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International Bilateral and Multilateral Arrangements in Energy Technologies

July 1978

U.S. Department of Energy
Assistant Secretary for International Affairs
Office of International Affairs

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Table of Contents

Table of Contents (continued)

Exhibits

Introduction

The Office of International Affairs of the Department of Energy (DOE) issues periodic status reports covering all major international energy research and development (R&D) activities in which DOE is involved. To provide a framework for the status reports, a series of background documents is being prepared.

This document, the second report in the series,* outlines current DOE international commitments under bilateral and multilateral arrangements, as of January 1, 1978. Included are bilateral agreements for cooperation in the civil uses of atomic energy with countries and international organizations, bilateral and multilateral technical exchanges in all energy technology areas, and multilateral agreements under the auspices of the International Energy Agency (IEA).

In addition to outlining the terms, scope, and status of these agreements, this document describes DOE's participation in the work of the major international energy organizations: IEA, the International Atomic Energy Agency (IAEA), and the Nuclear Energy Agency (NEA). Future reports will update the status of ongoing cooperative projects and provide information on new energy R&D activities.

*The first report in the series was ***International Energy Agency: Background and Current Activities,*** prepared by Office of International Affairs, Energy Research and Development Administration (ERDA 77-21), December 1976.

Agreements for Cooperation in the Peaceful Uses of Atomic Energy

Under the authority of Section 123 of the Atomic Energy Act of 1954, the United States has entered into a number of bilateral agreements with countries and international organizations on the peaceful uses of atomic energy. Under these agreements, which DOE inherited from the Atomic Energy Commission (AEC) and the Energy Research and Development Administration (ERDA), the United States may export production and utilization facilities (e.g., research and power reactors) and source and special nuclear materials (e.g., enriched uranium and plutonium). The agreements contain guarantees against the use of transferred facilities and materials for nuclear weapons or any other military purpose, and provisions for safeguards to verify compliance with such guarantees.

The bilateral agreements may involve exchange of information and materials related to nuclear-power production only, exchange of information and materials related to research reactors only, or both. Most of the 28 agreements now in effect cover both research and power reactors.

The major provisions of the agreements generally fall into two categories: those that provide the enabling framework to permit an activity to occur; and those that specify terms, conditions, or controls that apply when an activity is undertaken. Typically, the articles of these agreements include:

- Preamble
- Definitions
- Basic conditions (i.e., applicability of laws and regulations in effect)
- Provisions for unclassified information exchange
- Provisions for transfer of nonfuel material and equipment
- Disclaimer of responsibility for other party's use of material, equipment, and information
- Provisions for participation by persons under jurisdiction of parties
- Fuel-supply framework
- Fuel-supply conditions
- Guarantees of peaceful and authorized uses
- U.S. safeguards rights
- Application of IAEA safeguards while United States rights are suspended
- Extension of provisions to superseded agreement.

Exhibit 1 lists the current agreements for cooperation in the peaceful uses of atomic energy.

Exhibit 1

Agreements for Cooperation in the Peaceful Uses of Atomic Energy

Country	Scope	Effective Date	Termination Date
Bilaterals with Individual Countries			
Argentina	Research and power	July 25, 1969	July 24, 1999
Australia	Research and power	May 28, 1957	May 27, 1997
Austria	Research and power	January 24, 1970	January 23, 2014
Brazil	Research and power	September 20, 1972	September 19, 2002
Canada	Research and power	July 21, 1955	July 13, 1980
China, Republic of	Research and power	June 22, 1972	June 21, 2014
Finland	Research and power	July 7, 1970	July 6, 2000
India	Power (Tarapur)	October 25, 1963	October 24, 1993
Indonesia	Research	September 21, 1960	September 20, 1980
Iran	Research	April 27, 1959	April 26, 1979
Ireland	Research	July 9, 1959	July 8, 1978
Italy	Research and power	April 15, 1958	April 14, 1978
Japan	Research and power	July 10, 1968	July 9, 2003
Korea	Research and power	March 19, 1973	March 18, 2014
Norway	Research and power	June 8, 1967	June 7, 1997
Philippines	Research and power	July 19, 1968	July 18, 1998
Portugal	Research and power	June 26, 1974	June 25, 2014
South Africa	Research and power	August 22, 1957	August 21, 2007
Spain	Research and power	June 28, 1974	June 27, 2014
Sweden	Research and power	September 15, 1966	September 14, 1996
Switzerland	Research and power	August 8, 1966	August 7, 1996
Thailand	Research and power	June 27, 1974	June 26, 2014
Turkey	Research	June 10, 1955	June 9, 1981
Venezuela	Research and power	February 9, 1960	February 8, 1980
Vietnam, Republic of	Research	July 1, 1959	June 30, 1979
Bilaterals with International Organizations			
European Atomic Energy Community (EURATOM)	Joint nuclear power program	February 18, 1959	December 31, 1985
	Additional agreement to joint nuclear power program	July 25, 1960	December 31, 1995
IAEA	Supply of materials	August 7, 1959	August 6, 2014

Bilateral and Multilateral Technical Exchange Arrangements

Under the authority of the Atomic Energy Act of 1954, the Energy Reorganization Act of 1974, and the Department of Energy Organization Act of 1977, DOE has entered into bilateral and multilateral arrangements with corresponding foreign entities for the exchange of technology for specific programs. The purpose of these arrangements is to provide a means for acquiring technology through the exchange of information and the conduct of joint projects. Specifically, these arrangements provide a mechanism for increasing the technology base, technical manpower, and expertise of the participants; reducing financial burdens on the United States; and accelerating technical progress.

Most of the bilateral and multilateral technical exchange arrangements specify cooperation in a particular technology. However, specific technical activities with Japan and the USSR are conducted under broad umbrella agreements on cooperation in the field of energy and in the peaceful uses of atomic energy.

The forms of cooperation typically involve exchange of scientific and technical information, research and development (R&D) methods and results, personnel, samples, materials, instruments, and components for testing. In addition to the joint projects, visits, seminars, and meetings are held in cooperating countries.

The cooperative efforts are generally managed by a joint coordinating committee, which consists of participants from the two signatories to the agreement. The joint committee is expected to meet annually to evaluate the status of cooperation, a process that involves performing a comprehensive review of each party's program status and plans, assessing the balance of exchanges in the various technical areas of cooperation, and considering measures required to correct any imbalances.

At present, DOE is involved in 39 technical exchange arrangements.

Memorandum of Understanding in Nuclear Energy

Signatories: **United States,** DOE
Canada, Atomic Energy of Canada, Ltd.

Term: **1976-1980**

Current Scope and Status of Activities

Under the provisions of the memorandum of understanding in nuclear energy, cooperative efforts are proceeding in the areas of radioactive waste management and systems analysis of heavy water power reactors. Under waste management, specific areas for study include: terminal storage in geologic formations; retrievable storage; waste processing; and environmental effects. Under systems analysis, specific areas include: economic data; reactor-system, power-plant, and associated fuel-cycle characteristics; plant design and regulatory criteria; fuel-cycle and support facilities; and systems-analysis assessment and methodology.

Agreement in the Field of Liquid Metal-Cooled Fast Breeder Reactors (LMFBR)

Signatories: **United States,** DOE
Federal Republic of Germany, Federal Ministry for Research and Technology

Term: **1976-1986**

Current Scope and Status of Activities

The purpose of this agreement is to develop solutions to problems related to the design, development, construction, and operation of LMFBRs.

The agreement provides for the exchange of technical information, personnel, equipment, materials, seminars, and visits in the areas of:

- Reactor neutronics
- Fuels and materials
- Fuel recycle
- Reactor and reactor coolant system components
- Coolant technology
- Nonnuclear test facilities in support of LMFBR programs
- Quality assurance and nondestructive test procedures
- Design and operation of LMFBRs
- Economic and environmental considerations in the development of LMFBRs
- Reactor safety.

The joint coordinating committee is expected to meet annually and is responsible for the implementation, coordination, and review of activities carried out under the agreement.

Agreement on Cooperation in the Field of Radioactive Waste Management

Signatories: **United States,** DOE
Federal Republic of Germany, Federal Ministry for Research and Technology

Term: **1974-1979**

Current Scope and Status of Activities

The purpose of this agreement is to establish a reasonably balanced exchange of radioactive waste-management technology. The agreement provides for exchange of technical information, personnel, visits, and joint projects in the areas of:

- Disposal of radioactive wastes in salt deposits
- Retrievable surface-storage facilities
- Waste-management research and development
- Waste from decommissioning of nuclear installations
- Operating aspects of storage or disposal of low- and intermediate-level waste.
- Transportation of radioactive waste.

Agreement in the Field of Gas-Cooled Reactor Concepts and Technology

Signatories: **United States,** DOE
Federal Republic of Germany, Federal Ministry for Research and Technology
France, Atomic Energy Commission
Switzerland, Office of Science and Research

Term: **1977-1987**

Current Scope and Status of Activities

The signatories to this agreement are seeking solutions to problems related to the design, development, construction, and operation of gas-cooled reactors (GCR). The agreement provides for the exchange of technical information, personnel, equipment, materials, seminars, and visits in the areas of:

- GCR technology development (including fuels, materials, components, fission products, and coolants) and design, construction, and operation of test, prototype, and demonstration plants
- High-temperature GCR fuel recycle
- High-temperature GCR steam recycle
- High-temperature GCR direct cycle
- Very high-temperature reactor and process heat
- Gas-cooled fast breeder reactor technology (including components, fuel fabrication, and testing), and design, construction, and operation of test, prototype, and demonstration plants
- Safety
- Economic and environmental studies.

Implementation, coordination, and review are the responsibility of the joint coordinating committee, which meets annually.

Agreement in the Field of Liquid Metal-Cooled Fast Breeder Reactors

Signatories: **United States,** DOE
France, Commissariat a l'Energie Atomique (CEA)

Term: **1977-1982**

Current Scope and Status of Activities

Under this bilateral agreement, France and the United States will exchange technical information, personnel, equipment, materials, seminars, visits, and undertake joint projects on LMFBRs, specifically in the areas of reactor physics and safety.

The execution of this agreement will be supervised by a joint coordinating committee, which is expected to meet annually.

Memorandum of Understanding for Cooperation in Joint Research and Solar Thermal Conversion Systems

Signatories: **United States,** DOE
France, French National Center for Scientific Research

Term: **1976-1978**

Current Scope and Status of Activities

The following scope of activities was agreed upon in the memorandum of understanding:

- Information exchange on research regarding the design and prototype construction of solar cavity boilers
- Cooperation in the study, research, and evaluation of solar energy components, subsystems, and systems for the thermal conversion of solar energy into electric power
- Testing and evaluation of several prototype components such as radiation receivers and cavity boilers/subheaters, as well as ancillary controls and equipment. These tests are being conducted at the French solar test facility in Odeillo, France. In 1976, tests were conducted at Odeillo on a U.S. 1-MW cavity boiler.

Proposed Activities

France is planning to test its own solar boiler in a 5-MW solar thermal test furnace being planned for DOE's Sandia Laboratory in Albuquerque, New Mexico.

Memorandum of Understanding for Cooperation on Certain Safety Aspects of Solar Towers

Signatories: **United States,** DOE
France, French National Center for Scientific Research (CNRS)

Term: **1977-1979**

Current Scope and Status of Activities

The following scope of activities was agreed upon in the memorandum of understanding:

- DOE (at Sandia Laboratories) will test flux intensity measurements of single heliostat beams vs distance at ground level and characterize, by means of aircraft flyovers, the quality and quantity of light reflected into the airspace above the field of focused heliostats
- CNRS will conduct similar tests at Odeillo
- Test plans will be exchanged, and test data and analyses will be reviewed jointly.

Arrangement to Exchange Information on the Utilization of Energy from Geothermal Sources and Amendment

Signatories: **United States,** DOE
Iceland, Icelandic National Energy Authority

Term: **1973-1978**

Current Scope and Status of Activities

The current scope of activities provides for the two participating countries to exchange information. Specifically, the United States has agreed to provide information related to:

- Operating experience from any steam plant at The Geysers, California
- New exploration and resource assessment methods
- Development of binary cycles
- Use of hydrothermal systems
- Energy recovery from hot dry rock
- Production of fresh water from saline geothermal fluids
- Systems analysis of techniques for utilization of geothermal energy.

Iceland has agreed to provide information on:

- Engineering and operating experience in process heating
- Electricity generation from geothermal sources
- Geophysical prospecting, well completion, stimulation of wells, and use of downhole pumps.

A 1974 amendment to the arrangement expanded the original scope of activities to include cooperation in undertaking joint projects in any of 10 specific technology areas related to applications of geothermal energy.

Agreement Concerning Cooperative Information Exchange Relating to the Development of Geothermal Energy

Signatories: **United States,** DOE
Italy, Italian National Research Council (CNR) in cooperation with the Ente Nationale per l'Energia Elettrica (ENEL)

Term: **1976-1981**

Current Scope and Status of Activities

The bilateral agreement on the development of a geothermal data base calls for computerized information exchange, at 4-month intervals beginning July 1, 1976, on the location, size, and characteristics of geothermal wells and fields, bibliographic information, and heat transmission data. Italy and the United States have agreed on a common format for exchanging data and have designated representatives to coordinate implementation of the agreement.

Proposed Activities

To establish a data base, the United States will collect data on the Americas, Oceania, Iceland, and Asia (except for the USSR); CNR/ENEL will collect data on Europe (except for Iceland), Africa, and the USSR.

Agreement on Cooperation in the Field of Geothermal Energy Research and Development

Signatories: **United States,** DOE
Italy, ENEL

Term: **June 3, 1975-June 2, 1980**

Current Scope and Status of Activities

Italy and the United States are conducting cooperative work in the following aspects of geothermal research and development:

- Stimulation of hot dry rock and hydrothermal reservoirs
- Reservoir physics and engineering
- Environmental control technology
- Utilization of hot brine resources
- Deep drilling.

The two countries will exchange scientists, information, meetings, visits, and project and experiment plans.

Agreement on Cooperation in the Field of Energy Research and Development

Signatories: **United States**
Japan

Term: **1974-1979**

Current Scope and Status of Activities

A broad umbrella agreement, signed July 15, 1974, by Takeshi Yasukawa of Japan and Secretary Henry Kissinger of the United States; covers cooperative efforts in the following areas:

- Solar energy applications
- Geothermal energy applications
- Storage batteries
- Gasification and liquefaction of coal
- Energy applications of hydrogen
- Magnetohydrodynamic conversion
- Fuel cells
- Electrical energy transmission by superconduction or microwaves
- Advanced propulsion systems
- Energy conservation
- Utilization of waste materials and waste heat
- Other areas relating to energy research and development as may be agreed.

Cooperation is expected to take the form of visits, meetings, information exchange, and joint projects. Specific projects in the areas outlined in the umbrella agreement will be implemented by interagency protocols.

Currently, the United States and Japan are negotiating specific technical exchange arrangements in geothermal and solar energy. The two nations will soon undertake negotiations on battery and electric vehicle development.

Arrangement on Fast Breeder Reactors

Signatories: **United States,** DOE
Japan, Power Reactor and Nuclear Fuel Development Corporation

Term: **1969-1979**

Current Scope and Status of Activities

Japan and the United States are exchanging visits and documents on the development of LMFBRs. The exchange arrangement covers the following topics:

- Reactor physics
- Nuclear safety
- Fuels and materials
- Sodium technology
- Component development
- Plant experience.

Proposed Activities

Negotiations are in progress on a broadened agreement that will include fuel recycle, quality assurance, nondestructive practices, economic and environmental considerations, and safeguards technology and nuclear steam supply systems.

Agreement on Cooperation in Geothermal Energy R&D

Signatories: **United States,** DOE
Mexico, Comision Federal de Electricidad (CFE)

Term: **1977-1982**

Current Scope and Status of Activities

Under this agreement, CFE and DOE will conduct cooperative studies of the Cerro Prieto geothermal reservoir in Mexico. These studies may include:

- Analysis of geologic and hydrogeologic setting
- Geophysical studies
- Core sampling and well logging
- Isotope studies of geothermal fluid, shallow groundwater, and surface waters
- New methods of pressure measurement
- Subsidence measurements
- Monitoring of reservoir behavior
- Reinjection of waste water.

The objectives of these cooperative efforts, which will involve exchanges of experts, information, meetings, and project and experimental plans, are to develop an understanding of the nature and magnitude of geothermal energy resources, investigate the most economical and productive methods of exploiting this resource, and determine the impact of development on the reservoir's subsurface environment.

Definitive Agreement on Specific Projects in Coal Research

Signatories: **United States,** DOE
Poland, Polish Ministry of Mining (PMM)

Term: **June 30, 1977, until termination by mutual agreement**

Current Scope and Status of Activities

As part of the agreement between the government of the United States and the government of the Polish People's Republic on funding cooperative work in science and technology, signed in October 1974, the Marie Sklodowska Curie fund was established to support joint scientific and technological research projects, including coal research. This activity utilizes PL 480 funds* and some Polish funds. Total funding by the United States equals $6,550,000; funding by Poland totals $4,644,140.

The DOE-PMM agreement on specific projects in coal research implements the broader agreement between Poland and the U.S. The DOE-PMM agreement covers coal extraction and utilization research and development projects, specifically in the areas of coal liquefaction, mining technology, and coal gasification for MHD power generation. Poland will undertake R&D projects on the following topics and will provide semiannual progress reports and a final report on the following research projects:

- Test of suitability of pumps for high-parameter operation
- Catalysts for hydrogenation processes
- Coal extraction and ash removal from extracts on a laboratory scale
- Carbonization of solid residues from coal-liquefaction processes
- Effects of hydrogen-donor solvent and the proportion of extraction recycle solvent on coal extraction
- Noncatalytic coal liquefaction in the presence of hydrogen
- Coal combustion and gasification for MHD power generation
- Combustion of synthetic fuels for power generation.

Supervision of projects is the responsibility of designated project officers in each country.

*Special foreign currency.

Memorandum on Cooperation in the Peaceful Uses of Atomic Energy

Signatories: **United States,** DOE
Romania

Term: **Initiated in 1968, renewed periodically**

Current Scope and Status of Activities

A memorandum on cooperation in the peaceful uses of atomic energy provides for exchange of scientific personnel and information, principally in the basic nuclear sciences. This memorandum is currently in effect under the terms of the 1974 Cultural and Scientific Exchange Agreement.

Agreement Concerning a Cooperative Program on Radioactive Waste Storage in Deep Geologic Formations

Signatories: **United States,** DOE
Sweden, Swedish Nuclear Fuel Supply Company (SKBF)

Term: **July 1, 1977-June 30, 1980**

Current Scope and Status of Activities

The purpose of this agreement is to establish a cooperative program for field-testing experiments and techniques for measuring fluid movement through fractures in a granitic rock system. The abandoned Strupa mine in Sweden is being used to assess the suitability of such rock for storage of radioactive material.

Specific cooperative activities include investigation of:

- Temperature effects in granite
- Long-term effect of waste heat on fractured granite
- Fracture hydrology
- Methods for determining locations of fractures
- Properties of granitic rocks
- Method for measuring seepage rate in low-permeability rocks
- Virgin state of stress in fractured granitic rock mass.

Cooperation is taking the form of exchange of scientific information, visits, and personnel; joint meetings; provision of equipment for experiments by DOE; and site preparation by SKBF.

Letter of Agreement on Collaboration in Controlled Thermonuclear Research

Signatories: **United States,** DOE
United Kingdom, Atomic Energy Authority (UKAEA)

Term: **Ongoing since 1958**

Current Scope and Status of Activities

DOE and UKAEA are exchanging, on a routine basis, personnel and information on all aspects of basic fusion research. Specifically, this includes the areas of neutral beams and superconducting magnets, as well as other fusion technologies. On August 3, 1977, DOE loaned an ORMAK shell and core to the United Kingdom's Culham Laboratory for use in the upgrading of their HBTX-1 device for reversed field pinch experiments.

Agreement on Terms for Exchange of Information in Coal Technology

Signatories: **United States,** Department of the Interior
United Kingdom, National Coal Board

Term: **July 1, 1974-June 30, 1977 (automatic 2-year extensions)**

Current Scope and Status of Activities

The United States Department of the Interior and the United Kingdom National Coal Board are exchanging personnel, research material, and basic information on all aspects of coal utilization, from resource identification to end use, including:

- Identification of reserves
- Extraction technology
- Coal conversion
- Transport
- Utilization
- Impact of economic, legal, environmental, health, and safety requirements on the use of coal.

By letter agreement between the Administrator of ERDA and the Secretary of the Interior dated August 1975, ERDA agreed to participate in those program elements of the Agreement that fall within the purview of ERDA (now DOE).

Agreement in the Field of Liquid Metal-Cooled Fast Breeder Reactors

Signatories: **United States,** DOE
United Kingdom, UKAEA

Term: **1976-1981**

Current Scope and Status of Activities

The purpose of this agreement is to establish a reasonably balanced exchange of LMFBR technology. The United States and the United Kingdom will exchange technical information, materials, personnel, and equipment and organize joint seminars and visits in the areas of:

- Reactor neutronics
- Fuels and materials
- Fuel cycle
- Reactor and sodium systems and components
- Sodium technology
- Nonnuclear test facilities that support LMFBR programs
- Quality assurance and nondestructive practices
- Reactor safety
- Overall LMFBR programs of the United Kingdom and the United States
- Operation of LMFBRs
- Topics of interest in industry
- Economic and environmental considerations.

Implementation is governed by the joint coordinating committee, which is expected to meet annually to assess the balance of exchanges and review the status and plans of each country's LMFBR program. An activity of major importance is the proposed irradiation of several hundred U.S. and United Kingdom fuel pins in the United Kingdom prototype fast reactor, to be followed by post-irradiation testing in the United States.

Agreement on Cooperation in the Field of Energy

Signatories: **United States**
Union of Soviet Socialist Republics (USSR)

Term: **June 28, 1974-June 27, 1979 (with automatic 5-year extensions)**

Current Scope and Status of Activities

The objectives of this umbrella agreement are to accelerate energy research and development through cooperative efforts and to improve mutual understanding of each country's national energy programs and outlooks. Forms of cooperation include exchange of technical information, scientists, and specialists, as well as joint work and joint seminars. Cooperative activities are implemented by the Joint Committee on Energy and executive agents.

Nine projects implemented by joint groups of experts were transferred from the 1972 Agreement on Cooperation in the Fields of Science and Technology; one was transferred from the Environmental Protection Agreement. Specifically, these projects include:

- Thermal power stations
- Hydroelectric power stations
- Heat-rejection systems
- Power-plant pollution reduction
- Ultra-High Voltage and High Voltage Direct Current transmission technology
- Electric power systems
- Superconducting transmission technology
- Magnetohydrodynamics
- Solar energy
- Geothermal energy.

Specific plans for cooperative activity for each year are negotiated at meetings of experts groups for each technology and set forth in protocols.

At the October 1974 meeting of the Joint Committee, it was agreed that cooperation under this agreement would also be considered in the following areas:

- Coal technology
- Oil technology

- Gas technology
- Energy information and forecasting.

DOE has general oversight responsibility for all R&D projects, as well as the energy information activity, although implementation of several of the specific activities is the responsibility of other U.S. organizations (e.g., Tennessee Valley Authority and Department of the Interior). Day-to-day coordination of activities is handled by executive agents: DOE in the United States, and the Ministry of Power and Electrification in the USSR.

Descriptions of the projects under this agreement for which DOE has specific responsibility follow on succeeding pages.

U.S.–USSR Umbrella Energy Agreement

Thermal Power Stations

Current Scope and Status of Activities

Information is being exchanged on the design and operation of thermal and nuclear power stations. Specific areas of concentration are reliability, flexibility, and requirements for power systems.

Delegations were exchanged in June 1976. In June 1977, a USSR delegation visited the United States and concluded a protocol for future cooperation. In September 1977, a United States delegation visited the Soviet Union to discuss information and visit sites related to Soviet thermal power plant technology.

Hydroelectric Power Stations

Current Scope and Status of Activities

The scope of this project encompasses the design, construction, operation, and maintenance of hydroelectric systems, including dams, power plants, and associated electrical and mechanical equipment. In addition, projects related to construction technology in cold climate conditions have been transferred to the Energy Agreement.

A seminar on the design and construction of large dams in seismic regions took place in July 1977 in the USSR; a seminar in cold weather construction techniques took place in May 1977 in the USSR; and a seminar on engineering inspection of hydraulic structures and instrumentation took place in December 1977 in the United States.

U.S.–USSR Umbrella Energy Agreement

Heat-rejection Systems

Current Scope and Status of Activities

The purpose of this project is to exchange information in the areas of power-plant heat dissipation methodologies, process heat, district heating, and waste-heat utilization. The current scope of activities involves information exchange on the design and operation of heat rejection and water supply systems for thermal and nuclear power plants, including intake structures and piping, circulating pumps, condensers, outlet piping and structures, cooling towers, artificial reservoirs, spray ponds, and associated equipment.

An experts group meeting on heat dissipation was held in the United States in September 1977.

Power-plant Pollution Reduction

Current Scope and Status of Activities

The purpose of this project is to foster cooperation in the field of emission control from fossil-fired thermal power generating plants. Information has been exchanged in the areas of nitrogen oxide control, particulate control, and sulfur dioxide control. The current scope of activities includes:

- Design and operation of air pollution reduction and waste-disposal systems for thermal power plants
- Monitoring and control of nitrogen oxide and wet scrubbers.

A United States delegation visited the USSR in July 1977 to participate in joint ash-removal tests at the Reftinskaya Power Plant.

Ultra-High Voltage (UHV) and High Voltage Direct Current (HVDC) Transmission Technology

Current Scope and Status of Activities

Three meetings of project groups have been held since 1974 and a symposium on alternating current (AC) transmission was held in the United States in February 1975. In April 1976, the working group met in the USSR to define subtopics for cooperation. General areas of interest include determination of insulation requirements, the effects of contamination, and losses from interference.

The current scope of activities for cooperation in UHV and HVDC transmission technology includes the following:

- Mechanical and electrical UHV design criteria
- Effects of high voltage AC and direct current (DC) steady-state electrical and mechanical fields on human, animal, and plant life
- Determination of insulation requirements
- Effects of contamination
- Study of interference and corona losses
- Effects of fields.

Proposed Activities

The next symposium on AC transmission is scheduled for spring 1978 in the USSR.

Superconducting Transmission Technology

Current Scope and Status of Activities

The scope of cooperative efforts in superconducting transmission encompasses the design and development of commercial superconducting transmission lines. The program is very active, with several exchange visits each year for joint experiments. Cooperation proceeds in the areas of power transmission systems, dielectric systems, hydrodynamics and heat transfer, superconducting materials, and cryogenic systems.

U.S.–USSR Umbrella Energy Agreement

Magnetohydrodynamics

Current Scope and Status of Activities

The bilateral project with the USSR in MHD, which was initiated in 1973, allows for information exchanges, joint visits, and cooperative experiments testing U.S. components in two USSR facilities, the U-02 and the U-25.

Programmatically, the cooperative effort has focused on joint work contributing to the development and operation of the MHD channel—the major component of a commercial MHD power plant. Three working groups were organized to address the major problems in this area: (1) channel design and testing, (2) electrode system development, and (3) superconducting MHD magnet development and the study of high-field MHD interactions. A fourth working group was organized to analyze the technical and economic aspects of MHD and to prepare a comprehensive status report describing the current state-of-the-art in MHD. This joint status report on open-cycle MHD power generation has been completed and is being prepared for publication.

Effective April 21, 1977, the four working groups in MHD were superseded by two working groups: MHD Power Plant Systems and Engineering; and MHD Technology Development. The working group for MHD Power Plant Systems and Engineering will analyze the scientific, technical, and economic problems of MHD plant development; and exchange information on MHD plant development and facilities, analysis and optimization of MHD systems, and plant layouts. The working group on MHD Technology will develop MHD components and test programs, test MHD components, and conduct cooperative research.

Information from the cooperative exchange is transferred through frequent meetings, reports, and visits. During 1976, scientists and engineers from the United States spent 70 person-weeks in the USSR, and Soviet scientists and engineers spent 83 person-weeks in the United States.

Proposed Activities

A channel developed in the United States is scheduled to be tested in the Soviet U-25 facility in 1978. Similarly, a 40-ton superconducting magnet built in the United States is being operated in a specially constructed portion of the U-25 facility for a study of high magnetic field MHD phenomena.

U.S.–USSR Umbrella Energy Agreement

Solar Energy

Current Scope and Status of Activities

The current scope of cooperative activity under this agreement includes information exchange in:

- Solar heating and cooling
- Solar thermal power stations
- Photovoltaics.

Seminars were held in the USSR in all three areas in late 1977.

Geothermal Energy

Current Scope and Status of Activities

This bilateral agreement covers exchange of information on general technology for the utilization of geothermal energy, including:

- Drilling methods
- Reservoir modeling and production
- Utilization technology
- Environmental protection.

Cooperation in this area has been inactive since 1974.

U.S.–USSR Umbrella Energy Agreement

Oil Technology

Current Scope and Status of Activities

Cooperation in oil technology was approved as an official Energy Agreement project in December 1976. In October-November 1977, a Soviet delegation visited the United States and concluded a protocol that provides for future cooperation in the areas of: geochemical exploration; new methods of enhanced oil recovery; fundamental properties of petroleum; hydrocarbon extraction from heavy oil deposits and tar sands; and pressure maintenance by water and gas injection.

Proposed Activities

A symposium in geochemical exploration and fundamental properties of petroleum is tentatively scheduled for May or June 1978.

Gas Technology

Current Scope and Status of Activities

Cooperation in gas technology was approved as an official Energy Agreement in December 1976. The program will cover Arctic operations and enhanced gas recovery. Cooperation in gas-distribution systems and industrial gas burners is also under consideration.

In February-March 1977, a United States delegation of industry officials visited the USSR to exchange information and view Arctic operations sites. It is anticipated that a United States delegation will visit the USSR in early 1978 to update the protocols and discuss enhanced gas recovery.

U.S.–USSR Umbrella Energy Agreement

Energy Information and Forecasting

Current Scope and Status of Activities

The current scope of activities calls for exchange of information, seminars, and meetings on the following:

- Forecasting methodologies
- Methods for increasing fuel efficiency
- Methodologies for determining oil and gas reserves
- Relationship between energy growth and economic growth
- Optimal transportation on systems for delivery of fuel and energy to demand centers.

A seminar on the first two areas was held in the United States in late 1977.

Agreement on Cooperation in the Peaceful Uses of Atomic Energy

Signatories: **United States**
Union of Soviet Socialist Republics

Term: **June 21, 1973-June 20, 1983**

Current Scope and Status of Activities

The objectives of this umbrella agreement are to develop new energy sources through research, development, and utilization of nuclear energy. In addition, an agreement has been proposed in the field of spent fuel storage. Cooperative efforts include joint work, joint seminars, and exchanges of technical information, scientists, equipment, and materials. To execute cooperative activities, joint working groups of scientists and engineers are established. Day-to-day coordination of activities is managed by executive agents: DOE in the United States, and the State Committee for the Utilization of Atomic Energy in the USSR. Cooperation is concentrated in:

- Continued thermonuclear research
- Fast breeder reactors
- Fundamental properties of matter.

The U.S.-USSR Joint Committee on Atomic Energy meets annually to implement activities. At the third meeting of the Joint Committee on Atomic Energy (December 1975) it was agreed to consider cooperation in the areas of:

- Light-water reactors
- Thermionics
- Spent fuel storage.

U.S.–USSR Umbrella Atomic Energy Agreement

Controlled Thermonuclear Research

Current Scope and Status of Activities

Within the scope of the U.S.–USSR Atomic Energy Agreement, the United States and the USSR are cooperating on the research and development aspects of controlled thermonuclear fusion, including theoretical, experimental, and design-construction studies. Forms of cooperation include joint workshops, meetings, and exchange of personnel and information.

Proposed Activities

Additional activities are proposed in the following areas:

- Large fusion experiments and associated technology leading toward a fusion power plant by the year 2000
- Tokamaks, advanced concepts, supporting physics and technology, materials studies, system engineering, and environmental and safety considerations.

Fast Breeder Reactors

Current Scope and Status of Activities

On June 21, 1973, the United States and the USSR agreed to undertake cooperative efforts on basic and applied problems related to the design, development, construction, and operation of nuclear power plants that utilize fast breeder reactors. Forms of cooperation may include assignment of personnel to each country's laboratories, research centers, universities, and reactor test facilities. Presently, the two countries are conducting two joint seminars yearly and undertaking joint projects that involve exchange of fast breeder reactor materials and information.

As part of the agreement, the United States and the USSR have been discussing the possibility of conducting a test of an LMFBR steam generator in the Soviet BN-350 fast breeder reactor. This proposed large-scale test has increased in importance with the decision to defer construction of the Clinch River Breeder Reactor. The steam generator would be tested to achieve the equivalent of 5 years of full power operation.

Proposed Activities

Proposed activities include expansion of joint projects in this area and possible exchange of scientists for research and development in each other's laboratories.

U.S.–USSR Umbrella Atomic Energy Agreement

Fundamental Properties of Matter

Current Scope and Status of Activities

The United States and the USSR have undertaken joint theoretical and experimental studies in high-, medium-, and low-energy physics. The program of research projects primarily involves the use of proton accelerators at the Institute for High Energy Physics, Serpukhov, USSR, and at the Fermi National Accelerator Laboratory, Batavia, Illinois. Joint experiments on the 200-GEV accelerator have required long-term visits at Batavia by Soviet physicists, who have brought with them equipment from the 200-GEV accelerator at Serpukhov.

Proposed Activities

Activities may also include designing, planning, and constructing joint facilities. In addition, the program of cooperation, when fully implemented, will provide access to several new USSR facilities and present a better overall picture of the capabilities of Soviet facilities in high-energy physics and in such aspects of materials science as surface physics, neutron inelastic scattering, and radiation damage.

Light-water Reactors

Proposed Activities

Information exchanges are proposed, as a result of a protocol agreement, in the following aspects of light-water reactor (LWR) technology:

- Reactor safety regulation
- Peak load management
- Reactor safety research
- Reactor materials and in-pile testing
- Operation of nuclear power stations.

U.S.–USSR Umbrella Atomic Energy Agreement

Thermionics

Current Scope and Status of Activities

Two delegations of specialists visited each other's countries in July 1977. Proposals for specific topics for cooperation will be submitted to the Joint Committee in January 1978.

Spent Fuel Storage (Proposed)

Current Scope and Status of Activities

The United States has proposed LWR spent-fuel storage as a potential topic for cooperation. Specifically, the United States has proposed an exchange of information on:

- Improved methods of transportation and handling via rail, highway, sea, and air
- Long-term retrievable storage of fuel elements.

The USSR has indicated that it is interested in discussing the possibility for cooperation in this area.

International Energy Agency

The oil embargo of 1973 and the consequent sharp rise in world oil prices severely disrupted the economies and strained the political, strategic, and economic relationships of most oil-importing nations. Inadequate cooperation among the industrialized nations resulted in competitive unilateral efforts by many to ensure current and future supplies of oil.

Recognizing the need to unite in a coordinated effort to decrease dependence on foreign oil and thereby reduce strategic and economic vulnerability, the United States and most other members of the Organization for Economic Cooperation and Development (OECD) agreed in September 1974 to develop an International Energy Program (IE). The program was to serve as a vehicle for the participating nations to cooperate in the development of alternative energy sources and to share oil in times of emergency. To administer, monitor, and execute the IEP, the participating nations established the IEA as an autonomous institution with OECD. Nineteen nations are currently participating in IEA: Austria, Belgium, Canada, Denmark, the Federal Republic of Germany, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States. Under special arrangement (Article 72 of the basic agreement), the European Community (EC) and OECD's Nuclear Energy Agency (NEA) also participate.

At IEA's initial meeting in November 1974, the following specific objectives were defined:

- To promote secure oil supplies
- To develop an emergency self-sufficiency in oil supplies, restrain demand, and allocate available oil among member countries on an equitable basis
- To promote cooperative relations with oil-producing countries and with other oil-consuming countries, including those of the developing world
- To reduce member-country dependence on imported oil by undertaking long-term cooperative efforts on energy conservation, accelerated development of alternative sources of energy, energy research and development, and uranium supply and enrichment.

To accomplish these objectives, IEA was organized into a Governing Board (composed of one or more ministers or their delegates from each participating country), a Management Committee (composed of one or more senior representatives of the government of each participating country), and the following four standing groups (each composed of one or more representatives of the government of each participating country):

- Emergency Questions—to deal with emergency self-sufficiency, demand restraint, allocation, and activation
- Oil Market—to develop an international oil market information system and to establish an internal, permanent framework for obtaining information from or consulting with individual oil companies on the oil industry
- Long-Term Cooperation on Energy—to reduce member dependence on imported oil over the longer term

- Relations with Producer and Other Consumer Countries—to promote cooperative relations with oil-producing nations and other major oil consumers.

The member nations agreed that, except in the case of the Standing Group on Emergency Questions, standing group or project participation would be strictly voluntary.

The Standing Group on Long-Term Cooperation on Energy originally selected four major areas on which to focus its efforts: energy conservation, alternative sources of energy, energy research and development, and uranium enrichment. An autonomous subgroup was established for each of these areas and charged with responsibility for developing and conducting related cooperative projects. However, in recognition that energy research and development represents a broad area that offers significant opportunity for formulation of solutions to the major consumer nations' energy problems, in November 1975, the Subgroup on Energy R&D was redesignated a committee of equal status with the four standing groups. The committee was mandated to work closely with the Standing Group on Long-Term Cooperation on Energy to ensure a coordinated long-term program. In July 1976, a Nuclear Subgroup was also chartered by that standing group.

The IEA activities in which DOE, the Nuclear Regulatory Commission, the U.S. Bureau of Mines, and the U.S. Geological Survey of the Department of the Interior, and the Environmental Protection Agency have been most actively involved have been conducted under the Committee on Energy Research and Development. As IEA members express interest in developing and conducting cooperative energy R&D projects, working parties comprising representatives of those member nations interested in participating in a particular project are established. Under the chairmanship of a designated lead country or organization, each working party seeks to develop a cooperative program of mutually beneficial projects relating to various energy technologies. Currently, 14 working parties are conducting cooperative energy R&D projects:

Biomass Conversion
Coal Technology
Conservation
Energy R&D Strategy
Fusion
Geothermal
High-Temperature Reactors for Process Heat
Hydrogen
Nuclear Safety
Radioactive Waste Management
Small Solar Power Systems
Solar Energy
Wind Power
Ocean Energy Systems.

In addition, a working party on energy R&D strategy was established to develop an overall IEA R&D strategy based on quantitative analysis of the contribution that various energy technologies could be expected to make to energy balances in the future. This analysis will establish priorities for national and cooperative R&D efforts.

International Energy Agency (continued)

The United States has been designated the IEA lead country for working party efforts in the areas of conservation, nuclear safety, ocean thermal energy conversion, and energy R&D strategy. Various U.S. agencies are participating in all 14 working parties.

The efforts of the working parties have been directed toward the negotiation of multilateral implementing agreements governing activities in these areas. As of January 1, 1978, 21 implementing agreements were signed.

Working Party on Coal Technology

Coal Mining Technology Clearing House Service

Signatories:

Belgium	New Zealand
Canada	Spain
Federal Republic of Germany	United Kingdom
Italy	United States (Bureau of Mines)

Exchange of information and personnel to establish and operate a central collection and distribution center for information on R&D projects on underground and surface coal mining and coal preparation technology. Signed November 1975 for 3 years.

World Coal Resources and Reserves Data Bank Service

Signatories:

Belgium	Italy
Canada	United Kingdom
Federal Republic of Germany	United States (U.S. Geological Survey)

Exchange of information and personnel to establish and operate a central data bank service on world coal resources and reserves. Signed November 1975 for 3 years.

Coal Technical Information Service

Signatories:

Austria	Netherlands
Belgium	New Zealand
Canada	Spain
Federal Republic of Germany	Sweden
Italy	United Kingdom
Japan	United States

Information storage and retrieval system on current research in coal science and technology. Signed November 1975 for 3 years.

Economic Assessment Service for Coal

Signatories:

Canada	Spain
Federal Republic of Germany	Sweden
Italy	United Kingdom
Netherlands	United States

Exchange of information on assessments of coal utilization, effluent disposal, and coal conversion, cost, and availability. Signed November 1975 for 3 years.

Fluidized Combustion of Coal

Signatories:
Federal Republic of Germany
United Kingdom
United States

Joint design, construction, and operation of a facility to study the capabilities of a pressurized fluidized-bed combustion system. The facility will be located in the United Kingdom. Signed November 1975 for 8 years.

Coordination of National Planning in Coal Hydrogenation

Signatories:
United States
Federal Republic of Germany

Memorandum of Understanding. Exchange of information and periodic meetings of program staffs to coordinate national program planning to develop supportive and complementary R&D programs in coal hydrogenation. Signed October 1977 for 1 year.

Advanced Coal Gasification and Refining of Coal-Derived Liquids

Signatories:
United States
Federal Republic of Germany

Letter of Intent. Each party has agreed to execute IEA Agreements to invest $8-10 million in project of other party. The Federal Republic of Germany will invest in U.S. demonstration refinery for coal-derived liquids. The United States will invest in an existing German gasification plant using advanced Otto-Rommel process.

Working Party on Conservation

Heat Pump Systems

Signatories:

Austria	Netherlands
Denmark	New Zealand
Federal Republic of Germany	Sweden
Ireland	Switzerland
Italy	United States

Exchange of information and coordination of experimental programs on heat pump systems with thermal storage. Signed March 1977 for 3 years.

Energy Cascading

Signatories:

Austria	Sweden
Belgium	Switzerland
Federal Republic of Germany	United States
Netherlands	

Common study, including market assessment, technology survey, economic analysis, and identification of needed R&D for all electric systems, combined systems, all heat systems, and total systems. Signed March 1977 for 3 years.

Buildings and Community Systems

Signatories:

Canada	Switzerland
Denmark	United Kingdom
Italy	United States
Sweden	

Exchange of information and interface with LBL system to compare analytical techniques to evaluate load and energy usage for different materials, buildings, designs, and equipment. Signed March 1977 for 3 years.

Conservation in Building Complexes

Signatories:
Federal Republic of Germany
United States

Exchange of information and personnel and joint evaluation of community conservation demonstration projects at Wiehl and Esslingen in the Federal Republic of Germany. Signed June 1976 for 5 years.

Combustion

Signatories:
Sweden
United Kingdom
United States

Exchange of information on instrumentation, processes, and modeling to evaluate conservation possibilities of combustion processes and to develop improved designs for combustion systems. Signed March 1977 for 3 years.

Ekistics and Advanced Energy Systems

Signatories:
Greece
United States

Joint conferences and demonstration of site-specific application of ekistics (the science of human communities) and energy systems analysis to promote conservation of energy on a community scale. Signed October 1976 for 1½ years.

Heat Transfer and Heat Exchangers

Signatories:
Sweden
Switzerland
United Kingdom
United States

Exchange of information on R&D projects and theoretical studies in each country on extended surface heat transfer, optional design of heat exchanger networks, and heat exchanger tube vibration. Signed June 1977 for 3 years.

Working Party on Fusion

Intense Neutron Source Experiment

Signatories:
Canada
the European Communities
Japan
Sweden
Switzerland
United States

Exchange of personnel to conduct joint experimental and theoretical research on ion source development, vacuum engineering, and systems engineering at the Intense Neutron Source Facility at Los Alamos Scientific Laboratory. Signed May 1976 for 4 years.

International Energy Agency (continued)

Superconducting Magnets for Fusion Power

Signatories:
EURATOM
Switzerland
United States

Assignment of personnel and joint experiments on large superconducting magnet systems at the Oak Ridge Large Coil Test Facility (LCTF). Each participant will design, fabricate, and deliver a $1-million coil for testing in the LCTF together with three U.S. coils. Signed October 1977 for 6 years.

Plasma Wall Interaction in Textor

Signatories:
Canada
EURATOM
Switzerland
Turkey
United States

Assignment of specialists, testing of hardware and materials, and joint experiments at the TEXTOR facility in the Federal Republic of Germany on plasma wall materials, structures, and temperatures. Signed October 1977 for 8 years.

Working Party on Geothermal Energy

Man-Made Geothermal Energy Systems

Signatories:
Federal Republic of Germany
Sweden
Switzerland
United Kingdom
United States

Jointly funded study ($600 thousand) to identify possible technical systems and recommend possible future laboratory studies, hardware development, and field testing for extracting thermal energy from the earth's crust. Signed October 1977 for 2 years.

International Energy Agency (continued)

Working Party on Hydrogen

Hydrogen Production from Water

Signatories:

Belgium	Japan
the European Communities	Netherlands
Canada	Sweden
Federal Republic of Germany	Switzerland
Ireland	United States
Italy	

Exchange of information and personnel, including workshops, on (1) specific process steps for thermochemical production of hydrogen, (2) thermochemical production using high-temperature reactors as heat source, and (3) assessment of potential future markets. Signed October 1977 for 3 years.

Working Party on Nuclear Safety

Reactor Safety Research and Development

Signatories:

Austria	Netherlands
Belgium	Norway
Canada	Spain
Denmark	Sweden
Federal Republic of Germany	United Kingdom
Italy	United States (Nuclear
Japan	Regulatory Commission)

Exchange of technical information and progress reports and joint meetings of experts on reactor safety research. Provision for further bilateral or multilateral agreements on specific R&D projects. Signed May 1976 for 5 years.

Working Party on Small Solar Power Systems

Small Solar Power Systems

Signatories:

Austria	Spain
Belgium	Sweden
Federal Republic of Germany	Switzerland
Greece	United Kingdom
Italy	United States

Jointly funded design study (Phase I), leading to construction and operation (Phase II) of a 500-kW distributed collector solar power plant and a 500-kW central receiver solar plant in Almeria, Spain. Total funding Phase I—$850 thousand. Signed October 1977 for 6 years.

International Energy Agency (continued)

Working Party on Solar Energy

Solar Energy

Signatories:

Austria	Netherlands
Belgium	New Zealand
Denmark	Spain
the European Communities	Sweden
Federal Republic of Germany	Switzerland
Italy	United Kingdom
Japan	United States

Exchange and compilation of information on (1) performance of solar heating and cooling systems, (2) R&D on components, (3) performance testing of solar collectors, (4) insolation and instrumentation, and (5) application of existing meteorological information. Signed December 1976 for 3 years.

Working Party on Wind Power

Large-Scale Wind Energy Conversion Systems

Signatories:

Denmark	Sweden
Federal Republic of Germany	United States

Exchange of information and personnel, including periodic meetings of program directors, to coordinate execution of national projects to design, construct, and operate large machines with a rated power of 1 MWe. Signed October 1977 for 2 years.

Wind Energy Conversion Systems

Signatories:

Austria	Netherlands
Canada	New Zealand
Denmark	Sweden
Federal Republic of Germany	United States
Ireland	

Exchange of information, joint funding of studies, joint development of models, and workshops on (1) environmental and meteorological aspects, (2) evaluation of siting models, (3) integration into electricity supply systems, and (4) rotor-stressing and operation of large-scale systems. Total funding: $960 thousand. Signed October 1977 for 3 years.

International Atomic Energy Agency

IAEA was established in 1957 largely as a result of the U.S. initiative first expressed by President Eisenhower in an address to the United Nations. Today, with 110 member countries (see Exhibit 2), IAEA is the principal international organization responsible for furthering a broad range of nuclear technologies and related activities.

The organization of IAEA (see Exhibit 3) includes a Board of Governors, and a 34-member executive body with broad authority to establish policies and implement programs. The 110-member General Conference, which meets annually, elects the Board of Governors and approves members, budget, and program.

IAEA's objectives are to promote the development and application of nuclear energy for peaceful purposes; to foster the exchange of scientific and technical information; and to provide for materials, services, equipment, and facilities for nuclear development and application. One of IAEA's primary responsibilities under its enabling statute is to ensure, to the extent possible, that assistance provided under its auspices will not be used to further any military purposes.

To achieve its objectives of promoting peaceful nuclear applications, IAEA sponsors a variety of programs, including training courses, panels, and conferences. In addition, IAEA serves as executing agency for projects undertaken under the aegis of other organizations affiliated with the United Nations; supports research contracts; operates laboratory programs; and manages an International Nuclear Information System.

To fulfill its responsibility to prevent the misuse of transferred nuclear research or technologies, IAEA has created and implements a unique system of international safeguards that includes a provision for on-site inspections. The United States is principally interested in nuclear safeguards to ensure against diversion of sensitive nuclear materials for military purposes. However, the U.S. recognizes the primary interest of developing nations in the technical assistance program and provides extensive support for such programs, as well as for safeguards.

U.S. involvement in IAEA activities is concentrated in the following areas:

- Safeguards and accountability of nuclear material
- Nuclear safety and standards
- Scientific information exchange
- Technical assistance program.

Programs are implemented through five departments under the Director General, who is appointed by the Board of Governors. The Department of Safeguards and Inspection develops and implements the safeguards system designed to ensure against any military use of equipment and assistance. The Department of Technical Assistance and Publications promotes technology transfer to all members and provides less developed member states with experts, equipment, and training. Coordination of administrative operations is handled by the Department of Administration. Most activities related to energy R&D are the province of the Department of Technical Operations, which produces a comprehensive collection of nuclear information, ensures installation safety and environmental protection, and assists members in planning nuclear power projects. Finally, the Department of Research and Laboratories promotes research activity relating to nuclear energy applications in science, industry, medicine, biology, and food production.

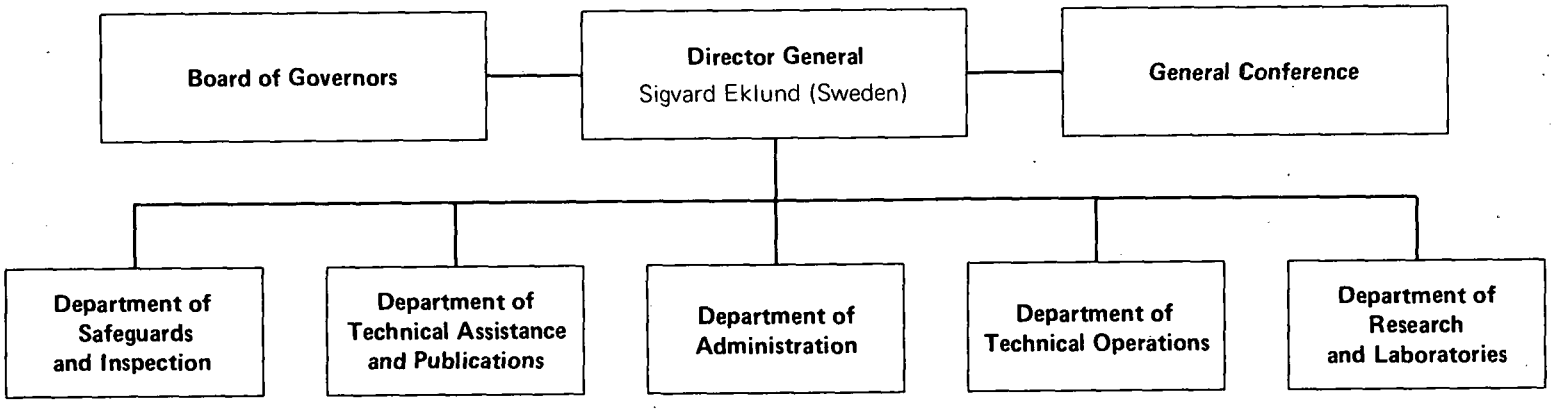
Exhibit 2

IAEA Member Nations

Afghanistan
Albania
Algeria
Argentina
Australia
Austria
Bangladesh
Belgium
Bolivia
Brazil
Bulgaria
Byelorussian Soviet Socialist Republic
Cambodia
Canada
Chile
Colombia
Costa Rica
Cuba
Cyprus
Czechoslovakia
Democratic People's Republic of Korea
Denmark
Dominican Republic
Ecuador
Egypt
El Salvador
Ethiopia
Finland
France
Gabon
Federal Republic of Germany
Ghana
Greece
Guatemala
Haiti
Holy See
Hungary
Iceland
India
Indonesia
Iran
Iraq
Ireland
Israel
Italy
Ivory Coast
Jamaica
Japan
Jordan
Kenya
Kuwait
Lebanon
Liberia
Libyan Arab Republic
Liechtenstein
Luxembourg
Madagascar
Malaysia
Mali
Mauritius
Mexico
Monaco
Mongolia
Morocco
Netherlands
New Zealand
Nicaragua
Niger
Nigeria
Norway
Pakistan
Panama
Paraguay
Peru
Philippines
Poland
Portugal
Qatar
Republic of Korea
Republic of South Vietnam
Romania
Saudi Arabia
Senegal
Sierra Leone
Singapore
South Africa
Spain
Sri Lanka
Sudan
Sweden
Switzerland
Syrian Arab Republic
Thailand
Tunisia
Turkey
Uganda
Ukrainian Soviet Socialist Republic
Union of Soviet Socialist Republics
United Arab Emirates
United Kingdom of Great Britain and Northern Ireland
United Republic of Cameroon
United Republic of Tanzania
United States of America
Uruguay
Venezuela
Yugoslavia
Zaire
Zambia

Exhibit 3

International Atomic Energy Agency



International Atomic Energy Agency (continued)

IAEA communicates the results of its efforts to government agencies and interested industries of member states through agency publications, seminars, international symposia, and other types of meetings. The United States and other member countries contribute to the agency's work directly through participation of consultants or members on committees, expert groups, and assignments to IAEA staff and technical-assistance projects.

Nuclear Energy Agency

The European Nuclear Energy Agency, a division of OECD, was renamed the Nuclear Energy Agency in 1972, when Japan, Canada, and Australia joined the group. The United States joined as a full member in October 1976, after 19 years of participation as an associate member.

NEA's objective is to promote the peaceful use of atomic energy in the member countries by providing a forum for national experts to exchange information on such topics as the nuclear fuel cycle, radiation protection and public health, radioactive waste management, reactor safety and regulatory practices, and nuclear data.

NEA is governed by a Steering Committee composed of senior-level representatives of the 24 member countries. This group oversees a number of committees in specific technological areas. The steering committee meets twice yearly and has overall responsibility for direction and budget of the NEA program.

The activities of the committees are as follows:

The Committee on Radiation Protection and Public Health assesses the relative significance of radiation exposure sources and contributes to the formulation of internationally accepted standards for the radiological protection of people and the environment. The committee is studying means for reducing radiation doses to workers, liquid and gaseous effluent releases, radiation and environmental protection in uranium mining, and radioactive materials in consumer goods.

The Committee on Radioactive Waste Management investigates waste management problems associated with large-scale development of the nuclear industry, e.g., conditioning of high-level wastes, geologic and seabed disposal, gaseous and airborne wastes, and decontamination and decommissioning.

The Committee on the Safety of Nuclear Installations investigates safety questions associated with reactor types currently in operation. The first priority of this committee is light water reactor safety, specifically, research on emergency core cooling, anticipated transients without scram, fuel/coolant interaction, and core melt. The committee also provides for exchange of information among licensing authorities in the member countries.

The Study Group on the Long-Term Role of Nuclear Energy examines worldwide uranium resources, production, exploration, R&D, and demand trends. In November 1977, this group was given a new mandate and renamed the Committee for Technical and Economic Studies on Nuclear Energy Development and the Fuel Cycle.

The Study Group on Isotopic Batteries studies miniature isotopic batteries, plutonium-fueled cardiac pacemakers, and chemical and tritium battery development.

The Working Group on Nuclear Energy Information analyzes data-gathering problems common to nuclear information centers in the member countries.

The Committee on Reactor Physics examines safety questions, such as power distribution, control rod uncertainties, and associated transients.

Nuclear Energy Agency (continued)

The Nuclear Data Committee specializes in nuclear cross-section measurements, including the impact of neutron data on power reactor technology and improvements in measurement accuracy.

The International Food Irradiation Project, jointly sponsored by NEA, IAEA, and FAO, studies the wholesomeness of irradiated foods.

NEA groups have also been established to coordinate exchange of information on gas-cooled fast reactors (GCFR) and third-party liability. The GCFR group coordinates national programs for the development of GCFR. The group of government experts on third-party liability examines specific questions pertaining to application of the Paris and Brussels Conventions on Third Party Liability in the Field of Nuclear Energy.

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International Bilateral and Multilateral Arrangements in Energy Technologies

July 1978

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Table of Contents

Table of Contents (continued)

Exhibits

Introduction

The Office of International Affairs of the Department of Energy (DOE) issues periodic status reports covering all major international energy research and development (R&D) activities in which DOE is involved. To provide a framework for the status reports, a series of background documents is being prepared.

This document, the second report in the series,* outlines current DOE international commitments under bilateral and multilateral arrangements, as of January 1, 1978. Included are bilateral agreements for cooperation in the civil uses of atomic energy with countries and international organizations, bilateral and multilateral technical exchanges in all energy technology areas, and multilateral agreements under the auspices of the International Energy Agency (IEA).

In addition to outlining the terms, scope, and status of these agreements, this document describes DOE's participation in the work of the major international energy organizations: IEA, the International Atomic Energy Agency (IAEA), and the Nuclear Energy Agency (NEA). Future reports will update the status of ongoing cooperative projects and provide information on new energy R&D activities.

*The first report in the series was ***International Energy Agency: Background and Current Activities***, prepared by Office of International Affairs, Energy Research and Development Administration (ERDA 77-21), December 1976.

Agreements for Cooperation in the Peaceful Uses of Atomic Energy

Under the authority of Section 123 of the Atomic Energy Act of 1954, the United States has entered into a number of bilateral agreements with countries and international organizations on the peaceful uses of atomic energy. Under these agreements, which DOE inherited from the Atomic Energy Commission (AEC) and the Energy Research and Development Administration (ERDA), the United States may export production and utilization facilities (e.g., research and power reactors) and source and special nuclear materials (e.g., enriched uranium and plutonium). The agreements contain guarantees against the use of transferred facilities and materials for nuclear weapons or any other military purpose, and provisions for safeguards to verify compliance with such guarantees.

The bilateral agreements may involve exchange of information and materials related to nuclear-power production only, exchange of information and materials related to research reactors only, or both. Most of the 28 agreements now in effect cover both research and power reactors.

The major provisions of the agreements generally fall into two categories: those that provide the enabling framework to permit an activity to occur; and those that specify terms, conditions, or controls that apply when an activity is undertaken. Typically, the articles of these agreements include:

- Preamble
- Definitions
- Basic conditions (i.e., applicability of laws and regulations in effect)
- Provisions for unclassified information exchange
- Provisions for transfer of nonfuel material and equipment
- Disclaimer of responsibility for other party's use of material, equipment, and information
- Provisions for participation by persons under jurisdiction of parties
- Fuel-supply framework
- Fuel-supply conditions
- Guarantees of peaceful and authorized uses
- U.S. safeguards rights
- Application of IAEA safeguards while United States rights are suspended
- Extension of provisions to superseded agreement.

Exhibit 1 lists the current agreements for cooperation in the peaceful uses of atomic energy.

Exhibit 1

Agreements for Cooperation in the Peaceful Uses of Atomic Energy

Country	Scope	Effective Date	Termination Date
Bilaterals with Individual Countries			
Argentina	Research and power	July 25, 1969	July 24, 1999
Australia	Research and power	May 28, 1957	May 27, 1997
Austria	Research and power	January 24, 1970	January 23, 2014
Brazil	Research and power	September 20, 1972	September 19, 2002
Canada	Research and power	July 21, 1955	July 13, 1980
China, Republic of	Research and power	June 22, 1972	June 21, 2014
Finland	Research and power	July 7, 1970	July 6, 2000
India	Power (Tarapur)	October 25, 1963	October 24, 1993
Indonesia	Research	September 21, 1960	September 20, 1980
Iran	Research	April 27, 1959	April 26, 1979
Ireland	Research	July 9, 1959	July 8, 1978
Italy	Research and power	April 15, 1958	April 14, 1978
Japan	Research and power	July 10, 1968	July 9, 2003
Korea	Research and power	March 19, 1973	March 18, 2014
Norway	Research and power	June 8, 1967	June 7, 1997
Philippines	Research and power	July 19, 1968	July 18, 1998
Portugal	Research and power	June 26, 1974	June 25, 2014
South Africa	Research and power	August 22, 1957	August 21, 2007
Spain	Research and power	June 28, 1974	June 27, 2014
Sweden	Research and power	September 15, 1966	September 14, 1996
Switzerland	Research and power	August 8, 1966	August 7, 1996
Thailand	Research and power	June 27, 1974	June 26, 2014
Turkey	Research	June 10, 1955	June 9, 1981
Venezuela	Research and power	February 9, 1960	February 8, 1980
Vietnam, Republic of	Research	July 1, 1959	June 30, 1979
Bilaterals with International Organizations			
European Atomic Energy Community (EURATOM)	Joint nuclear power program	February 18, 1959	December 31, 1985
	Additional agreement to joint nuclear power program	July 25, 1960	December 31, 1995
IAEA	Supply of materials	August 7, 1959	August 6, 2014

Bilateral and Multilateral Technical Exchange Arrangements

Under the authority of the Atomic Energy Act of 1954, the Energy Reorganization Act of 1974, and the Department of Energy Organization Act of 1977, DOE has entered into bilateral and multilateral arrangements with corresponding foreign entities for the exchange of technology for specific programs. The purpose of these arrangements is to provide a means for acquiring technology through the exchange of information and the conduct of joint projects. Specifically, these arrangements provide a mechanism for increasing the technology base, technical manpower, and expertise of the participants; reducing financial burdens on the United States; and accelerating technical progress.

Most of the bilateral and multilateral technical exchange arrangements specify cooperation in a particular technology. However, specific technical activities with Japan and the USSR are conducted under broad umbrella agreements on cooperation in the field of energy and in the peaceful uses of atomic energy.

The forms of cooperation typically involve exchange of scientific and technical information, research and development (R&D) methods and results, personnel, samples, materials, instruments, and components for testing. In addition to the joint projects, visits, seminars, and meetings are held in cooperating countries.

The cooperative efforts are generally managed by a joint coordinating committee, which consists of participants from the two signatories to the agreement. The joint committee is expected to meet annually to evaluate the status of cooperation, a process that involves performing a comprehensive review of each party's program status and plans, assessing the balance of exchanges in the various technical areas of cooperation, and considering measures required to correct any imbalances.

At present, DOE is involved in 39 technical exchange arrangements.

Memorandum of Understanding in Nuclear Energy

Signatories: **United States,** DOE
Canada, Atomic Energy of Canada, Ltd.

Term: **1976-1980**

Current Scope and Status of Activities

Under the provisions of the memorandum of understanding in nuclear energy, cooperative efforts are proceeding in the areas of radioactive waste management and systems analysis of heavy water power reactors. Under waste management, specific areas for study include: terminal storage in geologic formations; retrievable storage; waste processing; and environmental effects. Under systems analysis, specific areas include: economic data; reactor-system, power-plant, and associated fuel-cycle characteristics; plant design and regulatory criteria; fuel-cycle and support facilities; and systems-analysis assessment and methodology.

Agreement in the Field of Liquid Metal-Cooled Fast Breeder Reactors (LMFBR)

Signatories: **United States,** DOE
Federal Republic of Germany, Federal Ministry for Research and Technology

Term: **1976-1986**

Current Scope and Status of Activities

The purpose of this agreement is to develop solutions to problems related to the design, development, construction, and operation of LMFBRs.

The agreement provides for the exchange of technical information, personnel, equipment, materials, seminars, and visits in the areas of:

- Reactor neutronics
- Fuels and materials
- Fuel recycle
- Reactor and reactor coolant system components
- Coolant technology
- Nonnuclear test facilities in support of LMFBR programs
- Quality assurance and nondestructive test procedures
- Design and operation of LMFBRs
- Economic and environmental considerations in the development of LMFBRs
- Reactor safety.

The joint coordinating committee is expected to meet annually and is responsible for the implementation, coordination, and review of activities carried out under the agreement.

Agreement on Cooperation in the Field of Radioactive Waste Management

Signatories: **United States,** DOE
Federal Republic of Germany, Federal Ministry for Research and Technology

Term: **1974-1979**

Current Scope and Status of Activities

The purpose of this agreement is to establish a reasonably balanced exchange of radioactive waste-management technology. The agreement provides for exchange of technical information, personnel, visits, and joint projects in the areas of:

- Disposal of radioactive wastes in salt deposits
- Retrievable surface-storage facilities
- Waste-management research and development
- Waste from decommissioning of nuclear installations
- Operating aspects of storage or disposal of low- and intermediate-level waste
- Transportation of radioactive waste.

Agreement in the Field of Gas-Cooled Reactor Concepts and Technology

Signatories: **United States,** DOE
Federal Republic of Germany, Federal Ministry for Research and Technology
France, Atomic Energy Commission
Switzerland, Office of Science and Research

Term: **1977-1987**

Current Scope and Status of Activities

The signatories to this agreement are seeking solutions to problems related to the design, development, construction, and operation of gas-cooled reactors (GCR). The agreement provides for the exchange of technical information, personnel, equipment, materials, seminars, and visits in the areas of:

- GCR technology development (including fuels, materials, components, fission products, and coolants) and design, construction, and operation of test, prototype, and demonstration plants
- High-temperature GCR fuel recycle
- High-temperature GCR steam recycle
- High-temperature GCR direct cycle
- Very high-temperature reactor and process heat
- Gas-cooled fast breeder reactor technology (including components, fuel fabrication, and testing), and design, construction, and operation of test, prototype, and demonstration plants
- Safety
- Economic and environmental studies.

Implementation, coordination, and review are the responsibility of the joint coordinating committee, which meets annually.

Agreement in the Field of Liquid Metal-Cooled Fast Breeder Reactors

Signatories: **United States,** DOE
France, Commissariat a l'Energie Atomique (CEA)

Term: **1977-1982**

Current Scope and Status of Activities

Under this bilateral agreement, France and the United States will exchange technical information, personnel, equipment, materials, seminars, visits, and undertake joint projects on LMFBRs, specifically in the areas of reactor physics and safety.

The execution of this agreement will be supervised by a joint coordinating committee, which is expected to meet annually.

Memorandum of Understanding for Cooperation in Joint Research and Solar Thermal Conversion Systems

Signatories: **United States,** DOE
France, French National Center for Scientific Research

Term: **1976-1978**

Current Scope and Status of Activities

The following scope of activities was agreed upon in the memorandum of understanding:

- Information exchange on research regarding the design and prototype construction of solar cavity boilers
- Cooperation in the study, research, and evaluation of solar energy components, subsystems, and systems for the thermal conversion of solar energy into electric power
- Testing and evaluation of several prototype components such as radiation receivers and cavity boilers/subheaters, as well as ancillary controls and equipment. These tests are being conducted at the French solar test facility in Odeillo, France. In 1976, tests were conducted at Odeillo on a U.S. 1-MW cavity boiler.

Proposed Activities

France is planning to test its own solar boiler in a 5-MW solar thermal test furnace being planned for DOE's Sandia Laboratory in Albuquerque, New Mexico.

Memorandum of Understanding for Cooperation on Certain Safety Aspects of Solar Towers

Signatories: **United States,** DOE
France, French National Center for Scientific Research (CNRS)

Term: **1977-1979**

Current Scope and Status of Activities

The following scope of activities was agreed upon in the memorandum of understanding:

- DOE (at Sandia Laboratories) will test flux intensity measurements of single heliostat beams vs distance at ground level and characterize, by means of aircraft flyovers, the quality and quantity of light reflected into the airspace above the field of focused heliostats
- CNRS will conduct similar tests at Odeillo
- Test plans will be exchanged, and test data and analyses will be reviewed jointly.

Arrangement to Exchange Information on the Utilization of Energy from Geothermal Sources and Amendment

Signatories: **United States,** DOE
Iceland, Icelandic National Energy Authority

Term: **1973-1978**

Current Scope and Status of Activities

The current scope of activities provides for the two participating countries to exchange information. Specifically, the United States has agreed to provide information related to:

- Operating experience from any steam plant at The Geysers, California
- New exploration and resource assessment methods
- Development of binary cycles
- Use of hydrothermal systems
- Energy recovery from hot dry rock
- Production of fresh water from saline geothermal fluids
- Systems analysis of techniques for utilization of geothermal energy.

Iceland has agreed to provide information on:

- Engineering and operating experience in process heating
- Electricity generation from geothermal sources
- Geophysical prospecting, well completion, stimulation of wells, and use of downhole pumps.

A 1974 amendment to the arrangement expanded the original scope of activities to include cooperation in undertaking joint projects in any of 10 specific technology areas related to applications of geothermal energy.

Agreement Concerning Cooperative Information Exchange Relating to the Development of Geothermal Energy

Signatories: **United States,** DOE
Italy, Italian National Research Council (CNR) in cooperation with the Ente Nationale per l'Energia Elettrica (ENEL)

Term: **1976-1981**

Current Scope and Status of Activities

The bilateral agreement on the development of a geothermal data base calls for computerized information exchange, at 4-month intervals beginning July 1, 1976, on the location, size, and characteristics of geothermal wells and fields, bibliographic information, and heat transmission data. Italy and the United States have agreed on a common format for exchanging data and have designated representatives to coordinate implementation of the agreement.

Proposed Activities

To establish a data base, the United States will collect data on the Americas, Oceania, Iceland, and Asia (except for the USSR); CNR/ENEL will collect data on Europe (except for Iceland), Africa, and the USSR.

Agreement on Cooperation in the Field of Geothermal Energy Research and Development

Signatories: **United States,** DOE
Italy, ENEL

Term: **June 3, 1975-June 2, 1980**

Current Scope and Status of Activities

Italy and the United States are conducting cooperative work in the following aspects of geothermal research and development:

- Stimulation of hot dry rock and hydrothermal reservoirs
- Reservoir physics and engineering
- Environmental control technology
- Utilization of hot brine resources
- Deep drilling.

The two countries will exchange scientists, information, meetings, visits, and project and experiment plans.

Agreement on Cooperation in the Field of Energy Research and Development

Signatories: **United States**
Japan

Term: **1974-1979**

Current Scope and Status of Activities

A broad umbrella agreement, signed July 15, 1974, by Takeshi Yasukawa of Japan and Secretary Henry Kissinger of the United States, covers cooperative efforts in the following areas:

- Solar energy applications
- Geothermal energy applications
- Storage batteries
- Gasification and liquefaction of coal
- Energy applications of hydrogen
- Magnetohydrodynamic conversion
- Fuel cells
- Electrical energy transmission by superconduction or microwaves
- Advanced propulsion systems
- Energy conservation
- Utilization of waste materials and waste heat
- Other areas relating to energy research and development as may be agreed.

Cooperation is expected to take the form of visits, meetings, information exchange, and joint projects. Specific projects in the areas outlined in the umbrella agreement will be implemented by interagency protocols.

Currently, the United States and Japan are negotiating specific technical exchange arrangements in geothermal and solar energy. The two nations will soon undertake negotiations on battery and electric vehicle development.

Arrangement on Fast Breeder Reactors

Signatories: **United States,** DOE
Japan, Power Reactor and Nuclear Fuel Development Corporation

Term: **1969-1979**

Current Scope and Status of Activities

Japan and the United States are exchanging visits and documents on the development of LMFBRs. The exchange arrangement covers the following topics:

- Reactor physics
- Nuclear safety
- Fuels and materials
- Sodium technology
- Component development
- Plant experience.

Proposed Activities

Negotiations are in progress on a broadened agreement that will include fuel recycle, quality assurance, nondestructive practices, economic and environmental considerations, and safeguards technology and nuclear steam supply systems.

Agreement on Cooperation in Geothermal Energy R&D

Signatories: **United States,** DOE
Mexico, Comision Federal de Electricidad (CFE)

Term: **1977-1982**

Current Scope and Status of Activities

Under this agreement, CFE and DOE will conduct cooperative studies of the Cerro Prieto geothermal reservoir in Mexico. These studies may include:

- Analysis of geologic and hydrogeologic setting
- Geophysical studies
- Core sampling and well logging
- Isotope studies of geothermal fluid, shallow groundwater, and surface waters
- New methods of pressure measurement
- Subsidence measurements
- Monitoring of reservoir behavior
- Reinjection of waste water.

The objectives of these cooperative efforts, which will involve exchanges of experts, information, meetings, and project and experimental plans, are to develop an understanding of the nature and magnitude of geothermal energy resources, investigate the most economical and productive methods of exploiting this resource, and determine the impact of development on the reservoir's subsurface environment.

Definitive Agreement on Specific Projects in Coal Research

Signatories: **United States,** DOE
Poland, Polish Ministry of Mining (PMM)

Term: **June 30, 1977, until termination by mutual agreement**

Current Scope and Status of Activities

As part of the agreement between the government of the United States and the government of the Polish People's Republic on funding cooperative work in science and technology, signed in October 1974, the Marie Sklodowska Curie fund was established to support joint scientific and technological research projects, including coal research. This activity utilizes PL 480 funds* and some Polish funds. Total funding by the United States equals $6,550,000; funding by Poland totals $4,644,140.

The DOE-PMM agreement on specific projects in coal research implements the broader agreement between Poland and the U.S. The DOE-PMM agreement covers coal extraction and utilization research and development projects, specifically in the areas of coal liquefaction, mining technology, and coal gasification for MHD power generation. Poland will undertake R&D projects on the following topics and will provide semiannual progress reports and a final report on the following research projects:

- Test of suitability of pumps for high-parameter operation
- Catalysts for hydrogenation processes
- Coal extraction and ash removal from extracts on a laboratory scale
- Carbonization of solid residues from coal-liquefaction processes
- Effects of hydrogen-donor solvent and the proportion of extraction recycle solvent on coal extraction
- Noncatalytic coal liquefaction in the presence of hydrogen
- Coal combustion and gasification for MHD power generation
- Combustion of synthetic fuels for power generation.

Supervision of projects is the responsibility of designated project officers in each country.

*Special foreign currency.

Memorandum on Cooperation in the Peaceful Uses of Atomic Energy

Signatories: **United States,** DOE
Romania

Term: **Initiated in 1968, renewed periodically**

Current Scope and Status of Activities

A memorandum on cooperation in the peaceful uses of atomic energy provides for exchange of scientific personnel and information, principally in the basic nuclear sciences. This memorandum is currently in effect under the terms of the 1974 Cultural and Scientific Exchange Agreement.

Agreement Concerning a Cooperative Program on Radioactive Waste Storage in Deep Geologic Formations

Signatories: **United States,** DOE
Sweden, Swedish Nuclear Fuel Supply Company (SKBF)

Term: **July 1, 1977-June 30, 1980**

Current Scope and Status of Activities

The purpose of this agreement is to establish a cooperative program for field-testing experiments and techniques for measuring fluid movement through fractures in a granitic rock system. The abandoned Strupa mine in Sweden is being used to assess the suitability of such rock for storage of radioactive material.

Specific cooperative activities include investigation of:

- Temperature effects in granite
- Long-term effect of waste heat on fractured granite
- Fracture hydrology
- Methods for determining locations of fractures
- Properties of granitic rocks
- Method for measuring seepage rate in low-permeability rocks
- Virgin state of stress in fractured granitic rock mass.

Cooperation is taking the form of exchange of scientific information, visits, and personnel; joint meetings; provision of equipment for experiments by DOE; and site preparation by SKBF.

Letter of Agreement on Collaboration in Controlled Thermonuclear Research

Signatories: **United States,** DOE
United Kingdom, Atomic Energy Authority (UKAEA)

Term: **Ongoing since 1958**

Current Scope and Status of Activities

DOE and UKAEA are exchanging, on a routine basis, personnel and information on all aspects of basic fusion research. Specifically, this includes the areas of neutral beams and superconducting magnets, as well as other fusion technologies. On August 3, 1977, DOE loaned an ORMAK shell and core to the United Kingdom's Culham Laboratory for use in the upgrading of their HBTX-1 device for reversed field pinch experiments.

Agreement on Terms for Exchange of Information in Coal Technology

Signatories: **United States,** Department of the Interior
United Kingdom, National Coal Board

Term: **July 1, 1974-June 30, 1977 (automatic 2-year extensions)**

Current Scope and Status of Activities

The United States Department of the Interior and the United Kingdom National Coal Board are exchanging personnel, research material, and basic information on all aspects of coal utilization, from resource identification to end use, including:

- Identification of reserves
- Extraction technology
- Coal conversion
- Transport
- Utilization
- Impact of economic, legal, environmental, health, and safety requirements on the use of coal.

By letter agreement between the Administrator of ERDA and the Secretary of the Interior dated August 1975, ERDA agreed to participate in those program elements of the Agreement that fall within the purview of ERDA (now DOE).

Agreement in the Field of Liquid Metal-Cooled Fast Breeder Reactors

Signatories: **United States,** DOE
United Kingdom, UKAEA

Term: **1976-1981**

Current Scope and Status of Activities

The purpose of this agreement is to establish a reasonably balanced exchange of LMFBR technology. The United States and the United Kingdom will exchange technical information, materials, personnel, and equipment and organize joint seminars and visits in the areas of:

- Reactor neutronics
- Fuels and materials
- Fuel cycle
- Reactor and sodium systems and components
- Sodium technology
- Nonnuclear test facilities that support LMFBR programs
- Quality assurance and nondestructive practices
- Reactor safety
- Overall LMFBR programs of the United Kingdom and the United States
- Operation of LMFBRs
- Topics of interest in industry
- Economic and environmental considerations.

Implementation is governed by the joint coordinating committee, which is expected to meet annually to assess the balance of exchanges and review the status and plans of each country's LMFBR program. An activity of major importance is the proposed irradiation of several hundred U.S. and United Kingdom fuel pins in the United Kingdom prototype fast reactor, to be followed by post-irradiation testing in the United States.

Agreement on Cooperation in the Field of Energy

Signatories: **United States**
Union of Soviet Socialist Republics (USSR)

Term: **June 28, 1974-June 27, 1979 (with automatic 5-year extensions)**

Current Scope and Status of Activities

The objectives of this umbrella agreement are to accelerate energy research and development through cooperative efforts and to improve mutual understanding of each country's national energy programs and outlooks. Forms of cooperation include exchange of technical information, scientists, and specialists, as well as joint work and joint seminars. Cooperative activities are implemented by the Joint Committee on Energy and executive agents.

Nine projects implemented by joint groups of experts were transferred from the 1972 Agreement on Cooperation in the Fields of Science and Technology; one was transferred from the Environmental Protection Agreement. Specifically, these projects include:

- Thermal power stations
- Hydroelectric power stations
- Heat-rejection systems
- Power-plant pollution reduction
- Ultra-High Voltage and High Voltage Direct Current transmission technology
- Electric power systems
- Superconducting transmission technology
- Magnetohydrodynamics
- Solar energy
- Geothermal energy.

Specific plans for cooperative activity for each year are negotiated at meetings of experts groups for each technology and set forth in protocols.

At the October 1974 meeting of the Joint Committee, it was agreed that cooperation under this agreement would also be considered in the following areas:

- Coal technology
- Oil technology

Agreement on Cooperation in the Field of Energy (continued)

- Gas technology
- Energy information and forecasting.

DOE has general oversight responsibility for all R&D projects, as well as the energy information activity, although implementation of several of the specific activities is the responsibility of other U.S. organizations (e.g., Tennessee Valley Authority and Department of the Interior). Day-to-day coordination of activities is handled by executive agents: DOE in the United States, and the Ministry of Power and Electrification in the USSR.

Descriptions of the projects under this agreement for which DOE has specific responsibility follow on succeeding pages.

U.S.–USSR Umbrella Energy Agreement

Thermal Power Stations

Current Scope and Status of Activities

Information is being exchanged on the design and operation of thermal and nuclear power stations. Specific areas of concentration are reliability, flexibility, and requirements for power systems.

Delegations were exchanged in June 1976. In June 1977, a USSR delegation visited the United States and concluded a protocol for future cooperation. In September 1977, a United States delegation visited the Soviet Union to discuss information and visit sites related to Soviet thermal power plant technology.

Hydroelectric Power Stations

Current Scope and Status of Activities

The scope of this project encompasses the design, construction, operation, and maintenance of hydroelectric systems, including dams, power plants, and associated electrical and mechanical equipment. In addition, projects related to construction technology in cold climate conditions have been transferred to the Energy Agreement.

A seminar on the design and construction of large dams in seismic regions took place in July 1977 in the USSR; a seminar in cold weather construction techniques took place in May 1977 in the USSR; and a seminar on engineering inspection of hydraulic structures and instrumentation took place in December 1977 in the United States.

Heat-rejection Systems

Current Scope and Status of Activities

The purpose of this project is to exchange information in the areas of power-plant heat dissipation methodologies, process heat, district heating, and waste-heat utilization. The current scope of activities involves information exchange on the design and operation of heat rejection and water supply systems for thermal and nuclear power plants, including intake structures and piping, circulating pumps, condensers, outlet piping and structures, cooling towers, artificial reservoirs, spray ponds, and associated equipment.

An experts group meeting on heat dissipation was held in the United States in September 1977.

Power-plant Pollution Reduction

Current Scope and Status of Activities

The purpose of this project is to foster cooperation in the field of emission control from fossil-fired thermal power generating plants. Information has been exchanged in the areas of nitrogen oxide control, particulate control, and sulfur dioxide control. The current scope of activities includes:

- Design and operation of air pollution reduction and waste-disposal systems for thermal power plants
- Monitoring and control of nitrogen oxide and wet scrubbers.

A United States delegation visited the USSR in July 1977 to participate in joint ash-removal tests at the Reftinskaya Power Plant.

Ultra-High Voltage (UHV) and High Voltage Direct Current (HVDC) Transmission Technology

Current Scope and Status of Activities

Three meetings of project groups have been held since 1974 and a symposium on alternating current (AC) transmission was held in the United States in February 1975. In April 1976, the working group met in the USSR to define subtopics for cooperation. General areas of interest include determination of insulation requirements, the effects of contamination, and losses from interference.

The current scope of activities for cooperation in UHV and HVDC transmission technology includes the following:

- Mechanical and electrical UHV design criteria
- Effects of high voltage AC and direct current (DC) steady-state electrical and mechanical fields on human, animal, and plant life
- Determination of insulation requirements
- Effects of contamination
- Study of interference and corona losses
- Effects of fields.

Proposed Activities

The next symposium on AC transmission is scheduled for spring 1978 in the USSR.

Superconducting Transmission Technology

Current Scope and Status of Activities

The scope of cooperative efforts in superconducting transmission encompasses the design and development of commercial superconducting transmission lines. The program is very active, with several exchange visits each year for joint experiments. Cooperation proceeds in the areas of power transmission systems, dielectric systems, hydrodynamics and heat transfer, superconducting materials, and cryogenic systems.

U.S.–USSR Umbrella Energy Agreement

Magnetohydrodynamics

Current Scope and Status of Activities

The bilateral project with the USSR in MHD, which was initiated in 1973, allows for information exchanges, joint visits, and cooperative experiments testing U.S. components in two USSR facilities, the U-02 and the U-25.

Programmatically, the cooperative effort has focused on joint work contributing to the development and operation of the MHD channel—the major component of a commercial MHD power plant. Three working groups were organized to address the major problems in this area: (1) channel design and testing, (2) electrode system development, and (3) superconducting MHD magnet development and the study of high-field MHD interactions. A fourth working group was organized to analyze the technical and economic aspects of MHD and to prepare a comprehensive status report describing the current state-of-the-art in MHD. This joint status report on open-cycle MHD power generation has been completed and is being prepared for publication.

Effective April 21, 1977, the four working groups in MHD were superseded by two working groups: MHD Power Plant Systems and Engineering; and MHD Technology Development. The working group for MHD Power Plant Systems and Engineering will analyze the scientific, technical, and economic problems of MHD plant development; and exchange information on MHD plant development and facilities, analysis and optimization of MHD systems, and plant layouts. The working group on MHD Technology will develop MHD components and test programs, test MHD components, and conduct cooperative research.

Information from the cooperative exchange is transferred through frequent meetings, reports, and visits. During 1976, scientists and engineers from the United States spent 70 person-weeks in the USSR, and Soviet scientists and engineers spent 83 person-weeks in the United States.

Proposed Activities

A channel developed in the United States is scheduled to be tested in the Soviet U-25 facility in 1978. Similarly, a 40-ton superconducting magnet built in the United States is being operated in a specially constructed portion of the U-25 facility for a study of high magnetic field MHD phenomena.

U.S.–USSR Umbrella Energy Agreement

Solar Energy

Current Scope and Status of Activities

The current scope of cooperative activity under this agreement includes information exchange in:

- Solar heating and cooling
- Solar thermal power stations
- Photovoltaics.

Seminars were held in the USSR in all three areas in late 1977.

Geothermal Energy

Current Scope and Status of Activities

This bilateral agreement covers exchange of information on general technology for the utilization of geothermal energy, including:

- Drilling methods
- Reservoir modeling and production
- Utilization technology
- Environmental protection.

Cooperation in this area has been inactive since 1974.

U.S.–USSR Umbrella Energy Agreement

Oil Technology

Current Scope and Status of Activities

Cooperation in oil technology was approved as an official Energy Agreement project in December 1976. In October-November 1977, a Soviet delegation visited the United States and concluded a protocol that provides for future cooperation in the areas of: geochemical exploration; new methods of enhanced oil recovery; fundamental properties of petroleum; hydrocarbon extraction from heavy oil deposits and tar sands; and pressure maintenance by water and gas injection.

Proposed Activities

A symposium in geochemical exploration and fundamental properties of petroleum is tentatively scheduled for May or June 1978.

Gas Technology

Current Scope and Status of Activities

Cooperation in gas technology was approved as an official Energy Agreement in December 1976. The program will cover Arctic operations and enhanced gas recovery. Cooperation in gas-distribution systems and industrial gas burners is also under consideration.

In February-March 1977, a United States delegation of industry officials visited the USSR to exchange information and view Arctic operations sites. It is anticipated that a United States delegation will visit the USSR in early 1978 to update the protocols and discuss enhanced gas recovery.

U.S.–USSR Umbrella Energy Agreement

Energy Information and Forecasting

Current Scope and Status of Activities

The current scope of activities calls for exchange of information, seminars, and meetings on the following:

- Forecasting methodologies
- Methods for increasing fuel efficiency
- Methodologies for determining oil and gas reserves
- Relationship between energy growth and economic growth
- Optimal transportation on systems for delivery of fuel and energy to demand centers.

A seminar on the first two areas was held in the United States in late 1977.

Agreement on Cooperation in the Peaceful Uses of Atomic Energy

Signatories: **United States**
Union of Soviet Socialist Republics

Term: **June 21, 1973-June 20, 1983**

Current Scope and Status of Activities

The objectives of this umbrella agreement are to develop new energy sources through research, development, and utilization of nuclear energy. In addition, an agreement has been proposed in the field of spent fuel storage. Cooperative efforts include joint work, joint seminars, and exchanges of technical information, scientists, equipment, and materials. To execute cooperative activities, joint working groups of scientists and engineers are established. Day-to-day coordination of activities is managed by executive agents: DOE in the United States, and the State Committee for the Utilization of Atomic Energy in the USSR. Cooperation is concentrated in:

- Continued thermonuclear research
- Fast breeder reactors
- Fundamental properties of matter.

The U.S.-USSR Joint Committee on Atomic Energy meets annually to implement activities. At the third meeting of the Joint Committee on Atomic Energy (December 1975) it was agreed to consider cooperation in the areas of:

- Light-water reactors
- Thermionics
- Spent fuel storage.

U.S.–USSR Umbrella Atomic Energy Agreement

Controlled Thermonuclear Research

Current Scope and Status of Activities

Within the scope of the U.S.–USSR Atomic Energy Agreement, the United States and the USSR are cooperating on the research and development aspects of controlled thermonuclear fusion, including theoretical, experimental, and design-construction studies. Forms of cooperation include joint workshops, meetings, and exchange of personnel and information.

Proposed Activities

Additional activities are proposed in the following areas:

- Large fusion experiments and associated technology leading toward a fusion power plant by the year 2000
- Tokamaks, advanced concepts, supporting physics and technology, materials studies, system engineering, and environmental and safety considerations.

Fast Breeder Reactors

Current Scope and Status of Activities

On June 21, 1973, the United States and the USSR agreed to undertake cooperative efforts on basic and applied problems related to the design, development, construction, and operation of nuclear power plants that utilize fast breeder reactors. Forms of cooperation may include assignment of personnel to each country's laboratories, research centers, universities, and reactor test facilities. Presently, the two countries are conducting two joint seminars yearly and undertaking joint projects that involve exchange of fast breeder reactor materials and information.

As part of the agreement, the United States and the USSR have been discussing the possibility of conducting a test of an LMFBR steam generator in the Soviet BN-350 fast breeder reactor. This proposed large-scale test has increased in importance with the decision to defer construction of the Clinch River Breeder Reactor. The steam generator would be tested to achieve the equivalent of 5 years of full power operation.

Proposed Activities

Proposed activities include expansion of joint projects in this area and possible exchange of scientists for research and development in each other's laboratories.

U.S.–USSR Umbrella Atomic Energy Agreement

Fundamental Properties of Matter

Current Scope and Status of Activities

The United States and the USSR have undertaken joint theoretical and experimental studies in high-, medium-, and low-energy physics. The program of research projects primarily involves the use of proton accelerators at the Institute for High Energy Physics, Serpukhov, USSR, and at the Fermi National Accelerator Laboratory, Batavia, Illinois. Joint experiments on the 200-GEV accelerator have required long-term visits at Batavia by Soviet physicists, who have brought with them equipment from the 200-GEV accelerator at Serpukhov.

Proposed Activities

Activities may also include designing, planning, and constructing joint facilities. In addition, the program of cooperation, when fully implemented, will provide access to several new USSR facilities and present a better overall picture of the capabilities of Soviet facilities in high-energy physics and in such aspects of materials science as surface physics, neutron inelastic scattering, and radiation damage.

Light-water Reactors

Proposed Activities

Information exchanges are proposed, as a result of a protocol agreement, in the following aspects of light-water reactor (LWR) technology:

- Reactor safety regulation
- Peak load management
- Reactor safety research
- Reactor materials and in-pile testing
- Operation of nuclear power stations.

U.S.–USSR Umbrella Atomic Energy Agreement

Thermionics

Current Scope and Status of Activities

Two delegations of specialists visited each other's countries in July 1977. Proposals for specific topics for cooperation will be submitted to the Joint Committee in January 1978.

Spent Fuel Storage (Proposed)

Current Scope and Status of Activities

The United States has proposed LWR spent-fuel storage as a potential topic for cooperation. Specifically, the United States has proposed an exchange of information on:

- Improved methods of transportation and handling via rail, highway, sea, and air
- Long-term retrievable storage of fuel elements.

The USSR has indicated that it is interested in discussing the possibility for cooperation in this area.

International Energy Agency

The oil embargo of 1973 and the consequent sharp rise in world oil prices severely disrupted the economies and strained the political, strategic, and economic relationships of most oil-importing nations. Inadequate cooperation among the industrialized nations resulted in competitive unilateral efforts by many to ensure current and future supplies of oil.

Recognizing the need to unite in a coordinated effort to decrease dependence on foreign oil and thereby reduce strategic and economic vulnerability, the United States and most other members of the Organization for Economic Cooperation and Development (OECD) agreed in September 1974 to develop an International Energy Program (IE). The program was to serve as a vehicle for the participating nations to cooperate in the development of alternative energy sources and to share oil in times of emergency. To administer, monitor, and execute the IEP, the participating nations established the IEA as an autonomous institution with OECD. Nineteen nations are currently participating in IEA: Austria, Belgium, Canada, Denmark, the Federal Republic of Germany, Greece, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States. Under special arrangement (Article 72 of the basic agreement), the European Community (EC) and OECD's Nuclear Energy Agency (NEA) also participate.

At IEA's initial meeting in November 1974, the following specific objectives were defined:

- To promote secure oil supplies
- To develop an emergency self-sufficiency in oil supplies, restrain demand, and allocate available oil among member countries on an equitable basis
- To promote cooperative relations with oil-producing countries and with other oil-consuming countries, including those of the developing world
- To reduce member-country dependence on imported oil by undertaking long-term cooperative efforts on energy conservation, accelerated development of alternative sources of energy, energy research and development, and uranium supply and enrichment.

To accomplish these objectives, IEA was organized into a Governing Board (composed of one or more ministers or their delegates from each participating country), a Management Committee (composed of one or more senior representatives of the government of each participating country), and the following four standing groups (each composed of one or more representatives of the government of each participating country):

- Emergency Questions—to deal with emergency self-sufficiency, demand restraint, allocation, and activation
- Oil Market—to develop an international oil market information system and to establish an internal, permanent framework for obtaining information from or consulting with individual oil companies on the oil industry
- Long-Term Cooperation on Energy—to reduce member dependence on imported oil over the longer term

International Energy Agency (continued)

- Relations with Producer and Other Consumer Countries—to promote cooperative relations with oil-producing nations and other major oil consumers.

The member nations agreed that, except in the case of the Standing Group on Emergency Questions, standing group or project participation would be strictly voluntary.

The Standing Group on Long-Term Cooperation on Energy originally selected four major areas on which to focus its efforts: energy conservation, alternative sources of energy, energy research and development, and uranium enrichment. An autonomous subgroup was established for each of these areas and charged with responsibility for developing and conducting related cooperative projects. However, in recognition that energy research and development represents a broad area that offers significant opportunity for formulation of solutions to the major consumer nations' energy problems, in November 1975, the Subgroup on Energy R&D was redesignated a committee of equal status with the four standing groups. The committee was mandated to work closely with the Standing Group on Long-Term Cooperation on Energy to ensure a coordinated long-term program. In July 1976, a Nuclear Subgroup was also chartered by that standing group.

The IEA activities in which DOE, the Nuclear Regulatory Commission, the U.S. Bureau of Mines, and the U.S. Geological Survey of the Department of the Interior, and the Environmental Protection Agency have been most actively involved have been conducted under the Committee on Energy Research and Development. As IEA members express interest in developing and conducting cooperative energy R&D projects, working parties comprising representatives of those member nations interested in participating in a particular project are established. Under the chairmanship of a designated lead country or organization, each working party seeks to develop a cooperative program of mutually beneficial projects relating to various energy technologies. Currently, 14 working parties are conducting cooperative energy R&D projects:

Biomass Conversion
Coal Technology
Conservation
Energy R&D Strategy
Fusion
Geothermal
High-Temperature Reactors for Process Heat
Hydrogen
Nuclear Safety
Radioactive Waste Management
Small Solar Power Systems
Solar Energy
Wind Power
Ocean Energy Systems.

In addition, a working party on energy R&D strategy was established to develop an overall IEA R&D strategy based on quantitative analysis of the contribution that various energy technologies could be expected to make to energy balances in the future. This analysis will establish priorities for national and cooperative R&D efforts.

International Energy Agency (continued)

The United States has been designated the IEA lead country for working party efforts in the areas of conservation, nuclear safety, ocean thermal energy conversion, and energy R&D strategy. Various U.S. agencies are participating in all 14 working parties.

The efforts of the working parties have been directed toward the negotiation of multilateral implementing agreements governing activities in these areas. As of January 1, 1978, 21 implementing agreements were signed.

Working Party on Coal Technology

Coal Mining Technology Clearing House Service

Signatories:

Belgium	New Zealand
Canada	Spain
Federal Republic of Germany	United Kingdom
Italy	United States (Bureau of Mines)

Exchange of information and personnel to establish and operate a central collection and distribution center for information on R&D projects on underground and surface coal mining and coal preparation technology. Signed November 1975 for 3 years.

World Coal Resources and Reserves Data Bank Service

Signatories:

Belgium	Italy
Canada	United Kingdom
Federal Republic of Germany	United States (U.S. Geological Survey)

Exchange of information and personnel to establish and operate a central data bank service on world coal resources and reserves. Signed November 1975 for 3 years.

Coal Technical Information Service

Signatories:

Austria	Netherlands
Belgium	New Zealand
Canada	Spain
Federal Republic of Germany	Sweden
Italy	United Kingdom
Japan	United States

Information storage and retrieval system on current research in coal science and technology. Signed November 1975 for 3 years.

Economic Assessment Service for Coal

Signatories:

Canada	Spain
Federal Republic of Germany	Sweden
Italy	United Kingdom
Netherlands	United States

Exchange of information on assessments of coal utilization, effluent disposal, and coal conversion, cost, and availability. Signed November 1975 for 3 years.

Fluidized Combustion of Coal

Signatories:
Federal Republic of Germany
United Kingdom
United States

Joint design, construction, and operation of a facility to study the capabilities of a pressurized fluidized-bed combustion system. The facility will be located in the United Kingdom. Signed November 1975 for 8 years.

Coordination of National Planning in Coal Hydrogenation

Signatories:
United States
Federal Republic of Germany

Memorandum of Understanding. Exchange of information and periodic meetings of program staffs to coordinate national program planning to develop supportive and complementary R&D programs in coal hydrogenation. Signed October 1977 for 1 year.

Advanced Coal Gasification and Refining of Coal-Derived Liquids

Signatories:
United States
Federal Republic of Germany

Letter of Intent. Each party has agreed to execute IEA Agreements to invest $8-10 million in project of other party. The Federal Republic of Germany will invest in U.S. demonstration refinery for coal-derived liquids. The United States will invest in an existing German gasification plant using advanced Otto-Rommel process.

International Energy Agency (continued)

Working Party on Conservation

Heat Pump Systems

Signatories:

Austria	Netherlands
Denmark	New Zealand
Federal Republic of Germany	Sweden
Ireland	Switzerland
Italy	United States

Exchange of information and coordination of experimental programs on heat pump systems with thermal storage. Signed March 1977 for 3 years.

Energy Cascading

Signatories:

Austria	Sweden
Belgium	Switzerland
Federal Republic of Germany	United States
Netherlands	

Common study, including market assessment, technology survey, economic analysis, and identification of needed R&D for all electric systems, combined systems, all heat systems, and total systems. Signed March 1977 for 3 years.

Buildings and Community Systems

Signatories:

Canada	Switzerland
Denmark	United Kingdom
Italy	United States
Sweden	

Exchange of information and interface with LBL system to compare analytical techniques to evaluate load and energy usage for different materials, buildings, designs, and equipment. Signed March 1977 for 3 years.

Conservation in Building Complexes

Signatories:
Federal Republic of Germany
United States

Exchange of information and personnel and joint evaluation of community conservation demonstration projects at Wiehl and Esslingen in the Federal Republic of Germany. Signed June 1976 for 5 years.

Combustion

Signatories:
Sweden
United Kingdom
United States

Exchange of information on instrumentation, processes, and modeling to evaluate conservation possibilities of combustion processes and to develop improved designs for combustion systems. Signed March 1977 for 3 years.

Ekistics and Advanced Energy Systems

Signatories:
Greece
United States

Joint conferences and demonstration of site-specific application of ekistics (the science of human communities) and energy systems analysis to promote conservation of energy on a community scale. Signed October 1976 for 1½ years.

Heat Transfer and Heat Exchangers

Signatories:
Sweden
Switzerland
United Kingdom
United States

Exchange of information on R&D projects and theoretical studies in each country on extended surface heat transfer, optional design of heat exchanger networks, and heat exchanger tube vibration. Signed June 1977 for 3 years.

Working Party on Fusion

Intense Neutron Source Experiment

Signatories:
Canada
the European Communities
Japan
Sweden
Switzerland
United States

Exchange of personnel to conduct joint experimental and theoretical research on ion source development, vacuum engineering, and systems engineering at the Intense Neutron Source Facility at Los Alamos Scientific Laboratory. Signed May 1976 for 4 years.

International Energy Agency (continued)

Superconducting Magnets for Fusion Power

Signatories:
EURATOM
Switzerland
United States

Assignment of personnel and joint experiments on large superconducting magnet systems at the Oak Ridge Large Coil Test Facility (LCTF). Each participant will design, fabricate, and deliver a $1-million coil for testing in the LCTF together with three U.S. coils. Signed October 1977 for 6 years.

Plasma Wall Interaction in Textor

Signatories:
Canada
EURATOM
Switzerland
Turkey
United States

Assignment of specialists, testing of hardware and materials, and joint experiments at the TEXTOR facility in the Federal Republic of Germany on plasma wall materials, structures, and temperatures. Signed October 1977 for 8 years.

Working Party on Geothermal Energy

Man-Made Geothermal Energy Systems

Signatories:
Federal Republic of Germany
Sweden
Switzerland
United Kingdom
United States

Jointly funded study ($600 thousand) to identify possible technical systems and recommend possible future laboratory studies, hardware development, and field testing for extracting thermal energy from the earth's crust. Signed October 1977 for 2 years.

International Energy Agency (continued)

Working Party on Hydrogen

Hydrogen Production from Water

Signatories:

Belgium	Japan
the European Communities	Netherlands
Canada	Sweden
Federal Republic of Germany	Switzerland
Ireland	United States
Italy	

Exchange of information and personnel, including workshops, on (1) specific process steps for thermochemical production of hydrogen, (2) thermochemical production using high-temperature reactors as heat source, and (3) assessment of potential future markets. Signed October 1977 for 3 years.

Working Party on Nuclear Safety

Reactor Safety Research and Development

Signatories:

Austria	Netherlands
Belgium	Norway
Canada	Spain
Denmark	Sweden
Federal Republic of Germany	United Kingdom
Italy	United States (Nuclear
Japan	Regulatory Commission)

Exchange of technical information and progress reports and joint meetings of experts on reactor safety research. Provision for further bilateral or multilateral agreements on specific R&D projects. Signed May 1976 for 5 years.

Working Party on Small Solar Power Systems

Small Solar Power Systems

Signatories:

Austria	Spain
Belgium	Sweden
Federal Republic of Germany	Switzerland
Greece	United Kingdom
Italy	United States

Jointly funded design study (Phase I), leading to construction and operation (Phase II) of a 500-kW distributed collector solar power plant and a 500-kW central receiver solar plant in Almeria, Spain. Total funding Phase I—$850 thousand. Signed October 1977 for 6 years.

International Energy Agency (continued)

Working Party on Solar Energy

Solar Energy

Signatories:

Austria	Netherlands
Belgium	New Zealand
Denmark	Spain
the European Communities	Sweden
Federal Republic of Germany	Switzerland
Italy	United Kingdom
Japan	United States

Exchange and compilation of information on (1) performance of solar heating and cooling systems, (2) R&D on components, (3) performance testing of solar collectors, (4) insolation and instrumentation, and (5) application of existing meteorological information. Signed December 1976 for 3 years.

Working Party on Wind Power

Large-Scale Wind Energy Conversion Systems

Signatories:

Denmark	Sweden
Federal Republic of Germany	United States

Exchange of information and personnel, including periodic meetings of program directors, to coordinate execution of national projects to design, construct, and operate large machines with a rated power of 1 MWe. Signed October 1977 for 2 years.

Wind Energy Conversion Systems

Signatories:

Austria	Netherlands
Canada	New Zealand
Denmark	Sweden
Federal Republic of Germany	United States
Ireland	

Exchange of information, joint funding of studies, joint development of models, and workshops on (1) environmental and meteorological aspects, (2) evaluation of siting models, (3) integration into electricity supply systems, and (4) rotor-stressing and operation of large-scale systems. Total funding: $960 thousand. Signed October 1977 for 3 years.

International Atomic Energy Agency

IAEA was established in 1957 largely as a result of the U.S. initiative first expressed by President Eisenhower in an address to the United Nations. Today, with 110 member countries (see Exhibit 2), IAEA is the principal international organization responsible for furthering a broad range of nuclear technologies and related activities.

The organization of IAEA (see Exhibit 3) includes a Board of Governors, and a 34-member executive body with broad authority to establish policies and implement programs. The 110-member General Conference, which meets annually, elects the Board of Governors and approves members, budget, and program.

IAEA's objectives are to promote the development and application of nuclear energy for peaceful purposes; to foster the exchange of scientific and technical information; and to provide for materials, services, equipment, and facilities for nuclear development and application. One of IAEA's primary responsibilities under its enabling statute is to ensure, to the extent possible, that assistance provided under its auspices will not be used to further any military purposes.

To achieve its objectives of promoting peaceful nuclear applications, IAEA sponsors a variety of programs, including training courses, panels, and conferences. In addition, IAEA serves as executing agency for projects undertaken under the aegis of other organizations affiliated with the United Nations; supports research contracts; operates laboratory programs; and manages an International Nuclear Information System.

To fulfill its responsibility to prevent the misuse of transferred nuclear research or technologies, IAEA has created and implements a unique system of international safeguards that includes a provision for on-site inspections. The United States is principally interested in nuclear safeguards to ensure against diversion of sensitive nuclear materials for military purposes. However, the U.S. recognizes the primary interest of developing nations in the technical assistance program and provides extensive support for such programs, as well as for safeguards.

U.S. involvement in IAEA activities is concentrated in the following areas:

- Safeguards and accountability of nuclear material
- Nuclear safety and standards
- Scientific information exchange
- Technical assistance program.

Programs are implemented through five departments under the Director General, who is appointed by the Board of Governors. The Department of Safeguards and Inspection develops and implements the safeguards system designed to ensure against any military use of equipment and assistance. The Department of Technical Assistance and Publications promotes technology transfer to all members and provides less developed member states with experts, equipment, and training. Coordination of administrative operations is handled by the Department of Administration. Most activities related to energy R&D are the province of the Department of Technical Operations, which produces a comprehensive collection of nuclear information, ensures installation safety and environmental protection, and assists members in planning nuclear power projects. Finally, the Department of Research and Laboratories promotes research activity relating to nuclear energy applications in science, industry, medicine, biology, and food production.

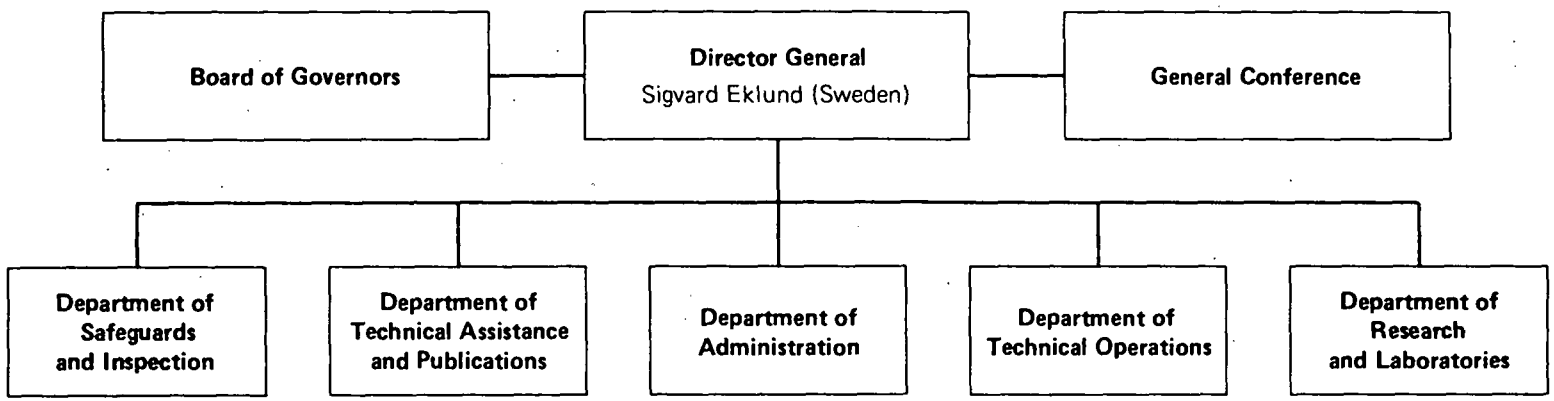
Exhibit 2

IAEA Member Nations

Afghanistan
Albania
Algeria
Argentina
Australia
Austria
Bangladesh
Belgium
Bolivia
Brazil
Bulgaria
Byelorussian Soviet Socialist Republic
Cambodia
Canada
Chile
Colombia
Costa Rica
Cuba
Cyprus
Czechoslovakia
Democratic People's Republic of Korea
Denmark
Dominican Republic
Ecuador
Egypt
El Salvador
Ethiopia
Finland
France
Gabon
Federal Republic of Germany
Ghana
Greece
Guatemala
Haiti
Holy See
Hungary
Iceland
India
Indonesia
Iran
Iraq
Ireland
Israel
Italy
Ivory Coast
Jamaica
Japan
Jordan
Kenya
Kuwait
Lebanon
Liberia
Libyan Arab Republic
Liechtenstein
Luxembourg
Madagascar
Malaysia
Mali
Mauritius
Mexico
Monaco
Mongolia
Morocco
Netherlands
New Zealand
Nicaragua
Niger
Nigeria
Norway
Pakistan
Panama
Paraguay
Peru
Philippines
Poland
Portugal
Qatar
Republic of Korea
Republic of South Vietnam
Romania
Saudi Arabia
Senegal
Sierra Leone
Singapore
South Africa
Spain
Sri Lanka
Sudan
Sweden
Switzerland
Syrian Arab Republic
Thailand
Tunisia
Turkey
Uganda
Ukrainian Soviet Socialist Republic
Union of Soviet Socialist Republics
United Arab Emirates
United Kingdom of Great Britain and Northern Ireland
United Republic of Cameroon
United Republic of Tanzania
United States of America
Uruguay
Venezuela
Yugoslavia
Zaire
Zambia

Exhibit 3

International Atomic Energy Agency



International Atomic Energy Agency (continued)

IAEA communicates the results of its efforts to government agencies and interested industries of member states through agency publications, seminars, international symposia, and other types of meetings. The United States and other member countries contribute to the agency's work directly through participation of consultants or members on committees, expert groups, and assignments to IAEA staff and technical-assistance projects.

Nuclear Energy Agency

The European Nuclear Energy Agency, a division of OECD, was renamed the Nuclear Energy Agency in 1972, when Japan, Canada, and Australia joined the group. The United States joined as a full member in October 1976, after 19 years of participation as an associate member.

NEA's objective is to promote the peaceful use of atomic energy in the member countries by providing a forum for national experts to exchange information on such topics as the nuclear fuel cycle, radiation protection and public health, radioactive waste management, reactor safety and regulatory practices, and nuclear data.

NEA is governed by a Steering Committee composed of senior-level representatives of the 24 member countries. This group oversees a number of committees in specific technological areas. The steering committee meets twice yearly and has overall responsibility for direction and budget of the NEA program.

The activities of the committees are as follows:

The Committee on Radiation Protection and Public Health assesses the relative significance of radiation exposure sources and contributes to the formulation of internationally accepted standards for the radiological protection of people and the environment. The committee is studying means for reducing radiation doses to workers, liquid and gaseous effluent releases, radiation and environmental protection in uranium mining, and radioactive materials in consumer goods.

The Committee on Radioactive Waste Management investigates waste management problems associated with large-scale development of the nuclear industry, e.g., conditioning of high-level wastes, geologic and seabed disposal, gaseous and airborne wastes, and decontamination and decommissioning.

The Committee on the Safety of Nuclear Installations investigates safety questions associated with reactor types currently in operation. The first priority of this committee is light water reactor safety, specifically, research on emergency core cooling, anticipated transients without scram, fuel/coolant interaction, and core melt. The committee also provides for exchange of information among licensing authorities in the member countries.

The Study Group on the Long-Term Role of Nuclear Energy examines worldwide uranium resources, production, exploration, R&D, and demand trends. In November 1977, this group was given a new mandate and renamed the Committee for Technical and Economic Studies on Nuclear Energy Development and the Fuel Cycle.

The Study Group on Isotopic Batteries studies miniature isotopic batteries, plutonium-fueled cardiac pacemakers, and chemical and tritium battery development.

The Working Group on Nuclear Energy Information analyzes data-gathering problems common to nuclear information centers in the member countries.

The Committee on Reactor Physics examines safety questions, such as power distribution, control rod uncertainties, and associated transients.

Nuclear Energy Agency (continuod)

The Nuclear Data Committee specializes in nuclear cross-section measurements, including the impact of neutron data on power reactor technology and improvements in measurement accuracy.

The International Food Irradiation Project, jointly sponsored by NEA, IAEA, and FAO, studies the wholesomeness of irradiated foods.

NEA groups have also been established to coordinate exchange of information on gas-cooled fast reactors (GCFR) and third-party liability. The GCFR group coordinates national programs for the development of GCFR. The group of government experts on third-party liability examines specific questions pertaining to application of the Paris and Brussels Conventions on Third Party Liability in the Field of Nuclear Energy.

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