill offshore oil wells so that there will be less chance of environmental damage.

Mr. WYDLER. Could I have that report as complete as I can get it?

Mr. WHITAKER. Yes, sir.

Mr. WYDLER. Mr. Chairman, I would like that.

Thank you.

[See Department of Interior submission at top of this page.]

Chairman HOLIFIELD. Mr. Fuqua?

Mr. FUQUA. Just one question following up what Mr. Wydler was saying. The question of offshore drilling—specifically in the Gulf of

Mexico—is rather controversial now in the State of Florida and directly affects my congressional district. The oil deposits in the Gulf of Mexico could serve as strategic reserves to be tapped for national defense purposes or other emergency situations. I am worried about the integrity of our environment and the devastating impact which an oil spill would have on our beaches and seafood industry. My question, however, is this: What research do you have ongoing and are you planning to upgrade that research in ERDA?

Mr. WHITAKER. Right now we are doing our environmental impact statement analyses, which has to be done preceding that sale that you referred to off the coast of Florida I believe. That includes, for example, research on such items as ocean currents, temperatures of water, environmental conditions on the ocean floor as to whether it is, you know, easily drillable, whether the platforms are easily mountable in there. Also, there is some assessment of the type of rocks from seismic work which we might go through particularly if we go though the situation we went through in Santa Barbara where we actually had a breach in the rock that created that spilloff. In addition, in concert with the Environmental Protection Agency, we are going to continue to monitor that area beyond the point which we have in the past which simply says to do what work that has to be done to complete the environmental impact statement. So we are going to keep going as we explore that area.

Mr. FUQUA. I will not dwell on that subject. I would certainly hope, however, that you have a greater technical competence and environmental controls before drilling begins. But I am concerned about the future. Are we going to have in ERDA the means whereby the type of research that Mr. Vydler was referring to can be accomplished?

Mr. WHITAKER. Well, let me think that through. I think the research for offshore drilling technology so to speak will continue to remain in the Department of the Interior.

Mr. FUQUA. Are you planning to increase your research effort in those areas?

Mr. WHITAKER. Well, for example, right now we are looking at—and I don't want to be committed to the costs because they haven't worked the program out yet—but when I made the statement to you we are looking for an ongoing research program in the area, I meant we are going to be committing probably somewhere in the order of $100,000 to $300,000 to that study. And the Environmental Protection Agency will also be making a financial contribution to it.

Mr. FUQUA. I can visualize a conflict between our needs for energy and EPA's regulations precluding the activity.

Mr. WHITAKER. Well, I am used to being there. I have been there before.

Mr. FUQUA. So I think we certainly should exert some effort in this area to improve the technology of offshore drilling.

Mr. WHITAKER. We went forward with the position where we tried and really tried on this and came to the judgment we shouldn't do it, that is, look at submersible drilling technology in this area.

As you know we have conflicts in there between defense utilization and other utilization.

Mr. FUQUA. Yes.

Mr. WHITAKER. And we really try to come up with the possibility of subsurface completion there, but when we assessed the technology in industry and in government we decided it would be environmentally less safe at this stage.

Mr. FUQUA. Thank you.

Chairman HOLIFIELD. Mr. Moorhead?

EMPHASIS ON COAL

Mr. MOORHEAD. Mr. Chairman, thank you.

Mr. Secretary, do you believe that coal research will get more money if we enact this bill than if we don't?

Mr. WHITAKER. Yes; I do. In 1968 we spent $18 million on coal research both in the Bureau of Mines and the Office of Coal Research. In 1974 we are spending $143.9 million. That in itself is a record. I don't know of how many percent that is, but a record. I think it is going to keep going up particularly as we approach the demonstration scale, get into the technology, as we get into plant demonstrations just like the dollars in nuclear research start to go up when you hit the breeder reactor scale.

Mr. MOORHEAD. But you believe you will get a fair shake under this bill with the personnel which would be so largely nuclear oriented?

Mr. WHITAKER. No; I don't think it will be nuclear oriented. I think everybody is trying very hard to make sure there is not a domination of nuclear or fossil, that there are honest to God tradeoffs here.

I think that has been one of the fundamental problems because you have had two bureaus, two jurisdictions, and frankly, two different pulls on the Hill with this. I think they are all coming together here and it is the right thing to do.

Mr. MOORHEAD. That is the question I wanted to ask you because on the exhibit that the Director of the Bureau of the Budget presented, the dollars and the people coming into ERDA are so much lower in coal. I think you will do better too, but I just wanted to see if you thought you would do better?

Mr. WHITAKER. Yes, I do definitely.

Mr. MOORHEAD. Thank you, Mr. Secretary. Thank you, Mr. Chairman.

Chairman HOLIFIELD. Thank you.

I agree that we should put this all together where it can be coordinated and can be looked at, and where the possibilities of improvement can be seen. You will have in this setup an assistant administrator for fossil energy development, and that man is on the same level as the nuclear energy administrator.

Mr. WHITAKER. They are both assistant administrators.

Chairman HOLIFIELD. And that doesn't mean necessarily there will be the same money for both when this thing is put together. However, you will have a strong voice under an administrator of energy research and development with all of the means to coordinate and to do the job.

And I think that the urgency of the need for fuel in this Nation is going to dictate vigorous programs in the fossil fuel area, just the

same as we have had a vigorous program in the nuclear area. There is no alternative that I can see to getting the amount of energy that we need, and there is no other source that I know of in the short range where we can get it except from coal.

Mr. WHITAKER. I believe with you that it is true in the short time frame.

RECOVERABLE OIL

Chairman HOLIFIELD. I am talking about an increased domestic source. We just can't get much in the way of oil because it is a declining resource. I live in a district, for example, that has three oil fields, and the oil wells which used to make 30 to 40 barrels per day now are making some 15 or 25 barrels a day, because the field is 50 years old and it is depleted, the oil is just not there. I don't care what you do, I don't think you can get more oil out than you are getting now.

We used it up. This is true in the Long Beach field. It is true in Bakersfield, and it is true in the Whittier field, and they are all within 10 to 15 miles of my district.

Mr. WHITAKER. I agree that the oil fields you cite are 1920 discoveries. The Bakersfield I know. Yet our geologists estimate 40 percent of our potentially recoverable resource, and now that is probably a geologist's dream I admit but 40 percent are inner offshore. So we do have a great potential in the Atlantic, in the Gulf of Alaska and in the Mississippi area that Congressman Fuqua referred to, well actually the Florida-Mississippi area.

Chairman HOLIFIELD. Offshore?

Most of the terrain has been pretty well explored within the domestic land mass of the United States though, not including offshore?

Mr. WHITAKER. Yes, the offshore is important.

Chairman HOLIFIELD. In the offshore there is still a lot of exploration. There has been some exploration in the gulf and the Santa Barbara Channel, which is producing oil.

Mr. WHITAKER. But the other 60 percent of the recoverable resources we think are on land, and they are just under basically, to pick an arbitrary number, 12,000 feet and the reason they haven't been drilled is because the market mechanism isn't working. That is why we need natural gas deregulation so bad.

Chairman HOLIFIELD. We have an oil well in the Montebello field, for instance, that is 12,000 feet deep, but it is very expensive to go that far down with existing technology.

Mr. WHITAKER. But as the price goes up——

Chairman HOLIFIELD. Yes, as the price of gas goes up and the price of gasoline and fuel oil goes up, it will make it more desirable to go that deep.

Well, thank you very much for your presence here today and your endorsement of the bill, Mr. Secretary.

Mr. WHITAKER. Thank you, Mr. Chairman.

Chairman HOLIFIELD. Our next witness is Mr. John Love, the Director of the Office of Energy Policy.

We are glad to have you before us again.

STATEMENT OF JOHN A. LOVE, DIRECTOR, ENERGY POLICY OFFICE; ACCOMPANIED BY DR. WILLIAM T. McCORMICK, JR., ASSISTANT DIRECTOR, ENERGY POLICY OFFICE FOR RESEARCH AND DEVELOPMENT

Mr. LOVE. Mr. Chairman, I am glad to be back and I would like to present our appreciation, mine particularly, for the part that you played, particularly, and your entire committee, in addressing yourself promptly to this very important action to which, I believe, I am the last administration witness to address myself.

Mr. WYDLER. Mr. Chairman, Governor Love, just one question for the record.

Could you give us some approximation of what part of your working time in the last month has been spent testifying before congressional committees?

Mr. LOVE. Well, I would be glad to. I think if I were to try to estimate it, I would be tempted to exaggerate it. It may seem longer than it really has been, but it has been a good deal of my time, a good quarter of my time, I believe, that I have spent on the Hill and I think that it has been a necessary part of my position as I see it and I am pleased to do it to the extent that I can.

Mr. WYDLER. I ask the question only because I think it would serve some useful purpose to give the public some idea of what goes into any action by the Government. I don't think people sometimes appreciate the amount of time that you have to spend explaining policy and programs.

I wonder, do you have any kind of estimate?

Mr. LOVE. I think I have spent perhaps as much as on the order of a quarter of my time testifying before various committees in this body and the Senate.

Chairman HOLIFIELD. Proceed, please, sir.

Mr. LOVE. As I say, I am pleased to appear before you today to discuss the important energy organizational legislation before the committee which would provide for the creation of a new Energy Research and Development Administration (ERDA) and a Nuclear Energy Commission (NEC) for handling licensing and regulation of nuclear energy facilities.

I am the last of several administration witnesses to appear before you to testify in support of this important legislation. Mr. Ash and Chairman Ray have already described for you, in some detail, the various elements of the proposed reorganization and Mr. Whitaker was just here, and they have discussed the rationale behind them. I wish only to briefly summarize the major features and advantages of this new legislation and to describe the way in which the proposed new energy organization would function, especially in relation to my Office, the Energy Policy Office.

RECENT DEVELOPMENTS

As you will recall, I testified before this committee on the 1st of August in support of H.R. 9090 which provided for the creation not

only of an Energy Research and Development Administration but also of a Department of Energy and Natural Resources. Since that time a number of events have caused an even greater sense of urgency regarding the need for Federal organizational machinery capable of rapidly initiating and implementing new and vitally needed energy research and development programs.

In his October 11 statement on energy research and development, the President first stated his goal of national energy self-sufficiency. Again in his November 7 nationwide television message the President emphasized the need to develop a capability for energy self-sufficiency by 1980, and he called upon the Congress to enact promptly his proposal to create an Energy Research and Development Agency to administer the long-range R. & D. programs necessary for developing technologies to insure self-sufficiency. The President indicated that such an agency would be essential for providing an organizational focus and management structure to conduct a greatly expanded energy R. & D. effort. Thus, it was with this new sense of urgency that the President requested the Congress to consider the ERDA/NEC proposal separately from his DENR organizational legislation. And I would like to repeat, Mr. Chairman, I am greatly pleased that you and this committee have moved so expeditiously in considering this modified, streamlined legislation.

Mr. Chairman, as you well know, energy research and development activities are currently fragmented among a number of Federal agencies. Coordination, planning and resource allocation for Federal energy R. & D. programs are, consequently, difficult and less than optimally performed. Thus, the primary goal of the proposed legislation is to improve the overall management of this R. & D. by consolidating the responsibility at the Federal level.

ORGANIZATIONAL OBJECTIVES

Specifically, the proposed legislation would accomplish two organizational objectives: First, it would focus the Federal responsibility for formulating, developing, and implementing the plans and programs for energy research and development; and second, it would create a separate independent Commission to handle the AEC's licensing and regulation of nuclear facilities. The proposed ERDA organization is built upon the considerable strength and demonstrated success of the Atomic Energy Commission in conducting R. & D. To this is added the functions and programs transferred from several other Federal agencies currently performing energy R. & D., namely, the Interior Department's fossil energy research, the National Science Foundation's development activities in solar and geothermal energy, and the Environmental Protection Agency's program for developing technology to control air pollutants associated with utilizing fossil fuels and its program in advanced automotive propulsion systems. The combination of these functions and resources results in a new independent agency with broad responsibilities and authorities for developing the required technologies to insure the future adequacy of our Nation's energy supplies.

Mr. Chairman, I believe the proposal in H.R. 11510 which contains elements of the administration's proposed energy organization, along with the modifications which you and your committee have recommended, is not only bold in its approach but fundamentally sound in its structure. It creates an agency with the organizational focus, sense of mission and balance that is needed to urgently develop and implement technologies to insure the efficient utilization of all our energy resources in an environmentally acceptable manner.

I should point out, however, that while sound organization is essential it is not, by itself, sufficient to provide everything we need to do this job. The task will require large amounts of Federal funds and also a commitment by the country. In this regard, the President has already announced a major new initiative by proposing a $10 billion energy R. & D. program over the next 5 years.

Let me add I am not at all sure that is still a valid number or ceiling in view of the increased sense of urgency. I would, depending upon the program which we do indeed identify, I would think that that need would not be the top limit.

The planning and design of this massive new effort, have already begun under the leadership of Dr. Ray at the Atomic Energy Commission. To bring about these programs, will require the continuing support of the Congress for funding and passage of this legislation to insure an organizational structure that can properly administer these large amounts of new funds.

The other major element of H.R. 11510 is the creation of a Nuclear Energy Commission. As you know, there has been concern by many that the Atomic Energy Commission should not exercise a dual role of both promoting the development of, and regulating the use of, nuclear power. Much of this concern, in my opinion, has been unfounded because, for several years, nuclear regulatory functions have been conducted separately within the Atomic Energy Commission. However, it is now generally agreed that to assure full public confidence in the safe development of nuclear power, that the regulatory functions should be fully independent. Thus, the legislation before you also would create a new separate regulatory commission, with its own expertise in nuclear matters in order to insure the olderly, safe, and environmentally acceptable development of nuclear power.

Mr. Chairman, I believe that these organizational proposals are vitally important to effectively carrying out the formidable task that lies ahead of us in the energy area. I am sure that with your assistance and that of the committee's that these new Federal energy agencies can come into being in the very near future.

ROLE OF ENERGY POLICY OFFICE

Let me turn now to a very brief discussion of the role of my Office, the Energy Policy Office, and its expected future relationships with the Federal agencies that would be created by H.R. 11510.

As you know, the President created the Energy Policy Office in the Executive Office of the President by Executive order on June 29, 1973. At that time, he named me as Assistant to the President and Director of that Office. As Director, I serve as the administration's chief

policy officer with respect to energy matters and as the President's principal advisor concerning those matters. As Director, I am also responsible for formulating and coordinating energy policies in the Executive Office of the President and in particular, responsibility for:

Identifying major problems, both present and prospective, in the energy area;

Reviewing energy policy options, making recommendations to the President and monitoring and implementation of approved energy policies; and

Insuring that executive branch agencies develop short- and long-range plans and programs to insure the availability of adequate supplies of energy.

Thus, my responsibilities and those of the Energy Policy Office lie primarily in the areas of policy formulation, coordination and recommendation. My Office, therefore, is not a line agency and, thus, has no direct responsibility for program operation. Its chief function is to provide advice and assistance to the President on energy matters and to oversee the wide range of related activities of Federal agencies.

With this overview of the functions and responsibilities of my Office, the nature of the future relationship between the proposed ERDA and the Energy Policy Office is clear. ERDA will have the responsibility for developing energy research and development policy, plans, and programs. It will also have the responsibility for conducting these programs and monitoring their implementation. The Energy Policy Office will provide ERDA with broad policy guidance in order to insure that ERDA's plans and programs concerning energy R. & D. are consistent with the broader goals of overall energy policy. Thus, in my role as the administration's chief policy officer with respect to energy matters, I will be providing broad policy guidance to ERDA and assisting the President in his review of ERDA's recommended research plans and programs.

Finally with regard to the relationship of NEC to the Energy Policy Office, let me say only that I fully expect NEC to function as an independent regulatory body, having complete independence and authority as is proper for a regulatory commission.

Mr. Chairman, this concludes my prepared statement. I would be pleased to answer any questions that either you or members of the committee may have concerning H.R. 11510 or the relationship of the Energy Policy Office to the energy organizations proposed in this legislation.

Thank you.

STATUTE FOR EPO

Chairman HOLIFIELD. Thank you very much, Mr. Director. We appreciate very much your support of this legislation. You are in this energy field, and you have a great responsibility, and your advocacy of this legislation is very important to us.

You are aware that there are proposals to make your Office statutory?

Mr. LOVE. Yes, I am, Mr. Chairman.

Chairman HOLIFIELD. Of course, there is a great deal of precedent for that. This committee has in a number of instances changed orga-

nizations created by Executive order into a statutory one. Now what is the position of the administration in regard to making your Office statutory rather than based on an Executive order?

Mr. LOVE. We favor that action, Mr. Chairman. We favor it for many reasons. To begin with it is my understanding of the statutory law that the operation of the Office, operating as it presently does from the emergency fund, can only extend until, I believe, next April. Second, it seems true that the Office is sufficiently important that it does merit statutory recognition and establishment.

Chairman HOLIFIELD. Well now, there has been no request of the administration for that to be included in this bill?

Mr. LOVE. Frankly it did not occur to me, but we do have a draft of a proposed bill that I would be very pleased to submit to this committee for your consideration. I hesitate to delay the passage of this bill by that addition but I would be——

Chairman HOLIFIELD. Well, I hesitate to delay this bill for any reason, including that particular reason. But if the administration is in earnest about wanting this to be a statutory body, I think we should have your bill, with the understanding that we would not delay this particular bill.

Mr. LOVE. All right.

Chairman HOLIFIELD. But we would be glad to consider it.

Mr. LOVE. Well, we will indeed provide you with a proposed draft of the bill, Mr. Chairman. I would agree with you that it should not delay this bill, but I would like to have your consideration of it.

Chairman HOLIFIELD. Very good. Thank you.

Mr. Horton?

Mr. HORTON. Mr. Chairman, I don't have any questions. I would just agree with you that I think it would be well for us to have a bill to give statutory authority to the Office and I am sure we could take it up as one of the first orders of business at the beginning of the next session. I thank you, Governor, for your testimony.

I think it is very helpful to us and to this committee to have your personal endorsement of the organization of ERDA. Thank you very much.

Mr. LOVE. Thank you Mr. Horton. I appreciate that.

Chairman HOLIFIELD. Mr. Moorhead?

OFFSHORE OIL

Mr. MOORHEAD. Thank you, Mr. Chairman. Thank you, Governor, for an excellent presentation. I was intrigued by something I think I got from Secretary Whitaker. He said that 40 percent of our known reserves, our resources, in the United States, were offshore. When are we going to develop and obtain that oil and what are the roadblocks that prevent us from getting it?

Mr. LOVE. Well, Mr. Moorhead, the effort has been made, first in the announcements of the President, to triple the leasing program on the offshore lands, which are of course subject to Federal Government control. Then, I am sure that the program will have to entail further application of that leasing program.

The constraints really are those. For example, I believe that on a lease proposal of the Florida panhandle coast, it was the subject of a lawsuit seeking to restrain the progress of that leasing situation. So there are constraints. There are those types of constraints. There are other constaints certainly as far as material is concerned, the availability of the necessary drilling rigs, and this is true not only offshore but onshore, the necessary amounts of pipe and so on. We do intend to move ahead as promptly as possible though.

Mr. MOORHEAD. Thank you very much, Governor. Since our economy seems to be so focused on oil for energy, we ought to be thinking about that until we get our coal resources going and the like.

Mr. LOVE. I think that the Secretary's testimony was accurate, but I would also suggest to you that you listen to some of the independent producers who have been involved and would like to be more actively involved in the future onshore drilling. I think if you do that, you would find that they have great hopes that a large percentage of it is still onshore. I hope they are right.

Mr. MOORHEAD. Thank you. Would ERDA have jurisdiction over these offshore or onshore drilling operations?

Mr. LOVE. No, as far as the leasing program, for example, the leasing program offshore, that would still be in the Department of the Interior. The research kind of activity which would aid and support secondary or tertiary recovery, or whatever it might be would be in ERDA.

Mr. MOORHEAD. Including the Administrator for Environmental Protection Research so that we would know that we would have safe offshore drilling?

Mr. LOVE. Yes, that is right.

DURATION OF ENERGY CRISIS

Mr. MOORHEAD. You point out in page 1 of your testimony that the ERDA is to administer the long-range R. & D. programs. And I think all of us recognize that the passage of ERDA wouldn't solve our problems this winter. What I would like to ask you, as I think it is important that the people understand this, the transfer of ERDA isn't something that would take effect this winter to benefit the people?

Mr. LOVE. No; unfortunately it would not have any effect on our situation this winter but it certainly does not lessen its importance to me because I think it needs to be realized by the people of the United States that this problem of an energy shortage is not simply a 6-month or a 1-year kind of a problem. It can be, oh, as short as 5 or 7 years if we indeed do bring the sense of urgency necessary, and an organization as represented by ERDA is badly needed to begin the kinds of solutions that are there and which need to be brought to bear.

Mr. MOORHEAD. I quite agree. That doesn't reduce the importance of the legislation of course but just so that the people don't expect the passage of this legislation to be an immediate panacea, I tossed that out.

Now what do you see in the short term? Is the only solution in the short term the reducing of demand?

SHORT-TERM ANSWERS

Mr. LOVE. I believe that to be true. The various solutions that are available to us will take time. There is no one solution. There are a series of solutions and we must pursue them all, but each of them will have a leadtime. For example the Alaskan pipeline, which will add to our production, is probably not going to be on line before 4 years. Hopefully, we can speed it up a little more than that.

You look at the time it takes to build a major grassroots refinery. It is 3 years. The length of time, if you look at it, to bring in and put into the pipeline an offshore well is of considerable time. So the whole program of getting coal that we are talking about and using it for energy, whether it be gasification, liquefaction, or simply the burning of more coal itself in the traditional way, even that has a long leadtime because it entails not only opening up new mines, but the construction of railroad cars and just the entire situation. So it seems to me the likelihood is that for the next 3 to 5 years there will not be substantial increases in domestic energy. Now it may vary somewhat.

Mr. MOORHEAD. So that would follow that reducing demand would be the only answer for the short term?

Mr. LOVE. Yes, the only thing now is to dampen that demand curve which has been going up at a very great rate.

Mr. MOORHEAD. And that program of relying primarily on dampening demand has got to go on for 3 to 5 years in your opinion?

Mr. LOVE. There is one major variable, of course, and that is the action of the Arab oil-producing nations. If they soon would reverse their policy and then commit to increase production, and after the international distribution system had settled down and absorbed it, we conceivably could again depend upon major imports of the product from European and other refineries but that isn't about to happen soon. And even when it does happen, in my opinion, it will not solve the problem in that the basic underlying problem was there before the Middle East war.

GASOLINE SHORTAGE

Mr. MOORHEAD. Thank you. And then you would see, at least as a possibility, gasoline rationing in our future?

Mr. LOVE. Yes, it is a possibility. If I may take just a moment of the committee's time to at least describe some of the problems?

We believe in the overall strategy for meeting our energy crisis that it is going to be necessary to reduce the use of gasoline from 25 to 30 percent. Now the various ways that are available to do that are simply voluntary action on the part of the people by the reduction of speed, the following up on the tuning of cars, the limitation of trips you take and various mandatory programs, such as the closing of gasoline stations on Sunday. We are hopeful, but we are not really confident, that that kind of program though will take that percentage out of gasoline usage to completely eradicate the problem.

I think another thing that needs to be said is that simply cutting back on the use of gasoline doesn't solve the problem. We also must make sure that that gasoline that is cut back goes into the other prod-

ucts that we need to sustain our economy. So we are moving in the area of cushioning the refineries toward as much emphasis as we can get them to give on the production of the middle weight and the heavier residual oils at the expense of gasoline. The problem is that we can decree, under the act that was passed by this Congress and signed by the President yesterday, we can through that allocation program simply decree or allot less gasoline to the filling stations, and yes we are starting to do that, but the net result of that would be probably just a scramble at the gasoline pumps which would not serve any of us too well, so the problem then is to determine how we thus can bring equity to that distribution system. And I think rationing is the thing to be avoided if at all possible. And we are going to monitor and hope, because when you start to think in detail about the problems of rationing, whether you assigned it to a car or to the holder of a driver's license, whether you set up boards to determine who needs to drive and who does not, the complexities of that thing and the possibility of making it truly equitable are truly as difficult as anything I have contemplated.

The only thing to recommend it is it may well be better than the alternatives.

OIL EXPORTS

Mr. MOORHEAD. Mr. Chairman, just one last question. I realize you could rule me out of order because it isn't directly on this bill, but I would appreciate the Governor's explanation or expression of opinion on whether the export of U.S. oil-related products and the U.S. export of coal is of any serious effect. And if it has any serious effect, whether you have enough legislative authority to stop it if it is necessary?

Mr. LOVE. Historically the amount of oil that we have exported is a very small percentage. I have forgotten but it is something like 1 or 1½ percent of our production or some such thing. And, much of it is specialty products, coke or lubricating oil, and then portions of it historically have been exported across the border in trade with Mexico and Canada in patterns that probably shouldn't be disrupted in view of the fact that we are heavily relying on imports.

Somebody just said it was 2 percent, or, rather, two-tenths of a percent. I am sorry. Two-tenths.

But, nevertheless, recently there was some disturbing actions in September in which some cargoes, not too many, but some cargoes of No. 2 heating oil did move to the United Kingdom and to the Netherlands and to Venezuela.

The allocation bill that was signed yesterday contains therein a prohibition against exports unless the President affirmatively finds that they are in the interest of the Nation. The legislative history makes it clear that the purpose of the Congress in taking that action was not to disrupt our traditional trade with our neighbors in Mexico and Canada. So we do have the necessary tools to deal with it.

Coal is something of a different problem. It may become a greater problem. Some of the nations have been very concerned that we might move toward elimination of exporting of coal. We have not yet come to that conclusion or found it necessary to date.

Mr. MOORHEAD. Mr. Chairman, you have been very kind and tolerant. I appreciate it.

Chairman HOLIFIELD. All right, and I think the information that the Governor has given has been very interesting.

Mr. Wydler?

Mr. WYDLER. Thank you, Mr. Chairman.

Governor, I find in this whole short-term energy problem that my greatest problem is trying to determine what the facts are. Do we really know what the facts are? Do we really know, for example, how much oil we have in the country and where it is and who has it? Are those facts available anywhere at all?

Mr. LOVE. We have, through establishment of an office of data analysis and collection in the Department of the Interior, been concentrating to a great deal on the acquisition of the true facts. We have a very recent study, which I would be glad to furnish to the committee if you would like to have it.

Chairman HOLIFIELD. We will be glad to have it.

Mr. LOVE. That gives the administration's best estimate of what the situation is.

[The information was retained in the subcommittee files.]

EXPECTED SHORTFALLS

Mr. LOVE. To summarize just a few of the facts, now, we expect that measured against demand on the basis of if there were no shortage of supply, we expect a shortfall of 1,400,000 barrels this current quarter and about 3½ million barrels shortfall in the first quarter of next year.

Now that shortfall does not fall equally on each of the products.

Currently the ones of most concern are the heavier, the residual oils. When I say we have the facts that we agree upon, I would have one reservation or one caveat to that. We do not presently have the amount of oil products in secondary storage, that is, how much inventory at the various factories, how many men have tanks and have stored some away, and so on.

The secondary storage we are not confident on, but we are confident we know basically the facts and we have, based on those facts, outlined a broad line study of what must be done.

PRESENT OIL SITUATION

Mr. WYDLER. Do we know how much oil the oil companies have at the present time?

Mr. LOVE. Yes; we know what their stocks are and so on but the secondary storage, you know, what the factory has in its tanks and so forth, no. We know pretty well what the utilities have as well as the oil companies but——

Mr. WYDLER. Well, the reason I raise this question is the President has made certain estimates in his statement as to our shortage of energy. And as I understand his figures, he says we are from 10 to as much as 17 percent short. Some other people have come along and immediately said that he is underestimating it considerably. Some people have said we are much shorter than that. And really this does seem to me to be something you could pretty well agree on.

I know, for example, you can't know certain things like how cold the winter is going to be—and that throws a certain degree of uncertainty into it.

So I really find it difficult to understand why we can't agree how short we are on fuel at this time.

What is causing the difficulty?

Mr. LOVE. At least in the administration we have agreed and I would be glad to submit those numbers to the committee, but I think that one of the problems earlier on causing the uncertainty was we did not know how effective the Arab producing nations' embargo would be and how serious the effect would be; that is, how much we would be limited in the product flowing through other countries and refineries and whether there would be tradeoffs and so on and, finally, we have determined how effective it has been and it has been very effective.

That was one uncertainty.

As you know, the Library of Congress, in putting together the worst possible situation with the colder winter and so on, did come up with larger numbers. I have not had the chance to examine that, but I can assure you that we have in the administration agreed that the numbers that we have and that I have generally quoted are the most accurate and are the best analysis that we can bring to it.

Mr. WYDLER. Well, I tell you this. I think that you are going to find that the American people will cooperate probably better than you think they are going to cooperate in cutting down in their use of power in general, and oil in particular, and things of this nature.

I can't help but think back to the meat shortage we faced last summer. I remember very clearly when a lot of people were in a state of crisis saying we won't have any meat. Actually in some of the counters in my area for about a week that situation did exist and everybody sort of said well, I guess I will have to live without meat and I will cut back on meat. That is what everybody did and suddenly we found we had more meat than we could possibly consume.

Now farmers are complaining they don't have a market for their meat and things have sort of turned around. And I have a feeling that the public in general will cooperate to a very great extent with each of them using a little less energy. I think you are going to find the situation won't be quite as bad as we think it will be.

Mr. LOVE. I have every confidence that the people are aware of the problem and will cooperate and want to do their part and share. I have only one reservation.

It becomes our obligation at the governmental level to make sure that, to the extent we can, the problems are solved equitably and equally. But I feel if they don't then the backing of the people is apt to deteriorate.

GASOLINE EXCISE TAX

Mr. WYDLER. Just one personal comment, Mr. Chairman, and then I will be done. There have been various ways suggested by various people on how we should handle the shortage of gasoline. And I think truthfully that the worst alternative I have heard—although it may work better than any of the others but anyway the worst possible solution would be the enormous excise tax that has been proposed as one possibility.

It would be, I think, accepted by the public with ill grace and rightfully so. And I hope to God that you do away with that part of

your planning, if it is part of your planning, at the earliest possible stage.

Mr. LOVE. Well, I would respond just very briefly by saying that there is no way that we can impose a tax, if a tax is going to be imposed, because it is going to have to move through the Congress of the United States starting in this body. I tend to get the impression that there is not great support for such a tax in the Congress of the United States.

Chairman HOLIFIELD. I want to make a personal pledge that I will vote against that. I will be with Mr. Wydler on that proposition. Mr. Mallary?

ENERGY PRIORITIES

Mr. MALLARY. Just one question, Governor. One concern expressed by some people here about ERDA, which uses as its core element the Atomic Energy Commission, is that there may not be adequate concentration on the development of our fossil energy resources.

Inasmuch as you will be providing policy guidance for ERDA as the President's policymaker in the energy field, would you want to comment as to your own feelings with regard to the priorities of fossil energy research?

Mr. LOVE. I have no fear that this program, that the structure of ERDA, would split one area of research and development at the expense of the other. I have the strong belief, No. 1, that we are going to need all of the component parts to solve this problem. I have the strong belief that the Congress of the United States is going to appropriate sufficient funds for the kind of massive R. & D. program that I envision. I think it is going to mean more money for all aspects whether it be nuclear; certainly the coal which is the great hope for the middle term would be given enough money; and geothermal, solar—just the entire range I think is going to be adequately funded in the ERDA programs.

Mr. MALLARY. I though it was worthwhile getting that on the record because I suspect there may be those even in your home State who are not enthused about further exploration of coal and oil shale.

Thank you, Mr. Chairman.

Chairman HOLIFIELD. Thank you. Mr. Roback has a question.

ASSUMPTIONS OF SELF-SUFFICIENCY

Mr. ROBACK. Governor Love, the concept of national self-sufficiency has been advanced. In pending legislation there is a declaration of a 10-year goal of national self-sufficiency. The President has said that it should be achieved by 1980. That would be 7 years. Some months ago you permitted yourself to say that possibly it could be achieved in 3 to 5 years. Has anyone staffed out the assumptions on national self-sufficiency by 1980?

Mr. LOVE. No; I don't believe they have. And as a matter of straight fact, it seems to me that to do so we are first going to have to discern exactly what we mean by the capacity for strategic self-sufficiency. That is, I do not think that it is necessarily to the best interest of the United States to not import any petroleum products. We simply want the capacity if we can achieve it to be able to move without undue reliance.

So, first the definitions have to be established.

As far as mapping out the actual strategy, I do have, through my chairmanship of the Energy Policy Committee, a membership which includes most of the Cabinet members. We have launched a program—and we will meet tomorrow incidentally—the concept of which is the institution of a good many interdepartmental task forces within a timeframe in this case of 1980.

We intend to go over with some arbitrariness perhaps, nevertheless within that timeframe, things like, for example, do we have to get out of coal in order to have it play its part? And for example, in order to do that, what do we have to do within the timeframe of this year, next year and what are the constraints, whether they be manpower, material, statutory, funding, or whatever it may be. And we intend to have that as quickly as we can and we will of course be bringing that report to the attention of the Congress. And I think that is our approach toward approaching the strategy for self-sufficiency.

Chairman HOLIFIELD. The idea of setting a goal of 1980, I approve of very much. I have some reservations as to whether we will be able to make it, unless we really take it out of the demand.

Mr. LOVE. Yes.

TRADEOFFS IN ENERGY AND ENVIRONMENT

Chairman HOLIFIELD. The short-range increase in energy, barring the imports, is in coal as I see it.

And the utilization of coal under present technology and the standards of air contamination set by the EPA are so stringent that in many parts of the country, particularly in the cities, you can't use it.

Now, we haven't been able to use coal in California for many years because of the smog conditions, particularly in southern California. But there are plenty of areas where you do not have this temperature inversion that we have in Los Angeles County, and coal can be burned. Now it doesn't make any sense to say that the ambient quality of air everywhere should not be affected. If you've got air that is affected, let us say, with 10 percent of pollutions, and that is putting it pretty high, you naturally have to consider that 10 percent. But if you've got air somewhere else that is only affected half of 1 percent, you can relax the standard somewhat.

I am thinking of a specific case now. I am thinking of the utilities in southern California that built a tremendous coal-burning plant in Utah, which is called the Four Corners Coal Plant. You know where it is, you probably have been there.

As I understand it, there is desert downwind from the plant and it is scarcely populated. Now to say you can't increase the pollutants by 1 or 2 percent in that type of an area by burning coal and then transmitting the clean electricity to the 10 million people in southern California; well, it just doesn't take into consideration the urgency of our needs in view of the curtailment of imports of oil. It just doesn't make any sense.

You can have that air very pure out there at Four Corners, and you can have bellies empty in Los Angeles, people who can't get to work because they don't have the fuel to put in their automobiles. And you

can stop the plants that are giving them employment in Los Angeles by curtailing the electricity to run those plants, but that doesn't make any sense.

And so this thing has got to be looked at, in my opinion, both by the Congress and the administration with a new evaluation of the situation that we face. And I am not saying that there should be a permanent lifting of some of these standards, but I am saying that there has got to be some flexibility in some of these standards in some areas of the country, so that we can keep up our employment as much as we can.

They are already predicting 8 percent unemployment. And I have 3,500 men laid off in an automobile manufacturing plant in my district. That happened last week when I was at home. Now 3,500 men out of work affects 3,500 families right now, before Christmastime. They are going on unemployment insurance.

We can get into a depression quicker than a lot of people realize unless we use commonsense during this time of urgency. If a man is thirsting to death he will drink dirty water when he can't get clean water. Well, I have been breathing contaminated air in southern California for about 50 years now and I am still going strong. But I had a full stomach most of the time, you see.

Mr. LOVE. That helps.

Chairman HOLIFIELD. And I would rather breathe a little smog than not have any job and not have any food.

Mr. LOVE. I would only add to that, Mr. Chairman—I certainly agree with what you say—I would only add to that that we need to direct our attention to this, and I don't know that I've got the exact language, but the fairly recent court decision that provided that there could be no substantial degradation. This is not relating to ambient standards at all, but if you've got the purest air in the world under this decision, well, I am not sure I am interpreting this right——

Chairman HOLIFIELD. How about Pike's Peak?

Mr. LOVE. Yes, the decision is, if you've got the purest air you couldn't degrade that in any way. And if that holds true, I would think, if interpreted strictly, it would bring any kind of development to a complete halt in most parts of undeveloped areas of the country.

Chairman HOLIFIELD. Well, I hope you can use your influence to have a quiet but firm discussion with Mr. Russell Train and urge that administrative flexibility be brought into some of these decisions that he has made.

When Mr. Ruckelshaus was EPA administrator, he came to Los Angeles and he said the only way you can comply with this act is just stop 80 percent of the automobiles. As you know, we have no mass transit and we can't build it within 10 years. It would take us 10 to 20 years to build a mass transit system that would be able to take care of the 10 million people down there. You stop that many automobiles and see what happens. And to say we've got to stop 80 percent of our automobiles, well, I am telling you I don't want to be in office when that happens.

Mr. WYDLER. You won't be.

Mr. LOVE. The chairman doesn't need to worry about that as yet.

Mr. HORTON. On that same subject, I get a lot of mail on that and a lot of suggestions, and I would say one of the things that is included in every letter that comes in with regard to waste is we can conserve more gas by postponing the auto emission features that are required on automobiles. One of the members of this committee was telling me how he was talking to a friend of his in his district over the weekend and he said it is a very simple operation to change it and it would save a tremendous amount of gasoline.

EFFECT OF AUTO EMISSION DEVICES

Mr. WYDLER. Would the gentleman yield? I am getting the same mail.

What are these auto emission devices that are burning so much fuel? Everybody is under the impression they are burning gas wastefully. Is that true or is it not?

I don't have any idea but——

Mr. LOVE. EPA has a study on it and of course there are many factors that go into the mileage a car gets, like the weight and the subsidiary devices such as air-conditioning and so on, but if my memory is correct, the emissions control represents some——

Mr. MCCORMICK. About 10 percent, about 7 to 10.

Mr. LOVE. Yes; about 7 to 10 percent.

Mr. WYDLER. Is it lost just by having that device on the car?

Mr. MCCORMICK. Yes, sir.

Mr. WYDLER. I am sorry to pressure you on this but that is a fantastic figure if it is true. You are saying that if we would take the emissions control devices off the current cars we would get 10 percent more mileage?

Mr. MCCORMICK. Sir, the new devices that are being produced are expected to be better, that is, in the sense that they would have less loss of gasoline consumption, but I believe, the study indicates the recent models have been estimated to consume about 7 to 10 percent more because of these controls.

Mr. HORTON. That is a tremendous amount. That is why I brought the subject up. There is a lot of talk about this and I think something could be done about it. It would be very helpful to the overall solution of the energy crisis.

Mr. LOVE. The matter is possibly going to be considered as a part of this emergency legislation that is moving through the House committee, I believe, today or tomorrow, and I would be interested if you would inquire as to what kind of attitude that committee would have on addressing something in this regard and adding it to the emergency legislation.

Mr. MOORHEAD. When you are talking about 7 to 10 percent, do you mean 7 to 10 percent on an automobile that has this device?

You are not talking about saving 7 to 10 percent of gas nationwide or are you? I just don't understand.

Mr. MCCORMICK. No; the figure is only for the automobiles that have those devices.

Mr. HORTON. But there are a substantial number of automobiles in the country that have those devices, so that a substantial amount of gasoline could be saved. I don't know what it would be but——

Mr. MOORHEAD. Any guess as to the total savings?

Mr. LOVE. By the way, this is Dr. McCormick of my office. I should have introduced him. We do have the numbers?

Mr. MCCORMICK. We can supply for the committee the EPA study and I think you can take a look at it.

Chairman HOLIFIELD. Very good. We would like to have that.

[The information referred to above was not received at time of printing.]

Chairman HOLIFIELD. Well, thank you very much, Governor. We will try not to call you back for a few days. We thank you for your kindness in coming up and your testimony.

[Whereupon, at 2:50 p.m., the subcommittee adjourned, to reconvene at 9:30 a.m., Thursday, November 29, 1973.]

ENERGY REORGANIZATION ACT OF 1973

THURSDAY, NOVEMBER 29, 1973

HOUSE OF REPRESENTATIVES,
LEGISLATION AND MILITARY OPERATIONS SUBCOMMITTEE
OF THE COMMITTEE ON GOVERNMENT OPERATIONS,
Washington, D.C.

The subcommittee met, pursuant to notice, at 9:40 a.m., in room 2154, Rayburn House Office Building, Hon. Chet Holifield (chairman of the subcommittee) presiding.

Present: Representatives Chet Holifield, William S. Moorhead, Don Fuqua, Frank Horton, John N. Erlenborn, John W. Wydler, and Richard W. Mallary.

Also present: Herbert Roback, staff director; Charles Goodwin, counsel; Michael T. McGinn, defense analyst; Elmer Henderson, general counsel; Miles Q. Romney, counsel-administrator; James Lanigan and John Reich, consultants; and Warren Buhler, minority professional staff, Committee on Government Operations.

Chairman HOLIFIELD. The committee will be in order.

We have as our first witness this morning a very famous scientist, Dr. Robert Sachs, who is the Director of Argonne National Laboratory, and his associate, Deputy Director Robert Laney.

Dr. Sachs, we want to express our appreciation for your presence here this morning. We are anxious to hear your testimony. You may proceed.

STATEMENT OF DR. ROBERT G. SACHS, DIRECTOR, ARGONNE NATIONAL LABORATORY; ACCOMPANIED BY ROBERT V. LANEY, DEPUTY DIRECTOR

Dr. SACHS. Thank you, Mr. Holifield. We appreciate the opportunity to give testimony in connection with H.R. 11510.

I have submitted a statement for the record and believe that it might be best if I simply tried to summarize the statement and respond to your questions.

Chairman HOLIFIELD. You may do so.

Dr. SACHS. In our statement we first try to indicate the basis for our opinions concerning this reorganization bill and that basis is the experience of Argonne National Laboratory in entering research and development.

As you know, I am sure, the Argonne National Laboratory is the successor to the University of Chicago's World War II metallurgical laboratory where the nuclear chain reaction was first demonstrated.

The Laboratory has been involved in nuclear research, nuclear power research since World War II, and has made essential contributions to the development of both the submarine reactor and light water central station power reactors.

Furthermore, the Laboratory was involved at the very earliest stages in developing the concept of the liquid metal breeder reactor under Walter Zinn, who was one of the people who developed the concept.

FAST BREEDER REACTOR

Argonne, as a matter of fact, designed and constructed the first feasibility demonstration of the breeder reactor, EBR–I, and then proceeded to design, construct, and now operates the experimental breeder reactor No. 2 at our Idaho facility; this is the only successful operating liquid metal breeder reactor powerplant in the United States.

Chairman HOLIFIELD. I might interrupt you to say that outside of our existing stores of fossil fuel, this offers the major contribution to our energy systems between now and the year 2000, and I am speaking now of indigenous sources of material as well as technology.

Dr. SACHS. Yes, that is certainly our projection of the importance of the liquid metal breeder reactor.

Chairman HOLIFIELD. As you say, you have made it work in the experimental ERB, ERB–II, and so we know that the concept has been proven by laboratory demonstrations.

Dr. SACHS. In fact, it is just about 10 years ago, within a few weeks, that the EBR–II first went critical. Since that time, it was run for several years to demonstrate the feasibility of power generation with an integrated fuel cycle; after that demonstration was complete, the reactor has been run and certainly is very successful as an engineering test reactor.

It is our principal engineering test reactor in the country at the present time. It is running continuously, and not only does it demonstrate the feasibility, but it also demonstrates the fact that one can run such a plant in a safe and reliable fashion.

Chairman HOLIFIELD. If we are successful in the full-scale plant which is now authorized and contracted for—and everything like that down in the TVA area—what is your estimate of the increase in energy that you would get from a gram of uranium?

Dr. SACHS. The increase in energy from a gram of uranium? I don't think I have that number in mind.

Mr. LANEY. If your reference is to natural uranium where we use less than 1 percent, we would be using 50 to 60 percent with the breeder.

Chairman HOLIFIELD. So you could say conservatively 50, and I have heard many predictions that it would be 70 times as much energy as we now get from a given amount of uranium?

Mr. LANEY. Yes, sir.

Dr. SACHS. The theoretical limit is the ratio of the amount of uranium-238 to the amount of uranium-235, and since uranium-235 is only seven-tenths of 1 percent, that would give you a very large factor, but that is the theoretical factor. Fifty, I think, is a reasonable estimate, as Mr. Laney has said.

The Laboratory has realized over the years that its function in research and development in the nuclear energy field is to create a body

of technology designed to support a nuclear industry and, of course, the Laboratory has been involved in the development, as I have mentioned before, of the submarine reactor and the light water central station power reactors, but its involvement in those has been very slight for many years.

ARGONNE ENERGY PROGRAMS

In view of the fact that we do anticipate the takeover of commercial power by industry, we look forward to other ways in which the Laboratory can contribute to national needs, so we have developed a variety of programs in recent years looking forward to the day when our main function would not be necessarily in the breeder reactor business, even though there remains much to be done. We have developed a number of other programs, including, for example, a program on clean coal combustion, fluidized bed combustion of high sulfur coal, which would be a method for burning the coal without polluting the atmosphere, taking the sulfur out in the process of burning.

We have a program in high performance batteries both for energy storage, which is a very important part of the energy conservation effort, and for automobile propulsion.

We have had a program looking into materials problems and neutronic problems and engineering problems associated with controlled thermonuclear reactors which will have to be faced some day when the feasibility of controlled thermonuclear reactors is demonstrated.

Chairman HOLIFIELD. That is commonly known as the fusion reactor?

Dr. SACHS. Fusion reactor, yes, f-u-s-i-o-n.

We have a program in magnetohydrodynamics, which is another possible way of extracting energy either from coal or from nuclear reactors in a more efficient manner. Again, it is a conservation measure.

We have had a substantial program in superconductivity technology that has a bearing on many aspects of the various energy programs.

Chairman HOLIFIELD. The transmission of——

Dr. SACHS. Transmission is one. For magnetohydrodynamics purposes one needs superconducting magnets. For the efficient use of fusion energy we believe one will need superconducting magnets.

As a matter of fact, I have heard the statement made that the superconducting magnet is to electrical engineering what the ball bearing is to mechanical engineering and it is, therefore, going to have a very important future. We have had a very substantial program in that area in the development of large scale superconducting magnets.

We have also been involved in a number of environmental programs including the related biological and physical research efforts.

We have a program in Lake Michigan thermal effects studies in connection with the impact of nuclear reactors, thermal impact of nuclear reactors on Lake Michigan. We have a project on the analysis of environmental impact of nuclear powerplants.

We also have a group undertaking systems analysis studies bearing on the interrelationships between energy production, national ecology, and costs.

So, we have a rather substantial number of programs in fields other than the nuclear energy field and are trying to accelerate this activity as fast as we can get the support to accelerate it.

That is the background against which we have looked at the proposed bill.

Chairman HOLIFIELD. Doctor, I have glanced ahead in your statement, and I think it is so important that every word of it should be read. Then you can add anything you want to it.

I would like to have this read into the record for the benefit of the members of the committee, if you will.

Dr. SACHS. Fine, thank you.

From this extensive background of experience, it is clear that we have had an unusual opportunity to participate in Government-sponsored research, supported both by the AEC and other Federal agencies. The following observations, pertinent to the purpose of H.R. 11510, may help you in your consideration of this important legislation.

PROGRAM CONCENTRATION AND FOCUS

First, the success in the execution of the national programs in nuclear science and nuclear energy has been due in large measure to the principles of concentration and focus which are inherent in the Atomic Energy Act, the JCAE, the Commission itself, and its organic structure of national laboratories. The ability to relate policy, priorities, and budget considerations simultaneously in both the executive and legislative branches has permitted expeditious decision and, importantly, has provided the laboratories a well-defined policy framework in which to carry on their work. At the same time, the network of independently managed laboratories has been able to provide objective information based on technical facts when tough policy questions arise. This has been particularly important in connection with environmental problems of a kind that arise in connection with any substantial energy technology.

I think it is important to realize that many of these problems we have agreed to in the nuclear energy business have their counterpart in any energy technology.

Since the system has worked well, it seems most important to apply similar principles to the solution of our current energy problems, namely, to concentrate the responsibility for energy research and development in a single executive agency with its associated laboratories, whether this be ERDA or some other agency.

ADVANTAGE OF SINGLE-AGENCY CONCEPT

My second observation also concerns an advantage of the single-agency concept. The need to support a balanced energy program, one that gives balanced consideration to all energy sources including fossil fuel, nuclear, and others, can best be met by an agency having equal responsibility with regard to all of them. The assignment of responsibility to one agency for considering and advancing all promising energy alternatives would provide a means for making comparisons of

technical feasibility and promise on a uniform basis. It is difficult to obtain a degree of objectivity in making such comparisons when separate agencies having different styles and standards are zealously sponsoring different systems. On the other hand, experience has shown that a healthy competition between different technical options can be realized within a single agency if it maintains a number of independently managed research and development facilities.

That last sentence is intended to emphasize the fact we do realize the importance of competition, in view of the experience we have with the AEC's national laboratory organization, since each of the national laboratories is independently managed, managed either by the university consortium or by an industry or what have you, the competition is possible and in a clearly independent way. The laboratory certainly competes vigorously in a friendly way.

The decisions that the Nation must make will require a sophisticated systems analysis encompassing all of the alternatives and determining the definitive decision points. Such an analysis is not easily pieced together from input provided by different agencies, each basing its analysis on its own criteria. It seems likely that a rational analysis of this kind could be obtained only if a single agency, employing uniform criteria, addresses all energy alternatives.

Third, our considerable experience in administering energy research with support from the AEC and other agencies convinces us that there would be a substantial advantage to a reorganization which would bring all of these energy-related activities under one set of administrative procedures. We have had an excellent relationship with the AEC and a clear understanding of procedures with regard to AEC programs, but we find that when another agency is involved as a source of funding there frequently are serious managerial complications. These arise in part because the authorizing legislation for each of the agencies is distinct and leads to different rules and procedures for each. Thus, it can easily happen that a good technical idea may be held in limbo while laboratory and agency counselors work for weeks on end to untangle the legal threads. I conclude that one advantage of a reorganization along the lines of H.R. 11510 would be a simplification of the rules and procedures, leading to a much more effective use of the Nation's research and development capability.

PROVEN AEC PERFORMANCE

And, finally, one important feature of H.R. 11510 is its recognition of the particular role that can be played by those organizations and facilities presently serving under the AEC. The AEC establishment has proved itself in both its research and development activities and its management of large, innovative technological enterprises. Furthermore the national laboratories have in recent years demonstrated a capacity to move quickly into energy and environmental problems outside the nuclear field as a result of the strong base in science and technology that they have built up over the years.

The existence of this strong base is due in no small part to the strong support that the AEC has accorded to its fundamental work in the

physical and biological sciences, support which was made possible and encouraged by the stated purposes of the original Atomic Energy Act of 1946 and (in somewhat different words) those of the current version of the Atomic Energy Act of 1954. In section 1(b), the act of 1946 gives as two of its purposes:

(1) A program of assisting and fostering private research and development to encourage maximum scientific progress, * * * and

(2) A program of federally conducted research and development to assure the Government of adequate scientific and technical accomplishment.

Corresponding words are found in section 3(a) of the 1954 act, which also emphasizes the importance of basic research in section 53(f) concerning the uses to be made of special nuclear materials.

These words have permitted the AEC to support research and development in many basic branches of science and technology long before their applications were immediately evident. As a result, the AEC has been in a strong position to move quickly into new technologies when the need became evident. This is why the AEC's laboratories have played such a significant role in providing for the "flexibility and responsiveness" emphasized by Dr. Dixy Lee Ray in her statement of July 31, 1973, to your subcommittee.

The outstanding successes of the AEC in the exploitation of new technologies are due largely to the foresight shown in formulating the act in such a way as to encourage the support of basic science and technology. New, unforeseen questions will constantly arise in any technological development and the more innovative the technology, the tougher the questions. If answers cannot be immediately drawn from a continuing, broadly based science and engineering program, the progress of the technology can be delayed by years.

It is worth noting that the support of basic science and technology provided in the Atomic Energy Act is inherently necessary in the development of all forms of energy, not only nuclear. Although we are all aware of the primary importance that must be attached to the early development of new methods for the generation of useful power, energy research and development will continue to have broader meaning: it includes the production of radiation sources for nuclear medicine, research on energy processes in molecules, chemical and biological investigations relating to the impact of energy sources on our environment, and even the study of energy stored in nuclei and nuclear particles. Paragraphs (4), (5), and (6) of section 103 of H.R. 11510 apparently establish this broader meaning as a purpose of the act, and this impression is reinforced by section 104(a) transferring AEC functions to ERDA. Thereby, ERDA appears to be given a clear mandate to continue the support of basic science and technology, making it possible to fully use the capabilities of both the national laboratories and the universities to contribute to basic science and technology as needed for all aspects of the energy program.

Chairman HOLIFIELD. That is a very valuable and concise statement Dr. Sachs, and we appreciate very much——

Dr. SACHS. Thank you, Mr. Holifield.

Chairman HOLIFIELD [continuing]. Your appearing here this morning with your associate, Mr. Laney.

Mr. Laney, did you have any comment that you wished to make?

Mr. LANEY. No, thank you.

Chairman HOLIFIELD. Mr. Horton?

Mr. HORTON. Mr. Chairman, I don't have any questions to ask.

I, too, want to join with the chairman in saying that this is a very valuable statement, Dr. Sachs. I think the point that you made in the latter part of your statement about the comparability of the language in the earlier AEC Act is a very significant one, and I think we do want to accomplish just the purpose that you referred to. I believe this is a very important contribution.

Thank you.

Chairman HOLIFIELD. While we do not, in this particular bill, have all of the language of the AEC Act, we have a very broad analysis in which the different sections of the act are shown to apply to ERDA and to the Nuclear Energy Commission. It is not our purpose to amend the Atomic Energy Act in its basic authority. We want that to apply, and our job is to reorganize and to bring over the functions and the responsibilities and the direction which now exist in the AEC to the administrative ERDA.

Dr. SACHS. I want to assure you, Mr. Holifield, that we in the laboratories, in the national laboratories, are anxious to implement the actions that are suggested by the act as we read it.

Chairman HOLIFIELD. Thank you very much.

Mr. Erlenborn?

Mr. ERLENBORN. Thank you, Mr. Chairman.

And, Dr. Sachs, Mr. Laney, let me also thank you for making this contribution to the efforts of our subcommittee.

I would like to point out to the members of the subcommittee that Argonne National Laboratory is in the 14th Congressional District of Illinois, which I am pleased to represent. In fact, we refer to that district as the nuclear research center of the world and, I think, with some basis in fact since we have not only Argonne but also the West Enrico Fermi accelerator. So the people of the 14th Congressional District are well aware of the research efforts of the Atomic Energy Commission.

Chairman HOLIFIELD. If they are not aware of the support that the gentleman from Illinois has given to the laboratories and the nuclear energy program, I want to give them notice at this time that he has been one of the most vigorous supporters of the nuclear energy programs and all of the other programs in those laboratories which Dr. Sachs has mentioned.

Mr. ERLENBORN. I thank the chairman for that observation.

I might in conclusion say though we are very proud of Argonne. Back in the early days when it was first being established, I must admit about all we knew about atomic energy at that point was that the original process at the University of Chicago did not explode. But the next two efforts at Nagasaki and Hiroshima did. We weren't certain we wanted that in our area, but it has been a very good neighbor. In fact the buffer zone around Argonne which was established for safety purposes has just recently been deeded over to our Forest Preserve Commission and is now a very valuable recreation resource for the people in our area.

Thank you again, Dr. Sachs.

Dr. SACHS. Thank you, sir.

Chairman HOLIFIELD. Mr. Wydler?

Mr. WYDLER. Let me say a word for Brookhaven.

Mr. ERLENBORN. We have a little competition.

Mr. WYDLER. I was delighted with your testimony. But if you don't mind, I would like to try to relate some of the things that you said in your testimony relating to Argonne to the Brookhaven situation in order to find out the extent to which your experiences are compatible.

In your statement you say you have considerable experience in energy research. I presume by that you are speaking of Argonne's considerable experience in administering energy research.

Is that what you are referring to here?

Dr. SACHS. This experience is the experience on which we base our statement and, of course, it is the experience of the Argonne National Laboratory on which I would have to base most of my statement.

Mr. WYDLER. What I am trying to get at, are the types of experience unique to Argonne; or do you and Brookhaven have the same experience in administering energy research?

BROOKHAVEN LABORATORY WORK

Dr. SACHS. There would be an overlap in experience. The experience is certainly not identical by any means.

I happen to have been closely associated with work at Brookhaven, especially in the earlier days, because I am a high energy physicist, and, of course, Brookhaven was a major center, was the major center of high energy physics at one time. But Brookhaven also has a program in research around a research reactor, high flux research reactor, and that was not a reactor designed for purposes of producing power but one designed for the purpose of producing neutrons. But there are many activities at Brookhaven relating in one way or another to energy research and development. They are particularly strong in the basic science areas which I emphasized in my statement are of the utmost importance in the long run.

Mr. WYDLER. I don't quite understand how the national laboratories are structured.

Do they have assigned responsibilities in specific fields? Is that the way they are organized?

Dr. SACHS. Well, your question addresses a very complicated issue. The different laboratories are quite different in the pattern of their programs.

Now, Argonne National Laboratory, I believe, could be said to have been the first of the national laboratories because it came right out of the Manhattan project. It was the metallurgical laboratory part of the Manhattan project and simply transferred outright into a national laboratory.

Brookhaven was created out of—you might say—the minds of men after World War II when it was realized that the universities in the Eastern belt should also have an opportunity to have access to the major facilities of the type that were available at Argonne because of its work during the war.

ARGONNE LABORATORY WORK

At Argonne the work developed in several parallel lines. We already had a mission orientation at Argonne. I happen to have been in my first incarnation at Argonne involved in the changeover from metallurgical laboratory to Argonne. I served there as the Director of the Theoretical Physics Division when Argonne was first established. So, at the time I am quite familiar with the situation. We had a definite mission related to power, development of nuclear power, tied in with the fact that this is where the first chain reaction had taken place.

We also had a definite mission to carry on basic research because of the understanding, the realization, at the end of World War II that the reason that the whole program had been possible is because of the deep roots in basic research that had been developed in the country and it was, and as I have already mentioned, the Atomic Energy Act indicated and AEC followed this indication that the basic research was essential to establish roots for future technology.

So Argonne National Laboratory also had a substantial program in basic research built originally around the facilities that had been built up during the war but, of course, those facilities were expanded.

Brookhaven was created primarily as a resource in basic research for the universities in the organization known as Associate University Inc., and they did develop programs that were related to technology but did not have the strong mission-oriented component that Argonne had.

Of course, there are other laboratories, too. Oak Ridge has an extremely varied program, too, from mission orientation to basic research, and you will hear later from Dr. Agnew from Los Alamos. He can tell you again at Los Alamos there is a program that has a very broad spectrum.

Mr. WYDLER. Maybe I could be more specific.

Are there any AEC centers working on energy research other than nuclear energy research at the present time?

Dr. SACHS. Yes.

AEC NONNUCLEAR RESEARCH

As I have indicated here, Argonne has for 5 or 6 years been working in a number of programs. Brookhaven has some programs. For example, I know of several programs that they have been pursuing, as we have, in a fairly low key of limitation on funding. Oak Ridge has had a very, very vigorous program of pursuing nonnuclear research.

Chairman HOLIFIELD. If the gentleman will yield, I might say that foreseeing the need for a broader mission, my colleague on the committee, Craig Hosmer, and I sponsored some amendments several years ago which gave the laboratories authority to do work in other fields. Dr. Sachs has mentioned work on coal combustion. A lot of people don't realize that these laboratories have that broad a mission. I believe you were doing this under a program from the Environmental Protection Agency?

Dr. SACHS. That is right.

Chairman HOLIFIELD. And up until, I guess it was late 1970 or 1971, they did this on a reimbursable basis, using outside sources, is that not true, agencies outside of AEC?

Dr. SACHS. Yes, sir.

Chairman HOLIFIELD. But now you are authorized actually to do it on your own?

Dr. SACHS. Well, on our own if we can obtain the money from the appropriate AEC program.

Chairman HOLIFIELD. And you have been able to obtain money.

One thing I did want to also emphasize, I think it is pertinent—there is a complete exchange of information among these laboratories of scientific data which they develop, is that not true?

Dr. SACHS. That is correct, there is a very vigorous exchange of information, people, and objectives that we work together very closely.

Chairman HOLIFIELD. And have frequent conferences with each other also under the Atomic Energy Act, under legislation that was sponsored by all of the members of the Joint Committee. I would say 95 or 96 percent of the information that is developed is made available to industry, made available in the public documents, and things like that, because we have felt that this contribution should not be tightly held. There are just a very few areas in which you have a classification of information that is developed, and that is practically all confined to weapons or weapons application, information as to how the weapons are made and how many we have, and that sort of thing.

But in general we have followed the course of trying to make this information available, not only very specific interchange in the laboratories, but also a specific release of information to industry.

Mr. WYDLER. Thank you.

Chairman HOLIFIELD. Thank you very much.

We do appreciate your appearance here, and if it is convenient, Doctor, I wish you would furnish us with biographies of yourself and Mr. Laney.

[Dr. Sachs' prepared statement and biography follow:]

PREPARED STATEMENT OF DR. ROBERT G. SACHS, DIRECTOR, ARGONNE NATIONAL LABORATORY

The following comments reflect the vital interest of the staff of Argonne National Laboratory in the Nation's energy problems, and they draw on the Laboratory's experience of more than a quarter of a century in nuclear energy research and development. In view of its influence on our opinions, it may be helpful to review that experience and some related information concerning this Laboratory. Argonne is the successor to the University of Chicago's World War II Metallurgical Laboratory where the nuclear chain reaction was first demonstrated. Since that time, Argonne has been a leader in the Nation's research and development efforts in the field of nuclear energy. Essential contributions to the development of both the submarine reactor and light water central station power reactors were made in the Laboratory. Furthermore, this Laboratory (under Walter Zinn as Director) was an early proponent of the liquid metal fast breeder reactor and has played a key research and development role in the Nation's efforts to develop that reactor as a prime source of energy. In fact, Argonne designed, constructed, and now operates EBR II, the only successful operating liquid metal breeder reactor powerplant in the United States. EBR II was used first to demonstrate convincingly the feasibility of power generation with an integrated fuel cycle, and now is eminently successful in its second role as an engineering test reactor.

Over the years, the laboratory has realized that the aim of our research and development in the nuclear energy field is to create a body of technology adequate to support a nuclear industry; and that when our program reaches ultimate success, the responsibility for commercial application naturally shifts to in-

dustry. Therefore, we have been constantly on the lookout for other ways in which to contribute to the Nation's needs, especially in the energy and environment field. In recent years, the laboratory has undertaken a variety of programs in order to be in a position to be helpful in this broader context. These include such energy-related problems as clean coal combustion, high performance batteries for energy storage and automobile propulsion, controlled thermonuclear systems, magnetohydrodynamics and superconductivity technology. We also have a number of environmental programs including related biological and physical research, Lake Michigan thermal effects studies, analysis of environmental impact of nuclear powerplants, and systems analysis studies bearing on the interrelationship between energy production, national ecology, and cost.

From this extensive background of experience, it is clear that we have had an unusual opportunity to participate in Government-sponsored research, supported both by the AEC and other Federal agencies. The following observations, pertinent to the purposes of H.R. 11510, may help you in your consideration of this important legislation.

First, the success in the execution of the national programs in nuclear science and nuclear energy has been due in large measure to the principles of concentration and focus which are inherent in the Atomic Energy Act, the JCAE, the Commission itself, and its organic structure of national laboratories. The ability to relate policy, priorities, and budget considerations simultaneously in both the executive and legislative branches has permitted expeditious decisions and, importantly, has provided the laboratories a well-defined policy framework in which to carry on their work. At the same time, the network of independently managed laboratories has been able to provide objective information based on technical facts when tough policy questions arise. This has been particularly important in connection with environmental problems of a kind that arise in connection with any substantial energy technology.

Since the system has worked well, it seems most important to apply similar principles to the solution of our current energy problems; namely, to concentrate the responsibility for energy research and development in a single executive agency with its associated laboratories, whether this be ERDA or some other agency.

My second observation also concerns an advantage of the single-agency concept. The need to support a balanced energy program, one that gives balanced consideration to all energy sources including fossil fuel, nuclear, and others, can best be met by an agency having equal responsibility with regard to all of them. The assignment of responsibility to one agency for considering and advancing all promising energy alternatives would provide a means for making comparisons of technical feasibility and promise on a uniform basis. It is difficult to obtain a degree of objectivity in making such comparisons when separate agencies having different styles and standards are zealously sponsoring different systems. On the other hand, experience has shown that a healthy competition between different technical options can be realized within a single agency if it maintains a number of independently managed research and development facilities.

The decisions that the Nation must make will require a sophisticated systems analysis encompassing all of the alternatives and determining the definitive decision points. Such an analysis is not easily pieced together from input provided by different agencies, each basing its analysis on its own criteria. It seems likely that a rational analysis of this kind could be obtained only if a single agency, employing uniform criteria, addresses all energy alternatives.

Third, our considerable experience in administering energy research with support from the AEC and other agencies convinces us that there would be a substantial advantage to a reorganization which would bring all of these energy-related activities under one set of administrative procedures. We have had an excellent relationship with the AEC and a clear understanding of procedures with regard to AEC programs, but we find that when another agency is involved as a source of funding there frequently are serious managerial complications. These arise in part because the authorizing legislation for each of the agencies is distinct and leads to different rules and procedures for each. Thus, it can easily happen that a good technical idea may be held in limbo while laboratory and agency counselors work for weeks on end to untangle the legal threads. I conclude that one advantage of a reorganization along the lines of H.R. 11510

would be a simplication of the rules and procedures, leading to a much more effective use of the Nation's research and development capability.

And, finally, one important feature of H.R. 11510 is its recognition of the particular role that can be played by those organizations and facilities presently serving under the AEC. The AEC establishment has proved itself in both its research and development activities and its management of large, innovative technological enterprises. Furthermore, the national laboratories have in recent years demonstrated a capacity to move quickly into energy and environmental problems outside the nuclear field as a result of the strong base in science and technology that they have built up over the years.

The existence of this strong base is due in no small part to the strong support that the AEC has accorded to its fundamental work in the physical and biological sciences, support which was made possible and encouraged by the stated purposes of the original Atomic Energy Act of 1946 and (in somewhat different words) those of the current version of the Atomic Energy Act of 1954. In section 1(b), the act of 1946 gives as two of its purposes: "(1) A program of assisting and fostering private research and development to encourage maximum scientific progress," and "(2) A program of federally conducted research and development to assure the Government of adequate scientific and technical accomplishment." Corresponding words are found in section 3(a) of the 1954 act, which also emphasizes the importance of basic research in section 53(f) concerning the uses to be made of special nuclear materials.

These words have permitted the AEC to support research and development in many basic branches of science and technology long before their applications were immediately evident. As a result, the AEC has been in a strong position to move quickly into new technologies when the need became evident. This is why the AEC's laboratories have played such a significant role in providing for the "flexibility and responsiveness" emphasized by Dr. Dixy Lee Ray in her statement of July 31, 1973, to your subcommittee. The outstanding successes of the AEC in the exploitation of new technologies are due largely to the foresight shown in formulating the act in such a way as to encourage the support of basic science and technology. New, unforeseen questions will constantly arise in any technological development and the more innovative the technology, the tougher the questions. If answers cannot be immediately drawn from a continuing, broadly based science and engineering program, the progress of the technology can be delayed by years.

It is worth noting that the support of basic science and technology provided in the Atomic Energy Act is inherently necessary in the development of all forms of energy, not only nuclear. Although we are all aware of the primary importance that must be attached to the early development of new methods for the generation of useful power, energy research and development will continue to have broader meaning: It includes the production of radiation sources for nuclear medicine, research on energy processes in molecules, chemical and biological investigations relating to the impact of energy sources on our environment, and even the study of energy stored in nuclei and nuclear particles. Paragraphs (4), (5), and (6) of section 103 of H.R. 11510 apparently establish this broader meaning as a purpose of the act, and this impression is reinforced by section 104(a) transferring AEC functions to ERDA. Thereby, ERDA appears to be given a clear mandate to continue the support of basic science and technology, making it possible to fully use the capabilities of both the national laboratories and the universities to contribute to basic science and technology as needed for all aspects of the energy program.

Biographical Sketch of Dr. Robert G. Sachs

Director, Argonne National Laboratory, and professor of physics, Enrico Fermi Institute, University of Chicago.

Background data: Johns Hopkins University; George Washington University; Purdue University; University of California; section chief, ballistic research laboratory, Aberdeen Proving Ground; division director, Argonne National Laboratory; associate professor, professor, University of Wisconsin; visiting professor, Princeton University; visiting professor, University of Paris; associate laboratory director, Argonne National Laboratory; director and professor of physics, Enrico Fermi Institute, University of Chicago.

Member: National Academy of Sciences, American Academy of Arts and Sciences.

Author: "Nuclear Theory" and many articles on theoretical physics.

Chairman HOLIFIELD. I understand Mr. Dave Freeman has agreed to step aside for Dr. Agnew, the Director of the Los Alamos Scientific Laboratory. Dr. Agnew is having a little trouble with planes, and he wants to get back to Albuquerque today.

Mr. Freeman, I appreciate you stepping aside for him to proceed. Dr. Agnew, you may proceed.

By the way, do you have a biography?

STATEMENT OF DR. HAROLD M. AGNEW, DIRECTOR, LOS ALAMOS SCIENTIFIC LABORATORY

Dr. AGNEW. No, I do not. If you would like——

Chairman HOLIFIELD. Would you just briefly give your background to the members of the committee and then furnish us your formal biography later?

Dr. AGNEW. I will do that, Mr. Chairman.

I have been in the nuclear energy business for a very long time. I was fortunate in being a member of the Enrico Fermi team that worked on the first nuclear reactor called CP–1, that was first brought into operation under Stagg Field at the University of Chicago. I was fortunate being there.

Chairman HOLIFIELD. You might amplify what you are saying, to help my colleagues understand; make it a little more explicit.

I know Mr. Erlenborn understands it, but tell us about the first work that was done.

EARLY NUCLEAR WORK

Dr. AGNEW. The first work, which indeed proved a self-sustaining nuclear chain reaction that could be controlled, was done at the University of Chicago under Stagg Field under the direction of Enrico Fermi. Dr. Sachs, Wally Zinn, a whole group of people were there, 30 of us altogether. I was one of that particular team that actually built the device and brought it into being, which opened the nuclear era.

I was also present over Hiroshima when the first weapon was used. So I have been in the business for a long time and have seen the good parts and bad parts of nuclear energy and am now presently Director of Los Alamos Scientific Laboratory.

I have served on PSAC panels, national security panels, NASA safety panels, and even served in the New Mexico State Senate for quite a number of years. So I have been in the business you might say, in management of research programs and interacting with the public, and I will provide a summary biographical sketch for the record.

Chairman HOLIFIELD. Very good.

Dr. AGNEW. Mr. Chairman, I think I would like to read this very short statement.

Chairman HOLIFIELD. You are now Director of Los Alamos Scientific Laboratory?

Dr. AGNEW. Yes, sir.

Chairman HOLIFIELD. And you have been associated with the programs there, both nuclear and nonnuclear, for many years?

Dr. AGNEW. Right.

I will read this very brief testimony and then elaborate on it as you see fit.

Mr. Chairman, as one who wishes, along with the rest of my scientific colleagues, to do something positive and constructive toward solving the energy problems of this Nation instead of just studying what might be done, I commend you and your colleagues for introducing H.R. 11510. I feel it is most important to enact legislation as soon as possible which will give specific responsibility to an individual and an organization for solving the Nation's total energy problems. H.R. 11510 does this. I urge adoption of this legislation as rapidly as possible, although I fully appreciate that in time it may need to be amended if particular problems arise and demonstrate deficiencies in the act. It is most important to do something now and not to wait forever in studying the problem and attempting to arrive at a perfect solution.

I favor this legislation because it marshals in particular the resources of one Federal agency, the AEC, which has a spectacular track record for R. & D. and production through its contractors. In my opinion, no other agency has conducted and supported R. & D. over such a wide spectrum of science as efficiently and as productively as has the AEC.

AEC INTERDISCIPLINARY APPROACH

I expect them to do equally as well when their resources are complemented and applied across the board in the energy field. The key to success of these laboratories has been to hire outstanding scientists, have no compartmentalization, and apply an interdisciplinary approach to the solution of problems. We believe that two heads are better than one, and two disciplines can contribute more than one.

By this interdisciplinary approach—and I am digressing from the testimony—I mean when we have a particular problem we will put together a group of individuals, chemists, physicists, mathematicians, biological scientists, attack a problem so they can all interact together to come up with a solution in the most efficient manner and quickest time. If you just put people on a certain discipline, they have to learn other disciplines in order to attack the problem properly. By putting a team together with different backgrounds, we are most effective in solving problems. That is what I mean by this interdisciplinary approach.

I might say we have attacked some very interesting problems with the Department of Agriculture recently on the quick diagnosis of cholera in polluted pork, and again it was putting electronic people and physicists and biological scientists together that came up with the techniques.

I have mentioned I am very much in favor of the bill and of doing something in a hurry.

SUGGESTED REVISIONS

I have a few specific suggestions with regard to the bill but I would support the bill as drafted without these suggestions. If these suggestions would delay passage then I would suggest they not be adopted.

The President and Senate must be very careful in the selection of the Administrator, and I would urge that he be appointed for a finite term, say 5 years, and should be removed only with the advice and consent of the Senate during his or her term.

I also believe that, at least for the first few years, the organization's appropriation should not be subject to annual authorization. If we are serious about the energy problem, I would urge that you authorize and appropriate at least a 3-year budget and review and amend it on of annual basis. We are going to have to make a commitment, a long-term commitment, in this area, and the best way of doing this is to commit funds on a longer basis than 1 year. You'll get a much more effective Administrator and staff with a commitment of funds to cover several years. The Administrator and staff will have enough to do without fighting for funds at the beginning of every year, especially initially. I urge you to give him a flexible organization, ample funds and a directive to produce results.

BAR ON IMPOUNDMENTS

In the same spirit I would urge at least for the first 5 years that the OMB be specifically forbidden to impound any funds authorized and appropriated to the ERDA. As an aid to the Administrator in starting new and vigorous programs without having to wait for the operation of the normal budget cycle in every case, I urge that at least $100 million a year in construction funds be made available to be spent at the discretion of the Administrator. Similarly, I urge that provision be made for purchasing capital equipment items with normal operating funds rather than having a separate capital equipment account. Do not tie the Administrator's hands by separating operation and equipment funds.

When I made the reference to OMB with regard to impounding of funds, the point I was trying to make was that if you are really serious about trying to do something in this program, OMB should not be allowed to get in the way. I know how hard the Congress has worked in reviewing the programs, having an Administrator justify his program. Having done that, I would say for the first few years that should be ample; and to have the OMB, lacking the benefit of the detailed discussions which take place between the administrators of laboratories and the Congress, who made the judgment, made the authorization, made the appropriation, to then have OMB essentially at their will impound funds could be disastrous to a program such as this.

I think it is very important to have a commitment of funds for a period of years so that the Administrator, his Assistant Administrators, and laboratories tasked, realize there is a commitment to get the job done. The program should not have the risk of being turned off at the end of a year and have a tremendous cutback.

Mr. HORTON. I don't want to interrupt your testimony but I do want to concur with you 100 percent even though I sit on the same side of the aisle as the administration. I am very much concerned about this problem, especially with regard to the scientific community. I have the University of Rochester in my district, and during this past year I have been concerned with the problems that they are facing in medical

research and in other disciplines also. I just want to underscore what you are saying. You are not going to get a scientist or other professional who has the ability and expertise that we are talking about here to commit himself for 1 year. He just is not going to do it. The Government will have to be aware of that problem. If we are going to have these scientists and technical people, they must have a program which they can count on.

I believe the Congress should have the ability to review appropriate funds. But in these very special fields, and especially in this one, you have to have some continuity. I think this is one of the problems we have today in the field of education: there is not a continuity or stability in the programs, and there is a lot of indefiniteness, because of the inability of the Congress to meet these longer term commitments.

So, I think you are making a very good point and I want to indicate my support for the position that you are taking. I think it would be very useful for the OMB people to have a copy of your testimony and I will personally make certain they do get it so that this point comes across to them.

Thank you.

Dr. AGNEW. Thank you very much, Mr. Horton.

ELEVATING DIRECTOR OF MILITARY APPLICATION

To continue, I urge that you specifically designate that the Director of Military Application be at the three-star rank. I believe this is very important, since the DOD officials with whom he has to interact are at that level, and I believe the caliber of officers who will be made available to the administration will be better qualified at this rank. A brigadier or major general equivalent, who wishes to further his military career, is at a decided disadvantage in questioning some of the requirements imposed upon him by his DOD counterparts who are at the three-star level.

I might digress. We have seen this en masse, and I know the Joint Committee on Atomic Energy has asked many times why the Division of Military Application hasn't been a little more, say forceful in rebutting some of the DOD requirements. I think part of the reason is that the senior officer has been at a lower rank than those in the DOD who impose certain requirements upon him. He just cannot talk back to these people.

DISPOSITION OF WASTE PRODUCTS

To continue with the suggested revisions, perhaps it is implied, but in section 103, page 6, line 24, I would add "and the disposition of their products".

Chairman HOLIFIELD. What is the reason for that particular suggestion?

Dr. AGNEW. The reason for that is, I think, in many of these new technologies one should, at the very beginning, face up to the fact there may be good or nonbeneficial results coming from the products of the particular energy production mechanism, and what I am talking about here you might construe as waste management.

It is not clear, when one looks at how one is going to produce some of these energy supplies, where the responsibility lies for taking into account what you are going to do with the products, be it combustion products from a coal plant, or radioactive waste from a nuclear plant. I think it clarifies the intent, which I am sure that you have, that you look at the complete systems, and I would just add that specific word.

Chairman HOLIFIELD. I think that is a valuable suggestion and I wonder, do you have a copy of the bill in front of you?

Dr. AGNEW. Yes, sir.

Chairman HOLIFIELD. I wonder if you would look at page 6, line 22, (4)?

Dr. AGNEW. Yes; I saw that.

Chairman HOLIFIELD. And read that.

Dr. AGNEW. That talks about safety and supporting environmental, but I see, as I say——

Chairman HOLIFIELD. You are talking about the physical disposition of waste products?

Dr. AGNEW. I am talking about physical disposition or utilization. It may be that these products can be utilized in a different manner than we thought. It adds a little bit. As I said, these are perhaps minor points, but I felt I should make that clear.

Chairman HOLIFIELD. I think it is a good suggestion and the staff certainly will review it. I have gone through your statement very carefully, and you make several good suggestions. In some instances I think they are covered, but I am not adverse to reemphasizing them by a few words like you suggest here. The disposition of energy products is certainly a major legislative problem, and if it is a reiteration of something already contained in the Atomic Energy Act——

Dr. AGNEW. It may be covered there, I was not able to go back and forth.

Chairman HOLIFIELD. It would help to buttress the point, and I think it is a valuable suggestion.

FACILITATING COMMERCIAL APPLICATIONS

Dr. AGNEW. To continue, in section 103 it might also be wise to recognize explicitly the fact that real impacts on the U.S. energy problem will occur only if newly developed technology is widely adopted by private industry. It would therefore seem appropriate to include in the list of functions an item (8) such as the following: "facilitating the transfer to industry of new energy technologies developed in Federal laboratories and encouraging their widescale utilization (by taking explicit actions with respect to the removal of barriers to implementation)." Alternatively it might be sufficient to replace line 10, item (6), page 7 with the following: "(10) work with the objective of facilitating the transfer of federally developed energy technology to the private sector."

There are many things developed under Government contracts which, because of some of the patenting regulations, industry just simply doesn't want to pick up. Without essentially an exclusive license or patent arrangement—they feel that in all cases they have to do something to adapt it to the civilian economy or to the private industrial

economy—it means investment and time on their part, and if they are not protected in some way they feel another organization will come in and take advantage of what they have done.

So, I would just like to say that, as one of the objectives, one should try to make it easy for industry to pick up this technology, either by allowing the industry to work right with this from the very beginning, or later on, and make sure there are no artificial barriers such as the one I specifically referred to as patents.

PROBLEM OF JOINT PROJECTS

Again it is more of a clarification for one who has just read the proposed legislation without knowing what else is behind the bill, or what in detail is in the Atomic Energy Act, but let me make another point for emphasis. Barriers to Government-industry should be removed. For instance, we have a proposal right now on solar panels. We have developed a solar panel at Los Alamos which looks like it is very efficient, very easy to construct. We are trying to get funds from the National Science Foundation jointly with United States Steel, and there are all sorts of legal problems, with the national laboratories such as ours being in concert with United States Steel as far as the attorneys are concerned. Everybody thinks it is a good idea, but there are lots of what I consider to be artificial barriers, and I think if it is made clear in the act that the objective is to get on with it, then sometimes attorneys can find ways of doing things; whereas if they aren't stimulated in the right direction, they can bring up more obstacles than you can possibly imagine.

Chairman HOLIFIELD. I think the purpose is set forth in the Atomic Energy Act, maybe in language which is not quite satisfactory, but there are problems of turning R. & D. over to industry. I don't know anything about this particular program you are speaking of.

As I understand it, you have been working with United States Steel on it?

Dr. AGNEW. No; we want to start to work and have them in at the very beginning, so what we come up with is readily adaptable to the private sector.

Chairman HOLIFIELD. Of course this does involve the problem of favoritism, let us say, by transferring of patent knowledge which has been acquired with public funds——

Dr. AGNEW. I understand.

Chairman HOLIFIELD [continuing]. To a private enterprise and discriminating against other private enterprises getting the same knowledge at the same time and having the same type of access to it. It is an old problem that we have had. In the British system, I believe, they solved it by the Government patenting the process and then making it available on a basis of royalties, just as a private individual does who has a patent. We have never done that. We have either given the technology to the favored participant in the process, which some claim to be a windfall, or we have made it available to all companies at the same time, and they can use it without hindrance but also without specific monopolized control.

Dr. AGNEW. I understand that.

Chairman HOLIFIELD. So it is a deep problem. It is not a simple problem, and we have wrestled with it for years. I appreciate your suggestion.

Dr. AGNEW. I appreciate that.

Mr. HORTON. I think you have a good point.

I believe the thrust of what you are trying to do is to indicate that you don't want any unnecessary obstacles thrown in the way of the cooperation between the Government and industry.

Dr. AGNEW. Right.

Mr. HORTON. I realize when you get a bunch of lawyers in they do create problems.

Dr. AGNEW. Well, they don't if they understand what their task is.

Mr. HORTON. But I think the thrust of your point is a good one, and that is if we don't cover it in the language, maybe we can cover it in the report.

Dr. AGNEW. Fine.

Mr. HORTON. We can indicate that we are interested in that point that you make, which I think is a valid point. You don't want to find technical reasons constantly being thrown in the way to prevent something from being accomplished. What you want to do is to research it, develop it, come up with the product and then have it available to the public.

Dr. AGNEW. That is right, that is the whole objective, as I understand what we are trying to do. It is not just to do the technical work and then write learned papers on it and publish it in technical journals. We want to transfer the technology to the private sector and get the energy flowing.

Mr. HORTON. Right.

Dr. AGNEW. In section 104, page 9, lines 14 through 19 seem somewhat limited. I would suggest the word "vehicular" in place of "automotive" in line 15 and would amend lines 18 and 19 to read "mobile and stationary sources using either fossil or synthetic organic fuels."

SYNTHETIC FUELS

As I interpreted this particular section, it seemed rather restricted to me, talking only about automotive. I think vehicular is more appropriate. I think the real impact is going to come on buses, trains, things like that; anything that moves should be covered. And then when you talk about fossil fuels, many people have pointed to hydrogen economies and use of synthetics. I would like to make it clear that we are not limiting it to any particular type of just fossil fuel but will include synthetic fuels, hydrogens, anything that may be used as combustionable.

Chairman HOLIFIELD. I think your explanation of that is good and I think it is pretty clear. What you have added there is language which goes beyond the word "fossil."

Dr. AGNEW. That is right.

Chairman HOLIFIELD. And it takes into consideration other synthetic organic fuels which might be developed at the same time?

Dr. AGNEW. Exactly, Mr. Chairman.

Chairman HOLIFIELD. We will look at that very carefully.

Thank you.

MAINTAINING WEAPONS COMPLEX

Dr. AGNEW. To continue, I believe it is extremely wise to keep the nuclear weapons R. & D. and production complex together as it exists today. This you propose doing. To split this combination would, in my opinion, increase the overall costs to the taxpayer manyfold and stretch out the time from concept to stockpile by at least a factor of 2.

Mr. HORTON. I think you are making an important point here. We have had some discussion before by other witnesses on this subject and some of the members who don't happen to be here now have asked questions about this subject.

I think it would be well if you could just elaborate a little bit on your reasoning here for saying that this would increase the cost. Perhaps you could support and substantiate that with some additional testimony.

Dr. AGNEW. OK.

When I finish the paragraph I will digress and do that.

The AEC's method of operating in this area is unique and an example the DOD should try to follow. Placing this total activity under the DOD would result in almost as disastrous a situation as splitting the production and R. & D. and putting one part in the DOD. The course you propose is most appropriate.

Let me explain this.

The way the laboratories work with the production complex in the AEC, they are one entity, even though they are separated geographically and separated as far as their management and the contractors are concerned. We in particular develop certain technologies in the handling of, let's say, uranium or plutonium; at the same time we are working with the people in the production plant to transfer this technology immediately. They know what they are doing, there are no barriers, no contractual barriers such as I could foresee if they were in a separate agency or not part of the family, so to speak.

Our people work with these people. We use the same, let's say, equipment in the production facility to do many things. The big lathes that were involved in doing some of, as an example, Spartan warhead development are presently also being used to make covers for some of the centrifuges. I can't get into some of these details because they are classified. But the machines are used all the time throughout the whole agency.

I think you are aware of the difficulties that the Defense Department in particular has had—when they build something they always seem to have overruns. We don't have overruns. We have a budget, and we do what we have to do within that budget. In the production complex, if we have to get things done, we get them done and belts get tightened, and other things don't happen if we run into a potential overrun problem. If we get into a problem, we solve it with the resources we have; we don't come back to renegotiate in the context of many defense contractors.

CIVILIAN BENEFITS FROM MILITARY R. & D.

Chairman HOLIFIELD. I don't want to break your train of thought, but I think this is quite important. Can you give some examples in the

unclassified area of discoveries in the process of military techniques and production——

Dr. AGNEW. OK.

Chairman HOLIFIELD [continuing]. Which are actual and of dual value to the civilian economy, immediately transferable to the civilian sector.

Dr. AGNEW. Well, one striking example is the whole program of fusion—fusion which ultimately will be the solution to the world's energy problems and will have distinct advantages in that everyone is surrounded with water, and you can get the deuterium out of the water, so there won't be have and have-not nations in the context of raw materials.

The fusion program really evolved from the weapons program.

Chairman HOLIFIELD. From the hydrogen bomb?

Dr. AGNEW. Yes; if you want to call it that. There are arguments as to where this initial activity really took place, whether it was specifically in the weapons laboratories or at Princeton. There are two places. Really all evolved at the same time. But it would never have happened at Princeton had they not had at the time, just preceding this, Project Matterhorn in which Prof. John Wheeler was trying to understand how one causes fusion to take place, but it was in the context at that time of the hydrogen bomb, to use that term.

Now, the fusion program, be it the conventional CTR magnetic confinement path or the laser fusion path, started as a direct result of people in the weapons program being concerned with this basic process; and then it evolved into how this could be transferred over to what you would call peaceful use. That to me is the most striking example of an area specifically out of the weapons program.

Another one which is going to be a long, roundabout way but I think it could happen, is the following: We are very much interested in materials in the weapons programs and in some of the military application. You recall there was a Rover program for space nuclear propulsion, and out of that program evolved materials to run at high temperatures. I think the real progress in the future in gas reactors is a result of this basically.

Another spinoff in the high-temperature materials is a rather unique concept of making holes in the process called "subterrene," which was recently demonstrated in the Washington area. This is where we actually melt rock and form the hole by the melting of the rock. Many people, industrial people have come around to see it and are interested. Oil well people are very interested for two reasons. One, when we drill this way in certain types of soil, such as alluvium, you may not need to put a casing in. For the lifetime of the bits, you may not have to bring up your drill system, you keep drilling the hole. And even more important, in my opinion, if we are going to put in the Alaskan pipeline—I personally believe that there are going to be some real difficulties putting in the pipeline, not because of what everybody thinks the problems will be, but the problems of digging the holes in order to put the caissons down, and in order to support the pipeline. They are having tremendous difficulty drilling the holes in the permafrost; drilling in a mixture of ice and rocks is presenting a

problem. They are having real problems to cope with. They can do it if they have very large drilling rigs, but there is a question as to whether or not it is going to be feasible to take those rigs over the terrain.

Using subterrene, I am convinced we can make, not a hole that you would normally drill to put a caisson in, but a hole—if you had some sand and you put a cup down in it, and you just make a hole where the edge of the cup is—we can drill a hole like that, and then they can slip the caisson down and grow it in, or freeze it in. We have shown this to several of the oil people, and the people that have to do the job are very much intrigued.

Unfortunately some of the management who haven't been out in the muck permafrost are saying, "Well, it hasn't been done yet, I worked my way in rotor rigs, and, by God, we will build a bigger rig and do it."

But, I have a feeling the subterrene technology, which by a circuitous route came from the weapons program, could well have an application even in our present problems with regard to putting in the Alaskan pipeline.

Mr. HORTON. You used the word "disastrous." As I say, there has been some discussion about splitting this off.

RESOLVING INTERFACES

Dr. AGNEW. I think it would be disastrous in that you immediately interject interfaces that don't exist now. Many times in a weapons production making any sort of a device, many times where you get in trouble with the Defense Department there is interface between two contractors. One contractor gets in trouble, let's say. In fact, I could give you an example in a particular missile called SRAM, where the contractor had some difficulties and he needed a half inch more space. Now, fortunately the technology in the AEC labs was such—this was an industrial contract, DOD contract—we were able to shorten our warhead so that we could place it in his missile. Had we not been able to do that, and we paid a penalty for it—had we not been able to do that, they would have had to renegotiate the contract; and having opened up the contract, it would have cost the Government a lot more money. Had all this been in one organization, the way we do in making a weapon, we would have worked out the interface problem on our own. We could have gone into our other space involving the production complexes; we could have worked it out mutually. There is no necessity to renegotiate a contract. In other words, we can give and take when we have a problem, if the production plant has a problem. We are in continual cooperation, continual communication, and continual transfer of information. If they have a problem, since we can consider them part of us, we give. If we have a problem, they give.

So you don't have these artificial barriers which you must have in the other type of arrangement because of contractual arrangements.

Mr. HORTON. I think one of the concerns was that if you left the national security part in, there would be a tendency to devote more of the funds and the personnel to the military than there would be to the civilian programs.

You have had experience with that, and I think perhaps your testimony on this would be helpful.

ENERGY AND NATIONAL SECURITY

Dr. AGNEW. Let me be specific with regard to Los Alamos. Our budget today is approximately two-thirds from the division of military application. The rest of it has no military application. It has national security implication. I think the whole energy problem is clearly connected with national security. But in the direct military DOD sense, one-third of our work has no connection with that.

Of the two-thirds which we get funded from the division of military application, half of that is what I call pure or applied research across the field. It has relevance to our military part, our weapon requirements, but it also is directly applicable to other areas.

For instance, take the laser fusion which started again under the division of military application. Some of the applications, I think, of that work are going to be as revolutionary as the first reactor under Stagg Field, or the first nuclear weapon, and I think these will be made known in the not too distant future.

I can't go into all the developments now, but I think you will find this in all national laboratories. We have a specific job to do. As far as the requirements imposed upon us by the Department of Defense, we are the Nation's armorers in the nuclear weapons field. It is reviewed in the present AEC budget, and the rest of the programs are also reviewed.

CIVILIAN BENEFITS TO MILITARY

Mr. HORTON. There is another phase of it the chairman asked you about, the research and development in the military field spilling over into the civilian area. I assume that it is true the other way also. In other words, by having this unique situation which you have now, with the whole research and development effort under one umbrella, I assume that if you have some accomplishments in what would be in the nonmilitary field, you might also find a spillover from that that would be of help to the military.

Dr. AGNEW. That is exactly right.

Mr. HORTON. So there are spillovers from both sides, so to speak.

Dr. AGNEW. As an example of this, to go back to the early days, people talked about hydrogen bombs, and at that time it was thought, if you are going to build a hydrogen bomb, and it was correct, you had to have hydrogen. At that time it was thought the way you did this was to use liquid hydrogen. As a result we at Los Alamos started a very strong—we still have it today—cryogenic program. This is low-temperature physics. In fact, I would say we have the best cryogenic laboratory in the world. These people, as a result of their expertise, liquid hydrogen handling, really evolved and set up the MBS laboratory at Boulder, Colo., which in turn supplied the technology, the basic technology that was needed for NASA to go in the Saturn program.

SUPERCONDUCTING ELECTRICAL ENERGY STORAGE

That hydrogen, the whole hydrogen business evolved from weapons requirements or what were thought to have been weapons require-

ment in the early days, and even today the same cryogenic engineering has led us to develop some concepts in the energy field, such as superconducting electrical energy storage.

Let me explain this very briefly. I think you are aware that superconducting material is material that has no basic electrical resistance when it is operating in a superconducting mode. That means if you put a current in the loop, and it is superconducting material, the current will continue to flow, no resistive loss, no heating, the current will continue to flow. There is quite a bit of energy stored in that magnetic field that accompanies this circulating current.

One can visualize a superconducting storage system in which you have a lot of current continually flowing with no losses.

When you need some of this electrical energy you draw it off. It is a completely new concept in storing electrical energy. I think you are aware of the water storage systems that are being developed on Lake Michigan, very large and very expensive. They are not too efficient because you are pumping water, then you are taking it during the off peak, then using that water in hydroelectric plants during the peak time in order to develop more power. If you could just run your plants all the time, making electricity, and directly store that electricity not through chemical reaction such as water, not through pump cycle, but actually store the electrical energy, we could almost double the effective amount of electricity we can have in this country without increasing the generating capacity, if one could do this.

Mr. HORTON. You have another great ability which I am sure won't show up in the biographical résumé; that is to make difficult subjects clear to the layman, and that is a very important aspect of what you are doing.

IMPORTANCE OF CIVILIAN CONTROL

Chairman HOLIFIELD. One thing I want to contribute from the background of my experience before the AEC was born. I was engaged in the fight along with others, for civilian control of atomic energy. What you are really saying is this, that because of civilian control—all of these scientists are civilians, they may have had military experience, many of them, but they are civilians—when they are doing work on military contracts, they are just as interested in the transfer of that information to the civilian sector as I am, or anyone else is. I am very much in favor of keeping something that has worked and worked well for the American people going just like it is, because I know that interchange of information does occur, and it is not compartmentalized into a one-purpose institution to defend our Nation, which is, of course, a very important purpose.

Dr. AGNEW. I think you are absolutely right, Mr. Chairman, and I would offer the proposal that if any of the individuals who believe that the weapons complex, that means the R. & D. and production, should be split up or put into a different box, if any of these people are honest individuals, objective individuals, if they will visit either of our laboratories, Los Alamos or Livermore, I think they will go away and change their mind. I would submit anyone who is making the proposal that we are both objecting to has never visited either installation to really see what is going on.

More than half of our facilities are wide open to the public, they are not behind a fence with a bunch of guards, we are open to the public. We have in the Clinton P. Anderson Meson Facility, which you and other members of the committee were instrumental in bringing into being, we have now over 900 users representing 44 countries in the world who have come and are planning to work at this facility. We had a very large meeting, and everything is open in the Laboratory.

Chairman HOLIFIELD. This is for the purpose of investigating the middle-energy range of accelerator physics, and practically all of that is directed toward civilian application?

Dr. AGNEW. Yes.

Chairman HOLIFIELD. In the medical field as well as in other fields?

Dr. AGNEW. That is right.

We have one group in that particular division specifically for applications and today there is a spinoff again from this accelerator technology, which was developed in the beginning for military purposes; in order to get the cross-sections which were required in order to understand the basic reactions in weapons, we had to develop better accelerators. The new accelerator technique which was produced for the LAMPF Facility, as it is called, is the technology which is now used in the private sector for producing all X-ray machines in this country and in the world. That transfer took place very quickly. Unfortunately for our people there are no patents involved, because they published the technology before patents were made, and so it is completely open. But that was good.

Chairman HOLIFIELD. Good for the benefit of mankind?

Dr. AGNEW. That is right.

Chairman HOLIFIELD. In other words, they got the benefit of that without having it constricted and withheld on a monetary basis——

Dr. AGNEW. That is right.

Chairman HOLIFIELD [continuing]. From utilization.

Dr. AGNEW. That is right.

I have a little bit more, Mr. Chairman.

NEC RESEARCH ROLE

It is wiser and proper that the licensing and regulatory function be separated although I am worried that the leadership for this important function may not be as readily available as you deserve to expect. In particular, I question the wisdom of that particular Commission engaging in research. Contracting for research yes, tasking ERDA, yes; but actually engaging in research, no. I believe that will only bring about duplication of facilities and an attempt to find talent which may not be readily available. I would prohibit the regulatory agency from actually conducting research. If they are authorized to conduct research, they will reinvent the wheel a century late. The talent will be in the ERDA and other places. The Commission should use it, not duplicate it.

Chairman HOLIFIELD. Where in the bill do you refer to this particular concern that you have?

Dr. AGNEW. Let me find that. There is a word in there.

Chairman HOLIFIELD. Page 21. The staff called it to my attention.

Dr. AGNEW. Let me see what caught my eye and what bothered me. The very beginning, line 2 and 3 on page 21, "The Nuclear Energy Commission may engage in or contract for research." I have seen what has happened, let's say, in the EPA as an example. They spent the first several years building up their own R. & D. capability, and I am not impressed with what they have built up. Had they gone immediately into using existing capability, they would have been much better off. I think the country would have been better off.

Chairman HOLIFIELD. That is what you mean by reinventing the wheel?

Dr. AGNEW. That is what I mean by reinventing the wheel. It is a natural thing if a person is in charge of an organization. He will have his people come to him and say, "You can't depend on those other people, we need our own." I get the same thing myself. And more administrators are. In fact, I think that is the way wars start. You have a staff that tells you that they can't let the other guy do to you what he is going to do to you, and the next thing you know you are saddled up in armor and a white horse and go out and come back and you have egg all over your face. And you find, if you ever get around to having a drink with the other guy, that is what happened to him, too. I just think that in this particular instance, there is competence in ERDA, there is competence in industry to do this. I think these people should decide what needs to be done and then task other agencies; if the other agencies, other existing people are not responsive, then I think NEC can do this.

Chairman HOLIFIELD. I have been concerned about this spinoff, not that I am against it, because for many years we have been trying to find a way to do this. I think this is the right time to do it. I have been concerned that this regulatory and licensing commission would want to go and reinvent the wheel, go out and ask for the building of a bunch of laboratories, recruit a bunch of scientists, some of them pirated from ongoing scientific projects, at better salaries, of course, and that is the way, that is the pattern, when you want to build an empire. And can you conceive the Nuclear Energy Commission, this regulatory and licensing body, needing to do—on a personally directed basis—research and development in any field which they are going to regulate? Years and years of expertise, both as to equipping the facilities and personnel, exists in the AEC laboratories or under contractual arrangements. NEC could get the information cheaper and quicker than they could get by building their own laboratories and starting out from scratch.

Dr. AGNEW. I cannot conceive of their having this requirement.

Chairman HOLIFIELD. Well, I have been concerned with this, too. And the key words in this is "engage in."

Dr. AGNEW. That is right.

Chairman HOLIFIELD. In this second line, "engage in or contract for research."

Dr. AGNEW. Or task, you could put in the word "task," or contract, is the way to do it. But I would also say they could almost direct that it get done, but I think it should be done in the other agencies.

Chairman HOLIFIELD. If you read further in the bill, we put language in there I think that takes care of that point.

Dr. AGNEW. That is right.

Chairman HOLIFIELD. "In order to achieve the objectives and carry out the purposes of subsection (a), the Energy Research and Development Administration and all other Federal agencies shall, to the extent practicable, (1) cooperate with respect to the establishment of priorities for the furnishing of such research services requested by the Nuclear Energy Commission as the Commission deems necessary for the conduct of its functions; and (2) furnish to the Nuclear Energy Commission, when requested, on a reimbursable basis, through its own facilities or by contract or other arrangement, such research services as the Commission deems necessary for the conduct of its functions." That means ERDA could go into the private sector, if it did not have that specific expertise, which I can't conceive of, because these laboratories have built the whole structure and know most about it, in my opinion. But if there is a specialty in the private sector, paragraph (2) provides that ERDA shall furnish through its own facilities or by contract or other arrangement, such research services as the Commission deems necessary for the conduct of its functions, and I can't see how you can write it any plainer than that.

Dr. AGNEW. I think that is absolutely right. What these little words "engage in" at the beginning mean, I think they will——

Chairman HOLIFIELD. Someone may get the idea that they want to build their own laboratories and build an empire to parallel, with all expense to the Government, the resources that already exist.

Dr. AGNEW. Also I would like to mention I think this is an integral part of the R. & D. work that is going on, and to separate those two by building up another set of laboratories in order to get whatever research they deem necessary, I just think would be wrong. It should be an integral part of the research that is going on. That research is going to be done in ERDA, and I think the other specific tasks that regulatory may require should be done in the same complex, be it national laboratories, be it industry.

In conclusion, I urge passage of this legislation as soon as possible. In particular, if you deem it feasible, I would urge that you include the suggestion I have made with regard to multiyear funding for at least the first 3 years with no OMB interference.

If you have any further questions, I would be happy to attempt to answer them.

Chairman HOLIFIELD. I want to thank you very much for your testimony.

Dr. AGNEW. Thank you, Mr. Chairman.

Chairman HOLIFIELD. We have another member here, a valuable member of our committee, Mr. Mallary. Do you have anything that you wish to question him on?

Mr. MALLARY. No; I have enjoyed it very much but I shall not ask any questions.

Chairman HOLIFIELD. Mr. Fuqua?

Mr. FUQUA. I have no questions.

INVITATION TO VISIT LABORATORY

Dr. AGNEW Mr. Chairman, I might add if any of the members of the committee or any colleague at any time would like to visit the

Laboratory, we would be delighted to have you. We are proud of what we are doing. We believe the country has a problem. We want to solve it. We have solved past ones.

Mr. HORTON. One of the most interesting trips I ever had was when I went out there several years ago with Congressman Lujan. I was there at that time in connection with the Small Business Committee assignment I had. I wish we had had more time, because I was tremendously impressed with the work of the Laboratory and it was very helpful to me in the conduct of my duties as a Congressman subsequently. I want to emphasize what you said before, it is very important for people unfamiliar with these programs to get out and see the national security or the military use of this research and development. To see this at firsthand I think is very, very helpful. I do want to express my appreciation again to you at this time for the manner in which you handled our earlier trip.

Dr. AGNEW. Thank you.

Chairman HOLIFIELD. I want to say, too, I certainly agree with the suggestion you made. Now that the members of this committee have taken on this particular responsibility for energy reorganization, I hope that they will be able to visit your laboratory and the other laboratories, and I might even be persuaded to go along, because it has been at least a year since I have been to your laboratory.

Thank you very much and I hope you make your plane.

Dr. AGNEW. Thank you.

[The biography of Dr. Agnew follows:]

BIOGRAPHICAL SKETCH OF DR. HAROLD M. AGNEW

Harold Agnew was born March 28, 1921, in Denver, Colo.

He graduated from South High School in Denver in 1938. In 1942, he received his A.B. in chemistry from the University of Denver with physics and mathematics as minors and earned a Phi Beta Kappa key for his scholarship. He attended the University of Chicago on a National Academy of Science Fellowship from 1946–48, receiving an M.S. in physics. In 1949, he received his Ph. D. in physics from the University of Chicago.

Dr. Agnew has been closely associated with the nuclear energy program since 1942 when he joined the Metallurgical Laboratory of the U.S. Army's Manhattan Engineer District and was one of the group which worked with Enrico Fermi on the first nuclear fission chain reaction at the University of Chicago. On December 2, 1942, man first initiated a self-sustaining nuclear chain reaction, and controlled it.

On April 1, 1943, he joined the staff of the Los Alamos Laboratory (the word "Scientific" was not added until 1947) where he made significant contributions to the work of developing the first atomic bomb. Dr. Agnew flew with the 509th Bombardment Group as a member of the scientific team on the first nuclear weapon strike against Hiroshima, Japan.

In 1946, Dr. Agnew left Los Alamos to earn his doctorate with Enrico Fermi at the University of Chicago, but returned to Los Alamos on August 10, 1949, as a staff member in the Physics Division. He was assistant to Technical Associate Director from 1951 to 1953; associate division leader, Theoretical Division, 1954–56; and from 1956 to 1961 was alternate Weapons Physics Division leader.

Dr. Agnew left the Laboratory on a leave of absence in 1961 to serve as scientific adviser to the Supreme Allied Commander in Europe at NATO headquarters in Paris. Upon his return to LASL, in 1964, he was named head of the Weapons Physics Division. In this capacity he directed specific investigations related to development of nuclear components of weapons. The scope of this work extends from fundamental physical and chemical research to actual detail design and testing of weapons. On September 1, 1970, he became Director of the Los Alamos

Scientific Laboratory, succeeding Dr. Norris E. Bradbury who retired after 25 years as Director.

His memberships include: Beta Theta Pi, Sigma XI, Omicron Delta Kappa, Phi Beta Kappa; member, U.S. Air Force Scientific Advisory Board, 1957–68; member, Von Karman Study Group, 1960; consultant, Joint Committee on Atomic Energy, 1960; member, USAF Minuteman Planning Committee, 1961; chairman, U.S. Army Scientific Advisory Panel, 1964–70, currently member; chairman, U.S. Army Combat Developments Command Scientific Advisory Group, 1965; member, President's Scientific Advisory Committee, Aircraft Panel, 1965—, Air Traffic Control Panel, 1970; member, Defense Science Board, 1966–70; member, NASA Aerospace Safety Advisory Panel, 1968 to present.

Dr. Agnew is also a fellow of the American Physical Society.

In recognition of his contributions to the nuclear weapons program he was awarded one of the AEC's Ernest O. Lawrence Awards in 1966. In the spring of 1971 he received the NASA Public Service Award for his dedicated service as a member of the Aerospace Safety Advisory Panel which contributed significantly to the safety and success of the Apollo program.

In addition to his technical achievements, Dr. Agnew has served two terms as a member of the New Mexico State Senate, 1955–61; Los Alamos County Board of Education Trustees, 1950–55 (president, 1955); member of the Governor's Radiation Advisory Council, 1959–61; New Mexico Health and Social Services Board, 1971–73; and member, Woodrow Wilson National Fellowship Foundation, 1973 to present.

Dr. Agnew and his wife, Beverly, reside at 1459 46th Street in Los Alamos. They have two children—a married daughter, Nancy Agnew Owens, born in 1944, and a son, John, born in 1949.

Chairman HOLIFIELD. I appreciate your coming in from Albuquerque.

Now I welcome an old personal friend of mine, a man who has been in the research and development business for a long, long time, and now has a very heavy responsibility as representative of the Ford Foundation in this field, Mr. David Freeman.

We appreciate very much your appearance here this morning and we look forward to your testimony.

STATEMENT OF S. DAVID FREEMAN, ENERGY POLICY PROJECT, FORD FOUNDATION; ACCOMPANIED BY J. FREDERICK WEINHOLD

Mr. FREEMAN. Mr. Chairman, I am delighted to be here. I must begin with an apology to the committee. When I was invited to testify there just wasn't enough time to reduce the thoughts that I have about this matter to writing and I accepted it with the understanding I would not have time to prepare a written statement. I regret it very much.

This is a subject that I have lived with for the last 10 years, many of them in the White House Office of Science and Technology, trying to struggle with these agencies on a piecemeal basis. I have with me Mr. Fred Weinhold, who was my associate when we were in Government in the R. & D. effort in the energy field, and who is with me at the Ford Foundation energy policy project.

Chairman HOLIFIELD. Could you briefly give us your background and experience in the scientific field?

Mr. FREEMAN. Yes.

Chairman HOLIFIELD. Then, if you will, furnish us a formal biography?

Mr. FREEMAN. Yes, I will.

[See p. 237.]

Mr. FREEMAN. My own background is that of an engineer who turned lawyer. I worked with the Tennessee Valley Authority for a number of years, first as an engineer, then as a lawyer, and was with the Federal Power Commission in the early sixties when Joseph Swidler was Chairman. I was briefly in private law practice, then under President Johnson returned to Government to head a new energy policy staff, where from 1967 until the Office of Science and Technology was eliminated, 6 months ago, there was an entity that attempted to coordinate energy policy and, of course, we spent a lot of our time on the research and development side. I left Government in 1971 and have been teaching at the University of Pittsburgh and am now engaged in a major study of energy policy which the Ford Foundation is funding.

Our testimony this morning, Mr. Chairman, is strictly personal and based upon our intimate experience with this issue in Government. Our project reports will be completed in the coming months, but our testimony this morning represents our own personal views.

Chairman HOLIFIELD. What is the size of your budget in the Ford Foundation for this energy purpose?

Mr. FREEMAN. It is a study that has been in progress for a year and a half now. We have a budget of upward of $3 million. We have put $2 million into grant contracts for building block studies of almost every facet of the energy puzzle, and we are hopeful to start publishing these reports in the spring and bring them out one at a time as they are completed to provide some fresh policy-oriented analysis of the many issues that now have hit us with an energy crisis that no one claims is not a crisis at this stage of the game.

Chairman HOLIFIELD. There are a few people who claim otherwise, but they are pretty poorly informed, in my opinion.

GRAVITY OF ENERGY SITUATION

Mr. FREEMAN. If we don't get some action in the form of more stringent conservation measures, I think everybody in the country who is not aware of it unfortunately is going to be aware of it. The situation to me is very, very serious, and I think we all are soberly aware of the responsibilties that we have as an independent group trying to help the Congress, the executive branch, and primarily the general public to understand the complexity of this issue and the fact that, in my view, the problem is not going to go away in the near future. Energy is a problem we are going to be struggling with probably for the rest of our lives, hopefully not in this crisis manner. But it is going to take a long-term effort and that is the reason why I feel the establishment of this Energy Research and Development Administration is such an important element of developing an energy policy for this country.

This leads into what I wanted to say initially; namely, we shouldn't lightly skip over the importance of establishing this agency. I can't get into my testimony without recalling what I think it is fair to say was bitter experience in the executive branch, trying to enlarge

the scope of research and development in the energy field outside of the nuclear area with the existing setup. In my judgment, it is just impossible to get the kind of research and development programs that this country needs with the existing scattered array of agencies which, outside of the Atomic Energy Commission, just don't have a critical mass of competence in-house to put together the kind of programs that this country needs. It is really just that simple.

In addition, the other reform that this bill provides—the separation of the regulatory functions—I believe is a long overdue reform primarily to give the public greater confidence in the licensing work. I am not sure that the licensing work will change that much, but I believe that people generally will have greater confidence in the work, and I think it is a reform that is very much needed for that reason alone.

The existing agencies in the research area are single minded. They were set up to be that way, and that has been their pattern. There very badly needs to be an agency head to bring together the kinds of projects that we associate with the work of the Manhattan project and work that the AEC has done in the past.

I believe that H.R. 11510 provides a good framework. We will have some specific suggestions to make to strengthen the bill, but it seems to me that the bill does provide the essentials of what is needed.

DEPARTMENT FAVORED

I would say this, however, that while setting up an energy research and development agency is an essential task immediately, I don't think we can turn our backs on this issue and say that, by just setting up an energy R. & D. agency, we have accomplished something in the long run. I am very much concerned that an agency that is just research and development all by itself, divorced from the energy policy-making and from operations, from the real problems, could wither and could get off the track over the years. Energy is such an important issue that we should be working toward creating a Department of Energy. Perhaps this energy research and development agency could be the nucleus of it. But, in passing this legislation and moving ahead to pull the R. & D. together and putting someone in charge of it, we should recognize that that is just the beginning and not the end of the reorganization needed in this area.

Chairman HOLIFIELD. I agree with the gentleman. I agree that a department, of course, has more prestige than an agency has, but an agency has more prestige than a commission has, and this will be an independent agency. It is something, under the urgency of today, that we can get going without the very difficult job of creating a department.

Now, I think I can speak with some experience, because I handled the legislation that created two departments, and I think I am the only Congressman in the history of our country who ever did that. So I have that unique bit of service. The Department of Housing and Urban Development and the Department of Transportation both came from this committee, and I know the travail we had to go through in order to get those two Departments established. We have got some-

thing in being here that we can transform into an ongoing job, and I believe you will agree with me the urgency of the time says, do what you can do today, what you can do politically, what you can do practically, and get on with the job. And if this agency does its job, and the next Congress or a future Congress decides to give it the prestige of a department, and I strongly believe that the urgency of this problem deserves a department, I don't have any hesitation in saying that, but I do think for the time being we have to build the house with the lumber we have got, and we have the lumber and we have the facilities, we have the scientific people, and I say let's get on with the job.

Mr. FREEMAN. Mr. Chairman, you have expressed my views better than I did. I think it is useful that the legislative history of the enactment of ERDA reflect your views and those of the witnesses that share that view that this is a giant step, but it is a step toward a larger goal.

Chairman HOLIFIELD. I hope so.

QUESTION OF NUCLEAR DOMINANCE

Mr. FREEMAN. Mr. Chairman, there is really only one major concern that I have heard expressed about this agency, ERDA, that would be created and I want to speak about it rather candidly. There is a concern that, if you have a mountain such as the Atomic Energy Commission and a few molehills such as the research in the other areas and combine the mountain with the molehills, you still have a mountain, and when the new agency is created, it will still be the Atomic Energy Commission by a new name, with a little added here and there. I know that is not the intention of the committee, not the intention of the statute, and not the thrust of what is going to happen.

Chairman HOLIFIELD. It is not the thrust of the administration either, because the President in his speech mentioned a figure of $10 billion over the next 5 years to go into this agency for ongoing research programs, and he especially mentioned coal and other programs which we know are terribly urgent. And so I want to say that as far as this committee is concerned, the members of this committee, we are going to look at this thing realistically. You have heard the two laboratory directors testify this morning, and you have heard their enthusiastic support of the bill and their willingness and eagerness to get into these problems which are affecting our Nation, are going to affect it very badly unless we solve them.

Mr. HORTON. I might say also in that connection, Mr. Freeman, that yesterday when the Director of OMB was testifying, I spent quite a bit of time questioning him on this very subject. He said the administration, just as the chairman has indicated, would have more than one horse to feed. Funds will be provided adequate to the needs of each one of these areas.

As the organizational chart shows, we have set up the agency specifically so that there will be equal status for these disciplines.

QUALIFICATIONS OF ADMINISTRATOR

Mr. FREEMAN. I raise this point because I think it is useful that it be stated perhaps over and over again. I will make the point in an-

other way. The most important decision with respect to this new agency is the appointment of the Administrator to head it. It seems to me that in order for the public really to accept the fact that this is a new agency, it should be understood that people who have been involved in promoting coal or atomic energy at present, the policymaking officials that are now in Government, who have put together budgets, that have pushed one particular form of energy, probably should not be appointed to the head of this agency. It seems to me quite important that we bring fresh new talent with a "can do" point of view that will give the general public the feeling and the confidence that we have created a very new entity that will get this job done.

It seems to me people who have been involved in pushing their budget, be it for coal research, atomic energy or any of the programs that we now have, will either have to lean over backward to prove that they are being fair or risk criticism of being proved unfair.

So I would suggest that while this is nothing that can be written into a statute, it is my view that perhaps the key item in this new agency is the appointment of a head of it. A lot of thought should be given to bringing in someone with the expertise and the ability to manage this kind of program to get the job done, who has not been intimately associated in the recent past with one or more of the forms of energy that will be competing for pieces of the pie.

There are several specific suggestions that I should like to offer for strengthening the bill which, as I say, I think provides an excellent framework for what we are trying to accomplish.

10-YEAR PLAN FAVORED

It seems to me that the new Administrator should be directed in the statute to provide a new energy R. & D. plan for the agency. He should not have to inherit the programs that have been put together by people working in the capacity of Atomic Energy Commissioners or Office of Coal Research heads or whatnot. It seems to me the statute should provide that, at the end of the first year, he present to the Congress and to the American people a 10-year plan to get the job that we want done, a plan that has been circulated to the Environmental Protection Agency and Antitrust Department of Justice for review, and have it laid before the Congress and distributed to the people.

This would serve two purposes. It would give the new Administrator a mandate to make a fresh start, to review everything that is going on, but to come up with new programs and have it his program. It would also give the Congress an opportunity to review this crucial first budget, not just on a basis of that year's budget, but laying out a plan similar to what the AEC put together in 1961 or 1962 that laid out a 10-year program that has been essentially successful and in developing the nuclear option. We have drafted some language which we could provide that would translate this idea into a section 103 (8) or (9) of the act.

It seems to me this would be useful to the Administrator, useful to the Congress and useful to the public.

Chairman HOLIFIELD. Will you submit that language? Do you wish to read it?

Mr. FREEMAN. Yes, sir; if I may.

Chairman HOLIFIELD. Go ahead.

Mr. FREEMAN. A proposed section 103(8) I assume is what it would be:

> Each year at the time the Administrator's budget is submitted to the Congress for authorization and appropriation, he shall submit to the Congress a report which (a) assesses the state of energy technology in the United States and abroad; (b) presents a detailed Federal energy research and development plan for the next 10 years, including specific programs, milestones, and deadlines for their completion; (c) incorporates the comments of other responsible Federal agencies on environmental and antitrust implications of the plan.

Chairman HOLIFIELD. I appreciate you presenting that because in the printing of this bill there was a paragraph inadvertently left out. It was the reporting requirement. This bill was dropped in, this revision of title II and III of H.R. 9090 was dropped in 2 hours before the adjournment for the Thanksgiving recess, and we were working against a deadline to get the bill in. The language intended for the bill didn't have quite as much detail as you propose and we are glad to have this information. We will certainly look at it very carefully.

I agree with you on a long-range plan. I don't want, however, to stand still in the next year waiting for the plan because, as you know, there are ongoing programs in your field, in the field of Dr. Chauncey Starr's organization, and in our laboratories now, and we want no interruption. We want that plan, whether it be a 10- or 5-year or whatever it is, we want that to be thought out concurrently with ongoing programs so that there will be no delay in the present programs, and I believe that would be your thought, too.

Mr. FREEMAN. Entirely. The motivation of requiring this requirement is not to delay what is going on, but to put some steam behind coming up with new programs and new thrusts and giving the Congress an opportunity, and the people an opportunity, to react to those plans and be in on the takeoff so we can all be in on the landing. I think it is important to get——

Mr. HORTON. There is certainly no reason why we can't include some language in the report to indicate that, Mr. Chairman. We can certainly indicate the hope of the Congress that goal setting will be accomplished.

I agree with you, you are not going to accomplish anything unless you set goals.

CONCERN FOR NONNUCLEAR RESEARCH

Mr. FREEMAN. That is right. Mr. Chairman, I have two or three other points I should like to make.

One, it seems to me the concern expressed that we have neglected the nonnuclear research over the past and have some catching up to do in those areas should be reflected in the bill. I have always been critical of the people who have criticized the Atomic Energy Commission program mainly because the Interior Department and other agencies have not been able to mount a program in the other areas. It is not a question, or should not have been a question, of dividing a fixed pot and holding back the only programs that were moving ahead. We are in a new era of awareness of ongoing programs, and I think it is important that this bill reflect the sense of the Congress and the people

that we want to continue as hard as we can with the things that are underway, but we want to launch new programs in the areas that have been neglected. It would seem to me a section should be added to the bill along these lines in the directions to the Administrator—because of the past neglect of nonnuclear research and development; he should undertake new programs for all such sources that hold promise of large supplies of economic energy on as large and rapid a scale as the state of the article permits.

It seems to me language to that effect in the statute would give the Administrator a sense of direction for new programs and reflect a genuine concern.

Chairman HOLIFIELD. It would also complement the organization plan that you have a copy of before you, which does set forth on the same level as nuclear energy development the fossil energy development and the advanced stages and so forth. So, that or similar language certainly is in accord with the spirit of what this committee thinks should be done.

Mr. FREEMAN. That was my understanding, and these suggestions were made to clarify and make express items that were either expressed elsewhere or implicit in everything that has been said.

INDUSTRY PARTICIPATION

There is one suggestion that I have in the way of interpretation of existing language in the bill. It seems to me important in some of these research and development areas, where perhaps the technology is close enough at hand that the Government does not need to build demonstration plants itself, that there be authority for the Administrator to contract with private industry and in a sense pull the technology out of the marketplace rather than the Federal Government pushing it all the way through.

Chairman HOLIFIELD. Let me question you on that point now, because I have had a lot of experience, you know, in getting this liquid metal fast breeder going. It has been delayed a couple of years because of the decision that private industry should participate, and it took that long to pick up pledges of $240 million from the private sector. The work is going ahead under the arrangement that you are familiar with, and it is going ahead with private industry doing the job, but it was like pulling eyeteeth to get the $240 million pledge over a 10-year period, and that is only $25 million a year. A massive effort was made by the people in private industry. They were enthusiastic, and they went out to do a good job. It was a committee of three people, all of them in the utilities business, that went to their fellow utility people to get this money, and I am telling you it took 2 years to get pledges of $25 million a year for 10 years.

Now, that is what you are up against when you are trying to get something done and get it done urgently. I am not blaming them. They have to invest their money to make profits, and research and development too often has no immediate profit, although it may have billions of dollars of benefits in the future. And so we have to move in a way that we can, and even with this massive effort that was made, the Federal Government probably will put in three to one on this liquid

metal fast breeder project. So experience in this field suggests that to express something that is desirable is one thing, to express something that is practical, to get it done, to raise the money to pay for it, is another thing.

Mr. FREEMAN. Mr. Chairman, I am painfully aware of the problems that we have had in getting the breeder program moving with the troika in charge of it and all of the administrative arrangements.

Chairman HOLIFIELD. The price we have paid in the form of management we had to pay because of the participation, and reluctance in some instances, participation of private industry in this project——

SHALE PROSPECTS

Mr. FREEMAN. What I had in mind is something really quite different from that. The situation perhaps could be illustrated with the shale oil. If the technology is there, and if the uncertainties are uncertainties that are strictly financial in nature, it is possible that the Federal Government could use its purchasing power for oil and simply take bids and agree to buy shale oil from the lowest bidder, and perhaps that shale oil plant might be built sooner than if we tried to go another route.

I realize when the technology is not there, when it is very risky such as——

Chairman HOLIFIELD. I don't want to get into an argument with the gentleman, because I think we are both hitting for the same objective, but the gentleman knows full well that to get 1 million barrels of oil out of shale means moving as much solid material as digging six Panama Canals annually, and more water to process the shale than you have in the Colorado River, which we in Los Angeles and California are not going to let you take, we want to drink it to keep our people alive. So you have the water problem, the massive movement of rock and dirt, and a technology that is a potential resource. I am all for it, and we can buy it. For instance, at the bottom of page 17, of the bill, the Administrator is authorized to acquire copyrights, patents, and application for patents, designs, processes, and data. We may put the word "specifications" in there, too. So, we are anticipating language in the act, which will make possible what the gentleman says he would like to see, and I would like to see.

Mr. FREEMAN. Mr. Chairman, it is my opinion that the authority is in the act and I was not suggesting any new authority, I was simply saying that in the future in the array of ways for implementing this program, it is primarily going to be a matter of the Federal Government funding first pilot plants and then demonstration plants—that is going to be undoubtedly the normal and the dominant mode. But there is another possibility where there is technology, especially related to the production of oil, an industry which you know receives tax incentives and others that give them more cash flow in a sense than the utility industry. It is possible that the contracting authorities, especially since the Federal Government has to buy a lot of oil anyhow, could be used to advantage, and I think the language in section 108 provides that authority. I don't intend to dwell on it. I cannot foresee any of the major research efforts that are still in a very, very iffy pilot plant ever getting there without the Federal Government

pushing it, but I do think the other option should be kept in mind and I wanted to comment, especially if the technology is there and it is possible to move faster.

Chairman HOLIFIELD. I agree with you that the Government should not re-invent the wheel either.

Mr. FREEMAN. That was the point I wanted to make.

Chairman HOLIFIELD. You made the point, and I agree with you.

ADDITIONAL RECOMMENDATIONS

Mr. FREEMAN. There is a point, a small point, that I would like to make about section 103(6), and it is just to add the authority to enter into joint ventures with other governments, if that is appropriate.

It is conceivable that perhaps the Japanese or other governments might want to contribute financially to some of the R. & D. projects that we are proposing, and I would not want to preclude that as an option. I suggest that perhaps language could be added to section 103 (6) that would authorize that, subject to congressional and other approval, of course, in due course.

Another point that I would like to suggest, and I think that this is one of some importance. The organizational chart in terms of the statutory assistant administrators, while it is excellent in the sense that it identifies the various components of the Agency and gives them a sort of life of their own, does lump energy conservation in the same boat with environment and safety. They are related in a sense, but it is my feeling that the research and development for more efficient utilization of energy, over the life of this Agency, could and should be an important enough activity to warrant a separate assistant administrator. Environment and safety are, in a sense, related to all of the options and could also be separate.

It also might be useful to give this new Administrator one statutory assistant administrator that he could designate for activities that become important over time that we don't foresee now.

These are suggestions. The first to emphasize that energy utilization is a very important aspect and deserves a separate box of its own, and also to give the Administrator a bit more flexibility than perhaps he has with naming precisely all of the assistant administrators.

Chairman HOLIFIELD. We have in the bill, I believe, authority for seven additional officials without specifically designating their functions. So it is possible that that can be effected, without changing the structure of the bill, by language in the report which would recommend that one of these seven high-level officials be assigned to more particular duties, and it would probably be done anyway.

Mr. FREEMAN. I think it is fairly important that you consider the establishment of a separate Assistant Administrator for Energy Utilization Technology.

OFFICE OF INVENTIONS

There is another point that grows out of our experience in Government. When we were in the Office of Science and Technology we used to get on the average of one or two or three letters a week from poten-

tial inventors, small people who thought they had an idea and didn't have the money, or know-how, to go about developing them. I don't know whether you need the express language in the statute, it probably covers it, but a small office of inventions that would be able, with the help of the Federal laboratories, to look at these ideas sufficiently to see if they have any merit and to provide small assistance to small individuals and businessmen who have ideas. I think it is an important part of an energy research and development agency. It is perhaps a small team, but among all of the crackpots there may be a Tom Edison or two. These letters are not now evaluated by the Government. We usually send back a form answer because we don't have the wherewithall and capability, but within the laboratories that will now be put together in this Agency, there should be a specific task of at least looking at these proposals sufficiently to see whether there is anything to them and providing financial help if necessary if there are.

STUDY OF MILITARY ROLE

There are two final points if I may. I listened to Mr. Agnew and others speak about the relationship between the Defense activities and the other research, and I am certainly impressed with their firsthand knowledge and feeling of importance. I do think that people have raised the question, and there is a question about putting a person in charge of energy research and development and having to also learn about and be responsible for the military side. I would suggest that we go ahead with the bill as it is, but have in the committee report and the bill itself an admonition that, based on his first year or 2 years' experience in running this Agency with the combined functions, that the Administrator furnish a report to the Congress giving his recommendations. After all, the proof is in the pudding and if the military side proves to be a diversion, if he has more than he can do, then there ought to be some thought given to resolving the problem. I would think that there should be a specific item in the legislative history, the committee report, to ask the first Administrator to tell us, on the basis of his experience, whether this is hurting or helping and make appropriate recommendations.

NEC REVIEW OF ERDA FACILITIES

There is one last item. There are questions that are raised about the authority of this new regulatory Agency over the facilities that will be operated by ERDA, and you have a section 202 that covers that matter.

I would think it would be useful, too, that we have at least an advisory opinion, such as now takes place on the military reactors, from the regulatory agency to this new agency covering all of its in-house facilities. I think the section you have here intends to cover the problem, but it would seem to me it would be a useful thing for this regulatory agency to do, to review the facilities that would be owned and operated by the research and development agency, at least on an advisory basis, with this advice made public.

I feel that the Government itself should have some sort of review of its own facilities and that this new agency would have the independent bases for doing so, and while perhaps a formal licensing procedure for in-house research facilities would not be in order, it seems to me that a review similar that now takes place with the military reactors and advisory review from the regulatory people would be a good idea.

Chairman HOLIFIELD. Do you think the ACRS could handle that?

Mr. FREEMAN. Perhaps so. Perhaps they could be the medium to make this review, but there should be independent review by someone other than the people actually doing the job.

Chairman HOLIFIELD. The bill's analysis does make it clear that they can use ACRS for this purpose.

Mr. FREEMAN. Perhaps that would be the way to handle it. I am not sure.

Chairman HOLIFIELD. Well, it is an advisory committee of great expertise that is in being, and you know its functions.

Mr. FREEMAN. Yes, sir.

My point is it would be useful to have some independent review of all of its in-house facilities and perhaps that committee could do it.

If we have another moment or two, I believe that Mr. Weinhold would like to add one or two points.

Chairman HOLIFIELD. Very good.

We are trying to get to Dr. Steinhart from the University of Wisconsin, so will you be as concise as possible?

Mr. WEINHOLD. Yes, sir.

I have two basic technical points that deal with the power section, section 108, that hopefully will clarify it or strengthen it in the long run.

PATENT POLICY NEED

One thing that disturbs me, when looking at the section dealing with the contracting and patent authority, is that nuclear is set apart from the nonnuclear work of the administration. There are reasons for doing this now. There are lots of difficult patent policy and technical questions where AEC's Atomic Energy Act takes a different approach from the rest of the Government. I think we have to go ahead with the separate approach now because of the difficulty in changing it quickly—but I think there ought to be a requirement that the Administrator come back within a year, or some finite period of time, with a uniform system of patent policy and contracting authority. We don't want to get whipsawing back and forth over the question of whether a project is nuclear research or is fossil fuel research.

Chairman HOLIFIELD. I think that is a desirable goal. But if the gentleman is acquainted with the history of trying to get a uniform patent program in the Congress and in the executive branch, he will realize that that is probably one of the most difficult things that is possible. I agree we should have a uniform—the President's Executive order on that subject matter is about the nearest that we have come to a uniform treatment of this matter, and I believe that is embodied either in the analysis or in the——

Mr. WEINHOLD. It is in the act for the nonnuclear——

Chairman HOLIFIELD. We do refer to it.

Mr. WEINHOLD. I would just hope we don't continue the separation; that the act not perpetuate indefinitely two different sets of regulations for work being done by the same agency. That is my point rather than a uniform policy for the whole Government.

Chairman HOLIFIELD. We are faced with the practical reality, if I understand what you are saying, that the Defense Department handles, as you know, the patents different from AEC and from NASA. This is an old problem we have had for a long time. We have never been able to resolve it, and I would share your objective certainly, but I just don't believe we can burden this legislation with such a load. I happen to know from a long experience that patent policy is very controversial in the Congress, and I just don't want to get embroiled in that kind of fight at this time because of the urgency of the legislation.

Mr. WEINHOLD. That is my point: we should not try to resolve it at this point, but leave it to the Administrator to come in with a uniform set of rules within a year or a similar deadline.

Chairman HOLIFIELD. There will be a number of problems, of course, that we are going to ask the Administrator to solve. We don't claim this bill is going to solve every problem in the world. We are painfully aware of some of the problems that remain unsolved and have remained unsolved for the 30 years I have been in Congress.

PROCUREMENT LEVERAGE

Mr. WEINHOLD. My second point deals with the idea of using the procurement authority that Mr. Freeman mentioned for fuel. It is also a very valuable authority or mechanism for R. & D. on utilization technology. I think the idea of the Administrator working with GSA, DOD, and other agencies which buy a lot of houses and cars is important. Using those procurements as part of an overall strategy to implement technology is a very useful concept that should be recognized in the legislation.

Chairman HOLIFIELD. My staff informs me that that is covered in the bill.

Mr. WEINHOLD. In talking with some of the OMB people yesterday, it was sort of questionable how the legislation would be interpreted. I wanted to emphasize——

Mr. REICH. There is room for some confusion. I am speaking from our limited point of view. We are confident the bill does contemplate the applicable authorities, including those that you mentioned.

Mr. WEINHOLD. Fine.

Chairman HOLIFIELD. For the benefit of the record, this is our consultant and counsel, Mr. Reich, and he has about 25 or 30 years with the Atomic Energy Commission in the legal department.

Mr. FREEMAN. I hope our comments have been helpful in making suggestions for strengthening what seems to me to be extremely important legislation and really will be the culmination of a dream that those of us who have struggled with this program have had for many, many years.

Chairman HOLIFIELD. We have struggled together, haven't we, and I do wish to thank you and your associate for your testimony and your valuable suggestions. The staff is going to look at every one and see what we can do in regard to them.

Any questions?

Thank you very much.

[Mr. Freeman's and Mr. Weinhold's biographical sketches follow:]

BIOGRAPHICAL SKETCH OF S. DAVID FREEMAN

Mr. Freeman is Director of the Ford Foundation's energy policy project and is also writing a book on national energy policy sponsored by the Twentieth Century Fund. Mr. Freeman resigned as Assistant Director for energy and the environment in the President's Office of Science and Technology (OST) on September 1, 1971. He served in OST from December 1967 and headed an energy policy staff with the responsibility for coordinating energy policy on a governmentwide basis. In the last year in addition to continuing his energy policy coordinating function, Mr. Freeman's responsibilities also included the activities of OST in the broad area of environmental quality.

From January 1966 to December 1967, when he returned to government, Mr. Freeman practiced law in Washington as a partner in the firm of Swindler and Freeman. Prior to entering private practice, he was Assistant to the Chairman of the Federal Power Commission from 1961 to 1965, playing a leading role in the conduct of the FPC's National Power Survey and in the planning and execution of the FPC's electric power and natural gas regulatory programs.

Before moving to Washington in 1961, Mr. Freeman served as an attorney with the Tennessee Valley Authority in Knoxville, Tenn. from 1956 to 1961, specializing in legal aspects of TVA's power program and in handling transportation matters before the Interstate Commerce Commission and the courts.

Born in January of 1926, Mr. Freeman is a native of Chattanooga, Tenn. He holds a civil engineering degree from Georgia Institute of Technology and a law degree from the University of Tennessee. He worked for TVA as an engineer from 1948–54, designing steam electric powerplants and hydroelectric stations.

In 1954, he entered law school, continuing to work as an engineer on a part-time basis. He earned a law degree from the University of Tennessee in December 1956, graduating first in his class. He is a member of the Order of the Coif, the American Bar Association and the Federal Bar Association. He is a member of the Bar of Tennessee, the District of Columbia, and the U.S. Supreme Court. He is also a licensed professional engineer.

Mr. Freeman and his wife, Marianne, have three children and live at 7211 Pyle Road, Bethesda, Md.

BIOGRAPHICAL SKETCH OF J. FREDERICK WEINHOLD

Mr. Weinhold joined the Energy Policy project in November 1972 as senior engineer. The EPP was established by The Ford Foundation to make a comprehensive analysis of energy policy problems, and Weinhold's responsibilities include those aspects of energy policy involving energy technology, particularly research and development. He is also concerned with the integration of broad energy policy issues involving a variety of disciplines.

From June 1968 to November 1972 Mr. Weinhold worked on energy matters in the Office of Science and Technology, Executive Office of the President. For 3 years he was a member of the energy policy staff; more recently, as technical assistant with the national resources group, he was the individual within OST most directly concerned with energy research and development, the environmental effects of energy and energy policy questions.

From September 1966 to June 1968 Mr. Weinhold attended Princeton University, receiving a master of science degree in engineering from the Department of Aerospace and Mechanical Sciences and a master of public affairs degree from the Woodrow Wilson School of Public and International Affairs, majoring in economics and public affairs.

Mr. Weinhold graduated from Cornell University in 1962 where he received a bachelor of mechanical engineering degree. While at Cornell, he took part in the

industrial cooperative program, working for the American Electric Power Service Corp. on several projects ranging from magnetohydrodynamics to a prototype gas-cooled nuclear reactor.

Mr. Weinhold was on active duty as an officer in the U.S. Navy from 1962 to 1966. During that period he was assigned to the naval reactor program. In the summer of 1967 he worked in AEC's division of reactor licensing and developed a procedure for evaluating reactor containment designs.

Mr. Weinhold is a registered professional engineer and a member of Tau Beta Pi honorary engineering society, the American Nuclear Society, the Society of American Military, and the American Society of Mechanical Engineers.

Mr. Weinhold resides with his wife, Barbara, and two children at 1309 Macbeth Street, McLean, Virginia.

Chairman HOLIFIELD. Now we will hear from Dr. John Steinhart of the University of Wisconsin.

Dr. Steinhart, our apologies for getting to you so late, but you have been here and you understand what has been going on.

We are going to start with your testimony, and if necessary we will carry it over to this afternoon. If we are interrupted by a quorum call, or vote on the floor, we will then come back and get the rest of it.

We are having the afternoon session in the Joint Committee on Atomic Energy quarters—which are close to the House floor—so that we can go back and forth to cast our votes more easily than we can from this room. The staff will tell you exactly how to get there if it is necessary for you to come back.

Now, you have a 15-page statement?

STATEMENT OF JOHN S. STEINHART, PROFESSOR OF GEOLOGY AND ENVIRONMENTAL STUDIES, UNIVERSITY OF WISCONSIN

Mr. STEINHART. I don't propose to read it.

Chairman HOLIFIELD. We will accept this in its entirety for the record, and then allow you to summarize it and to quote from it as you wish.

Mr. STEINHART. I would welcome that. It was prepared with that intention, Mr. Chairman; I did not intend to sit and read.

Chairman HOLIFIELD. I might say I have read it, and you have a very informative statement. It will help us in the consideration of this matter, although we are under such urgency we may not be able to accommodate everything that has been suggested by the witnesses; we are going into some pretty active and long hours' work on trying to perfect this bill.

Mr. STEINHART. I understand that, Mr. Chairman. In fact, I am following an old colleague of mine from OST on the witness stand here. Dave Freeman and I have known each other for a long time. My responsibilities at OST were not specifically for energy, but much more on the resources side, particularly marine resources, and I had, for instance, the Santa Barbara oil spill as an education of a kind that is not provided at the university.

Chairman HOLIFIELD. My mail has informed me adequately on that subject, being a Californian.

Mr. STEINHART. Perhaps I should identify myself.

I am John S. Steinhart. I am a professor of geology and environmental studies at the University of Wisconsin. I was formerly here at the Office of Science and Technology and at the Carnegie Institution of

Washington. I have become concerned with the energy difficulties possibly partly from sitting and talking with Dave Freeman some years ago. I have studied the matter rather extensively, done research in it, teach courses in it, and have just finished a rather long and, I am sorry to say, somewhat academic book on the subject. I have also spent a good deal of time in the last 10 years studying government organization problems for technical matters.

As I say in my statement, I don't think these experiences qualify me as an expert, particularly on the latter matter. I am not sure there are any. It is a difficult problem. I have more recently been on the advisory committee to Governor Lucey of Wisconsin for energy-related matters.

ENERGY AND POPULATION GROWTH

The first part of my statement, which I summarize, I think singles out the problems that are troublesome. Growth, the solution of the problem would be a great deal easier, and while I don't wish to enter the current academic dispute over growth or no growth, I do think——

Mr. HORTON. Let me add to what you are saying. I realize you are hitting it pretty fast. I think related to this whole energy crisis are the population problem and the growth problem. According to information I have, there are about 3½ billion people on the earth today, and I understand that by the year 2000 that figure will double to about 7 billion. And some of the figures down the line are even more staggering. I saw an estimate of 24 billion, I think, by 2050, which is just astronomical. So there is a problem of growth.

Mr. STEINHART. Yes, and I think it is a very serious problem, both in population and, in the case of the advanced, industrialized countries, a growing level of wealth presumably will have to stop somewhere. That is why I quoted Kenneth Boulding, who always seems to have a fine turn of phrase, that anyone who believes growth can go on forever is either a madman or an economist. I rather share that belief, being myself a reformed economist.

LIMITS ON TECHNICAL EFFICIENCY

I have tried to raise this issue of the end of technical efficiency improvements because I think we sometimes get misled. In the lifetime of everybody now living, we have witnessed continual improvements in technical efficiency. By technical efficiency, I mean machines which do precisely the same thing but do it with larger return of work for the amount of fuel put in. That period is near an end.

We had, for instance, an increase in efficiency of a factor of 5 between 1910 and the present. That brings us to a point where we are at about 50 percent efficiency for the total economy; about 50 percent of the fuel that goes in results in useful work out the other side. For a lot of engineering reasons it seems unlikely we will ever exceed 75 percent efficiency so that that long romance with increasing efficiency is about ended. Now we can do things more effectively and do things more efficiently by doing them in different ways, but it does mean substantial change in that case, not simply a better mousetrap that catches more mice. Finally, the environmental costs are coming due, and that is no news to anybody on this committee. I put it in because I think it is crucial.

Chairman HOLIFIELD. We are very much worried about that, too, and one of the things we believe has been neglected is research and development in fossil fuels, to prevent the pollution that we all know occurs in their use. I would conceive that one of the priority projects is the removal of sulfur and dioxides, ash and other particulates.

Mr. STEINHART. I couldn't agree with you more.

Chairman HOLIFIELD. This is urgent and must be attacked on a team basis by the best scientists and engineers.

Take my own State of California. We can't burn coal there because of the atmospheric conditions, and we simply must learn how to burn coal, that is all.

Mr. STEINHART. I was satisfied with the bill on that point. It seems to me that was covered. I could see the clear intent in that direction.

Chairman HOLIFIELD. The report is going to make it even more clear.

Mr. STEINHART. In some of the new power sources and old ones like coal to expand a large fraction of energy supplies we will find ourselves immediately confronted with many anticipated projects. One that can be foreseen is coal gasification use depending on which systems you use. Roughly half of the energy of the coal originally mined——

Chairman HOLIFIELD. Two tons of coal are now required to make one equivalent Btu ton of gas?

Mr. STEINHART. Well, that is precisely the point. That means doubling the strip mining for whatever level of gas one would like to have, and these kinds of multiplication factors, like the population multiplication factors, could be very troublesome. But, as I say, I am reasonably well satisfied with the bill on that point myself.

I think the major point I have to make is that in the next 10 years I do not see any opportunity to bring anything to be of any real assistance to us except those technologies which are presently understood. That represents no novel observation. I think, from an engineering point of view, expecting to bring anything that is presently in the research stage to some useful conclusion is fairly optimistic. The leadtimes are quite long on these large-scale things, and that is again well known to you who have had the nuclear energy responsibilities.

Chairman HOLIFIELD. I agree with you completely on that statement.

SOLAR ENERGY POTENTIAL

Mr. STEINHART. I refer now to coal gasification, which the bill covers fairly well, and solar application, which I think probably is the main point I have to make about the bill. And there I tend to be a pragmatist. I admit to being enthusiastic; I make no bones about that. I probably got enthusiastic about solar energy from having known Daniels in Wisconsin way back in the midfifties, a graduate student, who was possibly a man before his time in attempting to help the undeveloped world with direct applications of solar energy. But, rather than tell of my enthusiasm, I am sure you can find plenty of people to do so. I have tried to summarize some of the evidence. We have, in fact, missed the boat. The fact that the Japanese have more than 2

million solar hot water heaters suggests they may know something we don't know. Australia has more square feet of solar collectors than that, and Israel's water is heated with little else. The technologies for solar hot water heating and solar space heating, including commercial spaces, are really well understood; so it is at least my opinion—I think shared and I can offer evidence that it is correct—that this technology is really in the development stage, although there is lots of attractive research that could be very helpful if it came to fruition.

In these kinds of dispersed uses, we are talking about home heating or commercial space heating, which is the second largest category end use of energy in the United States, and most of it using premium oil, or natural gas, fuels, which cause us the most trouble and will cause the most trouble for the next decade.

Mr. FUQUA. For the gentleman's information, I have just returned from a markup session on the Solar Heating and Cooling Demonstration Act. This measure would authorize $50 million a year for a demonstration project to investigate the feasibility of utilizing solar energy as an alternative and supplementary energy source.

Mr. STEINHART. I couldn't be more delighted. That seems to me to be a step in the right direction.

I emphasize this strongly because the opportunity costs of delaying these kinds of applications are very large.

The laboratory directors a little earlier emphasized the importance of not reinventing the wheel. I am going to play devil's advocate for a moment, and I would like to point out that if we undergo a recession even next year, the economy will lose more money in a day than it would cost to reinvent all the wheels 10 times. So I am not really overconcerned if we do wind up having to expand the field faster than it can stand.

Chairman HOLIFIELD. I think the expression referred to doing something that has already been done, not in any other sense. In other words, if this solar technology has been advanced further in Japan than it has been here, and the small automobile is an example of something they did in Japan a little bit better and a little bit quicker than we did, then what we should do is to acquire that. The bill will provide that technology can be acquired, so that we don't have to go back and bring up our technology to the point where the Japanese are now.

Does that not fit in with your thinking?

Mr. STEINHART. Oh, yes.

Chairman HOLIFIELD. Then go from there to make it better.

Mr. STEINHART. I am certainly not advocating wasting public moneys purposely. I am only trying to indicate here that I think it will be difficult to expand this field as rapidly as it may require, and I think one probably has to face the possibility that there will be some significant amount of waste. But in comparison to the costs of failing to do it, I think those are the sort of things that are tolerable, just as the early years' waste in the space programs were tolerated somewhat, without feeling very good about them. It is a difficult thing to do to expand it that rapidly.

The opportunity cost here is shown in the expectation of building industry that we will increase our housing stock by 50 percent in the

next decade. Even a large fraction of those buildings could have incorporated in them solar heat and solar hot water heating; we could go enormous steps toward relieving the pressure on our most premium fossil fuel—and in the place where it is hardest to provide environmental controls—and replacing them with something about which, for once, we know precisely what we are doing environmentally. This is an old technology after all, very old. People were disassociating, or desalinizing water probably before they got very far along with civilization at all.

I have tried to summarize some of the relevant substitutes here. Take hot water heating, so often overlooked in the use of energy in this country. Just in order to dramatize it, I tried to point out that twice as much energy is used in domestic hot water heating as is used to power all of the airlines.

Chairman HOLIFIELD. Amazing.

Mr. STEINHART. So the simple, solar, hot water heater, which can be bought off the shelf in Australia, Japan, or Israel, could make a very large difference to us, and if we adopt this technology, I am sure the airlines would be delighted to support that point of view.

Getting to the recommendation that this entails, what I am recommending is that an equal branch of ERDA be set up on solar developments.

Chairman HOLIFIELD. Let me comment on that. Desirable as it sources. They all want a separate box on the level with the two most might be, you will notice that we have the same request for fusion, for instance. We have the same request for geothermal and other attainable and most prevalent goals at the present time, and while I understand your enthusiasm for it and I understand the desire that you have, and there is some logic in it, we cannot, in an organizational job like this committee has been asked to do in the time that we have to do it, we cannot spread these boxes across the board. Each of these, shall we say, are exotic or unusual, whatever word you want to use, sources of energy. You may have a better case than the others have, but from an organizational standpoint we have to move as fast as we can. Within that box which says "Assistant Administrator for Research and Advanced Energy Systems," there will be a latitude for the Administrator to come forward with an enlargement of the solar program. The Space Committee, on which Mr. Fuqua serves, is interested in it, and if we can join together with them and get this on the road, it will be all to the good. But for the time being, we just couldn't do that from a practical standpoint.

Mr. STEINHART. I guess I would like to just say this much. I understand you are going to have to make the decisions and I guess I am trying to say, before going to this much delving into the substitutes, that this case is fundamentally different. There are countries in the world who are vastly ahead of us in this. In our own country it is clear from the evidence, not from opinion, that this technology is in the development stage.

I just visited, a short while back, the solar house constructed at the University of Delaware. George Lapp has been living in a solar house for 13 years in Boulder, Colo. There are a number of these things around the country. The point being that D is more expansive than R,

as you well know, and putting technology that is really in the large-scale development stage in with things like fusion, which hopefully will be resolved at some time, but at the moment it is a basic research problem, would be a mistake.

Geothermal is, except for the well-understood technology of hot springs and hot steams—that is, dry rock geothermal—is, at best, a long way off if we are ever able to tap it. This is fundamentally different technology, and in my opinion can bring us more help in the next decade than the fossil fuel developments, because you can begin putting these units in houses now, if you wish to do so. Unfortunately, at present, our tax structure, not only at just the Federal level, but primarily at the local level, tends to penalize anybody who spends a significant amount on a——

Chairman HOLIFIELD. Capital investment.

COMMERCIAL SOLAR DEVICES

Mr. STEINHART. In this case I think the case can be made—not on the basis of my opinion, but on the basis of current activities, the technology transfer appears as though it is likely a good deal easier for the large-scale application, as opposed to other sources, where the capital investments are immense and returns are a long way off.

Minneapolis Honeywell is already quite active in this area, probably more active than they are willing to let on, at least to me. I know that Westinghouse and General Electric have had groups doing something about it, although I am unable to say precisely how far they have gone. This kind of thing is a manufacturable and salable item. If you wish to push that hard, in a year or two, we could have them on the market for homeowners to buy. In fact, the sales are really phenomenal for this little packet that is being sold by Edmunds Scientific, how to build your own. The point being that this is really doable now.

Chairman HOLIFIELD. How much do these devices cost for an average six-room house?

Mr. STEINHART. An average six-room house? Well, I will have to explain first that the presently economically viable ones are hybrid units, the solar heat provides all of your domestic hot water and about three-quarters of your winter heat, depending on what climate you are in. It will also provide air-conditioning, although that hasn't been as thoroughly tested as the solar home heating has been.

Given those caveats, if you have a house that is insulated, say, about the same as an electrically heated house, the overall lifetime cost will be cheaper and the initial capital investment is likely at present prices to be about $4,000. There is every expectation that one can reduce this cost very significantly. Since attempts at mass production have not yet been made, the best resource is to refer to the NASA–NFS report, in which they estimate somewhere between $2 and $4 a square foot. More conservative seems to be around $4, some of the industrial people around $2, and you require for a six-room, two-story house, something between 500 and 750 square feet of collector even without additional efforts at tight insulation.

Chairman HOLIFIELD. You may proceed.

Mr. STEINHART. I think I would go on to the other recommendations I make. Some of these I make with some diffidence in that I am not sure I am the best expert. I am attempting to give you my opinion. I do think, along with the energy research and development, and here I think I am picking up a thread from Dave Freeman's testimony, that the implementation, the technology transfer problems, are often the very sticky ones, particularly when we are in as much hurry as we are in this case. Therefore, I suggest that in the legislative history of the bill, though possibly not in the language, the agency be urged to set up a group to try and recommend a whole panoply of transfer programs. For instance, in the case of solar home heating, tax incentives to the individual might work very well, although I cannot say, without having done details, how well, but there are a whole range of industrial subsidies, tax incentives, bonuses, penalties, whatnot.

I think it would be highly desirable for this agency to continue to furnish you programs, in the annual report of the Director, a whole collection of options of this kind which the Congress and executive branch may consider as appropriate for ways to accelerate what they have already accomplished.

That is an activity not normally done by, say, for instance, the national laboratories. They have never been asked to do it, and are not specially equipped to do it, but the agency with a relatively small group, probably not much larger than Dave Freeman's group, would be able to accomplish that task and provide some relatively hard-headed recommendations of how to get the transfer of the new technology into the public arena as rapidly as possible.

Third, I would recommend, in addition to the solar energy group that you have assembled with the bill, that you tap NASA, which has some very fine engineers, for this subject, and transfer them. I am not sure that this requires language in the bill, but I would think it highly desirable. They may have to undergo a change in point of view to get away from the goldplated technology to day-to-day technology, but I think these are extremely bright and able people.

Just for example, there is no engineering reason why one could not expect a large price drop in direct solar energy to conversion to electricity, although so far it has eluded the energy effort. If that were to happen, the whole picture for power station solar generation would change dramatically. Even at present, central solar power generation is only twice as expensive as the current cost of a nuclear reactor and less than half the cost of the prototype breeder that the AEC announced a couple of weeks ago. So at that point we are in the right ballpark, and if we have any confidence in industry's ability to lower costs through large-scale efforts, I think it is time to give them a chance to do it.

I make a rather diffident suggestion. I understand the very great difficulties with this, but in the long run I think it would be desirable to separate national security and defense-related activities from this Agency, and then I would think it desirable for the committee to steer future Congresses a bit by indicating their intent to do that as it becomes possible.

Neither the national security nor the energy supplies are likely to be served at the best level if these activities are permanently combined. That is, at least, my opinion.

GENERAL ADVISORY COMMITTEE

One specific provision of the bill is that of transferring the general advisory committee to the Administrator as the advisory committee. There are two problems I see with that. One is that the makeup of the advisory committee, as it properly should have been in recent years, or ever since its inception, has been directed toward expertise in nuclear energy. These men may or may not know anything about fossil fuels and their difficulties, or solar energy and its difficulty, or the rest. More, I see a very great risk in having only one set of advisers. I am impressed with Franklin D. Roosevelt's use of a variety of advisers at the next level down so he could, once in a while, provoke a fight which he could profit from listening to.

Chairman HOLIFIELD. We have been thinking about this problem, and the staff in fact has been working on some language which would empower the Administrator to set up appropriate advisory groups in specific fields. So we are, I think, on the same wavelength with you.

Mr. STEINHART. Let me offer a specific suggestion that you might consider, the one I offer in my testimony, the possibility of leaving the general advisory committee with the regulatory commission, Nuclear Energy Commission, where they have a long history of also dealing——

Chairman HOLIFIELD. That is where we are placing them in the bill, as you know. They are being placed—are you talking about the advisory committee on reactor safeguards or general advisory?

Mr. STEINHART. General advisory.

Chairman HOLIFIELD. That does stay with ERDA. But I thought you were speaking of the advisory committee on reactor safeguards.

Mr. STEINHART. The general advisory committee, I think, because of its history. I would at least recommend that you consider leaving it with the Nuclear Energy Commission since they will have need for those kinds of expertise to make some of the hard decisions about regulations and licensing, and let the Administrator set up, as you just indicated, his own set of advisers so that we avoid the difficulty of one kind of experts, stepping out of their field. If I were administering such an agency, I would like to have several advisory committees with different kinds of experts and then listen to what their opinions were.

Chairman HOLIFIELD. I think the bill will allow that, and the report will have some language making it clear that the Administrator will have the authority to appoint such advisory committees as are pertinent.

Mr. STEINHART. That would seem to me to serve it perfectly well.

Chairman HOLIFIELD. So I think we are thinking about this same thing.

DEPARTMENTAL GOAL

Mr. STEINHART. Simply trying to avoid the problem of saddling him with one set of advisers in a legislated position whose own histories are very much in one direction. This is not to say these are not some of the most brilliant scientists in the country, but there is nothing like being out in the woods letting the Lord rain on you. That is the only way to learn about some of these others. We echo Dave Freeman in the final recommendation and that is that the consideration

continue. I understand the urgency of this and I applaud the committee heartily for going ahead, but I hope that this be thought of as a building block toward a Cabinet level department, whether it is a Department of Energy or Department of Energy and Natural Resources. I cannot offer you a convincing case for either one or the other of the solutions at the moment.

Mr. HORTON. Let me say this. The agreement of the chairman and myself to move forward with this legislation to establish ERDA, does not mean we were not interested in pursuing the establishment of a Department of Energy and Natural Resources. We have had hearings on that legislation; those hearings are not yet completed. I would certainly expect that after the new session starts next year we will continue with those hearings. I think that is a very good point that you make. Whether or not it is in the Department of Energy and Natural Resources or somewhere else would depend on how the hearings go and what the committee comes up with. But I do think that you should know that it is not our intention to abandon the concept of a Department of Energy and Natural Resources.

Mr. STEINHART. In fact, Mr. Horton, I have been following those hearings and it seems to me you are headed in the right direction, and with the possible exception of the question of where the weapons development belongs, it seems to me this building block is perfectly suited for such a subsequent development.

Chairman HOLIFIELD. You are substantially in accord with this approach, considering all of the factors involved?

Mr. STEINHART. Yes, sir.

Chairman HOLIFIELD. The approach of H.R. 11510?

Mr. STEINHART. Yes, sir.

Chairman HOLIFIELD. I want to say that I appreciate your testimony here today.

I am going to take this statement home with me and reread it tonight. It will receive consideration, I am sure, and I hope that when the Administrator is appointed to this agency, you will present to him a well-prepared brief on this solar energy problem, particularly out in the West where you have these desert areas and sunshine almost every day in the year. There is a great possibility, I think.

Mr. STEINHART. There is a solar heated house in Madison, Wis., and it works fine.

Mr. HORTON. That is what I was going to ask you.

I live in Rochester, N.Y. We seem to have a little cloud that hangs over Rochester all the time, about 30 miles around. If we get some sunshine, would it be possible to store it and then——

Mr. STEINHART. Yes, sir. The sum calculation is reported by Bow & Lapp, two engineers who have been in the business a long, long time. They point out that even in Boston, it is cheaper now to build a solar energy unit of the hybrid type I described, than it is to heat your house electrically in that climate.

Chairman HOLIFIELD. Thank you very much.

PROSPECTS FOR COAL

Mr. MOORHEAD. I have just one question.

I am excited about your solar energy testimony, but I want to get

back to a more prosaic thing, which is coal, and I agree with you, sir, that we shouldn't, in the long run, have a coal-based economy, and I also agree that if we had one, we would have to go into strip mining. But it does seem to me in the short run that the expansion of the use of coal can be justified. The representative from the National Coal Association said that the real problem in coal research was in the area of advanced technology for extracting the coal, and I understood that to mean deep mines, not new technology for strip mining.

From your experience, do you believe there is a need for coal extraction technology improvements, or would you agree with me that in the short run we should, as much as possible, convert to coal?

Mr. STEINHART. Well, in the larger sense of what we should use, I certainly agree that we have little choice but to expand our coal consumption. I guess I was aiming myself to the philosophical point, perhaps—I hope it is more than philosophical—we can use coal as a transitional measure, probably for a generation or more, to get to a society based primarily on nuclear or solar energy, or both. That seems to me to be eminently justifiable and, in fact, probably we don't have very much choice.

In regard to the technology, I would agree strip mining technology seems well in hand, sometimes better than we wish.

Mr. MOORHEAD. I agree.

Mr. STEINHART. And industry seems quite able to take care of that. In the case of deep mining, there does seem to be a problem. I am not the best expert on that, although a few years back, I did look into some of the work the Soviet Union has done with underground mining, using water cannons and semiautomated mines, producing slurries and the like. Not much of that technology is presently in use in this country, and it certainly seems worth looking into. The coal industry, by and large, has a very poor history of research. Every time the price of coal drops 5 cents a ton, they fire all of the research staff. They have been very conservative. So has the mining industry, by and large. It would be a mistake to back off in the Coal Mining Safety Act because it is already the most dangerous——

Chairman HOLIFIELD. Except automobile driving.

Mr. STEINHART. Well, that, presumably, is something we do by choice, like smoking cigarettes, and maybe human foolishness is harder to cure. But I would agree there is serious need for some new deep mining technology, hopefully to enhance the safety and enhance the output and not ruin the environment in the process. That sounds like a nice, tall order for some bright engineer.

Chairman HOLIFIELD. I want to thank you very much. You made a real contribution, Dr. Steinhart, and we appreciate your coming down from your place of residence for this purpose.

Mr. STEINHART. Thank you very much.

[Mr. Steinhart's prepared statement follows:]

PREPARED STATEMENT OF JOHN S. STEINHART, PROFESSOR OF GEOLOGY AND ENVIRONMENTAL STUDIES, UNIVERSITY OF WISCONSIN

Mr. Chairman and members of the committee, my name is John S. Steinhart. I am a Professor of Geology and Environmental Studies at the University of Wisconsin. I was formerly employed by the Office of Science and Technology, Executive Office of the President and by the Carnegie Institution of Washington. I have

been studying the energy situation and teaching courses in the area for several years and have just completed a book on the subject that has been two years in preparation. In addition I have studied, taught and written on government organization problems for technical matters for many years. I do not think these experiences qualify me as an "expert" but they have left me with a number of opinions. I am grateful for the opportunity to convey some of these views to the committee.

The energy shortages which have been troublesome for the past few years have been accelerated to crisis level by the events of recent months. Although the emergency measures that are now being undertaken have been precipitated by the construction of U.S. oil imports, it must be remembered that the shortages of domestic energy supplies have been coming upon us for some time. In my own state of Wisconsin, for example, fuel shortages for corn drying last winter caused the loss of some of the crop. Many other examples could be cited, but you all have had personal brushes with this problem prior to the recent events in the Middle East.

The remarks which follow have three main directions:

(1) Some basic themes in modern society important to attempts to solve energy problems,

(2) Problems and prospects for energy supplies for various time scales, and

(3) Implications for H.R. 11510 from the above considerations.

1. *Some Trends in Modern Society Relevant to our Energy Problems*

A. *Growth Here and Growth Elsewhere.*—Our energy consumption has been doubling every 15 or 20 years during most of this century. This growth has been a source of pride and has produced the highest per capita income of any nation in the world. The National Income is now large enough to provide a decent living for every American, although distribution difficulties have prevented this from happening yet. The directions taken by this growth have drawn heavily on our original stocks of fossil fuels, so that today remaining stocks of oil and natural gas are insufficient to support continued expansion. The unfortunate feature of our present situation is that the lead times to make major changes in our sources of energy (which are of the order of twenty years), are about the same as doubling times for amounts of fuel used. It takes no extensive calculations to understand that 20 years before cheap oil and gas are depleted, we will not sense difficulty since half the stock remains. But it is at that time that moves to new sources should begin. With these time scales, shortsightedness is likely to be all too common.

I will not enter the controversial question here of growth or no growth, but it is necessary in planning for the near future to repeat the commonplace observation that endless doubling of the production of fuels and mineral resources on a finite earth are impossible. Until we understand where our energy supplies are to come from, we cannot say for certain whether the day of growth slowdown can be postponed into a misty future—say 1000 years away—or whether we should plan for some reduction in growth soon. As the economist, Kenneth Boulding has remarked, "anyone who believes exponential growth can go on forever in a finite world is either a madman or an economist."

But some of the growth is beyond our immediate control. With about 6% of the world's population, the U.S. consumes almost one third of the world's annual supply of fuels. This is a smaller proportion of the world's fuels than we consumed 20 or 40 years ago. What these numbers reflect is growth of industrialization elsewhere in the world. We should expect this growth elsewhere in the world to continue—even to encourage it—for a world with 20% rich and 80% desperately poor is a world ripe for intolerable conflict. But this growth in energy and fuel use elsewhere means that we can no longer assume that imported fuels will be cheap or easy to come by.

B. *The End of Technical Efficiency Improvements.*—In the latter part of the 19th century only about 3 to 5% of the fuel used was converted to useful work. By 1910 this figure had improved to about 10%. In 1970 about 50% of the fuel we used was converted to useful work. This means that, accompanying growth, we have been able to continually find more efficient means of converting fuels to the work that was to be done. Just since 1910 we have increased this efficiency figure by a factor of about five. These improvements of efficiency are now near an end. For various technical reasons it is unlikely that we will exceed an

overall efficiency figure in fuel use of about 75%, but lest I offend that technological optimists, it is quite clear that doubling our present efficiency is a limit we cannot exceed without getting more energy out of the system than we put in. This observation is important because the lifelong experience of everyone now alive has been confined to this period of continual improvement in efficiency. How much more would energy use have grown in the recent past without the efficiency improvements? It is impossible to say, except that the growth in energy use would have to have been more.

I have been using efficiency in its technical sense. It is of course still possible to find more effective ways to do things, but only by making real changes in the way we do things that usually have secondary effects. We can reduce energy use in transportation by relying less on the automobile, and more on mass transit, but only with the realization that the reduction in numbers of autos produced will have its effects elsewhere in the economy.

C. *The Environmental Costs are Coming Due.*—In the past decade the unwanted side effects of use of fuels and resources have begun to be alarming and have occasioned some additional difficulties for society. These problems will not go away just because we now have a shortage of fuels. Several major cities—New York and Chicago for example—already have several episodes of SO_x air pollution each year which are serious enough to require temporary restriction of some fuel use. For those cases, lifting environmental standards to permit the use of high sulfur fuels will only make a bad situation worse. It is undoubtedly true that environmental activists have, at times, overstated their case, but if the President or Energy Company executives really believe that the present government standards are too restrictive, they might illustrate their conviction by locating their residence adjacent to a power plant fueled with high sulfur coal. I emphasize this point only because some unprincipled statements seem to imply that our energy difficulties are the result of environmental opposition. In fact, less than ¼ of the power plant delays in recent years are associated with environmental problems according to a recent E.P.A. study.

2. *Problems and Prospects for Future Energy Supplies*

A. *The Next Five Years.*—For the next 3 to 5 years new energy supplies cannot be expected from conventional or new energy sources. What is already planned and under construction will be welcome but it is easy to show that we will still have shortages. Expansion of imports, if that becomes possible could ease the situation somewhat. Otherwise, those measures which reduce consumption are the only recourse.

B. *The Next Ten Years.*—History of technological developments suggests that we will be unable to implement any new technology within ten years in such a way as to make any significant impact on energy supplies. The lead time for any schemes that require research and pilot plant work is usually twenty years or even longer. The history of nuclear power plant development is instructive in this connection. Even now, twenty-five years or more after development began, nuclear plants still provide less than one percent of our energy, and the total nuclear energy program has still consumed more energy than it has produced. Thus for help in the next decade, it is my opinion that we are restricted to technologies that are now understood. There are two that do not presently play a significant role in the U.S. energy supply:

1. *Coal Gasification.*—This technology was proven during World War II and is now in the pilot plan stage. H.R. 11510 does well to separate out a subgroup of the new agency to accelerate these developments. Unfortunately, any expansion of coal based energy generation has a high price associated with it. Strip mining must be expanded and is already troublesome in places. In the arid west, water availability will be a problem. Further, a recent analysis of restoration problems associated with strip mines concludes that areas with less than ten inches of annual rainfall cannot be restored at all.

2. *Solar Heating and Hot Water.*—This technology is even better understood than coal gasification. Japan, Australia and Israel now make use of it and solar hot water heaters may be purchased "off the shelf" in those countries. We had many more rooftop solar heating units in the U.S. in the 1940s than we do now, despite population growth since then. Until recently, cheap fuels made solar heating and hot water unattractive for economic reasons. The problem has been that the initial capital cost is high even though

the fuel is free. These capital costs can be reduced through engineering and large scale production. Even at present prices, however, fuel price increases up to 1970 already have made solar heating for residences *cheaper* than electric heating as far north as Boston (for a unit that supplies about 80% of winter heating requirements). This technology has lacked a constituency (or a lobby) and we have only a handful of technical experts in this country. But if Japan finds it worthwhile to employ more than two million solar rooftop heaters, we appear to have missed something. There is much that could be gained here. Home heating is the second largest end use for fuels in the country (10.4% in 1970) and residential hot water heating is the seventh largest end use (2.7% in 1970). Home heating uses twice as much energy as all the trucks in the country and heating of residential hot water, twice as much as all the airlines.

H.R. 11510 should separate out solar energy uses as a category much as nuclear sources and fossil fuel sources are now singled out. This technology is available and can begin to help in our energy supply as soon as we are able to bring appropriate units to the market place.

C. *The Future Beyond 20 Years.*—We are likely to be having energy problems even 20 years from now. For this longer run future we have only two options for our energy supplies. These are nuclear and solar energy sources. We could, if we wished to pay the price, switch to a largely coal based economy for a time, but if the growth in energy use continues at past rates, that shift will be a temporary one lasting a century or so at most. But there are other reasons for not aiming at an economy based primarily on coal: (1) The environmental cost is high, as already mentioned. This is not a purely cosmetic matter, but means real—and possibly extravagant—expenditures to maintain healthy surroundings in a coal based society. Because a large fraction of the energy of coal is lost when it is converted to gas or some other clean fuel, we shall have to expand strip mining far beyond past experience if we choose this option. (2) Although the United States has large stocks of coal in the ground, there are many countries that have little or none. As world energy use expands, these "have not" countries will need to solve their energy supply needs. We could find ourselves in the position of having to help supply these world needs or face the international tensions that have in past often led to war. The prospect of the U.S. strip mining for much of the world is as unattractive as trying to hoard our supplies for ourselves in an energy hungry world. (3) Fossil fuels (oil, gas, and coal) are valuable for other uses besides burning. Among the fastest growing uses of hydrocarbons is as feedstocks to our large and growing petrochemical industry. A wide variety of products—synthetic fabrics, plastics, and a host of other materials—depend upon a supply of hydrocarbons. We would do well to conserve some of our stocks of fossil fuels for this use. I think it entirely likely that, a century from now, people will think it peculiar that we produced fossil fuels to burn for the energy content. After all a century ago one of the favored home heating fuels in my part of the country was Black Walnut. It's not that the fossil fuels will disappear altogether—they will always be available at a price—but it is also true that it is still possible to heat your home with Black Walnut—at a price.

It is my opinion that coal should be regarded as a way to ease the transition from a fossil fuel based society to more permanent sources of energy. If we struggle and work to convert primarily to coal, only to postpone our problems, it would be a shabby trick to play on our children and grandchildren.

1. *A Primarily Nuclear Future.*—The optimistic expectations for cheap and abundant nuclear power have thus far eluded us. The extravagant hopes of 20 years ago have encountered unanticipated problems—remember the statements about power too cheap to meter—and there are still problems unsolved. Without repeating the problems (which are well known to the Chairman of the committee) it is worth noting that sober, well qualified experts are still engaged in vigorous argument about the advisability of extensive reliance on nuclear energy sources. Problems of accident, transport and, especially, storage of radioactive substances are unsolved, and the recent stance of the AEC that the storage problem will be deferred by temporary storage, is not encouraging. We have not yet even begun to understand what happens twenty or thirty years hence, when it becomes necessary to retire obsolete nuclear plants, with their large volumes of radioactive structure. Nor have we any clear idea of the ultimate cost of nuclear power. The recent announcement of a $2000 per KW cost for the prototype breeder reactor is threatening. To be sure, the AEC expects subsequent units to

be cheaper, but past experience with all kinds of industrial production shows that such cost reductions are often not realized. In any case, recent years have seen a steady rise in the costs of nuclear power plants and there is no assurance that the end of such cost increases is in sight. Until these problems are solved and the costs more clearly understood, it would be foolish to bet the nation's future on well intentioned assurances that these problems are easily solved.

Please understand that I cannot see any problems for which there is no possible solution. We should certainly accelerate the search for solutions. But, as a geologist, I cannot offer any assurance at present that the storage problem can ever be solved. What is more, the requirement to supervise storage of nuclear wastes for 1000 to 10,000 years is not a technical question. The advisability of undertaking such a commitment is dependent upon the stability of society, the choices citizens wish to make, and whether we have a right to commit future generations to such a task. Such questions are properly resolved in the political process—not in technical forums. This is what Dr. Alvin Weinberg calls the "Faustian Bargain" of nuclear energy. My own personal reading of the Faust legend makes me wish to obtain better value in exchange for my soul.

2. *A Primary Solar Future.*—Because solar energy is often lumped together in the media with fusion, MHD and a number of other basically unsolved technological prospects, there is a wide misunderstanding of the state of solar technology. We do understand this technology now. Further research can help to reduce costs, enhance efficiency of conversion, and increase the flexibility of solar energy use, but we can build solar energy power stations now, if we wish to, and we know more about the environmental consequences than we know about the ultimate environmental costs of nuclear energy.

There are two main categories of solar energy conversion: (1) Dispersed use of solar energy for heating, cooling and hot water production has already been mentioned. Solar cooling is less well developed than heating, but there is no fundamental research necessary to make such units. Primarily engineering is needed to reduce costs. Of course fundamental breakthroughs in solar cells would be welcome in reducing costs, but we need not wait for them. (2) Central power station solar farms to produce electricity or hydrogen gas (for use as a fuel) are possible now. No large scale units have yet been built, but with rising fuel costs they should be begun at the pilot plant stage at once. Costs for electricity generation have been estimated at $750 per installed KW by a NASA–NSF panel of experts, and at less than $1000 per installed KW by Honeywell spokesmen. Honeywell estimated that such stations could be constructed by 1980. Compare these estimates with the cost of the prototype breeder mentioned above. But even if the costs turned out to be higher initially, solar energy is already known to be environmentally safe and is widely available to most of the world without others depending upon us for their growing energy needs.

My strongest recommendation for the modification of H.R. 11510 is for the inclusion of a large and vigorous solar energy effort, at least co-equal with nuclear and fossil fuel efforts. To further illustrate the importance of this recommendation consider the following facts:

The place where solar energy can help us soonest is where we need it most.

46% of natural gas goes to space heating and hot water heating (24% homes, 14% industry, and 8% commercial). Rooftop units for solar heat could begin substitution for these uses as soon as units can be produced.

17% of natural gas production now goes to utilities, where it is consumed mainly for peaking purposes—purposes mainly associated with peak cooling loads in summer and heating loads in winter. Both of these needs would be eased by solar heating and cooling.

24% of petroleum production is consumed in space heating most of which is household and commercial. Solar could begin to help us here soon.

3% of petroleum production is used by utilities, again for peaking purposes.

30 million housing units are expected to be constructed in the next ten years—a growth of almost 50% in total housing stock. If a substantial portion of these were equipped with solar units, it would ease our situation. Converting older housing units to solar energy is also possible, and tax incentives to encourage such conversion should be considered.

3. *Specific Recommendations for Modification of H.R. 11510.*—I wish to compliment this committee for the attempt to bring together with this bill a vigorous effort to insure our future energy supplies. Such an effort has been badly needed.

The separation of the regulatory efforts of the AEC from its other activities is long overdue. Similarly, the Office of Coal Research has some able people but has been too long underfunded. In an effort to be constructive, I would offer the following suggestions for modification of the bill and the agency to be established.

A. Establishment of a strong subgroup within the agency to pursue the immediate applications of solar energy as well as a vigorous development program for applications of solar energy not yet ready for full scale use in society. Time is crucial here, because, as shown above, each day lost is an opportunity lost to reduce dependence on fossil fuels.

B. A function of the Energy Research and Development Administration should be to regularly offer implementation programs for the energy advances accomplished. None of the R & D will be of use unless it is adopted. Tax incentives, industrial subsidies, regulations and a range of schemes to accelerate the switch to new energy sources should be evaluated constantly and made available for possible implementation by the executive branch or Congress. There must be better ways to use government incentives than the subsidies we have supplied for years to the oil industry (which have left us in the present mess).

C. The solar energy expertise of the new agency could and should be strengthened by transfer of the NASA solar energy expertise to the new agency—as a part of the solar group suggested above.

D. In my opinion, the nuclear weapons activities of the present AEC have no place in the basic energy problems of the nation. While I can understand the difficulties of separating these activities out immediately, language of the bill should make clear the intention to transfer weapons activities to the Department of Defense at the earliest opportunity. The nation's defense is not likely to be best served by an energy agency, and, if we should adopt a basically nuclear future, energy supplies should not be under control of the military.

E. The General Advisory Committee include some of the most distinguished nuclear scientists in the nation, but there is no assurance that they know anything whatever about the other energy options available to us. I would recommend that the General Advisory Committee remain with the Nuclear Energy Commission (title II) to act as principal technical advisors for the regulatory and licensing activities. In the new agency, each of the major subgroups—solar, nuclear, fossil fuels, environment, etc., and advanced energy sources—should have their own advisory groups to assist the Administrator in his difficult responsibilities. This arrangement makes it likely that the Administrator will get some vigorous disputes to consider, and makes it likely that the members of the advisory groups may, in fact, be experts in their areas. This technique of encouraging more open disagreement to understand the options is the technique used so successfully by President Roosevelt many years ago.

F. Finally, I urge the committee not to neglect the long term reorganization problems in the crisis atmosphere of the present. It seems likely that some form of a Department of Energy and Natural Resources at the Cabinet level will be advisable in the future. It seems to me that the Energy Research and Development Administration might be a principal building block of such a department, especially if the weapons matters are transferred to the Department of Defense. It would be desirable for the bill to contain language indicating the intent of the committee to proceed with this larger reorganization problem in due course.

I apologize for the length of this commentary, but the nation's supply of energy is too crucial to be treated lightly. Thank you for the opportunity to contribute my views.

Chairman HOLIFIELD. The meeting will adjourn and we will meet this afternoon at 2:00 o'clock in the hearing room of the Joint Committee on Atomic Energy, which is over in the Capitol. We are doing that for the convenience of the members who may have to go to the floor and cast votes this afternoon.

The meeting is adjourned.

[Whereupon, at 12:30 p.m., the subcommittee adjourned, to reconvene at 2 p.m., the same day.]

AFTERNOON SESSION

Chairman HOLIFIELD. The committee will be in order. We continue our hearings on H.R. 11510. Our first witnesses are Dr. Alvin Weinberg, Director of the Oak Ridge Laboratory, and Mr. Floyd Culler, who is now Acting Director—I understand Dr. Weinberg is on leave—of the Oak Ridge National Laboratory.

At this time, we will be pleased to hear your testimony.

STATEMENT OF FLOYD L. CULLER, ACTING DIRECTOR, OAK RIDGE NATIONAL LABORATORY; ACCOMPANIED BY DR. ALVIN WEINBERG, DIRECTOR, OAK RIDGE LABORATORY

Mr. CULLER. I am grateful for the opportunity to testify before this subcommittee on H.R. 11510. The urgency to provide a vigorous Federal research and development program for the production of energy has now reached crisis stage. The extent to which the future of our Nation's economy depends upon energy is being spelled out in each day's news. None of us are yet fully aware of how important an adequate energy supply is to every activity in our technologically advanced society. We are in the very unfortunate position of having the damaging consequences of an energy shortage develop throughout our whole social, economic, and political fabric. Nor is it at all clear that we see our way to bringing these damaging effects under control. It is now obvious that sound energy policies must be established to meet the immediate emergency conditions, and that a bold and vigorous research and development program, based on farsighted and flexible energy policy, must be mounted if we are to avoid crippling energy shortages in the years to come.

The declaration of purpose in H.R. 11510 clearly defines the main goal of energy policy for the United States, as called for by the President: To make the Nation self-sufficient in energy while protecting the environmental quality and public health. To achieve this goal, it is proposed that all activities related to Federal research and development are to be brought together under an independent Federal agency, ERDA. The functions, facilities, and programs of the present Atomic Energy Commission will be transferred to ERDA, except for licensing and related regulatory functions. The research and development functions of ERDA will include all elements of the AEC program and all Federal research and development related to energy.

I heartily concur with the proposed actions of H.R. 11510. The centralization of Federal energy research and development is urgently needed. The delegation of the licensing and regulatory functions of the present Atomic Energy Commission to an independent regulatory Nuclear Energy Commission separates the potentially conflicting role of nuclear energy development from its regulation. It is surely justified now by the size and complexity of a growing nuclear industry. It is prudent and necessary to vest the proposed Nuclear Energy Commission with the authority to have research and development done to support R. & D. from the continuing nuclear research and development program of ERDA, but I suggest that a new research organization would be inappropriate. The authority to contract re-

search and development to ERDA and to other institutions should be sufficient.

I think, too, that the direction of ERDA by a single administrator, with a deputy administrator and five functionally distinct assistant administrators, will provide effective, responsive, and flexible leadership for energy research and development.

The broadening of the scope of energy research for the AEC and its transformation into ERDA is particularly appropriate. The AEC with its contractor-operated laboratories and extensive university research programs brings to ERDA an integrated multidisciplinary cadre of management and research personnel with experience in the development of energy resources, the application of energy systems, the control and assessment of the biological and ecological effects of energy production and use, and the supporting basic disciplinary research in the physical and life sciences. Dr. Dixy Lee Ray has given a summary of the AEC's array of talent and facilities in testimony earlier on H.R. 9090 before this committee.[1]

The key research and development capabilities on which ERDA will rest are the contractor-operated, multidisciplinary and multipurpose national laboratories. The national laboratories are uniquely powerful instruments for research and development because of their multidisciplinary structures, their combination of abilities and skills for doing heavy technological development in beneficial mode with basic research dedicated to advancing energy development and science.

During the past 30 years, ORNL has evoled in planned steps to its present multidiciplinary, multipurpose form. Each of the national laboratories has evolved in a somewhat similar pattern, but each retains its special skills and character.

Although each national laboratory started with a broad single mission in nuclear energy, it is no longer possible to define a single mission for any of them. This is particularly true at ORNL where early research and development have grown to separately objective programmatic thrusts, the more important of which are no longer encompassed by the rationale in which they originated. ORNL is perhaps the most diversified of the national laboratories. In my opinion, this diversification, managed in such a way as to support the primary elements of energy production and the overall objectives of the AEC, has prepared our laboratory for major research and development support of the broad energy initiative asked for under ERDA. To support this assertion, I am submitting for the record a summary which describes ORNL and its programs.

ORNL research and development gains strength from Union Carbide Nuclear Division's enriched uranium and weapons production staff and facilities in Oak Ridge. The support of a recently centralized engineering design staff of about 1,000 engineers and designers, experienced in very large project management, adds substantially to ORNL's ability to do heavy technology development. Recently, the three installations in Oak Ridge have combined all computer and mathematical functions and equipment. All procurement and contract

[1] Statement of Dr. Dixy Lee Ray, Chairman, U.S. Atomic Energy Commission, before the Legislative and Military Operations Subcommittee of the Committee on Government Operations of the U.S. House of Representatives on H.R. 9090, July 31, 1973.

management is controlled through a central organization, broadly competent to support the requirements for highly sophisticated materials and R. & D. subcontracts. The central management for the UCND, resident in Oak Ridge, can coordinate all of the facilities and staff of the nuclear division to accomplish major goals and missions. The Laboratory and the nuclear division have experience in coordination of major projects with a large number of engineering companies and with the management of subcontracted supporting research and development in universities and industrial firms. This diversity in research and development and supporting competence for the accomplishment of technological missions is now an inherent characteristic of ORNL and the other contractor-managed national laboratories.

The national laboratories can assign experienced scientists and engineers from every discipline of science to major technology development. This array of multidisciplinary talent is supported by applied supporting research. In addition, the major technological missions define the domains and, at times, the foci for basic disciplinary research in physics, chemistry, metallurgy, solid state, biology, ecology, and engineering sciences. This dual aspect—heavy technology broadly supported by basic research—sets a high standard for technology through interaction with basic research; the basic research is stimulated by the interaction with major technological development. And, the more fundamental research provides a reservoir of understanding from which necessary solutions to problems in the technology can be solved or major improvements and inventions evolve.

Perhaps this capacity to attack a practical problem in the whole is the most cogent argument for AEC's role in ERDA.

Since the President first proposed ERDA and particularly following the introduction of H.R. 9090 in July, there have been questions raised about the ability of the major AEC laboratories to knowledgeably participate in the broadened energy programs of ERDA. From discussions during the preparation of Chairman Ray's report to the President involving the Directors of the major AEC laboratories, there was displayed reasonable knowledge and experience existing in one or more laboratories for most all of the designated areas of research and development. There were, of course, specific exceptions, but these can be covered by contracted research with industry or other agencies under the general management of the AEC. In all programs, it is obvious that a combination of industry and Federal laboratory participation is desirable and necessary.

There is also the question of whether the staffs of the national laboratories will have sufficient interest, in effect, display enthusiasm for broadened programs in energy development. I can say emphatically that nothing since the initiation of the nuclear power reactor program has so stimulated the scientists and engineers at ORNL as the possibility of broader research and development related to all aspects of energy production and use. I am sure that similiar enthusiasm has been displayed in every other laboratory. For many years, we have been broadening our research and development in other than nuclear energy with support from the National Science Foundation and other Federal agencies. For many years our staff has been able to see what their research could offer in general energy development so

that a flood of ideas and applications for research have been pouring in from every discipline within ORNL.

Another somewhat dormant force has been reactivated under the stimulus of research and development planning for the broader energy initiatives proposed for ERDA: The force of combined planning among national laboratories. The directors and many staff members from each of the major national laboratories have participated with the AEC planning staff in the development of programs for which the AEC has responsibility. As a group, the laboratory directors have considered and discussed the overall program recommendations, we have developed a common understanding of where urgent development is required, where options must be pursued, where opportunities exist, and where the major impediments to achieving self-sufficiency in energy exist. This cooperative pattern hopefully will continue as actual work begins on ERDA's program. From the understandings already developed, I am confident that the laboratories will function in an interrelated and mutually supportive way.

In August, when I prepared testimony for H.R. 9090—the predecessor to H.R. 11510—I included my own analysis of what the short- and long-term goals of ERDA should be to meet the President's request for energy self-sufficiency. Since August, Chairman Ray has prepared the report requested by the President for an expanded program in energy research and development. This report will be submitted within a few days. My own views coincide with the program to be recommended by the Chairman of the AEC. Therefore, I shall refrain from any substantive discussion of what the $10 billion research and development effort should include.

However, there are some observations that I wish to make concerning the energy crunch and the contributions that research and development can make to ease the immediate and long-term energy crisis.

It is reasonably apparent that research and development will not be able to produce results that will completely eliminate our dependence on foreign oil imports by 1980, or even by 1985, in face of an overall annual rate of increase of about 4.3 percent. Predicted yearly shortfalls of as much as 30 mQ (30×15^{15} Btu or the equivalent of about 15 million barrels of oil per day) by 1985 cannot be met pursuing all options that are open using technology that is essentially on hand. It is evident that all reasonable measures to increase domestic production of oil and gas must be taken. The use of coal in direct combustion with the best possible systems for stack gas cleanup and tall stacks may be a necessary immediate measure, and the development and demonstration of coal conversion process to produce clean burning liquids and gases by hydrogenation is urgent.

Thus, the importance of energy policy, as distinct from reasearch and development, is brought again to focus. All measures possible to reduce oil consumption must be employed, particularly if the Mideast oil embargo continues. I am sure that it is recognized that the success of the energy research and development program in meeting the goal of self-sufficiency depends on the establishment of energy policy. To do so requires institutions for careful analysis and evaluation leading to policy development.

In the long term, with the advent of breeders and assuming the existence of capacity to convert coal and/or oil shale to clean burning liquids for stationary power generation and transportation requirements, the goal of self-sufficiency can be met. It is possible, too, that fusion will be producing energy in significant quantities, assuming that scientific and technological feasibility are achieved as currently favorable research seems to promise.

If we are to achieve the goal of economic self-sufficiency with clean fuel, either in the short- or long-term, it is apparent that certain policy decisions must be made for which research and development have been done for example:

An adequate supply of natural uranium must be developed;

Uranium enrichment capacity must be provided;

Coal production must double or triple in 10 years and continue to grow;

Fossil fuels other than coal must be used for uses other than electricity generation;

Industry must be provided with sufficient incentives to build capacity for production of fuels that may not be competitive; and

There must be infrastructure established between industry and the research and development agency to rapidly translate successful development into productive capacity—and there are many more.

There is no reason to hope that either the domestic or the worldwide energy shortage will ease in a few years. Rather, we along with the rest of the world will be running hard to keep from losing ground until breeders, fusion, or perhaps solar energy, provide us with an inexhaustible resource. To make sure alternate energy resources and the systems to convert resources to safe and efficient use are available, we must explore geothermal, solar, and synthetic fuels, such as hydrogen or methane produced from renewable resources. We must learn also the use of recycle waste heat to warm and cool our structures, to treat our wastes, to desalt water, and to shift slowly to producing the essential products in our society with less energy-intensive processes. We must become more efficient. Our research and development programs must explore each mode of energy production to confirm the resources and learn how the resource can be put to use, and at what cost.

The production and use of energy from lower quality resources will place further strain on our natural environment, and the problems of health protection will increase. We must expand our understanding of the environmental effects at the level of the organism, the cell, and the molecule, in order to provide for safe energy systems.

The applied research and technology necessary to meet energy demands must be supported by expanded basic disciplinary research in materials, the life sciences, chemistry, physics, and the social sciences. The technology on which our energy supply depends requires understanding of fundamentals. We no longer engineer systems or work with resources that can be put together with handbook knowledge. The technology required will not be available without expanded basic research.

Energy system development and research has been carried out by industry and Government in a heterogeneous mode, each development aimed at a particular purpose. Until now, however, most research and development has been directed to producing a system to supply energy competitive in price with that of the cheapest resource active in the market. This is good economics, but the underlying premise that each resource is available in long-term supply is not true. We now must plan how our depletable resources can best be used, not how most cheaply used. Therefore, research and development will aim not only at producing a product at a competitive price but rather at producing a replacement fuel at the lowest possible cost.

This replacement mode for energy research requires a cohesive and central approach. This can be achieved best under unified direction such as proposed in this bill. I urge that the bill be passed as expeditiously as possible.

Mr. Chairman, because of the importance of this bill, each word will be read and interpreted for legislative intent. I would like, with your permission, to ask several questions:

(1) Page 2, line 7: Not just the environment needs protection but also the public health and safety. I suggest that the following wording be added to line 7 "* * * to assure adequate protection of the general health and safety from the effects of energy production and use * * *."

(2) Page 6, line 18: Insert the word "storage" between "conversion" and "transmission".

(3) Page 7, after (7): I suggest that a section covering education and training be included.

(4) Page 9, (3) lines 3 and 4: Is it the intent to transfer responsibility for underground electric power transmission only?

What of research and development on overhead transmission?

(5) Page 9, line 8: In addition to "* * * solar heating and cooling development" that work on all aspects of solar energy should be supported, particularly in (1) biochemical production of fuels, and (2) solar generation of electricity.

(6) Pages 12 and 13 (g), lines 11 through 25, and lines 1 through 3: Is it the intent of section 108 to provide for carryover of funds, for other than capital obligations, from one fiscal year to the next? If not, such a provision is very desirable, particularly in this proposed accelerated program of research and development.

(7) Page 18. On the subject of patents: Although this bill may not be the vehicle for bringing about a common patent policy, it is very necessary that patents be handled in a uniform manner in energy research and development and, in my opinion, in such a way to provide some incentives for industrial participants to convert R. & D. to production practice.

(8) General: Are the basic research functions of the present Atomic Energy Commission to be transferred and supported under the proposed ERDA, particularly those areas in research in basic physics, biology, ecology, isotopes, chemistry, and materials for which the AEC has been historically the only or principal sponsor on a national level?

A BRIEF DESCRIPTION OF OAK RIDGE NATIONAL LABORATORY

Oak Ridge National Laboratory (ORNL) is located near the town of Oak Ridge (population 28,000) in eastern Tennessee. The nearest

urban center is Knoxville (population 175,000), 30 miles distant, which contains the main campus of the University of Tennessee and the central administrative offices for the Tennessee Valley Authority. ORNL is part of a three-plant complex in Oak Ridge operated by Union Carbide Corp. for the AEC; the others are the Oak Ridge Y–12 plant, a developmental engineering and fabrication organization engaged primarily in defense applications of nuclear energy, and the Oak Ridge Gaseous Diffusion Plant, one of the three U.S. production plants for separating uranium isotopes.

PROGRAM FUNDING

In fiscal year 1974, ORNL's operating budget is about $100 million of which 85 percent is for AEC work and the remainder is work primarily for other Federal agencies. At fiscal yearend, Laboratory employment was about 4,100, down from a level of about 5,000 in fiscal year 1969. Major operating programs in fiscal year 1974 include:

	Fiscal year 1974 funds (millions)
AEC:	
Waste management	2.2
Reactor development (including fuel materials and cycles)	24.0
Reactor safety	3.4
Fusion research and development	9.5
Biomedical and environmental research	14.7
Physical research (materials, chemistry, physics)	26.9
Regulatory and licensing support	3.3
Space nuclear	1.3
Other Federal agencies:	
National Science Foundation	5.5
National Institutes of Health	5.6
Federal Drug Administration	.3
Department of Defense	2.0
NASA	.4
HUD (demography, modular utility systems)	1.2
EPA	.3
Other	.4

Almost half of the NIH funding was from the National Cancer Institute. The NSF funds are primarily for environmental research and studies related to the use and conservation of energy; the DOD and NASA support is primarily for radiation and nuclear shielding research, chemical analysis, and computer services; the Interior funds are for desalting R. & D., and the HUD support is for studies of integrated utility systems and urban growth patterns.

FACILITIES

The investment in physical facilities at ORNL exceeds $350 million. Special facilities include: an assortment of nuclear reactors ranging from the HFIR (high flux isotope reactor), which produces the world's highest neutron flux, to the Tower Shielding Facility, a reactor that can be suspended in the air for shielding studies; several particle accelerators, including an advanced electron linear accelerator (ORELA), and the ORIC (an isochronous cyclotron), which has special capability for accelerating heavy ions; a variety of chemical processing development facilities, including the Transuranium Processing Plant for separating Californium and other heavy elements and

the Thorium-Uranium Recycle Facility for remotely processing reactor fuels; the Small Animal Facility which can house an experimental animal population of about 330,000; the Aquatic Facility for studying the effect of water temperature on fish and other aquatic life; extensive materials development facilities, including large laboratory-scale capabilities for purifying, casting, forming, and testing both metals and ceramics; extensive and varied chemical laboratories and chemical analysis facilities; a variety of engineering development and test facilities; a large diversified research fabrication and shop capability for the three-plant complex; and an extensive three-plant computer facility.

PERSONNEL INFORMATION

The ORNL staff includes the following:

Occupation:	*Number*
Engineers	525
Mathematics and computers	115
Life scientist	325
(includes ecologists)	50
Physical scientist	525
Technicians	600
Other	2,010
Total	4,100
Highest degree obtained (individuals):	
Doctor of philosophy	640
Master of science	350
Bachelor of science	500

In addition the 800 member design and general engineering staff for the three AEC plants at Oak Ridge is centrally managed and available to the separate plants as needed.

CURRENT ACTIVITIES AND MISSION

Applied programs in the field of Reactor and Engineering Science include strong programs in reactor engineering, instrumentation, chemistry, chemical technology, and materials. Nuclear energy development programs include LMFBR and gas-cooled reactors, controlled thermonuclear reactors, reactor safety, isotopic heat sources, structural design methods for steel and prestressed concrete useful for reactor vessels, remote handling operations, preparation of design and safety standards, radioactive and chemical waste disposal systems, development of containers for the transport of hazardous materials, and studies of the environmental impact of power plants. Other energy related work includes investigations of energy conservation technology, energy use in transportation, waste management, desalting, power-plant effluents in the environment, topping cycles for increasing efficiency, super-conducting electric transmission, and integrated urban energy systems. Evaluation programs include coal liquefaction and gasification, electricity generation from solar energy, low-temperature power cycles applicable to geothermal and solar energy, microbiological production of hydrogen and methane, and production and use of hydrogen and other synthetic fuels from non-fossil sources.

A 25-year program in biology on the genetic effects of radiation on mice has provided information of major significance in the setting of radiation safety standards. ORNL biologists are also conducting research on the genetic and somatic effects of drugs, gasoline smog, and other toxic materials in the environment. Research in health physics and ecology has led to advanced techniques and instruments for environmental monitoring of aquatic, terrestrial and atmospheric radioactive releases. Many ORNL dispersion models, sampling and measurement methods are being directly applied to broader non-nuclear environmental energy pollutants such as arsenic, cadmium, mercury, and heavy elements. Major assistance was provided the AEC in preparing environmental impact reports to meet NEPA obligations.

ORNL has many years of experience and high level of capability in carrying on basic research in the physical sciences. It performs research at the frontiers of nuclear science and in solid state and plasma physics, in chemistry and in mathematics. Modern accelerators provide tools for intensive studies in the fields of nuclear structure, scattering, cross sections, and energy levels. Chemistry research includes investigations of the properties of actinide elements, and solid state, aqueous and molten salt chemistry at high temperature and pressure. The unique high flux reactor provides one of the best tools for neutron diffraction and materials science research into the properties of perfect crystals and study of processes of crystal imperfection. The field of plasma physics has evolved in support of demonstrating controlled thermonuclear power.

SIGNIFICANT ACCOMPLISHMENTS

Major ORNL accomplishments include: extensive contributions to the development of nuclear power plants, including light-water reactors, sodium-cooled fast breeder reactors, both graphite-moderated and fast gas-cooled reactors, and molten-salt reactors; improvements in graphite for applications having high thermal-stress and radiation resistance requirements, such as solid-particle fuels for HTGFs and nose-cone materials for missiles; preparation of industrial standards for the design and construction of nuclear reactor components and systems; production of radioisotopes and development of techniques for their use that have wide application in industry, medicine and agriculture; development of solvent extraction processes for the recovery and purification of uranium and plutonium that are used worldwide for recovery of uranium from raw ore and plutonium and uranium from spent fuels; development of ultracentrifuge techniques for producing pure vaccines and performing rapid medical diagnoses that are now used commercially; demonstration of techniques for preserving embryos for long periods that are now being investigated by commercial interests as a technique for improving meat production and quality; development of INOR–8, a nickel-based alloy that is now an industrially used commercial material; development of methods for separating zirconium and hafnium, making these two important commerical materials available; development of isotope heat sources for use in space, remote meteorological stations, underseas transmitters, ect.; development of the neutron activation-analysis method which

permits precise analyses not possible by other techniques; development of a phase-sensitive eddy current technique that is in wide use industrially for non-destructive testing; and operation of ORMAK, the Oak Ridge Tokamak which represents a significant advance toward fusion reactor power plants.

ADAPTABILITY TO NEW PROGRAMS AND PROBLEMS

ORNL's experience in the development of chemical processes through the demonstration plant stage can be of value in the development of techniques for coal gasification, liquefaction, and sulfur removal. Evaluation of coal processing technology and coal processing catalysts is currently underway. Successful development of virtually every energy technology—MHD, coal processing, power transmission, geothermal energy, solar energy—will rest on the availability of specialized materials. In this regard, ORNL capabilities and facilities in the characterization and development of metal alloys and ceramics can be an important asset. The current research program on dielectric properties of liquid helium and improvement of conductor materials for cryogenic temperatures is basic to successful development of superconducting power transmission. Staff expertise in molten salt technology may be pertinent to the fields of coal processing and solid waste reprocessing.

Research techniques in the identification of carcinogenic materials will find new applications in future environmental research; the small animal facility complements staff expertise in this field. Capabilities in preparing environmental statements for nuclear power stations can be deployed for fossil power stations, coal processing plants, and oil shale extraction and processing facilities.

In addition to the foregoing specific examples, ORNL's strengths include general capability in analytical chemistry, instrument development, health physics, information handling and computerized system analysis that can easily adapt to a wide spectrum of energy, environment, safety, and other scientific and technological problems.

Mr. Chairman, this concludes my testimony. I will be glad to answer any questions.

Chairman HOLIFIELD. Very good. Thank you for your statement.

HEALTH PROTECTION

Mr. CULLER. In the general purposes of the act in the first section, it very correctly states the principle of protecting and improving the quality and enhancement of the environment. I think it is also evident that by environment, the protection of public health is implied. However, in other acts similar to this, there is a specific statement about protecting public health. I wonder whether it would not be advantageous to add a clause there?

Chairman HOLIFIELD. What part of the bill are you speaking of?

Mr. CULLER. This is on page 2, line 7. I suggest that something such as "to assure adequate protection of the general health and safety from the effects of energy production and use" might be added. The environment is specifically called out; the problems are slightly different.

Chairman HOLIFIELD. "Protecting and enhancing environmental quality." You wanted what words added?

Mr. CULLER. I suggested possibly "to assure adequate protection of the general health and safety from the effects of energy production and use," meaning human health and not just environmental protection.

Chairman HOLIFIELD. I see. I think that is a good suggestion.

Mr. CULLER. Most acts such as this have both the environment and the health protection in them and I think that is probably just an oversight.

Mr. HORTON. I think that is a good point.

Chairman HOLIFIELD. That is a good point. You do not have that written out, do you?

Mr. CULLER. Yes, I do. I will submit it to you.

Chairman HOLIFIELD. Fine.

Mr. CULLER. Under title I, section 103, paragraph (3)—I think this is a minor opinion—I suggest that the word "storage" be included, along with extraction, conversion, transmission, and utilization. Although it can be implied in there, it is a specific component in the development research plans and perhaps should be named.

Chairman HOLIFIELD. You want "storage, transmission," et cetera.

Mr. CULLER. Correct. I think the word "transmission" does include fuel transportation as well as electric transmission.

Chairman HOLIFIELD. Yes.

Mr. CULLER. I think it was meant to do that, so I think the wording is adequate.

Chairman HOLIFIELD. No problem.

EDUCATION AND TRAINING

Mr. CULLER. Now, on page 7, since it is reasonably apparent that one of the restraints in accomplishing the energy research and development and creating an industrial capacity to bring production up may be in manpower, I wonder whether an additional section, say after item 7, specifically related to training, education, and training, would be appropriate for the bill.

Chairman HOLIFIELD. Do you have some language?

Mr. CULLER. I do not, Mr. Holifield, but I would be happy to draft some. It is conceivable that the transfer of function under the Atomic Energy Commission could cover this educational option.

Chairman HOLIFIELD. It really does.

Mr. CULLER. I think we are going to find almost surely that there will be a real restraint on qualified manpower to do not only the research and development, but to put into operation the necessary plant capacity to get the energy business solved. And I do think we will face a problem in training.

Chairman HOLIFIELD. Just a minute. Let us check on that.

The staff tells me that on page 15, beginnning on line 13, it says:

The nonnuclear functions of the Administrator referred to in sections 103 and 104 of this act shall be carried out pursuant to the provisions of this act, applicable authority existing immediately before the effective date of this act or in accordance with the provisions of chapter 4 of the Atomic Energy Act of 1954, as amended.

That does cover training as well as R. & D.

Mr. CULLER. That is fine. I did not look up the act. I thought perhaps it was transferred, but from knowing how the manpower situation seems to be, I think it is important that some provision be made.

Chairman HOLIFIELD. I think it is an important point, and we can also take care of that in the report as well. But this does take care of nonnuclear training.

TRANSMISSION RESEARCH

Mr. CULLER. Now, on page 9, line 3, I have more of a question. This is a transfer of functions from the Department of the Interior. The wording on electric transmissions reads "relate to or are utilized for underground electric power transmission research." I assume the wording is meant to be specific, that all transmission research will not be vested in ERDA, only those portions dealing with underground transmission. It is an exclusion, of course, of all of the overground, overhead——

Chairman HOLIFIELD. Well, I guess the greatest field for research and development right now and the greatest desire is for underground electric power transmission rather than overhead.

Mr. CULLER. I understand.

Chairman HOLIFIELD. But it would not exclude it, certainly.

Mr. CULLER. The way it is worded, it would exclude any very high voltage work with electric power transmission.

Chairman HOLIFIELD. Staff tells me it is a transfer of a program in the Office of Coal Research established pursuant to the act of July 1, 1960.

Mr. CULLER. Well, Interior has a rather large program in overhead electric transmisssion as well as cryogenic and superconducting underground. It is just a question, Mr. Chairman, because it is not a specific exclusion the way it is worded.

Chairman HOLIFIELD. Well, we will check that. I might say that there is a division which was testified to, a division of functions. Everything is not being taken from Interior.

Mr. CULLER. I understand.

Chairman HOLIFIELD. Some of the ongoing programs are being left there. We will look into it.

Mr. CULLER. I thought it was perhaps one of those where agreement was being reached where transfer was to occur.

Chairman HOLIFIELD. I think there has been some agreement reached.

TRANSFERS FROM NSF AND EPA

Mr. CULLER. Similarly on transfer of functions from the NSF is specific reference to solar, solar heating, and cooling. There is other solar work, solar station power and solar process for the generation of alternate fuels—hydrogen, methane, and such—which are included in the overall development plan but are not included by this wording.

Chairman HOLIFIELD. Well, I think the idea was that these two items here have reached the stage of practical application possibly, more than some of the more exotic ones that are in there. But we will look at that also.

Mr. CULLER. And similarly, under the transfer of functions from EPA, the development and demonstration of "alternate automotive power systems." I presume that means alternate to internal combustion.

Chairman HOLIFIELD. It has been suggested that "automotive" be changed to "vehicular" power.

Mr. CULLER. Right.

Mr. BUHLER. I think that is a term of art: alternative automotive systems. It is abbreviated "AAS" in a number of publications I have seen.

Chairman HOLIFIELD. Well, the person who suggested "vehicular" to substitute for "automotive" was of the opinion that automotive was a limitation; for instance, that it would not apply to a diesel engine pulling a railroad train or something like that.

Mr. CULLER. Yes.

Chairman HOLIFIELD. Mr. Buhler, what did you have?

Mr. BUHLER. As I understand it, the term "alternative automotive power systems" is a term of art in this field and if we changed it to vehicular, there would be some question as to exactly what we were including. These are ongoing programs within EPA now that are known by these terms, so we wanted to transfer the programs by name.

Mr. CULLER. That is satisfactory. I just raised it for clarity.

Chairman HOLIFIELD. I am going to call on Mr. Reich to comment on this. He is more familiar with it.

Mr. REICH. It is our understanding that the wording that you are looking at now represents the best judgment of OMB and the executive branch, and certainly including these agencies, as to the precise description of the programs that are being transferred. Now, that is one aspect of what you are saying.

However, this would not preclude ERDA under this new authority, without regard to these transfers from engaging in advanced R. & D. with respect to any of these fields of activity, even though EPA, for example, could continue on its own with that part of a program that was not transferred.

Is that reasonably clear?

Mr. CULLER. I think it is, because——

Mr. REICH. We cannot fool around much with the language that describes the programs they are conducting. But this does not bespeak or judge in advance the scope of activity that ERDA can engage in on its own.

Mr. CULLER. Under the usual description, solar energy is not just precluded to heating or cooling buildings. I think that is something our staff worked on, can we have just heating or cooling systems, or can we go to a biological system, and I said, I will ask tomorrow.

Chairman HOLIFIELD. Well, the staff believes that you can under the language.

FUND CARRYOVER

Mr. CULLER. On page 13, a question that Harold Agnew brought up this morning. I am sorry, it is just generally on the process of budgeting and budget control and the establishment of an operating, contin-

uing operating account. We were not sure whether, on pages 11, 12, and 13, there was a provision for carryover of funds from 1 year to another and from 20-some years of experience now, it is very difficult, with no carryover provisions at all except in capital commitments, to run R. & D. programs. I think I endorse what Dr. Agnew had to say this morning, particularly in a rapidly expanding program. It will be difficult to operate new programs that are just being initiated without some ability to carry forward, because the budget actions do not anticipate exactly what happens. And if there is any way to provide for this within the act or to put it down in a legislative note, essentially that there is some intent, it would be very helpful in operation.

Chairman HOLIFIELD. Mr. Buhler?

Mr. BUHLER. If I may clarify your question a bit, this section in the bill creates a working capital fund which would cover common administrative expenses, such as stenography, typing, Xeroxing, and things like that. It would not handle expenses for research and development projects such as contracts. If you are talking about having R. & D. money authorized so that commitments could be made for more than 1 year, this section does not deal with that.

Mr. CULLER. I am talking about——

Mr. BUHLER. So you are talking about R. & D. commitments for more than 1 year.

Mr. CULLER. To carry forward money to cover commitments made in operating as opposed to capital accounts. We can now carry, of course, capital accounts.

Mr. BUHLER. Then this section does not apply. But in terms of whether or not it would be possible to have carryover, that would have to be handled in annual authorizations and appropriations.

Chairman HOLIFIELD. Yes, I think we will watch that.

Mr. CULLER. Again, it is a problem common to all of us. We have great difficulty with them.

Mr. HORTON. Well, they are practical problems, and I think we are grateful to you for bringing them to our attention.

Mr. CULLER. Very difficult problems, because as a practical problem, your estimates are not as good as your actual.

HANDLING PATENTS

In the section dealing with the patents, on page 18, as time goes on, I think it will be necessary to look at the handling of patents. The rights that may go to an industrial participant, that conceivably might give him a slight edge for having participated in joint development. The question of how patents are now handled, as you well know, Mr. Chairman, is a difficult one and you spent quite some time on it this morning.

I think that I endorse whatever direction can be taken to get uniformity. But in this period when we expect to translate research and development and demonstration plants rapidly into privately capitalized plants, there may need to be particular attention paid to what edge is given the industry that participates with its own money in patents, or special rights for 6, or 7, or 8 years.

Chairman HOLIFIELD. I think that has not been done outside of this act.

Mr. CULLER. Yes.

Chairman HOLIFIELD. This is a very controversial area. It has been fought over in the Congress for years, this patent problem. In referring to the President's statement of Government patent policy, it seemed to me that we were getting just about as far in advance as we could over previous statutes, because this was an attempt on his part to set a uniform patent policy. Now, it has not been completely effective, but it is about the best that we can do at this time in this act, unless we want to become embroiled in a very controversial and complicated matter and try to make new law. And I do not think this is any place to do that.

Mr. CULLER. Yes, Mr. Chairman.

Chairman HOLIFIELD. Desirable as it might be.

Mr. CULLER. Mr. Chairman, there is only one other question, and I think I know the answer to it, but I will ask it because our research people are always concerned. In the basic research functions that are carried in very special areas, actually, within the AEC—high energy physics is a very good example—I presume that they will be moved entirely into ERDA and that they will occupy the same general slot for consideration as they do now, that the responsibility for these special areas of research in the United States—high energy physics being one—will remove——

Chairman HOLIFIELD. We have not tried to change the Atomic Energy Act. We have tried to make it applicable. About the only thing we have done, and we have done this in a separate analysis which will be in the report, is to show which provisions of the Atomic Energy Act apply to ERDA, to NEC, or to both.

Mr. CULLER. I see.

Chairman HOLIFIELD. It would be transferred into and be applicable in ERDA.

Mr. CULLER. I have no further questions, Mr. Chairman. Dr. Weinberg may have some remarks.

Chairman HOLIFIELD. Dr. Weinberg?

Dr. WEINBERG. Well, I want to say that Mr. Culler has said just about everything that I had on my mind. We had consulted before he presented his testimony. And of course, I have been on leave from the Laboratory and so have not been as intimately involved with the problems of the Laboratory as Mr. Culler has indicated so completely. There are a couple of things that I would like to stress.

SHORT- AND LONG-TERM CONSIDERATIONS

I suppose the first one is that, as you look at the energy problem, there is a short-range problem and a long-range problem, and one must recognize that the general thrust of the R. & D. tends really to be aimed at the long-range problem rather than the short-range problem. I think this is something that must be made fairly clear to the American people, that R. & D. is not going to put more gallons of gas into your fuel tank next month. There is, however, one exception which Floyd Culler did mention, and which I think is immensely important.

That is, to make a dent in the short term, one is going to have to devise and implement a sensible policy. One is going to have to ration, one is going to have to have tax incentives, one is going to have to intervene on a policy level, and what is perhaps lacking at this stage is the firm basis for establishing the most sensible kind of policy.

And, therefore, I would reinforce the remarks that he made, that when ERDA gets set up, it be made clear, either through the legislative history or in the act itself, that ERDA will be expected to examine, in as sophisticated and thoroughgoing and analytical ways as possible, the various policy options that are available. And in particular, just to give an example, to try to make some estimates as to what, say, rationing as opposed to putting a very large tax on gasoline is going to do to the economic structure of the country.

I cannot stress too strongly that in the short run, it is this kind of thing that is going to make a difference. And if you are talking about self-sufficiency by 1980, I guess my instinct is that somehow, there is no way short of a sensible and rational policy action of that sort.

Chairman HOLIFIELD. In other words, what you are really saying is that it is all right to set the goal of self-sufficiency for 1980, but the problem is so great, it is doubtful if we can get there. But if we set a close time goal maybe we will work a little bit harder to reach it.

The alternative is a large-scale resumption of importation of Middle Eastern oil and oil from other sources at high prices. We would have the quantities of oil we need, but we might have it at $10 a barrel. And the economy could not stand the fiscal shock.

Last year, we had about $6½ billion or $7 billion worth of oil imports, and it was estimated that we would have about nine this year if it continued at the old price. But the old price has gone up in general from about $3 a barrel to $7 a barrel. We predicted that in 1980—at the old price—it would be $2.50, but God knows what it will be in 1980 when we are on the receiving end with no control over the supply. So this goal of self-sufficiency is a goal to shoot for, but it is going to be very difficult to attain.

Our first thing in the short range is conservation.

Dr. WEINBERG. This is essentially what I am saying, that conservation has to be done intelligently and you have to establish the basis for intelligent action, which is intelligent study and sophisticated study of the problem.

Chairman HOLIFIELD. Yes.

USING AVAILABLE RESOURCES

Dr. WEINBERG. The other point that I would like to make is to stress again what Mr. Culler said, that as you look at the projections and examine what the overall strategy for our energy future is going to be, it has been pointed out many times, I am sure at this hearing, that the overall strategy is to replace the resources that we do not have with the resources we do have. The resources we do not have are oil and gas. The resources we do have are coal and uranium.

When I try to reorder my own priority of what are the most important things we must do over this period—and I do not care whether

you say within the next 7 years or 8 or 10 or 15 years: No. 1, we must guarantee the validity of the coal option. Floyd Culler mentioned that there are some estimates that we will have to mine, by 1985, 1,800 million tons of coal, which is three times as much as we have ever mined before. Is that a feasible kind of thing? It seems like such an overwhelming thing that somehow one has to absolutely guarantee that it will be there.

Chairman HOLIFIELD. How does that compare to the annual production now?

Dr. WEINBERG. The annual production presently is 500 to 600 million—it is about tripling the annual production.

PRESERVING THE NUCLEAR OPTION

The other thing is something you and I have talked about over these years. If you look at the projections in energy use, most of the projections suggest that nuclear energy is going to have to take over about 20 percent of the energy load by 1985. I guess I would only say that there is the very highest order or requirement that nothing happens between now and then that would compromise the validity of that nuclear option.

So those two things, I think, are the very highest order of things, and the kind of thing that one is rather bothered about is when you try to calculate, well, how much uranium are you going to have to dig out of the ground by 1985? The answer is about 70,000 tons.

Mr. CULLER. Per year?

Dr. WEINBERG. Per year, if some of these scenarios are taken at face value.

Then you ask how much are we mining now? It is 14,000 tons. So you have to increase the production of uranium fivefold.

I might say that I guess, well, this is an argument, if you like, for getting on with the breeder just as fast as possible. Because if we had breeders now, then you would not be faced with that possibility. And you know, over the years, we have always talked about it. But here, what we want as much as anything to make certain of, Mr. Chairman, is that when 1985 comes rolling around, we do not have the same bind with respect to coal and uranium that we are now experiencing in oil and gas.

I think that is about all I want to add.

SOLAR ENERGY POTENTIAL

Chairman HOLIFIELD. I think I agree with you 100 percent and I think you evaluate the situation just about right.

I wonder if you would comment on this solar potential? You know, we had Dr. Steinhart from the University of Wisconsin this morning, and he gave us what seemed to be an optimistic presentation of the capability of immediate or almost immediate utilization of solar power for heating of homes and so forth. I know in your studies, you have looked at this problem. Would you care to comment on that?

Dr. WEINBERG. Well, I do not think that either Floyd Culler or I consider ourselves great experts on solar. The Laboratory has done

some studies on it and I have talked a great deal to people who have worked on it at Los Alamos and so on. I think we tend to agree with him that, yes; solar energy can be used for heating houses, especially if the cost of oil keeps going up. I think there is a very sharp divergence of opinion between us, from studies made at Oak Ridge and the view expressed by Dr. Steinhart, as to the cost of energy from large-scale central solar power stations. I think our estimate would be that the cost of energy from central power stations, large solar collectors and so on, is perhaps 6 cents per kilowatt-hour. I think the figure that he was quoting was closer to 2 to 3 cents per kilowatt-hour.

My own conviction, then, is from what I know about the matter—and, as I say, I have done a fair amount of reading and have done some studies at the Laboratory—my own conviction is that the society will not go to solar as its primary energy source unless, for some reason other than economic, it finds nuclear energy unacceptable.

Now, you choose your expert and you get your answer. Different people will disagree. I do not know if Floyd would agree with the position I expressed.

Mr. CULLER. I am more pessimistic, I think, than Dr. Weinberg on how rapidly solar power from central stations might evolve. The studies we did essentially with another group were done with great optimism. I mean we gave the benefit of the doubt to the solar system. The capital costs were on the order of $3,000 to $3,300 per kilowatt.

Chairman HOLIFIELD. Compared to around $400 to $600 for regular generating capacity, normal?

Mr. CULLER. Yes. My own feeling was that we did give a lot of benefit to the system event then. As a consequence, as Dr. Weinberg says, I think that the movement toward solar will go for reasons other than economic, if it goes. There are sometimes many technical problems.

In home heating, I think, although the systems are available and costs of $4,000, $5,000, $6,000 per home in capital expenditures are probably about right, it is something that has to enter the marketplace in a very diffuse manner. I mean the fact that each individual who builds a home has an additional $5,000, or $6,000, or $8,000, with the insulation included; capital could be—to obtain—may be a real impediment.

Chairman HOLIFIELD. Most people building houses nowadays find it difficult to get the capital investment to buy any kind of house for their family. Inflation has taken a $15,000 house up to $30,000 or more. And, as you say, to put on another $4,000 or $5,000 for a long-range recovery, why, would be very difficult. It would be a matter of absolute necessity for them to do that, I suppose, if they do it.

Mr. CULLER. I do think that research and development should continue at an expanded pace. You asked whether it would take over and at what pace. I do not think it will take over very rapidly, solar energy, but it is an area for increased research and development, because I think we should understand better what the options are there.

Chairman HOLIFIELD. You understand the proposal the President made in his speech of $10 million for 5 years, and he even indicated that he wanted to refer this to ERDA for research and development work. That, of course, was not $2 billion worth a year of new money. That was in addition to ongoing programs.

Mr. CULLER. Yes.

Chairman HOLIFIELD. But it was a substantial annual increase. And in the other body, over in the Senate, they have some programs that are substantially the same, but larger amounts for more years—$20 billion for 10 years in place of $10 billion for 5 years.

You know well what the present program of research and development is of the Government. What is your opinion as to the adequacy of the $2 billion a year for any number of years—5 years, 10 years, whatever you want to make it?

INADEQUACY OF FUNDING

Mr. CULLER. I think this will become more apparent when Dr. Ray reports, but generally, the accepted level of energy R. & D. funding is somewhere around $6½ to $7 billion per year—that is over 5 years, I am sorry.

Chairman HOLIFIELD. Yes.

Mr. CULLER. This says that approximately $3 billion have been added in the $10 billion framework. In the various committees and all of the study groups that have worked on preparing a program within the $10 billion budget, we found the $10 billion level rather constraining. Basically, nuclear energy obviously has to continue; the fusion option is likely to require more money. It is sorely evident that all kinds of work in coal research, starting even with basic coal chemistry, up to the building of reasonably sized demonstration plants, is urgent. A demonstration plant for the liquefaction of coal will cost somewhere between $250 and $400 million and it is not a very significant plant.

As a consequence, when all of the options were added together, the incentives that may be necessary to increase oil production by secondary and tertiary treatment and research going that way, the coal options and the number of things that need to be done there, the processes to improve efficiency of conversion like the potassium topping cycles, MHD, uses of waste heat, desalting, home heating, and such for some of the throwaway heat—all of these added up, I think we all found the $10 billion was a constraint.

Although they may not be reported, there are alternate thoughts that have been evolved in reasonably good form. But each session, I think, ended with a period of cutting and slicing and of awkwardly fitting pieces together.

Chairman HOLIFIELD. In other words, the total amount was adjusted downward for fiscal reasons rather than to give us an adequate amount of money to really get the job done?

Mr. CULLER. That is my impression.

Dr. WEINBERG. You may recall, Mr. Chairman, that there is an additional billion dollars that has been included as a sort of separate add-on item that does not cover environmental work, basic research, and manpower and training. So the total, if you add them all up, is about $11 billion.

I basically agree with Floyd that, considering the magnitude of the problem, I think it is kind of a skimpy amount of money.

Chairman HOLIFIELD. You know, we tackled the space problem as a matter of international challenge, you might say. Our space budget

ran $4 or $5 billion a year for several years, as you remember. It has run not much higher than $2 billion a year since then.

Dr. WEINBERG. There is a little difference here, because you add up the amount that private industry is putting in and that can be added up to another $10 billion per year; so in some sense, the country's commitment to this can be interpreted as a total of $21 billion per year——

Mr. CULLER. For 5 years.

Dr. WEINBERG. Yes; for 5 years.

Mr. CULLER. I think, too, that—well, I know that all of us that have been for the last 5 months rather involved in trying to judge what levels were proper did feel the constraint. In addition to that, the 5-year period as the defined period to accomplish the objectives that were set is far too short. As Alvin has said, the accomplishment of the research and development goals to put more Btu's on the line somewhere in 5 years is too short a period. So in addition to considering a 5-year period, it is really necessary to consider 10 and then the longer term options that must be pursued to make sure that we are running fast enough to keep up with ourselves, to keep the longer term options viable enough to pick up the load in 1990, 1995, and such. All in all, the program is thought out, I think, but there are constraints in the $10 billion and the time period.

Chairman HOLIFIELD. You used a very nice word there, "constraints." What you are really saying is there is inadequacy of funding?

Mr. CULLER. I think so.

PROBLEMS IN COAL USE

Chairman HOLIFIELD. You know, we talk about this doubling of the coal output. The reason we talk about that is because we do have the coal in the ground.

Mr. CULLER. Yes.

Chairman HOLIFIELD. And we do know how to get it out.

Mr. CULLER. Yes.

Chairman HOLIFIELD. But at this time, about 50 percent of the coal is being mined by strip mining. And we have bills in the Congress which are aimed at discouraging any further strip mining. And of course, there is a great demand in this country for a cleaner environment, and I think all of us would like to see a cleaner environment. But we have here really two opposing forces that are running head on to collision. You could get twice the amount of coal—I do not say you could get it even in 5 years. I doubt if you could get the mining equipment. These huge machines, I am told are four stories high, and take as much as 4 or 5 years to build. There are only two companies that are really making these big strip mining, coal mining machines. So when you begin to look at the real problems that we face, some of these assertions that we can double the production of coal become hard to believe.

Mr. Bagge, the head of the National Coal Association, gave a very fine piece of testimony the other day about that. Part of that testimony was to the effect that you cannot liquefy and gasify coal if you

do not have it. Of course, we know that when you gasify coal, you burn 2 tons of coal to obtain the equivalent in Btu's of 1 ton of gas. In other words, if you transfer the solid into gas, you lose 50 percent right there.

Mr. CULLER. That is why, incidentally, we favor liquefaction. It is more efficient.

Chairman HOLIFIELD. We are not quite sure yet what the figures are on that, because we have not really developed that technology quite as far as we have the gasification. Is that not right?

Dr. WEINBERG. Yes.

Mr. CULLER. That is true. However, there is another advantage, that it takes less hydrogen, too, and the fuel is a little bit more useful across the board for all uses, including automotive.

Chairman HOLIFIELD. What about the manpower involved?

Mr. CULLER. I do not know that I can——

Chairman HOLIFIELD. In the mining I am speaking of.

Mr. CULLER. We do not know.

Chairman HOLIFIELD. The younger people are not going into the mines. I am told that attrition from the standpoint of age and mortality is a very serious factor right now in the coal mining areas.

Mr. CULLER. In guessing how many miners might be required, we estimated about a 25- to 30-percent increase in efficiency in mining per man-hour, a continued 50–50 split between deep mines and strip mines, and assumed that by 1985, the amount of coal that might be required had to be a factor of 3 higher. It turns out that about 700-some, 720,000 people would have to be in the mines versus a little less than half of that now.

Dr. WEINBERG. I guess I should, however, Floyd, place on the record that not everybody agrees with these figures. You get some figures that are very much lower than that as the requirement on the number of miners. For example, the Cornell workshop, which was part of the Dixy Lee Ray exercise, looked into the matter. Well, they made different assumptions. They said they would be able to double the efficiency of mining—take out 24 tons per day per miner instead of the present 12 tons per day per miner.

Chairman HOLIFIELD. What are they going to take it out with? They have not made any advance in coal mining in the last 20 years that is really substantial.

Dr. WEINBERG. This is one of the reasons I am so pleased with this sort of bill, because one of the things that is in fact in Dixy Lee Ray's proposal, and presumably would be done under this bill, would be to actually develop the new and necessary coal mining technology. One of the very nice ideas, I think, is to have a demonstration coal mine in which you actually go in and try out the very best in this technology.

Mr. CULLER. The technology and the reclamation, Mr. Holifield, because that obviously is going to be the restraint, that you take 10 square miles or 50 square miles and lease, possibly to coal operators, but under careful Government control, and then make sure that the best mining techniques are done and that the land is reclaimed. There are probably three regions where this is required—the western coals, where it is arid and the coal seams are thick; the eastern coals, say in Illinois and Kentucky; and the Appalachian coals, where techniques

differ. Now, basically, everyone thinks that it is possible to reclaim the land. How much the cost will be and the followup is not completely evident. So the idea of putting down coal mining experiments and reclamation as part of a major demonstration project, I think, is almost a necessity if we are going to get the coal out.

Chairman HOLIFIELD. I think you are right about that, and I agree with Dr. Weinberg that we actually have to do these in existing mines.

Mr. CULLER. Yes.

Chairman HOLIFIELD. This cannot be done by pencil and paper.

Mr. CULLER. It has to be done——

Chairman HOLIFIELD. It cannot be done theoretically; it has to be done by testing these improved methods. Unfortunately, though you hear a lot about it, when you come down to the specifics, you do not get very much in the way of improvements over existing processes.

Dr. WEINBERG. Was Mr. Bagge optimistic about being able to get three times as much coal by 1985?

Chairman HOLIFIELD. I cannot really comment on that. One of the reasons why he wanted to see this problem come into the ERDA orbit was to get more money. As I understand it, the Bureau of Mines has been working mostly in health and safety. It really has not had any money up until the 1974 budget. I have heard two figures—$3 million and $7 million—in the 1974 budget that would really go into development of machinery—improved machinery to do this job. That has not been spent yet.

It has been a neglected area. The Government has not done it, the private people have not done it, in the scale that is needed in order to get the tonnage of coal that we need.

So there is a great problem here and part of the planning of ERDA will be to analyze this more completely and push forward.

The suggestion was made this morning that there be a report within a year of an overall plan. Maybe with the work that has been done—I know you gentlemen participated in it—by Dr. Ray, there will be an outline. I hope it will be a practical outline—I have not seen any of it—that we could adapt to a 10-year plan or a 5-year plan, or something like that, that would bring about a greater advance. But I think we will just have to leave that to hopes.

Mr. CULLER. The idea of having a redone plan in 5 years, however, I think is a good one. The plan that has been drawn has been drawn very rapidly with a large number of people participating, and I think it will be acceptable and all, but——

Chairman HOLIFIELD. It will be acceptable, but I think it is going to have to be analyzed very carefully and then implemented, because it is a statement of conclusions, I think, rather than a definite plan of how to do it.

Is that right?

Mr. CULLER. Right.

Chairman HOLIFIELD. Thank you very much, gentlemen.

Are there any questions?

Mr. HORTON. I have no questions, Mr. Chairman.

Chairman HOLIFIELD. Our next witness is Ms. Ann Roosevelt, of Friends of the Earth.

We are pleased to have you with us, Ms. Roosevelt. Will you please introduce your associate?

STATEMENT OF ANN ROOSEVELT, ASSISTANT LEGISLATIVE DIRECTOR, FRIENDS OF THE EARTH; ACCOMPANIED BY RICHARD LAHN, SIERRA CLUB

Ms. ROOSEVELT. Thank you, Mr. Chairman. My associate is Mr. Richard Lahn from the Sierra Club. He does not have a statement, but he will be available to answer questions.

Chairman HOLIFIELD. Very well. You may proceed.

Ms. ROOSEVELT. Mr. Chairman, thank you for the opportunity to appear here today and present the views of Friends of the Earth on the proposed Government reorganization. Too often these days, we hear unfounded charges that environmentalists have a completely negative attitude toward society, civilization and progress—that we would be happier living in dark, dank, unheated caves with our only comfort being a wood fire. This is not so, and in the interest of offering positive alternatives and positive criticism to H.R. 11510, and in the interests of dispelling these misconceptions about environmentalists, we would like to offer some thoughts about what we think should be the thrust of any effort to reorganize and centralize the energy research and development functions of the Federal Government.

NEED FOR RATIONAL PLANNING

Rather than being against progress, we are trying to point out that rational plans must be made now for the future because the natural resources of the Earth are finite. The only infinite resources are the Sun and the heat within the Earth. If we continue to rape the land and waste our finite natural resources, our descendants will condemn us as the ravagers and destroyers of our one unrecyclable home, the Earth.

We now have the unprecedented opportunity to undertake rational planning for our future energy needs. This planning must not be shortsighted. Now that we have the opportunity to organize a cohesive program for energy research and development, we must not put all our eggs in one basket, we must not favor any one research direction—whether it be nuclear energy or coal—over others. However, we should keep in mind that the perfect source of energy would be cheap, abundant, and environmentally clean. Therefore, in any Manhattan Project type effort, we should stress those energy options for R. & D. which would provide this plentiful clean energy. We must not be content with the old solutions—with improving supply in fossil fuels and nuclear—we must strike out now and take decisive action to find new energy sources. In any new Government energy R. & D. organization, it should be made perfectly clear—to borrow a phrase—that a crash program is intended in the areas of solar, fusion, and geothermal and in other areas which show promise of providing clean plentiful energy.

IMPORTANCE OF CONSERVATION

Further, the other essential ingredient in any new program is a broad-scale commitment to energy conservation. In the Weekly Energy Report for November 19, an AEC representative is quoted as saying

that conservation "has no sex appeal." It is this kind of attitude that we must avoid in setting up a new R. & D. program. Conservation is recognized by this administration as being the key to getting us over the energy shortages this winter, but true conservation in the near and midterm will demand a broad-scale research commitment. Energy conservation does not just mean using less, as we will have to do this winter. It means inventing new energy efficient goods, and developing processes for the more efficient and economic use of what we have. It means planning and design so that consumers will be able to use less energy and will not be compelled to use more.

Because of the importance of energy conservation, I suggest that a change in structure should be made in the proposed ERDA. As the bill is now drawn, an Assistant Administrator is designated to handle environment, safety, and conservation. In our opinion, the area of energy conservation is so important and so broad as to demand a division of its own. Conservation should become the cornerstone of any R. & D. program. Although it is tangentially related to environment and safety, it really stands alone in its importance, complexity, and scope. Better mass transit, more efficient freight systems, urban design, total energy system utilization, building design, economic incentives, planning of all kinds, recycling and invention of new goods—all fall within the scope of energy conservation R. & D.

We think it is imperative that conservation be split off from environment, and safety and be placed under a separate Assistant Administrator. This split is easily accomplished and the structure of five Assistant Administrators retained by the dropping of the Assistant Administrator for National Security. We believe that it is improper and totally unsatisfactory to place the nuclear weapons R. & D. programs within a civilian high technology energy agency. The AEC weapons divisions should be moved intact over to the Department of Defense. The argument that the national labs perform work important to the weapons program and that shifting the program would disrupt their work is not valid. The laboratories could remain intact and take contracts from both Defense and ERDA. If the military weapons program were removed from ERDA and a new Assistant Administrator for Conservation formed, the effect would be to strengthen the whole Administration and provide the vehicle for much needed conservation research and development.

RENEWABLE ENERGY RESOURCES

A major fear of environmentalists is that the promising renewable energy sources will get short shrift in any new energy research structure. A single all-powerful research administration will most likely determine what the mix of energy sources will be in the future merely by establishing funding priorities. The danger, of course, lies in favoring a single solution over the others.

For instance, a recent Library of Congress study found no clear congressional committee jurisdiction over energy conservation, solar and geothermal energy. This presents a problem in the present structure because the authorization of funds for each Assistant Adminis-

trator, as this bill is presently drawn, will most likely go through separate congressional committees. Since there is presently no committee whose jurisdiction fully encompasses these renewable energy sources, some provision in the congressional authorization process would have to be made so that adequate authorization of funding for these areas occurs. As you know, the situation for these areas is far different from that of coal and nuclear where powerful interests push for new development, exploitation, and technological innovation. There are, of course, no special economic interest groups pushing for solar, wind, or some of the other advanced technologies. Because of this and because there is even fragmented committee jurisdiction in these areas, it is possible for disproportionate budget distribution to take place despite any intentions of this committee that it should not occur.

CONGRESS AND PRIORITIES

This brings me to a major problem of this bill. Under the bill as it is presently drawn, the Administrator, naturally, as the head of the administration will have a very large role in setting priorities and funding levels for each of the areas under the Assistant Administrators. I think the power of the Administrator in this area is the major flaw in this bill. Under the bill as it is currently written, it is probable that no single committee of Congress would have the opportunity to examine fully the total budget of the Administrator and discuss the funding priorities. This is extremely unfortunate because we believe that national policy issues of this kind should be decided by the Congress or at least initiated by the Congress, and not be left to the administrative actions of ERDA. Under the present language of the bill, this would not be possible.

What would occur is merely a realinement and rearrangement of personnel from the various agencies now doing energy R. & D. The setting of priorities would be up to the Administrator and there would be very little congressional oversight of the total energy picture.

The problem with this approach is highlighted by recent actions of this administration. The President has asked Dixy Lee Ray, Chairman of the Atomic Energy Commission, "to undertake an immediate review of Federal and private energy research and development activities—and to recommend an integrated energy research and development program for the Nation." In the November 19, Weekly Energy Report, the broad outlines of the administration's plan for a 5-year, $10 billion R. & D. program were spelled out. Unfortunately, I left this in my office, but I would like to submit it later for the record.

Chairman HOLIFIELD. It will be received.

[The material follows:]

WEEKLY ENERGY REPORT, NOVEMBER 19, 1973

PREVIEW OF $10 BILLION PROGRAM: QUESTIONS STILL ABOUND

Industry and scientific experts got their first look at the administration's $10 billion, five-year funding recommendations last week plus an inside line on some of the problems program architects have been struggling with. Fifteen technical panels were asked to consider funding on three levels (minimum, orderly and crash programs), Gorman Smith, special assistant to AEC Chairman Dixy Lee

Ray, told the Energy R. & D. Advisory Council last week. After all recommendations were in and totaled, it became apparent that the panels' minimum program (about $11 billion) was more an orderly approach in the eyes of the overview panel chaired by Stephen Wakefield, Interior's Assistant Secretary for Energy and Minerals. What the panels considered orderly ($16 billion), the overview panel considered crash. And the panels' crash program ($30 billion) was completely out of the running. "Less the panels' fault than ours," Smith told Weekly Energy Report, "for not staying in close enough contact with them and giving specific guidance." But he points out that the $30 billion request from the panels does not mean there is $30 billion worth of work that can be done in 5 years. The overview panel judged manpower, lab facilities and manufacturing capability are too low to absorb funding on that level. "The objective is not necessarily the fastest R. & D. program," Gorman Smith notes. "If we go a little slower on R. & D., we may get commercial entry by private industry that much quicker."

That the $10 billion is all brand new money "is a common misconception that's been floating around," said Smith. Both base funding and recommended increases are in constant 1973 dollars with no allowance for inflation. "If OMB does not release any more than $10 billion and inflation continues, in the long run it may well represent a decrease in effort," one council member observed. Smith noted that the program will be submitted to Chairman Ray with the strong recommendation that an extra $1 billion be added on for basic research and environmental effects studies as support work for the larger energy R. & D. program. The overview panel felt that including the $1 billion in the $10 billion program would cut too deeply into the amount of new money earmarked for hard-core energy R. & D. With 11 percent of the basic program already aimed at environmental control technology (1.1 billion), adding an extra billion dollars for basic research and environmental effects would leave "damn little energy R. & D."

Private industry participation presented an equally knotty problem. "The biggest single problem," Smith says, was resolving the two extremes between (1) the Government stepping in and doing it all, or (2) letting the market take over, allowing prices to rise and assuming private industry will grasp the incentive and do R. & D. on its own. "The range of estimates between the two extremes is very wide indeed. The biggest single obstacle was finding an answer to the question: what are the appropriate recommendations regarding Government's role and private industry participation in each technology," Smith said.

In working up their recommendations, the technical panels confronted what Gorman Smith called an "unpleasant series of choices" between energy self-sufficiency, continued environmental cleanup and energy pricing. "Complete attainment of all three at this point is mutually exclusive," he said. "But energy R. & D. is aimed at reducing the difference between those three. The ultimate goal is plenty of clean cheap energy from domestic sources." The overview panel decided appropriate R. & D. strategy should focus on self-sufficiency, the environment and prices, in that order. Some council members questioned the overview panel's consensus and suggested the choice of trade-offs should be left to the President. Such a possibility is unlikely, however. There are 10 ways to reach the balance point between self-sufficiency, the environment and prices and each would require a different R. & D. funding profile.

Then other problems emerged. Where, for example, does energy R. & D. leave off and energy policy begin? It's a commonly held belief that whoever decides where R. & D. money is to be spent is deciding energy policy for all intents and purposes. And how do you handle the undefined interface between R. & D. and energy production? "We wrestled with defining the dividing line between R. & D. and energy policy," said Smith. "For example, is it appropriate to call Federal funding of demonstration plants R. & D.?" he asked. Assuming the administration's ERDA and DENR plans materialize, "to what point does ERDA work on oil shale at what point does ERDA say to DENR: 'OK, if you want more production, you go out and build plants.'" The United States must increase domestic energy production by the equivalent of 11 billion barrels per day of oil over the next 5 years, Smith noted. "Now, is the R. & D. program to do this? Although it will contribute, we had to keep in mind that it's not a production program."

"What the Nation needs is just that—a production program," said Louis Roddis, vice chairman of New York's Consolidated Edison. "But should it be a Government program," asked AEC Commissioner William Anders. "I know one thing . . . it shouldn't be run by R. & D. people." Roddis replied. The R. & D. production dividing line bothered several council members besides Roddis.

Someone "should get the message across to the public that there will be no immediate technical effect," they recommended. Probably less than 50 percent of the R. & D. money will make any impact on energy supply in the 1980–85 time frame, Gorman Smith affirmed.

NPC REPORT MEASURES CRISIS

The National Petroleum Council's committee on emergency preparedness is projecting a possible $48 billion annual loss to the U.S. economy as measured by the GNP resulting from oil import interruptions conservatively measured at 2 million barrels per day. A 3-million-barrel-per-day shortfall would drive unemployment up into the 7.5 to 8 percent range. Conservation steps already identified would still leave the United States short by 312,000 barrels per day of gasoline, 140,000 barrels per day of distillate and 294,000 barrels per day of residual oil, NPC says. The committee acknowledges throughout their report that estimates of supply interruption may be too low, figures for conservation savings may be too high.

ENERGY ADVISORY COUNCIL GETS A LOOK AT $10 BILLION R. & D. PLAN

The Energy Research and Development Advisory Council, the industry group formed to advise Energy Policy Office Director John Love, met for the second time last Wednesday. Gorman Smith, special assistant to AEC Chairman Dixy Lee Ray, briefed council members on the status of administration R. & D. plans. The broad outlines of the 5-year, $10 billion R. & D. program are spelled out below. The proposed plan represents the work of some 15 technical panels, 200 or 300 people (less than a third of them from the AEC), and will be presented to Chairman Ray within a week or 10 days. The funding recommendations are by no means set in concrete. Dr. Ray has specifically reserved the right to adjust the funding levels based on input now being received from industry and other groups. As Weekly Energy Report has noted in past weeks, the program does not provide $10 billion in new money as many had thought. New funding will be a little less than $3.4 billion.

COMPARISON OF BASE AND RECOMMENDED FISCAL YEAR 1975–79 ENERGY R. & D. PROGRAMS

[Dollar amounts in millions]

	Base	Recommended	Percent increase
Total program	6,622	10,000	51.0
I. Fossil option	1,027	3,675	258.0
A. Conservation	95	1,340	(1,310.0)
1. Reduced consumption	15	210	----------
2. Improved efficiency	80	1,130	----------
B. Increased supply	892	2,335	(162.0)
1. Oil and gas	50	310	----------
2. Coal	842	1,875	----------
C. Resource assessment	40	150	(275.0)
II. Fission option	4,090	4,390	7.3
A. HTGR, Safety, Waste Mgt., etc.	1,560	1,660	(6.4)
B. Breeder reactors	2,530	2,730	(7.9)
III. Other programs	1,505	1,935	28.5
A. Fusion	1,405	1,550	(10.3)
B. Solar	80	200	(150.0)
C. Geothermal	20	185	(825.0)

The largest chunk of the new money is expected to go towards what the funding review panel has called "validating the fossil option." The chart below breaks down funding for general conservation, a necessary but unexciting area. As an AEC representative noted: "It has no sex appeal."

FOSSIL OPTION—CONSERVATION: FISCAL YEAR 1975-79 PROGRAM

[Dollar amounts in millions]

	Base	Recommended	Percent increase
Total program	95	1,340	1,310
I. Reduced consumption	15	210	1,300
A. Energy conservation	5	150	
B. Improved management	10	60	
II. Increased conversion and distribution efficiency	80	1,130	1,313
A. High temperature gas turbine		225	
B. Other (low temperature cycles, waste heat and fuels, fuel cells, etc.)		200	
C. Advanced auto propulsion		300	
D. Rail, bus, and ship systems		205	
E. Energy and fuel transportation, distribution, and storage		200	

The chart below details funding to increase fossil fuel supply. The oil shale in situ classification includes in situ gasification of coal underground, we are told. The $265 million for high Btu gasification assumes 50/50 government/private industry cost sharing. If private industry support does not materialize, the figure is obviously low. The high Btu gas research also assumes one demonstration plant based on the most successful of the four pilot processes presently either in operation, shakedown, or under construction. MHD funding is expected to key mainly on "fundamental materials kinds of problems," said William Gouse, newly appointed Director of the Office of Research and Development in the Interior Department. The recommended funding for mining includes $106 million for environmental control technology (including about $50 million for reclamation techniques on surface-mined land) and about $219 million for underground mining technology. The latter will include a demonstration mine. "We will back up and start coal mining anew * * * get all the techniques together, put them in a mine and see what happens," said AEC's Gorman Smith.

FOSSIL OPTION—INCREASED SUPPLY: FISCAL YEAR 1975-79 PROGRAM

[Dollar amounts in millions]

	Base	Recommended	Percent increase
Total program	892	2,335	
I. Oil and gas	50	310	520
A. Fluid injection		71	
B. Stimulation		97	
C. Oil shale in situ		126	
D. Drilling		16	
II. Coal	842	1,875	123
A. Clean combustion		200	
B. Low Btu gas		250	
C. High Btu gas		265	
D. Liquefaction		375	
E. Support R. & D.		120	
F. MHD		80	
G. Mining		325	
H. Environmental control technology		260	
III. Resource assessment	40	150	275

The study groups recognized that private industry R. & D. is committed to short-term goals, because industry is keyed to a short-term payout. Government R. & D. funding has leaned toward larger expenditures in projects for which a mid- or long-term payout can be expected. So the 258-percent increase in fossil funding (compared to 7.3 percent for fission and 28.5 percent for other programs)

is less a question of easing off fission and other long-range R. & D. commitments than a desire "to bring other sources—with the emphasis on fossil—up to the level of other programs in the Federal effort," says the AEC's Gorman Smith.

FISSION AND OTHER PROGRAMS: FISCAL YEAR 1975-79 PROGRAM

[Dollar amounts in millions]

	Base	Recommended	Percent increase
I. Fission option	4,090	4,390	7.3
A. HTGR, safety, waste management, etc.	1,560	1,660	6.4
B. Breeder reactor	2,530	2,730	7.9
II. Other programs	1,505	1,935	28.5
A. Fusion	1,405	1,550	10.3
B. Solar	80	200	150.0
C. Geothermal	20	185	825.0

The projected private industry investments below are "the figures in which we have least confidence," commented Gorman Smith of the AEC last Wednesday. Smith did note that about $2 billion per year of private money is not reflected in the table, and that it is "mainly scattered across the fossil option." One council member observed that "there is a lot of oil company money going into coal R. & D. and that is reflected under the 'Petroleum' heading."

Estimates of private investment in energy related R. & D.

Industry:	*Estimated amount per year*
Petroleum	$800, 000, 000
Oil equipment	60, 000, 000
Natural gas	120, 000, 000
Gas equipment	30, 000, 000
Gas transmission	60, 000, 000
Coal	10, 000, 000
Electric utilities	180, 000, 000
Electric suppliers	400, 000, 000
Automotive manufacturers	250, 000, 000
Total	1, 910, 000, 000

NOTE.—Estimated private investment for 5-year period, approximately $10,000,000,000.

INITIAL RESPONSE TO R. & D. BUDGET: COAL NEEDS A BOOST

If industry comment is any index, the initial funding for coal technology in the $10 billion plan may be inadequate. Louis Roddis of Consolidated Edison suspects there should be "more emphasis on utilization of coal in the next 5 years" and Edward Gornowski of Exxon Research and Engineering thinks that "one demonstration plant for gasification—all the initial proposal provides for—and one for liquefaction is probably not enough." At a meeting earlier in the day to discuss coal R. & D. strategy, Gornowski noted that no one is yet ready to go into liquefaction on a demonstration plant basis, "but we can move on second-stage piloting. That could easily absorb $100 million over the next 5 years," he said. At the same meeting, Henry Linden of the Institute of Gas Technology suggested "shooting for five demonstration programs in high Btu gas" including processes to handle Western, Eastern and Illinois Basin coals and at least one fixed bed plant. "This program alone could easily run to $2 billion over the next 5 or 6 years." Says Gorman Smith of the AEC: "It's safe to predict that coal will be getting another hard look from the (AEC) Chairman." Any increase in coal money will probably result in a drawdown of funding in some other area, he added. But William McCormick, staff assistant to Gov. John Love in the Energy Policy Office, said the $10 billion "is not viewed by Love as a magic figure. If it takes $11 billion or more that's what it will be." Among other off-the-cuff comments on the proposed R. & D. plan was Louis Roddis' recommendation that

funding for increased manpower training—through college grants—be made. "I don't want this aspect lost in the shuffle. On the surface, cutting it doesn't hurt much, but it begins to hurt 5 or 6 years from now." The university fellowship training program has produced such alumni as Admiral Rickover and former AEC staffer Milton Shaw, he noted, and "should be identified in the same voice as the $1 billion add-on for basic research and environmental effects."

Ms. ROOSEVELT. Under the proposed plan, which is not yet finalized, solar will get only 2 percent of the total budget and geothermal will get 1.85 percent. In our opinion, this amount is woefully inadequate. But, I think the proposing of this amount by Dr. Ray highlights the problem with this administrative structure of ERDA. The impetus for this program has come from the Executive. Congressional control over the setting of priorities will be minimal because the authorization for this program will go through several different committees. No one committee will be able to consider the total energy picture and establish priorities. Instead, piecemeal authorizations and funding will occur, and we will not have an integrated energy policy with Congress fully participating in the formulation of that policy.

There are several actions which could somewhat decrease the power of the Administrator, and I would like to offer them as suggestions which could be incorporated into the present structure. They would only mitigate the Administrator's power, however, and I believe that to form a truly effective organization, some new structure should be formulated which would give Congress more power in determining overall energy policy.

QUALIFICATIONS FOR ADMINISTRATOR

Since, under this bill, the Administrator will be a major force in formulating R. & D. budget priorities. We believe, at the very least, that it is imperative to set qualifications for the first Administrator which would preclude anyone from the AEC or the Department of the Interior from assuming this position. The reasons for this are obvious. An Administrator free from the established priorities of these agencies would be able to take a fresh look at national R. & D. priorities and would be free from any charges of favoritism. Therefore, we urge that language be inserted in this bill which sets qualifications, at least for the first Administrator, Deputy Administrator, and Associate Administrator, and which precludes their being from the AEC or Interior.

Further, the initial assessment of R. & D. priorities by Chairman Ray and her staff inspires a complete lack of faith in their expertise. We believe that the lack of vision of her plan should not be passed on to the new Administrator of ERDA. The new Administrator should be compelled to formulate his own R. & D. program. Therefore, we suggest that a section be inserted into this bill which declares that it is the intent of Congress that the Administrator draw up his own R. & D. program, and that such a program must be submitted as a report to Congress 1 year after the Administrator assumes his duties.

SOLAR AND GEOTHERMAL RESEARCH

Third, I would suggest that the legislative history of this bill show that it is the intention of Congress that solar and geothermal research

be funded up to the level that can be used for a crash development program of these technologies. I believe this is necessary because the possible payoff from wide-scale commercial feasibility of these technologies is so great—the possibility of cheap, plentiful and environmentally safe energy. Another benefit from Government R. & D. support in these areas would be the effect on competition in the energy industries.

For example, a heavy concentration of Government R. & D. in fossil fuels and nuclear will further support the oligopolies which control these fields. On the other hand, Government support for alternative forms of energy can result in the creation of energy industries to compete with the existing concentrations of industrial power.

TECHNOLOGICAL INNOVATIONS

Last, I would like to touch on an area which environmentalists see as being left untreated in this new ERDA structure—that is a provision for the small business and the individual inventor. In a large administration such as the proposed ERDA, we feel that there must be a vehicle for the reception and support of unconventional ideas. Promising technological innovations have often in the past been stifled or neglected as being too unorthodox or unreasonable. For instance, Robert Goddard was often derided as being "moon mad" and his brilliant research in rocketry was largely neglected and underfunded for many years.

We believe that a special effort must be made to prevent this occurrence in the area of energy research. Most Government agencies—the National Science Foundation would be an obvious exception here—tend to ignore small inventors and direct their funding to large R. & D. organizations.

Therefore, we would suggest the establishment of an Office of Inventions which would seek out and provide financial support for ideas from independent scientists and small businesses. Because the jurisdiction of this Office would cut across the areas of all the Assistant Administrators, we would suggest establishing it under the Deputy Administrator of the Administration. In this way, the Deputy Administrator would be able to report on progress and innovations and coordinate with the various Assistant Administrators.

Thank you, Mr. Chairman, for allowing us to comment on this bill, and we hope you will consider our suggestions.

I would like to offer some specific language tomorrow, if that is all right.

Mr. HORTON. In what area?

Ms. ROOSEVELT. In some of these areas that I have delineated, such as in making the bill have more of a conservation mandate. This would be in the first section of the bill.

Chairman HOLIFIELD. You may submit it, yes.

Ms. ROOSEVELT. Mr. Lahn would like to say a few words.

CONGRESSIONAL MANDATE FAVORED

Mr. LAHN. If I could make just a few points here.

The Sierra Club does not necessarily endorse the views of Friends of

the Earth on this issue. I guess my main reason for being here is to just get across one point which I would like to try to make. That is our concern that the R. & D. program expected with this legislation is first delineated, so that the substance of the program is known before any type of reorganization be approved. I think the main fear I have is that there will be a major reorganization, shifting various parts of the Atomic Energy Commission and the Department of the Interior into a new agency without a congressional mandate being given in specific terms as what the direction is going to be. I would prefer that there be spelled out in budgetary and priority terms within the legislation what the program is going to be before—this should at least go through at the same time. I think otherwise we fall into the trap of having the main initiatives filtered through OMB for possible modification and slight revision at the authorization and appropriation stage. I think at this stage, the main thrust should be with Congress explicitly to set the priorities in this structure and not have the main control of the program in the hands of the administration and being further refined through Congress. Rather, the initiation of the program should be in the control of the Congress.

CONSOLIDATING PROGRAMS

Chairman HOLIFIELD. Maybe I could help you to understand the system. In the Congress, we have to work with not only what we want in the future, but what we have today. The purpose of this particular bill is to reorganize and bring together programs that are scattered in agencies and committees. Each one of these programs has been approved by the committee involved and by the full Congress. Each one of them has had funds authorized and appropriated to them. The purpose of reorganization at this time is to try to bring these programs together under one head, so that they can be coordinated and evaluated rather than have a half dozen different committees setting up the programs and having them run as they are now.

The purpose, of course, is pretty well set forth in the bill and the organization charts. I do not know whether you have these plans or not. I imagine you do, from Ms. Roosevelt's reference to the organization. This is the best organization that we can evolve after looking at the myriad pieces to be put together.

Now, you have to build a house before you live in it, and you have to construct an automobile before you run it. Under our system of government, you have to build a governmental organization before you can function on programs. What we are doing here is an attempt to reorganize at this late date—I wish it had been earlier, but we are always fighting the situation as it exists and trying to improve it for what we hope to gain by it in the future. So we propose to bring together these functions, and get the approval of Congress, and then have the Administrator come before us for a review of his plans and his programs.

REPORTING REQUIREMENTS

There is a reporting section, by the way, which was inadvertently left out of the bill, which we referred to earlier. It will cause the Administrator to come to Congress and report. Also, he has to come back

to Congress for any priorities that he sets, any plan that he sets. He will take over the ongoing programs and he will formulate, we hope within a year, an overall plan.

Now, the President has had Dr. Ray and a great variety of people working together on this energy problem. It is supposed to be out in a few days. When that plan does come out, I can assure you every Member of Congress will probably scrutinize it very carefully. I am sure that when this ERDA organization is put together, the Administrator would take that, and start studying it, and he would start explaining, as he goes along, any changes he makes in ongoing programs.

Mr. HORTON. Let me make this point, too, Mr. Chairman, on that very thing. I have to go get this quorum call, but I did want to make this point: The problem we have today and why we need ERDA is that every one of these agencies we are talking about submits its own different plans and there has been no way, there is no organization in the Federal Government that can pull all this together and make one presentation. What you propose is a good idea, but at the present time, we do not have any group that can pull all this together. That is why I think personally that ERDA, or an agency such as ERDA where you can pull all this research and development together, is needed. The chairman and I and this committee have been working on this proposal for over a year. We have had hearings earlier, as I am sure you are aware. This proposal was made, and we have tried to refine it.

But the point I am making is that you have to have some organization in existence before you can flesh out the plans and proposals. At the present time, it is very loosely handled throughout the Federal Government. I wish you could have sat in here and heard the coal people talk about the problems that they have had because they have not had enough money. Well, the point is that they are a little bitty piece of a big department, so they have just not gotten the emphasis that they ought to have.

So I think it is very important and I would hope that your organization would get behind this bill and emphasize the need for something like this. Because if you do not have this organization, you are not going to have capability to preserve the environment, which I think is very important.

Mr. LAHN. I certainly do not have any problem with the reorganization per se. It is the question of where the process starts and whether, at the initial stage, at the same time that you reorganize, you lay out the priorities in the same legislation for what the program may mean.

PRIORITIES QUESTION

Chairman HOLIFIELD. This is an important suggestion you make, but it is impossible for me or any other member of my committee to set the priorities in this very comprehensive field. You folks have set certain priorities. Other people set other priorities. Now, in the last analysis, you have to get the votes to put a piece of legislation through, and it does not make any difference what priority I set or what priorities anything less than a majority of the Congress set. It does not make

any difference what they are if you cannot get the votes for it. So we are living in a real world and not an idealistic world.

We have our ideals, too, you know, and we would like to have everything perfect. We would like to have perfect lumber to build a perfect house, but human beings are imperfect. We have to work with what we have, not only with imperfect lumber, but with inadequate funds. We have to fight for the funds for these different programs.

I just want to assure you that there are people who have integrity, there are people who have a desire for the best for their children and their grandchildren, just the same as you folks have ideals and purposes and goals. But in a democracy, no man can set his priority up and demand that everybody else accept it. We have to get a consensus on priorities, and it is difficult to do when you have 435 men in the House and 100 men in the Senate. But we are working as hard as we can to do the best job we can, and we hope you will consider that we are trying to do that.

We appreciate your testimony here, and we appreciate your ideals, and with many of them, we agree.

PRIORITIES AND CONSENSUS

Ms. ROOSEVELT. Mr. Chairman, one point I would like to make. I agree that, obviously, 435 people are trying their very best to set priorities or to establish some priorities. But the structure of Congress being what it is, structured along the committee system, I think that probably a decision was made a long time ago that within the committees is the best means of establishing an overall priority or an overall understanding.

Chairman HOLIFIELD. That is exactly right. We have had to divide up in committees and assign in this complicated society certain areas of jurisdiction. Now, within a given committee, you have 30 to 40, maybe more, people, all of them with different ideas, all of them with different ideals. So the committee comes out with the best thing that it can agree upon. Now, it may not suit me 100 percent, it may not fully suit any member of the committee, but we have had to go through the democratic process of giving each man one vote.

Ms. ROOSEVELT. Sure.

Chairman HOLIFIELD. When we come out with the consensus, the best one we can get, then we take that to the floor and try to get that consensus accepted by the full membership.

Ms. ROOSEVELT. Right.

Chairman HOLIFIELD. Now, if we cannot do that, then of course, the bill is changed on the floor and changed drastically, and we have had that experience many, many times.

Ms. ROOSEVELT. But the only point that I was making was that the bill, the way it is presently constituted, I think does not really allow for a committee such as the Joint Committee, which has become extremely proficient and knowledgeable in all areas of nuclear energy—well, the bill as it is presently constituted, as I read it, would send authorizations through on the one hand, the Joint Committee; on the other hand, the Interior Committee, various and sundry other committees.

Chairman HOLIFIELD. Of course, the young lady is making assumptions which are not based upon reality.

Ms. ROOSEVELT. They are based upon what a member of your staff told me, sir.

Chairman HOLIFIELD. Well, I am not answerable for all the things my staff tells you.

Mr. FUQUA. Will the gentleman yield?

Chairman HOLIFIELD. Yes.

Mr. FUQUA. Your concern about the diffusion of responsibility in the House on energy matters is justified. You should be aware, however, that the Select Committee on Committees is presently working in this area and will soon report back to the full House of Representatives. One major area of reorganization, I am informed, will deal with committee jurisdiction over energy.

Mr. MALLARY. Mr. Chairman, if I may.

AUTHORIZATION VERSUS APPROPRIATION

I might also add the fact that, if you look on page 4 of your statement, you mention that at the present time, no single committee of the Congress would have the opportunity to fully examine the total budget of the Administrator and discuss funding priorities. What you say is of course, true, with regard to authorizations.

Ms. ROOSEVELT. And not appropriations, right.

Mr. MALLARY. The Subcommittee on Appropriations would have full authority to examine priorities. Normally, authorizations are sufficiently high so priorities are set by the Appropriations Committee by cutting down below authorizations.

Ms. ROOSEVELT. I realize that, and I agreed with Representative Coughlin's suggestion yesterday that it would be good if the Appropriations Committee established a separate subcommittee to consider just ERDA. But I think the point I would like to make again holds, that I think the authorization committee is the one that, the way Congress is set up, has the most knowledge and develops the most expertise. It really works.

Chairman HOLIFIELD. We agree with that. And we agree that the Joint Committee, which you have complimented as to their oversight over the nuclear problem, has the majority of these programs, personnel, and facilities under its judisdiction at this time.

COMMITTEE SYSTEM REORGANIZATION

As to what the future holds next year, when the Bolling committee reports and when the Congress acts on a reorganization of the House committee system, we cannot foresee at this time and you cannot either. However, before you were born, I went through the 1946 reorganization of the Congress, in which we consolidated more than 50 committees into 17 committees. I have had some experience in reorganization. I have handled scores of reorganization plans within the Government. I feel qualified to say at the present time, in my judgment, this is about the best that we can do to get on with the job that needs to be done.

Ms. ROOSEVELT. Could I make one point just to get one thing on the record?

Chairman HOLIFIELD. Yes, and then we have other witnesses.

Ms. ROOSEVELT. Right, and I talked to your staff about it, and I am sure this was the intent of the legislation, but I would like to get it on the record, just to make absolutely sure that it was.

On page 7 of the bill, you transferred functions of the Commission to the Administrator—all functions of the Atomic Energy Commission. Now, this is qualified on page 15 somewhat in lines 8 to 18. But I assume you mean that you do not transfer the "fully and currently informed" provision that applies to the Joint Committee on Atomic Energy; you do not transfer this to nonnuclear matters?

Chairman HOLIFIELD. Oh, yes.

Ms. ROOSEVELT. You do transfer it on to nonnuclear matters?

Chairman HOLIFIELD. Oh, yes, the AEC Act has not been amended as to the powers and functions.

Ms. ROOSEVELT. I see.

Chairman HOLIFIELD. We have not modified or repealed, you might say. All of those obtain. Others do not obtain—for instance, the regulatory and licensing will not go to ERDA. I am sure you are in accord. This has been one of the concerns of the public for many, many years, to get the regulatory and licensing over to a separate commission——

Ms. ROOSEVELT. We applaud that.

Chairman HOLIFIELD. I know you do. Now, the part of the act that applies to regulations, the environment, ACRS and all of that, goes over to the Nuclear Energy Commission.

JOINT COMMITTEE'S AUTHORITY

Ms. ROOSEVELT. But the question—and I think it is very important to get this on the record—the question still is whether the Joint Committee has the power to be kept fully and currently informed now on all functions of the Atomic Energy Commission, including nonnuclear R. & D.

Chairman HOLIFIELD. We do.

Ms. ROOSEVELT. Right. Does this mean that under this proposed structure here, you will be able to be kept—the Joint Committee will be able to be kept fully and currently informed on everything that goes on in fossil energy development as well as nuclear energy development, environment safety and conservation, and advanced energy systems?

Chairman HOLIFIELD. The Atomic Energy Act is still under jurisdiction of the Joint Committee on Atomic Energy. That part of the program has not been nullified in any way, and if that comes over to us, why, we will certainly look at it.

Ms. ROOSEVELT. I would like clarification of this from Mr. McGinn, if possible, because Mr. McGinn gave me the opposite response.

Mr. MCGINN. Excuse me, Mr. Chairman. I think what we are referring to here is on page 15, line 8:

> Such functions of the Administrator under this act as are applicable to nuclear activities transferred shall be subject to the provisions of the Atomic Energy Act as amended and to other authority applicable to such nuclear activities.

Chairman HOLIFIELD. That is right.

Mr. MCGINN. In other words, this is the oversight function which the Joint Committee provides for nuclear activities.

Chairman HOLIFIELD. That is right.

Mr. MCGINN. The lady was concerned that possibly on page 9——

Ms. ROOSEVELT. Page 7.

Mr. MCGINN. Page 7, where the bill would transfer all functions of the Atomic Energy Commission to the Administrator, that oversight functions for nonnuclear matters—in other words, the Assistant Administrator for Fossil Fuels, et cetera—would also come under the oversight of the Joint Committee.

Chairman HOLIFIELD. It will come under the Joint Committee as far as I know, unless there is a change by the Bolling committee. It cannot be in a vacuum and the Joint Committee does have charge of all the Atomic Energy Act.

Ms. ROOSEVELT. I would like to say that this goes to my previous testimony—which Mr. Fuqua did comment on—that the Bolling committee is reportedly going to propose a committee of Congress that would manage energy. If this is true, then the committee of Congress that will manage ERDA is the Joint Committee by extension, because there will certainly be Joint Committee jurisdiction under the "fully and currently informed" clause.

Mr. REICH. You are talking about two things, if I may say so. And there is a slight ambiguous area because, since 1971, the Atomic Energy Commission has been empowered to perform R. & D. in nonnuclear areas.

Ms. ROOSEVELT. Right.

Mr. REICH. As a matter of fact, that program has been funded to a very small degree.

Ms. ROOSEVELT. I am aware of that.

Mr. REICH. So you are talking about a very small aspect. Along comes ERDA, which will be a powerful agency, and one hopes it will be heavily funded in all these areas. But I think you are really asking two questions.

On "currently informed," which is not oversight, that is just to obtain an understanding what is going on——

Ms. ROOSEVELT. I know, but——

Mr. REICH. May I answer that part of it, first?

I think the Joint Committee under the language of the statute—and considering that the Atomic Energy Commission was empowered before the enactment of this bill to perform R. & D. in the nonnuclear area, and considering the committee's interest in ERDA's affairs—would have the right to be kept currently informed.

Now, let us put that aside. That is only being kept informed. As far as authorizations are concerned, I think your point is well taken. This bill does not change committee jurisdictions with respect to authorization. Subsequent legislation would have to go into that area. Currently informed is not the same as taking authorization action——

Ms. ROOSEVELT. No.

Mr. REICH. I think that the Joint Committee would have the right to be currently informed, among other committees that have an interest in authorization or ERDA's programs. They could also be currently informed if they want to be.

Ms. ROOSEVELT. I am a political scientist by profession and I have done a study of the "fully and currently informed power" of the Joint Committee. I realize Chairman Holifield, of course, is one of the masters of using the fully and currently informed clause to get what he would like to achieve.

Mr. REICH. It says "fully and currently informed."

Ms. ROOSEVELT. Well, I know, but you and I, and I am sure Chairman Holifield, could tell you that this particular phrase in law goes much beyond being fully and currently informed as a masterful person would use it. Now, perhaps this would not necessarily be used by the Joint Committee in this way, but I think that even though this does not affect the authorization process per se, it very subtly expands the Joint Committee's jurisdiction over this new administration, because they can be then fully and currently informed about all of these Assistant Administrators which would be going through other committees.

Mr. REICH. But that militates against your central point. You are concerned that the whole thing would be fractionated, and if all committees are fully informed, are they not then in a better position to act even though in a fractionated way?

Ms. ROOSEVELT. But all committees do not have that phrase. That is what makes this unique.

Mr. REICH. May I say as a practical matter, I think you can assume that any committee that has an oversight function, certainly an authorization committee that has the power to authorize funds, can, with or without an explicit charter to remain fully and currently informed, insist on being fully and currently informed.

Chairman HOLIFIELD. And all they have to do if they really want that phrase is to put that language in there.

Thank you, Ms. Roosevelt and Mr. Lahn.

Our next witness is Mr. Shearon Harris.

Mr. Harris, we will be pleased to have you at the witness chair.

You are a familiar witness in this joint committee room. I do not believe you have been before the House Committee on Government Operations before.

STATEMENT OF SHEARON HARRIS, CHAIRMAN, RESEARCH DIVISION EXECUTIVE COMMITTEE, EDISON ELECTRIC INSTITUTE

Mr. HARRIS. No. Mr. Chairman, it is my first experience before your Government Operations Committee. You and I have had many encounters over the years, and I appreciate many things, including the committee allowing me to come somewhat out of order, because on last Tuesday, when you heard a number of other trade association representatives and other industry people, would have been the normal time for me to appear, and I could not be here.

I spent a while in Atlanta with nuclear power operations people on adequate quality assurance in order that we may be able to obtain our share——

Chairman HOLIFIELD. I hope you said your word for standardization of reactors.

Mr. HARRIS. I think standardization is a way to accelerate. I think while we are standardizing, we do not wish to standardize anything less than full quality assurance.

Chairman HOLIFIELD. That is right.

Mr. HARRIS. Mr. Chairman, I have left with the staff a paper which I think has probably been filed in the record. I would like now to ask, if I may, that it be included in the record as though fully read and then I would like to be excused from reading it.

Chairman HOLIFIELD. We will accede to both your requests. It will be in the record and you may proceed.

Mr. HARRIS. I am Shearon Harris, as you indicated, and my present occupation is as chairman and president of Carolina Power & Light Co. I appear here in my capacity as chairman of the Research Division Executive Committee of the Edison Electric Institute, to note the support of the Edison Electric Institute for H.R. 11510. Rather than succumb to the temptation, Mr. Chairman, to address the whole energy crisis, about which I have a million thoughts, and also rather than succumb to the temptation of extolling the capabilities of the chairman of this committee, either in his masterful performance under the currently informed clause or his patience in hearing witnesses, I would like to just talk about two or three aspects of this bill.

The first one I denominate as the management mechanism that is provided for a massive R. & D. program. I need not enumerate the scattered responsibilities and activities that now go on in Government. We commend you for drawing this together in the concept of this bill.

ELECTRIC POWER RESEARCH INSTITUTE

Within our own electric utility industry, while we were not doing enough, we were doing a lot of things in the same sort of fractured activity. We have recently drawn together our interest into a coordinated management of the industry's electric energy research and development in the Electric Power Research Institute, and on Tuesday, you heard Dr. Chauncey Starr, who is the president of that institute.

Chairman HOLIFIELD. He made a masterful presentation and absolutely fascinated the members of the committee who had never heard him before. His response to questions was brilliant and responsive. He did your institute credit.

Mr. HARRIS. Mr. Chairman, I denote a little pride in a citizen and resident of California, but I share your admiration for Dr. Starr. It was during my chairmanship of the Edison Electric Institute that we brought together the plan for EPRI, and we set out to find the most qualified man in the world to take on this very challenging endeavor, and we think that we found him in Dr. Starr.

Now, there we have tried to pull together under one coordinated management the interest and the concerns and the activities of a great industry for finding new and more efficient ways of meeting our energy demands. I look upon this bill as your effort to do a similar sort of thing with the Government's even greater involvement than our industry, and we commend you for it. We think the mechanism is right. It will provide a coordinated management for the first time and we support that.

UTILIZING PRIVATE INDUSTRY

I also would like to comment briefly about whatI call the five categories of energy research and development that I refer to in my paper. In the philosophy of dealing with energy research and development and the interrelationship between industry and Government, I have denominated five categories.

Others have put the first three of my categories into one and called it three categories. But I should like to remind you that under our old traditional way of doing a lot of research and development through the equipment manufacturers, that system for a long time did serve our Nation well. It does no longer serve it without all the other things that we are going to do. But we do not want to kill off, in anything that we do, the great value that still lies in private industry being able with its own money to invent something new, get a patent for it because they are spurred by the incentive of profit. Now, this is still going to produce a lot of good technology for our country.

Now, in the second category, there are instances where a private manufacturer may not have enough incentive or willingness to undertake it by himself, so he works in coordination with the using utilities to produce it. This is another aspect of totally private effort.

Then there comes a time when the manufacturers will not do it, but there is enough interest for the utilities themselves to pull themselves together, and this is a part of what we will be doing in Electric Power Research Institute. There will be some things we will do totally with our own money, with no manufacturers and no Government involvement.

Now, in each instance, there is an incentive that propels the action. If the manufacturers do not do it, the utilities and manufacturers may do it. If the utilities and manufacturers do not do it, the utilities may do it on their own initiative, for the incentive reasons that propelled them to do it.

Now, when those three categories do not meet the task then comes the opportunity for Government to stimulate industry with a joint participation between industry and Government.

Then lastly, as we have all recognized, when private industry will not do what society needs, it is completely proper for Government to step in as society's mechanism for meeting its needs.

Now, there is a point in connection with sort of an area between the fourth and fifth category that I want to comment on just a little bit, and I hope that my remarks may result in the development of some report language that would go with this bill. We have been talking some astronomical numbers—maybe not for Government in terms of the space program—and I do not know what the right number is, Mr. Chairman. Numbers, I really think, come after we have measured the needs, after we have developed a program to meet those needs, and then we price it. I do not know that $2 billion a year is right. It may be that $6 billion or $10 billion will come nearer being right. It will take some time before we know what the numbers are, but they will be huge.

SHARING COSTS AND MANAGEMENT

Now, in those cases where huge Government funds are involved, I would like to suggest the report language, and I have not brought

the language to submit, I just simply want to communicate the concept at the moment, that you encourage the Administrator to make use of the technique of partial industry money and industry management to the extent that it is available. When only Government funds and only Government management are involved, there is missing a disciplinary mechanism that will trigger cutoff when the project no longer holds promise.

Now, this is not to criticize any individual or any agency of Government, it is just the nature of the thing. You set up a project and people become involved in it, they want to stay with it even beyond the point that it may no longer hold any promise. But if the Administrator will induce private industry to put up some money and to provide the management wherever these situations present themselves, there will be an added discipline that will allow the redirection of those resources when it becomes perfectly apparent to good management that this does not hold the promise we thought it had and we ought to really redirect these resources to do something else that does hold promise. So I think this is a little mechanism that, as you set up ERDA, you ought to encourage the Administrator to make use of that technique when it seems in the interest to do so.

CONSTRAINTS ON INDUSTRY PARTICIPATION

Chairman HOLIFIELD. If I understand what you have said, and I go along with you on the five categories, I think you have stated them rather well. But now you are beginning to talk in the gray area. As I understand what you have said, the problem is in those areas where there is no profit motive, or incentive, or capability of private industry to participate in a program. If a program is started by the Government, as we have started programs and as we are continuing programs—in the diffusion plant program we have invited industry to come in, and very frankly, industry is loath, for its own reasons, and I am not being critical, to come into that particular thing.

You and I know there are areas where the amount of the research and development is so much and the time is so great that you really, in justice to your stockholders, cannot predicate these large sums of money. You can predicate that which you are doing through the Electric Institute—and I want to commend you. I was surprised when Dr. Starr mentioned the sums that the industry plans to generate. And I would say this, that when and if the industry does generate that plant to the extent that it does, then there will be no incentive on the part of Congress—let us put it that way—to dip into that field. These projects that we have started have not been done because of some inordinate incentive on our part for power or for grandeur or for fame, to start programs just to be starting them. We have started them because we felt that they were necessary, and no one else could do it or would do it.

Now, in the original building of the diffusion plant, in the whole space program, we could not expect private industry to do that. Yet private industry participated on a contractual basis and got the benefit of the know-how and the technology that was involved in that.

Now, let us get to your gray area between categories 4 and 5.

Mr. HARRIS. Mr. Chairman, what I really am saying is this, that the stance of Government in this program ought to be that instead of rushing to do as much as possible in category 5, that an effort be made to harness private management and some private funds in category 4. Whenever a situation gives an option between 4 and 5, and you can get somebody to put the money and the management in it, the Administrator ought to be encouraged to go that way. Now, that is all I am talking about.

DELAY IN LMFBR

Chairman HOLIFIELD. I certainly would agree with that, if that is what you are talking about. However, I want to point out to you that there is some delay involved in that. I point out that it took 2 years to get the utility industry to participate in the LMFBR. Now, theoretically, the Government could have started on that 1½ or 2 years sooner by itself. But we waited for this to happen. I do not have to go through the details, because you know them. You participated in it and you helped. You know how long it took to get $25 million a year contribution from 260-some-odd entities in the private industry sector.

Now, I am not minimizing it, because it is probably the biggest cooperative effort that any group in America ever went into with their Government, and I am proud of it and I am appreciative of it. But I point out to you that there has been delay on this particular thing, and we are not even sure yet just exactly how the management is going to work out. This is an experiment. It is an experiment which is fraught with many difficulties. So you and I can talk across the table really, because we have both been in the game a long time.

Mr. HARRIS. I share the feeling that you have expressed about the specific instance, and all I say in response to that is you have to weigh the delay and the cumbersomeness of the mechanism against what good it does. If it does not do enough good, then I think you have to abandon the emphasis I am talking about.

Chairman HOLIFIELD. Yes.

Mr. HARRIS. In the case of the breeder reactor, I feel like here at the time the decisions were made, not against today's background of energy crisis, because everybody has a much higher sense of urgency today than we had even 2 weeks ago, but against the background of the time when the decision was made, it was a good decision to get as much of industry involved, because the ultimate use of that technology will be accelerated because, with their money in it, these companies are going to follow the development of the technology and be ready many years sooner to adapt it to their systems.

Chairman HOLIFIELD. Well, I trust and hope you are right. I prove my trust and hope by going ahead and supporting it and fighting for it, as I have for the past 10 years. Is that not right?

Mr. HARRIS. But your point is well taken. My emphasis on pushing to category 4 leads itself to cumbersome arrangements and some delay in bringing people together.

Chairman HOLIFIELD. It also lends itself to an impossible frustration unless it is pretty clearly understood, as it is in the LMFBR project, that if private industry pulls out, Government is going to go on with it if the Congress determines that it should go on with it.

Mr. HARRIS. Mr. Chairman, I do not think that we differ at all in our thinking about it.

Chairman HOLIFIELD. I do not think so. I think your five categories discussed, and I think the work that your institute is doing, as characterized to us by Dr. Starr, deserve nothing but praise. I just hope that the tremendous sum that he mentioned as being in your program, I just hope that it materializes, and to the extent it does materialize, as far as I have anything to do with it, we will not encroach upon those fields where you feel that industry has a justifiable program.

Mr. HARRIS. I might also observe in closing——

Chairman HOLIFIELD. And we might even stand in the wings when you get in trouble and help you in the future as we have in the past.

Mr. HARRIS. There are going to be many instances when I think ERDA and EPRI are going to work together.

Chairman HOLIFIELD. I hope so.

Mr. HARRIS. I think we are going to generate many ideas that ERDA will use, and maybe we won't be involved in the discussion of the plans, but we will have an opportunity to work together, I think to the good of society.

Mr. Chairman, I would like to note also that my paper notes the endorsement and support of the concept of the Nuclear Energy Commission. I need not elaborate on that. Coming from a company which has seven nuclear units in various stages of operation, construction, and design, I share the views that I know I have read as expressed by you on other occasions, that we need to get the regulatory process separated from the argument as to whether or not the care in regulation is compromised by the interest in promotion. I do not think it is going to change the substance of anything, but I think the cosmetic value is worth the exercise.

[Mr. Harris' prepared statement follows:]

PREPARED STATEMENT OF SHEARON HARRIS, CHAIRMAN, RESEARCH DIVISION EXECUTIVE COMMITTEE, EDISON ELECTRIC INSTITUTE

My name is Shearon Harris. I am chairman and president of Carolina Power & Light Co., and chairman of the Research Division Executive Committee of the Edison Electric Institute. The Edison Electric Institute is the principal national association of the investor-owned electric utility industry. Its 194 member companies serve about 78 percent of the electric power customers in our Nation. The institute appreciates this opportunity to present to this committee its views on Federal organization for energy research and development.

Before commenting specifically on the proposals contemplated in H.R. 11510, I would like to make a general statement regarding the respective roles of Government and industry in energy research and development. We believe that these roles will best be determined if they rest upon certain basic concepts.

We believe first of all that the traditional role of equipment manufacturers in research and development relating to the generation, transmission and distribution of electricity should be preserved and utilized whenever this approach will serve the need. The legitimate and compelling incentives of anticipated patent rights and profits from manufacturers and sale may be expected to be productive in the future as they have in the past.

A second category of research and development would involve joint undertakings by manufacturers and the electric utility industry and would fill the need in situations where the incentives are inadequate to permit manufacturers to undertake alone a given research and development effort.

A third area of research and development involves work which can be undertaken independently by the electric utility industry itself. There are occasions when incentives are lacking for manufacturers, but the R. & D. work in question

is of great interest to electric utilities and can willingly be undertaken by them.

There will also be circumstances when research and development can most appropriately be undertaken as a joint effort of industry and Government. This will be the case when economic incentives by themselves are not adequate to stimulate a wholly private effort. Government funding will be required, but the industry can contribute financially and from its accumulated managerial expertise.

Finally, there is a fifth category of research and development which can only be undertaken by Government itself, and where none of the first four arrangements I have mentioned will suffice. This will most often be the case with regard to basic, long-term undertakings which hold little promise for early return on private investment.

The Edison Electric Institute believes that the Nation's energy research and development needs will best be served if we proceed with recognition of these five basic categories. For its part, the electric utility industry has already organized itself, through the establishment of the Electric Power Research Institute (EPRI), to establish priorities and to move forward in the undertaking of needed R. & D. programs. The existence of EPRI will permit us to pursue R. & D. programs on our own, as well as to cooperate with manufacturers and with Government. And I should note that the efforts our industry is making through EPRI are in addition to the very substantial contribution being made in the national effort to develop the liquid metal faster breeder reactor.

We believe that H.R. 11510, if properly administered after enactment, would be compatible with the concepts which I have just set forth. The Nation's energy needs are such that reorganization of the Federal Government for better coordination and pursuit of its energy research and development goals is badly needed. I need not detail for this committee the proliferation and overlapping of energy responsibilities which characterize the Federal structure at the present time. The establishment of the Energy Research and Development Administration as contemplated in the bill before you would constitute a significant step forward in the reduction of that proliferation and confusion.

We particularly welcome those provisions of the bill which would include among the functions of ERDA the correlation of its own research and development programs with other public and private activities, and the support of cooperative R. & D. projects involving other public and private bodies. We believe that these provisions are fully consistent with the basic concepts which I described earlier.

We also support the establishment of the Nuclear Energy Commission to perform the licensing and related regulatory functions of the existing Atomic Energy Commission. We believe that the detachment of these functions from the promotional aspects of nuclear power development is salutary and will increase public confidence in the reliability and safety of nuclear power.

At the same time, however, we would hope that a new NEC would work to expedite the licensing process, consistent with the President's recent appeal for a reduction from 10 to 6 years in the time required to get a nuclear powerplant into operation. This goal can only be reached if the NEC insists vigorously upon expedited procedures in all phases of the licensing sequence, including the procedures before atomic safety and licensing boards. And the Congress, as part of its oversight responsibilities, must continually urge upon the NEC the need to streamline and expedite its procedures.

Another point that needs to be made with regard to the future activities of the NEC is that the antitrust review, which is now a part of the licensing process, must not be allowed to delay the operation of needed nuclear powerplants. We do not object to the antitrust review in principle. But we do believe that the licensing process should be administered in such a way as to permit the issuance of operating licenses prior to the completion of the antitrust review when that review would otherwise delay plant operation.

In summary, the Edison Electric Institute supports H.R. 11510, in the expectation that its provisions will advance energy research and development in cooperation with industry and other non-Federal entities, and that the licensing process for nuclear power reactors will be expedited.

Chairman HOLIFIELD. We long ago did the best that we could to isolate into independent functions, as you know, the regulatory and licensing process. As we made it statutory, we gave it independence.

But it was still under the umbrella and therefore, it was contaminated in the eyes of people. But I say this: Even now that we have cured that, the same people that criticize that will continue to criticize the work of this Congress.

Mr. HARRIS. Mr. Chairman, I am going to defend their right to continue criticizing and I hope we are going to overwhelm them with merit of information.

Chairman HOLIFIELD. I am with you on that.

Are there any questions?

Mr. HORTON. No questions, Mr. Chairman.

Chairman HOLIFIELD. Thank you very much, sir, for your always willing response to my invitations to appear and give us the benefit of your advice. I consider you one of the great leaders of the electric utility industry. Certainly your company, under your leadership and guidance, has achieved an enviable place in the nuclear generation of electricity.

Mr. HARRIS. Thank you, Mr. Chairman. We hope to generate more than 50 percent of our kilowatt hours from nuclear fuel in the very early 1980s. To that extent, we are trying to contribute our part to relieving the pressures on Middle East oil.

Chairman HOLIFIELD. That is a good objective.

Thank you very much.

Now, Mr. Ramey.

STATEMENT OF JAMES T. RAMEY, FORMER COMMISSIONER, ATOMIC ENERGY COMMISSION

Mr. RAMEY. Mr. Chairman, I have submitted a brief outline of what I am going to say. I guess I am having the last word here. I have sat through all of your hearings on H.R. 11510 and have a few points that have not been taken up, that I thought I might mention for your benefit.

Of course, you are familiar with my background——

Chairman HOLIFIELD. I will ask the staff to take recognition of the points that the witness makes for further consultation.

Mr. RAMEY [continuing]. Having worked with you for many years. For the benefit of the other gentlemen whom I have met but have not worked with so much, I have been in energy business now about 30-odd years, having started out with TVA and then as Regional Counsel for the Atomic Energy Commission for about 9 years, then Staff Director for the Joint Committee on Atomic Energy for 6 or 7 years, then as AEC Commissioner until last July for about 11 years.

I have worked, in other words, in a policy and decisionmaking capacity as well as a lawyer on legislation, including the original Atomic Energy Act. I would say that this bill, which is a refinement of an earlier bill, is a rather good piece of legislation, particularly in the context of the relatively rapid refinement that you made in the last few weeks or month, recognizing that you had spent a good deal of time on the concepts in the earlier legislation.

PARITY OF RESEARCH

I mentioned that I had sat in the hearings that you have had. One point I would stress, that has come up a number of times, is whether the

AEC and the nuclear community recognize that this new agency, ERDA, is going to be a new agency and is going to put nonnuclear research on the same par as nuclear research. I think this is very well recognized in the AEC, in the nuclear community, and in the scientific community generally. It is not only recognized, but I think it is thought to be desirable. Everyone realizes that there will have to be some catching up by some of the other nonnuclear areas of research which have not had the concentrated attention that nuclear has had by reason of historical circumstance, the interest of the country following World War II, the Joint Committee interest, and so on.

One other point that impressed me was that at the time when H.R. 9090 was involved, there was some concern that ERDA did not have adequate planning authority, that it would not be in a position to assess the needs for research and development adequately, and that it would be overshadowed by the Department of Energy and Natural Resources. I think these hearings have brought out pretty well that ERDA will have quite adequate planning authority and assessment authority, and that it can work out its relationships with the Department of the Interior or with DENR if it gets established.

AEC MERIT SYSTEM

There are several areas that I believe further emphasis could probably be given, either in the bill or perhaps more appropriately, in the legislative history and report. One of them is that in establishing ERDA, it is recognized that the career merit system that the Atomic Energy Commission has established will apply to all of the personnel employed in the ERDA organization. I think it is not well understood or talked about that one of the secrets of the AEC success in R. & D. has been that it is essentially a nonpolitical agency. The five Commissioners are appointed by the President and confirmed by the Senate, but everything else in the AEC is operating under a merit system in which there are and have been, really, no political considerations involved.

Similarly, under the AEC contract system of operations for its laboratories, there are no political considerations involved. So you have a rather unique organization operating in this field of research and development, and it is, I believe, very important that this continue. I believe Dr. Ray in her statement indicated that the administration did intend that under the language of the bill that carries forward section 161(d) of the Atomic Energy Act applying to ERDA, the AEC merit system will be applied. But I believe further that the committee might appropriately show at least the congressional intent, if not in the language of the act, that this merit system be continued.

Chairman HOLIFIELD. I think we are in agreement on the principle that is involved here.

We are faced by a need to go to the floor. Would you like to proceed further? If you do, Mr. Horton and I will go and make this rollcall and come back.

Mr. RAMEY. Well, that is up to you, Mr. Chairman.

Mr. HORTON. Were you finished with your statement?

Mr. RAMEY. No, I have just a couple of other points.

Mr. HORTON. Why not hit those two points? We can wait until the next bell rings.

Mr. RAMEY. I can do it in about 5 minutes.

Mr. HORTON. We do not really have that long. We have about 3 minutes.

Go ahead.

GENERAL MANAGEMENT OF ERDA

Mr. RAMEY. The second point I wanted to make is that the bill is not clear perhaps on the role of what one might call general management in the administration of the ERDA functions. In the previous bill——

Chairman HOLIFIELD. I am sorry. We do not have the time. If you will just wait here, I will come back. This is an important vote.

[Recess.]

Chairman HOLIFIELD. The committee will resume its sitting.

Mr. Ramey, you were speaking about the AEC merit system and the——

Mr. RAMEY. The role of general management, how that is handled.

Chairman HOLIFIELD. Yes. Did you have any language to suggest, and if you do, give us an idea where you think it ought to go.

Mr. RAMEY. Yes, sir. Well, I have a suggestion. I do not have precise language.

Chairman HOLIFIELD. Give us the idea.

ASSOCIATE ADMINISTRATOR?

Mr. RAMEY. The idea is that under your bill, you have set up an Administrator, a Deputy Administrator, and then these five Assistant Administrators, who are appointed by the President on the advice and consent of the Senate, which makes them sort of politically appointed assistants. Back on H.R. 9090 last summer, you, Mr. Holifield, raised some questions about the role of the AEC general manager, and at that point, the Bureau of the Budget people, the OMB people, suggested that they would have an Associate Administrator under the Deputy Administrator who would serve in the role of providing the general management. And they said they would like at your request to think about it some more.

Now, as I gather, they have dropped this, although I do not know that this has been discussed very much.

Chairman HOLIFIELD. As far as I know, it has not been discussed.

Mr. RAMEY. My suggestion would be that the Administrator be given the option, the alternative, of appointing an Associate Administrator at the same level as the Assistant Administrator, as a level IV job, and that it be authorized in the section that authorizes these seven additional positions, section 102(e).

Mr. HORTON. What page is that on?

Mr. RAMEY. I think it is on page 4 at the bottom. That has seven additional officers at level V. If you could provide that one of these, perhaps, might be at level IV, or perhaps to add a position at level IV, that would give the Administrator the option of utilizing a person as an Associate Administrator.

Mr. HORTON. Let me ask you in that connection——

Mr. RAMEY. Yes, sir.

Mr. HORTON. How would that be different from the Deputy Administrator? Would not the Deputy Administrator be able to do that?

Mr. RAMEY. It is possible, and that is why I thought it ought to be an option for the Administrator to do it. The problem with the Deputy is that he may be occupied on other things. The Administrator undoubtedly will be looking outward, dealing with Congress and other agencies a great deal of the time. The Deputy will be the Administrator's alter ego, I believe, and he will be looking outward and inward and working on the inward side.

Chairman HOLIFIELD. What you are talking about, as I understand it, is that the AEC now has a general manager.

Mr. RAMEY. Yes, sir.

Chairman HOLIFIELD. And we did discuss this. I remember, and somehow or other, this dropped in a crack. Now, the question in my mind is how the Associate Administrator would fit into the chart here. Below the Administrator and Deputy Administrator we have six staff positions designated at level V—legal, finance, administration, external affairs, civil rights, planning and analysis, and five operating administrations at level IV.

Mr. HORTON. John, can you look at this a minute?

I would think that the language of the bill is sufficiently broad so that the Administrator could, if he so desires, use one of these executive level V's. We have not tied them down, as I understand it.

Mr. RAMEY. Yes sir, that is right, but——

Mr. HORTON. So he could use one of those and designate him to be a general manager.

Mr. RAMEY. Yes sir, that is possible. I think the one problem with that would be that the Assistant Administrators are at level IV and the general manager will, particularly on administrative matters, be telling them what to do on some of these things. And we have these peculiar situations in Government where people are at different levels, but I think if they were at the same level, it would not be a problem.

Mr. HORTON. Could we go off the record just a minute, Mr. Chairman?

Chairman HOLIFIELD. Sure.

[Off the record discussion.]

Chairman HOLIFIELD. Back on the record. We will discuss this point in executive session.

ERDA CONTRACT AUTHORITY

Mr. RAMEY. I just had two or three short points to make with respect to the contract authority of ERDA. These have been mentioned earlier to a certain extent in your hearings, and I think they are of some importance. One of them is that there will be a tendency, and this is something that does not go to the drafting of the bill, but to the way it is administered and the committee intent. One of them is that with this additional funding for R. & D., and particularly in the new fields, there will be a great tendency to try to get ERDA——

Chairman HOLIFIELD. I hope the staff is taking notes on the points that he is making, because this transcript will not be available to us at markup time tomorrow.

Mr. RAMEY. With the additional funding for R. & D. and particularly the interest in these more exotic fields, there will be a tendency to try to make ERDA a kind of contract brokerage outfit sponsoring a lot of small-scale kinds of projects. I think some committee intent—and Dave Freeman mentioned this, I believe—committee intent that these advanced R. & D. projects should be funded to the full extent that they merit, and that ERDA will follow them and ERDA will have an interest in them, that it will not be just parceling out money, but that they will be real programs looking to ultimate development if they show promise.

Chairman HOLIFIELD. In other words, you are afraid that it may become just a grant operation?

Mr. RAMEY. Yes, sir.

Chairman HOLIFIELD. For any kind of concept that may come along.

Mr. RAMEY. That is right, and this will be the tendency.

Chairman HOLIFIELD. And you are thinking further that if in these new and advanced fields there are areas that they need to explore, they should justify it by doing it themselves.

Mr. RAMEY. And through various contracts, but that they have got to have such staff depth to do it right and rather than just parceling out and not really running that kind of a program.

CONTRACT PERFORMANCE

The second point goes to the other end of matters. That is where you have engineering development, and particularly in the nonnuclear areas, that ERDA contract with organizations and installations of such size and having such engineering depth, again, that they can do the job right. There will be a tendency in this area also, with additional funding, that a number of people with projects will come in and want to sponsor small-scale projects. The success that AEC has had has been in being able, through their larger installations, to have sufficient engineering depth, scientific talent, and funding that they can really push a project together all the way up from laboratory experiment to pilot plants, to prototypes, to demonstration plants. That has to be done in the fossil areas. That has to be done in all of these nonnuclear areas, this same type of process, which is expensive, which requires additional personnel, but it is the way that experience has shown is the best way that you can develop new technology.

MULTIYEAR FUNDING

Lastly, I would just mention a problem that you might want to look at in the future a little bit, the problem of multiyear funding.

Mr. HORTON. We have talked about that a little bit, as you know. We talked about that this morning.

Mr. RAMEY. That is right. And I think it is important that means be developed legislatively and administratively for multiyear funding in the R. & D. area. I thought your comments, Mr. Horton, were extremely wise in that regard.

DESALTING R. & D.

The second point I would make, once ERDA gets established, there may be other areas of R. & D. that probably ought to be transferred to ERDA as the prime R. & D. agency in the Government. One area that I have been very interested in, for example, is the area of desalting of sea water. There is a potential hookup between nuclear power and desalting, which is a very attractive area in the energy field. The AEC has cooperated with the Office of Saline Water in this area. Unfortunately, the Office of Saline Water has been cut back considerably by the OMB and others, and particularly in the distillation area, which would be involved with the large nuclear plants. They are going ahead with a process called reverse osmosis.

It might very well be in future years that Congress will get interested, and the administration will get interested, in the need for water and, perhaps we will find that water is just about as important as energy, and that this area of research and development might be appropriately transferred to ERDA to provide the funding and the technical administrative talent for pushing that field of endeavor.

Thanks very much.

Mr. HORTON. In connection with this last point that you made, we should be cognizant of the fact that in time there may be additional substantive programs that should be transferred over, and I see no reason why that cannot be done in the future.

Chairman HOLIFIELD. I want to thank you, Jim, for your help.

At this time, we will go into executive session for a few minutes.

You may remain. There are some questions I want to ask you in regard to past experiences you have had.

The hearing is adjourned.

[Whereupon, at 4:55 p.m., the hearings were adjourned and the subcommittee proceeded into executive session.]

APPENDIX

STATEMENTS ON ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION AND RELATED MATTERS SUBMITTED FOR THE RECORD

MELVIN PRICE, ILL.
G. C. FISHER, TEX.
CHARLES E. BENNETT, FLA.
SAMUEL S. STRATTON, N.Y.
OTIS G. PIKE, N.Y.
RICHARD H. ICHORD, MO.
LUCIEN N. NEDZI, MICH.
WILLIAM J. RANDALL, MO.
CHARLES H. WILSON, CALIF.
ROBERT L. LEGGETT, CALIF.
FLOYD V. HICKS, WASH.
RICHARD C. WHITE, TEX.
BILL NICHOLS, ALA.
JACK BRINKLEY, GA.
ROBERT H. (BOB) MOLLOHAN, W. VA.
DAN DANIEL, VA.
G. V. (SONNY) MONTGOMERY, MISS.
HAROLD RUNNELS, N. MEX.
LES ASPIN, WIS.
RONALD V. DELLUMS, CALIF.
MENDEL J. DAVIS, S.C.
JAMES R. JONES, OKLA.
PATRICIA SCHROEDER, COLO.

NOV 30 1973

U.S. House of Representatives
COMMITTEE ON ARMED SERVICES
Washington, D.C. 20515

NINETY-THIRD CONGRESS
F. EDWARD HÉBERT, CHAIRMAN

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MARJORIE S. HOLT, MD.
ROBERT W. DANIEL, JR., VA.

FRANK M. SLATINSHEK, CHIEF COUNSEL
ONETA L. STOCKSTILL, EXECUTIVE SECRETARY

November 28, 1973

Honorable Chet Holifield
Chairman
Legislation and Military Operations Subcommittee
Committee on Government Operations
Rayburn House Office Building, Room B-373
Washington, D. C.

Dear Mr. Chairman:

Thank you for your letter of November 21, 1973, advising me of the hearings on H. R. 11510, and inviting me to appear as a witness or supply a statement or other material for the Committee's consideration.

Although it will not be possible for me to appear as a witness due to my current commitments, I do wish to state that I thoroughly agree with the purposes of H. R. 11510 and would hope that the congress and the executive branch will get on with the business of energy research and development as a priority matter, particularly in the interests of our national defense and national security.

I note, Mr. Chairman, that mention is made of "all energy sources" in section 2 of the bill. It would appear that the Naval Petroleum Reserves could be interpreted as coming within the meaning of that section as available energy sources. In that regard I would respectfully call to your attention the provisions of Chapter 641 of Title 10, United States Code and Rule XI of the House Rules relative to oversight responsibilities and jurisdiction of this Committee in Naval Petroleum Reserves matters. Particularly, we are charged with insuring that the Reserves are to be maintained for use only in the national defense.

While I recognize that an Energy Research and Development Administration, as envisioned by H. R. 11510, would go a long way toward arriving at a realistic solution to the serious energy problems that face this

nation in the years ahead, at the same time I would trust that the legislation would in no way be in conflict with the jurisdiction of this Committee over the Naval Petroleum Reserves.

With best regards, I am

Sincerely,

F. Edw. Hebert
Chairman

U.S. HOUSE OF REPRESENTATIVES,
COMMITTEE ON POST OFFICE AND CIVIL SERVICE,
Washington, D. C., August 1, 1973.

HON. CHET HOLIFIELD,
Chairman, Committee on Government Operations,
House of Representatives, Washington, D.C.

DEAR MR. CHAIRMAN: By letter dated July 16, 1973, you requested my comments on H.R. 9090, which proposes to create a new Department of Energy and Natural Resources and a new Energy Research and Development Administration.

The proposed legislation, if enacted into law, would not have a significant effect upon the jurisdiction or duties of the Committee on Post Office and Civil Service. Therefore, my comments will be confined to technical aspects of the legislation.

H.R. 9090, proposes to abolish the Department of the Interior and transfer the functions of that Department, as well as certain functions of other agencies, to the newly created Department of Energy and Natural Resources. In the process, a number of existing executive schedule positions would be abolished, such as the Secretary of the Interior, Under Secretary of the Interior, Assistant Secretaries of the Interior (6), and the Solicitor of the Department of the Interior, to name a few.

Since the above positions are included within the executive schedule contained in chapter 53 of title 5, United States Code, H.R. 9090, should be amended by adding provisions which specifically would remove such positions and all other similarly affected positions from the executive schedule. I would suggest language along the following lines:

"Title 5, United States Code, is amended as follows:

(1) Clause (6) of section 5312 is repealed.

(2) Clause (7) of section 5314 is repealed.

(3) Clauses (18) and (42) of section 5315 are repealed.".

Similar amendments would be required to remove the other affected positions from the executive schedule.

Title II of the bill, which establishes the Department of Energy and Natural Resources, provides that such Department will have a Secretary, Deputy Secretary, two Under Secretaries, an Assistant Secretary, and a General Counsel who shall be appointed by the President by and with the advice and consent of the Senate. While the bill contains specific language relating to the compensation of such officials, it is not clear whether such positions are intended to be placed within the executive schedule of title 5. For example, section 201(a) relating to the Secretary provides as follows:

"* * * The Secretary shall receive compensation at the rate now or hereafter prescribed for officers and positions at level I of the Executive Schedule (5 U.S.C. 5312). * * *"

The above-quoted language would not have the effect of placing the position of the Secretary under level I of the executive schedule. Rather, the bill would have to include a provision which specifically would place that position under section 5312 of title 5. For example—

"Clause (6) of section 5312 of title 5, United States Code, is amended by striking out the words 'Secretary of the Interior' and inserting 'Secretary of Energy and Natural Resources' in lieu thereof.".

Similar amendments would be required to bring the other newly created executive positions under the compensation provisions of sections 5312 through 5316 of title 5.

It is the view of this committee that only those positions that are subject to Presidential appointment and confirmation by the Senate should be placed within the executive schedule of title 5. Therefore, we object to the provisions of section 202(e) of the bill which apparently are intended to place within levels IV or V of the executive schedule 25 officers who would be appointed by the Secretary of the Department.

I trust the above comments will be helpful to your committee and I appreciate the opportunity to express my views on the proposed legislation.

With kind regards,

Sincerely yours,

THADDEUS J. DULSKI, *Chairman.*

DEC 6 1973

NINETY-THIRD CONGRESS

THADDEUS J. DULSKI, N.Y., CHAIRMAN

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U.S. House of Representatives
COMMITTEE ON POST OFFICE AND CIVIL SERVICE
207 CANNON HOUSE OFFICE BUILDING
Washington, D.C. 20515

December 5, 1973

RECEIVED
DEC 06 1973
HON. CHET HOLIFIELD

The Honorable Chet Holifield
Chairman
Committee on Government Operations
House of Representatives
Washington, D. C. 20515

Dear Mr. Chairman:

By letter dated November 21, 1973, you requested my comments on H.R. 11510, which proposes to establish a new Energy Research and Development Administration and a Nuclear Energy Commission.

You point out that H.R. 11510 actually incorporates the provisions of Part B of H.R. 9090, on which I furnished my views by letter dated August 1, 1973. Since that bill (H.R. 9090) would not have a significant effect upon the jurisdiction or duties of the Post Office and Civil Service Committee, my comments thereon were limited to technical aspects of the legislation.

In reviewing the provisions of H.R. 11510, I note that several of the provisions contained therein are substantially similar to certain provisions in H.R. 9090 which I discussed in my letter of August 1. Therefore, the comments set forth in that letter would be equally applicable to the provisions of H.R. 11510.

Again, I appreciate the opportunity to express my views on the proposed legislation.

With kind regards,

Sincerely yours,

T. J. Dulski

THADDEUS J. DULSKI
Chairman

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

OFFICE OF THE
ASSISTANT DIRECTOR
FOR RESEARCH APPLICATIONS

November 30, 1973

Honorable Chet Holifield
Chairman, Government Operations
House of Representatives
Washington, D. C. 20515

Dear Mr. Chairman:

I appreciate the opportunity offered by your invitation to testify on the legislation proposing the establishment of an Energy Research and Development Administration. I am anxious to present my views to you, because of the importance of this legislation and the critical nature of the energy problems confronting us as a Nation. It is with sincere regret, therefore, that I must inform you that I will be unable to testify due to my attendance as U.S. Chairman at the second meeting of the US-USSR Joint Commission on Scientific and Technical Cooperation in Moscow later this month and a subsequent visit to Poland in early December for a joint review of cooperative research activities undertaken pursuant to an Agreement entered into last year by our two governments. Because of the long-term importance of these international agreements -- both to the general progress of scientific research and to the furtherance of improved international relations -- I am obliged to honor the long-standing commitments which have been made for my attendance at these various formal meetings. I hope, however, that this letter can be made part of your record so that I may present the views of the Foundation on this significant subject.

Energy R&D policy objectives provide the driving force behind investment in energy R&D. The formulation of our present and future energy R&D program should be based on the following major policy objectives set forth by the President for "Project Independence":

1. Provision of the Nation with adequate energy at a minimum cost.

2. Development of a national energy system having minimal impact on the environment.

3. Development of an energy system of high reliability and maximum security against natural disaster and acts of war or sabotage.

4. Achievement of a capability for energy self-sufficiency by the end of this decade.

In order to achieve these policy objectives, the Administration is recommending a major increase in our national energy research and development program to a level of expenditure of at least $10 billion cumulative over the next five-year period. In executing and administering such a program, it is vital to take into account the complexity of our national energy system, with its many components involved in the production, distribution, and use of energy. It is most important that proposed projects or areas in energy R&D be examined and evaluated from a total systems point of view. This can best be accomplished by the creation of a new independent agency, the Energy Research and Development Agency (ERDA) as proposed in H.R. 11510. Such an agency would provide the coherent direction necessary both for the formulation of effective policy in these complex areas, and for the development and implementation of the required major new technologies. I would expect that ERDA, in the performance of these functions, would, where indicated for best overall program execution, utilize the laboratory and research facilities of other Federal agencies, such as NASA and DOD, as well as those of private industry.

One principal mission of the National Science Foundation is to support basic research in all fields of science and to maintain the health of science in the United States, which includes insuring a strong cadre of manpower in science and engineering. Many of the fields of basic research contribute directly to the energy R&D which is now being discussed. Let me illustrate this important fact.

Any of the energy technologies proposed will benefit in both the short- and long-term from deeper understanding of the phenomena on which they are based. Coal gasification plants depend upon improvements in catalysis, organic chemistry, sulphur chemistry, chemical kinetics, thermodynamics, and materials. The success of fusion reactors will depend on behavior of plasmas under conditions not yet established

in the laboratory. The impacts of various energy supply and utilization patterns on people, economics, and the environment are of the utmost importance, but we now lack the understanding needed to make sound predictions. High temperature gas turbines, attractive for coupling to gas-cooled reactors, depend on unknown behavior of materials subjected to mechanical and thermal stresses in helium atmosphere with parts per million of nitrogen, carbon monoxide, carbon dioxide, and water. Hydrogen proposed as the clean fuel might be produced economically by mimicking photosynthesis or by vastly accelerating thermochemical reactions which are now impractically slow. Fluid dynamics and heat and mass transport must be further researched to improve the behavior of heat exchangers, building insulation, and cooling towers and their plumes. Biological effects of trace amounts of toxic substances and the movement and concentration of these substances through the environment must be understood.

NSF expects to continue this basic research role, cooperating fully with the new ERDA in the discharge of its overall energy research and development responsibilities.

Proof-of-concept for new alternative sources of energy is strongly dependent on an effective linkage with basic research. The unique relationship of the NSF with the Nation's universities provides an exceptionally efficient means of bringing the best new ideas forward, designing the needed energy research, and establishing proof-of-concept tests of these ideas. These relationships have proven to be effective in providing options for future development. This development would be carried out by ERDA.

Recognizing the need for energy research of this type, the Foundation has actively supported research on solar, geothermal and other advanced systems concepts for helping to meet national energy needs. Because our activities in these areas have a bearing on the relationship of the Foundation to ERDA, I believe a brief review at this point will help provide some background useful for your consideration.

The overall objective of the NSF research in solar energy is to establish the potential of solar energy as an alternative energy source at the earliest feasible time.

Although Federal support for research on terrestrial application of solar energy extends at least as far back as 1950, the first sizable Federal effort to investigate the practical uses of solar energy in meeting our domestic needs may be dated from FY 1971 when NSF obligated more than $1 million for solar energy support. Since that time the pace of events has increased rapidly with universities, complemented by industries, national laboratories, and other institutions mobilized in a program aimed at proof-of-concept experiments. Details of this effort appear in a tabulation of NSF solar energy research grants in FY 1973 and FY 1974 to date, which I attach to this letter. Funding for solar energy research by the NSF has increased, through its Research Applied to National Needs (RANN) program, to an expected level of $13.2 million in FY 1974, and we expect further growth to occur next year.

Thus, NSF has played the key role in the national research efforts which are designed to lead to the domestic use of solar energy as soon as possible. Because of our active role in sponsoring research on terrestrial uses of solar energy, the Foundation is well on its way to carrying out a carefully-organized, fast-paced plan which is designed to bring solar heating and cooling systems for buildings through the proof-of-concept phase to the development, demonstration and commercial design stages in 1975. It is planned that ERDA will take over responsibility for the program in these stages. At the same time that NSF is moving to the initiation of system proof-of-concept experiments, we are also working to obtain improved efficiency and reduced cost of various technological components out of which such systems would be constructed.

In the area of geothermal energy, the Foundation maintains a smaller but incisive program to assess and prove the potential of geothermal energy as an energy resource. As you know, the only large scale geothermal power-generating complex in the U.S. is the Geysers field in northern California. But the Geysers complex utilizes dry steam, which is a rare phenomenon and is unlikely to become a major factor in the U.S. energy system. If we are to exploit geothermal energy, we must work with more prevalent types of geothermal resources, but unfortunately they are not as easy to convert to economic sources of energy. The

most abundant of the potential sources of geothermal energy are hot brines and hot rock. While they have the advantage of being more abundant, they are also the hardest of the geothermal resources to utilize.

Much of the technology required to exploit these sources still needs to be developed, and the geothermal research program undertaken by the Foundation has focused on learning more about these types of resources and how best to exploit them. We are hopeful that we will be successful in these undertakings which could lead to large scale hot brine power plants being designed and constructed in this decade. If efforts in rock-fracturing now underway are successful, power plants using hot rock resources could be on line by the next decade. In the pursuit of these practical objectives, we are not neglecting the potential impact of these new technologies and we are studying the legal, economic, and environmental aspects of such technological developments. It is planned that ERDA will take over responsibility for the geothermal program in the development, demonstration and commercial design stages.

In addition to its research support activities for solar and geothermal energy the Foundation is also active in other aspects of energy research. These include research to:

-- Analyze and synthesize alternative means of meeting U.S. energy requirements while satisfying economic and environmental quality constraints.

-- Discover methods for more effectively managing and utilizing conventional energy resources and new or modified energy resources.

-- Improve methods to convert energy to a form which is practical for transmission and use.

-- Discover novel power transmission concepts to transport energy from current and new production sources to consumption sites, and apply computer methods to operate, plan, model, and optimize these systems.

We recognize and support the many persuasive reasons for establishing an Energy Research and Development Administration that is capable of coordinating and funding research

on all energy sources. At the same time we believe that it is important for NSF to continue to support research on advanced energy concepts in selected areas. This is essential to supplement the work of ERDA by assuring that all avenues of research to deal with our long-range energy problems are fully explored.

Research through proof-of-concept experiments is intended to provide the assurance we need to make prudent and wise choices. During these early stages it is essential that new ideas be encouraged and evaluated as a basis for selecting candidates for prototype development, large scale demonstration, and commercialization. We believe that the Foundation is especially qualified to carry out the early stages of this type of work because it has no institutional mission to preserve, has extensive ties with the research community, and is experienced in managing large interdisciplinary undertakings.

When programs reach the developmental and demonstration stages we believe that they should be taken over by the appropriate mission agency or user groups such as private industry. In this regard, we believe it entirely appropriate that the proposed Energy Research and Development Administration undertake the management of all energy R&D programs after proof-of-concept has been established. In cooperation with industry, ERDA could apply its resources to large scale implementation programs which have a high probability of success. Such an arrangement would have the added advantage of giving the Foundation the freedom to look at new ideas and concepts wherever they may be found and to explore some of them through the proof-of-concept stage if they contained promise in the research stages. The research work through the proof-of-concept stage supported by NSF would be funded mainly from its own appropriation. If it becomes desirable to have funds transferred to the Foundation from other agencies, the Foundation has authority to accept and use such funds from other agencies for such research.

To summarize, the National Science Foundation fully endorses the enactment of H.R. 11510 and the establishment of an Energy Research and Development Administration to achieve a more effective management of the energy-R&D functions of the Federal Government. We believe that NSF's role of

research in selected energy areas is fully compatible with the ERDA concept and will serve to support and strengthen ERDA when it is created. The mandate of the Foundation gives it the flexibility to initiate and support energy research, and its continuing role therein would be in harmony with the broader purposes of H.R. 11510.

I thank you for the chance to express these views to you and to the Committee on Government Operations and stand ready to respond to any further questions you may have when I return to the United States.

The Office of Management and Budget has advised us that there is no objection to the submission of this report from the viewpoint of the Administration's program.

Sincerely yours,

Raymond L. Bisplinghoff
for H. Guyford Stever
Director

Enclosure

25-108 O - 74 - 21

NSF/RANN SOLAR ENERGY RESEARCH GRANTS AND CONTRACTS IN FY 1973

Institution & Program Mgr.	Title and Grant Number	Amt., Duration(Mos.) and Effective Date
Heating & Cooling of Bldgs.		
American Society of Htg., Refrigeration & Air Conditioning C. MacPhee	Preparation & Publication of an ASHRAE Guide Chapter on the Application of Solar Energy for Heating & Cooling of Bldgs. (GI-39247)	$ 5,000/12 7/1/73
Univ. of Florida E. Farber	Formulation of a Data Base for the Analysis, Evaluation and Selection of a Low Temp. Solar Powered Air-Conditioning System (GI-39323)	49,400/9 7/1/73
Univ. of Maryland R. Allen	Optimization Studies of Solar Absorption Air-Conditioning Systems (GI-39117)	129,300/18 8/15/73
Univ. of Wisconsin J. Duffie	Computer Modeling & Simulation of Solar Htg. and Cooling Systems (GI-34028-1)	65,300/12 10/1/73
Solar Thermal Conversion		
Aerospace Corporation A. Greenberg	Solar Thermal Conversion Mission Analysis (C-797)	125,885/6 4/16/73
Aerospace Corporation A. Greenberg	System Analysis of Photothermal Conversion Systems (C-716-1)	12,118 5/23/73
Univ. of Arizona B. Seraphin	Chemical Vapor Deposition Research for Fabrication of Solar Energy Conversion (GI-36731X)	171,200/12 1/1/73

11/15/73
LOH

Institution & Program Mgr.	Title & Grant Number	Amt., Duration(Mos.) and Effective Date
Solar Thermal Conversion (Contd.)		
Colorado State Univ. (Westinghouse) G. Lof	Analysis of Solar-Thermal Electric Power Systems (GI-37815)	$ 491,800/18 4/1/73
Univ. of Houston (McDonnell-Douglas Astronautics Co.) L. Vant-Hull	Feasibility Study of a Solar Thermal Power System Based upon Optical Transmission (GI-39456)	130,900/12 6/15/73
Univ. of Minnesota (Honeywell) R. Jordan	Research Applied to Solar-Thermal Power Systems (GI-34871X1)	494,700/12 7/1/73
Photovoltaic Conversion		
American Cyanamid Co. (U. Penn & U. Delaware) G. Haacke	Research on Cadmium Stannate Selective Optical Films for Solar Energy Applications (GI-39539)	151,500/18 7/1/73
Boston College P. Fang	Low-Cost Polycrystalline Silicon Photovoltaic Cells for Large Solar Power Systems (GI-34975-1)	67,100/9 6/15/73
Boston University (Exxon Research) N. Lichtin	Photochemical Conversion of Solar Energy (GI-38103)	115,000/12 6/1/73
Brown University J. Loferski	Investigation of Thin Film Solar Cells Based upon Cu_2S and Ternary Compounds (GI-38102X)	76,900/12 7/1/73

11/15/73
LOH

Institution & Program Mgr.	Title & Grant Number	Amt., Duration(Mos.) and Effective Date
Photovoltaic Conversion (Contd.)		
Univ. of Calif./Berkeley G. Somorjai	Studies of Surface Structure and Electronic Properties of Polycrystalline Photovoltaic Materials and Devices (AG-472)	$ 186,700/18 7/1/73
Harvard University (Tyco Labs.) B. Chalmers	Low-Cost Continuous Fabrication of Silicon Solar Cells (GI-37067X)	150,000/12 3/1/73
Southern Methodist U. (Texas Instr. Corp.) T. Chu	Development of Low-Cost Thin Film Polycrystalline Silicon Solar Cells for Terrestrial Applications (GI-38981)	149,400/18 6/1/73
Stanford University R. Bube	Applied Research on II-VI Compound Materials for Heterojunction Solar Cells (GI-38445X)	48,300/12 7/1/73
Bioconversion		
Univ. of Calif./Berkeley W. Oswald	Solar Energy Fixation and Conversion with Algal-Bacterial Systems to Produce Methane (GI-39216)	51,800/18 5/1/73
Dynatech Res. & Dev. Co. (U. Mass. & MIT) D. Wise	Research on a Program for Economic Fuel Gas Production from Solid Waste (C-827)	427,000/13 6/28/73
University of Illinois J. Pfeffer	Biological Conversion of Organic Refuse to Methane (GI-39191)	83,900/12 6/1/73
Univ. of Massachusetts W. Short	Bioconversion Energy Research Conference (GI-39215)	17,800/5 5/15/73

11/15/73
LOH

Institution & Program Mgr.	Title & Grant Number	Amt., Duration(Mos.) and Effective Date
Bioconversion (Contd.)		
Stanford Research Inst. J. Henry	Effective Utilization of Solar Energy to Produce Clean Fuel (GI-38723)	$ 49,000/9 5/1/73
Univ. of Tennessee A. Hollaender	Workshop on Energy Conversion Sources (GI-35970)	18,500/6 9/15/72
Wind Conversion		
Montana State Univ. R. Powe	Technical Feasibility Study of a Wind Energy Conversion System Based on the Tracked-Vehicle Airfoil Concept (GI-39415)	49,900/12 9/1/73
NASA/Lewis Res. Ctr. J. Savino	Wind Energy Conversion Workshop (AG-465)	11,700/6 6/1/73
Oklahoma State Univ. W. Hughes	Development of an Electrical Generator and Electronics Cell for a Wind Energy Conversion System (GI-39457)	141,600/18 7/1/73
Ocean Thermal Conversion		
Carnegie-Mellon Univ. A. Lavi	Conference on Power Generation for Ocean Temperature Differences (GI-39115)	14,000/12 5/15/73
Carnegie-Mellon Univ. C. Zener	Solar Power Ocean-Based Plants (GI-39114)	190,000/18 6/1/73

11/15/73
LOH

Institution & Program Mgr.	Title & Grant Number	Amt., Duration(Mos.) and Effective Date
Ocean Thermal Conversion (Contd.)		
Univ. of Massachusetts (J. H. Anderson, Inc. & United Airc. Res. Labs.) W. Heronemous	Ocean-Sited Power Plants (GI-34979-1)	$ 25,200/18 2/15/73
Program Analysis		
Audio Productions P. Mooney	Motion Picture Services (C-664)	7,000/3 11/30/72
Int'l Solar Energy Soc. (ISES) W. Cherry	Printing of the 1973 International Solar Energy Congress Abstracts (GI-39240)	10,000/6 6/1/73
Univ. of Maryland R. Allen	Solar Energy Panel (GI-32488-2)	24,600/6 11/1/72
Univ. of Maryland F. Morse	Personnel Mobility Assignment	34,900/11 9/1/73
Univ. of Massachusetts R. Ward	Personnel Mobility Assignment	21,000/9 10/1/73
Mitre Corporation R. Greeley	System Study of the NSF Solar Energy Research Program (C-831)	152,334/4 7/1/73
Univ. of Pennsylvania M. Wolf	Solar Energy Research Conference (GI-37124)	11,000/6 2/1/73

11/15/73
LOH

NSF/RANN Solar Energy Grant: GI-39247
Granted: 6/8/73
Institution: ASHRAE
Principal Investigator: Carl W. MacPhee
Project Title: Preparation and Publication of an ASHRAE Guide Chapter on the Application of Solar Energy for Heating and Cooling of Buildings

Amount: $5,000
Eff. Date: 7/1/73
Duration: 12 mos.

The substantial research program on the application of Solar Energy for Heating and Cooling of Buildings supported by the National Science Foundation, RANN Directorate has begun to generate new data not generally available to practicing engineers and mechanical construction contractors. This project will support the collection, analysis and condensation of this new material into a form most useful to practicing mechanical engineers and builders. The material produced will be published as a chapter in the ASHRAE Guide, widely regarded as the "bible" of the air conditioning, heating and mechanical ventilation industry. Through this process, the availability of new research information will be expedited to potential users outside the research and development community.

NSF/RANN Solar Energy Grant: GI-39323
Granted: 6/11/73
Institution: University of Florida
Principal Investigator: E.A. Farber
Project Title: Formulation of a Data Base for the Analysis, Evaluation and Selection of a Low Temperature Solar Powered Air-Conditioning System

Amount: $49,400
Eff.Date: 7/1/73
Duration: 9 mos.

The development of an economical and efficient means of cooling buildings with solar energy is considered an important requirement for the implementation of solar energy as an alternative to fossil energy sources for producing thermal comfort in buildings. This project will provide an engineering evaluation of water cooled and air cooled refrigerant systems and related machinery upon which recommendations can be made for the development of an operational unit. If found feasible, such a unit will be considered for fabrication and installation in a solar heated house now in operation at the University of Florida. The proposed work covers only the preliminary engineering development phase.

NSF/RANN Solar Energy Grant: GI-39117
Granted: 5/21/73
Institution: University of Maryland
Principal Investigator: Redfield W. Allen
Project Title: Optimization Studies of Solar Absorption Air Conditioning Systems

Amount: $129,300
Eff.Date: 8/15/73
Duration: 18 mos.

The objective of this project is the evaluation of the effects of system options and actual process factors on the performance and optimization of solar absorption air conditioning systems. Specific goals include (1) the development of parametric performance factors for ideal and actual system operation at various thermodynamic conditions, (2) evaluation of the thermal heliotrope for use with sun-tracking collectors, (3) the thermodynamic and economic optimization of the collector and absorption refrigeration systems.

In a recent study, the NSF/NASA Solar Energy Panel concluded that, with a substantial development program, by the year 2000 solar energy could economically provide up to 10% of the total building heating and cooling energy requirements. This represents a major impact on the building industry, with an annual fossil fuel savings of approximately $2.1 billion, based on a fuel cost of $1.00/$10^6$ btu. While the energy requirements for air conditioning are a small fraction of the total annual building heating and cooling energy demand, the rapidly growing air conditioning power demands periodically tax the peak load capacity of regional power networks. This situation gives added emphasis to the need to develop solar powered air conditioning. Once solar air conditioning becomes a marketable product it will be possible to combine it with solar heating, with associated savings in initial cost. This project to conduct optimization studies of solar powered air conditioning systems, should define limitations of present technology and point to ways of lowering cost and improving performance.

NSF/RANN Solar Energy Grant: GI-34028-1
Granted: 6/11/73
Institution: University of Wisconsin
Principal Investigator(s): Beckman, W.A. - Duffie, J.A.
Project Title: Computer Modeling and Simulation of Solar Heating and Cooling Systems

Amount: 65,300
Eff. Date: 6/11/73
Duration: 12 Mos.

This grant provides for the last 12 months of a 27 month project to model heating and cooling systems for buildings. The general objectives are to develop a versatile simulation tool to evaluate from engineering and economic points of view various processes for utilizing solar energy for building energy needs, and to use the simulations to evaluate solar heating and cooling processes in various United States locations. The simulations will be useful in selecting processes for further development and aid in the design of specific applications of solar energy to buildings. The general approach using the concept of a versatile "building block" program, in which various combinations of a process' components can be evaluated, has proved to be a valid one. The approach has been a step by step development of component models and of matter programs for using component models in system analyses. The plan includes the following specific tasks: 1) Complete simulations of water heating/storage/LiBr-H O cooler system, and compare results with those of Tybout and Lof for selected stations. 2) Comparison check of the model for heating systems alone with stations evaluated by Tybout and Lof. 3) Run water heating/collector/storage/absorption cooler models for several locations. 4) Run heating/hot water systems for Madison, WI. 5) Program and evaluate air heating systems with rock bed storage, with or without absorption cooling or open-cycle humidification-dehumidification cooling. 6) Evaluate other concepts of heating and cooling systems for buildings. 7) Explore some of the major design parameters, evaluate the processes from thermal and economic standpoints, and identify critical design considerations.

NSF/RANN Solar Energy Grant: C-797
Granted: 4/16/73
Institution: Aerospace Corporation
Principal Investigator: A. B. Greenberg
Project Title: Solar Thermal Conversion Mission Analysis

Amount: $125,885
Eff. Date: 4/16/73
Duration: 6 mos.

The objectives of this study are to (1) develop a methodology for assessing the potential role of solar thermal conversion systems in satisfying a portion of the nation's energy needs, (2) develop a methodology for comparative analysis of competing solar thermal conversion systems, and (3) apply this methodology to assess the potential of various types of solar thermal conversion systems in Southern California.

The methodology will include (a) the ability to incorporate various projected energy demands for different regions of the country for the period 1990-2020, (b) a selected approach to standardize solar insolation flux calculations, (c) the definition of mission requirements appropriate for central station power plants, municipal power plants, community power systems, and/or individual load centers, (d) the identification of key parameters and definition of system/subsystem requirements, (e) the identification and definition of system/subsystem constraints and competing characteristics including economic, environmental, social, and institutional factors, (f) synthesis of alternative systems, and (g) an assessment technique to estimate market capture potential. The method will be tested with specific data for Southern California in order to assess the completeness/validity of the methodology.

NSF/RANN Solar Energy Grant: C-716-1
Granted: 5/23/73
Institution: Aerospace Corporation
Principal Investigator: A. B. Greenberg
Project Title: Systems Analysis of Photothermal Conversion Systems

Amount: $12,118
Eff. Date: 5/23/73
Duration:

This is a continuation of Grant C-716.

The assessment of a system concept will include technical and economic feasibility studies of each principal component, identification of key technical and economic problem areas, and evaluation of the credibility and capability of the overall concept to meet system objectives. An important aspect of an assessment will be the development of realistic performance characteristics and cost estimates for each system concept. Results from assessments of components and concepts will be used in comparative systems analysis to evaluate advantages and disadvantages of various components and concepts. Estimates will be made of research and time schedules to bring each concept to a relatively developed level where economic feasibility can be determined. Program planning documents and schedules for demonstration plants and prototype plants will be prepared. Some attention will be given to cost comparisons of photothermal electrical generating plants with nuclear and fossil fuel plants in the 1990's.

NSF/RANN Solar Energy Grant: GI-36731 Amount: $171,200
Granted: 9/20/72 Eff. Date: 9/15/72
Institution: University of Arizona Duration: 12 mos.
Principal Investigator: Bernhard O. Seraphin
Project Title: Chemical Vapor Deposition Research for Fabrication of Solar Energy Converters

This project will support research on a new approach to a selective solar energy converter that can be used to transform solar radiation into high temperature heat. This heat can be transferred and applied to a steam turbine-generator unit to produce electricity. The selective solar energy converter is basically a two-layered construction in which the top layer is a semiconductor material, such as silicon, having high absoprtion for solar radiation and high transparency for black body radiation from the heated unit. The bottom layer is a metal film having high reflectance.

A second significant feature of this project is the use of chemical vapor deposition (CVD) techniques for applying semiconductor materials for optical structures. The objective of the project is to adapt the CVD process to the fabrication of multilayered semiconductor coatings, to demonstrate the fabrication of semiconductor absorber-type optical coatings, and to measure the physical characteristics and the optical performance of these coatings as a function of temperature up to 500 C.

A previous NSF grant GI-30022 has supported initial work in evaluating various coating methods for fabricating multilayer stacks utilizing semiconductor materials. Results of this work have provided new understandings of system variables in the pyrolysis of silane on silver surfaces and have demonstrated the practicality of forming more complex layered structures using CVD techniques.

NSF/RANN Solar Energy Grant: GI-37815 Amount: $491,800
Granted: 4/6/73 Eff. Date: 4/6/73
Institution: Colorado State University Duration: 18 mos.
Principal Investigator: G.O.G. Lof
Project Title: Analysis of Solar-Thermal Electric Power System

The objective of this research project is to develop very general and widely applicable analytical relationships for describing the detailed functioning of solar thermal electric power systems.. Using mathematical modeling techniques, these analytical relationships would be used to optimize the design of the various components and subsystems and the design of entire systems for generating electricity from solar energy using heat engines and relatively conventional turboelectric generative equipment. Computerized mathematical models will be developed and used to produce information for component and systems engineering and optimization and to correlate power output and costs with system design parameters and insolation data. The plan is to develop component and subsystem models in forms suitable for use in larger models of entire systems in order to optimize a solar thermal power system to produce power at the lowest cost.

Under this project, all known methods for solar conversion to heat energy and for heat energy transfer, storage, and conversion will be examined so that future research and development funds can ve applied most effectively and so that some potentially attractive systems will not be overlooked. The research project will provide information required for the selection of the best methods and systems for practical generation of electricity from solar energy by a thermal process.

The project will include data collection and organization, conceptual development of components and subsystems, preliminary component engineering, preliminary systems engineering, cost analysis, and environmental impact.

NSF/RANN Solar Energy Grant: GI-38456
Granted: 6/26/73
Institution: University of Houston
Principal Investigator: Lorin L. Vant-Hull
Project Title: Feasibility STudy of a Solar Thermal Power System Based Upon Optical Transmission

Amount: $130,900
Eff. Date: 9/1/73
Duration: 12 Mos.

The objective of this project is to perform a preliminary technical and economic feasibility study of a solar thermal electric power system based upon optical transmission of collected solar energy to a central location. The study includes system definition, modeling, and preliminary component design. In the concept, solar radiation is reflected from a relatively large number (field) of steered mirrors to a common target receiver located on a central tower. The highly concentrated solar radiation impinging on the receiver surface is largely absorbed and converted to high temperature heat energy that is used to drive a heat engine to produce mechanical or electrical power. This approach to solar energy collection utilizes the transmission path of reflected light to bring relatively large quantities of energy to a central location-thus avoiding the need for relatively extensive heat transfer networks from field arrays of collectors to a central collection point. Of course, another set of problems are encountered in this approach to developing an efficient, economical collection system for solar energy. This project is a combined effort by staff of the University of Houston and the McDonnell Douglas Astronautics Company. The approach includes completion of tasks on (1) the solar flux concentration system, including system geometric analysis of the optical characteristics, guidance and control system studies, and reflector designs; (2) the receiver and energy transfer system including conceptual designs of the tower; and, (3) system definition and evaluation with particular attention to economic analysis of the collection, energy transfer, and energy conversion systems.

NSF/RANN Solar Energy Grant: GI-34871X1
Granted: 6/29/73
Institution: University of Minnesota
Principal Investigator: R.C. Jordan
Project Title: Research Applied to Solar-Thermal Power Systems

Amount: $494,700
Eff.Date: 7/1/73
Duration: 12 mos.

This project is the second-year continuation of a two-year project initiated in FY 1972. It is a collaborative project between the University of Minnesota and Honeywell Corporation to conduct research on solar thermal conversion systems to produce electricity or high temperature process heat. Substantial progress has been made in analyzing the optical characteristics of solar ray collector-absorber systems using three-diminsional computer modelling; testing and evaluating mirror surface coatings; calculating absorber coating characteristics and testing coating lifetimes under accelerated life conditions; analyzing and testing of gravity assisted heat pipes; analyzing heat transfer and storage concepts; and analyzing subsystem and system characteristics.

The continuing research will extend the previous work and undertake new tasks based upon the progress to date. These tasks in the continuing project include work on (1) solar reflector surface life, (2) solar absorber coating life, (3) design, fabrication, and test of a 12 meter prototype heat pipe, (4) experiments with heat transfer test facilities, (5) experiments with a central heat storage test facility, (6) analysis of heat transfer in heat storage units, (7) selection of a reference system and recommendations for additional research, (8) design, fabrication, and test of a solar thermal collection system using a three-eighths scaled model, (9) analysis of insulation of transfer loops, (10) heat exchanger interfaces with heat pipes, transfer storage, and boilers, and (11) system cost estimates.

NSF/RANN Solar Energy Grant: GI-39415
Granted: 6/20/73
Institution: American Cyanamid Company
Principal Investigator: G. Haacke
Project Title: Research on Cadmium Stannate Selective Optical Films for Solar Energy Applications

Amount: $151,500
Eff. Date: 7/1/73
Duration: 18 mos.

The objective of this research project is to develop a transparent, electrically conductive material, cadmium stannate (Cd_2SnO_4), for incorporation into CdS solar cells and solar heat collectors. The research will seek to develop technology for the preparation of crystalline Cd_2SnO_4 films and optimize the electrical and optical properties of these films for energy conversion applications. Optical data on Cd_2SnO_4 films will be evaluated for use as coatings for flat plate collector covers. When the desired optical properties are achieved, flat plate collectors will be assembled and tested to determine heat collection efficiency. Cd_2SnO_4 films on transparent substrates will be used for the fabrication of thin film CdS solar cells and the photovoltaic properties of these cells will be evaluated.

A feasibility study of low-cost methods for the production of large area Cd_2SnO_4 coatings will be conducted.

NSF/RANN Solar Energy Grant: GI-34975-1
Granted: 4/20/73
Institution: Boston College
Principal Investigator: Paul H. Fang
Project Title: Low-Cost Polycrystalline Silicone Photovoltaic Cells for Large Solar Power Systems

Amount: $67,100
Eff. Date: 6/15/73
Duration: 9 mos.

During the first year of this study, three different growth techniques (evaporation, chemical vapor deposition, and sputtering) were successfully used to form polycrystalline silicone, approximately 10μ thick, on several different substrates. The crystallinity and crystal grain size of the silicone film was examined by x-ray difraction and optical investigation. Certain silicone films, formed by evaporation onto foil or quartz substrates, exhibited a polycrystal structure with small and uniform grains of about 10μ size. Preliminary electrical conductivity measurements indicate acceptable values in the 20-100 Ω-cm. Additional characterization of the polycrystalline films will be made and junction information techniques will be developed.

NSF/RANN Solar Energy Grant: GI-38103
Granted: 4/23/73
Institution: Boston University
Principal Investigator: Norman N. Lichtin
Project Title: Photochemical Conversion of Solar Energy

Amount: $115,000
Eff. Date: 6/1/73
Duration: 12 mos.

This grant is for the identification and characterization of inorganic photo-redox systems which can be used in solar powered photogalvanic cells or for the photo formation of fuels. Fundamental research concerned with photo chemical reactions of coordinating complexes of transition metals will be performed in the chemistry department of Boston University. Applied research concerned with the investigation of devices which employ the photo chemical processes studied at Boston University will be performed at Corporation Research Energy Conversion Unit of Exxon Research and Engineering Co. The overall goal is for the construction and demonstration of a photogalvanic cell which has 5% engineering efficiency, i.e., converts at least 5% of the energy of the solar flux at ground level into electrical power. There is anticipated an achievement of 25% quantum efficiency of photo generation of useful fuel by photoredox reactions of homogeneous inorganic aqueous solutions.

NSF/RANN Solar Energy Grant: GI-38102
Granted: 9/20/72
Institution: Brown University
Principal Investigator: Joseph J. Loferski
Project Title: Investigation of Thin Film Solar Cells Based on Cu_2S and Ternary Compounds"

Amount: $76,900
Eff. Date: 7/1/73
Duration: 12 mos.

The objective of this project is the investigation of thin film solar cells based on Cu_2S and ternary compounds of the type $CuInS_2$ and $CuInSe_2$ for large scale, hence low-cost, terrestrial solar energy utilization. Specific goals include the fabrication and testing of (1) metal-semiconductor photovoltaic cells consisting of Cu_2S or Cu, (2) homojunction cells involving $CuInS_2$ on Cu, 3) heterojunction cells involving $CuInS_2$ on Cu, 3) heterojunction cells of $CuInS_2$, 4) heterojunction cells consisting of P-type $CuAlS_2$, 5) heterojunction cells of Cu_2S on single crystal Si, and, 6) homojunction cells involving $CuInSe_2$ and $CuInSe_xS_{1-x}$.

The conversion of solar energy directly to electric power using silicon solar cells (photvoltaic conversion) is a proven technology for use in space where power is very valuable. This same general technology could be used to generate substantial quantities of terrestrial power from solar radiation if the system costs can be reduced below space costs by a factor of 100 to 1000, principally the costs of producing reliable photovoltaic conversion devices. This project is directed towards the problem of developing new photovoltaic materials having the promise for low-cost, long-lived solar arrays for use in terrestrial applications, providing power with minimum environmental effects and with reduced dependence on nonrenewable fuel resources.

NSF/RANN Solar Energy Grant: AG-472
Granted: 6/26/73
Institution: University of California
Principal Investigator: Gabor A. Somorjai
Project Title: Studies of Surface Structure & Electronic Properties of Polycrystalline Photovoltaic Materials and Devices

Amount: $186,700
Eff. Date: 7/1/73
Duration: 18 Mos.

The objective of this project is to establish the relationship between the electronic properties and the surface structure and indepth composition of thin film polycrystalline photovoltaic devices. The motivation is to develop devices having high conversion efficiencies and low-cost potential. Specific goals of this project include (1) to study the morphology of thin polycrystalline films of various materials and to correlate this with electronic properties, (2) to study the correlation between surface structure, junction region, composition changes with thickness and electronic properties of currently available single-crystal silicon solar cells, of polycrystalline silicon solar cells, and of polycrystalline CdS/Cu_2S solar cells, and (3) to evaluate how changes in film deposition parameters influences device performance through the effect on the surface structure.

The conversion of solar energy directly to electric power using single crystal silicon solar cells is a proven technology for use in space. This same general technology could be used to generate substantial quantities of terrestrial power from solar radiation if the photovoltaic system costs can be reduced below space costs by a factor of 100 to 1000. This project is concerned with research to examine advanced methods for producing thin films of polycrystalline silicon, which could then be used to develop an automated continuous process for producing these cells and to reduce cell costs per wall substantially below those of present production methods.

NSF/RANN Solar Energy Grant: GI-37067X
Granted: 4/4/73
Institution: Harvard University
Principal Investigator(s): Bruce Chalmers
A.I. Mlavsky
Project Title: Low-Cost Continuous Fabrication of Silicon Solar Cells

Amount: $150,000
Eff. Date: 3/1/73
Duration: 12 mos.

The goal of this project is the development of techniques for low-cost continuous production of silicon crystal ribbon for continuous manufacture into low-cost silicon solar cells. A technique of crystal growth has been developed by the university and industrial collaborators in this proposal and has been previously applied to the production of continuous sapphire single crystal shapes including large single crystal ribbons. Their technique of Edge-defined, Film-fed, Growth (EFG) of single crystals is a process by which single crystals may be grown having a shape controlled by the outside dimensions of a die with the crystal growth taking place from a very thin film of liquid fed by capillary action from a crucible below. This project proposes research to develop the basic understanding and the engineering processes necessary for the application of the EFG process to the growth of silicon single crystal ribbons that can be used in continuous production of silicon solar cells.

The conversion of solar energy directly to electric power using silicon solar cells (photovoltaic conversion) is a proven technology for use in space where power is very valuable. This same general technology could be used to generate substantial quantities of terrestrial power from polar radiation if the system costs can be reduced below space costs by a factor of 100 to 1000, principally the costs of producing reliable photovoltaic conversion devices. This projects seeks to develop a process for producing low-cost, suitable silicon solar cells for use in practical, large-scale terrestrial power systems that could produce power with minimum environmental effects and with reduced dependence on nonrenewable fuel resources.

NSF/RANN Solar Energy Grant: GI-38981
Granted: 5/4/73
Institution: SMU
Principal Investigator: Ting L. Chu
Project Title: Development of Low-Cost Thin Film Polycrystalline Silicon Solar Cells for Terrestrial Applications

Amount: $149,400
Eff. Date: 6/1/73
Duration: 18 Mos.

The objective of this project is the development of low-cost thin film polycrystalline silicon solar cells suitable for large-scale terrestrial utilization. Specific goals include (1) the deposition and characterization of polycrystalline silicon films of adequate quality, (2) the preparation and characterization of suitable junction, of the p n type and/or the Schottky barrier type, and (3) the fabrication and evaluation of thin film solar cells having efficiencies and cost projections warranting further research and development support.

The conversion of solar energy directly to electric power using single crystal silicon solar cells is a proven technology for use in space. This same general technology could be used to generate substantial quantities of terrestrial power from solar radiation if the photovoltaic system costs can be reduced below space costs by a factor of 100 to 1000. This project is concerned with research to examine advanced methods for producing thin films of polycrystalline silicon, which could then be used to develop an automated continuous process for producing these cells and to reduce cell costs per wall substantially below those of present production methods.

NSF/RANN Solar Energy Grant: GI-38445X
Granted: 5/4/73
Institution: Stanford University
Principal Investigator: Richard H. Bube
Project Title: Applied REsearch on II-VI Compound Materials for Heterojunction Solar Cells

Amount: $48,300
Eff. Date: 7/1/73
Duration: 12 mos.

The objective of this project is the investigation of heterojunction solar cells based on several II-VI systems suitable for large-scale terrestrial utilization. Specific goals include the preparation and characterization of the CdTe-CdS, ZnTe-ZnSe, CdTe-ZnSe and ZnTe-CdS systems. The Bi_xS_yCdS system will also be studied.

The terrestrial conversion of solar energy directly to electricity using thin film Cu $_2$S-CdS offers many benefits over the silicon solar cells developed for use in space. The difficulties encountered with the Cu_2S-CdS cell, while presently under active investigation, suggest that new photovoltaic materials, keeping the positive advantages of the Cu_2S-CdS system, while avoiding the stability and degradation problems, are needed. This project is directed towards the problem of preparing and testing several II-VI compound photovoltaic materials having the promise of low-cost, long-lived solar arrays for terrestrial applications.

NSF/RANN Solar Energy Grant: GI-39216
Granted: 5/14/73
Institution: University of California
Principal Investigator: William J. Oswald
Project Title: Solar Energy Fixation & Conversion With Algal-Bacterial Systems to Produce Methane

Amount: $51,800
Eff. Date: 5/1/73
Duration: 18 mos.

A study which involves optimization of a solar energy conversion and waste utilization system, whereby the visible light energy component of solar energy will be fixed through photosynthesis as the chemical energy of algae cellular material growing on wastes. Through the process of anaerobic digestion, variable fractions of the chemical energy of the algae cellular material will, in turn, be converted to chemical energy in the form of methane. The nutrients in wastes and recycled materials will be rendered soluble and available for additional algae growth by successive aerobic and anaerobic bacterial action.

The national significance of the project rests in the fact that, to the extent it is economical, the process will aid in meeting the nation's critical energy needs through multipurpose use of land and facilities to produce: (1) a renewable clean energy resource either in the form of combustible gas or as electricity, (2) an environmentally and economically sound method for treating and recycling the increasing amounts of concentrated organic wastes, and (3) a potentially inexpensive source of protein rich animal feed.

During this phase the investigators will (a) undertake a detailed economic study and economic feasibility report on the process of algae solar energy conversion; and (b) explore the comparative methane fermentation rates of a number of species of algae.

NSF/RANN Solar Energy Grant: C-827
Granted: 6/28/73
Institution: Dynatech Research and Development Co.
Principal Investigator: Donald L. Wise
Project Title: Research on a Program for Economic Fuel Gas Production from Solid Waste

Amount: $427,000
Eff. Date: 6/28/73
Duration: 13 mos.

The objective of the project is the development of a process for the economic production of transmission line fuel gas from the large organic fraction of municipal solid waste. Laboratory experiments on the anaerobic digestion of solid waste and the feasibility of this new recovery/gas production process has been demonstrated. Continuing research and development is now required using a pilot plant designed to carry out experiments on 1 ton/day of municipal solid waste. The proposed program is one of engineering development integrated with an effective testing and evaluation program. Emphasis has been placed on the formation of an interdisciplinary team, and it is intended that guidance of the project plant will be through quarterly meetings of this team. The pilot plant, operation, administration, and management will be carried out by Dynatech R/D Co., a firm experienced in the production of fuel gas from solid waste. Experiments will also be carried out by faculty, and students at the University of Massachusetts, MIT, and Northeastern University. Consolidated Natural Gas Service Co., Inc., a distributor of fuel gas produced by the proposed process will cost share this project by contributing $125,000. The Black Clawson Co., equipment vendors, will supply at no cost, equipment suited for preparation of the solid waste for conversion to fuel gas. Local, municipal, county, state and Federal Government representatives complete the project team. It is intended that individuals representing the technical disciplines and the industrial and municipal groups on the project team will participate in the project early in the program as well as continuously through the two years duration proposed for the program.

NSF/RANN Solar Energy Grant: GI-39191
Granted: 6/1/73
Institution: University of Illinois
Principal Investigator: John T. Pfeffer
Project Title: Biological Conversion of Organic Refuse to Methane

Amount: $83,900
Eff. Date: 6/1/73
Duration: 12 mos.

The objectives of this project are to investigate several of the problem areas of bio-conversion. The bioconversion process has been applied as a laboratory scale to the conversion of refuse and wastewater sludge to methane gas on a laboratory scale. The result of the laboratory studies have been encouraging. STudies will be carried out on the effluent wastes of the process and work will be carried on with Dynatech and others to develop the necessary guidelines for a large-scale system. A mathematical simulation of the system will be developed for predicting the most practical combination of process variables for producing methane at the lowest cost. The analysis will demonstrate the economic practicality of the system.

NSF/RANN Solar Energy Grant: GI-39215
Granted: 5/16/73
Institution: University of Massachusetts
Principal Investigator: W. Leigh Short
Project Title: Bioconversion Energy Research Conference

Amount: $17,800
Eff. Date: 5/15/73
Duration: 05 mos.

A conference on the subject of Biological Conversion of Waste Materials to Methane will be convened at the University of Massachusetts on May 31 and June 1, 1973. Those to be invited include researchers active in the field of bioconversion as well as others concerned with various aspects of this process. Participants would include representatives from appropriate federal, state and local governmental agencies, industries (e.g. meat packing, utilities, waste handling) and universities. The objectives of the conference are: (1) To exchange information between engineers and scientists on research accomplishments and problems related to bioconversion studies, (2) to contribute to the long range planning of the funding agencies and research workers in the field, (3) to provide improved communications between the research community and the user groups, (4) to identify the processes and technology important to the production of methane from waste and feed lot materials, and (5) to identify the important economic factors associated with bio-conversion processes. The report of the conference will be prepared in the Institute and disseminated to all participants as well as other interested agencies and groups. Two hundred copies will also be supplied to the National Science Foundation. Each speaker will prepare a written summary of his presentation to be included in the report. These summaries will be supplemented with materials from the discussion sessions following each presentation. The report will be ready for distribution approximately six weeks after the conference.

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NSF/RANN Solar Energy Grant: GI-38723
Granted: 4/20/73
Institution: Stanford Research Institute
Principal Investigator: John P. Henry
Project Title: Effective Utilization of Solar Energy to Produce Clean Fuel

Amount: $49,00
Eff. Date: 5/1/73
Duration: 9 mos.

Principal Investigator: John P. Henry, Jr.
The goal of this project is to examine and evaluate the technical and economic feasibility of growing large quantities of organic materials (biomass) to be harvested and converted to power directly through combustion processes or to clean fuels, e.g. methane, through bioconversion or other processes. In this concept, large fuel farms would be used to convert solar energy to biomass through photosynthesis processes in land or aquatic plants.

The objective of the analysis are to determine the types of vegetation best suited for producing and harvesting massive quantities of plant tissue; to assess the type and availability of lands or waters for growing the desired crops including insolation, climate, water availability, soil characteristics, current land use and value; to examine the logistics of growing, harvesting, and transporting desirable crops; to evaluate plants for yield characteristics, growth requirements, heat of combustion, disease resistance, etc.; to compare firing the crops directly to produce electric power with conversion of them to clean fuel gas (high or low-Btu gas) either at the farm site or at a remote site; to analyze power costs from cultivated fuels; to analyze net energy production in the projected system; and to assess the overall project feasibility - both technically and economically - including a sensitivity analysis of the many contributing cost factors and the outlook for improving the economics in the future. Recommendations for research in key areas of technical and economic uncertainties will be developed.

NSF/RANN Solar Energy Grant: GI-35970
Granted: 9/20/72
Institution: University of Tennessee
Principal Investigator: Alexander Hollaender
Project Title: Workshop on Energy Conversion Sources

Amount: $18,500
Eff. Date: 9/15/72
Duration: 6 mos.

This project proposes to conduct a workshop for the putpose of summarizing our present understanding of biological energy conversion processes and identifying problem areas that must be resolved to develop practical energy conversion systems utilizing biological processes. Through encouraging cooperation in exploring the possibilities for exploitation of new sources of energy, e.g. conversion of sunlight by biological materials and transformations of organic and mineral materials by biological organisms, more rapid progress and more pointed research projects can result. This workshop will meet for about three days and will bring together about 45 invited engineers, biologists, geologists, microbiologists, biochemists, etc. to discuss problems of mutual interest in these research areas. Through public notices of this workshop, other engineers and scientists will be able to participate if they are interested in attending at their own expense. The exchange of ideas and information is expected to stimulate new interdisciplinary approaches that might not otherwise have developed as rapidly.

NSF/RANN Solar Energy Grant: GI-39415
Granted: 6/21/73
Institution: Montana State University
Principal Investigator: Ralph E. Powe
Project Title: Technical Feasibility Study of a Wind Conversion System Based on the Tracked Vehicle-Airfoil Concept

Amount: $49,900
Eff. Date: 9/1/73
Duration: 12 Mos.

The objective of this proposal is to evaluate the technical feasibility of a wind energy conversion system based on the tracked vehicle-airfoil concept. Specific goals include (1) to establish performance specifications for the major system components and to identify interface requirements, (2) to formulate sets of alternative system designs to meet above conditions, (3) to perform engineering analysis of these systems, to identify major strengths and weaknesses and to select most promising design, (4) to initiate a detailed systems design, including economic considerations, to establish technical feasibility.

Solar energy sustains the winds. It is calculated that the power potential in the winds over the continental U.S., the Aleutian arc and the Eastern seaboard is about 10^{11} kilowatts electric. Winds are remarkably repeatable and predictable. The momentum in moving air can be extracted by momentum-interchange machines located in suitable places such as plains, valley, and along the continental coastal shelves. A desirable windpower system would incorporate a storage and a peaking capability, thereby being able to span between the variable wind and the patterned electricity consumer demand. This project is concerned with assessing the technical feasibility of a novel momentum-interchange device which involves vertical airfoils mounted on carriages which move along on a horizontal closed track system.

NSF/RANN Solar Energy Grant: AG-465
Granted: 5/31/73
Institution: NASA/Lewis Res, Ctr.
Principal Investigator: Joseph M. Savino
Project Title: Wind Energy Conversion Workshop

Amount: $11,700
Eff. Date: 6/1/73
Duration: 06 Mos.

A wind energy conversion workshop will be held in Washington, D.C., June 11, 12, and 13, 1973. The purpose of this workshop is to provide a forum for discussions of governmental, research and development, and industrial aspects of wind energy conversion systems. These discussions will provide for:

Information exchange on research project accaomplishments

An assessment of the state of the art

The priorties for future efforts

The workshop will bring together people who have been or are presently active in this field, as well as representatives from the power equipment industry, appropriate aircraft industries, government agencies - such as the FPC, DOI, NOAA and the potential users - such as utilies, industry, etc.

The program will include short presentations by representatives from each research project, and will provide discussion periods to address such general questions as coordination, continuing information exchange, communications with the user community, contributions to program planning and operation, and cooperation in other solar energy applications. These discussions will benefit the entire program.

NSF/RANN Solar Energy Grant: GI-39457
Granted: 6/20/73
Institution: Oklahoma State University
Principal Investigator: William L. Hughes
Project Title: Development of an Electrical Generator and Electrolysis Cell for a Wind Energy Conversion System

Amount: $141,600
Eff. Date: 7/1/73
Duration: 18 Mos.

The objective of this project is to develop an electrical generator and electrolysis unit suitable for a wind energy conversion system. Specific goals include (1) to design, fabricate and test a 10 kw electrical generator suitable for a wind conversion system, (2) to design, fabricate and test a 10kw electrolysis unit suitable for a wind conversion system, and (3) to perform a systems study of a wind energy conversion system incorporating the above components.

Solar energy sustains the winds. It is calculated that the power potential in the winds over the contineneta U.S., the aleutian arc and the Eastern seaboard is about 10^{11} kilowatts electic. Winds are remarkably repeatable and predictable. The momentum in moving air can be extracted by momentum-interchange machines located in suitable places such as plains, valleys, and along the continental coastal shelves. A desirable windpower system would incorporate a storage and a peaking capability, thereby being able to span between the variable wind and the patterned electricity consumer demand. This project is concerned with developing two key components in such a windpower system, i.e., the electrical generator to convert the variable shaft power into either constant frequency ac power or dc power to run an electrolysis cell which, in turn, would generate hydrogen and oxygen for storage and reconversion on demand.

NSF/RANN Solar Energy Grant: GI-39115
Granted: 5/17/73
Institution: Carnegie-Mellon University
Principal Investigator: Abrahim Lavi
Project Title: Conference on Power Generation from Ocean Temperature Difference

Amount: $14,000
Eff. Date: 5/15/73
Duration: 12 mos.

A conference on the generation of electric power by utilizing the temperature differential in tropical oceans will be held at Carnegie-Mellon University in order to exchange information among present researchers and potential contributors to this scheme of power generation and utilization. The participants will include (1) engineers and scientists presently supported by NSF-RANN programs and other governmental organizations and (2) specialists from government, industry and universities on the generation, transmission and utilization of Solar Sea Power Plants (SSPP). The conference will be a two day affair. The first day will be devoted to the presentation of various schemes and proposals for the solution of important technical problems in a SSPP. The second day, the participants will break into small working groups for more detailed and substantive discussions of specific problem areas. 500 copies of the conference paper summaries and discussions will be made available to attendees and NSF six weeks after the conference.

NSF/RANN Solar Energy Grant: GI-39114
Granted: 5/21/73
Institution: Carnegie-Mellon University
Principal Investigator: Clarence Zener
Project Title: Solar Power Ocean-Based Plants

Amount: $190,000
Eff. Date: 6/1/73
Duration: 18 mos.

The objective of this project is the investigation of solar power systems based upon thermodynamic cycles of heat engines utilizing the natural energy resource system of ocean temperature differences. These power plants could produce electricity or storable fuel, e.g., hydrogen, while also producing large quantities of fresh water. The operation of these power systems depends upon use of the enormous quantities of warm ocean surface water, warmed by the sun particularly in tropical oceans and the Gulf Stream, for the boiler heat and the use of deep, cold water at the same location, due to deep currents from the earth's poles, for the condenser side of a heat engine. Though the temperature difference between boiler and condenser gives rise to small carnot and practical conversion efficiencies, preliminary designs and economic analysis indicate that the potential for economic power systems should be investigated further. This project will develop computer-based analytical models for technical and economic analyses of components and subsystems of the most important approaches to these power systems. A system model for analysis and optimization of power systems will be developed to undertake parametric analysis and to obtain minimum power costs. Sensitivity analyses of system parameters on performance and power costs will also be done. The project will include studies of heat exchangers, turbine-generators, and possible effects of the ocean environment.

NSF/RANN Solar Energy Grant: GI-34979
Granted: 2/9/73
Institution: University of Massachusetts
Principal Investigator: William E. Heronemus
Project Title: Ocean Sited Power Plant

Amount: $25,200
Eff. Date: 2/15/73
Duration: 18 mos.

This project provides support for additional work on one of the two exploratory research tasks supported initially under GI-34979. The augmented effort will be applied to marine system conceptualizations and feasibility studies of power generation from ocean temperature differences where the boiler and condenser temperatures are about 75-85 degrees F (tropical surface waters) and 35-45 degrees F (bottom waters below 2000 feet), respectively. The goal of the research is to determine the technical and economic feasibilities of a complete system, including hull designs and anchoring, that is designed around a selected heat engine and working fluid. All components of a system will be conceptualized and evaluated including hulls, heat exchangers, pumps, pipes, electrolysis of water to hydrogen fuel, etc. for a 100-400 Mw central power station moored in the Gulf Stream. An estimate of the cost of a complete system will be developed. The augmented project will develop additional system information and data related to selection of heat engine working fluids, associated turbine design, design of heat exchangers, analysis of cold water intake piping and power requirements, water desalting equipment, and preparation of cost estimates for turbomachinery and heat exchangers.

NSF/RANN Solar Energy Grant: GI-39240
Granted: 5/4/73
Institution: International Solar Energy Society
Principal Investigator(s): Cherry, W.R. - Chairman
Project Title: Printing of the 1973 International Solar Energy Congress Abstracts

Amount: $10,000
Eff. Date: 6/1/73
Duration: 6 Mos.

An international meeting on Solar Energy will be held in Paris, France on July 2-6, 1973. The funds from this grant are to be used to support in part the printing of 700 sets of abstracts of the approximately 350 papers selected for the meeting. One hundred sets of the abstracts are to be submitted to the National Science Foundation for its use and the other 600 sets are to be given to the attendees of the congress. The primary purpose of this grant is the dissemination of information on solar energy research. Each abstract will have printed at the bottom, "The printing of this document was supported by a grant from the Research Applications Directorate of the National Science Foundation, an agency of the U.S. Government."

NSF/RANN Solar Energy Grant: GI-32488
Granted: 11/21/72
Institution: University of Maryland
Principal Investigator: Redfield W. Allen
Project Title: Solar Energy Panel

Amount: $24,600
Eff. Date: 9/15/72
Duration: 6 mos.

The objective of this project is the evaluation of the effects of system options and actual process factors on the performance and optimization of solar absorption air conditioning systems. Specific goals include (1) The development of parametric performance factors for ideal and actual system operation at various thermodynamic conditions, (2) evaluation of the thermal heliotrope for use with sun-tracking collectors, (3) the thermodynamic and economic optimization of the collector and absorption refrigeration systems.

In a recent study, the NSF/NASA Solar Energy Panel concluded that, with a substantial development program, by the year 2000 solar energy could economically provide up to 10% of the total building heating and cooling energy requirements. This represents a major impact on the building industry, with an annual fossil fuel savings of approximately $2.1 billion, based on a fuel cost of $1.00/$10^6$ btu. While the energy requirements for air conditioning are a small fraction of the total annual building heating and cooling energy demand, the rapidly growing air conditioning power demands periodically tax the peak load capacity of regional power networks. This situation gives added emphasis to the need to develop solar powered air conditioning. Once solar air conditioning becomes a marketable product it will be possible to combine it with solar heating, with associated savings in initial cost. This project to conduct optimization studies of solar powered air conditioning systems, should define limitations of present technology and point to ways of lowering cost and improving performance.

NSF/RANN Solar Energy Grant: C-831
Granted: 7/2/73
Institution: The Mitre Corporation
Principal Investigator: Richard S. Greeley
Project Title: System Study of the NSF Solar Energy Research Program

Amount: $152,334
Eff.Date: 7/1/73
Duration: 4 mos.

The proposed objectives of this contract are to perform a system analysis of the NSF Solar Energy Research Program, and based on the analysis, develop a recommended five-year preliminary program development plan emphasizing proof-of-concept experiments and the supporting advanced research required in the program. The study will identify major issues, establish priorities among the various program elements and provide cost-benefit analysis.

NSF/RANN Solar Energy Grant: GI-37124
Granted: 2/12/73
Institution: University of Pennsylvania
Principal Investigator: Martin Wolf
Project Title: Solar Energy Research Conference

Amount: $11,000
Eff. Date: 2/1/73
Duration: 05 mos.

A grantee solar energy research conference will be held at the University of Pennsylvania February 6 and 7, 1973, for the purpose of exchanging information on NSF-RANN sponsored solar energy research projects. The objectives of the conference are:

1) Information exchange on research project accomplishments;
2) Identification of special problem areas in research
3) Coordination of solar energy research;
4) Improvement of communications with the user community;
5) Contribution to solar energy research program planning; and to
6) Foster cooperation in applications of solar energy research.

The program will include short presentations by representatives from each research project, and will provide discussions periods to address such general questions as coordination of solar energy research projects, continuing information exchange, communications with the user community, contributions to program planning and operation, and cooperation in solar energy applications.

Participants from other interested Federal agencies will be invited to attend.

NSF/RANN Solar Energy Grant: GI-34992
Granted: 6/26/72
Institution: Case Western Reserve University
Principal Investigator: L.O. Krampitz
Project Title: Hydrogen Production by Photosynthesis and Hydrogenase Activity--An Energy Source

Amount: $150,000
Eff. Date: 7/1/72
Duration: 18 Mos.

The objective of this research project is to investigate the feasibility for direct formation of hydrogen gas through bioconversion of solar energy, employing the photosynthetic apparatus of green plants and algae and the catalytic activity of the enzyme, hydrogenase. Under the stimulation of light the photosynthetic apparatus in chlorophyll and other accessory pigments can raise the oxidation-reduction potential of the electrons released from water to a level as much as 0.3 volt more negative than the hydrogen electrode. Therefore, it is thermodynamically possible to couple the reducing potential of these electrons with hydrogenase to bring about the reduction of hydrogenions to form hydrogen gas. The hydrogenases may exist either endogenously in algae or exogenously in bacterial sources. Several possibilities will be investigated for accomplishing the required coupling of photosynthetically reduced substances and appropriate hydrogenase activity.

NSF/RANN Solar Energy Grant: GI-32726
Granted: 4/1/72
Institution: Rutgers, the State University
Principal Investigator: Wayne A. Anderson
Project Title: An Improved Schottky Barrier Photovoltaic Diode for Solar Energy Conversion

Amount: $16,000
Eff.Date: 4/1/72
Duration: 18 mos.

The objective of this project is to develop a more efficient and cheapter photovoltaic device using Schottky Barrier Diode (SBD) principles. This project includes calculations to determine the optical properties and to select thicknesses of various metal coatings on semiconductor substrates for proposed designs of SBD solar cells; the testing of metal films (e.g., Au-Cr) for optical and electrical properties; the fabrication of solar cells using evaporation and sputtering techniques; and testing to evaluate the efficiency of the resulting SBD solar cells. Preliminary calculations and experiments indicate that SBD principles can improve the efficiency of a solar cell by increasing the fraction of photons that optically reach the active volume and by increasing the usable photon energy range for generating free carriers in the metal or semiconductor films.

11/15/73
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NSF/RANN SOLAR ENERGY RESEARCH GRANTS AND CONTRACTS IN FY 1974

Institution & Program Mgr.	Title and Grant Number	Amt., and	Duration (Mos.) Effective Date	
Texas A&M University (R. R. Davison)	Further development of the compressed-film floating-deck solar water heater (GI-39584)	$	36,900/12 9/1/73	
University of Delaware (K. W. Boer)	Direct solar energy conversion for large scale terrestrial use (GI-34872)		294,100/12 9/10/73	
Colorado State University (G. Lof)	Design, construction, and testing of residential solar heating and cooling system (GI-40457)		238,000/24 9/ /73	
Indiana University/Bloomington (A. San Pietro)	Workshop on hydrogen production by biophotolysis (GI-40253)		13,000/12 8/21/73	
Arthur D. Little, Inc. (J. B. Berkowitz)	Technology assessment of terrestrial solar energy resources development (C-835)		246,664/12 9/12/73	(ERPA)
Systems Group of TRW, Inc. (J. E. Boretz)	Solar heating & cooling of buildings (C-853)		485,652/08 10/9/73	(PTP)
Westinghouse Elect. Corp. (R. E. Kirby)	Conduct phase 0 of a multiphased solar heating & cooling of buildings program (C-854)		503,085/08 10/9/73	(PTP)
General Electric Company (A. D. Cohen)	The solar heating and cooling of buildings (C-855)		547,322/08 10/9/73	(PTP)
University of Houston (J. R. Howell R. B. Bannerot)	The evaluation of surface geometry modification to improve the directional selectivity of solar energy collectors	*	53,800/12 12/1/73	

* Estimated

NSF/RANN SOLAR ENERGY RESEARCH GRANTS AND CONTRACTS IN FY 1974

Institution & Program Mgr.	Title and Grant Number	Amt., Duration (Mos.) and Effective Date
National Bureau of Standards (J. E. Hill)	Development of methods of evaluation and test procedures for solar collectors and storage devices	$ * 76,700/06 11/1/73
Hittman Associates, Inc. (Wm. P. Menchen)	Assessment of Rankine cycle engines for potential application to solar powered cooling of buildings	* 49,200/05 11/1/73
Jet Propulsion Laboratory/ NASA (R. Lutwack)	Assessment of photovoltaic conversion of solar energy for terrestrial applications (AG-485)	34,000/06 9/1/73
Aerospace Corporation (A. B. Greenberg)	Solar thermal conversion mission analysis	*250,000/9-1/2 11/1/73
G. T. Schjeldahl Company (R. A. Stickley)	Solar power array for the concentration of energy	*260,100/12 11/1/73
Associated Universities, Inc. (V. Bremenkamp)	Support of U.S.-U.S.S.R. cooperation in solar and geothermal energy (C-847)	120,000/11 8/1/73
University of Maryland (R. Allen)	Solar Energy Panel (GI-32488-3)	15,000/06
NOAA (L. Machta)	Workshop on solar radiation monitoring for solar energy applications	* 19,040/06 11/15/73
McDonnell Douglas Astronautics Company-West (G. F. Pittinato)	Elimination or control of material problems in water heat pipes	*189,450/12 12/1/73

* Estimated

NSF/RANN Solar Energy Grant: GI-39584 | Amount: $36,900
Granted: 7/19/73 | Eff. Date: 9/1/73
Institution: Texas A&M University | Duration: 12 mos.
Principal Investigator: Richard R. Davison
Project Title: Further Development of the Compressed-Film Floating-Deck Solar Water Heater

A solar heater, invented* by the investigators, will be further developed as a potentially low-cost solar energy collector. The collector employs a thin compressed film of water on a floating insulated deck so that rapid response to solar conditions and low cost objectives are realizable. The objectives of the proposed research are: 1) to make performance runs using a wide variety of conditions so heat performance can be corrected in terms of solar, meterological and configurational parameters; and 2) to test various design details and materials to optimize these with respect to cost and performance.

Two heaters will be built, one to be used strictly for performance correlations and the other to test various design configurations.

*Under study for Office of Saline Water. Patent assigned: United States of America.

NSF/RANN Solar Energy Grant: GI-34872 | Amount: $294,100
Granted: 9/10/73 | Eff. Date: 9/10/73
Institution: University of Delaware | Duration: 12 mos.
Principal Investigator: Karl W. Boer
Project Title: Direct Solar Energy Conversion for Large-Scale Terrestrial Use

This research is the renewal proposal for the second year of a project directed to further understanding and development of CdS/Cu_2S solar cells to obtain longer-life, higher performance, more economical cells for applications in large and small-scale solar energy conversion systems. The principal objectives are (1) improved understanding of the basic properties and conversion mechanics of CdS/Cu_2S cells, (2) improved understanding of the effect of every single process step on the cell mechanism and, (3) lifetime testing and development of reliable accelerated test methods.

NSF/RANN Solar Energy Grant: GI-40253 | Amount: $13,000
Granted: 8/20/73 | Eff. Date: 8/21/73
Institution: Indiana University/Bloomington | Duration: 12 mos.
Principal Investigator: Anthony San Pietro
Project Title: Workshop on Hydrogen Production by Biophotolysis

The objectives of this research workshop are, first to discuss the development of biosolar conversion technology to produce practical fuels and, secondly, to encourage an information exchange necessary to achieve this goal. Three major research questions will have to be considered at this conference.

These are:

1. What are the requirements to stabilize individually each photosystem (of photosynthesis) or to stabilize collectively both photosystems? In concert with this question, the efficiency of the bio-solar conversion process will also be considered in depth.

2. What should be the nature of the reduced product of the bio-solar conversion process? Should it be hydrogen gas?

3. If the bio-photolysis of water to produce hydrogen is the process of preference, the availability of an oxygen-insensitive hydrogenase is absolutely necessary. Do such hydrogenases exist in nature or will it be necessary to resort to genetic manipulation to provide such an enzyme?

The in-depth assessment of these three questions will require a conference of two days length. These discussions will hopefully formulate a plan of approach designed to provide sufficient additional information to allow for a technological assessment of the problem some five or so years hence. During this initial period, the goal will be the evaluation of the theoretical and practical factors relating to successful application of the solar conversion process using a biological photo-catalyst.

Five hundred copies of the conference paper summaries and discussions will be made available to attendees and the NSF six weeks after the conference.

NSF/RANN Solar Energy Grant: GI-40457
Granted: 9/ /73
Institution: Colorado State University
Principal Investigator: George Lof
Project Title: Design, Construction, and Testing of Residential Solar Heating and Cooling System

Amount: $238,000
Eff. Date: 9/ /73
Duration: 24 mos.

This project is a two-year experimental development of a fully operational residential heating and cooling system based on solar energy as the principal energy supply. No completely integrated system has ever been operated in this country. The objective is to design, build, and test a reliable and economical, integrated solar heating and cooling system. A lithium bromide absorption air conditioner, previously tested with a solar energy supply at the University of Wisconsin by personnel associated with this project, will be utilized for the cooling cycle. The computer program developed in the Wisconsin project, "A Simulation Study of Solar Heating and Cooling for the United States," will be used to optimize the design of this particular system of heating, cooling and water heating, and detailed studies on the technical performance and economics of this system will be conducted. Design will require six months, construction--six months, preliminary and final performance testing--one year. These facilities are then to be used for testing components and complete systems for solar heating and cooling developed by other NSF grantees and commercial manufacturers.

NSF/RANN Solar Energy Grant: C-853
Granted: 9/12/73
Institution: Arthur D. Little
Principal Investigator: Joan Berkowitz
Project Title: Technology Assessment of Terrestrial Solar Energy Resource Development

Amount: $246,664
Eff. Date: 9/12/73
Duration: 12 mos.

ADL will conduct a technology assessment of terrestrial solar energy resource development in order to identify and examine direct and indirect effects, impacts, and consequences of the development and use of energy systems that include substantial solar components. The program will be subdivided into a number of integrated tasks:

Task I - Selection of Terrestrial Solar Technologies for Assessment
Task II - Identification of Possible Points of Impact
Task III - Identification of Parties at Interest
Task IV - Analysis of Impacts
Task V - Alternate Energy Strategies
Task VI - Definition of Public Policy Options
Task VII - Dissemination and Utilization of Results

NSF/RANN Solar Energy Grant: C-853
Granted: 9/28/73
Institution: TRW Systems Group
Principal Investigator: J. E. Boretz
Amount: $485,652
Eff. Date: 10/9/73
Duration: 8 mos.
Project Title: Solar Heating and Cooling of Buildings - Phase 0 Study

This is the initial phase of a multiphased program whose objective is to advance the widespread use and availability of systems utilizing solar energy for heating, cooling and the hot water needs of buildings by proving that such systems are economically justifiable, technically feasible, and socially acceptable.

This project is one of three independent study efforts with each contractor team working independently to bring widely diverse experience and expertise to bear on the problem, and to assist in the development of a broad industrial base.

The objective of the Phase 0 study will be to establish the program feasibility and provide the basis of planning the later phases of the program by: 1) Developing the heating, cooling and hot water requirements of all building types in all climatic regions of the U.S. 2) Conceptualizing integrated solar energy systems to meet the requirements and utilizing conventional fuels to supplement the solar energy systems. 3) Determining the economic viability of the various systems and applications, recommending the systems which are viable and have an impact for proof-of-concept experiments. The experiments will be conducted in subsequent phases under separate contracts.

NSF/RANN Solar Energy Grant: C-854
Granted: 9/28/73
Institution: Westinghouse Electric Corp.
Principal Investigator: R. E. Kirby
Amount: $503,085
Eff. Date: 10/9/73
Duration: 8 mos.
Project Title: The Solar Heating and Cooling of Buildings - Phase 0 Study

This is the initial phase of a multiphased program whose objective is to advance the widespread use and availability of systems utilizing solar energy for heating, cooling and the hot water needs of buildings by proving that such systems are economically justifiable, technically feasible, and socially acceptable.

This project is one of three independent study efforts with each contractor team working independently to bring widely diverse experience and expertise to bear on the problem, and to assist in the development of a broad industrial base.

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NSF/RANN Solar Energy Grant: C-855
Granted: 9/28/73
Institution: General Electric Co.
Principal Investigator: A. D. Cohen
Project Title: The Solar Heating and Cooling of Buildings

Amount: $547,322
Eff. Date: 10/9/73
Duration: 8 mos.

This is the initial phase of a multiphased program whose objective is to advance the widespread use and availability of systems utilizing solar energy for heating, cooling and the hot water needs of buildings by proving that such systems are economically justifiable, technically feasible, and socially acceptable.

This project is one of three independent study efforts with each contractor team working independently to bring widely diverse experience and expertise to bear on the problem, and to assist in the development of a broad industrial base.

The objective of the Phase 0 study will be to establish the program feasibility and provide the basis of planning the later phases of the program by: 1) Developing the heating, cooling, and hot water requirements of all building types in all climatic regions of the U.S. 2) Conceptualizing integrated solar energy systems to meet the requirements and utilizing conventional fuels to supplement the solar energy systems. 3) Determining the economic viability of the various systems and applications, recommending the systems which are viable and have an impact for proof-of-concept experiments. The experiments will be conducted in subsequent phases under separate contracts.

NSF/RANN Solar Energy Grant:
Granted:
Institution: University of Houston
Principal Investigators: John R. Howell and Richard B. Bannerot
Project Title: The Evaluation of Surface Geometry Modification to Improve the Directional Selectivity of Solar Energy Collectors

Amount: $53,800
Eff. Date: 12/1/73
Duration: 12 mos.

The performance of the flat-plate collector can be greatly enhanced with the use of spectrally (wave length) and/or directionally selective surfaces. Since the sun's radiation approximates that from a 5600°K black body, it possesses significantly differett spectral characteristics from those exhibited by the radiation emitted from the collector surface (around 400°K). If surface coatings can be selected which absorb efficiently in the shorter wavelength region and emit poorly in the longer wavelength region, a collector surface will result with efficiency greater than that of a black body. Directional selectivity can also be very useful. The preferred absorption direction of the collector surface can be aligned to take advantage of this fact. In addition, if the surface emits directionally, it may emit only a fraction of that energy emitted by another otherwise similar diffuse surface.

This project will examine two model geometrics to determine the optimum parameters that will maximize the directional selectivity. The choice of the models will be based on a trade-off study considering cost and predicted performance. The two models will be constructed and tested for their actual radiative behavior. This behavior will then be compared with the predicted values. The radiative properties necessary to the analysis will be determined experimentally. This experimental work will be carried out using existing laboratory equipment through a cooperative agreement with the NASA Johnson Spacecraft Center.

NSF/RANN Solar Energy Grant:
Granted:
Institution: National Bureau of Standards
Principal Investigator: James E. Hill
Project Title: Development of Methods of Evaluation and Test Procedures for Solar Collectors and Storage Devices

Amount: $76,700
Eff. Date: 11/1/73
Duration: 6 mos.

The objective of this project is to identify those parameters which are inherent in the equipment design and which should be covered by the testing and rating procedures, and to develop test procedures that will equitably compare different designs in relation to representative standard design climate conditions. The testing procedure should have the characteristics of reasonable accuracy and reproducibility, be easily understood, and be similar in form to testing and rating procedures for other heating systems. The project will consist of three tasks: (1) review of the methods of analysis that have been proposed in the past for evaluation of solar equipment; (2) review of current procedures for testing and reporting performance data of solar collectors and storage devices; and (3) the development of recommended test methods and rating procedures. A follow-on project may be the experimental verification of the recommended test methods and rating procedures, however this step is not included in the initial project.

NSF/RANN Solar Energy Grant: Amount: $49,200
Granted: Eff.Date: 11/1/73
Institution: Hittman Associates, Inc. Duration: 5 mos.
Principal Investigator: Wm. P. Menchen
Project Title: Assessment of Rankine Cycle Engines for Potential Application to Solar Powered Cooling of Buildings

The Clean Air Amendments of 1970 prompted renewed and vigorous attempts to develop a "steam" engine for automotive propulsion since such a system has the potential of exceeding the stringent emission standards set by EPA for automobiles. Many engine designs have been proposed and built for the automotive application since 1970. The work proposed under this project is to examine these engines and to project their potential performance under the conditions of a heat source from a solar energy collector and load from a building cooling plant. The basic components of a Rankine engine are a boiler, expander, pump, condenser, and the working fluid (and in some cases, a recuperator). In an automobile, the boiler, pump, and condenser are critical components whose size and weight significantly influence performance. In a solar energy-Rankine engine cooling system these limitations may not exist; however, the temperature of the heat source and the temperature differential between source and condenser may be much smaller.

This study will review and compare the performance characteristics of the Rankine engines developed recently. Solar energy system components will be characterized as they influence the quantity and quality of thermal energy that can be delivered to the heat exchanger in the Rankine engine boiler or to the Rankine engine directly if the solar collector serves as a boiler. The performance of the various Rankine engines will be projected in terms of solar energy system operating conditions to provide insight into problems requiring further research and development.

NSF/RANN Solar Energy Grant: (AG-485) Amount: $34,000
Granted: 10/3/73 Eff.Date: 9/1/73
Institution: Jet Propulsion Lab./NASA Duration: 6 mos.
Principal Investigator: Ralph Lutwack
Project Title: Assessment of Photovoltaic Conversion of Solar Energy for Terrestrial Applications

The objective of this project is to provide a detailed technical assessment of the photovoltaic conversion of solar energy for terrestrial applications. Recommendations will be made concerning research and development programs necessary to develop the full potential of this solar energy conversion technology. These recommendations will contain task objectives, milestones, program phasing, implementation approach and required levels of support. A workshop on photovoltaic energy conversion will be organized to provide a sound basis for this assessment. A report on the conclusions of this project will be prepared for widespread dissemination.

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NSF/RANN Solar Energy Grant: Amount: $250,000
Granted: Eff.Date: 11/1/73
Institution: Aerospace Corporation Duration: 9-1/2 mos.
Principal Investigator: A. B. Greenberg
Project Title: Solar Thermal Conversion Mission Analysis

The objective of this analysis is to provide a basis for selecting the most promising missions, i.e. (powerplant scale and function) for solar thermal conversion systems in the Southwestern United States for the period 1980-2000. This effort will apply the methodology which has been developed for assessing the role of solar thermal conversion in large scale production of electrical energy throughout the Southwestern U. S. and develop and apply methodology necessary to assess the role of total solar energy systems in that region. The study approach will include: 1) Collection and correlation of regional solar insolation and climatological data over the Southwestern U. S., 2) Review, analysis and projection of electrical and thermal demands in the region for the time period 1980-2000, 3) Application of the previously developed methodology to evaluate the potential of municipal or remote central station solar thermal power plant, and assess the applicability of such power plants to the existing power grid, 4) Extension of the methodology to combine electrical/thermal service systems for industrial, community, military base or municipal applications, 5) Development of system and subsystem requirements, and 6) Evaluation of siting opportunities and constraints in the Southwestern U. S.

NSF/RANN Solar Energy Grant: Amount: $260,100
Granted: Eff.Date: 11/1/73
Institution: G. T. Schjeldahl Company Duration: 12 mos.
Principal Investigator: Ross A. Stickley
Project Title: Solar Power Array for the Concentration of Energy

The objective of this project is to estimate the technical and economic performance of a heliostat (steerable reflector) array-central receiver solar thermal conversion system operating in a hybrid configuration with a conventional fossil fuel generating system. This approach is one wherein solar energy is utilized when available in a so-called "energy displacement" mode; thus minimizing or eliminating the requirement for energy storage and simultaneously reducing fossil fuel usage. The scope of the effort includes: 1) definition of hybrid power plant functional, performance and operation requirements, 2) conceptual design of alternative systems, 3) development of analytical tec-niques for estimating the incident solar flux on the receiver and the heat transfer to the receiver working fluid, 4) defining a baseline system design and 5) conducting materials analysis and specimen testing to define the applicability of metallized thin film reflective materials to heliostat reflectors.

NSF/RANN Solar Energy Grant: (C-847) Amount: $120,000
Granted: 10/10/73 Eff. Date: 8/1/73
Institution: Associated Universities, Inc. Duration: 11 mos.
Principal Investigator: Victor Bremenkamp
Project Title: Support of U.S.-U.S.S.R. Cooperation in Solar and Geothermal Energy

The U.S.-U.S.S.R. Joint Commission on Scientific and Technical Cooperation approved action programs of direct cooperation in six general areas of strong mutual interest and benefit to both countries. The six areas identified are energy, computer applications to management, agricultural research, microbiological synthesis, chemical catalysis, and water resources. This project provides support for the U.S. activities in two subgroups--solar energy and geothermal energy.

NSF/RANN Solar Energy Grant: GI-32488-3 Amount: $15,000
Granted: Eff.Date:
Institution: University of Maryland Duration: 6 mos.
Principal Investigator: Redfield Allen
Project Title: Solar Energy Panel

Under a previous grant, the University of Maryland organized and conducted two workshops: The Solar Thermal Energy Conversion Workshop and the Solar Heating and Cooling for Buildings Workshop.

The objective of this supplementary grant is to provide support for the preparation, publishing and distribution of the reports of these workshops, as well as the distribution of the remaining copies of the Solar Energy Panel Report.

NSF/RANN Solar Energy Grant:
Granted:
Institution: National Oceanic & Atmospheric Administration
Principal Investigator: Lester Machta

Amount: $19,040
Eff.Date: 11/15/73
Duration: 6 mos.

A workshop will be conducted to define the needs for, and availability of, geophysical data (mainly on solar insolation) for solar energy applications. Attendees will be drawn from the solar energy user community, from meteorologists, and from persons specializing in the instrumentation, measurement, and dissemination of these data or monitoring devices. Emphasis will be placed upon the status of existing data, how to make the best use of such data, present monitoring capabilities, and the development of priorities for obtaining appropriate data for solar energy requirements in the future.

NSF/RANN Solar Energy Grant:
Granted:
Institution: McDonnell Douglas Astronautics Company-West
Principal Investigator: G. F. Pittinato
Project Title: Elimination or Control of Material Problems in Water Heat Pipes

Amount: $189,450
Eff.Date: 12/1/73
Duration: 12 mos.

The objective of this research project is to determine an effective combination of materials, fabrication methods, and operating procedures for a water heat pipe that will provide satisfactory long life operating performance for temperatures up to 310°C. The research project will be conducted in three subphases. These subphases will: 1) Define the most effective combination of design, materials fabrication methods, and operating procedures that eliminates or minimizes noncondensable gases in water heat pipes, 2) Fabricate and test a 15-20 meter long water heat pipe that utilizes the procedures established in (1) and is projected to be cost effective and compatible with full-scale production and preparation methods and 3) Establish material and fabrication process specifications applicable to full-scale solar collector heat pipe life test.

NOV 30 1973

AMERICAN PETROLEUM INSTITUTE
1801 K STREET, NORTHWEST
WASHINGTON, D.C. 20006
(202) 833-5580

Frank N. Ikard
PRESIDENT

November 30, 1973

The Honorable Chet Holifield
Chairman
Government Operations Subcommittee
on Legislation and Military
Operations
B-373 Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. Chairman:

As I am sure you know, our intention to testify at the Subcommittee's hearings on H.R. 11510, to create an Energy Research and Development Administration, was sidetracked by scheduling difficulties. However, per discussions between the Subcommittee staff and API staff, we are submitting the attached statement for the record.

Sincerely,

Frank Ikard

FNI:lr
Attachment
cc: The Honorable Frank Horton

STATEMENT OF

AMERICAN PETROLEUM INSTITUTE

on

H.R. 11510 "The Energy Reorganization Act of 1973"

submitted to

COMMITTEE ON GOVERNMENT OPERATIONS
UNITED STATES HOUSE OF REPRESENTATIVES

November 30, 1973

The American Petroleum Institute welcomes the opportunity extended by the Subcommittee on Legislation and Military Operations of the House Committee on Government Operations to present its views on the proposal to establish an Energy Research and Development Administration.

The goal of increasing domestic energy supplies has the wholehearted support of the petroleum industry. Over a period of years, this industry has warned of the dangers of excessive reliance upon insecure foreign sources for the energy we must have to heat our homes, run our factories, and operate cars, trucks, buses and aircraft. Recent events in the Middle East expose the dangers of over-dependence on potentially unreliable sources for any significant portion of our energy supply.

We must now take aggressive action to shore up our nation's energy base by developing secure domestic energy supplies, including supplies of both conventional and non-conventional fuels. This cannot be done overnight. It will take time. But unless our nation is to stagnate, unless we want to risk rising unemployment and spreading poverty, we

must start now down the road to a greater degree of energy self-sufficiency. This requires that we develop all of our domestic fuels -- conventional fossil fuels, nuclear energy, oil and gas from coal, oil from shale and tar sands, geothermal steam, solar power, and other potential energy sources. We no longer have the luxury of concentrating our efforts on selected fuels while neglecting others.

An accelerated technological development program is an essential element of any program designed to rebuild our nation's domestic energy base. But to accompany this effort, policies must be developed to clearly define research objectives; to provide for continuing diversity in research, including balance between projects with short-term and longer-term impacts; to foster development of parallel technological options to insure a wide choice of alternatives; to use the potential of patent rights to provide incentives both for innovation in the R&D area and to justify the risks of commercial investment; and to dovetail the efforts of private industry and government so as to avoid unnecessary duplication and take advantage of the particular capabilities of both sectors.

The API endorses the proposed Energy R&D Administration as a means to develop and implement those policies by bringing together central responsibility for policy planning, coordination, support, and management of all Federally funded programs related to energy R&D.

The petroleum industry has directed increasing efforts to new sources of energy to meet the long-term needs of the nation, but its major programs remain focused upon finding and developing supplies of oil and gas from conventional sources. We believe this emphasis is correct. We will need every barrel of oil and every cubic foot of natural gas we can get to meet our energy needs over the next decade or more.

Among the examples of research of this type are efforts to improve oil recovery efficiency, including flooding with chemical solutions; to release natural gas, now locked up in tight reservoirs, by various fracturing techniques; to develop oil and gas production capability in deep water; to improve seismic methods and exploration techniques; and to convert crude oil more efficiently to useful products. Research projects such as these offer the quickest route to increasing our energy supplies in the near term.

Government, for its part, should direct its efforts more to nonconventional fuels and long-range R&D. Where the

time span to commercial feasibility is so uncertain or so far in the future that it is difficult or impossible to attract necessary funding from the private sector, government support can supplement private efforts and accelerate technological development. Sound and well-balanced R&D programs can sharply reduce the time it takes to go from the laboratory through the demonstration stage, and thus speed the day when these new energy sources can be made available to consumers.

Thus, it is logical for government efforts to focus more on projects with longer time frames, and where private funding is unavailable or inadequate, while focusing private efforts on projects where technology is closer at hand and capital investment can be attracted to bring the energy source to commercial fruition.

Many projects will fall in between these two poles, and a different mix of government and industry funding will be required in each case. For example, the economic development of deep oil shale deposits may require in-situ processes, and much R&D remains to be done. Heavy government funding of joint government-industry R&D projects to develop methods and to demonstrate feasibility would be appropriate. On the other

hand, oil from shallow mined oil shale is further along, and much of this work has been done by consortia of oil companies. Research and pilot plant development work have been completed, and the next step is to demonstrate technical and economic feasibility. Private capital is probably available for this demonstration and subsequent commercialization if appropriate oil shale leasing policies are adopted. We are pleased to note that a prototype leasing program has been announced this week. To achieve a balanced R&D program, it is apparent that shallow mined oil shale development can be funded primarily by private industry, while deep oil shale development would be speeded by increased government funding.

There is a clear and pressing need for a continuing organization which can recommend federal funding levels and their allocation in accordance with national energy priorities, and consistent with emerging national energy policies. There are probably a number of ways in which this need can be filled.

We believe the proposed Energy Research and Development Administration is one way in which this objective can be achieved. We believe that passage of this legislation would be an important step toward a strengthened and effective government R&D program.

To begin with, for an agency to effectively carry out programs for the optimal development of all domestic energy sources, it must be given maximum flexibility. To impose requirements that it spend a certain amount of money for oil shale, or some other fixed amount for coal liquefaction or solar energy, would place the agency in a straight-jacket. It would be unable to accelerate efforts in areas which looked increasingly promising, or to reduce efforts in areas where technological or environmental problems clouded the outlook for commercial development. Optimum development of a given technology requires that the program and organizational structure be established specifically to fit the project. The Energy Research and Development Administration should have full flexibility to accomplish this. We are pleased to note that the bill provides the proposed agency with the flexibility needed to carry out its responsibilities.

As the energy crisis has deepened, the oil industry has been increasingly concerned over the failure of government agencies with important energy responsibilities to utilize the expertise available in our industry, in part because antitrust and conflict of interest laws stand in the way. This contrasts sharply with the situation during World War II, when hundreds

of industry people were involved in all government agencies dealing with the problems of curbing domestic energy consumption and insuring adequate fuel for our Armed Forces. These people rendered distinguished service to their nation. In the case of the proposed Energy Research and Development Administration, it is important that individuals with strong backgrounds in fossil fuels be asked to accept important staff positions in the proposed new agencies, and that close liaison be maintained with both private industry and leading scientists in our universities through extensive use of advisory committees. If the new agency is to be staffed mainly by transferring people with background in nuclear energy R&D, and little effort is made to take advantage of the knowledge and skills available in other energy industries, the development of a well rounded and effective research and development program would be severely handicapped. With all respect for the sincerity, dedication and intelligence of many in government working on the energy problem, there is a crying need for experienced industry people in the government in both operational and advisory positions.

We have some questions about the desirability of including military R&D in the proposed new agency. We fully recognize the need for a strong and continuing military R&D

program. However, there are few similarities between military and civilian R&D programs. In energy R&D, the problem is not only to develop technology but to reduce costs to make new fuels competitive with conventional fuels. Competitive costs are not a major consideration in military R&D. The objective of energy R&D will be to make newly-developed technology available freely and as quickly as possible, while military R&D must operate under maximum security and it is unlikely that even programs with commercial application could be made available without long delays to obtain security clearance.

We are concerned that military requirements might adversely affect the funding of important energy R&D programs unless these two different functions are completely separated.

Another of our concerns is that, while full consideration may be given in the development of an R&D program to the physical environment -- air, water and land use -- insufficient attention will be paid to the development of a sound economic environment. This is essential to assure the commitment of the massive private resources needed to bring new supplies to the consumer after the development of technology.

An important aspect of this economic environment is the area of proprietary rights. The protection of these rights

by patents has traditionally been the incentive for technological innovation by industry. When patents related to Federally assisted development of technology are held by government and are freely available without royalty, experience has shown that utilization by the private sector often languishes. We concur with the patent provisions of the bill which recognize this problem by making it possible for industry to retain proprietary patent rights on a case-to-case basis. If we are to have government-industry partnership in the R&D funding and demonstration of new energy sources, there should also be partnership in sharing the rewards of success.

Another area which must be given attention if we are to have an effective energy R&D program is funding. It will take five to ten years for most R&D programs to achieve meaningful results. Such programs will require long-term commitments by energy companies. These commitments must be matched by long-term government contract authorizations rather than by annual appropriations subject to interruption or wide fluctuation.

Our present technological strength stems from the diversity of specialized knowledge and aggressiveness of personnel employed in our research organization. In some industries, the U.S. no longer enjoys the world leadership

that it enjoyed in the past. This is not true in the oil industry. U.S. technology in exploration, onshore and offshore drilling and production, and every other phase of petroleum operations is second to none. It is largely U.S. technology and equipment which is developing the North Sea, and which is gradually increasing the self-sufficiency of Western European nations. U.S. technology is employed throughout the Middle East, in Africa, in Indonesia, and throughout the Pacific Basin.

Federal R&D efforts should be designed to increase efforts to develop energy technology, including new energy sources, by building upon this strong and diverse technological base.

We believe this bill can contribute to this objective.

AMERICAN MINING CONGRESS,
Washington, D.C., November 30, 1973.

Hon. CHET HOLIFIELD,
Chairman, Committee on Government Operations,
U.S. House of Representatives,
Washington, D.C.

DEAR MR. CHAIRMAN: Enclosed is the statement of Mr. Edmund W. Littlefield, chairman of the American Mining Congress Energy Resources Policy Committee, regarding H.R. 11510, a bill to create a new Energy Research and Development Administration. We request that this statement be included in the record as if read.

The American Mining Congress deeply appreciates the opportunity you have provided the mining industry to comment on this important legislation.

With warmest personal regards, I am

Sincerely,

J. ALLEN OVERTON, JR., *President.*

Enclosure.

AMERICAN MINING CONGRESS
1100 RING BUILDING • WASHINGTON, D. C. 20036 • TELEPHONE 202/331-8900
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ESTABLISHED 1897
J. ALLEN OVERTON, JR., President

STATEMENT OF THE AMERICAN MINING CONGRESS ENERGY RESOURCES POLICY COMMITTEE -- RE: H.R.11510

Committee on Government Operations
U.S. House of Representatives
December 2, 1973

Mr. Chairman and distinguished members of the Committee:

My name is Edmund W. Littlefield. I am Chairman and Chief Executive Officer of Utah International Inc., a surface miner of steam coal, uranium, copper, and iron ore in the United States, and coking coal, iron ore, and copper outside the United States. I also serve as Vice Chairman of the American Mining Congress and Chairman of its Energy Resources Policy Committee.

The American Mining Congress is a national association of United States companies that produce most of the nation's metals, coal and industrial and agricultural minerals. It represents companies that produce both nuclear and non-nuclear fuels and, therefore has a very deep interest in this legislation.

As stated in Chairman Holifield's letter inviting our comments on H.R. 11510, the bill consists primarily of those portions of H.R. 9090, introduced June 29, which deal with creation of the Energy Research and Development Administration and the Nuclear Energy Commission. The American Mining Congress reaffirms its position as presented in my October 17, 1973 statement before this Committee (copy attached), that we support governmental reorganization to consolidate energy research. The present energy situation impels even greater emphasis on the need to further develop our existing energy resources as well as to find new sources of energy.

Our primary concern regarding the reorganization, as proposed in H.R. 9090, was the provision for only one Deputy Administrator of ERDA, leaving open the possibility that a balance between nuclear and non-nuclear energy research would be extremely difficult to achieve. H.R. 11510 apparently resolves this problem by providing for five Assistant Administrators of equal status, three of whom would deal directly with energy research. The proper balance is afforded by providing separate, but equal, administrative leadership in research for fossil fuel development, nuclear energy development and "advanced energy systems".

We think it extremely important that any new energy research agency avoid the natural pitfall of "putting all its eggs in one basket", thus failing to develop the full potential of the various alternate sources of energy.

We reiterate that we wholeheartedly support the concepts and reorganization proposed in H.R. 11510, and think this is an important first major step in providing energy self-sufficiency for the nation.

We thank you for the invitation to comment on this important legislation and would be pleased to hear from you should you feel we might be of any further assistance.

AMERICAN MINING CONGRESS
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J. ALLEN OVERTON, JR., President

copy

Statement of

Edmund W. Littlefield
Chairman and Chief Executive Officer
Utah International Inc.

In Re

S. 2135

Committee on Government Operations
United States Senate
October 17, 1973

Mr. Chairman and distinguished members of the Committee:

My name is Edmund W. Littlefield. I am Chairman and Chief Executive Officer of Utah International Inc., a surface miner of steam coal, uranium, copper, and iron ore in the United States, and coking coal, iron ore, and copper outside the United States. I also serve as Vice Chairman of the American Mining Congress and Chairman of its Energy Resources Policy Committee.

The American Mining Congress is a national association of United States companies that produce most of the nation's metals, coal and industrial and agricultural minerals. I am pleased to submit this statement in behalf of this association.

We very much appreciate the opportunity to comment on S.2135, the bill which would establish both the Department of Energy and Natural Resources and the Energy Research and Development Administration.

We in the mining and energy-producing industry are strongly supportive of a reorganized government structure which could better deal with the nation's energy problems. While the proposed DENR and ERDA are not ideal from the viewpoint of administration and emphasis, they are nevertheless much needed improvements, given the political realities, and accordingly we support their creation.

It is indeed a logical step to combine the functions of the various departments and agencies concerned with energy research and development into one efficient administration. Care must be taken however to insure that ERDA's efforts are proper and appropriately balanced between coal and nuclear and other energy sources. It would be most unfortunate if ERDA were to adopt a bias toward one or more energy sources, since the energy problems which the nation is experiencing today are attributable in large part to the failure of public policy to encourage finding, extracting, and optimizing the use of all of our domestic energy sources. Future energy demand, even under the most conservative assumptions, will require in addition to nuclear research and development substantially accelerated research and development for coal, petroleum and natural gas, oil shale, geothermal, and the exotic energy sources.

To more effectively administer ERDA, we would propose that initially there be at least two Deputy Administrators instead of just one. Under the proposal for two, one Deputy would be assigned to nuclear energy sources while the other Deputy would work with non-nuclear energy sources. It would also be reasonable to provide three Deputies; one for nuclear sources; one for coal, petroleum and oil shale; and one for geothermal, solar, and other energy sources for the more distant future. The Deputies should operate independently and should possess the same authority. Each Deputy should be responsible for the development of the fiscal year budget for his respective energy group, and while these budgets would then be grouped for submission to Congress for approval, the specific line items and the ultimate distribution of funds should be readily identifiable.

We thank you for the invitation to comment on S.2135 and we hope that our comments will be seriously considered by you and will be of assistance in your further deliberations. Again, with slight exception we wholeheartedly support the concepts and the reorganization proposed in S.2135, and we look forward to the passage of the much-needed legislation.



DEC 3 1973

AMERICAN PUBLIC POWER ASSOCIATION

2600 VIRGINIA AVENUE NW WASHINGTON DC 20037 • 202/333-9200

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Wenatchee, Washington

December 3, 1973

The Honorable Chet Holifield
Chairman
Legislation and Military Operations
Subcommittee of the Committee on Government Operations
House of Representatives
Room B-373 Rayburn House Office Building
Washington, D.C. 20515

Dear Chairman Holifield:

American Public Power Association, which represents some 1,400 local publicly owned electric power systems in 48 states, Puerto Rico, the Virgin Islands, and Guam, wishes to offer for the consideration of your subcommittee the following comments on H.R. 11510, to reorganize and consolidate certain functions of the Federal government in an Energy Research and Development Administration and in a Nuclear Energy Commission:

1. APPA strongly supports efforts to accelerate and coordinate research and development so as to expand the nation's options in dealing with energy-related economic and environmental problems.

APPA itself has taken steps to help advance this goal. APPA set up its own APPA Research Program in 1968, was one of the original participants in the electric industry's Electric Research Council, joined with other utility ownership sectors to form and fund the Electric Power Research Institute, and is taking part in the Liquid Metal Fast Breeder Reactor plant demonstration project.

APPA has also endorsed legislative proposals aimed at broadening the Federal government's role in energy research and development. APPA has backed the objectives of S. 357, to create a Federal Power Research and Development Board, and S. 1283, to provide coordination and financial supplementation of Federal energy research and development and to demonstrate particular technologies. APPA support of the purposes of these measures is predicated on the belief that reliance on voluntary efforts and existing governmental programs is not an adequate answer to the need for energy research and development because (a) the very large volume of funds required will not be forthcoming and (b) the public policy direction demanded is not present.

2. The two principal steps which would be taken with enactment of H.R. 11510 are (a) to create a new Federal agency charged with exercising central responsibility for policy planning, coordination, support, and management of energy research and development and (b) to separate licensing and regulatory functions of the Atomic Energy Commission from its other activities. APPA has endorsed the principle involved in the first step in connection with other legislative proposals, and while the Association has no formal position on the second step, it is clear that separation of nuclear licensing and regulatory responsibilities from so-called "promotional" duties would decrease the potential for conflict of interests, thus enhancing public confidence in the integrity of the decision-making process involved in approval of nuclear power plants.

3. Advantages of the approach to Federal energy research and development contained in H.R. 11510 include creation of a Federal focal point of such work which will permit more systematic consideration of alternate courses of action, opportunity for more rational reviewing of funding of all energy-related projects, coordination in carrying out programs, and easier identification of progress in specific fields. It is important to note, however, that while the plan contained in H.R. 11510 encompasses energy research and development activities in the AEC, Office of Coal Research, Bureau of Mines, Department of the Interior underground research program, National Science Foundation, and Environmental Protection Agency, it does not cover all of the energy-related and development work of all of those entities nor does it touch at all the work of others in the Federal government.

4. APPA would like to make these suggestions for changes in H.R. 11510:

a. Section 103 (1) specifies that the functions of the Administrator shall include "exercising central responsibilities for policy planning, coordination, support, and management of research and development programs respecting all energy sources, including assessing the requirements for research and development of the various forms of energy sources, managing such programs, and disseminating information resulting therefrom..."

The ways in which we move in energy research and development are in part dependent on what our objectives are. Since resources of time and money are finite, it is necessary to make choices. There is an environmental maxim which says that "Everything is connected to everything else." It is becoming ever more apparent that this statement applies to energy as well. For this reason, we need in the Executive Branch a high level agency capable of formulating a comprehensive and coherent energy policy and of coordinating its implementation through "line" agencies and departments. A move in this direction is Senate passage of S. 70, to create a statutory three-member Council on Energy Policy. APPA urges that in

your subcommittee's deliberations on H.R. 11510, you consider incorporating the proposal embodied in S. 70 because it has a direct bearing on the functions of ERDA.

The establishment of priorities for energy research and development must flow from broad energy policy decisions involving such matters as environmental protection, economic growth, population expansion and distribution, balance of payments, and foreign relations. These questions must be decided in a fashion which insures full public discussion and broad political support. Research and development efforts should be aimed at supporting the resulting decisions. Addition of the concepts of S. 70 to H.R. 11510 would aid in achieving this objective.

b. One of the by-products of the energy research and development work carried out or financed by ERDA will be fuel and/or energy. Large scale demonstration facilities may produce significant quantities. APPA urges that H.R. 11510 be amended to include a preference clause which provides that in the disposal of such fuel and energy as represents the Federal interest, preference shall be given to Federal agencies, public bodies, and cooperatives. An anti-monopoly feature of this type is found in Federal water power statutes, certain projects of the AEC, and other laws. Its inclusion in H.R. 11510 would be appropriate and desirable in the public interest. In the same vein, the bill should include language giving Federal, State, and local government first rights to acquisition of property surplus to ERDA's needs.

c. By achieving a dominant grasp of new technology, an energy company may place itself in a position to engage in anti-competitive activities contrary to the public interest. ERDA's activities should not become a possible means for enhancement of monopolistic control. Ability to deny know-how to others can constitute an important weapon in killing competition. To discourage this possibility, it would be useful to incorporate in H.R. 11510 the requirement that major agreements concluded with non-Federal participants be reviewed by the Department of Justice in advance of execution to determine that activities under the arrangement would not create or maintain a situation inconsistent with the anti-trust laws.

d. Because the activities of ERDA have a close relationship to on-going energy research and development work by other entities in the electric utility field, it would seem useful to provide for a means of communication and coordination in H.R. 11510. APPA suggests that the bill be modified to provide explicity for a permanent liaison committee composed of utility personnel representing all ownership segments of the industry, thus insuring availability of an important body of expertise for consultation and aiding elimination of undesirable duplication of effort.

e. H.R. 11510 does not deal with the substance of energy research and development projects. If H.R. 11510 is enacted, subsequent supplemental decisions must be made as to what research and development tasks will be tackled and in what order of priority.

Attention needs to be devoted to dealing with institutional inhibitions which may represent obstacles to implementation of the product of energy research and development, including such proposals as the modular integrated utility system (MIUS), the fuel cell, and solar energy.

The Government, for instance, should consider funding for the creation and building of a model city that would make the best utilization of energy, and would serve as a laboratory for testing new concepts in energy conservation.

At the present time, the Disneyworld complex in Florida represents the only sizeable effort to marry advanced techniques of sewage and waste disposal, heating, cooling, hot and cold water supply, transportation, and electric service into a single complex.

APPA is aware of the work being done by several Government agencies on the MIUS, which is a combined processing plant that generates electricity; uses residual and recycled energy for heating, air conditoning and hot water; treats water, and processes solid and liquid wastes.

APPA applauds these efforts, and hopes they will be accelerated. Although MIUS could be incorporated in a model city such as we envision, the concept of developing a model city that would have energy conservation as its primary focus would extend beyond MIUS.

A Federal program aimed at demonstrating energy conservation techniques in residences, commercial buildings, industrial processes and urban planning would serve as an excellent living laboratory for utilities, developers and manufacturers. It would not be necessary for the Federal Government to provide all of the funds for such a model; private enterprise could participate in a meaningful way, and the model itself could provide a tremendous stimulus to private interprise to seek further refinements and improvements upon the innovations developed by the model.

One Federal agency which might be considered for the role of building such a model city would be the Tennessee Valley Authority. At an earlier stage in history TVA established a model for regional water resources development that has served as a model for many nations. As a pioneer in many areas of energy resources development and utilization TVA would be an appropriate agency to carry on this new experiment. It

goes without saying, of course, that environmental considerations also should be a prime objective in the design of such a model city.

Furthermore, reassessment of old solutions is needed to determine their applicability to the future. For example, the U.S. has developed only one-third of its total potential hydroelectric potential, even though this resource permits substantial savings in terms of fuel conservation. Hydroelectric energy generated annually is currently the power supply equivalent of 354 million barrels of oil, 2,233 billion cubic feet of natural gas or 93 million tons of coal.

I would appreciate it if these views could be incorporated in the hearing record on H.R. 11510.

Sincerely,

Larry Hobart

Larry Hobart
Assistant General Manager

LH/dt

DEC 3 1973

National Forest Products Association
Forest Industries Building
1619 Massachusetts Avenue, N.W.
Washington, D.C. 20036
202-332-1050

Ralph D. Hodges, Jr.
Executive Vice President

December 3, 1973

The Honorable Chet Holifield
Chairman, Legislation and Military
Operations Subcommittee of the
Committee on Government Operations
Rayburn House Office Building, Room B-373
Washington, D.C. 20515

Dear Mr. Chairman:

We are pleased to add our support to H.R. 11510, a bill to reorganize and consolidate certain functions of the Federal Government in a new Energy Research and Development Administration and in a Nuclear Energy Commission in order to promote more efficient management of such functions.

All aspects of energy supply and use must be investigated if our Nation is to be assured of economic growth and security. The most immediate impacts, however, will be felt from efforts to improve the ways we currently use available energy supplies. We are, therefore, pleased to see that Section 102 (c) provides for an Assistant Administrator to handle conservation. But the involvement of the proposed Energy Research and Development Administration is energy conservation is not clearly specified as one of the functions of the Administration in Section 103. We, therefore, suggested that Section 103 include language specifying one of the functions of the Administration to be research into modifying existing processes and materials use patterns that will conserve available supplies of energy.

Like other industries, the forest products industy is concerned that its production, employment and markets will be affected by fuel shortages. The softwood plywood industry has already been impacted by shortages of natural gas and propane and of petrochemical-based glues. In some areas logging operations are being curtailed because of diesel fuel shortages. Producers of other products, while less affected at present, are apprehensive about their abilities to operate in the future.

Alaska Loggers Association • American Institute of Timber Construction • American Plywood Association • American Wood Preservers Institute • Appalachian Hardwood Manufacturers, Inc. • California Redwood Association • Canadian Wood Council • Fine Hardwoods—American Walnut Association • Hardwood Dimension Manufacturers Association • Hardwood Plywood Manufacturers Association • Maple Flooring Manufacturers Association • National Oak Flooring Manufacturers Association • National Particleboard Association • National Woodwork Manufacturers Association • North American Wholesale Lumber Association • Northeastern Lumber Manufacturers Association, Inc. • Northern Hardwood and Pine Manufacturers Association, Inc. • Red Cedar Shingle & Handsplit Shake Bureau • Southern Cypress Manufacturers Association • Southern Forest Products Association • Southern Hardwood Lumber Manufacturers Association • Western Wood Moulding and Millwork Producers • Western Wood Products Association

Recognizing the industry's concern over energy problems, the Board of Directors of the National Forest Products Association recently approved the following policy statement:

> "Energy shortages have rapidly emerged as a most important factor affecting the national economy. Adequate supplies of energy will be encouraged if regulatory restrictions on production and pricing are removed and free market prices are allowed to work. However, conservation measures to extend existing supplies should be adopted by all energy user classifications; the need to strike realistic balances between energy supplies and environmental considerations must be recognized and acted on. Research and development of alternative energy sources should be sufficiently financed by both the government and the energy industry.
>
> "Government fuel allocation programs should be used only under emergency circumstances and terminated as rapidly as possible so as not to subvert normal allocation processes of the free market pricing system. When government allocation programs are necessary, after allowing for basic survival and defense needs, energy sources should be allocated to those industries that can make most efficient use of them in maintaining economic activity and in producing for uses that are in themselves energy conserving."

We appreciate this opportunity to comment on H. R. 11510 and request that these comments be added to the hearing record on the bill.

Sincerely,

Ralph D. Hodges, Jr.

DEC 3 1973

National Society of Professional Engineers

2029 K STREET, N. W., WASHINGTON, D. C., 20006

(202) 331-7020

OFFICE OF THE EXECUTIVE DIRECTOR

December 3, 1973

The Honorable Chet Holifield, Chairman
Committee on Government Operations
United States House of Representatives
Washington, D. C. 20515

Dear Mr. Chairman:

The Institute of Electrical and Electronics Engineers and the National Society of Professional Engineers, representing an aggregate of over 200,000 individual engineers, respectfully submit the attached Statement in support of H.R. 11510, a bill to reorganize and consolidate Federal energy R&D functions.

Also submitted herewith is a Statement on H.R. 11510 subscribed to by the presidents of the American Institute of Aeronautics and Astronautics, American Institute of Chemical Engineers, American Institute of Mining, Metallurgical and Petroleum Engineers, American Society of Civil Engineers, American Society of Mechanical Engineers, Institute of Electrical and Electronics Engineers, and National Society of Professional Engineers.

We request that these Statements be considered during the course of Committee deliberations on the measure, and that they be incorporated in the official transcript of current hearings.

Very truly yours,

Paul H. Robbins

Paul H. Robbins, P.E.
Executive Director

Enclosures
cc - Committee Members

STATEMENT
OF THE
INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS
TO THE
COMMITTEE ON GOVERNMENT OPERATIONS
UNITED STATES HOUSE OF REPRESENTATIVES
ON
H.R. 11510
DECEMBER 3, 1973

The Institute of Electrical and Electronics Engineers and the National Society of Professional Engineers appreciate the opportunity to submit their views concerning H.R. 11510. The membership of these societies includes over 200,000 engineers, many of whom are directly involved in the production, transformation, distribution and use of energy in industry and commerce and all of whom are consumers of energy.

We are encouraged that the general public, the Congress and the Administration are becoming aware of the real magnitude and the numerous debilitating consequences of the growing shortages of primary energy in this country. Self sufficiency in energy production, a national goal just recently established, however, involves large scale increases in research and development related to energy as well as a vast improvement in the overall national strategy and management of that effort. While public pronouncements containing optimistic self-sufficiency forecasts in terms of time and effort might have some psychological value, engineers realize that solutions of the problems are complicated and difficult.

Research and development, including large scale pilot plant and process demonstrations, will be required in all phases of energy recovery, conversion, processing, distribution and utilization. Areas of research and development which heretofore have been of little or secondary interest to industry must be expanded. These include nuclear fusion, solar, and geothermal sources of energy, as well as conservation and improved efficiency in energy conversion, distribution, and use.

Governmental proposals for increased funding of energy research generally and attention to the neglected areas are encouraging, but can not be implemented unless effectively and efficiently managed.

The Chairman of the Senate Interior and Insular Affairs Committee has stated, in his memorandum transmitting the staff analysis "Federal Energy Organization" [Serial No. 93-6 (92-11)] March 6, 1973, prepared in response to Senate Resolution 45 of the 92nd Congress:

> "The well-publicized deficiencies of Federal organization in the energy field have become increasingly apparent in the course of the National Fuels and Energy Policy Study authorized by the 92nd Congress. Whether the subject is oil import policy, energy resource management or research and development programs, the lack of adequate authority

and proper coordination is all too clear. And while no one suggests that better organization by itself will solve our energy problems, there appears to be general agreement that a revamped and strengthened energy organization is a necessary event to more rational energy policies."

The Analysis states:

"Throughout the hearings and studies, it has been apparent that there is a significant organizational aspect to energy problems. The existing organization has contributed to current and emerging problems in at least three respects:

(1) it has failed to anticipate emerging energy problems, such as diminishing fuel reserves and environmental confrontations, and to initiate timely corrective action to forestall crises;

(2) it has failed to react adequately to mitigate those crises which have, in fact, occurred, such as increasing fuel shortages and loss of electric power system reliability, and

(3) it does not appear to have the initiative and sufficient reliable and credible information to develop and support the policy decisions which must now be made."

The societies clearly recognize the solutions to tough problems depend upon men and not organizations, but faulty or inadequate organization can, nevertheless, often frustrate and nullify the efforts of the best of men.

The United States has on occasions in the last few decades demonstrated it's capabilities to combine men and organizations to achieve great things. What this country really needs, in the view of it's technologists, is firm commitment to a national purpose structured in much the same way and with promise of the same success as were the programs that put men on the moon through NASA's efforts; provided electricity to rural areas through the creation of TVA; produced the Navy FBM weapons system through the Special Project Office; unlocked the secrets of the atom for defense needs through the Manhattan Project, and for peaceful uses through establishment of the AEC.

Once we establish an adequate research and development organization, we can proceed to install the visionary leadership and administrative talent needed to accomplish this truly herculean task.

H.R. 11510 provides a major step in improvement of energy organization. Further steps will be required to translate research and development results into national energy production and management programs which can make us self sufficient. But rationalizing the organization for energy research and development is an essential

immediate step in the implementation of this activity if we are to reach energy self sufficiency even by the year 2000.

The engineering societies wholeheartedly support H.R. 11510.

We recognize that there continues to exist a serious concern with the placement of weapons research and development responsibility in the proposed Energy Research and Development Agency. We believe, however, that the inevitable delays which would develop as the Congress attempts to resolve that problem at this time could have a most serious effect delaying critically needed energy research and development programs.

We strongly recommend proceeding expeditiously with H.R. 11510. While noting that the Energy Reorganization Act of 1973 is intended "to bring together and direct Federal activities relating to research and development on various sources of energy" we would in closing point out that, important as H.R. 11510 is, it is but a single factor in the extraordinarily long list of vital measures that the Congress and the Administration must address without a single days further delay if the United States is to survive, socially, economically and militarily as a free nation.

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STATEMENT OF

AMERICAN INSTITUTE OF AERONAUTICS AND ASTRONAUTICS

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

AMERICAN INSTITUTE OF MINING METALLURGICAL AND PETROLEUM ENGINEERS

AMERICAN SOCIETY OF CIVIL ENGINEERS

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS

NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

ON

H.R. 11510

The above listed engineering societies appreciate the opportunity to submit their views concerning H.R. 11510. The membership of these societies includes approximately 480,000 engineers and scientists, many of whom are directly involved in the production, transformation, distribution and use of energy in industry and commerce, and all of whom are consumers of energy as citizens of the United States.

We are encouraged that the general public, the Congress, and the Administration are becoming aware of the real magnitude and the numerous dehabilitating consequences of the growing shortages of primary energy in this country. Self sufficiency in energy production, a National goal just recently proclaimed, involves large scale increases in research and development related to energy as well as a vast inprovement in the overall National strategy and management of that effort. A general misunderstanding exists, however, as

to the great length of time and the enormous magnitude of effort which will be required for the United States to become self sufficient in the production of environmentally clean energy.

Research and development, including large scale pilot plant and process demonstration, will be required in all phases of energy recovery, conversion, processing, distribution and utilization. Governmental attention must be devoted to areas of research and development which have heretofore been neglected. All this essential effort could come to little or naught, however, unless the research activity were effectively coordinated and the development activity effectively and efficiently managed.

The solutions to difficult problems depend upon men and not organizations, but faulty or inadequate organization can frustrate and nullify the efforts of the best of men. We share a concern in this connection that Section 106(a) of H.R. 11510 does not reference the voluntarily developed consensus standards that have been consistently referenced by state and Federal regulatory bodies over the years. We offer for your consideration the following wording which could be added to Section 106(a):

> "The Administrator is authorized to reference American National Standards as appropriate in Administrative Regulations and Guides."

H.R. 11510 recognizes the need for a major step in the improvement of energy organization. Much more will be required if research and development results are to be translated into National energy production and management

programs to make us self sufficient in 20 years (even by the year 2000), but a National organization for energy research and development is a necessary, first step because the products of research, development and demonstrations are going to be necessary to all future actions.

We strongly recommend proceeding expeditiously.

Holt Ashley, President
American Institute of Aeronautics and Astronautics

Theodore Weaver, President
American Institute of Chemical Engineers

James B. Austin, President
American Institute of Mining, Metallurgical and Petroleum Engineers

Charles W. Yoder, President
American Society of Civil Engineers

Daniel C. Drucker, President
American Society of Mechanical Engineers

Harold Chestnut, President
Institute of Electrical and Electronics Engineers

Robert L. Reitinger, President
National Society of Professional Engineers

December 3, 1973

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS,
New York, N.Y., November 30, 1973.

COMMITTEE ON GOVERNMENT OPERATIONS,
House of Representatives, Washington, D.C.

GENTLEMEN: I have received a copy of Mr. Holifield's bill, H.R. 11510, from the office of our ASME Washington representative, and have been advised your committee is holding hearings on the bill this week. As there is insufficient opportunity to circulate copies of this bill among interested members of our power department, which is deeply concerned with the continuing development in the fields of production and consumption of energy, I will respond only with my personal comments rather than the consensus of my colleagues in our power department.

First, I would like to commend the efforts of the staff of Congressman Holifield for their efforts in drafting this bill to implement our President's research and development program in the energy field. Our country must regain its position of eminence in the efficient use of energy resources which can only be obtained through continuous adequate funding of research and development programs. In general, it is desirable that these programs be carried out in the private sector with only appropriate Government support as necessary to assure an atmosphere conducive to substaining the effort. Our Federal Government should only take over those programs such as the LMFBR program where the monetary risk is too great for the private sector to carry alone.

My specific comments on the bill directed to individual page and line numbers are as follows:

Page 2, Line 6

The word "advance" is incompatible with the statements preceding it in this paragraph. I would suggest the word "recognize" would be more appropriate. If we are to bring some order into the present almost chaotic condition of our economy, we must recognize that environmental quality can only be one consideration in our overall program rather then the ultimate goal.

Page 9, Line 1

I would suggest the words "needed to" be replaced with the words "to those governmental agencies which". This would eliminate a possible misunderstanding that this administration would actually establish and administer national policies.

Page 9, Line 4

It would seem more appropriate to replace the words "electric power" with the word "energy".

Page 11, Line 9

It is suggested the word "standards" be deleted. For a successful transfer of the results of the administration's programs to the private sector, it is essential that these programs be compatible with the standards used in the private sector. Appropriate American National Standards Institute (ANSI) standards, which are recognized and used by industry, can be part of the criteria described by the administrator.

Page 20, Lines 12 & 14

It is suggested that the word "when" in each of these lines be replaced by the words "to be". It would seem more appropriate to provide the Nuclear Energy Commission with licensing authority for demonstration reactors which may not operate as part of a power generation facility during their development phases but would so operate at a later stage in development.

I trust these comments may be of assistance and appreciate the opportunity to forward them to you.

Very truly yours,

DUDLEY E. OTT.

NOV 29 1973

ADVANCING VOLUNTARY LEADERSHIP IN A CHANGING WORLD

Chamber of Commerce of the United States
LEGISLATIVE ACTION GENERAL MANAGER
HILTON DAVIS
202·659-6140

1615 H STREET, N.W.
WASHINGTON, D.C. 20006

November 28, 1973

The Honorable Chet Holifield, Chairman
Legislation and Military Operations
Subcommittee
Committee on Government Operations
House of Representatives
Washington, D. C. 20515

Dear Mr. Chairman:

The National Chamber supports establishment of an Energy Research and Development Administration, and a Nuclear Energy Commission, as provided in H.R. 11510.

This proposal to bring together the research and development activities now located in the Atomic Energy Commission and the Department of Interior would significantly improve the organization of such activities and help to resolve the energy problems which now confront the nation.

In addition, the provision in the bill to establish a separate Nuclear Energy Commission to handle the regulatory functions of the present Atomic Energy Commission constitutes a sound organizational arrangement for this energy activity.

Therefore, we urge approval of H.R. 11510.

We appreciate your consideration of our views and request that this letter be made a part of the hearings record.

Sincerely,

Hilton Davis

Hilton Davis
General Manager
Legislative Action

cc: Subcommittee Members
Herbert Roback, staff director
John P. Carlson, minority counsel

CONGRESS OF THE UNITED STATES,
HOUSE OF REPRESENTATIVES,
Washington, D.C., November 30, 1973.

Hon. CHET HOLIFIELD,
Chairman, Government Operations Committee,
Washington, D.C.

DEAR MR. CHAIRMAN: I know your committee is considering legislation for a new Energy Research and Development Administration.

My purpose in writing is to urge you to consider the work which private industry can do in this vein along with Government and educational institutes.

An eloquent statement by one of my constituents, Dr. Donald M. Carlton of Austin, Tex., was submitted to you on the contributions which private industry can make towards energy research and development. I do feel he makes some good points in his statement which are worth studying.

I do hope consideration will be given to private industry working with the Government and educational institutes in energy research and development. Your attention in this matter is appreciated.

Sincerely,

J. J. PICKLE.

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My name is Donald M. Carlton. I am President of Radian Corporation of Austin, Texas. I appear today in support of the concept of unified federal government leadership in energy research and development, and to present to you my thoughts on the contribution which private industry in general and small research and development companies in particular can make to the solution of the Nation's energy problem.

Radian Corporation is a Company which supplies research, development, and other technical services to both government and industry. The staff of some one hundred people has participated in a variety of energy-related technical programs, especially those associated with the environmental aspects of fossil fuels. Radian's experience with EPA's program to develop flue gas cleaning technology is a prime example of a program in which strong leadership and funding was provided by the federal government and in which the lion's share of the effort was conducted by private industry. As will be described more fully later in my testimony, Radian's experiences in this program provide an excellent example of the government's favorable return on investment with such an approach. A relatively modest expenditure with Radian, catalyzed by the fundamental motive of business to

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produce profits, yielded a variety of programs sponsored at Radian by industry rather than government. The net result of Radian's efforts is that SO_2 emissions are now being partially controlled at an operational power station.

RECOMMENDATIONS

There is no question that a coordinated federal program of energy research and development is desperately needed. My view is that this can take many forms. A unified agency such as is proposed in H. R. 9090 could be an effective approach. (While AEC is qualified for such a role, Interior and EPA appear to be equally viable candidates from a technical viewpoint.)

There is a great deal of merit in the approach suggested in S. 1283 in which a commission composed of representatives of the existing key energy agencies is formed to direct the Nation's energy effort in the various agencies. The advantages to this approach are that existing efforts would not be disrupted, Congressional responsibilities and authority would be less impacted than under the ERDA concept, and most importantly it would preclude the lengthy and severe disruption and confusion which accompanied the formation of EPA. On the negative side there

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are unquestionably advantages and efficiencies which accrue to having a program of the magnitude proposed centralized in one administrative structure.

My specific suggestions to this Subcommittee lie in a different direction. In my testimony I will establish the critical need for a deep involvement of private industry in the federal agency development mission. More particularly, I will present evidence of the contribution which those small companies such as Radian Corporation can make in this area. My concern is that in an attempt to move ahead rapidly with legislation to meet the urgent energy needs of the Nation, insufficient attention will be given to the role which private industry large and small and other types of technical organizations can and must play.

Data from the National Council of Professional Services Firms of which Radian is a member show that professional services organizations have a total revenue of $9 billion per year. Ninety percent of the firms in this category are small businesses. This vital segment of our economy must be allowed to compete with government laboratories and Federal Contract Research Centers even though these organizations either have a guaranteed existence or many competitive advantages, such as not having to pay corporate profit taxes, not enjoyed by private industry.

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The mechanism which can be utilized to insure the role of all qualified organizations of all sizes in the overall energy equation is the research and development contract. Jointly funded industry and government programs are good for big projects and big industry, but the underlying technical backup for such large scale programs should be provided by all segments of the technical community in conjunction with and under the leadership of federal technical personnel.

I suggest that any legislation in the energy area contain the statement that it is the intent of Congress that energy research and development should be conducted by private enterprise. I suggest for your consideration the language of the Education Amendments of 1972, Section 405(e)2:

> "Not less than 90 per centum of the funds appropriated pursuant to subsection (h) for any fiscal year shall be expended to carry out this section through grants or contracts with qualified public or private agencies and individuals."

In addition, I suggest that special attention be given to small business by specifying that a portion of the funds available for research contracts (e.g., 10%) be set aside for small business.

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THE ADVANTAGES AND THE NEED FOR INDUSTRIAL PARTICIPATION IN THE NATION'S ENERGY PROGRAM

There are three critical elements to the energy development program required by the Nation.

(1) We must very rapidly develop technology to use domestic fuel supplies to meet our near and intermediate term needs.

(2) We must assure that as these new technologies are developed they are rapidly introduced to energy-utilizing industrial organizations.

(3) The longer term energy picture must be anticipated now by initiating programs directed toward radically different energy generation concepts which provide for energy and fuel conservation and environmental acceptability.

Private industry under the leadership of a strong federal program has critically important contributions to make.

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A. Rapid Development of Technology

Industry can respond more rapidly to the call for new technology than any other segment of our society whether it be government or university laboratories. This is because industry is already doing energy-related research and development. Other companies like Radian have technical staffs who are proficient in energy-related technology and equally importantly are already oriented and trained to operate within the technical and economic confines of huge plants producing low cost energy. It is, in fact, this question of training and orientation which has made the transition from aerospace engineer to environmental technologist so difficult, and it is important to recognize the magnitude of this impediment to the rapid reorientation both of private and governmental organizations presently operating in non-energy technical areas.

What is lacking in private industry is the funds and coherent direction which can be provided only by the type of program under consideration by this Subcommittee. As I will discuss in greater detail later in this testimony, this statement does not mean that there is no role in energy research and development for government and university laboratories or engineers and scientists whose orientation at this time is defense or aerospace. It does say, however, that assurances must

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be provided by which the critically important contributions of industry in general and small research and development organizations in particular can be realized. It also says that the nation's energy R&D program must be built around the small kernel of existing energy-related expertise wherever it can be found.

B. Industry Acceptance of New Energy Technology

In contrast to some of our nation's technology development programs such as the space program and nuclear weapons development, the energy technology development program anticipated by H. R. 9090 will be a success only if private industry adopts this technology and introduces it into the mainstream of American life. This cannot be accomplished by fiat. Mechanisms must be structured by which the fuel and energy-based industries of America come to understand the new energy technology and appreciate its benefits. It is my opinion that if all segments of our society including industry participate in this development, our industrial organizations will be creative enough to develop services and hardware systems which will find their way into the marketplace. Conversely, if the Nation's energy technology programs are conducted largely as government "in-house" programs, my view is that the transfer of this technology to

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private industry will be difficult indeed. In contrast to nuclear energy technology which can reach the customer if a few large companies can sell nuclear power plants to a relatively few large utility companies, the utilization of fossil fuels extends from those same large utility companies to each space heater, foundry, and service station in the Nation.

C. Longer Term Energy Needs

Most experts agree that American life in the year 2000 will differ radically from that of 1973. New methods of generating and distributing energy will contribute heavily to this alteration of life-styles. To incorporate these needed changes, industry similarly must change. In fact, significant institutional changes will be required both in government and industry.

A cooperative program involving government and industry is required to realize these necessary alterations. At this time a great deal of fundamental research must be conducted. As knowledge of this speculative technology is increased, government agencies will have to make decisions regarding the feasibility of the candidate technologies developed, discriminate among them, and provide the funds, the mechanisms for further development, and finally implementation. Industry will not and

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cannot provide the leadership, funds, nor the institutional initiatives required. But, industry can contribute to the development of this technology and work with government to create the mechanisms by which radically different technology can be introduced into the American life-style.

A specific example of the points discussed above is Radian's participation in EPA's program to develop air pollution control processes. I would like to discuss this briefly.

THE ROLE OF RADIAN CORPORATION IN THE DEVELOPMENT OF SULFUR DIOXIDE REMOVAL PROCESSES

One of Radian's most important business activities deserves particular attention because it demonstrates that the effectiveness of the relatively small amounts of money spent by the government at Radian has been enhanced by the aggressiveness of our Company in pursuing business opportunities based upon our government funded accomplishments. In this regard I refer to the program to develop sulfur dioxide removal technology presently under the direction of the Environmental Protection Agency.

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The ultimate purpose of this program from its inception was to limit the emissions of sulfur dioxide from stationary sources. EPA's strategy was that the development and demonstration of control technology in conjunction with the setting of standards would result in the implementation of this technology by the polluting industries, thereby limiting SO_2 emissions. EPA recognized, however, that the strategy as stated above required more than just standards and research programs. It was necessary both to provide for industry's acceptance of the technology and to develop sufficient expertise in the private sector of the economy so that polluting industries could have access to the products and services necessary to obtain operational systems. The mechanism they selected to accomplish this was to depend on private industry through the mechanism of research and development contracts to develop the technology under the leadership of the EPA staff.

Radian's role in this effort began shortly after the founding of the Company in 1969. Several of our scientists and engineers recognized that before large scale demonstration equipment could be constructed and successfully operated, it was necessary to understand the complex chemistry of the lime/limestone wet scrubbing process for sulfur dioxide control. On our own initiative we submitted an unsolicited proposal to develop the theoretical basis for the lime/limestone wet scrubbing

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process. The proposal resulted in an award of an $80,000 contract to Radian. The output of this program was a computer model which described the complex chemistry of the system and made it possible both to predict certain types of chemical behavior and to analyze experimental data.

One of the benefits of this model recognized immediately by our staff was that the model could specify those parameters which should be analyzed to determine the performance of the process. As a result of an unsolicited proposal, Radian received a $160,000 contract to select analytical methods for the lime/limestone wet scrubbing process. Concurrently, Radian worked in conjunction with EPA engineers on a variety of pilot plant programs designed to supply the data necessary to design larger plants. This program included both laboratory studies to provide answers to questions raised by the pilot programs and the direct interaction with other EPA contractors operating pilot and larger scale equipment. This contract was for a total of $140,000 and lasted some thirteen (13) months.

Radian's strategy with respect to this business area was two-fold. First, we recognized that this was good business for us in and of itself. It was technically challenging, fit the capabilities of our staff, supported the project teams, and provided the Company a small (7% gross) profit. Second, we

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felt that there would be a place in the private sector for companies with our expertise as industry began to implement the technology to limit emissions as required by the standards. After working solely for EPA in this area for two years, Radian obtained its first industry-sponsored program in January of 1971. This $12,000 contract sponsored by a major electric utility was to prepare a report on the status of technology for removing sulfur oxides from flue gases. Subsequent to this program, Radian has received seventeen contracts in the field of SO_2 removal from electric utilities in California, Minnesota, Ohio, Illinois, Tennessee and Pennsylvania, as well as Texas. For one company we helped plan a program by which SO_2 removal technology could be implemented in that company's system. For another we worked in conjunction with the company and their architect/engineers to review the design of the equipment manufacturer who was supplying flue gas equipment. For still other companies we have operated pilot plant programs, analyzed the water pollution potential of flue gas cleaning equipment, and provided assistance in planning the strategy by which applicable emissions and ambient standards would be met.

Concurrent with the EPA and industry funded programs at Radian, we invested a portion of our limited resources in enhancing our capabilities in this area. A faster, more capable computer model of the process was developed for an investment

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in excess of $15,000, laboratory equipment in excess of $50,000 was purchased to support our SO_2 control efforts, and our laboratory facilities were expanded by a factor greater than ten to accommodate this as well as other experimental programs. These developments allowed us to better serve all of our clients both governmental and industrial and to hasten the day when Radian could assume a more prominent role in programs to implement full scale SO_2 control technology.

Perhaps the most significant step for Radian in providing to the private industrial segment of the economy the expertise developed originally under EPA sponsorship occurred last year. At that time Radian signed a contract with Joy Manufacturing of Pittsburgh. This contract calls for Radian to provide Joy with the chemistry and chemical engineering services required by Joy to supply full scale, operational SO_2 removal systems to industrial organizations. At this time a pilot plant program is under way at a power plant in Pennsylvania to develop the design data necessary to construct full scale systems.

In summary, EPA capitalized on the unique contribution which can be made by highly skilled technical organizations which interface with both government and industry. Relatively modest sums invested by the government with us were multiplied

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many fold because of our motivation to increase profits and our ability to introduce the technology developed under EPA funds to industrial users. As a result, we and other organizations operating in the private sector of the economy are contributing to EPA's overall goal of reducing sulfur dioxide emissions from stationary sources.

Mr. Chairman, this concludes my testimony. I am deeply appreciative of this opportunity to express my thoughts to you and the members of this Subcommittee. The fact that some of the most important people in our country can find the time to listen to a businessman from a small company in Austin, Texas, whether or not my suggestions are adopted, is an outstanding tribute to the American system of government.

I would be pleased to answer any questions at this time or to furnish additional written testimony to the Subcommittee if you wish.

STATEMENT OF ROBERT LOWENSTEIN, COUNSEL
NUCLEAR ENERGY DIVISION
GENERAL ELECTRIC COMPANY

My name is Robert Lowenstein. I am Counsel to General Electric's Nuclear Energy Division, which has its worldwide headquarters at San Jose, California. I have had more than 20 years' experience in the regulatory programs affecting the nuclear energy industry, including service for five years as AEC's Director of Licensing and Regulation and as Assistant Director of Regulation. Before taking my present position in August, 1972, I was a partner in Lowenstein, Newman and Reis, a Washington law firm, which specialized in nuclear energy legal problems. In addition, I presently serve as Chairman of the Atomic Industrial Forum's Lawyers Committee and as a member of the Special Committee on Environmental Law of the American Bar Association. I am appearing before you today solely as counsel to General Electric's Nuclear Energy Division.

I should like to thank the subcommittee for this opportunity to submit this statement regarding reorganization of the federal government's energy efforts. General Electric supports separation of the Atomic Energy Commission's developmental and regulatory functions and urges the prompt enactment of legislation to create a Nuclear Energy Commission and an energy research and development agency.

We support establishment of an energy research and development agency because of the need to bring together the now fragmented programs and resources of many federal agencies. Establishment of an agency to administer energy research and development programs will make it possible for the federal government to coordinate its energy research and development programs and to apply its resources, including the unique capabilities of the AEC's National Laboratories, more effectively to develop new sources of energy and new means for their utilization.

General Electric's original and still basic business lies in the generation, distribution, and use of electric energy, whatever fuel is used. We are confident that an energy research and development agency will facilitate those technological developments which are now so vitally necessary to maintain our society. We are confident that these developments can be accomplished and that they can provide the bridge to an unprecedented era of peace and prosperity in our country and throughout the world.

A second major objective of the proposed reorganization, to which I propose to direct the balance of my statement, is the establishment of a Nuclear Energy Commission. Proposals to place the AEC's regulatory functions in an agency separate from the Commission's operating and promotional programs have been made repeatedly over the years since 1955. There has been recurring concern that the combination of regulatory and promotional functions in the Atomic Energy Commission has weakened the credibility of the Commission and impaired public confidence in the adequacy of its regulatory programs.

I do not mean to suggest that the Commission's promotional responsibilities have resulted in any weakening of its safety requirements, or that the Commission ever failed to take appropriate action on any matter because of its promotional concerns. As one who spent many years deeply involved in administration of the AEC's regulatory program, I can affirm that the Commission has always regarded its nuclear safety responsibilities as its paramount and overriding concern. Nevertheless, the combination of regulatory and promotional functions has been a cause of impaired public confidence in the AEC for many years. Since public confidence is so vitally important to the administration of the Commission's programs and to utilization of nuclear energy, we believe that the Commission's regulatory responsibilities should be separated from its other functions and placed in a separate agency unless there are other compelling reasons why separation would not be in the public interest.

In earlier years, when the Joint Committee on Atomic Energy considered the desirability of separating AEC's regulatory from its other responsibilities, there were persuasive reasons not to do so, including the relatively small size of the regulatory staff, the dependence of the regulatory staff on the AEC and its laboratories for technical assistance, and the fact that the nuclear power program was still in its infancy. Since that time, however, the regulatory staff has grown in size and competence, much safety research and development has been accomplished, and the nuclear safety standards program is well advanced. Operating experience with large nuclear power plants is accumulating at a rapid rate, and, with the encouragement of the Atomic Energy Commission, reactor designers, architect-engineering firms and others engaged in the industry are standardizing nuclear plants. There is no reason today to doubt that the regulatory staff is now of sufficient size and capability to provide the personnel and resources which would be needed by the Nuclear Energy Commission to carry out a healthy and vigorous regulatory program. I think, too, there can be little doubt that the Commissioners who constitute the heads of the Nuclear Energy Commission will be in a far better position to administer the AEC's regulatory responsibilities without the added responsibilities which would be vested in the energy research and development agency.

Separation of AEC's regulatory functions will serve an additional important objective. At present, the five Atomic Energy Commissioners have vast responsibilities of an extremely diverse nature; these responsibilities have made it impossible for the Commissioners to spend more than a minor portion of their time on regulatory matters. The addition of other energy development responsibilities to the agency's nuclear responsibilities would reduce still further the time available for the Commissioners to administer the regulatory program.

The Commission's regulatory program encompasses responsibility for the licensing and regulation of nuclear power plants, which are an increasingly significant source of electric energy. It also includes regulatory responsibility with respect to those related activities in the fuel cycle, which are indispensable to nuclear power. Moreover, the regulatory program has, during recent years, been broadened to include pervasive environmental and antitrust functions which must add significantly to the burdens already imposed on

those charged with their administration. The burden of responsibility imposed by these regulatory functions on the heads of the regulatory agency will increase as the number of plants increases.

We believe that creation of a separate Nuclear Energy Commission to administer AEC's regulatory responsibilities is so important that even if the committee should decide to postpone establishment of an energy research and development agency as a separate organization, the Nuclear Energy Commission should be established now. Creation of the Nuclear Energy Commission would become still more urgent to the extent that the AEC is given additional development responsibilities prior to the creation of the new development agency.

We have a number of additional suggestions in connection with the provisions to establish a Nuclear Energy Commission:

1. It would, in our view, be desirable to provide a Commission of at least five members. A Commission of five members should be adequate to assure that the heads of the agency have adequate time to become deeply and personally involved in the formulation and administration of nuclear regulatory programs, as well as the adjudication and review of cases. Moreover, five Commissioners can bring to the agency's deliberations a more diverse array of talent to oversee its diverse nuclear safety, environmental, and antitrust responsibilities.

2. We believe the committee should make plain its expectation that the Nuclear Energy Commission should discontinue the use of Appeals Boards. The AEC Appeals Boards have proven in our judgment to be a cumbersome, time-consuming, and unsatisfactory procedure for review of licensing board decisions. We believe that the questions involved in these decisions involve many novel and important policy questions which should be decided by the heads of the agency. A separate NEC with five Commissioners should be able to provide for review of licensing board decisions by some or all of the five Commissioners.

3. Provisions should be included in the bill to make it clear that the new Nuclear Energy Commission can adopt existing AEC regulations, decisions, and licenses as its own without further proceedings, and that AEC proceedings initiated prior to reorganization may be continued by the Nuclear Energy Commission as if they had been commenced before the new Commission. It should also be made clear that the new Commission may extend existing rules, regulations, and orders and may grant temporary authorizations to provide a reasonable transition procedure.

4. There has been, we understand, discussion as to whether the new Nuclear Energy Commission should be given responsibility to regulate nuclear activities of the Atomic Energy Commission or its successor agency. We do not have a judgment as to whether vesting such responsibility in the Nuclear Energy Commission would be desirable; we urge, however, that, if the Congress decides to impose such responsibilities on the Nuclear Energy Commission, that the new agency be given adequate additional resources to carry out such programs, and that the time table for assumption of those responsibilities should be developed so that the Nuclear Energy Commission can assume them gradually and without interference with or delay in its nuclear power licensing programs.

TRW

EXECUTIVE OFFICES

November 29, 1973

Mr. Herbert Roback
Staff Director
Committee on Government Operations
United States House of Representatives
Rayburn Office Building, Room B-373
Washington, D. C. 20515

Dear Mr. Roback:

Subsequent to your conversations with Mr. D. N. Pitts, Director of Government Business Policy for TRW Inc., regarding possible testimony by TRW on H. R. 11510 and the proposed Energy Research and Development Administration embodied therein, we have determined that the tightly compressed schedule of hearings would make it impractical for us to present a personal statement to the Committee on Government Operations during this week's hearing period on the bill.

However, I am pleased to submit the enclosed statement for the record, which reflects TRW's great interest in the organizational concept of ERDA, and our sincere desire to place ourselves on record as favoring timely passage of this important legislation.

I hope that this statement will be informative and useful to the Committee on Government Operations in connection with its deliberations on H. R. 11510.

Very truly yours,

Richard D. DeLauer
Executive Vice President
Systems and Energy

encl

STATEMENT OF
DR. RICHARD D. DE LAUER
EXECUTIVE VICE PRESIDENT FOR SYSTEMS AND ENERGY
TRW INC., REDONDO BEACH, CALIFORNIA
ON THE
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
PROPOSED UNDER
H. R. 11510 "ENERGY REORGANIZATION ACT OF 1973"

November 29, 1973

I strongly endorse the organizational concept of mobilizing the various related federal activities to concentrate on development of all energy sources, as embodied in the proposed Energy Research and Development Administration (ERDA) under H. R. 11510.

In this regard, I would like to offer my thoughts and views on (1) the nature of the energy R&D challenge facing the nation, (2) the ready availability of industry's R&D capabilities to help meet this challenge, (3) the essential role of the federal government in creating an operable market to facilitate application of industry's R&D capabilities, and (4) the need for precautionary measures to avoid unintentional barriers that might otherwise hinder the application of qualified industrial capabilities and resources to the federal energy R&D program.

Nature of the Energy R&D Challenge

Recent developments with respect to the increasingly severe shortage of energy resources in the United States and throughout the world have served to focus public attention on the very critical nature of the problem now confronting us. Our nation has just begun to face

what undoubtedly will be a series of crises with respect to the availability of various types of energy sources, most particularly fuels and other products derived from petroleum and natural gas.

In the near term, by which I mean the next three to five years or so, the most direct way of responding to the shortages we anticipate will be through stringent conservation measures and by maximizing our domestic production of oil and gas. While some new wells can be drilled both on- and off-shore, a much greater emphasis on secondary and tertiary petroleum recovery through production stimulation techniques may be our best source for increasing the domestic production in the next few years. The time required to develop new facilities for the generation and distribution of electrical energy is such that little immediate relief can be expected through the expansion of hydroelectric, nuclear, or geothermal generating facilities in the near term, but efforts should be accelerated.

However, there are certain actions which can and should be taken in the near term in addition to merely controlling the allocation of our available energy resources. While our supplies of crude oil and natural gas are limited even with maximized production efforts, the United States does possess vast reserves of another useful fossil fuel—coal. Research and development should be intensified immediately into the technology of recovering, transporting, and using coal in forms that will not only satisfy our needs for additional energy sources, but will also meet our environmental quality standards and requirements.

Intensified research into means of making coal a more acceptable energy source, such as by modifying its chemical content prior to combustion to eliminate undesirable by-products, by changing its physical structure so it can be used as a liquid or gaseous fuel, and advanced techniques for transporting and distributing coal-fuel products should be investigated on a high priority basis, even though useful results may be some years off.

Research efforts should also be initiated or intensified into other alternate energy sources, such as shale oil production, utilization of solar

energy, generation of electricity by nuclear fission and fusion, and efficient methods of storing electrical energy on a large scale. All of these represent long range candidates for the solution of our energy problem, but research and development efforts must be started now if results are to be seen years from now.

In the intermediate term, around the mid-1980's, we should expect to see some significant transition from oil and gas to coal and nuclear power as important energy resources. As this transition continues, it must be accompanied by increasing levels of specifically-directed research and development into ways of producing and utilizing these new energy resources. The utilization of solar energy will also begin to come into practical use, and R&D for applications of this new energy resource will become increasingly important. Also, research in the area of energy storage for portable and peak power needs should also begin to show some results in the intermediate term.

In the long term, and here I have in mind the period beginning about the 21st century and beyond, our energy needs will require the large-scale availability of alternates to our present means of producing, distributing, and generating energy, such as wide utilization of solar energy, generation of electrical energy by nuclear fusion processes, harnessing of geothermal energy sources, and quite probably conversion of energy to electricity by concepts not even identified today. But none of these things will be available if research and development effort is not started now, and continued according to a well-thought-out and adequately supported master plan.

Fortunately, the capability to carry out such advanced research and development does exist in ample supply in the United States today. The resources of U.S. industry are more than adequate to undertake this important challenge. In fact, research into many of these advanced energy sources and energy utilization techniques is already underway in a limited way in many of our industrial laboratories and research centers.

Availability of Industry's Technological Capabilities

The scientific and technological capabilities of U.S. industry are unsurpassed by any nation in the world. Our industrial community has demonstrated its value as a vast national resource on many occasions in the past. One need only think of such critical efforts as the Manhattan Project, the ICBM Program, and the Apollo Program to be reminded of the great versatility and adaptability of our industrial technology to meet great challenges which face our nation from time to time. Just as our scientific and technical community was equal to the task posed by these earlier challenges, so can our great industrial R&D capacity now be brought to bear to solve the great problems posed by our energy needs.

This is perhaps a particularly good time to bring the resources of industry to bear on such a complex technical problem, since there is presently a considerable underutilization of our research and development capabilities. Our defense and space programs have flattened out in the past few years, and our levels of R&D effort related to defense and space have increased during the last few years at a rate barely equal to the rate of inflation. Our aerospace and other advanced technology industries are faced with over-capacity in terms of both manpower and facilities, and thus have R&D resources readily available for application to the technological aspects of our energy problem without having to disrupt other important effort associated with ongoing defense and space programs.

The declines in defense and space activity in recent years have resulted in the availability of great numbers of skilled scientists, engineers, and technologists with experience and training directly applicable to many of the technical disciplines which relate to our present energy problem. Too many of these valuable people have been unemployed in recent years, or are perhaps underemployed in occupations which do not fully utilize their training and experience. In an effort to retain the services of as many of these people as possible, U.S. industry has already turned to

expansion and diversification efforts in various non-defense and space areas—the so-called "civil systems" or domestic/social problem areas. Thus, there is at the present time a considerable amount of exploratory research and development activity in such areas as transportation, housing, medical care delivery, education, law enforcement, and similar fields. There has also been a significant increase in R&D effort in the field of energy in recent years. Such technology diversification—sometimes referred as "aerospace technology transfer"—has been encouraged by the Congress and by various governmental agencies for some time now, and has resulted in the establishment of a significant industrial R&D capability in these areas.

My own company, TRW Inc., for example, has established itself in such fields as transportation engineering, advanced technology housing, environmental planning and analysis, and various commercial applications of computer technology. In addition, we have initiated specific research and development efforts in such energy-related areas as the desulfurization of coal; electro-chemical methods for the extended storage of large quantities of electrical energy; various concepts for utilizing the energy available from the sun; advanced systems for producing petroleum and natural gas; and computer-based systems for increasing the productivity and efficiency of producing and distributing oil, gas, and electrical energy. Much of this advanced work, though fragmented, is being supported in part by R&D contracts with such various government agencies as the National Science Foundation, Environmental Protection Agency, Interior's Bureau of Mines, NASA, DOT, HUD, HEW, and Atomic Energy Commission, as well as under our company-initiated independent research and development programs.

Unfortunately, however, the mere fact that there is an evident and growing need for research and development in these non-aerospace fields such as energy is not wholly sufficient to produce the desired results. A need is not a market. The free enterprise system of the United States in which our industrial sector operates requires viable and operable markets in order to motivate and support its activities, whether for the design

and manufacture of consumer products or for the conduct of research and development into new sources of energy. The need is there; the necessary technological capabilities are available; but the market must be created. It is in this latter area that the government can and must play a key role with respect to solving our national energy problems.

The Government Role in Creating an Operable Market

At the present time—and speaking specifically with reference to our immediate energy problems—the United States does not have an aggregated market through which the capabilities of our industrial R&D community can be channeled and directed toward the solution of our energy problems. There is no centralized federal organization or agency—no aggregated procurement infrastructure—to which a qualified supplier of applicable research and development capability can go to "sell" his services. There is no readily identifiable or well-defined "customer" who can define the requirements for energy R&D, generate comprehensive planning data for a coherent energy R&D program, coordinate the numerous fragmented energy R&D activities now ongoing or contemplated, or provide that overall policy guidance and administrative direction of the total effort that is necessary if our national goals and objectives in the area of energy resource utilization are to be fulfilled in an efficient and timely manner.

The Energy Research and Development Administration as proposed in H. R. 11510 embodies the functional concept of a centralized governmental agency which is necessary to create an operable market focal point for energy R&D effort by U. S. industry. Although my comments here are oriented more toward the functional need for such an agency, the bill does appear to provide the appropriate organizational structure for meeting the basic objectives which in my view are required if we hope to get a coherent national program of energy R&D underway quickly and effectively.

Although many of the technological details involved in our energy problem are of course different from those which this nation faced in the

Sputnik period of the late 1950's, there are also many similarities in the concentrated technical content of the challenge, the requirement for widely diversified research and development by industry, and the extreme urgency for taking appropriate and timely action. In this sense, it would appear that the highly successful results we have enjoyed as a result of the creation some fifteen years ago of the National Aeronautics and Space Administration can indeed be taken as a valid precedent for the creation now of a "NASA for Energy" so to speak. Just as NASA provided that operable market for the planning, R&D, procurement, and implementation of our civilian space program, so should ERDA now be created to fulfill our urgent need for a centralized procurement and administrative agency to manage and direct a vitally-needed program of research and development into energy production, conversion, distribution, and consumption on a comprehensive and long-range basis.

As I suggested in the opening portion of my statement, the rapid initiation of such a coordinated program of research and development is imperative, but the effort must be recognized as a very long-term undertaking which will call for a continuity of planning and support well into the next century. The sooner we begin, the sooner we can expect useful results to appear to ease our existing shortages of energy resources. This nation cannot afford to be limited in its growth and development—and in its ability to defend itself militarily—by a continued shortage of the energy resources which our economy demands.

Even while ERDA is in the legislative process of being created, it is most timely to exercise precautionary foresight to avoid raising unintentional barriers that might otherwise block or hinder the application of our industrial research and development resources to the federal energy R&D program. If we are to create an organizational structure and an environment which is conducive to attracting and utilizing the best abilities of our scientific and technological community—academic and governmental, as well as industrial—we must take care to avoid policies

and practices that might unintentionally hinder the timely application of such research and development capabilities.

Avoidance of Unintentional Barriers

As an executive of an industrial company which has been applying advanced technology to defense and space projects for the government for over twenty years, a few words of caution may be in order with respect to avoiding potential barriers to tapping industry know-how for energy R&D. To provide—through ERDA—the goals, programs, funds, and overall direction for energy R&D is obviously a sound approach in my opinion. This must be coupled, however, with carefully shaped procurement policies which will maximize the motivation of industry to participate in the federal energy R&D program, rather than to discourage or hinder such involvement by industry. A few brief examples may help to emphasize this point.

Arbitrary restrictions on the recovery of industry's independent research and development and bid and proposal costs, if applied to energy R&D contracts, would tend to drive potential contractors away from the energy business. Such company-initiated efforts are an essential element of industry's technology-oriented business enterprise. Undue cost recovery restrictions erode the fair profit potential or even force contracts into a net loss position, and would cause industry to withdraw from ERDA business. If industry is to be attracted to the energy R&D business area, it should be clearly evident that ERDA will not adopt arbitrary constraints, such as "relevancy tests" or percentage limitations, for determining the allowability of IR&D/B&P costs.

For example, the existence of such policies within the Atomic Energy Commission is presently causing industrial contractors to elect not to pursue AEC R&D contracts for just this reason. With the even broader industrial and commercial scope of the energy R&D program, more commercially-oriented contractors would almost surely decide against pursuing marginal or unprofitable contract opportunities if ERDA

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adopts such policies as have been embraced by the AEC in recent years.

Due to the wide range of scientific and technological disciplines involved in the solutions to our energy problems, and the broad spectrum of industrial and commercial activities involved in the realization of workable solutions, it would seem advisable for ERDA to make the widest possible use of this country's diversified industrial research and development capacity, in much the same fashion as NASA has implemented the national space program through broad use of industrial contractor resources. While our excellent government laboratories, and our government owned/contractor operated facilities, will undoubtedly be very useful in particular aspects of the federal energy R&D effort, precautionary measures should be taken to avoid an over-reliance on "in-house" government operations as a means of sovling the energy problem. Reliance on private industry to the maximum extent possible is sound national policy and should be so implemented by ERDA in solving our energy problems on an effective and lasting basis.

As a final example, the policy for assignment of patent rights can be a key motivating factor as to whether industry pursues or avoids business with ERDA. Positive motivation is provided by policies which assign industrial contractors the rights to their inventions or discoveries arising out of work performed under contracts with ERDA, with exclusive licenses for the use of such inventions and discoveries going to the government, as is the case in Department of Defense patent policy. The lack of pre-stated policy determination as to where patent rights will flow, or the wrong policy, would cause serious reservations and tend to discourage industrially and commercially oriented contractors from pursuing ERDA business.

While the patent provisions called out in H. R. 11510 appear to be generally acceptable, explicit policy should be enunciated that ERDA contractors will take title to their patent rights, rather than leave this for clarification when energy R&D contracts are being negotiated on a case by case basis.

Conclusion

In closing this statement, I would like to summarize by reiterating that it seems clear to me that the United States is presently faced with a most serious energy research and development challenge. The science and high technology industrial community of the nation has readily available and directly applicable technological capabilities and resources to meet this challenge. The proposed Energy Research and Development Administration will meet the urgent need for the government to provide an organizational focal point for the creation of an operable market through which U.S. industry can bring its capabilities to bear on the energy R&D challenge. However, in so doing, precautionary foresight is necessary to ensure that ERDA's procurement policies do not create unintentional barriers but instead attract and stimulate the fullest participation by industry.

Since a fully mobilized energy research and development program is the first prerequisite step to this nation's achieving its goal of self sufficiency in energy as soon as possible, it is my sincere hope that the legislation embodied in H.R. 11510 to create the Energy Research and Development Administration will be expediently enacted by the Congress.

November 29, 1973
Redondo Beach, California

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HON. CHET HOLIFIELD

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Babcock & Wilcox

161 East 42nd Street, New York, N.Y. 10017
Telephone: (212) 687-6700

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HON. CHET HOLIFIELD

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November 27, 1973

The Honorable Chet Holifield
U.S. House of Representatives
Washington, D.C. 20515

Dear Congressman Holifield:

I am pleased to have the opportunity to reply to your request for comments on H.R. 11510.

There is no question that our country needs a basic policy on energy that gives emphasis to energy-related research and development. The efficiency of energy conversion must be addressed. The improvement in efficiency of electrical equipment, including the generation and transmission of electrical energy, is one area to which R&D effort should be specially directed.

While the more effective use of present energy sources is clearly called for, we believe R&D effort should be applied to new sources. This includes a stepped-up program for the construction of coal gasification plants and the expansion of R&D for oil shale, geothermal and solar energy. We believe that Senator Jackson's long-range proposal of $20 billion over a ten-year period for energy R&D is much more realistic than the Administration's proposal of $10 billion, and the fair allocation of R&D monies to nuclear, fossil and advanced energy systems within the energy R&D agency is also clearly called for.

We note that the bill seeks to bring about part of what was originally proposed in H.R. 9090, an Energy Research and Development Administration and a separate Nuclear Energy Commission.

We are in favor of this approach and strongly recommend the immediate passage by the Congress of H.R. 11510, with the following reservations:

The creation of a Nuclear Energy Commission to handle regulatory safety research, environmental and waste programs and material safeguard programs leaves some question in our minds. As we enter an era in which there will be less competition between power sources as there will be careful planning, it is not clear why two key agencies are needed. Perhaps, an expansion of the Federal Power Commission with the addition of some existing AEC Commissioners would be more effective in overseeing the entire power regulatory function. In the licensing process for nuclear power plants, any move which would improve the time required while maintaining necessary safety factors is desperately needed.

We note that the energy R&D administration which would also be made up of part of the current AEC will apparently assume the contracting systems for naval nuclear fuels that is now administered by the AEC. We believe this raises many questions concerning the possible effects on contract terms, approval cycles, levels of staffing and funding, etc. Also, what will be the role of the Director of Naval Reactors in ERDA?

Finally, as you note, a joint government-industry effort in the overall energy areas is very clearly called for. It is needed to avoid developing a national energy policy which would create goals that are not in concert with the well-being of the nation as a whole. Because of this and in view of the continually changing technology, it would appear strongly advisible to involve knowledgeable public groups as responsible representatives to participate in the development of such a policy.

Sincerely,

George G. Zapf
Chairman and President

GGZ/mc

AREA 415
DA 2-1439

JOHN G. MEITNER

120 EAST CREEK DRIVE
MENLO PARK, CA. 94025

November 28, 1973

RECEIVED
NOV 30 1973
HON. CHET HOLIFIELD

Hon. Chet Holifield, Chairman
Committee on Government Operations
U. S. House of Representatives
Washington, D. C. 20515

Dear Mr. Chairman:

Thank you for your letter of November 14 and your invitation to attend the energy hearings on November 27 - 29; unfortunately, I was unable to do so, and I attach a statement for the record instead.

There is a concern which I should like to discuss with you when next in Washington: the homework conducted by the Administration on energy conservation options is rather thin, and impact statements, technology assessment statements and trade-offs are lacking. It may be necessary to provide this vital information through study elsewhere.

With many thanks for your invitation and with best wishes,

Cordially,

JGM:ss
Att.

STATEMENT OF DR. JOHN G. MEITNER
CONSULTANT IN SCIENCE AND SPACE TECHNOLOGY
MENLO PARK, CALIFORNIA

I welcome this opportunity to state my views on a particular point of concern I have in regard to your five-year plan within the proposed ERDA effort; specifically I am concerned with what appears to me a low-level budget for the work on solar energy.

If I divide the solar energy effort broadly into the categories of far-term pay-offs and near-term applications, I find in the first category such items as a photovoltaic energy conversion, and I surely feel that you must fund research in these and other far-term areas, even though fundamental breakthroughs may be required to permit practical use, and, the pay-offs are a long time away.

My major concern here is with the second category of our solar energy effort, including such applications as heating and cooling of buildings, that is here and now quite practicable in some of the western and southwestern parts of the United States (and is moreover based on simple and old-hat technology); I similarly find in this near-term category some schemes of converting solar heat to electricity, and I find these also based on present art and technology. I feel very strongly that the best and perhaps the only way to bring about a quick and fruitful adoption of these techniques by the industrial and utility sector is via immediate and substantive demonstration programs conducted by the Federal government. The cost of a few of these demonstration programs that appear promising to me is perhaps double your total budget for the solar energy effort of ERDA's five-year plan (and, moreover, leaves no coverage for the far-out research effort in the first category). For this reason, I urge you to increase substantially ERDA's budget for the on-coming five-year solar energy effort -- -- I would propose a minimum of 500 million dollars to be budgeted at this time, and, to leave yourself open for a hard-headed review some two years from now, where encouraging results will hopefully prompt you to provide even greater funding.

I would like to express here my confidence in your effort and hence my confidence in solving what is perhaps one of the greatest and one of the most difficult problems that has confronted this nation. Your enthusiasm and tenacity are unparalled among many technology efforts previous Congresses have made within the past 30 or so years of my association with you in important technical efforts. I wish to thank you for the unfaltering manner in which you have provided leadership in this difficult task, and I wish to thank you for the opportunity to express my thoughts to you.

EDGENE ZWOYER, *Executive Director*

JAN 7 1974

AMERICAN SOCIETY OF CIVIL ENGINEERS

WASHINGTON, D. C. OFFICE
1625 EYE STREET N.W., WASHINGTON, D. C. 20006 (202) 785-4454

November 27, 1973

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HOUSE COMMITTEE
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GOVERNMENT OPERATIONS

The Honorable
Chet Holifield
Chairman, Committee on Government Operations
House of Representatives
Washington, D.C. 20515

My dear Mr. Holifield:

Your invitation to submit a statement for the record of hearings on "Project Independence" is appreciated.

The American Society of Civil Engineers is a professional association of 68,000 civil engineers from private practice, industry, government, and the academic community. The objective of our Society is the advancement of the science and profession of engineering to enhance the welfare of mankind.

In response to recognition of the importance and urgency of expeditious and effective progress in meeting the energy research and development needs of the Nation, some 70 persons knowledgeable and actively concerned in that subject met during the week of July 15-20, 1973 for the purpose of assisting in attainment of that objective. Members of the American Society of Civil Engineers were prime movers in this Engineers Foundation Conference on Energy Research, Development and Demonstration.

Speaking for the Engineering Foundation Conference, William C. Ackerman, a civil engineer and member of ASCE, who was General Chairman, summarized the findings and recommendations as follows:

"A serious energy problem exists in the United States, and if massive attention, talent, and funds are not devoted to it at once, serious consequences to our national security, economy, life style and environment will result. The problem has immediate, short, medium, and long term dimensions.

Energy research, development and demonstration are central to solution of our national energy problem. Although there are numerous excellent programs underway, we find that these are highly fragmented, underfunded, unbalanced, and that the overall program lacks policy, leadership, and plans.

The Conference recommends that an intense, directed, national and regional program of research, development, and demonstration (R.D. & D.) be initiated at once. Organizational units are proposed which can be established quickly and are adequate at this time. . . "

A copy of the report with the letter submitting it to the President is enclosed herewith. The recommendations are as timely and pertinent now as when written four months ago. They should be especially valuable to the committee at this time in its consideration of H.R.11510 and H.R. 9090 and are submitted for this purpose.

It is requested that this letter and enclosure be included in your record of hearings.

Very respectfully,

Louis L. Meier, Jr.
Washington Counsel, ASCE

LLM:sed
enclosures
cc: The Honorable Benjamin S. Rosenthal
The Honorable Jim Wright
The Honorable Fernand J. St Germain
The Honorable Don Fuqua
The Honorable William S. Moorhead
The Honorable Robert E. Jones
The Honorable Frank Horton
The Honorable John N. Erlenborn
The Honorable John W. Wydler
The Honorable Clarence J. Brown
The Honorable Richard W. Mallary

ENGINEERING FOUNDATION CONFERENCES
ENGINEERING FOUNDATION, 345 East 47 Street, New York, New York 10017 • (212) 752-6800, Ext. 294

July 20, 1973

Hon. Richard M. Nixon
The White House
Washington, D. C.

Dear Mr. President:

Pursuant to decision of the Engineering Foundation Conference on Energy Research, Development, and Demonstration, its report is respectfully transmitted herewith. The report presents findings and conclusions regarding principles and policies for organization and management of the energy research functions of the Federal Government.

In response to recognition of the importance and urgency of expeditious and effective progress in meeting the energy research and development needs of the Nation, some 70 persons knowledgeable and actively concerned in that subject met during the week of July 15-20, 1973 for the purpose of assisting in attainment of that objective. To that end, the conference has formulated recommendations that may be a basis for consideration and action in the public and the private sectors. These are set forth in the report, together with summaries of the deliberations from which they emerged.

While we recommend immediate acceleration of the coal research program, another recommendation is that a White House Conference on Energy Research, Development, and Demonstration be convened in the early future. It would provide opportunity for communication of the views and advice of the many able and deeply concerned representatives of public and private interests. A White House Conference would also enhance public understanding of energy problems and of what research and development can do for preservation and enhancement of the quality of life through provision of adequate energy supplies along with protection of environmental and social values.

The conference respectfully urges that you and officials of your administration favorably consider the recommendations presented in the conference report. We trust that our efforts will prove to be helpful to you and to all who are engaged in meeting the Nation's overwhelmingly important energy problems.

Respectfully,

William C. Ackermann

William C. Ackermann
General Chairman
Conference on Energy Research,
Development, and Demonstration

ENGINEERING FOUNDATION CONFERENCE

ON

ENERGY RESEARCH, DEVELOPMENT, AND DEMONSTRATION

Summary - Findings and Recommendations

A serious energy problem exists in the United States, and if massive attention, talent, and funds are not devoted to it at once, serious consequences to our national security, economy, life style and environment will result. The problem has immediate short, medium, and long term dimensions.

Energy research, development and demonstration are central to solution of our national energy problem. Although there are numerous excellent programs underway, we find that these are highly fragmented, underfunded, unbalanced, and that the overall program lacks policy, leadership, and plans.

The Conference recommends that an intense, directed, national and regional program of research, development, and demonstration (R.D. & D.) be initiated at once. Organizational units are proposed which can be established quickly and are adequate at this time. Their operational considerations are outlined.

A research, development, and demonstration effort at a billion dollars per year has been proposed by the President and from within Congress. If properly phased, this appears to be a reasonable initial effort.

The President is urged to convene a White House Conference on Energy to enhance public understanding, but timed so as not to impede implementation of Conference recommendations.

Operational Considerations

The R.D. & D. program must essentially be concerned with the equation: Supply = Demand. The program will be equally concerned with both sides of the equation, although equal funding may not be required on both sides. The program should be concerned with testing and demonstrating alternative courses of action in priority order while maintaining environmental quality, societal objectives and reasonable reserves.

Leadership must be exercised by the federal government using broadly representative advice and participation, and employing both public and private expertise and facilities.

The program must be concerned with immediate, short range (3-5 years) mid-range (5-15 years) and long range (15 years - end of fossil era).

The supply R.D. & D. must be concerned with all conventional fuels, conversions, and deliveries that are commonly recognized as well as environmental and social matters. It should also be equally concerned with unconventional sources and approaches for long range application. Attention must be devoted to creating incentives and streamlined contractual procedures and patent interests.

The demand R.D. & D. must be concerned with utilization, conservation, environment, economics, incentives, and education. It must utilize fully the social and behavioral sciences.

The program must be conducted in an open manner with attention to public information and opportunities for formal and informal input from the public.

There must be continuous overview of the R.D. & D. program from the perspective of total energy considerations and national objectives.

Planning and program evaluation coupled with needed adjustments in priorities or programs must be a major characteristic.

The R.D. & D. program must be a judicious mix of governmental, joint government/private, and private enterprises. Experience in the energy field, particularly, emphasizes the desirability of heavy use of the private sector for innovation and rapid transfer of new technology to commercialization.

Collection, analysis, and dissemination of data on manpower, fuel resources, and other pertinent factors as well as demands should be maintained on a regional, national, and international basis.

Universities should be encouraged to become heavily involved in energy R.D. & D. by conducting research and by developing qualified manpower in the technical, social, and managerial fields.

The Conference strongly favors competition while avoiding unnecessary duplication among qualified R. & D. entities whether within government, university, industrial, or private firms as a means of stimulating innovation, flexibility, and quality of R. & D. product.

We believe that the current generation of R.D. & D. programs and projects are sufficiently well identified that they should be undertaken without delay, but subject to the simultaneous establishment of planning, monitoring, and review processes. An example of an area urgently requiring attention is coal research and its conversion to cleaner and alternate forms.

Management Options

Discussions at the Conference included numerous administrative suggestions - only three elements of which are set forth in this report. These must be staffed and advised by individuals broadly representative of the industry and the various public interests.

Meanwhile, a strong concensus evolved with regard to several principles of energy organization. One is that planning, implementation, and regulation must

be administratively separated. A further point is that the weapons function should be clearly separated from energy research.

The Conference recognizes that at various times in our national history circumstances have required, and we have successfully forged new technicalogical organizations. The Manhattan Project, the AEC, and NASA are successful examples of these. Yet, while these are examples of our organizational and managerial genius, they are not appropriate models of the organization required for energy at this time.

The Conference also recognizes that many institutional arrangements are both possible and have been proposed for energy R.D. & D. and the numerous and important related fields. The Conference feels that it is critically important that we not lose time in debating and deciding upon the optimum or ultimate total institutional arrangement. Therefore, it proposes that the three organizational elements for which it sees a clear need be established at once with further organizational form evolving if this proves desirable. Specifically we propose:

1. An Energy Policy Council be established in the office of the President. This is viewed as a small, powerful, and essential body comparable to the Council of Economic Advisors or the Council on Environmental Quality. This Board would advise the President on all matters concerning energy including planning, evaluation, and priorities; the R.D. & D. agency, and related elements throughout government; and the relations and implications of all energy matters to national policy, objectives, and programs.

2. An Energy Research, Development and Demonstration Agency be created as an independent agency with location in government comparable to the present NASA, AEC, or NSF.

3. A National Energy Research, Development and Demonstration Planning Body be created with responsibility to concentrate on energy R.D. & D. national strategy and separated from the ongoing tactical operational programs of the independent Energy Research, Development and Demonstration implementing agency. A major characteristic of this Planning Body would be the wide and very strong mix of government and industry representatives; of those concerned with supply of and demand for energy; and of those concerned with environment, quality of life and life-styles. While initially this R.D. & D. planning agency should be a separate organization, its ultimate organizational locus would be determined by experience.

About the Conference

The Engineering Foundation Conference on "Energy Research-Management Alternatives to meet Regional and National Needs" met at New England College, Henniker, New Hampshire during July 15-20, 1973. The Conference organization, the six supporting work group reports, the list of participants, and the invited papers are contained in companion documents.

The Conference participants of some 75 persons were not only concerned with the subject issue, but brought together a wide variety of backgrounds. This was enhanced by documents provided from recent reports primarily from the Legislature and Executive branches of the federal government. Our deliberations were prefaced and greatly stimulated by a number of prominent invited speakers.

The findings and conclusions are the responsibility of the individual conferees. While not every individual may fully agree with every point, broad concensus was obtained in the findings and recommendations expressed here.

It should be ehmpasized that the conference was concerned with research, development, and demonstration; but this was considered with reasonable appreciation of the much larger total energy question which is far more complex and almost boundless. There was also a conscious effort to consider previous national efforts in advanced technology and the potential roles of branches and levels of government, the private sector, the universities, and other groups.

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