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Volume I

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MINING RESEARCH & DEVELOPMENT

Historical Goal: To develop the technology and information to reduce underground and surface coal extraction costs, thus improving the economic attractiveness of coal relative to other fuels.

Current Goal: To encourage the substitution of coal for oil and natural gas by supporting the development of technology and information leading to a reduction in the cost of underground coal extraction, thus improving the economic attractiveness of coal relative to these and other fuels.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$78.2	\$78.9	\$69.1	\$43.5	\$14.2

- FY 81 SUBPROGRAMS:**
- o Underground Coal Mining
 - o Surface Coal Mining

- FY 82 SUBPROGRAM:**
- o Underground Coal Mining

ACCOMPLISHMENTS

Developed a technology base for designing improved mining systems and equipment by supporting over 300 individual research efforts directed to developing and testing improved coal mining techniques, including the:

- o Conduct of field trials on two new underground mining systems and six new designs of underground mining equipment.
- o Initiation of long-term field trials with industry to assess the potential of adapting three foreign underground coal technologies to domestic coal mines.
- o Conduct of field trials to assess impact on productivity of four new surface mining systems and three new designs of surface mining equipment.

PROJECTED PROGRAM ACTIVITY

- o Potential transfer of program to DOI. Program currently limited to in-house R&D.

COAL LIQUEFACTION

Historical Goal: To facilitate the establishment of a synthetic liquid fuels industry by developing and demonstrating, in cooperation with industry, advanced, environmentally acceptable coal liquefaction processes capable of utilizing a wide range of U.S. coals as feedstocks.

Current Goal: To facilitate development of environmentally acceptable synthetic fuels technologies through research and development of high-risk, long-term, high-payoff processes.

FUNDING PROFILE

HISTORICAL
(\$ TOA Millions)

FY 78
\$199.8

FY 79
\$223.1

FY 80
\$332.7

FY 81
\$363.7

CURRENT
(\$ BA Millions)

FY 82
\$228.4*

FY 81 SUBPROGRAMS:

- o Direct Hydrogenation
- o Solvent Extraction
- o Indirect Liquefaction
- o Third-Generation Processes
- o Support Studies/Engineering Evaluations
- o Liquefaction Demonstration Plants

FY 82 SUBPROGRAMS:

- o Direct Hydrogenation
- o Solvent Extraction
- o Indirect Liquefaction
- o Third-Generation Processes
- o Support Studies/Engineering Evaluations

ACCOMPLISHMENTS

The Coal Liquefaction Program has successfully facilitated the establishment of a synthetic liquids fuels industry by developing and demonstrating, in cooperation with industry, advanced, environmentally acceptable liquefaction processes. This has been accomplished by:

- o Meeting major milestones toward the construction and operation by the late 1980's of four direct liquefaction projects designed to use specific coals. Specific milestones achieved include:
 - designing, constructing, and operating two large pilot plants and transferring the data base developed to industry; and
 - reaching the detailed design phase on SRC-I and SRC-II demonstration plants, in cooperation with industrial partners, and transferring the data base developed to industry.
- o Identifying and developing a number of improved liquefaction processes capable of operating on coals representative of major U.S. resources.
- o Developing a data base concerning the environmental and health impacts of coal liquefaction technology by:
 - performing EIS work and environmental and health studies for the 4 large direct liquefaction pilot projects and demonstration plants; and
 - identifying principal toxicity problems for coal-derived liquid fuels.

PROJECTED PROGRAM ACTIVITY

- o Orderly phaseout of activities for pilot plants and demonstration plants.
- o Develop and evaluate promising long-range, high-risk liquefaction concepts which will produce greater yields of higher quality liquid fuels from coals representative of major U.S. resources.
- o Develop a data base concerning the environmental and health impacts of coal liquefaction processes, including mitigation strategies.
- o Transfer technical information developed by program to industry.

*Includes approximately \$130 million in FY 81 carryover funds.

SURFACE COAL GASIFICATION

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Historical Goal: To develop and demonstrate, in cooperation with industry, advanced, environmentally acceptable coal gasifiers/gasification processes that are capable of using a wide range of U.S. coals as feedstocks and economically converting them either into fuel gases having a range of heating values from low/medium Btu gas for industrial and electric utility use to high Btu gas for use as a substitute natural gas or into a synthetic gas suitable for subsequent conversion to chemical feedstocks or indirect liquids.

Current Goal: To advance the state of the art of surface coal gasification technology to the point where the private sector can conduct normal risk assessments on which to base commercialization decisions through the development of promising long-term, comparatively high-risk concepts that have the potential to effect significant improvements in process efficiency, operational reliability, product costs, and environmental acceptability.

FUNDING PROFILE

HISTORICAL
(\$ TOA Millions)

CURRENT
(\$ BA Millions)

<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	
\$194.8	\$181.7	\$221.4	\$149.7	

FY 82
\$53.1

FY 81 SUBPROGRAMS:

- o High-Btu Gasification
- o Low-Btu Gasification
- o Third-Generation Processes
- o Special Projects & Support Studies
- o Technical Support
- o Gasification Demonstration Plants

FY 82 SUBPROGRAMS:

- o High-Btu Gasification
- o Low-Btu Gasification
- o Third-Generation Processes
- o Technical Support

ACCOMPLISHMENTS

The Surface Coal Gasification Program has successfully developed and demonstrated in cooperation with industry, advanced gasification processes. This has been achieved by:

- o Reaching the detailed design phase on three gasification demonstration plants (high-Btu gas and industrial fuel gas) with industrial partners, and transferring the data developed to industry.
- o Developing two second-generation high-Btu gasification processes to commercial readiness (through pilot plant operation).
- o Developing two low/medium Btu gasification processes to commercial readiness (through process development unit operation).
- o Constructing and operating three first-generation industrial gasifiers in cooperation with industry partners (Gasifier-in-Industry projects).
- o Conducting preliminary work to identify and accelerate development of third-generation gasifiers. One process developed and selected for commercialization by industry.
- o Initiating the development of a coal gasification environmental impact data base by performing worker health and safety studies.
- o Completing preliminary environmental control efforts, including the performance of required environmental analyses and project Environmental Impact Statements, and the collection of effluent data.

PROJECTED PROGRAM ACTIVITY

- o Phase out activities for six existing pilot and demonstration projects in an orderly manner.
- o Identify and develop promising long-range, high-risk gasification process concepts through proof-of-concept for medium Btu/synthesis gas production.
- o Develop key instrumentation components and materials concepts required to improve operational reliability and efficiency.
- o Develop effluent treatment systems and environmental control technologies to minimize impact of gasification processes.
- o Develop and maintain comprehensive data base suitable for use by industry to scale-up and design key gasifiers and gasification process units.

IN-SITU COAL GASIFICATION

Historical Goal: To support development of a regionally dispersed and economically competitive source of fuel for electric power or synthetic gas for use as a fuel or feedstock for production of synthetic natural gas and liquid transportation fuels by developing, in cooperation with industry, at least one in-situ gasification technology to commercial stage by the late 1980's.

Current Goal: To complete legally required postburn environmental monitoring and transfer all DOE developed data to industry to assist in completion of process development.

FUNDING PROFILEHISTORICAL
(\$ TOA Millions)

<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	
\$13.0	\$15.2	\$10.3	\$10.1	

FY 81 SUBPROGRAMS

- o Low/Medium Btu Gasification
- o Steeply Dipping Beds
- o Environmental Support
- o Supporting Research

ACCOMPLISHMENTS

To support development of at least one commercially ready in-situ coal gasification technology, the program has:

- o Conducted six of seven small-scale field tests scheduled for completion by 1984 to assess potential of process under various geologic conditions.
- o Developed environmental impact data for use in designing mitigation steps in commercial design.
- o Conducted 4 national symposia and university short courses, prepared 200 technical papers, and reduced field test results to data tapes to transfer technical information to industry.

CURRENT
(\$ BA Millions)

<u>FY 82</u>
\$8.3

FY 82 SUBPROGRAMS:

- o Low/Medium Btu Gasification
- o Steeply Dipping Beds
- o Environmental Support
- o Supporting Research

PROJECTED PROGRAM ACTIVITY

- o Complete third of three small-scale field tests to assess potential of process in a steeply dipping coal bed.
- o Continue to transfer technical information from field tests to industry.
- o Fulfill postburn test monitoring requirements.

FUEL CELLS

Goals (Historical and Current): To develop high efficiency (greater than 40 percent) fuel cell technology by the 1990's that will allow for the cost-effective displacement of oil and natural gas in the electric utility, commercial, and industrial sectors with coal and coal-based fuels in an environmentally acceptable manner.

FUNDING PROFILEHISTORICAL
(\$ TOA Millions)

<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>
\$35.7	\$41.5	\$26.5	\$32.4

FY 81 SUBPROGRAMS:

- o Phosphoric Acid Systems Development
- o Molten Carbonate Systems Development
- o Advanced Concepts

CURRENT
(\$ BA Millions)

<u>FY 82</u>
\$34.5

FY 82 SUBPROGRAMS:

- o Phosphoric Acid Systems Development
- o Molten Carbonate Systems Development
- o Advanced Concepts

ACCOMPLISHMENTS

Successfully conducted base research and development in high-risk, long-term elements of the National Fuel Cell Program in phosphoric acid, molten carbonate, and solid oxide (first, second and third generation, respectively) fuel cells. Major accomplishments include:

- o Completed developments of subscale components for pressurized cell and stacks for multi-MW phosphoric acid fuel cell, achieving, for 20 cell stacks a power density of 250w/ft² at 400° F and 120 psia.
- o Completed development of subscale components for phosphoric acid cell and stacks for on-site/Integrated Energy System achieving a power density of 100-130w/ft² and 43 percent efficiency, and an endurance of a 24 cell stack life to 20,000 hours.
- o Completed manufacture of 4.8 MW pre-prototype phosphoric acid powerplant for demonstration in Con-Ed utility site.
- o Proved feasibility and established the economic viability of the molten carbonate fuel cell. Initiated technology development stage.
- o Proved feasibility of manufacturing techniques and identified suitable materials for solid oxide fuel cell.
- o Achieved 10,000 hours of direct continuous generation of electricity from a flame-heated thermionic diode. This life test was 2 years ahead of schedule.

PROJECTED PROGRAM ACTIVITY

- o Continue required efforts on first-generation phosphoric fuel cell development prior to transfer of effort to private sector.
- o Field-test 4.8 MW pre-prototype phosphoric powerplant.
- o Complete development activities for molten carbonate and solid oxide fuel cells.
- o Transfer thermionic energy conversion program element to Director of Energy Research for evaluation and continued support.

MAGNETOHYDRODYNAMICS

Historical Goal: Facilitate by the 1990's the commercialization of coal-fired Magnetohydrodynamics (MHD) electric plants that meet environmental standards and produce electricity at a lower cost than conventional coal plants.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$73.8	\$80.9	\$81.0	\$61.6	\$27.8*

FY 81 SUBPROGRAMS:

- o Open-Cycle Plasma Systems
- o Closed Cycle Systems

FY 82 SUBPROGRAMS:

-----N/A-----

ACCOMPLISHMENTS

- o Demonstrated MHD generator scaling feasibility, obtaining 10.5 percent (88 percent of objective) enthalpy extraction.
- o Completed construction of and activated a 28 Mwt coal-fired MHD facility; completed 100 hours operation meeting all NO_x and SO_x environmental standards. Currently in the initial phase of the heat and seed recovery test program.
- o Completed construction of a 50 Mwt coal-fired MHD facility. The facility was 80 percent activated by 4/81. Electricity was generated using AVCO 1A MHD channel; data was obtained from initial generator tests with a simulated coal combustor.
- o Completed design to increase 50 Mwt MHD facility to 100 Mwt.
- o The conceptual design and economic analysis was completed for a 500 Mwt commercial prototype MHD electric power plant (ETP).

PROJECTED PROGRAM ACTIVITY

- o Program to be phased out in FY 82.

*Includes \$6 million deferred from FY 81.

HEAT ENGINES

Historical Goal: To develop stationary gas turbines and diesel engines with improved efficiency that are capable of being fired with minimally upgraded coal and shale-derived fuels, thereby displacing premium oil and gas fuels for higher priority applications.

Current Goal: To bring to a logical conclusion and phase out the Heat Engines program by FY 83.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$30.6	\$52.5	\$50.6	\$32.2	\$15.4

FY 81 PROGRAMS:

- o Central Power Systems
- o Dispersed Power Systems
- o Heat Recovery Component Technology

FY 82 SUBPROGRAMS:

- o Gas Turbine Technology
- o Diesel Engine Technology
- o Combustion Zone Durability

ACCOMPLISHMENTS

- o Completed Phase II, component development of high-temperature turbine technology (HTTT) development project. The follow-on Phase III (verification testing of engine) was terminated.
- o Completed 50 percent of effort to develop clean gas combustors that will meet NO_x emission standards while operating with coal- or shale-derived fuels. Achieved NO_x emission levels of 75 ppm with staged combustors.
- o Obtained environmental and operational data from tests run on five diesel engines using SRC-II and oil shale fuels.
- o Successfully operated ceramic heater tubes at 1,800° F in a fluidized bed.

PROJECTED PROGRAM ACTIVITY

- o Phase out low-NO_x technology base for components of staged and catalytic combustors.
- o Phase out externally fired heater technology base development.
- o Conduct preliminary evaluation of potential of coal-water slurry fuel in diesel engines.
- o Phase out technology base development for engineering of materials and coatings for heat engine combustion zones.

COMBUSTION SYSTEMS

Historical Goal: To develop and demonstrate reliable AFB and PFB combustion systems and COM that will allow for the cost-effective displacement of oil and natural gas in the industrial and utility sectors with coal or coal-based fuels in an environmentally acceptable manner.

Current Goal: To develop the technology base for reliable AFB and PFB combustion systems and CWS that will allow for the cost-effective displacement of oil and natural gas in the industrial and utility sectors with coal or coal-based fuels in an environmentally acceptable manner.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$79.2	\$57.4	\$50.3	\$44.7	\$41.0

FY 81 SUBPROGRAMS:

- o Atmospheric Fluidized Bed (AFB)
- o Pressurized Fluidized Bed (PFB)
- o Advanced Combustion Technology
- o Alternative Fuel Utilization

FY 82 SUBPROGRAMS:

- o Atmospheric Fluidized Bed (AFB)
- o Pressurized Fluidized Bed (PFB)
- o Advanced Combustion Technology
- o Alternative Fuel Utilization

ACCOMPLISHMENTS

- o Completed the 30 MW AFB utility demonstration project. Completed construction of three industrial-sized demonstration plants and began testing of one of the AFB's.
- o Completed construction and commissioned PFB Research Facility plant. The PFB pilot plant was terminated at 50 percent of construction.
- o Demonstrated 600 hours MTBF for AFB with 6,000 hours of overall operation.
- o High-sulfur coals for use in AFB's were successfully tested in lab scale and demonstration-sized units.
- o Current emission standards were met or exceeded in tests of AFB pilot and prototype units.
- o Developed capital costs from three AFB units indicating savings over conventional systems.
- o Developed and demonstrated that coal-oil mixtures (COM) can be substituted for oil in boilers and furnaces. This project is completed; COM is now considered commercial.

PROJECTED PROGRAM ACTIVITY

- o Extend industrial AFB technology and data base to include broader range of coals, including low-quality coals and coal-waste mixtures. (Phased out in FY 82.)
- o Develop and assess advanced AFB and PFB technology base. (Advanced AFB work phased out in FY 82.)
- o Develop and assess candidate concepts for advanced coal-fired retrofit combustors. (Phased out in FY 82.)
- o Develop and establish the technology data base for private sector decisions on industrial use of coal-water mixtures (CWM).

ADVANCED RESEARCH AND TECHNOLOGY DEVELOPMENT

Goals (Historical and Current): To develop a base of coal technology knowledge and discover advanced concepts for significant process improvement through long-range, fundamental and applied research and high-risk, potentially high-payoff exploratory development, ultimately to accelerate direct substitution of coal into the industrial and utility sectors.

FUNDING PROFILE

HISTORICAL
(\$ TOA Millions)

CURRENT
(\$ BA Millions)

FY 78
\$50.6

FY 79
\$73.6

FY 80
\$64.5

FY 81
\$65.1

FY 82
\$56.3

FY 81 SUBPROGRAMS:

- o Processes
- o Direct Utilization
- o Materials and Components
- o University Coal Research

FY 82 SUBPROGRAMS:

- o Processes
- o Direct Utilization
- o Materials and Components
- o University Coal Research

ACCOMPLISHMENTS

PROJECTED PROGRAM ACTIVITY

- o Substantially (over 95 percent) achieved the objectives of developing a technology base through concept evaluations and experiments in:
 - advancing processes for converting coal to clean gaseous and liquid fuel;
 - improving pulverized fuel and synfuel combustion processes and heat exchangers;
 - advancing environmental control technology; and
 - improving materials, components, instrumentation, and control.
- o More than 280 fundamental studies and experiments in support of the above were conducted on coal chemistry, coal utilization processes, and coal-related process engineering sciences.
- o Some significant discoveries or spin-offs included demonstration of coal-water mixture fuels, staged combustion of coal with air preheat for NO_x control, and more effective method of producing liquefaction solvent of SRC fractions.
- o Technical information was transferred to approximately 17,000 potential users through numerous publications, workshops, and presentations.
- o Grants were awarded to 44 institutions to promote and encourage coal research by universities.

- o Continue basic and applied research in the areas of processes, direct utilization, and materials and components.

A. (9)

ADVANCED ENVIRONMENTAL CONTROL TECHNOLOGY

Historical Goal: To permit, through the development of improved gas cleanup technology, the burning of coal or coal-derived fuels in existing and new industrial and utility installations in an environmentally acceptable and cost-effective manner.

Current Goal: To develop improved coal cleaning and gas clean-up technology that allows for the burning of coal or coal-derived fuels in existing and new industrial and utility installations in an environmentally acceptable and cost-effective manner so that the private sector can commercialize the technology when market conditions permit.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$0.0	\$7.0	\$38.4	\$34.4	\$22.0
<p><u>FY 81 SUBPROGRAMS:</u></p> <ul style="list-style-type: none"> o Flue Gas Cleanup o Gas Stream Cleanup o Cleanup Base Technology o Coal Preparation and Analysis 				<p><u>FY 82 SUBPROGRAMS:</u></p> <ul style="list-style-type: none"> o Flue Gas Cleanup o Gas Stream Cleanup o Cleanup Base Technology o Coal Preparation and Analysis

ACCOMPLISHMENTS

- o Completed bench tests on hot gas stream cleanup technologies; particulate and alkali target levels achieved.
- o Initiated base technology R&D activities in hot desulfurization for application to gasifier fuel gas streams.
- o Achieved flue gas clean-up objectives of 90 percent availability and meeting NSPF standards on an experimental basis at several test sites.
- o Achieved improved coal preparation techniques objective of extracting at least 50 percent of organic sulfur by chemical methods.

PROJECTED PROGRAM ACTIVITY

- o Funding at the FY 82 level will provide for research in the areas of coal preparation and analysis, gas stream cleanup, process modification technology, fuel cell cleanup systems, and cleanup base technology.

OIL SHALE

Historical Goal: To accelerate the development of oil shale technology by developing engineering design studies of first generation surface retort processes; developing and demonstrating the technical and environmental potential of in-situ oil shale processes applicable to three of the four major types of western shales leading to commercial development in the 1980's; and by developing a data base and evaluating advanced concepts for long-term (1990-2000) development of more efficient and environmentally benign processes capable of increased economic recovery of the western resources and extension to the eastern shale resources.

Current Goal: To provide the data base required to develop more efficient and environmentally benign second- and third-generation processes needed for increased economic recovery of the western resources.

FUNDING PROFILEHISTORICAL
(\$ TOA Millions)

<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>
\$29.0	\$49.9	\$43.8	\$37.4

FY 81 SUBPROGRAMS:
o In-Situ Conversion
o Surface Conversion

CURRENT
(\$ BA Millions)

<u>FY 82</u>
\$19.2

FY 82 SUBPROGRAMS:
o Technology Base
o Environmental

ACCOMPLISHMENTS

The oil shale program has accelerated the development of oil shale technology by:

- o Selecting two first-generation surface retort processes for the development of engineering design studies and completing, at the end of 1981, a commercial-scale process module for one (Paraho) process.
- o Evaluating two vertical modified in-situ (VMIS) retort designs and initiating a large-scale demonstration of the design with the best overall test performance.
- o Developing and initiating the demonstration of a production retort for a horizontal modified in-situ technology (HMIS) applicable to Utah near-surface shale deposits.
- o Performing necessary tests and evaluating test results leading to the development of more efficient in-situ blast designs, process controls, and environmental controls.
- o Developing a superheated steam retorting concept applicable to the Colorado leached zone and demonstrating its technical feasibility.
- o Developing an extensive data base on Michigan eastern shale resources, testing four deep eastern shale in-situ fracturing techniques, and identifying the fracture technique with the greatest potential for future in-situ development of deep eastern shales.
- o Conducting process concept development tests, with conclusion expected by 1982, at lab scale of a hydrogen retorting technique on both eastern and western shales.
- o Conducting limited laboratory and field tests aimed at evaluating the feasibility of an advanced in-situ radio frequency processing concept.
- o Transferring technology data base to industry through cost-sharing, workshops, and publications.

PROJECTED PROGRAM ACTIVITY

- o Develop basic data and extend single borehole blast model capability to multiple borehole, multiple row model to support effective, and predictable shale fragmentation design.
- o Obtain reaction chemistry and kinetics and develop a two dimensional modified in-situ retort process model and surface process model for indirect heat transfer systems.
- o Develop geochemical data base for lower-grade western shales.
- o Characterize environmental emissions and wastes from retorting processes so that environmental impact mitigation procedures can be designed, developed and evaluated.
- o Design, develop, and test control technologies for water, air, and solid waste.
- o Continue transferring technology data base.

A. (ii)

UNCONVENTIONAL PETROLEUM TECHNOLOGIES

Historical Goal: To accelerate the development of advanced processes to recover an increasing portion of the 334 billion barrels of oil in place that is not recoverable through known recovery techniques; and to provide the technology base in support of private industry initiatives to increase the production rate and recovery of domestic fossil-derived liquid hydrocarbons.

Current Goal: To develop improved understanding and predictability of advanced, highly promising, novel extraction technologies that would lead to the recovery of a greater portion of currently inaccessible crude oil resources (estimated at some 300 billion barrels); and to pursue research in high-risk, advanced technologies and processes related to the production, processing, and utilization of domestic, fossil-derived liquid hydrocarbon resources.

FUNDING PROFILEHISTORICAL
(\$ TOA Millions)

<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	
\$53.7	\$54.0	\$35.2	\$26.3	

CURRENT
(\$ BA Millions)

<u>FY 82</u>
\$20.2

FY 81 SUBPROGRAMS:

- o Enhanced Oil Recovery
- o Advanced Process Technology

FY 82 SUBPROGRAMS:

- o Enhanced Oil Recovery
- o Advanced Process Technology

ACCOMPLISHMENTS

- o Accelerated the development of enhanced oil recovery (EOR) techniques through applied research and field tests.
- o Completed 75 percent of effort to determine EOR potential for all processes and types of oil reservoirs.
- o Began development and testing of a downhole generator for steam injection (EOR) in deep, heavy oil reservoirs.
- o Completed lab studies and began field testing of chemical additives for improving efficiency in steam drive process for enhanced recovery of heavy oil.
- o Conducted preliminary experiments to test the feasibility of thermal recovery methods to tar sands.
- o Made technological breakthrough toward developing novel equipment, instrumentation, and processes for use in extraction, upgrading, and utilization of crude oil, natural gas, and shale oil.
- o Disseminated technical information concerning UPT to industry and public through technical symposia, scientific papers, and public access to the data base.

PROJECTED PROGRAM ACTIVITY

- o Improve steam-drive process efficiency by the end of 1983 using additives.
- o Conduct advanced research in enhanced oil recovery.
- o Conduct basic and applied R&D in unconventional oil, gas and shale technologies; develop specialized instrumentation and techniques through R&D at the Energy Technology Centers and National Laboratories.

DOMESTIC ENERGY SUPPLY

Historical Goal: To encourage increased availability of fuel supplies utilizing domestic coal, shale oil, and oil and gas resources.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$15.3	\$22.2	\$25.8	\$18.1	\$0.0

FY 81 SUBPROGRAMS:

- o Coal
- o Shale Oil
- o Oil and Gas
- o Industrialization Planning

FY 82 SUBPROGRAM:

- o Coal Loan Guarantee

ACCOMPLISHMENTS

The availability of domestic fuel supplies was encouraged by:

- o Supporting commercial development of synthetic fuels and advanced coal combustion systems through a series of feasibility studies and participating with industry in early design of specific projects.
- o Encouraging expanded low-sulfur coal supply through the Coal Loan Guarantee Program.
- o Encouraging the development of a shale oil industry by designing economic incentives, identifying socioeconomic constraints, and working toward the removal of impediments to the granting of licenses and permits.
- o Developing a set of economic incentives to encourage oil and gas production by new, enhanced, and marginal recovery methods.
- o Conducting studies to identify constraints to increased domestic exploration, production, and refining of petroleum.

PROJECTED PROGRAM ACTIVITY

- o Coal Loan Guarantee activities will continue with prior-year funding.

ENHANCED GAS RECOVERY

Goal (Historical and Current): To assist the industry through research and development efforts to achieve full exploitation of the currently estimated 300 trillion cubic feet of unconventional gas resource which at present is not recoverable with existing or emerging technology.

<u>FUNDING PROFILE</u>				
<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$29.1	\$34.5	\$30.6	\$27.6	\$11.7

FY 81 SUBPROGRAMS:

- o Eastern Gas Shales
- o Western Tight Gas Sands
- o Methane From Coal Beds
- o Environment & Support

FY 82 SUBPROGRAMS:

- o Eastern Gas Shales
- o Western Tight Gas Sands
- o Methane From Coal Beds
- o Environment & Support

ACCOMPLISHMENTS

- o Completed on schedule most of resource assessment geologic work on eastern shales, coalbed methane and western tight sands, and transferred technical information to industry. Developing an accurate, readily accessible data base for gas resources on schedule.
- o Reoriented the Western Tight Gas Sands (WGS) subprogram to the multiwell concept (a research-oriented field laboratory that will utilize highly instrumented, controlled field experiments to obtain comprehensive geologic/reservoir characterization of a tight lenticular sandstone) and began drilling the first of three close-spaced wells. Work is slightly behind schedule.
- o Conducted considerable number of field tests and met schedules developing advanced extraction technology for eastern shales, western tight gas sands, and coalbed methane. Workable production/utilization systems proven.
- o In 1980, responded to over 8,000 requests by industry for publications and maps.

PROJECTED PROGRAM ACTIVITY*

- o The Eastern Gas Shales (EGS), Western Gas Sands (WGS), and Methane from Coalbeds (MFC) subprograms are not funded beyond FY 82.
- o Development of instruments and diagnostic techniques that will precisely measure key reservoir parameters. Assess and quantify potential of unconventional gas resources.
- o Complete geologic/engineering studies and development of production capability in the Western Gas Sands (WGS) subprogram.
- o Complete field experiments to optimize stimulation designs in coal seams; also evaluate extraction methods for deep unmineable coal seams.
- o Complete drilling, coring, logging, of the first two wells of the WGS multiwell project.

*No activities are projected beyond FY 82 pending congressional action on the Administration's proposal to terminate the Enhanced Gas Recovery Program at the end of FY 82.

ALTERNATIVE FUELS PROGRAM

Goal (Historical): To stimulate activities prior to the activation of the Synthetic Fuel Corporation to foster investigation and development of initial commercial alternative fuels production through feasibility studies, cooperative agreements, and other incentives authorized by P.L. 96-126 and P.L. 96-304.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$0.0	\$0.0	\$5518.0	\$5116.6	\$0.0

FY 81 SUBPROGRAM:

- o Alternative Fuels Utilization

FY 82 SUBPROGRAMS:

-----N/A-----

ACCOMPLISHMENTS

- o Stimulated investigation of commercial production of alternative fuels by funding 110 feasibility studies and cooperative agreements, 2 loan guarantees, and 1 product purchase commitment for alternative fuels projects.

PROJECTED PROGRAM ACTIVITY

- o All feasibility studies and cooperative agreements awarded under this program in FY 80 and FY 81 will be completed in FY 82. No future funds are budgeted for this program.
- o DOE will continue to monitor one loan guarantee with existing staff.

FEDERAL LEASING

Goal (Historical): To increase the availability of Federal lands for energy resource development through the leasing of larger onshore and Outer Continental Shelf (OCS) tracts.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$0.0	\$0.0	\$1.2	\$2.4	\$0.0

FY 81 SUBPROGRAM:
o Federal Leasing

FY 82 SUBPROGRAM:
-----N/A-----

ACCOMPLISHMENTS

Increased availability of Federal lands for energy resource development by:

- o Developing initial leasing programs for coal and for Outer Continental Shelf (OCS) oil and gas.
- o Developing coal and OCS resource production estimates.
- o Developing resource and regulatory, economic, and environmental analyses for bidding systems, diligent development, royalty oil, lease competition, and production rates.
- o Developing resource analyses for identification of areas with high energy production potential.
- o Reviewing DOI energy lease terms and conditions.
- o Reviewing Coastal Zone Management (CZM) Plans submitted by coastal states.

PROJECTED PROGRAM ACTIVITY

- o Any low-level monitoring required will be done in appropriate DOE offices using general support funds.

URANIUM RESOURCE ASSESSMENT

Historical Goal: To assess and expand the nuclear fuel resource base of the United States through the National Uranium Resource Evaluation (NURE) program and through the use of voluntarily supplied industry data; and to make available to industry, resource information and advanced, efficient, and cost-effective technology.

Current Goal: To assess and expand the nuclear fuel resource base of the United States using voluntarily supplied industry data; and to reduce uncertainties in the extent, availability, and economics of domestic and foreign nuclear fuel resources.

FUNDING PROFILE

<u>HISTORICAL</u> ((\$ TOA Millions)				<u>CURRENT</u> ((\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$68.5	\$72.9	\$61.5	\$30.8	\$10.0

FY 81 SUBPROGRAMS:

- o NURE Program
- o Assessment Program

FY 82 SUBPROGRAM:

- o Assessment Program

ACCOMPLISHMENTS

- o Of the 621 2-degree National Topographic Map Series quadrangles, completed assessment of a total of 162 most likely to contain uranium deposits.
- o Published 1,925 Interim and Assessment reports of radioactive and geochemical surveys and geologic studies on schedule.
- o Created a data base on entire United States for use in continuing resource studies.
- o Worked on schedule to support international uranium resource evaluations and other international activities.

PROJECTED PROGRAM ACTIVITY

- o Maintain program operations to comply with congressional mandates for FY 82; program proposed for termination in FY 83.

CONVENTIONAL REACTOR SYSTEMS

Historical Goal: To conduct research and development (R&D) on plant and fuel technology and to transfer technology to the private sector to enhance the role of the light water reactor (LWR) and other converter reactors in meeting the energy needs of the United States.

Current Goal: To conduct R&D to demonstrate advanced technology that can significantly assist in resolving the institutional problems now faced by the nuclear industry to develop improved measures for enhancing safety and reliability of nuclear plants using TMI and other plant information; and to provide a technological base for High Temperature Reactors (HTR), especially for process heat applications.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$149.4	\$114.9	\$81.0	\$104.4	\$106.9

FY 81 SUBPROGRAMS:

- o Light Water Reactor Systems
- o Three Mile Island Activities
- o High Temperature Reactors
- o Reduced Enrichment Research and Test Reactor Program (RERTR)

FY 82 SUBPROGRAMS:

- o Light Water Reactor Systems
- o Three Mile Island Activities
- o High Temperature Reactors

ACCOMPLISHMENTS

- o Completed 15 individual Safety Program projects directed principally toward improving LWR safety and lowering the probability and consequences of nuclear accidents. Published results in 33 technical reports.
- o Successfully demonstrated the capability of current design fuel to achieve extended burnups for more efficient uranium utilization. Initiated irradiation of advanced design fuel. Examined proliferation and economics aspects of high burnup fuel.
- o Undertook a safety research program at Three Mile Island (TMI) designed to secure data of value to the safety of all nuclear reactors.
- o Reassessed the High Temperature Reactor (HTR) program and redirected it to emphasize development of fuels, graphite, and materials for high temperature applications not suitable for light water reactors. Technology development on schedule. Lead plant options narrowed.
- o In the RERTR subprogram, defined limitations of commercial fuel fabrication technology and established uranium densities achievable in candidate fuels in the interest of reducing proliferation concerns from test reactors. Early program objectives were met on schedule. Deferred fuel irradiation demonstration pending restudy of program priorities.

PROJECTED PROGRAM ACTIVITY

- o Continue Safety Program activities consistent with P.L. 96-567 (Nuclear Safety R&D Act of 1980) with emphasis toward resolving safety-related institutional barriers.
- o Complete uranium utilization and dose reduction program activity to permit orderly closeout.
- o Examine TMI reactor and core components to evaluate licensing criteria and analyze failure mode effects.
- o Conduct R&D on TMI waste that pertain to management and immobilization of abnormal waste products and develop technology for processing and disposing of these wastes.
- o In cooperation with industry, select a lead plant project that will demonstrate the commercial viability of HTR.
- o In the RERTR subprogram, defined limitations of commercial
- o Irradiate full core of reduced enrichment fuels in Ford Nuclear Reactor. Terminate other RERTR activities.

REMEDIAL ACTIONS PROGRAM

Goals (Historical and Current): To keep radioactively contaminated sites and facilities that are no longer being used from becoming an actual health, safety, or environmental hazard.

<u>FUNDING PROFILE</u>				
<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$21.2	\$24.0	\$31.6	\$42.8	\$43.1

FY 81 SUBPROGRAMS:

- o Manhattan Engineer District/Atomic Energy Commission (MED/AEC) Sites
- o Grand Junction, Colorado
- o Uranium Mill Tailings
- o DOE Surplus Facilities

FY 82 SUBPROGRAMS:

- o MED/AEC Sites
- o Grand Junction
- o Uranium Mill Tailings
- o DOE Surplus Facilities

ACCOMPLISHMENTS

- o Performed remedial actions on as many MED/AEC facilities as funding permitted:
 - completed at Kellex site;
 - 2/3 completed at Middlesex; and
 - initiated at Niagara Falls.
- o Completed radiological surveys for 126 MED/AEC facilities requiring remedial action.
- o Performed maintenance and surveillance on facilities on which remedial actions cannot be performed due to funding limitations.
- o Carried out mandates of P.L. 92-314 with remedial action under way or completed at 410 of an estimated 740 occupied contaminated structures, near Grand Junction, Colorado.

PROJECTED PROGRAM ACTIVITY

- o Maintain program operations to comply with congressional mandate for FY 82; program proposed for termination in FY 83.

BREEDER REACTOR SYSTEMS

Historical Goal: To conduct R&D to develop breeder reactor systems to a state of readiness should a decision be made in the future to demonstrate one or more of them; to develop alternative fuel cycle technologies for LMFBR fuels; and to defer LWR reprocessing, and conduct R&D on alternative fuel cycles for thermal reactors.

Current Goal: Conduct R&D to confirm the economics, safety, and reliability of breeder reactor systems to support the timely and effective integration of these reactors with the current nuclear industry and fuel cycle technology, thus making available the essentially inexhaustible nuclear resources of the United States for electrical energy production. Provide a demonstrated fuel reprocessing technology that ensures safety, environmental protection, safeguards, and operational reliability, and minimizes proliferation risks with acceptable economics.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$756.9	\$721.8	\$693.7	\$689.5	\$678.1

FY 81 SUBPROGRAMS:

- o Liquid Metal Fast Breeder Reactor (LMFBR)
- o Gas Cooled Fast Breeder (GCFB)
- o Water Cooled Breeder (WCB)
- o Fuel Cycle R&D

FY 82 SUBPROGRAMS:

- o Liquid Metal Fast Breeder Reactor (LMFBR)
- o Water Cooled Breeder (WCB)
- o Fuel Cycle R&D

ACCOMPLISHMENTS

- o Clinch River Breeder Reactor (CRBR) design (86 percent complete) and procurement activities (\$600M of components on order) continued on schedule and within cost. This project will demonstrate scale-up of breeder reactor technology from experimental and test reactors.
- o Conceptual Design Study (CDS) of Large Plant completed on schedule and submitted to Congress on March 31, 1981.
- o Continued successful operation of the Experimental Breeder Reactor-II (EBR-II) at Idaho Falls, Idaho, and began operation of the Fast Flux Test Facility (FFTF) near Richland, Washington, in 1980, obtaining performance and operating data, and testing fast breeder reactor fuels and components.
- o Performed R&D through phase where engineering scale demonstration of LMFBR technology is required to test its reliability as a commercial energy production option.
- o Answered feasibility questions on the Gas Cooled Fast Breeder concepts and terminated the program in FY 81.
- o Tested the Light Water Breeder Reactor (LWBR) core concept at the Shippingport Atomic Power Station, accumulating over 23,400 effective full power hours of operation while breeding. Defueling and end-of-life testing work is proceeding as planned.
- o Performed R&D to develop fuel reprocessing technology for LMFBR fuel. All designs, components, tests, and studies were completed satisfactorily within cost and schedule.

PROJECTED PROGRAM ACTIVITY

- o Construct the Clinch River Breeder Reactor (CRBR).
- o Continue to develop cooperation of U.S. industry on Large Developmental Plant; begin safety and environmental documentation and preparation of specifications for long-lead equipment.
- o Continue R&D in the areas of safety, physics, fuels, components, materials, and test facilities to demonstrate the economics, safety, and reliability of the LMFBR.
- o Continue operation of Test Facilities in support of plant projects and breeder technology program elements.
- o Prepare for termination of the LWBR program including end-of-life operations, and the documentation of LWBR technology.
- o In Fuel Cycle R&D, complete the Remote Operation and Maintenance Demonstration (ROMD) and demonstrate REMOTEX technology necessary for eventual adoption of LMFBR systems.

ADVANCED NUCLEAR SYSTEMS

Historical Goal: To respond to other Federal agencies' requirements for the design, development, and delivery of space nuclear power systems and adaptation of applicable technologies to beneficial terrestrial use; assess the technical, economic, environmental, and institutional aspects and impacts of nuclear systems in meeting a broad range of the Nation's energy needs; and analyze economic data relative to conventional and emerging nuclear power systems and competing technologies.

Current Goal: To respond to other Federal agencies' requirements for the design, development, and delivery of space nuclear power systems and adaptation of applicable technologies beneficial to terrestrial use.

FUNDING PROFILEHISTORICAL
(\$ TOA Millions)

<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>
<u>\$73.9</u>	<u>\$54.5</u>	<u>\$39.4</u>	<u>\$40.7</u>

FY 81 SUBPROGRAMS:

- o Space and Terrestrial Applications
- o Advanced Systems Evaluations

CURRENT
(\$ BA Millions)

<u>FY 82</u>
<u>\$37.6</u>

FY 82 SUBPROGRAM:

- o Space and Terrestrial Applications

ACCOMPLISHMENTS

- o Designed, developed, and demonstrated nuclear power systems for use in spacecraft. Met all technical objectives and launch date milestones.
- o Designed, developed, and demonstrated terrestrial nuclear applications such as irradiated sewage sludge treatment. Pilot sludge irradiation operational in FY 79.
- o Conducted assessments and evaluations of advanced nuclear technologies and applications, fully meeting all objectives.
- o Initiated the Nonproliferation Alternative Systems Assessment Program in FY 78, publishing final report in 1980.
- o Terminated the Advanced Systems Evaluation subprogram in FY 81.

PROJECTED PROGRAM ACTIVITY

- o Continue nuclear power system activities for scheduled future spaceflights (Galileo mission [1985] and International Solar Polar mission [1986]).
- o Continue and initiate R&D for longer term NASA and DOD missions.
- o Continue R&D for terrestrial applications including use of nuclear wastes.

COMMERCIAL NUCLEAR WASTE

Historical Goal: To provide the technology and facilities necessary to meet all applicable safety and environmental requirements for the long-term management of nuclear wastes from commercial sources.

Current Goal: To ensure that existing and future commercial nuclear waste will be isolated from the biosphere and pose no significant threat to public health and safety.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$193.4	\$211.2	\$206.9	\$206.1	\$226.1

FY 81 SUBPROGRAMS:

- o Commercial Waste Management
- o Spent Nuclear Fuel

FY 82 SUBPROGRAMS:

- o Commercial Waste Management
- o Spent Nuclear Fuel

ACCOMPLISHMENTS

- o Investigated five alternate geologic formations for first repository site. Waste disposal in geologic repository will be final step in waste management solution.
- o Issued required NEPA reports for radioactive waste disposal: Generic EIS, Confidence Rulemaking, Final EIS.
- o Developed and initiated tests of in-situ testing activities for repository characterizations; continuing to develop technical information required to support the program.
- o Issued a draft EIS in 1981 for disposal of 600,000 gallons of waste at the West Valley site, a required preliminary step before beginning cleanup operations.
- o Provided assistance to states and regional groups to develop low-level waste plans.
- o Held initial discussions with owners of potential spent fuel away-from-reactor facilities before program was discontinued.

PROJECTED PROGRAM ACTIVITY

- o Finish conceptual design of interim retrievable storage facility, if one is required before final repository is available.
- o As part of the geologic repository program, characterize 3 sites; begin drilling exploratory shafts in 1983; complete by 1985; compile NEPA documentation/process.
- o Construct a Test and Evaluation Facility at one of the three sites starting in 1985 and completing in 1989.
- o Submit a license application to NRC for the first repository in 1988.

MAGNETIC FUSION ENERGY

Goals (Historical and Current): To develop fusion energy that is both environmentally sound and economically competitive; this includes the development of fusion applications for electrical energy generation as well as other possible applications such as production of fissile fuels and synthetic chemical fuels. Intermediate, near-term goals are the demonstration of scientific feasibility, and subsequently, the assessment of fusion's potential based upon the parallel efforts of exploring fusion's engineering feasibility and developing improved reactor concepts.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u> \$368.3	<u>FY 79</u> \$364.6	<u>FY 80</u> \$359.8	<u>FY 81</u> \$376.3	<u>FY 82</u> \$453.8

FY 81 SUBPROGRAMS:

- o Applied Plasma Physics
- o Confinement Systems
- o Development & Technology Program
- o Planning & Projects
- o Program Direction

FY 82 SUBPROGRAMS:

- o Applied Plasma Physics
- o Confinement Systems
- o Development & Technology Program
- o Planning & Projects
- o Program Direction

ACCOMPLISHMENTS

- o Recent technical progress in key parameters approaching those required for fusion to occur and in understanding the basic plasma processes has led to increased confidence that program goals can be achieved.
- o Developed technical program judged ready to proceed to explore fusion's engineering feasibility.
- o Developed extensive basis of understanding of plasma physics.
- o Developed selective basis of component technologies for fusion experiments.
- o Developed soundly based scientific, technological, and engineering plans to reach fusion program's goals.

PROJECTED PROGRAM ACTIVITY

- o Continuation and completion of the effort to demonstrate scientific feasibility in the TFTR project.
- o Continuation of the base science and supporting technology programs to understand the basic properties of fusion plasmas and develop improved reactor concepts.
- o Contingent upon increased real budgets, initiate new engineering emphasis aimed toward systems engineering and fusion nuclear technologies.
- o Conduct design studies to identify promising fusion configuration and define specific technical issues for resolution.

SOLAR APPLICATIONS FOR BUILDINGS

Historical Goal: To conduct the supporting research, development, demonstration, and commercialization necessary to accomplish utilization of active solar technologies in buildings to a level of 1.5 quads per year by the year 2000; to provide a cumulative contribution of 1.5 billion barrels of oil equivalent by the year 2000 through accelerated acceptance and use by industry of passive solar energy measures to heat and cool residential and commercial buildings; to establish an aggressive research, development, and demonstration program for photovoltaic systems to produce electricity cost-competitive with utility generated electricity (P.L. 95-590).

Current Goal: To conduct an orderly phaseout of the active and passive programs during FY 1982 because the private sector is expected to have incentives to undertake these activities. To carry out the photovoltaic technology mandate of P.L 95-590 to the extent feasible within the limits of appropriated funds, giving priority to long-term, high-risk, but potentially high-payoff, research and development.

FUNDING PROFILEHISTORICAL
(\$ TOA Millions)

<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$171.0	\$276.1	\$266.3	\$206.7	\$99.1

CURRENT
(\$ BA Millions)**FY 81 SUBPROGRAMS:**

- o Active Heating & Cooling
- o Passive Heating & Cooling
- o Photovoltaic Energy Systems

FY 82 SUBPROGRAMS:

- o Active Heating & Cooling
- o Passive Heating & Cooling
- o Photovoltaic Energy Systems

ACCOMPLISHMENTS

- o Active program has demonstrated the practicality of domestic water heating, space heating, and solar-assisted heat pumps and has helped stimulate the almost twentyfold growth of the industry since 1975.
- o Passive program has developed better design tools and improved the thermal and optical properties of collection, storage, and insulation materials.
- o One flat plate and three concentrator designs developed by the Photovoltaic Program have achieved the \$3.08 per installed watt near-term cost target; 20-year life-cycle cost of advanced encapsulation materials is approaching \$15/m².
- o The efficiency of three thin film cells has reached 10 percent; that of gallium arsenide has reached 17 percent.

PROJECTED PROGRAM ACTIVITY

- o The Active and Passive programs will emphasize long-range research to develop suitable materials and integrated systems. Phase-out will occur in FY 83.
- o The Photovoltaic program will emphasize:
 - production of low-cost balance of systems;
 - improvement of encapsulation materials; and
 - close coordination with universities and industry to ensure rapid improvement in low-cost cell efficiencies and durability
- o Present Photovoltaic cost goals are:
 - to show technical feasibility by 1984/85 of device and system costs of \$1.75-\$2.45 per installed peak watt, and;
 - to show technical feasibility by 1988/89 of device and system costs of \$1.20-\$2.00 per installed peak watt.

SOLAR APPLICATIONS FOR INDUSTRY

Historical Goal: To accelerate the introduction and widespread use of solar energy to provide fuels, petrochemical substitutes, thermal and mechanical power, and electrical energy. The program has two components: Biomass Energy Systems (BES) and Solar Thermal Energy Systems (STES). The historical goal of the Biomass Energy Systems was to develop technologies that would provide an additional 0.5 to 1.5 quads per year from biomass sources before 1985, an additional 6 quads per year before 2000, and a total of 10 quads per year after 2000. The historical goal of the Solar Thermal Energy systems was to establish the technical and cost readiness of midtemperature and high-temperature concentrating collector systems and solar ponds as a prerequisite to commercial implementation by industry at a level of 3 quads per year by the year 2000.

Current Goal: The current goal of Biomass Energy Systems is to establish the technical feasibility of innovative biomass energy feedstock production and conversion technologies that exploit regional biomass resources to increase the supplies of gaseous and liquid fuels and petrochemical substitutes. The current goal of Solar Thermal Energy Systems is to establish the technical and cost readiness of concentrating collector systems and solar ponds to permit commercial implementation by industry and to reduce U.S. dependence on imported and scarce fuels.

FUNDING PROFILE

HISTORICAL
(\$ TOA Millions)

<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	
\$156.4	\$203.8	\$222.0	\$163.2	

- FY 81 SUBPROGRAMS:**
- o Biomass Energy Systems
 - o Solar Thermal Energy Systems

CURRENT
(\$ BA Millions)

FY 82
\$75.5

- FY 82 SUBPROGRAMS:**
- o Biomass Energy Systems
 - o Solar Thermal Energy Systems

ACCOMPLISHMENTS

- o Biomass conversion and feedstock research has to date:
 - developed and transferred to the private sector the Barstow anaerobic digester;
 - demonstrated the practicality of cheaply converting biomass into synthetic gas; and
 - isolated a nitrogen-fixing alga that may displace petrochemical-based fertilizers.
- o Solar Thermal program has tested a variety of concentrating collector types and integrated them with advanced Brayton and Stirling engines.
- o 10 MWe Barstow Solar Thermal Central Receiver Plant is nearing completion; related component R&D has included design and testing of molten salt receivers, storage subsystems, advanced heliostat designs and development of 500° to 600° C durable multilayer selective absorbers.

PROJECTED PROGRAM ACTIVITY

- o Biomass program will continue thermochemical, biochemical, and photobiological conversion research and identify and develop new biomass feedstocks, such as hydrocarbons, plants, short-rotation woody crops, and algae/aquatic plants.
- o Future Solar Thermal central receiver R&D will employ Barstow and laboratory facilities to test heliostat, receiver and storage subsystem designs.
- o Other Solar Thermal R&D will test parabolic dishes with advanced engines and cooling technologies; demonstrate large-scale solar ponds; and investigate the technical feasibility of solar thermal fuel and chemical production.
- o Product development of successfully tested prototypes will be transferred to industry.

SOLAR POWER TECHNOLOGY

Historical Goal: To accelerate the development and widespread use of solar energy in the production of electricity, by performing research and development, enhancing the establishment of an industrial base, and removing barriers to the acceptance of these technologies (Note: Other solar subprograms also have this goal in addition to the wind and oceans subprograms).

Current Goal: To accelerate the development and widespread use of solar energy in the production of electricity, by performing research and development on high-risk, high-payoff ocean systems and wind technologies (Note: Other solar subprograms also have this goal in addition to the wind and ocean systems subprograms).

FUNDING PROFILE

HISTORICAL
(\$ TOA Millions)

CURRENT
(\$ BA Millions)

<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	
\$77.2	\$106.1	\$104.1	\$100.7	

<u>FY 82</u>
\$56.2

- FY 81 SUBPROGRAMS:
- o Wind Energy Systems
 - o OTEC

- FY 82 SUBPROGRAMS:
- o Wind Energy Systems
 - o Ocean Energy Technology

ACCOMPLISHMENTS

PROJECTED PROGRAM ACTIVITY

- o Small wind machine prototype and component durability testing has reduced costs to 8¢ to 15¢ per kWh, led to installation of commercial machines in 24 states, and helped expand industry annual production from dozens of machines to thousands.
- o Large wind machine pilot tests, component and materials design and reliability research reduced generating costs to 6¢ to 10¢ per kWh, assisted integration of three large machines (approx. 7.5 MW) into the Bonneville Power Administration grid, and helped to convince five public utilities to consider wind farms in their capacity expansion plans.
- o OTEC energy resource assessments were made off Puerto Rico, Hawaii, and the U.S. coast adjacent to the Gulf of Mexico.
- o OTEC research has developed biofouling cleaning techniques for large heat exchangers and demonstrated the structural integrity of small-scale cold water pipes and transmission cables.

- o Future wind activities will emphasize the attainment of further reductions in cost of energy from WECS through testing of blades and other advanced components as well as basic study of system, component, and materials failure mechanisms in the field.
- o Private sector will be relied on for development of small and large wind machines.
- o Additional wind energy prospecting and siting methodology research will be conducted through FY 82 to enable the private sector to estimate returns on wind machine investment with an acceptable degree of certainty.
- o The Oceans Systems Program (waves, currents, and OTEC) is proposed for elimination in FY 83.

SOLAR INTERNATIONAL, INFORMATION, & SERI

Historical Goal: To accelerate the development and use of solar energy technology in the United States and worldwide through joint projects with cooperating foreign countries, through international information exchange and market development; through a broad information base for research, industry, and user needs; and through the construction of permanent facilities for the Solar Energy Research Institute (SERI).

Current Goal: To accelerate the development and use of solar energy technologies through cooperative research projects, and through R&D information acquisition and dissemination. The need for a SERI permanent facility is being reassessed.

FUNDING PROFILE

HISTORICAL
(\$ TOA Millions)

CURRENT
(\$ BA Millions)

FY 78
\$4.1

FY 79
\$16.5

FY 80
\$16.8

FY 81
\$25.5

FY 82
\$10.7

FY 81 SUBPROGRAMS:

- o Solar International Activities
- o Solar Information Systems
- o Solar Energy Research Institute Facility

FY 82 SUBPROGRAMS:

- o Solar International Activities
- o Solar Information Systems
- o Solar Energy Research Institute Facility

ACCOMPLISHMENTS

- o U.S. participation in International Energy Agency has provided solar technical assistance to international energy organizations.
- o United States/Saudi Arabia SOLERAS agreement has established projects involving U.S. and Saudi Arabian Government agencies and private companies; a 5-year \$100 million cooperative program scheduled for completion in 1983; U.S. share is \$50 million.
- o Solar data base and information services are maintained by the conservation and renewable energy inquiry and referral service; over 4,500 written and telephone requests weekly.
- o Design objectives were met for SERI permanent facility; original plan called for facility for 1,000 personnel by late FY 81.

PROJECTED PROGRAM ACTIVITY

- o Partial funding for major cooperative programs; lower level of support for international information activities.
- o Continue solar information activities at reduced level of effort with concentration on transfer of R&D information to the private sector.
- o Suspend funding for construction of a major facility at SERI while construction plans are being reassessed. Construction of a test site and adjacent lab space with existing funds will continue.

ALCOHOL FUELS

Historical Goal: To develop the technology to produce economically competitive alcohol fuels from biomass; to transfer production and conversion technologies to the private sector; and to increase U.S. production of alcohol to at least 10 percent of U.S. gasoline consumption by 1990.

Current Goal: To develop the technology to economically produce and utilize alcohol fuels from biomass and to stimulate the growth of the industry through loan guarantees.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$0.0	\$0.0	\$22.0	\$22.1	\$10.0

FY 81 SUBPROGRAM:

- o Solar Technology (in part)

FY 82 SUBPROGRAM:

- o Technology Development & Utilization

ACCOMPLISHMENTS

- o Financial Assistance Programs have aided the development of plants with planned production capacity of 470 million gallons per year (about 0.1 quad per year) of alcohol by 1983.
- o R&D advances include:
 - isolation and transformation of organisms required for sugar utilization;
 - mapping of engine performance and road-testing for dissociated methanol system; and
 - development of bacteria system for improved production of ethanol.

PROJECTED PROGRAM ACTIVITY

- o Continued sponsorship of R&D to provide a technology base for production of efficient, economically competitive alcohol fuels.
- o Current focus is on long-term improvements in process technologies in the following areas:
 - production of alcohol from wood,
 - cellulose fermentation processes; and
 - utilization technologies for combustion, multifuel and hybrid engines.
- o Federal program is unfunded beyond FY 83.

HYDROPOWER

Historical Goal: To revitalize the small hydropower industry in the United States through research, development, demonstrations, and technical and financial assistance and to encourage development by private and non-Federal Government sectors.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$10.7	\$29.5	\$33.7	\$11.9	\$3.0

FY 81 SUBPROGRAMS:

- o Small Hydroelectric Resource Development
- o Feasibility Studies Loan Program

FY 82 SUBPROGRAMS:

- o Small Hydroelectric Resource Development
- o Feasibility Studies Loan Program

ACCOMPLISHMENTS

- o Federal cost-sharing of 20 projects will bring 133 MW on line by 1985, representing full achievement of program objective.
- o Provided 170 loans for feasibility studies and licensing costs, with average processing time of less than 90 days.
- o Achieved goal of reestablishing small hydropower industry as evidenced by tenfold increase in small hydro permit applications to FERC during last 5 years.
- o Provided technical assistance through regional offices to stimulate projects.
- o Conducted R&D to reduce cost of small hydro development through 54 feasibility grants, ULH devices installed in 2 locations, and publication of 4 environmental manuals.
- o Provided assistance in mitigating legal, institutional, and technical barriers to small hydropower development with grants to 40 states, technical assistance to 24 state legislatures and 16 PUCS, and publication of 3 generic and 36 state-specific studies.

PROJECTED PROGRAM ACTIVITY

- o FY 82 funds will be used to monitor demonstration projects.
- o Goal of the revitalization of the small hydropower industry met; thus, no funds are requested for FY 1983 or beyond. An orderly phaseout of program activities will take place during FY 82.

GEOTHERMAL RESOURCES

Historical Goal: To increase the use of geothermal energy resources to 0.4 quad in 1985 and to 6.2 quads in the year 2000, by reducing resource uncertainties; by removing the technological, economic, and institutional impediments inhibiting development; and by stimulating development through demonstrations and information dissemination.

Current Goal: To increase the use of geothermal energy resources for electric power generation and direct heat applications by conducting high-risk, high-payoff research and development and by transferring the technology to the private sector.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$153.2	\$202.3	\$194.1	\$161.0	\$55.4

FY 81 SUBPROGRAMS:

- o Hydrothermal Resources
- o Geopressured Resources
- o Geothermal Technology Development
- o Geothermal Resource Development Fund

FY 82 SUBPROGRAMS:

- o Hydrothermal Industrialization Phaseout
- o Geopressured Resources
- o Geothermal Technology Development

ACCOMPLISHMENTS

- o Demonstrated the technical feasibility and economic viability of electric power systems for high and moderate temperature resources and for direct heat applications for low and moderate temperature resources. Twelve of 23 direct heat applications successfully demonstrated.
- o Provided assistance in alleviating legal and institutional barriers to geothermal development. State laws changed or under active consideration in one-third of states with geothermal resources.
- o Developed and maintained a technology base and provided for technology transfer to the private sector. Technology transfer on schedule.
- o Coordinated and monitored the geothermal programs of all Federal agencies. All IGCC reports issued as required.
- o Initiated successful program to determine the technical and economic feasibility of extracting energy from hot dry rock resources; 5-MWt pilot system operated successfully; near-commercial system being installed on schedule.
- o Utility companies have publicly announced plans to construct geothermal plants with generating capacity of more than 1,000 MWe.
- o Successful tests of advanced drilling components and small-scale binary cycle power systems promise to reduce drilling and generating costs by 20 to 25 percent by the mid-1980's.
- o A successful test of a pilot scale H₂S removal process has prompted a major utility to develop plans for a full-scale plant.

PROJECTED PROGRAM ACTIVITY

- o Emphasize support of critical heat transfer, materials durability, and electricity conversion R&D.
- o Continue efforts to assess the size and recoverability of geopressured and hot dry rock resources.
- o Conduct theoretical design, experimental extraction, and equipment fracture research to enable estimation of the cost of geopressured and hot dry rock thermal or electric energy.
- o Monitor existing projects that have already been provided guaranteed loans.
- o Transfer technology to private sector.

BUILDINGS AND COMMUNITY SYSTEMS

Historical Goal: Accelerate energy efficiency improvements and the utilization of more abundant energy sources in buildings and communities through the implementation of research, information, and regulatory programs; and achieve the production or conservation of 25,000 BOED by 1985 through increased use of municipal waste as a source of energy and materials and by improving the efficiency of water and wastewater processing technologies.

Current Goal: Accelerate the rate of energy efficiency improvement of the Nation's building inventory by conducting long-term, high-risk, basic R&D to support private sector activities. Continue to reduce energy consumption in Federal buildings through FEMP. Phase out BERD and Urban Waste Program by the end of FY 82.

FUNDING PROFILE

HISTORICAL
(\$ TOA Millions)

CURRENT
(\$ BA Millions)

FY 78
\$69.1

FY 79
\$94.0

FY 80
\$109.6

FY 81
\$67.8

FY 82
\$47.7

FY 81 SUBPROGRAMS:

- o Building Systems
- o Residential Conservation Service
- o Community Systems
- o Technology & Consumer Products
- o Appliance Standards
- o Urban Waste
- o Analysis and Technology Transfer
- o Federal Energy Management Program
- o Small Business
- o Energy Impact Assistance
- o Residential Conservation Retrofit

FY 82 SUBPROGRAMS:

- o Building Systems
- o Residential Conservation Service
- o Federal Energy Management Program
- o Community Systems
- o Technology and Consumer Products
- o Appliance Standards
- o Urban Waste
- o Analysis and Technology Transfer

ACCOMPLISHMENTS

- o Cost-shared RD&D program has developed more efficient building equipment and appliances.
- o Federal Energy Management Program (FEMP) instituted that reduced energy consumption in Federal buildings by 9.3 percent between FY 79 and FY 80.
- o Twenty (20) waste-to-energy projects currently under construction whose processes were demonstrated by program research; \$7 million of program spending leveraging over \$1 billion in private investment.
- o Proposed rules for RCS, BEPS, and appliance standards were developed and issued.

PROJECTED PROGRAM ACTIVITY

- o Discontinuing demonstration and regulatory efforts and concentrating on long-term research.
- o Urban waste program to be phased out by end of 1982 because industry now developing waste-to-energy technologies.
- o Future research emphasis in areas of building envelope systems, ventilation controls, performance calculation, test procedures for appliances, and development of advanced appliance technologies.
- o FEMP will develop 10-year energy plans for Federal buildings.

INDUSTRIAL CONSERVATION

Historical Goal: To cost-share research, development, and demonstration to increase the technology options commercially available to industry and to agriculture for improving the energy efficiency of processes and for reducing the amount of waste energy and substitution of more abundant fuels for scarce fuels; to achieve incremental annual energy savings of 1.0 quad by 1985 and 5.5 quads by the year 2000 from industrial investment in the technologies supported by DOE; and to transfer information on the costs and benefits of technologies developed.

Current Goal: No further Government support; industry is expected to achieve the aforesaid results under the incentives provided by the market place.

FUNDING PROFILE

HISTORICAL
(\$ TOA Millions)

CURRENT
(\$ BA Millions)

FY 78
\$33.2

FY 79
\$40.3

FY 80
\$65.7

FY 81
\$48.2

FY 82
\$28.8

FY 81 SUBPROGRAMS:

- o Waste Energy Reduction
- o Industrial Process Efficiency
- o Industrial Cogeneration
- o Implementation & Deployment

FY 82 SUBPROGRAM:

- o Program Direction

ACCOMPLISHMENTS

- o An established RD&D program that has supported 165 new technologies between 1978 and 1981:
 - 162 installations of 8 technologies supported by program; and
 - 6.51 trillion Btu's (0.0065 quad) of incremental annual energy savings to date from these new technologies.
- o Six Energy Analysis and Diagnostic Centers established; 369 energy audits completed through FY 81.
- o Technical assistance and information activities for industrial users including 24 workshops and seminars, and dissemination of more than 31,000 publications.

PROJECTED PROGRAM ACTIVITY

- o Industry should be responsible for and, in fact, will develop more efficient processes, equipment, and products.
- o Phaseout of all projects in program at next meaningful milestone during FY 1982 and prepare reports on results to date.
- o Orderly termination of the program at the end of FY 1982.

TRANSPORTATION

Historical Goal: Reduce petroleum use by 25 percent (as compared with the 1980 baseline projection of 13 MBD by the year 2000) through cost-effective improvements and fuel substitution in the transportation sector by the year 2000 while maintaining personal mobility and freight service levels, protecting human health and safety, and avoiding degradation of the environment.

Current Goal: Complete current program activities on advanced engines, electric and hybrid vehicles (EHV), fuel efficiency, and fuel substitution to satisfy congressional mandates for FY 82, transfer technology data base to industry and phase out program operations by the end of 1982.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$69.1	\$100.3	\$115.2	\$98.2	\$58.9

FY 81 SUBPROGRAMS:

- o Vehicle Propulsion R&D
- o Electric & Hybrid Vehicle R&D
- o Transportation Systems Utilization
- o Alternative Fuels Utilization

FY 82 SUBPROGRAMS:

- o Vehicle Propulsion R&D
- o Electric & Hybrid Vehicle R&D
- o Transportation Systems Utilization
- o Alternative Fuels Utilization

ACCOMPLISHMENTS

- o Vehicle Propulsion: conducted cost-shared R&D on turbine and Stirling engines, tested heavy duty turbine engines in bus service, completed feasibility study in waste heat recovery technology, and tested alternative fuels in medium speed diesel engines, and met interim program milestones on schedule.
- o Electric and Hybrid Vehicle RDT&D: tested nickel/iron batteries, assisted in getting 1,000 EV's into operation at 61 sites, provided \$3 million in loan guarantees, and transferred data to industry.
- o Transportation System Utilization: produced and distributed an annual automobile fuel economy guide (average of 16 million copies per year), conducted a driver fuel efficiency training course for 3,500 participants, and prepared contingency plans on schedule for state gasoline consumption targets in emergencies.
- o Alternative Fuels Utilization: established technology base with regard to new fuels and sponsored roundtable forums with engine manufacturers and fuel suppliers.

PROJECTED PROGRAM ACTIVITY

- o In FY 82 focus basic research on advanced engine and EHV technology, concentrating on materials for making heat engines more efficient, improvements in the range and life of EV batteries and components, and development of supporting technology needed for making use of waste heat in diesel.
- o In FY 82, publish and distribute Gas Mileage Guide to all new car dealers.
- o Phase down program activities in anticipation of program termination at the end of FY 82; program proposed for termination in FY 83.

MULTI-SECTOR CONSERVATION

Historical Goal: To expand and enhance the technology base available to the private sector for the development of improved energy systems and devices, and evaluate new or innovative concepts for improved efficiency of alternative fuel use in energy conversion or utilization systems; and to support and encourage, through the provision of financial and technical assistance, the research, development, and demonstration of energy-related inventions (and small-scale, decentralized renewable energy technologies) in multiple end-use sectors to realize energy savings in the shortest possible time.

Current Goal: To expand and enhance the technology base available to the private sector for the development of improved energy systems and devices, and evaluate new or innovative concepts for improved efficiency or alternative fuel use in energy conversion or utilization systems.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$4.0	\$12.2	\$19.7	\$25.4	\$16.5

FY 81 SUBPROGRAMS:

- o Energy Conversion & Utilization Technology (ECUT)
- o Energy-Related Inventions Program
- o Appropriate Technology Small Grants Program

FY 82 SUBPROGRAMS:

- o Energy Conversion & Utilization Technology (ECUT)
- o Energy-Related Inventions Program

ACCOMPLISHMENTS

- o ECUT program achieved intermediate milestones related to (a) development/verification of models for two innovative internal combustion engine concepts, (b) assessment of technology needs for Stirling engine, (c) analysis of data on heat exchangers, and (d) establishment of research agenda for chemical process project. Program remained on schedule for achieving specific objectives in mid- to late-1980's.
- o Energy-Related Inventions Program evaluated merit of 10,914 inventions, provided financial assistance for 115 technologies for the RD&D of inventions to individuals and small businesses, and disseminated information monitored progress on inventions.
- o The Appropriate Technology Small Grants Program promoted RD&D and the dissemination of information with respect to small-scale, decentralized renewable energy systems; 45,000 proposals were evaluated; 2,400 small-scale renewable energy technologies have been awarded grants.

PROJECTED PROGRAM ACTIVITY

- o Energy-Related Inventions Program will phase out during FY 82. No funds will be request for this program for FY 83.
- o Future research in ECUT will investigate use of less energy-intensive environments in chemicals production through biocatalysis, development of heat exchangers that are at least 10 percent more effective than current state-of-the-art equipment, and development of large-scale computer models of engine intake processes.
- o Appropriate Technology Program has been terminated. Program continuing to work toward historical goals.

STATE AND LOCAL PROGRAMS

Historical Goal: To support and encourage through grants and technical assistance the efforts of states, local governments, and, to a lesser extent, small businesses, organizations, and individuals in their efforts to enhance energy efficiency and support the use of renewable energy technologies.

Current Goal: Continue to meet the mandates of the individual state and local assistance programs. Phase down all activities by the end of FY 82.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$181.9	\$633.0	\$603.2	\$478.3	\$231.9

FY 81 SUBPROGRAMS:

- o State Energy Conservation Programs
- o Energy Extension Service
- o Weatherization Assistance Program
- o Schools & Hospitals Grant Program

FY 82 SUBPROGRAMS:

- o State Energy Conservation Programs
- o Energy Extension Service
- o Weatherization Assistance Program
- o Schools & Hospitals Grant Program

ACCOMPLISHMENTS

- o Energy Extension Service (EES) provided energy information and assistance outreach programs in the states directed toward public institutions, small business, and individuals. Stimulated substantial savings in energy costs and investments in energy conservation measures.
- o State Energy Conservation Program (SECP) provided financial and technical assistance, training workshops, and information-sharing activities to states to manage energy conservation programs.
- o Weatherization Assistance Program (WAP) provided grants nationwide to increase energy efficiency of dwellings for the poor, elderly, and handicapped. Estimated 750,000 homes were weatherized under this program by the end of FY 81 (if the CSA program is included, this number totalled \$1 million).
- o Schools and Hospitals-Local Government and Public Care Grant Programs provided grants nationwide for institutions and municipalities to conduct energy audits, to provide technical assistance, and for schools and hospitals, to acquire and install energy conservation measures.

PROJECTED PROGRAM ACTIVITY

- o Combined grants for the EES and SECP programs will total approximately 170 under the FY 82 funding level.
- o Current FY 82 funding levels for WAP will allow retrofit of approximately 124,000 to 145,000 low-income homes.
- o Schools and Hospitals-Local Government and Public Care Grant Programs will continue grant activities described in "Accomplishments"; 1,000 technical assistance grants and 1,350 energy conservation measures grants are estimated to be awarded under the FY 82 funding level.

ELECTRIC ENERGY SYSTEMS

Historical Goal: Provide future options to improve the electric energy system efficiency, reliability, economy, and safety through development of advanced theory, methodologies for assessment, materials applications, and controls.

Current Goal: Gradual phaseout of carryover activities. No new projects to be undertaken.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$43.9	\$43.0	\$39.3	\$37.8	\$24.3

- FY 81 SUBPROGRAMS:
- o Power Supply Integration
 - o Power Delivery

- FY 82 SUBPROGRAMS:
- o Systems Architecture & Integration
 - o Power Delivery

ACCOMPLISHMENTS

- o System Architecture and Integration:
 - completed assessment of dispersed storage and generation integration requirements on schedule;
 - initiated integration studies for solar photovoltaics, wind generation, and OTEC; efforts terminated due to funding constraints;
 - completed initial field tests in development of communication technology for dispersed generation, storage, and end-use management in utility distribution systems; efforts terminated due to funding constraints;
 - initiated assessment of advanced control concepts for energy management in utility distribution systems; and
 - developed computer model to improve system efficiency, reliability, and adaptability under normal and emergency conditions.
- o Power Delivery: initiated research in semiflex, OTEC, and superconducting cable development; reached testing, conceptual designs, and fabrication stages respectively; completed initial studies of effect of massive electric fields on animals; and began assessment of feasibility of amorphous metal applications to transformers and electric motors.
- o Generation and Storage Analysis: completed construction of BEST laboratory and began research and development on Zn/Cl battery.

PROJECTED PROGRAM ACTIVITY

- o Continuation of ongoing research projects; no new projects being initiated.
- o Activities conducted during phaseout include:
 - identification of safety and protection requirements for integrating new technologies into the grid;
 - definition of requirements for interfacing DC source with AC system and developing power conditioning interface hardware; and
 - development of advanced process models and simulation techniques for improving control.
- o Program recommended for phaseout in FY 83.

ENERGY STORAGE SYSTEMS

Historical Goal: To develop energy storage technologies and demonstrate, in cooperation with industry, reliable, cost-effective, and environmentally acceptable storage systems that provide for increased substitution of coal, nuclear, and solar energy for petroleum and natural gas; allow intermittent energy systems to provide continuous service; and promote conservation by recovering waste heat and improving process efficiency.

Current Goal: To perform energy storage research and exploratory development that will confirm technical feasibility for engineering development by industry and that will help lead to reliable, environmentally acceptable energy storage systems that allow for substitution of coal, nuclear, and renewable energy for petroleum, and that allow for increased productivity by improving efficiency of energy processes.

FUNDING PROFILEHISTORICAL
(\$ TOA Millions)

<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	
\$52.3	\$60.0	\$66.9	\$52.0	

CURRENT
(\$ BA Millions)

<u>FY 82</u>
\$32.2

FY 81 SUBPROGRAMS:

- o Battery Storage
- o Thermal and Mechanical Storage

FY 82 SUBPROGRAMS:

- o Electrochemical Energy Storage
- o Physical & Chemical Energy Storage

ACCOMPLISHMENTS

- o Private sector has commercialized improved lead-acid batteries, and thermal energy storage materials researched by DOE.
- o Energy density, power density, and cycle life of zinc-bromine, lithium/metal sulfide, and sodium sulfide batteries have been increased.
- o An improved oxygen electrode has been developed to increase the efficiency of energy use in the chloralkali industry.
- o Promising sensible and latent heat storage materials for residential, commercial, and utility applications have been developed, and private venture capital is now commercializing these materials.
- o The technical and economic feasibility of heat and chill storage in aquifers has been established.
- o Designs for compressed air energy storage, underground pumped hydro-electric, and superconducting magnetic energy storage have been completed, and engineering and performance testing of those designs has begun.
- o Hydrogen storage has been advanced by improvements in methods of hydrogen production and studies of how best to store and transport hydrogen safely.

PROJECTED PROGRAM ACTIVITY

- o Improve technology base for electrochemical energy storage through development of new cell components and research on generic problems which affect cell performance and lifetime.
- o Improve advanced batteries for use in electric vehicles and in conjunction with photovoltaics.
- o Develop improved Hall cell to increase the efficiency of energy use in the aluminum industry.
- o Increase the cycling lifetimes of phase change materials for thermal energy storage.
- o Continue to develop technology for underground storage of heat and chill, compressed air energy storage, and superconducting magnetic energy storage.
- o Improve technology base for hydrogen storage.
- o Program will be terminated in FY 83.

ENERGY SUPPORTING RESEARCH

Goals (Historical and Current): Energy Supporting Research includes four activities which are crosscutting in nature and support the Department's energy R&D mission. The specific goals of these activities are: 1) to produce the fundamental scientific and technological knowledge and insight needed for the development of new and improved options to meet national energy goals through research in Nuclear Science; Materials Science; Chemical Sciences; Engineering, Mathematical, and Geoscience; Biological Energy Research; and Advanced Energy Projects (an activity aimed at exploring the scientific feasibility of novel energy-related concepts); 2) to enhance the preparation and training of future energy professional manpower through support of special manpower development and research efforts; 3) to provide the Department with independent, objective analyses and assessments of research and technical activities and needs on the Department's R&D programs; and 4) to rehabilitate and replace deteriorated, unreliable, or otherwise inadequate general support facilities which are required to continue the operation of DOE's multiprogram laboratories.

FUNDING PROFILE

HISTORICAL
(\$ TOA Millions)

CURRENT
(\$ BA Millions)

FY 78
\$189.3

FY 79
\$227.1

FY 80
\$247.6

FY 81
\$277.2

FY 82
\$305.6

FY 81 SUBPROGRAMS:

- o Basic Energy Sciences
- o Technical Assessment Projects
- o University Research Support
- o Multi-Program General Purpose Facilities

FY 82 SUBPROGRAMS:

- o Basic Energy Sciences
- o Energy Research Analysis
- o University Research Support
- o Multiprogram General Purpose Facilities

ACCOMPLISHMENTS

- o Supported approximately 1,000 research projects per year which continue to produce valuable data used in applied R&D (e.g., research which improved the ability to predict consequences of nuclear reactor accidents and developed erosion-resistant coatings with a variety of applications. Approximately 70 percent of this research is conducted at DOE laboratories, 26 percent at universities, and 4 percent at other institutions (BES).
- o Expanded scope of BES program to include additional energy-related research and established an engineering activity and the Biological Energy Research and Advanced Energy Projects programs (BES).
- o Completed construction of two forefront research facilities, the Intense Pulsed Neutron Source and the Combustion Research Facility; a third major facility, the National Synchrotron Light Source, will be operational in FY 82 (BES).
- o Carried out several activities in energy-related education and manpower development (e.g., strengthened capabilities) at 20 universities by providing "seed money" for small-scale exploratory research and provided a variety of training opportunities and information to 4,000 college students, faculty members, and secondary school teachers (URS).
- o Conducted a variety of technical assessments which contributed to decisions on pace and scope of DOE R&D programs (ERA).
- o Initiated 13 projects in FY 81 as part of effort to correct deficiencies in general purpose facilities at multiprogram laboratories (MGPF).

PROJECTED PROGRAM ACTIVITY

- o Core research in the chemical, materials, nuclear, mathematical, engineering, and geosciences will be supported (BES).
- o Moderate funding increases will be allotted to the newer subprograms of Biological Energy Research, and Advanced Energy Projects (BES).
- o The Combustion Research Facility and the research reactors will operate at their current level of effort, and construction of the National Synchrotron Light Source will be completed (BES).
- o The URS program will support selected joint university-industry energy research projects, provide fuel-related assistance for university research reactors, and carry out a number of activities aimed at improving the numbers and quality of students pursuing energy-related scientific and technical careers (URS).
- o Approximately seven technical assessments of selected programs will be conducted (ERA).
- o Continue design and construction of MGPF projects started in FY 81 and initiate four new projects (MGPF).

ENVIRONMENT AND SAFETY

Goals (Historical and Current): To provide support, assistance, assessments, and overview to ensure compliance with environmental, safety, and health (ES&H), and quality assurance protection goals and requirements in the Department's nuclear and non-nuclear energy programs and in its Government-owned, contractor-operated facilities; and to provide ES&H support in carrying out remedial actions related to past governmental nuclear operations.

<u>FUNDING PROFILE</u>				
<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$58.2	\$65.4	\$69.3	\$65.8	\$57.3

FY 81 SUBPROGRAMS:

- o Environmental Assessments
- o Environmental Compliance and Overview

FY 82 SUBPROGRAMS:

- o Safety
- o Environment

ACCOMPLISHMENTS

- o Provided guidance, assistance and overview to:
 - achieve a high level Department-wide ES&H protection, which resulted in DOE maintaining an operational safety and health record substantially better than that of comparable private industry; and
 - ensure that all DOE projects comply with NEPA and other environmental requirements, which resulted in processing delays experienced on less than 1 percent of the actions and with no delays caused by successful litigation.
- o Anticipated and resolved ES&H protection issues related to implementation of DOE program by defining ES&H research, assessment, and control needs for more than 30 DOE technology programs and developing Departmental responses to over 40 proposed Federal regulations affecting energy programs.
- o Initiated upgrading of nuclear safety in DOE operations and facilities.

PROJECTED PROGRAM ACTIVITY

- o To strengthen significantly and make even more effective DOE operational nuclear and non-nuclear environmental protection, safety, health protection, and quality assurance activities.
- o To continue to provide guidance, assistance, and overview efforts to ensure that all DOE projects comply with NEPA and other environmental requirements.
- o To continue to anticipate and resolve ES&H protection issues related to implementation of DOE programs.

HEALTH AND ENVIRONMENTAL RESEARCH

Goals (Historical and Current): To seek a comprehensive understanding and quantitative description of the human health and genetic effects associated with energy technology development, including development of new methods and instrumentation for early detection, possible prevention and treatment of adverse health effects; to seek a comprehensive understanding of the environmental (terrestrial, aquatic, and atmospheric) effects of energy technology development; and to conduct research aimed at enhancing the beneficial applications of radiation, radionuclides, and stable isotopes in the diagnosis and treatment of human diseases. About half of the program is conducted in DOE multiprogram laboratories, a quarter in specialized and environmental facilities, and the rest at over 150 universities, hospitals, and other institutions. These activities focus on the long-term generic health and environmental energy-related uncertainties that neither industry, regulatory agencies, nor basic and health sciences agencies are likely to address. They provide a basis for comparing potential health and environmental effects of advanced technology options and current energy alternatives.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$207.5	\$197.1	\$210.1	\$209.9	\$215.0

FY 81 SUBPROGRAMS:

- o Biological & Environmental Research
- o Life Sciences Research & Nuclear Medicine Applications

FY 82 SUBPROGRAMS:

- o Biological & Environmental Research
- o Life Sciences Research & Nuclear Medicine Applications

ACCOMPLISHMENTS

- o Continued to provide most of the experimental data used to develop the human radiation exposure standards in worldwide use today.
- o Continues to be the Nation's primary experimental health and environmental effects research effort in support of all energy-related activities.
- o Successfully developed the technology and almost all the diagnostic instrumentation now in use in clinical nuclear medicine.
- o Met legislative intent by annually supporting about 1,000 individual research projects at 180 institutions involving more than 2,000 scientists, while providing research opportunities for 900 graduate students and 450 post-doctoral fellows annually. Research results published in peer-reviewed journals exceeding 3,000 articles per year.

PROJECTED PROGRAM ACTIVITY

- o Maintain the national core program, specialized facilities and cadre of multidisciplinary researchers and analysts dedicated to identify, address, and reduce the health and environmental uncertainties of the long-term impacts of energy activities.
- o Conduct an objective evaluation of the more important environmental and human health effects resulting from exposure to low levels of ionizing radiation and energy-related toxic chemicals.
- o Update the risk analysis of energy technologies to reflect new research results and to analyze the effects of pollutants common to several technologies.
- o Exploit high energy physics and radiation chemistry developments to produce new medically useful radionuclides, radiopharmaceuticals, radiation beams, and instrumentation for diagnosing and treating human disease.

ECONOMIC REGULATORY ADMINISTRATION

Historical Goal: To ensure adequate and reliable supplies of energy to meet the needs of this country by encouraging crude oil production from high-risk drilling ventures; to encourage the use of more abundant fuels; to ensure equitable distribution and pricing of crude oil and petroleum products; to control imports of oil and natural gas; and to assist states in developing policies for greater conservation and the equitable pricing of electricity and enforcement of existing laws.

Current Goal: To ensure the enforcement of regulations that were legislatively mandated by the Emergency Petroleum Allocation Act of 1973; to control the imports of oil and natural gas; to facilitate coal conversion and to provide for the orderly phaseout of those regulatory programs no longer required as a result of the President's Executive Order 12287, which decontrolled crude oil and petroleum products.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$66.2	\$92.8	\$132.3	\$105.4	\$47.2

FY 81 SUBPROGRAMS:

- o Fuels Conversion
- o Utility Programs & Regulatory Intervention
- o Compliance
- o Oil and Gas Operations
- o Emergency Preparedness

FY 82 SUBPROGRAMS:

- o Fuels Conversion
- o Compliance
- o Oil and Gas Operations

ACCOMPLISHMENTS

- o Under authority of the expired Emergency Petroleum Allocation Act (EPAA), ensured equitable pricing and distribution of crude oil and petroleum products.
- o Partially met energy independence objectives by controlling imports and exports of crude oil, petroleum products, and natural gas to ensure equitable pricing and preserve the viability of the domestic market.
- o Performed audits and investigations which successfully recouped millions of dollars from those violating allocation and pricing regulations and returned money to harmed parties or to the U.S. Treasury. Accomplished objectives and met congressional intent.
- o Began effort to shift emphasis away from regulating the oil industry.
- o Encouraged high-risk drilling ventures by certifying 423 tertiary projects of which 284 are producing oil.
- o Met congressional objective of assisting state utility regulatory commissions to conform with the Public Utility Regulatory Policies Act of 1978.

PROJECTED PROGRAM ACTIVITY

- o Process coal conversion orders, issue exceptions, and approve gas conservation plans.
- o License oil imports.
- o Authorize natural gas imports and exports.
- o Achieve an orderly phaseout of EPAA audit activity; complete audits, negotiate settlements, or pursue litigation during FY 82 and FY 83.

HEARINGS AND APPEALS

Historical Goal: To ensure the lawful and equitable operations of DOE regulatory programs, particularly those related to the administration of the mandatory petroleum and price allocation regulations, by expeditiously resolving petitions for regulatory relief and taking prompt enforcement actions where necessary.

Current Goal: To concentrate staff efforts on completing all exception and enforcement matters associated with the termination of the mandatory petroleum and price allocation regulations; to continue to provide a forum for the adjudication of other matters within OHA jurisdiction.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$2.3	\$2.9	\$5.9	\$8.3	\$4.8

FY 81 SUBPROGRAM:

- o Office of Hearings & Appeals

FY 82 SUBPROGRAM:

- o Office of Hearings & Appeals

ACCOMPLISHMENTS

- o Speedily resolved over 38,000 adjudications in the 4-year period FY 78 through FY 81.
- o Exceptions:
 - modified generally applicable rules in individual cases to alleviate serious hardships and inequities experienced by regulated firms, thereby preventing bankruptcies and minimizing interference with market forces;
 - adjusted price levels in more than 500 cases to encourage new capital investment in and prevent abandonment of marginally profitable crude oil producing properties; and
 - quickly resolved more than 24,000 petitions for relief from the crude oil and motor allocation regulations to prevent market dislocation and hardships to small firms.
- o Remedial Orders:
 - issued adjudication orders on thousands of enforcement proceedings in a timely fashion;
 - established a body of case law which is widely used by regulated firms in interpreting DOE Regulations.
- o Appeals: processed substantial numbers of Freedom of Information appeals cases.

PROJECTED PROGRAM ACTIVITY

- o Continue to adjudicate all exception applications and provide an adjudicatory forum in enforcement cases and other appellate matters, to meet the objective of an orderly wind-up of the price control program.
- o Provide for efficient and equitable distribution of funds received by DOE through enforcement procedures.

FEDERAL ENERGY REGULATORY COMMISSION

Goals (Historical and Current): To regulate the national operations of the public utilities that serve much of the Nation's energy needs in order to ensure that business and consumers have adequate supplies of energy at just and reasonable prices, and that energy producers have rates of return that provide sufficient incentives for increased production and efficiency.

<u>FUNDING PROFILE</u>			
<u>HISTORICAL</u>			
(\$ TOA Millions)			
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>
\$43.1	\$54.0	\$71.1	\$77.3

<u>CURRENT</u>
(\$ BA Millions)
<u>FY 82</u>
\$76.2

FY 81 SUBPROGRAMS:

- o Gas Regulation
- o Hydropower Regulation
- o Oil Regulation
- o Electric Regulation

FY 82 SUBPROGRAMS:

- o Gas Regulation
- o Hydropower Regulation
- o Oil Regulation
- o Electric Regulation

ACCOMPLISHMENTS

- o Completed 184,064 gas regulation cases while reducing pending casework by 28 percent.
- o Through gas regulation auditing programs, caused over \$4 billion in refunds to consumers. Reduced pending casework by almost 50 percent since FY 78.
- o Completed 8,938 oil regulation cases of 9,289 received. Approximately 30 percent of all tariff and rate change filings are suspended until final decision in Williams Phase I is issued.
- o Completed 2,712 hydropower regulation cases; however, receipt of new hydro cases has increased sixfold since 1978 while completions have increased by only fivefold. Cited by FEMA as having the "model" dam safety program in the United States.
- o With receipts of electric regulation cases up by 25 percent in FY 80 over the FY 78 level, pending cases at the end of FY 81 were reduced by 7 percent.
- o Through the FERC Energy Data Validation Program, eliminated 571,996 hours (275 workyears) of reporting burden placed on the oil, gas, hydropower, and electric industries.
- o Implemented 2 major areas of NEA of 1978, the NGPA and PURPA.

PROJECTED PROGRAM ACTIVITY

- o Bring pending casework current by 1985 while maintaining the quality of FERC case reviews.
- o Respond to the mandates of the NGPA, PURPA, National Energy Act of 1978, and other pertinent enabling legislation.
- o Complete review, processing, and issue commission decision on the Trans Alaska Pipeline System (TAPS).
- o Respond to tremendous increase in hydropower licensing programs and ensure the safety of licensed dams as well as those under construction.
- o Carry out legislative mandates of the Pacific Northwest Planning and Conservation Act.

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ENERGY INFORMATION

Goals (Historical and Current): To carry out an independent, central, comprehensive, and unified energy data information program to collect, evaluate, assemble, analyze, and disseminate data and information relevant to energy resource reserves, energy production, demand and technology, and related economic statistical information, or which is relevant to the adequacy of energy resources to meet demands in the near- and long-term future for the Nation's economic and social needs.

FUNDING PROFILE

HISTORICAL
(\$ TOA Millions)

CURRENT
(\$ BA Millions)

<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	
\$45.4	\$61.5	\$90.8	\$90.4	

<u>FY 82</u>
\$78.9

FY 81 SUBPROGRAMS:

- o Energy Applied Analysis
- o Collection, Production & Dissemination
- o Information Validation
- o Data Information Services

FY 82 SUBPROGRAMS:

- o Collection, Production & Analysis
- o Program Services
- o Policy and Management

ACCOMPLISHMENTS

PROJECTED PROGRAM ACTIVITY

EIA has successfully developed and maintained a system whereby comprehensive, detailed information is made available to decision-makers and policy makers in Government and private industry and to the public. This has been done by:

- o Successfully carrying out an independent, central, comprehensive, and unified energy information program.
- o Preparing high quality annual and quarterly reports on schedule.
- o Revising, verifying, documenting, and simplifying models and methodologies, thereby providing timely projections to the user.
- o Collecting, evaluating, assembling, analyzing, and disseminating information on coal, electric power, petroleum and natural gas, solar and alternative energy sources, and energy consumption information in compliance with 12 governing statutes.
- o Eliminating 109 superfluous or duplicative Federal energy information collection forms.
- o Reducing substantially the reporting burden on businesses and others.

- o Improve methods and procedures so that essential energy information is provided at the lowest direct cost, with the minimum burden on the public.
- o Continue to prepare Annual Report to Congress and quarterly national forecast; as required by law, and provide other analyses as requested, eliminating longer term forecasts.
- o Continue to collect, evaluate, assemble, analyze, and disseminate data required by existing statutes in an accurate and timely manner.
- o Continue elimination of burdensome, detailed data collection and overly refined analyses. Support (S-1281), Energy Information Administration Amendments of 1981, to help accomplish this reorientation.

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NAVAL PETROLEUM AND OIL SHALE RESERVES

Goals (Historical and Current): To develop the Naval Petroleum Reserves (NPR) to their full productive capacity to achieve the optimum capability for supplying petroleum to meet national defense needs; to produce petroleum at the rate established by law; to sell, or otherwise dispose of, the petroleum as directed by Congress, the President, and the Secretary of Energy; and to develop and implement an operating strategy for the development and production of the Naval Oil Shale Reserves (NOSR) that will make these resources available to meet national defense needs.

FUNDING PROFILE

<u>HISTORICAL</u>				<u>CURRENT</u>
(\$ TOA Millions)				(\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$154.1	\$128.1	\$76.9	\$198.4	\$213.1
FY 81 SUBPROGRAMS: <ul style="list-style-type: none"> o Headquarters o Reserves 1 & 2 (California) o Reserve 3 (Wyoming) o Naval Oil Shale Reserves (NOSR) 				FY 82 SUBPROGRAMS: <ul style="list-style-type: none"> o Headquarters o Reserves 1 & 2 (California) o Reserve 3 (Wyoming) o Naval Oil Shale Reserves (NOSR)

ACCOMPLISHMENTS

- o Between October 1977 and end-FY 1981, NPR-1 and NPR-3 produced at their maximum efficient rate, which resulted in production of 220 million barrels of oil and sales of the Government's share providing revenues to the U.S. Treasury of over \$4.6 billion. Between 1,500 and 2,000 persons were employed in California and Wyoming to support these reserves.
- o Met commitment to sell all recovered petroleum either competitively or to SPR and DOD at market prices.
- o Since October 1977, as part of program to expand known and recoverable reserves, drilled 28 exploratory wells out of 64 exploratory wells planned and began pilot enhanced oil recovery project at NPR-3 to determine potential for increasing recoverable oil.
- o Since October 1977, as part of developing known reserves to full productive capacity, drilled 594 development wells out of total of 1,069 development wells planned through 1987, and completed NPR-1 production facilities and NPR-3 gas processing plant.
- o Essentially completed Predevelopment Plan for NOSR-1, which analyzes the environmental, technical, and socioeconomic factors required to develop the reserve. Completed seismic tests at NOSR-2.

PROJECTED PROGRAM ACTIVITY

- o Continue recovery of petroleum at Maximum Efficient Rate (MER) (average production, 175,000 barrels per day in FY 82) providing estimated annual revenues to the U.S. Treasury of \$1.9 billion.
- o Continue supply of petroleum to DOD and SPR, as required.
- o Drill planned exploratory and development wells.
- o Continue enhanced oil recovery tests at NPR-3, completing pilot phase in 1983, followed by full-scale design and development of enhanced oil recovery projects.
- o Complete Predevelopment Plan for NOSR-1.
- o Complete geological evaluation of seismic test program at NOSR-2 and lease for oil and gas development, if appropriate.

URANIUM ENRICHMENT ACTIVITIES

Goals (Historical and Current): To meet domestic, foreign, and U.S. Government requirements for uranium enrichment services in the most economical, reliable, safe, and environmentally acceptable manner possible.

FUNDING PROFILE

HISTORICAL
(\$ TOA Millions)
(\$ Revenue in Millions)

CURRENT
(\$ BA Millions)
(\$ Revenue in Millions)

<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>
\$1,483.2	\$1,334.8	\$1,122.3	\$1,438.5
\$ 896.0	\$1,217.0	\$1,117.0	\$1,248.1

<u>FY 82</u>
\$1,796.0
\$1,805.0

FY 81 SUBPROGRAMS:

- o Gaseous Diffusion Program
- o Gas Centrifuge Program
- o Revenues
- o Advanced Isotope Separation Technology

FY 82 SUBPROGRAMS:

- o Gaseous Diffusion Program
- o Gas Centrifuge Program
- o Revenues
- o Advanced Isotope Separation Technology

ACCOMPLISHMENTS

- o Met objectives for both production and cost for enriched uranium for finished nuclear weapons, fuel elements for naval reactors, and fuel elements for land-based power and research reactors.
- o Provided enrichment services to domestic and non-U.S. utility customers to fuel nuclear powerplants on a fully reimbursed basis.
- o Completed planned capacity expansions below cost estimate (CIP-CUP).
- o Met major cost and construction milestones for the Gas Centrifuge Enrichment Plant.
- o Met major research milestones on Advanced Gas Centrifuge (AGC) and Advanced Isotope Separation (AIS) technologies.

PROJECTED PROGRAM ACTIVITY

- o Continue to meet domestic, foreign, and U.S. Government requirements for uranium enrichment services in the most economical, reliable, safe, and environmentally acceptable manner possible.
- o Complete construction of the gas centrifuge enrichment plant (GCEP) by 1994.
- o Develop Advanced Isotope Separation (AIS) and Advanced Gas Centrifuge (AGC) technologies that produce enriched uranium at a cost less than present production cost.

POWER MARKETING ADMINISTRATIONS

Goals (Historical and Current): To transmit and market power produced at multipurpose Federal water projects, subject to constraints established by law. (The Bonneville Power Administration has additional responsibilities to purchase, conserve, "wheel," promote renewable resources, and enhance the fish and wildlife of the Columbia River.)

<u>FUNDING PROFILE</u>						
<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)		
	<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>		<u>FY 82</u>
PMA:*	\$162.5	\$208.6	\$255.8	\$317.6	PMA:*	\$243.3
Bonneville Power Administration:**	\$414.6	\$467.8	\$620.0	\$830.7	Bonneville:**	\$655.7
FY 81 SUBPROGRAMS: -----N/A-----				FY 82 SUBPROGRAMS: -----N/A-----		

ACCOMPLISHMENTS

- o 122 Federal water projects are being operated, and 30,000 miles of transmission lines and associated facilities are being maintained (TVA not included under this program).
- o Through FY 80, the program has collected \$10 billion in revenues; \$2 billion of this has been applied to repay capital investment.
- o Power administrations have excellent safety records, have kept outages to a minimum, and, when outages have occurred, have restored service promptly.
- o 35 rate actions have been approved between March 1979, and June 1981, to adjust for escalation of costs; these will ensure continued timely repayment of Federal costs.

PROJECTED PROGRAM ACTIVITY

- o No major change in program activities.
- o Continue to sell all available hydropower produced at Federal multiple-purpose water projects.
- o Continue repayment of capital investment with interest and operating costs.
- o Add to and upgrade transmission lines and substations to improve reliability.

*Includes Alaska Power Administration, Southeastern Power Administration, Southwestern Power Administration, and Western Area Power Administration.

**Includes borrowing authority and revenues.

STRATEGIC PETROLEUM RESERVES

Goals (Historical and Current): To reduce the vulnerability of the United States to severe petroleum supply interruptions and to meet the obligations of the United States under the International Energy Program.

<u>FUNDING PROFILE</u>				
<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$3,299.4	\$3,551.7	\$767.5	\$3,768.1	\$3,875.4*
<p>FY 81 SUBPROGRAMS:</p> <ul style="list-style-type: none"> o Planning o Petroleum Acquisition & Transportation o Storage Facilities Development & Operation o Program Direction 				<p>FY 82 SUBPROGRAMS:</p> <ul style="list-style-type: none"> o Planning o Petroleum Acquisition & Transportation o Storage Facilities Development & Operation o Program Direction

ACCOMPLISHMENTS

- o The objective was to store 168 MMB by September 30, 1981; 199.3 MMB were in storage on that date.
- o The objective was to develop an SPR drawdown throughput capability of 1.7 MMB/D by 1981; drawdown rate of 1.7 MMB/D achieved; unscheduled drawdown exercise conducted successfully.

PROJECTED PROGRAM ACTIVITY

- o Increase SPR storage capacity and oil inventory from 267 million barrels at the end of FY 82 to 343 million barrels at the end of FY 83.
- o Continue development of Phase II facilities.
- o Meet objective of expanding capacity (Phase III) to 750 MMB by the end of FY 90.

*\$3,684.0 off-budget funds.

ENERGY EMERGENCY PREPAREDNESS

Historical Goal: To reduce the impacts of supply disruptions on the domestic economy; to ensure adequate supplies for priority users; to formulate and coordinate Federal emergency response measures; and to plan for continuity of government, civil emergency management and mobilization.

Current Goal: To reduce U.S. vulnerability to energy supply disruptions; to analyze and assess economic and social impacts of energy shortfalls; to plan and implement response measures to mitigate their impacts; and to implement response in the event of a severe energy supply disruption.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$5.8	\$7.6	\$14.8	\$16.5	\$10.1

FY 81 SUBPROGRAMS:

- o Emergency Conservation
- o Oil Supply Security
- o Emergency Coordination
- o Power Supply and Reliability
- o Energy Emergency Preparedness
- o Petroleum Market Analysis

FY 82 SUBPROGRAMS:

- o Energy Contingency Planning
- o Emergency Operations

ACCOMPLISHMENTS

- o Achieved objective to remove price and allocation controls on gasoline, propane, and crude oil.
- o Prepared assessments of electric power supply to maintain adequacy and reliability.
- o Met legislative requirements by completing gas rationing plan, promulgating state emergency conservation measures for meeting energy demand reduction targets, and issuing public interest exemptions to promote oil-to-gas switching.
- o Prepared analytical review of potential supply interruptions; developed preliminary contingency plans.
- o Evaluated IEA oil sharing program by participating in allocation simulation test (AST-3) with industry, states, and member countries of the EIA activation plans.
- o Met objective to process and issue Presidential permits for international interconnections.
- o Completed interim continuity of government plans for national emergencies.

PROJECTED PROGRAM ACTIVITY

- o Redirect national emergency preparedness strategy toward market reliance by identifying impediments to the free market and develop options to mitigate impediments.
- o Reactivate and train to ensure operational readiness of the executive manpower reserve administrations and related advisory groups.
- o Continue development of comprehensive energy emergency preparedness plans.
- o Continue active support and participation with IEA, NATO, DOD, and FEMA (including EMPB and affiliated working groups).
- o Continue supply adequacy and reliability assessments and analyses of electric power and other energy supply systems.
- o Perform vulnerability and risk assessment analyses of energy supply systems and strategic petroleum reserves.

NAVAL REACTORS DEVELOPMENT

Goals (Historical and Current): To design, develop, test, and support naval nuclear propulsion plants and reactor cores covering a wide range of configurations and power ratings to meet various military requirements in support of the national defense.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$255.1	\$298.1	\$278.4	\$304.7	\$359.2

FY 81 SUBPROGRAMS:

- o Plant Development
- o Reactor Development
- o Reactor Operation & Evaluation

FY 82 SUBPROGRAMS:

- o Plant Development
- o Reactor Development
- o Reactor Operation & Evaluation

ACCOMPLISHMENTS

- o Advanced core designs and materials efforts have allowed development of present operating reactors with core endurance in submarines increased from 62,000 miles to 400,000 miles, a significant step toward designing cores that will last the projected life of a ship.
- o In the 27 years of the Naval Nuclear Propulsion program since the Nautilus prototype first operated there has never been an accident involving a reactor nor has there been any significant effect on the environment.
- o The TRIDENT prototype plant began operation in FY 1980 and the first TRIDENT submarine underwent sea trials in June 1981. The reactor core for this first advanced ballistic missile submarine was produced consistent with the submarines construction schedule.
- o Operated 8 land-based prototype nuclear propulsion plants to complete developmental tests and trained and qualified over 53,000 Navy personnel sufficient to man the nuclear navy.
- o Installed the Advanced Submarine Plant core in a prototype nuclear reactor plant.

PROJECTED PROGRAM ACTIVITY

- o Development of advanced core concepts leading to increasingly powerful, long-life, reliable cores for a variety of possible ship applications, ultimately lasting the life of a ship.
- o Improve plant reliability through development of improved reactor and steam plant components and systems, alternate plant materials, and new heat treatment and water chemistry methods to minimize operating ship problems.
- o Continuation of prototype reactor plant test programs, reactor plant analysis and support work, and improvements to various reactor plant components and systems.

MATERIALS PRODUCTION

Goals (Historical and Current): To develop and direct the program to produce nuclear materials to meet near-term national defense and nondefense requirements and to sustain a base production program to meet long-term national material production requirements consistent with the annual Presidential stockpile memorandum and the annual DOE Materials Management Plan.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$399.8	\$452.1	\$490.3	\$667.0	\$913.4

FY 81 SUBPROGRAM:
o Materials Production

FY 82 SUBPROGRAMS:
o Reactor Operations
o Processing of Nuclear Materials
o Special Isotopes Separation (SIS)
o Supporting Services

ACCOMPLISHMENTS

- o Produced scheduled quantities of plutonium and tritium as needed for the Weapons Program.
- o Received, stored, and processed spent Naval Reactor fuels, recycling recovered material.
- o Produced nuclear materials needed by DOE Nuclear Energy Program on schedule.
- o Initiated steps to meet future increased nuclear materials production requirements associated with the Weapons Program (L Reactor restart, N Reactor conversion, PUREX restart, Pu blending, Special Isotope Separation).
- o Initiated a Materials Production Facility restoration program to remedy past deterioration of production facilities.
- o Initiated a Replacement Production Reactor study as first step toward future replacement of existing production reactors.
- o Produced and sold to the Washington State power system sufficient steam to generate approximately 4 BKWhe per year.

PROJECTED PROGRAM ACTIVITY

- o New production requirement increases expected in next NWSM.
- o SIS facilities needed to clean up fuel grade Pu for weapons and to clean up existing weapon Pu.
- o Restoration, safety improvements, environmental, and safeguards projects are needed.
- o Conduct program leading to a Replacement Production Reactor.
- o Conduct studies leading to expansion and modification to existing fuel processing facilities to support the DOE breeder reactor program.
- o Continuation of activities to increase production capability. These include N Reactor conversion, upgrade of PUREX, upgrade of L Reactor, blending, etc. The Special Isotope Separation Program will continue technology development, prototype demonstration and construction.
- o Continue evaluating design option for a replacement production reactor.

NUCLEAR MATERIALS SECURITY AND SAFEGUARDS

Goals (Historical and Current): To prevent unauthorized disclosure, theft, destruction, or loss of classified items; to provide a base of safeguards and security technology and information directed toward assisting in the protection of DOE facilities, and the control and accountability of nuclear weapons, materials, and components to minimize the success of malevolent acts that would affect DOE operations and national security; to minimize adverse consequences resulting from malevolent acts or threats involving DOE activities and provide assistance to other agencies in responding to malevolent nuclear acts or threats potentially affecting national security or the U.S. public; and to strengthen international safeguards and physical security to deter diversion of nuclear materials and support non-proliferation and national security.

<u>FUNDING PROFILE</u>			
<u>HISTORICAL*</u> (\$ TOA Millions)			
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>
<u>\$58.0</u>	<u>\$61.3</u>	<u>\$63.0</u>	<u>\$67.4</u>
<u>CURRENT</u> (\$ BA Millions)			
<u>FY 82</u>			
<u>\$69.1</u>			

FY 81 SUBPROGRAMS:

- o Nuclear Materials Security and Safeguards
- o Security Investigations

FY 82 SUBPROGRAMS:

- o Nuclear Materials Security and Safeguards
- o Security Investigations

ACCOMPLISHMENTS

- o Developed countermeasures to preclude malevolent access to DOE facilities and compromise of classified information including assurance of personnel reliability (Security Investigations). Program objectives met.
- o Conducted R&D on physical protection components and systems and SNM control accountability components and systems.
- o Provided systems implementation assistance to program organizations.
- o Performed SNM accountability operations. Activities performed within cost and schedule.
- o Made efforts toward gaining a comprehensive understanding of potential adversaries and actions; assessed vulnerabilities to and consequences of malevolent acts directed against critical U.S. energy resources/DOE operations; and defined DOE threat deterrence and response strategies.
- o Developed and tested concepts, systems, and inspection strategies, in collaboration with the IAEA, to facilitate effective international safeguards, including their application at DOE facilities under the U.S./IAEA safeguards agreements. Met all IAEA requests.
- o Collaborated with other countries on an individual basis to improve effectiveness of safeguards and physical security systems. Fulfilled all U.S. commitments.
- o Conducted training in safeguards and physical security. Complied with section 202 of the Nuclear Nonproliferation Act.

PROJECTED PROGRAM ACTIVITY

- o Continued development of countermeasures to preclude malevolent access to DOE facilities and compromise of classified information, including assurance of personnel reliability (Security Investigations).
- o Continued R&D on physical protection components and systems and SNM control accountability components and systems.
- o Continued systems implementation assistance to program organizations.
- o Continued performance of SNM accountability operations.
- o Continued efforts toward gaining a comprehensive understanding of potential adversaries and actions; continued assessment of vulnerabilities to and consequences of malevolent acts directed against critical U.S. energy resources/DOE operations; and continued definition of DOE threat deterrence and response strategies.
- o Continued development and testing of concepts, systems, and inspection strategies in collaboration with the IAEA, to facilitate effective international safeguards, including their application at DOE facilities under the U.S./IAEA safeguards agreements.
- o Continued collaboration with other countries on an individual basis to improve effectiveness of national safeguards and physical security systems.
- o Continued training in safeguards and physical security.
- o Continued implementation of DOE Classification and Declassification Program.

*Does not include Classification.

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NUCLEAR WEAPONS ACTIVITIES

Goals (Historical and Current): To provide the required support for the research, development, testing, production, and lifetime surveillance of safe and reliable nuclear weapons to meet national defense needs as directed by the President and funded by Congress.

<u>FUNDING PROFILE</u>				
<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$1,458.3	\$1,526.2	\$1,710.1	\$2,161.9	\$2,734.0

FY 81 SUBPROGRAMS:

- o Research, Development & Testing
- o Production & Surveillance
- o Program Direction

FY 82 SUBPROGRAMS:

- o Research, Development & Testing
- o Production & Surveillance
- o Program Direction

ACCOMPLISHMENTS

- o Met weapons production, delivery, and retirement requirements on schedule as approved by the President.
- o Conducted a program of weapons R&D providing the concepts and designs for future improved weapons, to the limit of available resources.
- o Conducted a series of underground nuclear tests each year, meeting test objectives, and observing the constraints of the TTBT and the LTBT.
- o Maintained the stockpile in a high state of readiness.
- o Initiated a stockpile improvement program to modernize older weapons in the stockpile.
- o Initiated a facility restoration program to halt R&D and production facility deterioration.

PROJECTED PROGRAM ACTIVITY

- o Weapons manufacturing activity will increase substantially to meet increasing DOD requirements as provided by the President's stockpile memorandum.
- o Continued revitalization of weapons R&D program (staff increases and new research facilities) needed to reinvest in the nuclear weapons science and technology base.
- o Increase testing level to support both near-term systems development requirement and long-term research and development objectives.
- o Continue program to restore deteriorated equipment and facilities throughout the weapons complex.
- o Maintain program oversight and management.

INERTIAL CONFINEMENT FUSION

Goals (Historical and Current): To determine the scientific feasibility of laser and particle beam initiated thermonuclear reactions using the principles of inertial confinement.

<u>FUNDING PROFILE</u>				
<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$130.9	\$145.7	\$196.2	\$211.9	\$209.1

FY 81 SUBPROGRAMS:

- o Laser Development
- o Particle Beam Source Development
- o Fusion Theory and Experiments
- o Systems and Advanced Technology

FY 82 SUBPROGRAMS:

- o Glass Laser Experiments
- o Gas Laser Experiments
- o Pulse Power Experiments

ACCOMPLISHMENTS

- o Antares gas laser, Nova glass laser, and PBFA accelerator facilities under construction.
- o Target physics understanding has grown consistent with available resources.
- o Efficient beam-target energy coupling demonstrated with short wavelength laser light.
- o Efficient system conversion of glass lasers to short wavelength laser light.
- o Target compression to 100 times liquid hydrogen density achieved, about one order of magnitude less than needed for significant TN burn.

PROJECTED PROGRAM ACTIVITY

- o Complete and operate high energy drivers (Antares, Nova, and PBFA).
- o Continue development of targets and diagnostics.
- o Continue work on target-beam interaction theory.

VERIFICATION AND CONTROL TECHNOLOGY

Goals (Historical and Current): To contribute to nuclear explosion detection capability consistent with treaty requirements; to support formulation and implementation of arms control policy; to increase understanding of foreign nuclear weapons capabilities in support of intelligence community efforts; and to review proposed energy-related exports for national security impact.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$26.1	\$29.9	\$38.1	\$39.2	\$50.0

FY 81 SUBPROGRAMS:
-----N/A-----

FY 82 SUBPROGRAMS:
-----N/A-----

ACCOMPLISHMENTSPROJECTED PROGRAM ACTIVITY

- o Met without fail all delivery schedules for spaceborne nuclear test detection instrumentation.
- o Spaceborne instruments have achieved reliability far exceeding program targets, accumulating more than 1 million hours of operation without failure.
- o Conceived, developed, and tested engineering models of in-country, unattended seismic station in Tennessee and Alaska on accelerated schedule; now establishing five-station Regional Seismic Test Network. All milestones met.
- o Provided most of technical base for negotiation of Limited Test Ban Treaty, Threshold Test Ban Treaty, and Peaceful Nuclear Explosions Treaty; now providing same for trilateral negotiations of Comprehensive Test Ban Treaty.
- o Review of proposed nuclear-related exports has kept pace with steadily mounting numbers of cases; in FY 81, 85 percent of 7,200 cases reviewed were completed within statutory 30-day initial period. The majority of those cases extending beyond 30 days required referral to the inter-agency Ad Hoc Subgroup on Nuclear Export Coordination for resolution.

- o Continued research, development, design, fabrication, preflight integration, and post-flight monitoring of nuclear test detection systems for operational DOD satellites.
- o Continued scientific and engineering research in seismic and nonseismic detection of underground nuclear explosions, with emphasis on regional seismology through the operation of the Regional Seismic Test Network with stations in the United States and Canada.
- o Continued studies of nuclear weapons practices and foreign nuclear fuel cycle technology to support the Intelligence Community and U.S. arms control policy-makers.
- o Continued reviews of export license applications pertaining to nuclear materials, equipment, and technology, and analysis of export control and technology transfer issues.
- o Increased activities for new initiatives in Southern Hemisphere and deep space nuclear detection, advanced sensors and sensor deployment techniques, advanced sample analysis, and detection of nuclear material.

DEFENSE NUCLEAR WASTE MANAGEMENT

Goals (Historical and Current): The Defense Nuclear Waste Management Program has the responsibility for the safe handling, storage, utilization, and disposal of radioactive by-products and waste generated in the defense nuclear materials production, naval reactors, and research and development (R&D) programs. This program assures that nuclear wastes from DOE program activities are isolated from the biosphere and pose no significant threat to public health and safety. The program components have the following goals: provide safe utilization or interim storage of wastes; develop alternative technologies and processes to support final disposal; develop an R&D facility to demonstrate geologic disposal of defense wastes; test and coordinate operation of transportation systems to carry defense generated wastes safely; and maintain and clean up surplus facilities from defense activities.

<u>FUNDING PROFILE</u>				
<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$296.3	\$274.8	\$278.6	\$302.2	\$368.4
FY 81 SUBPROGRAMS: <ul style="list-style-type: none"> o Interim Waste Management o Long-Term Waste Management Technology o Terminal Storage (WIPP) o Decontamination & Decommissioning o Transportation R&D 				FY 82 SUBPROGRAMS: <ul style="list-style-type: none"> o Interim Waste Management o Long-Term Waste Management Technology o Terminal Storage (WIPP) o Decontamination & Decommissioning o Transportation R&D

<u>ACCOMPLISHMENTS</u>	<u>PROJECTED PROGRAM ACTIVITY</u>
<ul style="list-style-type: none"> o Completed construction of 20 double-shell waste tanks and deactivated all 149 old tanks at Richland. Activity slightly behind original schedule due to budget limitations and technical problems. o Completed construction of 8 double-shell waste tanks and new evaporators at Savannah River on schedule. o Completed construction of the New Waste Calcining Facility at Idaho. "Hot" operations on schedule to begin in FY 82. o Completed conceptual design, initiated Title I, prepared NEPA documentation, and performed supporting technology development for high-level waste immobilization facility (Defense Waste Processing Facility) at Savannah River and conceptual design for a facility to process transuranic waste (Transuranic Waste Treatment Facility) at Idaho. o Completed Title I design of the Waste Isolation Pilot Plant; issued EIS and Record of Decision; initiated drilling of exploratory shaft. Construction proceeding consistent with P.L. 96-164 which authorized WIPP as an unlicensed R&D facility. 	<ul style="list-style-type: none"> o Complete construction of Waste Isolation Pilot Plant (WIPP) by 1988 for conduct of research and development to demonstrate the disposal of defense waste. o Construct the Defense Waste Processing Facility (DWPF) at Savannah River by 1990 to immobilize high-level waste (HLW). o Construct the Transuranic Waste Treatment Facility (TWTF) at Idaho by the early 1990's to immobilize transuranic waste (TRU). o Complete 10 additional new tanks at Savannah River to transfer HLW from 23 old tanks by 1991. o Complete the stabilization and isolation of 149 single-shell tanks at Richland by 1988. o Continue other interim waste operations for the safe maintenance, storage, and disposal of DOE wastes. o Ensure availability of transportation systems.

HIGH ENERGY & NUCLEAR PHYSICS

Goals (Historical and Current): The goal of this National Trust program is to achieve a comprehensive understanding of the fundamental structure and constituents of matter, the basic forces in nature, and the laws of nature which underlie all physical processes involving transformations of matter and energy. The program is based on a long-range plan that calls for an approximately constant level of effort and operation of three accelerator centers.

FUNDING PROFILEHISTORICAL
(\$ TOA Millions)

<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>		<u>FY 82</u>
\$365.2	\$394.7	\$424.6	\$458.8		\$484.3

CURRENT
(\$ BA Millions)FY 81 SUBPROGRAMS:High Energy Physics

- o Physics Research
- o Facility Operations
- o High Energy Technology

Nuclear Physics

- o Medium Energy Physics
- o Heavy Ion Physics
- o Nuclear Theory

FY 82 SUBPROGRAMS:High Energy Physics

- o Physics Research
- o Facility Operations
- o High Energy Technology

Nuclear Physics

- o Medium Energy Physics
- o Heavy Ion Physics
- o Nuclear Theory

ACCOMPLISHMENTS

- o Worldwide recognition of excellence of U.S. programs in high energy and nuclear physics.
- o U.S. high energy physicists have won two Nobel prize awards and shared in two other Nobel prize awards since 1975.
- o A unified theory describing the electromagnetic force and the weak nuclear force has been developed, which is consistent with experimental tests to date.
- o Provided a basis in the physics of elementary particles to understand the observed predominance of matter over antimatter in the universe.
- o Successfully and efficiently constructed, operated, and maintained a set of nationally available accelerators, colliding beams, detection, and analysis systems required to carry out HENP research.
- o Successfully developed advanced technologies for particle acceleration, transport, and detection--most notable example is developments in areas of superconducting technology.
- o Maintained a position of world leadership in high energy and nuclear physics research.
- o Many of the Nation's best scientists are attracted to HENP work.

PROJECTED PROGRAM ACTIVITY

- o Continue the highest priority lines of scientific inquiry that, historically, have led to major breakthroughs in new knowledge, including the development of and the current applications of nuclear energy.
- o The major accelerator centers will operate at a level below that of FY 81 with attendant adjustments and terminations of selected program components.
- o Construction of new facilities at Fermilab will continue.
- o Construction of ISABELLE, a key component of the national program, is an issue with resolution dependent on technical and cost reviews as well as the FY 83 budget.

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Goals (Historical and Current):

- o Management and Support: To provide effective management of the Department of Energy headquarters and its field establishment.
- o Technical Information Services: To ensure effective management and dissemination of DOE's scientific and technical information resources.
- o Program Management and Project Support: To provide management and support for major systems acquisitions and projects, and direction of energy conversion of retrofitting and related in-house energy conservation.
- o Staff functions:
 - Congressional, Intergovernmental, and Public Affairs: To develop, manage, and coordinate departmental relations with Congress; with local and state governments, territories, and tribal units; with consumer groups; with business, industrial, and labor communities; and with the news media.
 - Inspector General: To promote economy and efficiency and to prevent or detect fraud and abuse in programs administered or financed by the Department of Energy.
 - General Counsel: To provide legal opinion, advice, and service with respect to all departmental activities, except those of the Federal Energy Regulatory Commission.
 - Policy, Planning, and Analysis: To provide for a mechanism through which a coordinated national energy policy can be formulated and implemented to deal with the short-, mid- and long-term energy problems of the Nation.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$321.6	\$377.4	\$430.8	\$456.1	\$338.02

FY 81 SUBPROGRAMS:

- o Management and Support
- o Technical Information Services
- o Program Management and Project Support
- o Staff Functions

FY 82 SUBPROGRAMS:

- o Management and Support
- o Technical Information Services
- o Program Management and Project Support
- o Staff Functions

ACCOMPLISHMENTS

- o Management & Support: assistance and support to the entire DOE organization in the areas of financial management, management resources and systems, project and facilities management and maintenance, ADP and communications management, administrative services, procurement and personnel management, and technical and loan assistance to minority businesses and educational institutions.
- o Technical Information Services: communication link and decision-making resource base for all U.S. energy research and development.
- o Program Management and Project Support: project and facilities acquisition, management, and maintenance; in-house energy management.
- o Staff Functions:
 - Congressional, Intergovernmental, & Public Affairs: Assistance and liaison activities/programs that have benefited Congress; other Federal agencies; State, tribal, and local governments; consumers; the media; and promotion of competence in the energy industry.
 - Inspector General: audits, inspections, and investigations with results reported annually to Congress.
 - General Counsel: legal support to administrative and program offices; administrative and judicial litigation; legal advice and support for enforcement activities.
 - Policy, Planning, and Analysis: central policy direction for crosscutting programs.

PROJECTED PROGRAM ACTIVITY

- o Continue all activities cited in "Accomplishments."

INTERNATIONAL AFFAIRS

Goals (Historical and Current): To establish and implement international energy policy consistent with domestic energy policy and U.S. foreign policy, improve U.S. accessibility in world energy markets, and reduce U.S. vulnerability to supply disruptions in concert with the Department of State.

FUNDING PROFILE

<u>HISTORICAL</u> (\$ TOA Millions)				<u>CURRENT</u> (\$ BA Millions)
<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>	<u>FY 81</u>	<u>FY 82</u>
\$9.6	\$9.2	\$8.7	\$6.4	\$4.9

FY 81 SUBPROGRAMS:
-----N/A-----

FY 82 SUBPROGRAMS:
-----N/A-----

ACCOMPLISHMENTS

- o Developed policies to reduce dependence on foreign oil, lessen vulnerability, and increase supplies of alternative energy sources.
- o Participated in the International Energy Agency.
- o Negotiated with foreign governments concerning pipeline gas and LNG, and reviewed gas import applications.
- o Conducted analyses of various world energy markets.
- o Helped Department of State negotiate bilateral and multilateral agreements for civil nuclear cooperation and reviewed "subsequent arrangements" thereunder.
- o Encouraged, initiated, and managed technical collaboration agreements resulting in 101 formal agreements under which over 250 projects are under way.
- o Assisted 5 foreign governments in analyzing and assessing their energy needs and resources and developing their energy planning capabilities.

PROJECTED PROGRAM ACTIVITY

- o Continue to meet essential policy formulation and legislative mandates in the international area.