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REPORT TO THE CONGRESS
Department of Energy Organization Act

Title X

SUNSET REVIEW

PROGRAM-by-PROGRAM ANALYSIS

APPENDIX: SUMMARY TABLES

U.S. Department of Energy
Office of Policy, Planning and Analysis

February 1982

DOE/PE-0040 (Vol. 3)
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APPENDIX: SUMMARY TABLES

U.S. Department of Energy
Office of Policy, Planning and Analysis
Washington DC 20585

February 1982

Preface

This Appendix contains program and funding detail for program analysis units described in the President's Summary Report and the Program-by-Program Analysis as required by Title X of the Department of Energy Organization Act of 1977 (P.L. 95-91).

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INTRODUCTION

Funding data for the fiscal years 1978 through 1981 period are shown in terms of Total Obligation Authority (TOA), which comprises unobligated balances carried forward and new budget authority, and Obligations (OBS). These data were developed from internal accounting records, reconciled with official departmental reports issued to OMB and Congress, and crosswalked into the Sunset Report structure. Because the report has been prepared on a programmatic basis, such items as payments to states, advances for cooperative work, and reimbursable work for other Federal agencies have been excluded since they are not program-specific and are not appropriated directly to the Department.

The fiscal year 1982 funding data comprise new budget authority and prior year deferrals and have been crosswalked from three sources into the program analysis unit (PAU) structure of the Sunset Report. For PAU's whose funding derives from the Interior and Related Agencies appropriation, amounts shown are based on the revised Conference Report, Report No. 97-315, subsequently enacted as Public Law 97-100. For PAU's whose funding derives from the Energy and Water Development appropriation, amounts shown are based on amounts appropriated in the Energy and Water Development appropriation, Public Law 97-88, with the following exception: For the Bonneville Power Administration, which operates on a self-financing basis, the amount shown is taken from H.R. 97-177, which accompanied the House version (H.R. 4144) of the Energy and Water Development appropriation bill.

TABLE 1-1

COAL MINING RESEARCH AND DEVELOPMENT

PROGRAM ACCOMPLISHMENTS[1/]

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$78.2	$78.9	$69.1	$43.5	
Obligation:	$67.6	$69.1	$67.3	$41.4	
Conduct field trials to assess by 1981 the increased productivity of 2 new underground mining systems--room-and-pillar (rp) and long-wall (lw)--and 6 new equipment designs. By 1981, select first generation model rp system for further development.	o Underground trial conducted on rp miner (AES) concept with manual bolters critical to total rp system. Also conducted a trial on continuous rp haulage concept (serpentix). o Trials conducted on lw shield-type roof supports at 2 sites. Design and lab tests on sensors for automated lw.	o Underground trials of two remote drilling concepts for rp system. An advanced roof drill tool bit was tested for long life. Surface tests on high-capacity lw conveyor conducted in England.	o Underground trials conducted on a totally automated rp roof bolting device. o Trial conducted with a high-capacity lw conveyor. Sensors for automated lw tested underground.	o Underground trial conducted on rp miner (Joy) concept with automated bolters. A trial was conducted on compact version of the automatic bolters. Trial was conducted on a critical lw horizon control system (NASA) at the core of an automated system.	o New concepts tested, strengths and weaknesses assessed. Funding cutbacks set back second and third equipment model refinement of key rp components and delayed field trials of high-performance, high-production lw.
Conduct long-term field trials with industry to assess potential of adapting 3 foreign underground coal technologies to domestic coal mines.	o Began mine development for thin-seam lw field trial in Kentucky. Finalized plans for steeply pitching lw field trial in Colorado.	o Finalized plans for two-pass lw mining of thick seam in Colorado.	o Began thin seam lw mining, but seam conditions turned poor, necessitating field trial delay. Began mine development for steeply pitching seam lw trial.	o Resumed thin seam lw trial. Began steeply pitching seam lw trial. Began mine development for two-pass thick seam trial.	o Two of three trials suffered unexpected delays in foreign equipment purchasing, but all trials now proceeding.
Conduct field trials to assess the increased productivity of 4 new surface mining systems and 3 new equipment designs by 1981.	o Conducted successful field trials of specialized reclamation equipment.	o Two field trials completed: (a) computer control system for dragline operations; and (b) continuous wheel excavator for overburden removal.	o Initiated field trial of cross-ridge mountaintop removal system.	o Conducted field tests of low wall conveyor mining system for contour mining, and completed innovative reclamation equipment test (winch dozer).	o Completed field trials of 3 new mining systems and 3 innovative mining machines.

[1/]Budget data include funding for coal preparation activities transferred to Advanced Environmental Control Technology (AECT) program. Accomplishments for coal preparation activities are listed in AECT section.

TABLE 1-2

COAL MINING RESEARCH AND DEVELOPMENT

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $14.2

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Develop a technology data base to support improvement in underground mining equipment and systems when market conditions permit.	o Rely on private sector to develop technology base with Federal contract assistance (previous program). o Rely on foreign development and import new technology.	o Conduct in-house research on untested elements of new mining systems and mining machines.	o Industry is not currently investigating long-range, high-risk technology for recovering coal economically from very thick, very thin, or steeply pitching seams.
Transfer technical information to potential users through annual workshops and technical papers.	o None.	o Transfer technical information to industry as developed. This is a continuous process.	o To build a technical information base for use by industry as its needs for advanced mining concepts evolve.

TABLE 2-1

COAL LIQUEFACTION

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$199.8	$223.1	$332.7	$363.7	
Obligation:	$109.8	$139.3	$246.7	$279.3	
Construct and operate by the late 1980's four precommercial direct liquefaction plants on specified design coals.	EDS o Continued design, started construction.	EDS o Continued construction.	EDS o Construction complete; shakedown operations.	EDS o Started and completed first coal test (Eastern bituminous); started second coal test (Western subbituminous).	EDS o Design and Construction--100%. Operation--50%-based on planned operations completed.
	H-Coal o Construction in progress.	H-Coal o Pilot plant construction 90% complete.	H-Coal o Completed pilot plant construction. o Completed break-in on coal.	H-Coal o Completed testing on first coal (Eastern bituminous).	H-Coal o Design and Construction--100%. Operation--30%-based on planned operations completed.
	SRC-I o Initiated preliminary design (Phase 0).	SRC-I o Completed preliminary design and documented supporting information. Performed bridging tasks to supplement preliminary design as the basis for proceeding into the detailed design of the demonstration project.	SRC-I o Negotiated and executed cost-sharing contract with industrial partner, International Coal Refining Company. Initiated Phase I detailed design. Completed Draft Environmental Impact Statement (DEIS).	SRC-I o Established and approved process design configurations. Continued final EIS. Responded to Congressional and Administration directions relative to program expenditures and associated slowdown in design and related activities.	SRC-I o Original costs and schedules for demonstration plant have not materialized. Project process design improvements and associated changes have significantly increased estimated costs at completion.
	SRC-II o Initiated preliminary design (Phase 0) for a 6,700 ton per stream day plant.	SRC-II o Completed preliminary design and performed supplementary bridging efforts that served as the basis for proceeding to detail/final design (Phase I) of the demonstration plant.	SRC-II o Negotiated and signed agreements with governments of Japan and Germany. Negotiated and signed cost-sharing contract with industrial participant. Initiated Phase I design. Completed DEIS.	SRC-II o Completed final EIS and 15% of design before program terminated in July 1981. Redirected efforts toward acquisition of data base, accomplishment of termination activities, and close-out of early site activities.	SRC-II o Satisfactory progress toward original objective was made until project termination.

TABLE 2-1

COAL LIQUEFACTION

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
Transfer technology to industry as it is developed, through industrial participation, cost-sharing, workshops, and reports.	EDS o 6 cofunding sponsors; 20 tech reports.	EDS o 6 cofunding sponsors; 20 tech reports.	EDS o 6 cofunding sponsors; 20 tech reports.	EDS o 7 cofunding sponsors; 20 tech reports.	EDS and H-Coal o Progress toward original objective essentially on schedule through construction phase. Curtailment of government funding during operation phase resulted in realignment of objectives consistent with funding availability.
	H-Coal o 6 cost-sharing participants. o 12 tech exchange meetings. o 5 technical workshops. o 12 technical status reports.	H-Coal o 6 cost-sharing participants. o 12 tech exchange meetings. o 5 technical workshops. o 12 technical status reports.	H-Coal: o 7 cost-sharing participants. o 12 tech exchange meetings. o 5 technical workshops. o 12 technical status reports.	H-Coal o 7 cost-sharing participants. o 12 tech exchange meetings. o 5 technical workshops. o 12 technical status reports.	
		SRC-I o Published Phase O deliverables.	SRC-I o Cost-sharing contract with industrial partner provides for data from workshops and pilot plant data in support of liquefaction demonstration plant designs to be available to industrial participants. Industrial partner personnel have been released to publish technical papers and to participate in various Fossil Energy sponsored symposia and workshops in which industry participation is encouraged.	SRC-I o Industrial participants continued to take part in workshops sponsored by Fossil Energy management. Industrial partner published five technical status reports (4 quarterly, 1 yearly) containing non-proprietary data.	SRC-I o Phase O deliverables placed in Public Reading Room July 1979. Environmental Impact Statement made available to public. Non-proprietary data made available through industrial partner participation in workshops and technical journal publications.

TABLE 2-1

COAL LIQUEFACTION

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
	SRC-II o Four periodic and three topical reports published.	SRC-II o Four periodic and seven topical reports published. Twenty-volume Phase 0 deliverables published.	SRC-II o Four periodic and five topical reports published. Industrial partner participated in FE-sponsored workshops and symposia.	SRC-II o Four periodic and five topical reports published. Industrial partner continued participation in workshops and symposia.	SRC-II o Phase 0 deliverables placed in Public Reading Room in 1979. EIS made available to public. Non-proprietary data made available through industrial partner participation in workshops, symposia, and technical journal publications.
Identify and accelerate the development of improved liquefaction processes capable of operating on coals representative of major U.S. resources.		o Exploratory research identified high potential of staged liquefaction.	o Two-stage liquefaction process development project initiated.	o Demonstrated low hydrogen consumption and yield of more than 3 bbls. liquid per ton, using two-stage liquefaction process.	o Completed R&D program to establish process design basis for SRC demonstration plants.
	o Bench testing of Process Development Units (PDU's) established design basis for SRC-I and SRC-II demo plants.	o PDU testing established operating conditions for H-Coal pilot plant.	o PDU testing established transient mode operating behavior of H-Coal process.	o Demonstrated improved catalyst for H-Coal process.	o Completed R&D program to establish operating modes for H-Coal pilot plant.
		o Exploratory research identified high potential for use of disposable catalysts.	o Disposable catalyst process development program initiated.	o Disposable catalyst increased liquid yield from subbituminous coal by over 25%.	o Identified promising approaches to improved liquefaction processes. Initiated three process development programs.
			o Research requirements to improve indirect liquefaction technology identified.	o Indirect liquefaction R&D program initiated.	

TABLE 2-1

COAL LIQUEFACTION

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Develop a data base concerning the environmental and health impacts of coal liquefaction technology.	EDS o (Integrated environmental and health activites included in all design, construction, and operational activities).			EDS o Initiated Phase I of toxicology program.	EDS o 60% of original objectives met based on percent completion of pilot plant program schedule.
	H-Coal o (Integrated environmental and health compliance activities included in all design, construction, and operational activities).		H-Coal o Initiated environmental and health R&D program to study environmental and health effects of H-Coal liquids.	H-Coal o Samples taken from pilot plant to be used in studying health effects of coal-derived materials. Other environmental studies under way.	H-Coal o Coal-derived materials required for program generated at the pilot plant, and necessary samples taken. Environmental studies and health studies initiated and ongoing.
				SRC-I o Issued Environmental Impact Statement to reflect environmental obligations and mitigation measures.	SRC-I o FEIS issued July 17, 1981; SRC-I specific health effects and compliance testing initiated.
		SRC-II o Initiated environmental monitoring at proposed site.	SRC-II o Completed DEIS. o Completed Project Environmental Plan and initiated health studies of coal liquefaction products.	SRC-II o Completed EIS. o Completed environmental baseline monitoring at proposed site. Continued biological and chemical evaluation of SRC-II products. Held program review of health research program.	SRC-II o FEIS issued Jan. 1981; baseline environmental survey at site completed; approx. 70% of the health impacts tests of SRC-II products completed.

TABLE 2-1

COAL LIQUEFACTION

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
	Generic o Coal liquids identified as biologically active.	Generic o Identified specific subtractions of coal liquids responsible for biological activity.	Generic o Hydrotreating of coal liquids shown to reduce potential adverse health effects.	Generic o Initiated program to identify and evaluate feasible mitigation strategies.	Generic o Identified biological activity of coal liquids as a major environmental issue. o Initiated coordinated program to qualify health effects and develop mitigation strategies.

TABLE 2-2

COAL LIQUEFACTION

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $228.4[1/]

Goals/Objectives	Alternative Methods[2/]	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Phase out of activities for pilot plants and demonstration plants consistent with congressional action and Administration guidance.	o None.	o Transfer responsibility for development of near-term technology to the private sector.	o Complete program transition consistent with the Administration's Economic Recovery Plan. o Conduct orderly phaseout of Government involvement in major pilot plant operations.
Develop and evaluate promising long-range, high-risk liquefaction concepts that will produce greater yields of higher quality liquid fuels from coals representative of major U.S. resource.	o Rely on private sector to develop technology, although industry is typically not doing much work in this area. o Rely on foreign technology development, which could cause substantial delay.	o Perform experimental testing of improved concepts to establish yields and quality of products as a function of process parameters. o Conduct engineering and conceptual studies to provide reliable evaluations of process efficiencies and forecasted economics.	o Provide yield and quality of liquid products and forecasted effects on conversion efficiency. o Determine impacts of improved technology based on results of experimental testing to determine most promising process concepts. o Demonstrate applicability of improved concepts to coals representative of U.S. resources to expand useable resource and geographic diversity.
Develop a data base concerning the environmental and health impacts of coal liquefaction processes, including mitigation strategies.	o Rely on private sector to develop data base, although this would likely lead to fragmented results.	o Conduct studies and tests to identify and evaluate environmental and health effects. o Perform evaluations to establish efficiency of mitigation strategies in reducing potential environmental and health effects.	o Establish data base on potential health and environmental effects of production, distribution, and use of coal liquids. o Develop mitigation strategies to reduce or eliminate potential adverse environmental or health effects.
Transfer technical information developed by program to industry.	o None.	o Promote cost-sharing in industrial contracts to ensure active industry commitment and participation. o Ensure prompt and accurate technical reports. o Promote seminars, workshops, and program reviews to facilitate rapid transfers of information.	o Conduct seminars, workshops, program reviews. o Publish technical reports.

1/ Includes approximately $130 million in funds carried over from FY 1981.

2/ The current program has been sufficiently focused so that there are no efficient alternative methods.

TABLE 3-1

SURFACE COAL GASIFICATION

PROGRAM ACCOMPLISHMENTS

	Budget Data ($ Millions) Status				
Goals/Objectives	FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$194.8	$181.7	$221.4	$149.7	
Obligation:	$115.0	$ 71.8	$141.9	$131.7	
Construct and operate by 1985 4 gasification demo plants; accomplish this objective in a manner that ensures maximum transfer of data to participants and industrial sector.	o Pilot plant work completed and conceptual design work under way on 2 high-Btu gasifier demo plants: Slagging Lurgi and COGAS. o Conceptual design work in progress on two industrial fuel/syn gas demo plant projects.	o Conceptual commercial design completed on 2 high-Btu gasification concepts. o Detailed designs started for 2 high-Btu demo plant. o Conceptual design work on industrial fuel (U-Gas) demo plant completed; environmental impact statement started. o Work scope on 2nd industrial fuel gas demo plant changed to synthesis gas for methanol production (Grace).	o Detailed design for 2 high-Btu demo plants continued. o Environmental impact statements begun for 2 high-Btu demos. o Final design of U-Gas (Memphis project) initiated; work on EIS continued. o Preliminary design for methanol to gasoline demo plant initiated. Site evaluation continued. o Process verification runs on PDU completed for industrial fuel gas utility demo project. Conceptual design study initiated.	o As result of program reorientation mission, phaseout initiated for slagging Lurgi and COGAS high-Btu demo plants. o Memphis and Grace projects directed to achieve logical conclusion within available funds. o In light of modified DOE mission, effort on industrial fuel gas utility demo plant terminated.	o 75-80% of preconstruction work completed on high-Btu demo plants--enough to establish technical and economic feasibility of projects. Resource materials and design data made available to industry. o Major part of preconstruction work completed in medium-Btu industrial demo plant effort. Design data and resource material available. o Conceptual design completed; project feasibility established for 2nd medium-Btu industrial demo plant. Data available to industry. o Objective achieved in stimulating industrial participation through loan guarantee mechanism.
Concurrently, develop 5 promising 2nd-generation high-Btu gasification processes to ensure that a viable alternative exists that can utilize all U.S. coals and produce substitute natural gas (SNG) at higher efficiencies and lower cost than can be achieved in existing 1st generation processes.	o Of 5 concepts selected in prior years, 1 (CO_2 Acceptor) successfully developed through pilot plant stage. - Data show cost of gas produced significantly less than by state-of-the-art processes.	o 2nd concept (HYGAS) developed. - Demonstrated capability of using all coals as feedstocks. - Produced high-Btu gas at lower cost than 1st generation processes.	o Development work on BiGas process contin. - Integrated operation of all stages of this slagging gasifier established for long periods. - Feasibility of 2-stage gasifier demonstrated.	o Development work on BiGas process contin. - Supplementary fuel source backed out of gasifier, fully establishing feasibility of BiGas concept.	o Original objective achieved, as two 2nd-generation gasifiers developed successfully and ready for commercialization, with a 3rd concept reaching final stages of development.

TABLE 3-1

SURFACE COAL GASIFICATION

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
	- Materials of construction selected that could improve operational life of gasification facilities. o Efforts on Synthane and Agglomerating Burner concepts ended because of technical problems and economics. o Efforts on HYGAS and BiGas concepts continued.	- Oil/coal slurry feed system established as method for feeding coal into high-pressure reaction vessels. o Work continuing on development of BiGas process. - New char burner designed and installed as advanced system. - Cold Wall concept for protection of slag-tap demonstrated successfully.	- Water/coal slurry feed system established as method for feeding coal into pressure vessels. - Fines recycle loop established as operational.	- Advanced interlock control system developed that significantly increases capability for control and operational safety of entrained bed systems. - Char burner and control feeder systems improved and demonstrated as reliable over long periods of operability. o Other components of gasification facility under development.	
Construct and operate by 1983 3 low/medium-Btu process development projects.	o Operational testing started at PDU-level on 3 processes: two agglomerating fluidized bed and 1 entrained bed gasifier system. - Operational feasibility of concepts established. - Several types of coal processed successfully. - All shakedown activities completed and test program initiated.	o Operational results continued to show promise from 3 concepts under development. - Higher operational reliability obtained by demonstrating feasibility of operating a 1-vessel system in agglomerating gasification process. - Most coals can be considered as suitable feedstocks for these gasifiers.	o 1 agglomerating bed concept, the U-Gas gasifier, selected for demo. Process Development Unit work continued on 2 other concepts. - Operational data show agglomerating gasifiers capable of using all U.S. coals as feedstock. - Projected economics indicate that gasifiers produce fuel gas at cost competitive with other sources. - Agglomerating bed systems operated over long periods. Associated problems (deposit formation, fines recycle) solved.	o 2nd agglomerating bed concept (Westinghouse) gasifier selected for commercialization by industry. PDU efforts continued on entrained bed concept. - High operating efficiencies established. - Increased operational reliability demonstrated. - Scale-up criteria confirmed by correlating reactor performance with model prediction.	o Objectives achieved. 2 advanced medium-Btu gasifiers developed to point that technology could be transferred to industry, and industry has selected those concepts for commercialization.

TABLE 3-1

SURFACE COAL GASIFICATION

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
Construct and operate by 1980 4 Gasifiers-In-Industry projects.	o 7 candidate projects selected as part of a Gasifiers-In-Industry program. Operation started on 1 project. - Fixed-bed gasifier being used to generate fuel gas from coal at competitive price. - Operational data indicate improvements that can increase operational reliability.	o 3 candidate projects ended. o 2 projects in operation. - 2nd gasifier on-stream producing fuel gas. - Operational reliability demonstrated. o 1 gasifier being constructed.	o 1 project successfully completed. - Process efficiency and cost of gas from small fixed-bed gasifier established. - Operability of gasifier with reduced level of emissions demonstrated. o 2 projects in final design. o Operation of gasifier in 1 project started.	o 1 project successfully completed. - Suitability of small fixed-bed gasifiers as source of energy for some industrial applications established. o 1 gasifier in start-up phase. o 1 project ended.	o While 2 gasification projects using available 1st generation gasifiers were successfully completed and a 3rd is successfully entering operational stage, some question exists about degree of success achieved in meeting objective. Original incentives to industry have changed, with little evidence to show that industry would proceed on its own.
Identify and accelerate the development of at least 4 promising 3rd generation gasifiers/gasification processes.	o Concepts selected for study and development including Hydrogasification, Catalytic Coal Gasification, and High Mass Flux PDU. - Experimental programs started. - Projected economic and technical data show justification for doing devel. work.	o Studies being performed at PDU-level on 3 concepts. - Feasibility of concepts established. - Evaluations of operational data show processes have potential to achieve economic and technical (reliability) goals.	o Studies continued on 2 concepts; one PDU effort ended. - Increased efficiencies and projected favorable economics established for CAT-GAS. - Capability of 3rd generation gasifiers to use all coals as feedstocks established.	o Catalytic Coal Gasification concept developed and transferred to industry for commercialization; 2nd PDU effort in hydrogasification continued. - Evaluations of operational data show CAT-GAS capable of producing SNG from coal at cost considerably less than state-of-the-art systems.	o Objective achieved as one 3rd generation concept developed and selected for commercialization by industry; pilot plant effort started.

TABLE 3-1

SURFACE COAL GASIFICATION

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
Develop and update, as required, a data base concerning environmental impact of coal gasification technology. Develop improved environmental control systems, process improvements, and effluent control equipment with potential to minimize environmental impacts of gasification processes.	o Extensive environmental characterization programs under way at pilot plants; in process as well as effluent streams sampled and analyzed. o Environmental characterization report completed for 1 high-Btu gasification facility.	o Worker safety and health studies initiated at high-Btu coal gasification pilot plant. o Environmental and health programs written and implemented at several medium-Btu industrial gasification facilities. o Work on environmental impact statement for high-Btu demo plants started. o EIS for medium-Btu industrial demo plant started.	o Coordinated health and worker environmental studies initiated at DOE gasification test centers. o Environmental impact statements for high-Btu demo plants completed. o EIS for medium-Btu industrial demo plant completed.	o Studies initiated on relationships between operational parameters and effluent stream composition. o Extensive wastewater studies initiated at DOE Energy Centers. o Environmental characterization report completed for 2nd high-Btu gasification process. o Environmental characterization studies continued at operational pilot plants and PDU's.	o Initial effluent characterization efforts on pilot plant and PDU facilities completed. o Procedures being prepared to correlate characterization data, with process parameters.

TABLE 3-2

SURFACE COAL GASIFICATION

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $53.1

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Phase out activities for six existing pilot plant and demonstration plant projects by end of FY 82.	o Abandon facilities in-place. Ignore acquisition of valuable data generated to date.	o Prepare and circulate lists of available Government property. o Perform evaluations of alternative ways to dispose of facilities. o Submit recommendations for disposal of facilities. o Disassemble equipment and prepare and ship to eligible recipients. o Complete design work to logical point of phaseout. Accumulate and prepare all data for storage and retrieval.	o Orderly disposal of existing facilities is required to minimize safety problems and to maximize any potential benefit to the Government. o Implementation of a phaseout plan is essential to ensure all contractual commitments are satisfied and that all experimental data reports, records, drawings, etc., are stored and appropriate safeguards are installed. o Phaseout activities are required to reduce employee relocation problems and to permit contractors to make equitable adjustments to work force and reduce impact on community. o Careful attention must be given to the collection and compilation of the design data base generated to date to ensure any subsequent use by industry.
Identify and develop promising long-range, high-risk gasification concepts through proof-of-concept scale for medium-Btu gas production capable of achieving efficiencies at least 5% higher than current technology and process economics at least 15% better.	o Rely on private sector to respond to pressures for alternate supplies of fuel gas or synthesis gas as driving force to initiate similar development efforts. o Wait for European technology development efforts to produce proprietary processes for subsequent use by industry in the United States.	o Perform investigation of new, potentially attractive (economic and technical) processes at stage when associated risk is high. o Provide proof-of-concept for promising concept and develop estimates of associated economics for evaluation by industry. o Develop reliable data base and scaling criteria suitable for subsequent demonstration and commercialization efforts.	o Energy supply alternatives are required for most industrial consumers of energy products. o Selection of coal gasification by industry as way to generate alternate energy products from coal will depend on its being economically competitive. o Full use of the flexibility of coal gasification (a process to convert coal to fuel gas, liquid fuels, and chemicals) requires new approaches to some phase of process.

TABLE 3-2

SURFACE COAL GASIFICATION

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
		o Develop viable alternatives that can be used to reduce cost of alternate energy supplies.	o Increased operational reliability, conversion efficiencies and resulting decreases in product cost depend on identifying and developing solutiona to existing process problems. o Continued use of coal gasification will depend on advancing the state-of-the-art of the technology as required to meet economic and environmental requirements.
Develop key instrumentation component and materials concepts required to improve operational efficiency and reliability (of at least 90%) of second-generation gasification processes.	o Wait until need is great enough to stimulate private industry to develop the required components, materials, and instrumentation. o Attempt to modify and adapt state-of-the-art equipment for use in these processes.	o Develop candidate sensors capable of monitoring some process parameters as required for instrumentation development. o Develop test data on samples of materials actually exposed to representative gasification environments.	o Newly designed operating equipment is required to increase operational reliability (reduce downtime) of coal gasification systems, thus reducing the cost of product. o Improved instrumentation must be developed to permit optimization of operating conditions, provide improved control, and permit use of these systems in more complex end-use applications.
Overdesign and use an excessively large number of redundant systems composed of unreliable components.	o Accept comparatively low operational efficiencies and excess facility downtime associated with the use of existing equipment and instruments.	o Generate scale-up data on concepts applicable to the continued development of key operating equipment. o Design instrumentation loop with potential of providing sophisticated operational control and safety of medium pressure systems. o Develop technology data base needed for material selection, projection or operating environments, and scale-up of equipment.	o Operational safety of high-capacity systems requires quick response instrumentation systems with suitable interlocks. o Suitable materials are required in the construction of gasifiers and vessels capable of performing over long periods of time under harsh environments of gasification processes and as required to produce acceptable onstream periods.
Prepare a comprehensive data base and models suitable for use by industry for correcting scale-up and designing key gasifiers and gasification process unit operations.	o Rely on private sector to complete these scale-up criteria.	o Establish a technology data base management system. o Test analytical models of coal gasification systems to generate or confirm scale-up criteria.	o Adequate scale-up criteria will be required for design optimization and reduction of construction costs.

TABLE 3-2

SURFACE COAL GASIFICATION

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
	o Collect and correlate existing data on gasifier systems, and attempt to extrapolate these data to other end-use applications.	o Develop techniques to evaluate and compare data needed in designing component parts of coal gasification processes.	o Validated process models and comprehensive data base must be developed to permit comparison of options and produce sensitivity assessments of parameters that affect product cost and operational efficiency.
		o Expand existing design data support capabilities.	
		o Generate key experimental data needed to complete technology baselines and confirm design correlations.	o A comprehensive data base is needed for establishing a technology baseline that will define problem areas and show where additional data are required.
			o The commercialization of a coal gasification industry will depend upon the availability of data that permit assessment of comparative risks.
Develop suitable effluent treatment systems and process controls that offer the potential to minimize environmental impact of gasification processes.	o Wait until size of industry or tightening of environmental standards provides adequate incentives for industry to assume development costs.	o Develop scale-up data for new, promising effluent control systems.	o Size of commercial facilities will require integrated sophisticated environmental control technology to minimize environmental impact of those facilities.
	o Utilize existing state-of-the-art equipment through overdesign or system redundance.	o Generate data base required in characterization of gasification process in-streams, as well as possible effluents.	o Operation in compliance with projected environmental standards will require the development of new control systems.
	o Accept performance of currently available control technology.	o Perform and complete comparative evaluations of possible alternatives for effluent control.	o More effective and efficient treatment systems, as well as effluent control equipment, must be developed to minimize operational costs associated with achieving environmental compliance goals.
		o Develop procedures for minimizing any environmental impact associated with a coal gasification system.	
		o Produce effluent characterization data needed to establish suitability of selected technologies to achieve compliance.	o Many assumptions currently associated with environmental control (e.g., zero effluent) need examination based upon operational test data.

TABLE 4-1

IN SITU (UNDERGROUND) COAL GASIFICATION

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$13.0	$15.2	$10.3	$10.1	
Obligation:	$12.8	$14.9	$10.2	$9.4	
Conduct 7 small-scale field tests at 5 locations by 1984, to assess the potential of in-situ gas production under different geologic conditions.	o Three field tests initiated; one terminated because of geologic anomalies. Defined site characterization needs.	o Three field tests completed: a) first U.S. SDB test: high-efficiency, good gas quality; b) successfully gasified 900-foot deep, high-swelling bituminous coal; c) first-ever 57-day oxygen injection: stable, good gas quality; 2 seams gasified, substance noted.	o Postburn evaluation of 2 past tests completed. Cavity defined, void zones delineated, and char volumes determined.	o Postburn evaluation of 4 more tests completed. Added greatly to data base knowledge of burn zone shape, recovery efficiency. Second SDB test initiated.	o Process tested under various geologic settings; site characterization needs defined; issues requiring resolutions prior to large-scale application defined.
Complete a series of reports by 1984 describing potential environmental impacts of in-situ gasification on surface subsidence, hydrology, and air quality.	o Data and research results published in 9 technical reports.	o Data and research results published in 10 technical reports; Environmental Development Plan published.	o Data and research results published in 11 technical reports.	o Data and research results published in 11 technical reports.	o Composition of produced gas defined; leaching and sorption of organic contaminants defined; large data base developed.
Transfer technical information developed by program to potential users through the preparation of professional papers, sponsorship of symposia, presentation of short courses, and the preparation of data tapes summarizing results of field tests.	o Two oil companies and one foreign country sent full-time employees to work at DOE field site for training. 45 technical papers published. One national symposium and one university short course conducted.	o Consortium of 10 industries hired engineer to work full-time with DOE on field test. DOE developed instrumentation (HFEM) used by ARCo on private test. Texas test mirrored DOE field tests. One symposium, 1 short course, 48 papers published.	o ARCo sent 10 men for more than 2 weeks to study full time with DOE scientists. Complex software control and data acquisition paper copied for industry use. Over $60K of program funds spent on 1-to-1 instruction of various industrial groups. One symposium, 1 short course, 48 technical papers published.	o Data tapes for 13 past field tests prepared for use by industry. Subsidence instrumentation and techniques used by ARCo on private test. Also by Gulf on Rawlins 2. State of Texas requested advice and assistance in setting up own program. One symposium, 1 short course, 54 papers published.	o Industry using government data for private design economic studies. Widespread requests for data; high participation in symposia.

TABLE 4-2

IN SITU (UNDERGROUND) COAL GASIFICATION

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $8.3

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Complete, by 1983, the third of three small-scale field tests to assess in situ gas production from a steeply dipping coalbed.	o Rely on private sector to develop technology.	o Study specific application of UCG to steeply dipping coals. o Compare air gasification with steam/oxygen injection under similar conditions. o Study optimum steam/oxygen ratios for injection gases. o Study use of produced gas as boiler fuel. o Compare operation of slant and vertically drilled injection wells.	o Verification of process parameters and resource recovery predicted by bench-scale tests and determination of optimal operating techniques.
Prepare reports by describing potential environmental impacts of in situ gasification on surface subsidence, hydrology, and air quality.	o None.	o Verify reduction in clean water usage. o Verify organic pollutants adsorbed by boundary coal. o Verify cost sensitivities of pollutant abatement strategies.	o Identification of potential environmental impacts of in situ gasification to support design of control or mitigation strategies.
Transfer technical information developed by program to potential users through the preparation of professional papers, sponsorship of symposia, presentation of short courses, and the preparation of data tapes summarizing results of field tests.	o None.	o Ensure responsiveness to industry needs. o Industry project design needs input data.	o Facilitate technology transfer to the public and potential developers of in situ gasification process.
Monitor postburn environmental impacts for 5 years following field test.	o None.	o Determine delayed environmental effects of process.	o Meet legal commitments.

TABLE 5-1

FUEL CELLS

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status: FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$35.7	$41.5	$26.5	$32.4	
Obligation:	$35.7	$41.5	$26.1	$32.4	
Complete solid oxide cell and stack technology development for Multi-MW electric utility and industrial applications of coal, unconventional and conventional hydrocarbon-fueled systems having power density of 230 to 250 watts/sq. ft. and stack electrical efficiency of 55% to 65%, with life greater than 60,000 hrs., operating at 1,800° F, with the reject heat suitable for gas or steam turbine bottoming or cogenerating applications by 1990 to 1992.	o Exploratory development of basic cell configuration.	o Manufacturing methods for producing cell for feasibility testing identified.	o Suitable materials identified and feasibility of manufacturing techniques proven.	o Improved design concept alleviating previous major technical problem developed.	o Schedule stretched due to funding constraints. Progress toward meeting objectives on revised schedules has been encouraging.
Increase, by end of FY 1985, thermionic converter efficiency from 12 to 30 percent by increasing power density from 5 W/cm^2 to 20 W/cm^2 and temperature from 2,655° F to 2,870° F, with 40,000 hours lifetime for silicon carbide protected converters.	o Exploratory development of thermionic converter for direct conversion of heat to electricity.	o Potential technical & economic feasibility of using current thermionic technology to augment power output of combined cycle gasification powerplant established.	o 5,000 hrs. of direct, continuous generation of electricity from heat at 1,630K (2,455° F) with flame-heated thermionic diode.	o 10,000 hrs. of direct, continuous generation of electricity from heat at 1,750K (2,655° F) with flame-heated thermionic diode.	o All technical objectives successfully completed on schedule, except for FY 81, where 10,000-hour lifetest achieved 2 years <u>ahead</u> of schedule.

TABLE 5-1

FUEL CELLS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Field test in 1981-1982 preprototype multi-MW (4.8 MW in Manhattan Island, New York) Phosphoric Acid powerplant to define operational requirements, and in turn identify technology development specifications for key components and subsystems. (Cost shared with EPRI, UTC, Con-Ed, and NIMO; DOE share 30%.)	o Contract with utility for siting and demonstration. (Manufacture of powerplant started 1977.)	o Continue powerplant manufacture.		o Installation of powerplant complete.	o Completion of siting assembly and initial operation delayed 3 years to 1981-1982 due to technical problems (e.g., heat exchanger failures).
Field test by 1985 45 to 48 40 kW preprototype On-Site/Integrated Energy Systems. (Cost shared by GRI, UTC, and 20 utilities and users; DOE share 30%.)					o One-year delay in initiation of manufacturing contract due to delays in signing agreement with cofunding partner (GRI).
Complete development of molten carbonate cell and stack technology for large central station (500 MW or more) and small (10 MW) industrial cogeneration coal, unconventional and conventional hydrocarbon-fueled systems, having a power density of 140 to 160 watts/sq. ft., stack conversion efficiency of 50 to 65%, operating at 150 psi, and stacklife of 40,000 to 60,000 hrs., stack operating temperature of 1,200° F, suitable for supplying high-quality reject heat for bottoming and cogenerating applications.	o MCFC cell feasibility proven and economic viability established. Decision made to enter technology development stage.	o Contractors for technology development stage selected and contracts let.	o Technology development of subscale components (e.g., 1 ft.^{2} low-cost cell) and endurance testing of bench-scale cells.	o Component tested in stack of 10 cells 1 ft.^{2} for 3,000 hrs. Preferred powerplant design selected.	o Schedule stretched due to funding constraints. Progress toward meeting objectives of revised schedule excellent.

TABLE 5-1

FUEL CELLS

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
Complete pressurized cell and stack technology development for Multi-MW Phosphoric Acid coal systems having a power density of 160 to 280 watts/sq. ft., operating at 100 to 120 psi, and 300 to 400° F, and stack electrical conversion efficiency of 50 to 60%, and life of 40,000 hours or greater, by 1983 (UTC) to 1984 (Westinghouse).	o Component and system definition. Started manufacture of preprototype system.	o Technology development of subscale components (e.g., 2 inch x 2 inch cells).	o Technology development of 20-cell stacks (e.g., 3.7 ft^2 cell, 250 watts/ft^2, 120 psia, 400° F).	o Initial verification of high pressure and temperature in 20-cell stacks.	o All technical objectives completed successfully on schedule. Manufacture of preprototype powerplant delayed approx. three years as a result of technical problems (see 4.8 MW objective).
Complete phosphoric acid cell and stack technology development for multi-kilowatt On-Site/Integrated Energy (co-generation) Systems (natural gas and methanol-fueled, having a power density of 100 to 130 watts/sq. ft.), electrical conversion efficiency of 43 to 46%, and life of 40,000 hrs. or greater by 1984 (UTC) to 1985 (Westinghouse and Engelhard).	o Component and system definition. Started manufacture of pre-prototype system.	o Technology development of subscale components (e.g., 2 inch x 2 inch cells 100-130 watts/sq. ft., 43% efficiency).	o Technology development of subscale components for endurance and performance improvement. (24-cell stack life to 20,000 hours.)	o Verification of subsystem and system performance durability.	o All cell-stack technical objectives successfully completed on schedule. Other, non-cell-stack components/subsystems failures (e.g., pumps) have delayed system verification.

TABLE 5-2

FUEL CELLS

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $34.5

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Continue pressurized cell and stack technology development for Multi-MW Phosphoric Acid coal systems having a power density of 160 to 280 watts/ sq. ft., operating at 100 to 120 psi, and 300° to 400° F, and stack electrical conversion efficiency of 50 to 60%, and life of 40,000 hours or greater by 1983 (UTC), phasing out the Westinghouse project in FY 1983.	o None.	o Commitment by DOE (through FY 83), EPRI, and TVA[1/] to completing their share of the national program, which provides essential, key subsystem technology for prototype acid fuel cell powerplant.	o Complete by 1983 subscale cell and stack. Funding beyond FY 1983 to be provided by private sector. electric utility phosphoric
Phase out in FY 83 phosphoric acid cell and stack technology development for multi-kilowatt On-Site/ Integrated Energy (cogeneration) Systems (natural gas and methanol fueled) having a power density of 100 to 130 watts/sq. ft. and an electrical conversion efficiency of 43 to 46% and life of 40,000 hrs. or greater.	o None.	o Continued commitment by DOE (through FY 83), GRI, the manufacturers, and the users to this cost-shared part of the National Fuel Cell program which provides essential, key technology subsystem for prototype kW-size On-Site/ Integrated Energy Systems phosphoric acid fuel cell powerplant.	o Complete by 1983 subscale cell and stack. Funding beyond FY 1983 to be provided by private sector.
Continue field test in 1982-83 of preprototype multi-MW (4.8 MW in Manhattan Island, New York) Phosphoric Acid powerplant to define operational requirements and in turn identify technology development specifications for key components and subsystems. (Cost shared with EPRI, UTC, Con-Ed, and NIMO; DOE share 30%.)	o Rely on EPRI, the manufacturer, and electric utilities to increase their present funding for completion of test program, replacing the DOE cost share. ($10 million.)	o Continued commitment by the participants to the field test which provides essential verification of siting and utility operation of preprototype electric utility fuel cell powerplant.	o Complete testing in 1983 of preprototype powerplant on utility site (grid connected system).
Field test by 1985 45 to 48 40-kW preprototype On-Site/Integrated Energy Systems. (Cost shared by GRI, UTC, and 20 Utilities and Users, DOE share 30%.)	o Industry/GRI assumption of DOE share of funding. ($1.2M FY 82-FY 84.)	o Continued commitment by GRI to the DOE/GRI agreement and continued user commitment to verifying operational capability of this configuration and to identify technology development specifications for key components and subsystems.	o Completion of field test will provide in-service operational experience necessary to complete technology development and ultimate prototype system application.

[1/] At present TVA is in the process of withdrawing from the national program for lack of funding, causing serious impacts on program integrity.

TABLE 5-2

FUEL CELLS

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Continue development of molten carbonate cell and stack technology for large central station (500 MW or more) and small (10 MW) industrial cogeneration coal, unconventional and conventional hydrocarbon-fueled systems, having a power density of 140 to 160 watts/sq. ft., stack conversion efficiency of 60 to 65%, operating at 150 psi, and stack life of 40,000 to 60,000 hrs., stack operating temperature of 1,200° F, suitable for supplying high-quality reject heat for bottoming and cogenerating applications.	o None.	o DOE commitment (through FY 83) to the technology base program which provides essential key technology subsystem for prototype electric utility or industrial cogeneration MCFC powerplant.	o Complete by FY 83 subscale cell development. Funding beyond FY 83 to be provided by private sector.
Continue solid oxide cell and stack technology development for Multi-MW electric utility and industrial applications of coal, unconventional and conventional hydrocarbon-fueled systems, having power density of 230 to 250 watts/sq. ft., and stack electrical efficiency of 55% to 65%, with life greater than 60,000 hrs. operating at 1,800° F, with the reject heat suitable for gas or steam turbine bottoming or cogenerating applications.	o None.	o DOE commitment (through FY 83) to the technology base program which provides essential key technology subsystem for prototype electric utility or industrial cogeneration SOFC powerplant.	o Complete by FY 83 preliminary cell and stack design. Funding beyond FY 83 to be provided by private sector.

TABLE 5-2

FUEL CELLS

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Definition of fuel cell system configuration, system cost, and performance requirements and derivation of subsystem and component performance requirements and associated cell and stack technology development needs for the following transportation applications: - Railroads (by 1982). - Marine (by 1982). - Buses and Trucks (by 1982). - Hybrid automobiles (by 1985).	o None.	o Conduct bench-scale tests to determine process efficiencies under proposed operating conditions. o Determine cost and operational parameters.	o Major thrust of the U.S. fuel cell program thus far has been toward stationary applications. Now that both power density and efficiency performance of the technology have increased significantly (and now that the economics of primary fuels have changed) a need exists to evaluate mobile applications.
Increase, by end of FY 85, thermionic converter efficiency from 12 to 20 percent by increasing power density from 5 W/cm^2 to 20 W/cm^2 and temperature from 2,655° F to 2,870° F, with 40,000 hours lifetime for silicon carbide protected converters.	o None.	o Conduct research activities (new designs, materials) to achieve proposed performance requirement.	o Industry is not currently in a position to cost share the funding of the technology development phase (through FY 84) of this long-range, high-risk, high-payoff technology. Cost sharing by industry will start in FY 85 with the initiation of the engineering development phase.

TABLE 6-1

MAGNETOHYDRODYNAMICS

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$73.8	$80.9	$81.0	$61.6	
Obligation:	$71.1	$79.9	$80.5	$61.3	
Complete MHD generator scaling combination test by 1984 (in a short-duration, clean fuel, 250-MWt facility).				o 10.5% enthalpy extraction.	o Reached 88% of objective, which is to attain 12% enthalpy extraction in order to demonstrate MHD generator scaling feasibility. Additional tests in present facility required to meet objective fully.
Demonstrate by 1985 (in a 28-MWt coal-fired MHD test facility) availability of a technology base for downstream MHD heat and seed recovery systems and environmental controls.		o Construction--50% complete.	o Construction--80% complete.	o Construction--100% complete. o Facility Activation--3/81. o 100 hours of operation. o NO_x and SO_x environmental standards 100% met. o Constructed and tested superconducting magnet at 6.2 Tesla.	o Estimated 70% completed. o Tests continuing on the heat recovery and seed recovery system.
Demonstrate by 1985 (in a coal-fired 50-MWt MHD test facility) technology base available for the MHD power train.	o Construction--54% complete.	o Construction--61% complete.	o Construction--95% complete.	o Construction--100% complete. o Facility 80% activated by 4/81. o Generated electricity 5/81, using AVCO designed MHD channel 1A (50-MWt size).	o Estimated 70% completed. o Obtained initial generator test data with simulated coal combustor. Tests of 50-MWt coal-fired combustor and operation of generator using coal combustor remain to be performed.

TABLE 6-1

MAGNETOHYDRODYNAMICS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
					o Successfully operated at AVCO Everett 20-MWt size 1A type MHD channel, simulating base load MHD plant conditions (no failure of generator electrodes) for 1,000 hours. o Operated at TRW facility 20 MWt direct coal-fired MHD combustor, meeting all requirements for an MHD generator (temperature, pressure, electrical conductivity, heat loss limitation, etc.). Design is scaled to 50-MWt size.
Increase coal-fired 50-MWt MHD facility size to 100 MWt, and by 1985: - Operate plant for at least 2,000 cumulative hours. - Meet project performance standards.			o 100% of design complete.		o Estimated 30% completed. o 60% of present facility can be used. Tests at 50 MWt provide design base for 100-MWt test program.
Construct and operate by 1992 a 500-MWt commercial prototype MHD electric powerplant (ETF).				o Conceptual design 100% complete. o MHD/steam plant economic analysis 100% complete.	o Estimated 5% completed.

TABLE 6-2

MAGNETOHYDRODYNAMICS

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $27.8

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Closeout MHD facilities and bring other ongoing efforts to an orderly conclusion.	o None.	o Decision on disposition of facilities. o Mothball or dispose of facilities.	o Facilities to be mothballed or made available to interested industry groups.
Maximize the number of key attainable milestones and document the technical requirements and accomplishments.	o None.	o Prepare documentation. o Complete reports.	o Documentation of technical requirements and accomplishments are required, for industry/government development of the technology.

TABLE 7-1

HEAT ENGINES

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$30.6	$52.5	$50.6	$32.2	
Obligation:	$28.4	$52.5	$50.2	$32.2	
Improve by 1986 high-temperature turbine technology (HTTT) by increasing turbine temperature from 2,000° F to 2,600° to 3,000° F with a projected durability of not less than 20,000 hours and a turbine efficiency in the range of 86-88%.	o Initiated work on Phase II (component development) with 2 contractors.	o Continued Phase II activity. Completed 500 hours of successful operation on air-cooled components, operating at 2,600° F burning distillate fuel.	o Continued Phase II activity. Ran additional 300 hours on air-cooled components, operating at 2,600° F burning natural gas.	o Continued Phase II work. Efficiency of air-cooled stages lower than expected. Durability is encouraging.	o Work is about 40% complete. The air- and water-cooled components work satisfactorily in preliminary bench tests. Efficiency and durability data, planned for Phase III, not obtained due to termination decision.
Develop by 1985 gas turbine combustors to meet NO_x emission standards while operating with high fuel bound nitrogen coal- or shale-derived liquid fuels.		o Initiated low NO_x combustor program Phase I (Rig testing) with 5 contractors (coal-derived liquids and shale).	o Completed 50% of Phase I. Results indicate possibility of meeting NO_x emission levels burning coal & shale liquids in staged combustors.	o Completed Phase I. Tested about 75 rig concepts. Tests indicate NO_x emission levels of 75 ppm can be met with staged combustors. Initiated Phase IA, coal-derived gases, with same contractors.	o Work is about 50% complete. Completed research on combustion of coal-derived liquids as planned. Research on combustion of low/medium-Btu gases initiated. Engineering development to determine optimum combustor cooling techniques remains to be accomplished.
Determine by 1981 the environmental and operational performance of diesels with coal- and shale-derived liquid fuels.	o Initiated program to use coal-derived liquids in slow-speed marine/utility diesel, using one contractor.	o Completed tests. Results indicate that COED and SRC-2 fuels can be successfully burned in test engine. COM test unsuccessful.	o Initiated testing of coal-derived liquids in medium-speed diesel engines.	o Completed tests of 5 engines, using SRC-2 and shale oil. Initiated additional tests with EDS and H-Coal.	o FY 82 completion of EDS and H-Coal tests will result in 50% program completion. Engine operability will have been established. Although no adverse durability effects were noted in test runs, limited fuel availability precludes full durability testing prior to program phaseout.

TABLE 7-1

HEAT ENGINES

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Develop by 1983 heater tubes to operate at 1,550° to 1,700° F in primary heaters for industrial cogeneration application.	o Continuation of Phase I (Program Definition).	o Completed Phase I, which produced a program for developing externally fired power systems for central station and cogeneration use. Issued RFP for Phase II (Component Testing).	o Initiated Phase II with one contractor.	o Successfully operated ceramic heater tubes for 300 hrs. at 1,800° F in heated fluidized-bed.	o Primary heater test facility completed. Component testing representing 30% of original program scope completed. Pilot scale Phase III (technology readiness verification testing) will not be initiated.

TABLE 7-2

HEAT ENGINES

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $15.4

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Phase out low-NO_x combustor component technology base development.	o None.	o Develop data base to assist extrapolation to full scale.	o Perform rig testing at lab scale for staged and catalytic combustors on coal-derived fuels.
Phase out externally fired primary heater technology base development.		o Develop data base to assist continuation (by others) of primary heater development.	o Complete construction of primary heater test facility and preliminary screening tests of metal and ceramic heat exchanger tubes.
Conduct preliminary evaluation of the potential of coal-water slurries as a diesel fuel, using highly beneficiated coals and new wear-resistant combustion zone materials.	o None.	o Preliminary evaluation of coal-water slurries as a diesel fuel required to assist other organizations in further development.	o Conduct lab scale combustion tests and engine tests at temperature/pressure profiles of low- and medium-speed diesels; examine problem of fuel injection of coal-water slurry fuel.
Phase out technology base development in alloy and ceramic materials and coatings engineered for increased combustion zone durability in gas turbines and diesel engines.	o None.	o Develop data base to assist further development and application (by others) to the unique hostile environments of heat engines operated on coal-derived fuels.	o Complete studies and screening of properties of alloys and ceramics (e.g., microstructures) to obtain desired characteristics; complete studies of bonding mechanisms for combustion zone coatings; complete studies of four deposition techniques (electron beam-physical vapor deposition, chemical vapor deposition, plasma spraying, and sputtering).

TABLE 8-1

COMBUSTION SYSTEMS

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
Total Obligational Authority:	$79.2	$57.4	$50.3	$44.7	
Obligation:	$75.1	$57.3	$43.3	$40.1	
Construct and operate by 1980 a 30-MW utility AFB demonstration plant and four industrial-sized AFB demonstration plants.	o Awarded 3 contracts for AFB demonstration plants.	o 200-hour continuous operation of 30-MW plant achieved. Completed construction of one industrial AFB.	o Completed parametric testing of 30 MW. Initiated parametric testing of one industrial AFB.	o Completed 30 MW program. Completed construction of second and third industrial AFB plants; awarded fourth AFB demonstration plant contract.	o 30 MW boiler demonstrated AFB for utility use; industrial prototype AFB boilers developed design cost base and operating criteria. Approximately 60% of the data base has been obtained.
Construct and operate PFB Combustion Research Facility and a PFB pilot plant by 1983.	o Completed final design for Combustion Research Facility plant. o Completed construction of process development unit (PDU) for design verification tests for pilot plant.	o Completed final design for pilot plant. o Completed long-term PDU design verification tests.	o Completed construction of PFB Combustion Research Facility. Initiated construction for pilot plant.	o Completed hot commissioning of Combustion Research Facility plant.	o PFB pilot plant project terminated at 50% of construction. PFB Research Facility in operation, representing 80% project completion.
Demonstrate system reliability of at least 3,000 hours MTBF for AFB by 1983 and a 350-hour continuous run for PFB by 1984.				o Demonstrated 600 MTBF hours, with overall operation of 6,000 hours for AFB.	o Program is proceeding on planned schedule. AFB runs during FY 82 complete; demonstrated efforts on first generation systems.
Operate AFB combustors on a range of coals, including high-sulfur (at least 3%), low-Btu (less than 7,000 Btu/lb.), and high-ash (at least 30%).	o Combustion testing of 10 high-sulfur coals (2-4%) and 4 anthracite culms (coal dust of 3,000-7,000 Btu/lb.).	o Combustion testing of high-sulfur coals; oil shale and Texas and North Dakota lignites.	o High-sulfur coals, lignites, char, and oil shale combustion tests at lab-scale and demonstration.	o High-sulfur coals, lignites, char, and oil shale combustion tests at lab-scale and demonstration.	o High-sulfur bituminous coal combustion tests proceeding on schedule; lignite testing requires long-term effort. Anthracite culm testing in prototype units initiated late FY 1981.

TABLE 8-1

COMBUSTION SYSTEMS

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
Meet current emission standards for all fluidized-bed combustion (FBC) systems.	o Parametric testing at bench and lab scale.	o Parametric testing at bench, lab, and PDU scale.	o Testing expanded to include pilot and prototype demo scale.	o Testing expanded to include pilot and prototype demo scale.	o All FBC systems demonstrate control of SO_x NO_x and particulates that meets or exceeds current emission standards.
Project AFB life cycle costs compared to conventional systems based on engineering data analysis.					o Capital costs developed at 3 AFB units indicate savings over conventional systems. Operating costs are planned to be obtained during FY 1982.
Develop and demonstrate by FY 1981 a coal/oil mixture (COM) of at least 30% coal as a substitute for oil in boilers, furnaces, and process heaters.	o Signed 2 contracts: one utility and one blast furnace.	o Initiated final design.	o Completed construction and installed test program at a utility.	o Completed construction and completed test program in blast furnace application.	o Project completed. Coal/oil mixture now on commercial market. Program goals of 100% complete.

TABLE 8-2

COMBUSTION SYSTEMS

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $41.0

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Phase out industrial application of AFB to include low-quality coal and multiple fuel uses (lignites, anthracite, culm, oil shale, char wastes, etc.) and asessment of advanced AFB concepts in FY 82.	o None.	o Complete and document accomplishments and technical data.	o Complete scheduled bench- and PDU-scale studies, including natural and synthetic sorbent evaluation, effect of sorbent and coal composition on bed agglomeration, determination of relevant devolatilization and combustor chemistry, and verification of scaling methodology to provide the critical data base required for effective use of low-quality fuels. o Complete scheduled collection and distribution of data from previously constructed demonstration units to provide basis for industrial assessment and utilization decisions.
Assess advanced PFB concepts by 1985.	o None.	o Conduct preliminary performance evaluation. o Conduct environmental and economic performance projection.	o Conduct R&D studies for preliminary candidate selection, and perform preliminary systems analysis to verify initial performance projections and provide basis for industrial development and acceptance decisions.
Develop by 1987 a PFB system data base, including environmental, cost, and range of coals tested; and disseminate to electric utilities and industry through seminars, papers, and reports.	o None.	o Establish PFB combustor operating data at commercial scale, including transient responses, critical component performance, and selected component technology development.	o Utilize PFB combustion test facility, supported by bench- and PDU-scale studies for component testing in operating environment, determination of load-following capabilities, materials testing, improved component technology development, and systems analysis, to provide basis for industrial assessment and potential system development.

TABLE 8-2

COMBUSTION SYSTEMS

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Demonstrate by 1986, an economic coal-water mixture (CWM) as a coal-based fuel that can totally displace oil in boilers, furnaces, and process heaters designed for oil firing, while meeting current environmental standards. - Transfer data to industry through publications, reports and seminars. - Develop engineering data needed to project reduced energy costs relative to not retrofitting existing equipment.	o None.	o Define tolerable slagging/erosion/corrosion levels as a function of fuel ash content and chemistry, and combustion efficiencies/dynamics over a range of industrial and utility scale boilers/furnaces. o Define oil-designed boiler/furnace requirements to accept combustion products of selected retrofit combustor concept(s).	o Development of a broad, commercially acceptable Engineering Data Base for the application of CWM technology to industrial- and utility-scale boilers and furnaces via contracted efforts as a primary data source, and via the PETC 100 hp and 700 hp liquid fuel test boilers as support activities. The contracted efforts are focused on the quality and quantity of engineering data judged by the private user sector to be acceptable in forming explicit engineering decisions on new technology use. o Data Base will include a comprehensive definition, over a range of boiler/furnace sizes and types, of ash-loading, slagging tolerances, erosion, corrosion, unit/system derating, fuels, combustion, and emissions characterization.
Phase out assessment of the potential of coal-fired, ash-retaining combustors for retrofit to existing oil- and gas-fired equipment.	o None.	o Complete survey of existing and new ash-retaining combustor concepts. o Identify specific concepts for further development.	o Economic, technical, and feasibility definitions for the use of specified combustor concept(s) with spectrum of designs and sizes representing emplacement to allow assessment of potential for conversion to direct coal firing o Conduct R&D studies for preliminary candidate selection and perform preliminary systems analysis to verify initial performance projections and provide basis for industrial development and acceptance.

TABLE 9-1

ADVANCED RESEARCH AND TECHNOLOGY DEVELOPMENT

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$50.6	$73.6	$64.5	$65.1	
Obligation:	$41.7	$66.3	$57.7	$60.8	
Develop a technology base, through a program of concept evaluation and experiments, to support long-term activities for: - Advanced processes for converting coal to clean gaseous fuel.	o 184 fundamental studies and experiments on coal utilization processes and coal-related process engineering sciences.	o 176 fundamental studies and experiments on coal chemistry, coal utilization processes, and coal-related process engineering sciences.	o 246 fundamental studies and experiments on coal chemistry, coal utilization processes, and coal-related process engineering sciences.	o 287 fundamental studies and experiments on coal chemistry, coal utilization processes, and coal-related process engineering sciences.	o It is estimated that the AR&TD program has substantially (better than 95%) achieved the objectives for FY 1978-81. DOE has obtained data and results directly relevant to advancement of coal conversion and utilization technology.
- Advanced processes for converting coal to liquid fuel.	o 28 new project starts versus 138 project renewals.	o 18 new project starts versus 168 project renewals.	o 96 new project starts versus 173 project renewals.	o 63 new project starts versus 244 project renewals.	
- Improved pulverized fuel and synfuel combustion processes.	o 17 new thrusts initiated in the research program.	o 20 new thrusts initiated in the research program.	o 32 new thrusts initiated in the research program.	o 21 new thrusts initiated in the research program.	
- Improved heat exchangers.	o 13 significant technology spin-offs and transfers to development programs.	o 24 significant technology spin-offs and transfers to development programs.	o 20 significant technology spin-offs and transfers to development programs.	o 22 significant technology spin-offs and transfers to development programs.	
- Advanced environmental control technology.	o 31 significant scientific discoveries and process concepts evaluated.	o 57 significant scientific discoveries and process concepts evaluated.	o 47 significant scientific discoveries and process concepts evaluated.	o 48 significant scientific discoveries and process concepts evaluated.	

TABLE 9-1

ADVANCED RESEARCH AND TECHNOLOGY DEVELOPMENT

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
- Improved materials, components, instrumentation, and control.	o Significant spin-offs and discoveries included: - Computer models for coal gasification with proven industrial applications. Deuterium tracer method for investigating chemistry of coal liquefaction.	o Significant spin-offs and discoveries included: - Staged combustion of coal with air preheat for nitrogen oxide control. In-situ hydrogen probe for measuring hydrogen concentration in coal liquefaction systems.	o Significant spin-offs and discoveries included: - Demonstration of coal-water mixture fuels. Novel device for measuring viscosity of coal melts at high temperatures. Spectroscopic technique for correlating mineral matter composition with catalytic activity for liquefaction.	o Significant spin-offs and discoveries included: - Method for producing more effective liquefaction solvent by selective hydrogenation of Solvent Refined Coal fractions. High-speed laser welding of fluted heat exchanger tubes. Method for in-situ regeneration of methanation catalysts.	
Transfer technical information as developed to interested private sector parties through publication in referred journals; research presentations at professional society meetings; research patent applications; and management of national, multi-agency/university/industry conferences and workshops.	o 16,300 potential users covered. o 990 publications provided. o 209 presentations made. o 5 patents applied for. o 5 workshops and conferences held with 1,000 attendees.	o 16,600 potential users covered. o 1,000 publications provided. o 225 presentations made. o 6 patents applied for. o 4 workshops and conferences held with 511 attendees.	o 17,200 potential users covered. o 1,043 publications provided. o 238 presentations made. o 9 patents applied for. o 6 workshops and conferences held with 1,235 attendees.	o 17,400 potential users covered. o 1,140 publications provided. o 328 presentations made. o 8 patents applied for. o 11 workshops and conferences held with 1,430 attendees.	o It is estimated that the program substantially (better than 95%) achieved the objectives for FY 78-81.
Promote and encourage research on coal by universities through a system of grants.	o Not active FY 1978.	o Not active FY 1979.	o 41 grants awarded; 34 institutions supported; 153 faculty and students involved.	o 32 grants awarded; 44 institutions supported; 225 faculty and students involved, including carry-overs from previous year.	o The objectives for FY 80-81 are estimated to have been substantially (better than 95%) achieved.

TABLE 9-2

ADVANCED RESEARCH AND TECHNOLOGY DEVELOPMENT

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $56.3

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Develop a technology base, through a program of concept evaluation and experiments, to support long-term activities for: - Advanced processes for converting coal to clean gaseous fuel. - Advanced processes for converting coal to liquid fuel. - Improved pulverized fuel and synfuel combustion processes. - Improved heat exchangers. (FY 82 only) - Advanced environmental control technology. - Improved materials, components, (FY 82 only) instrumentation, and control.	o Rely on private sector to provide funds for support of technology base activities.	o Conduct fundamental studies and experiments to develop a better understanding of coal chemistry, coal utilization processes, and coal-related process engineering sciences. o Initiate new projects and continue with promising projects that contribute to the development of the research program technical base. o Identify, analyze, and solve engineering problems common to coal conversion processes, utilization processes, and control technologies. o Conduct investigation into behavior of materials to improve reliability and endurance of conversion and utilization processes, heat exchangers, and control technologies.	o Evaluation of concepts that offer the potential for new processes and process improvements for coal conversion and utilization, i.e., truly advanced, lower cost technology that has fewer steps, that is simpler, or that permits substantially higher production rates per unit volume of reactor. o Provision of a better scientific and engineering base for ongoing research and development programs. o Evaluation of unique approaches to improved materials of construction and component design that may lead to enhanced reliability, efficiency, and long life in coal conversion and utilization processes. o Development of improved understanding of behavior of materials and components in fossil energy processes.
Transfer technical information as developed to interested private sector parties through publication in referred journals; research presentations at professional society meetings; research patent applications; and management of national, multi-agency/university/industry conferences and workshops.	o Rely on private sector information services to collect, review, and submit information, and to sponsor all conferences and workshops.	o Promote seminars, workshops, and conferences and publish reports to facilitate rapid transfer of information. o Ensure technical reports are accurate and timely.	o Effective dissemination of research results to other researchers and to technical persons in the private sector for use in enhancing the viability and commercial feasibility of processes for coal conversion and direct use of coal.
Phase out grants for research on coal by universities in FY 82.		o None.	o No funding beyond FY 82.

TABLE 10-1

ADVANCED ENVIRONMENTAL CONTROL TECHNOLOGY

PROGRAM ACCOMPLISHMENTS[1/]

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	0	$7.0	$38.4	$34.4	
Obligation:	0	$6.8	$36.8	$32.4	
Develop by 1986 improved flue gas cleanup technologies. - Achieve availability of at least 90 percent.			o DOE/EPA cooperative evaluations on full scale forced oxidation, lime/limestone tests completed. NSPS achieved. 90-98% availability attained in short-term tests.	o TVA's Shawnee Power Plant completed tests on adipic acid and forced oxidation. Indicate improvements in sulfur formation. capture and sulfur formation NSPS achieved. 5 to 10% cost reduction indicated. Runs too short to measure availability.	o Program objectives were met on an experimental basis at several test sites. It remains for the private sector to utilize this data to refine commercial processes to achieve this objective under a wide range of conditions and coals.
- Reduce scrubber sludge by at least 50% compared to current lime/limestone scrubbers.			o Initiated joint DOE/EPA large-scale evaluation of promising emerging FGD systems (i.e., regenerable systems, gypsum producing systems, sulfur and sulfuric acid producing systems). Based on work to date, 50-100% sludge reduction should be obtainable.	o DOE/R&D program focused on lime spray dryers for high sulfur eastern coals, potentially the most valuable system for U.S. applications. Completed lab tests verifying NSPS sulfur capture.	o The feasibility of economically employing dry and regenerable processes which would greatly reduce sludge has been demonstrated at small scale. It remains for the private sector to utilize this data to develop commercial processes to achieve this objective under a wide range of conditions.
- Achieve projected costs no greater than the current state-of-the-art systems.				o Lime spray dryer as a utility system projected to offer more than 10% reduction in capital cost and 15% reduction in operating cost.	o Engineering features and costs will be validated in FY 82-84 program with utility slip stream tests (81 funding).

[1/] Accomplishments include coal cleaning (previously part of Mining Research and Development program); however, funding for coal cleaning activity is included in the Mining Research and Development section.

TABLE 10-1

ADVANCED ENVIRONMENTAL CONTROL TECHNOLOGY

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
Develop by 1985 hot gas stream cleanup technologies for application to PFB turbine combined cycle systems that will enable the achievement of a turbine inlet stream containing no greater than .012 grams of SCF particulate and 0.02 ppm of alkali.		o Initiated contracts resulting from hot gas cleanup PRDA.	o Laboratory and bench-scale tests initiated.	o Particulate goals achieved in cold flow bench-scale tests. 0.2 ppm alkali achieved in lab tests.	o Hot gas tests were planned to begin in early FY 82 Curtiss-Wright Pressurized Fluidized-Bed Combustor facility.
Develop by 1986 hot desulfurization technology for application to gasifier fuel gas streams to reduce sulfur concentration below 1 ppm.			o Initiated base technology R&D activities.	o 10 ppm sulfur achieved in laboratory tests.	o Expect to demonstrate regenerable sorbent system on gasifier slipstream in FY 82 to achieve hydrogen sulfide removal levels below 5 ppm. If successful, objective expected to be achieved by planned date.
Develop and demonstrate improvements in coal preparation techniques as a means of decreasing the cost of coal utilization.		o Initiated development of high-gradient process (HGMS).	o Showed feasibility of ash-pyrite separation by two-stage froth flotation.	o Completed laboratory development phase, HGMS process.	o Met original objectives of incrementally improving selected cleaning processes with respect to separation efficiency.
		o Continued research on chemical coal cleaning processes.	o Proved high-gradient magnetic separations (HGMS) process to separate pyrites and other metallic minerals from fly ash.	o Sulfur and ash extraction of up to 90% achieved by chemical coal cleaning.	o Met basic objective of extracting at least 50% of organic sulfur by chemical methods.
		o Initiated development of two-stage froth flotation process to separate ash and pyrite.		o Initiated process validation tests of two-stage froth flotation, selected preferred chemical processes for continued development.	

TABLE 10-2

ADVANCED ENVIRONMENTAL CONTROL TECHNOLOGY

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $22.0

Goals/Objectives	Alternative Methods[1]	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Develop by 1990 combined flue-gas cleanup technologies that meet current environmental standards at lower costs than separate conventional systems.	o Shorter term, low-risk research will be the responsibility of industry. No viable alternatives for these longer term, high-risk activities.	o Test and evaluate advanced combined NO_x/SO_x removal technologies.	o Simultaneous removal of pollutants in one process offers potential cost advantages. This approach is being pursued by characterization of one or more promising combined NO_x/SO_x removal technologies.
Develop by 1989 improved hot gas stream cleanup technologies for gasification and pressurized fluidized-bed (PFB) combustion systems to achieve process stream cleanup of less than 0.02 cu. ft. particulate loading.	o Same as above.	o Develop a sorbent regeneration process for alkali cleanup at the proof-of-concept scale. o Evaluate advanced particulate removal concepts at the proof-of-concept scale.	o Successful achievement of these objectives would result in a clean gas stream that would not erode or corrode turbine components and would not require to meet NSPS. o Characterization of alkali removal/sorbent regeneration and particulate removal processes are under way.
Develop by 1991 hot desulfurization technology for application to gasifier fuel-gas streams to reduce sulfur concentrations below 1 ppm for use in fuel cells.	o Same as above.	o Evaluate fuel cell tolerance to gas stream contaminants. o Develop required instrumentation for contaminant measurement. o Process research and development to meet hot desulfurization requirements.	o Stringent sulfur cleanup is required to prevent degradation of fuel cell performance to unacceptable levels. o Sensitivity of fuel cell performance to contaminants such as particulates, chlorides, and others must be identified.

[1] The current program has been sufficiently focused so that there are no efficient alternative methods.

TABLE 10-2

ADVANCED ENVIRONMENTAL CONTROL TECHNOLOGY

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Identify and develop modifications to combustion and gasification processes to either suppress pollutant formation or remove the pollutant from the gaseous phase.	o Same as above.	o Assess the most desirable NO_x control techniques. o Select most suitable sorbents for capture of alkali, trace metals, and hydrocarbon contaminants.	o Suppressing pollutant formation or removing pollutants in the combustion or gasification process itself is potentially more cost-effective than flue-gas cleanup.
Identify and develop advanced coal combustion waste management techniques.	o Same as above.	o Perform fossil fuel waste sampling and characterization.	o Provide greater incentives for coal utilization by ameliorating the economic and potential environmental constraints associated with coal combustion waste products--through development of waste sampling and analysis methodology, and characterization.
Refine coal preparation technology to obtain up to 90% extraction of sulfur and ash.	o Same as above.	o Perform characterization of fine coal samples representative of most critically important coal sources by washability and structural tests. o Develop advanced technologies to liberate and extract inert mineral matter from fine coals. o Perform development tests to extract organic sulfur from fine coal by chemical techniques. o Perform development tests to grind, dewater, consolidate, and handle fine coals by ultrasonic, microwave, and other methods. o Prepare "superclean" coal samples for engineering test evaluation.	o Provide technology to assess the cleanability of specific U.S. coals and develop advanced processes to upgrade the quality of such coals to levels rivaling distillate fuels. o Fine coal washability testing of high-sulfur Appalachian and midwestern coals to enhance their utilization. o Design feasibility evaluation of fused salt and microwave processes to reduce sulfur and ash to less than 1%.

TABLE 11-1

OIL SHALE

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$29.0	$49.9	$43.8	$37.4	
Obligation:	$28.7	$34.3	$39.5	$35.3	
Conduct studies to select one or more first-generation surface retort processes and complete engineering design studies on commercial-scale process modules by 1983.			o Chose two designs (Paraho, Superior).	o Paraho design completed 12/81.	o Two designs selected; one completed 12/81. Demonstration objective eliminated from original set.
Evaluate two vertical modified in-situ (VMIS) retort designs by 1980 and demonstrate at large scale the design with the best overall performance by 1983 in a cluster configuration.	o Completed test of 120' x 120' x 200' vertical-slot design (field).	o Completed test of 164' x 164' x 270' horizontal-slot design (field).		o Completed 3 tests of new startup burner designs (field).	o Achieved 40% recovery; need 60-70% for commercial viability.
Develop and demonstrate at large scale a horizontal modified in-situ technology (HMIS) by 1981 applicable to near-surface deposits in Utah.	o 20' x 50' x 75' pilot, 30' overburden, produced 1,003 barrels.	o Blasted 94,000 ton production retort, 217' wide, 45' overburden, 30' thick, 230' wide.	o Increased pilot width to 108', length to 156'; produced 5,480 barrels, blasted second production retort improved design.	o Ignited first production retort. Produced 12,600 barrels.	o Met or exceeded dimension objective. Developed improved blast designs; pilot retorts produced up to 54%. Fischer assay first production-scale retort demonstrated. Need for further improvement in blast and process control design—estimated 25-30% oil recovery. No cluster demonstration. Needs for environmental control research identified.

TABLE 11-1

OIL SHALE

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Develop technology for more efficient in-situ blast designs, process control, and environmental control.	o Defined heating mechanism for large shale blocks. One-dimensional retort model. Static mechanical properties of shale. Char reactions. Begin environmental data base assembly for wastewater treatment.	o Lab and field tests to develop fracture models (true and modified in-situ). Oil degradation mechanisms defined. Kinetics input to process model. Standard retort process water samples prepared and distributed.	o Completed initial series of fundamental blast tests; completed bench-scale water treatment studies. Shale oil chemistry identified indicators for oil degradation during retorting. Steam/air effects on VMIS identified.	o Tracer gas and logging technique developed for rubble evaluation. Lab studies of low-void retorting. Initial tests of environmental control technology for gas. Initiated sulfur chemistry study. Initiated geochemical study of eastern shales. Eastern shales PDRA issued.	o Modified in-situ retorting chemistry fully understood. Refinement of one-dimensional model and extension to two-dimensions needed. Similar studies and models needed for surface retort processes. Half of environmental mitigation studies on retort water completed; need engineering-scale studies. Lab tests to develop fracture models extended to field--substantial engineering-scale blast data required to develop generic predictive design capability. Substantial beginning on eastern shale technology base for Michigan, and more limited studies on Ohio and Kentucky shales, under Dow and IGT contracts described below.
Develop, demonstrate at large scale, and evaluate by 1983 a superheated-steam retorting concept applicable to the Colorado leached zone.	o Field site tests for design completed.	o Stimulation test (lab), field construction, initiate steam injection.	o Achieved continuous superheated steam injection, established closed recycle water self-sufficiency. First oil production.	o Continued oil production, research needs on oil/water separation, oil recovery, environment, diagnostics, improved heat delivery system identified.	o Technical objectives of test substantially met, concept feasibility demonstrated, long-range technology base research needs identified.

TABLE II-1

OIL SHALE

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
Develop data base for deep eastern shales in Michigan, including field tests of four fracture concepts and two energy recovery tests by 1980.	o Completed field fracture tests and first combustion test.	o Completed evaluation of fracturing, initiated second combustion tests.	o Completed all field and laboratory research on Antrim shale deposit.		o Developed extensive data base on Michigan eastern shale resource; identified fracture technique with greatest potential for future. Development of a process for low-to-medium Btu gas production indicated, but would require extensive long-term and high-risk research.
Complete process concept development tests at PON-scale using a hydrogen retorting technique on at least two eastern and one western shales by 1982.		o Awarded contract to IGT.	o Lab-scale unit tests on eastern shales achieved greater than twice Fischer assay.	o Conducted runs on both eastern and western shales in PDU and achieved improved yields.	o Sufficient promise demonstrated so that industrial sponsor is underwriting further development.
Evaluate feasibility of an advanced in-situ radiofrequency processing concept, including at least one small field experiment on oil shale by 1981.		o Awarded contract to IITRI.	o 2 small field experiments in Utah in 1 cubic meter blocks produced shale oil.	o Completed reports on oil shale laboratory and field studies. Continued experiments on tar sands.	o This was a joint oil shale/tar sand feasibility study. Concentrated on tar sand because of funding ratio. Limited contract objectives for oil shale were achieved.
Transfer technology to industry through cost sharing, workshops, and publications.	o 118 publications 96 papers 1 workshop 6 conferences 1 seminar 4 task force meetings 11 task force presentations 7 task force publications	o 142 publications 73 papers 1 workshop 4 conferences 3 seminars 5 task force meetings 15 task force presentations 9 task force publications	o 127 publications 104 papers 3 workshops 5 conferences 4 seminars 9 task force meetings 18 task force presentations 13 task force publications 1 peer review	o 82 publications 54 papers 1 workshop 12 conferences 2 seminars 12 task force meetings 7 task force presentations 7 task force publications 3 peer reviews	o A dynamic technology transfer program was achieved.

TABLE 11-2

OIL SHALE

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $19.2

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Develop basic data and extend single-borehole blast model capability to multiple-borehole, multiple-row model to support effective and predictable shale fragmentation design by 1990.	o Rely on private sector, which has low probability of expending resources in this area.	o Test data from instrumented field-scale, multiple borehole explosive shots and computer model development by 1987.	o Improved capability to design blast patterns to give desired distribution of particle size and permeabilities for in-situ processes.
Obtain reaction chemistry and kinetics and develop two-dimensional, modified in-situ retort process model by 1987; on surface process models for indirect heat transfer systems by 1993.	o Empirical approach to design, low efficiency.	o Multiple test runs in laboratory retorts, mathematical evaluation of results, chemical analyses of product and waste streams, integration of results in computer models.	o Improved technology will accelerate use of shale oil by U.S. infrastructure. More efficient recovery since less energy per barrel of product will be required. Design processes for reduced environmental emissions and to match resource characteristics. Higher resource recovery.
Develop geochemical data base for lower grade western shales.	o Discard or ignore lower grade resource, which causes loss of majority of resource (80-95% loss).	o Mineralogic analyses and Fischer assays of oil shales representative of specific deposits.	o Geochemical information is needed for rational design of processes.
Characterize emissions and wastes from retorting processes so that environmental impact mitigation procedures can be designed, developed, and evaluated.	o EPA and industry have specific and limited access to process and R&D facilities and data which will stifle progress. DOE has in-place program and facilities.	o Determine the relationship between process variables and emission characteristics of first generation processes by 1987 (particularly Tosco and Union).	o Environmental impact mitigation strategies may be incorporated into process designs for second generation.
Design, develop, and test control technologies for water, air, and solid waste.	o Limited EPA and industry R&D, will stifle progress.	o Utilize LETC North Site 150 ton Retort as an experimental test bed. Various new and existing control strategies will be evaluated by 1986.	o Conventional and existing control technology have only a moderate probability of being applicable to shale. New technologies will have to be developed.

TABLE 12-1

UNCONVENTIONAL PETROLEUM TECHNOLOGIES

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$53.7	$54.0	$35.2	$25.3	
Obligation:	$50.0	$50.9	$33.1	$24.7	
Accelerate the development of enhanced oil recovery (EOR) technologies through applied research and field tests, covering light and heavy oils and tar sands.	o Initiated 1 DOE/industry cost-shared field test; continued 22.	o Initiated 3 cost-shared field tests; terminated 4, continued 22. Incentive program begun.	o Initiated 2 cost-shared field tests; terminated 4, continued 20. 278 incentive projects proposed.	o Initiated 0 cost-shared field tests; terminated 4, continued 16. 423 incentive projects proposed.	o Within the budget and time period limits the objectives have been met.
	o 8 field test reports published.	o 10 field test reports published.	o 21 field test reports published, giving original engineering data.	o 10 field test reports published presenting several successes.	
	o Data and resource results published in 6 technical reports.	o Data and resource results published in 33 technical reports.	o Data and resource results published in 53 technical reports.	o Data and resource results published in 54 technical reports.	o Developed improvements in design of EOR processes and integrated three improvements into field tests. Scientific information developed not otherwise available.
Determine the potential of microbial stimulation of oil production.			o Determination that microbial enhancement of oil recovery held promise and escalating oil prices may make it economic.	o Discovery of brine-tolerant microbes that can displace oil by: (1) formation of carbon dioxide and solvents in situ, (2) formation of powerful emulsifying biosurfactants, (3) formation of biopolymers, and (4) the degradation of heavy oil.	o Early phases of research very promising. Will complete early phases in FY 82 as background for an international symposium in Oklahoma in FY 82. Established preliminary operating parameters for both anaerobic and aerobic bacteria.
Determine EOR potential for all processes and types of oil by 1983.		o Chemical flood candidate reservoir studies completed.	o Thermal and CO_2 candidate reservoir studies completed.	o Detailed field test analysis for determining EOR state-of-the-art begun. Merging of candidate reservoir studies results begun (all processes).	o Defined areas of process and reservoir constraints. Results are used to focus R&D to improve predictability for EOR processes. Original objectives 75% completed. Identified best candidate reservoirs.

TABLE 12-1

UNCONVENTIONAL PETROLEUM TECHNOLOGIES

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
Develop technology by 1982 for steam injection in deep (2,500 ft.) heavy oil reservoirs.		o Began work towards development of insulated down-hole tubing and down-hole steam generator.	o Completed surface testing of tubing and generator.	o Down-hole testing initiated.	o Testing to date shows the concepts and prototype equipment are operative down-hole. Long-term testing is in progress.
Improve steam-drive process efficiency from current average of 50% to 60%, using additives.		o University R&D on surfactant additives for improved mobility control begun.	o Field sites selected for pilot testing of additives.	o University research directed to find improved additives. Additional field testing initiated.	o Contributions from many university projects. Several promising additives resulted from lab studies. Field results to date look promising, but tests not yet complete.
Apply thermal recovery methods to tar sands, including completion of an in-situ combustion and steam injection test.	o Investigation of technical feasibility of steam drive process initiated.	o Combination of reverse and forward combustion processes tested. 25% of original oil-in-place recovered in one experiment.	o Data from first in situ steam drive field experiment obtained.	o Major problem areas, such as process control and efficient handling of the extremely viscous produced oil, identified and indications of solutions provided.	o Experiments have provided encouragement for application of the combustion processes to tar sands on a larger pilot scale to determine economic parameters. Objectives 75% met.
Support the petroleum, gas, and shale oil programs through the development of novel equipment, instrumentation, and processes in extraction, upgrading, and utilization; continue drilling technology research by:	o See below.	o See below.	o See below.	o See below.	o See below.
- Characterization Research.	o Characterization studies on hydrogenated shale oil and raw shale oil indicated deleterious compounds needing removal.	o Increasing support of Strategic Petroleum Reserve Office shows which oils can be comingled.	o Beginning of cooperation between BETC and Venezuela in characterization studies needed for processing of heavy petroleum.	o Analytical work on Cerro-Negro, Venezuela, crude in progress.	o Continued long-term effort, with phases completed each fiscal year. SPR and industry very supportive.

TABLE 12-1

UNCONVENTIONAL PETROLEUM TECHNOLOGIES

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
	o Fingerprinting of crude oils advanced with many determinations of benzene and toluene in crudes.	o Correlation developed that allows prediction of 1,050° F resid volume from knowledge of 787° F resid volume.	o New methods explored for separating heavy ends using HPLC techniques. Work continues. o Continuation of significant support on storage compatability. o Field ionization mass spectrometry and GC/MS being developed for analyzing heavy ends/heavy oils.	o New methods developed for removing acids and bases using ion exchange resins. o Continuation of support to Strategic Petroleum Reserve Office. o Probe microdistillation mass spectrometry studies have led to development of technique for determining heats of vaporization from detailed compositional data.	o Fingerprinting of crude oils to identify sources 90% complate.
- Thermodynamics Research.	o Apparatus built for measurement of gas solubility in fossil fuels, a useful apparatus for all hydro-treating studies.	o Spectroscopic studies commenced on nitrogen compounds known to be deleterious in shale oil. Knowledge of thermodynamic properties will show best conditions for removal.	o Funding requested to study thermodynamic properties of nitrogen compounds that must be removed from shale-derived fluids.	o Funding received for study of organic nitrogen compounds. o Synthesis and purification of 5 nitrogen compounds in progress used. o Thermodynamic studies in progress on two organic nitrogen compounds.	o Continued long-term effort. Distinct phases completed each year. Fundamental work accepted by industry.
- Processing Research.	o Re-refining method for used lubricating oil potential that was developed at BETC. o Bench-scale hydrogeneration unit received for upgrading fossil fuels and removal of heteroatoms.	o Shake-down runs were done with bench-scale hydrogenation unit.	o Shale oil liquids were upgraded with bench-scale hydrogenation unit. o Mechanisms of chemical reactions causing instability of fossil-derived liquids during storage were studied.	o Individual bad-actor nitrogen compounds were identified, and relationship of molecular structure to storage instability was shown.	o Continued long-term effort, with phases completed each fiscal year. A unique waste oil process fully developed.

TABLE 12-1

UNCONVENTIONAL PETROLEUM TECHNOLOGIES

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
	o Fleet studies indicate BETC-process re-refined lube oil equivalent to virgin oil.				
- Drilling Technology Research.	o Improved drilling techniques developed.	o Improved drill bits and down-hole telemetry developed.	o Unique pressure core barrel designed, and sea floor instrumentation placed.	o Started Arctic and offshore research; continued drilling research.	o Improved drill bits and telemetry 100%, sea floor and Arctic research continuing. Results commercial on drill bits and telemetry.
Transfer technical information developed by program to potential users through professional reports, quarterly reports, and data banks.	o BETC staff papers - 17.	o BETC staff papers - 26.	o BETC staff papers - 59.	o BETC staff papers - 43. (FY 81 figures are for the first three quarters.)	o All aspects 100% successful annually; EOR data bank still being assembled. Avoid use of data by independent oil producers.
	o In-house technical reports - 29.	o In-house technical reports - 30.	o In-house technical reports - 15.	o In-house technical reports - 19. (FY 81 figures are for the first three quarters.)	
	o Contractor technical reports - 15.	o Contractor technical reports - 41.	o Contractor technical reports - 60.	o Contractor technical reports - 73. (FY 81 figures are for the first three quarters.)	
	o Distribution via mail list - Numbers not available.	o Distribution via mail list - 33,674.	o Distribution via mail list - 39,171	o Distribution via mail list - 59,822.	
	o Distribution by request - Numbers not available.	o Distribution by request - Numbers not available.	o Distribution by request - 12,960. (For the last half of FY 80 only. Earlier records not available.)	o Distribution by request - 30,502.	
	o EOR Quarterlies via mail list - Numbers not available.	o EOR Quarterlies via mail list - 14,333.	o EOR Quarterlies via mail list - 16,516.	o EOR Quarterlies via mail list - 22,460.	
	o LFFC Quarterlies via mail list - Numbers not available.	o LFFC Quarterlies via mail list - 659.	o LFFC Quarterlies via mail list - 5,955.	o LFFC Quarterlies via mail list - 5,632.	

TABLE 12-1

UNCONVENTIONAL PETROLEUM TECHNOLOGIES

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
	o EOR Symposium - 1,000 attendees.	o EOR Symposium - 1,000 attendees.	o SPE/DOE EOR Symposium - 1,941 attendees. 5 Research Seminars. 3 conferences. o Start on EOR data bank.	o SPE/DOE EOR Symposium - 1,760 attendees. 6 Research Seminars. SPE/DOE Gas Symposium - 1,500 attendees. 3 workshops. - 240 attendees. 6 meetings. o Supplement data bank information.	

TABLE 12-2

UNCONVENTIONAL PETROLEUM TECHNOLOGIES

CURRENT PROGRAM OBJECTIVES & BUDGET

FY 82: $20.2

Goals/Objectives	Alternative Methods[1/]	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Complete applied research and field tests for light and heavy oils in FY 82 and phase out in FY 83.	o In future rely on private sector and provide public dissemination of R&D results for remaining FY 82-83 projects. o Advanced R&D addresses those processes which currently are high risk and long term, with low potential for immediate economic return. Accordingly, the private sector is constrained in investing funds in this type of research.	o Demonstrate required improvement to extent possible. o Develop better understanding of displacement mechanisms. o Improve diagnostic instrumentation and prediction capability. o Mitigate nontechnical constraints, including environmental.	o Development of improved geophysical techniques for reservoir description, and EOR field performance. o Complete R&D in laboratory to develop better surfactant and mobility control agents to improve total recovery. o Complete R&D on improving understanding of chemical/physical mechanisms of the injected fluid-resident fluid-rock interactions.
Determine feasibility of using in-situ microbes to improve oil recovery.	o Rely on private sector. However, only a limited amount of private sector work is being done, and it is proprietary.	o Develop improved process for increasing recovery of petroleum from reservoirs containing highly viscous oils in high saturation, depleted waterflooded zones of lighter oil, and the relase of oil from tar sands and oil shales.	o This is a neglected area of EOR research with great long-range potential. Will complete preliminary research in FY 82 and host an international symposium in Oklahoma in FY 82. Symposium results will form basis for prioritization of FY 83 program. Overall justification is to get more oil more cheaply.

[1/] The current program has been sufficiently focused such that there are no efficient alternative methods.

TABLE 12-2

UNCONVENTIONAL PETROLEUM TECHNOLOGIES

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Develop technology by 1982 for steam injection in deep (more than 2,500 ft.) heavy oil reservoirs.	o Rely on private sector to develop and market technology.	o Transfer technology to industry as final testing is completed by FY 82.	o Final performance evaluation in FY 82. DOE design appears superior and needs full validation.
Improve steamdrive process efficiency from current average of 50% to 60%, using additives.	o Rely on private sector to develop and market technology. This could significantly delay benefits.	o Determine effects of candidate additives on fluid flow and heat transfer and identify those which optimize performance.	o Complete early small-scale field testing and supporting research already in progress. o Improved additives possible. May be applicable to light oil reservoirs.
Develop novel equipment, instrumentation and processes in extraction, upgrading and utilization; continue frontier area research by:	o Rely on private sector.	o See below.	o See below.
- Characterization Research.	o Rely on private sector to perform & publish research. Most will be kept proprietary. o Charge user fees for private companies to obtain DOE results.	o Develop the tools and techniques required to determine the basic compositional data and technology to produce and efficiently refine products derived from tar sands, shale oil, heavy oils, heavy ends of petroleum, and similar materials.	o In concert with industry and university representatives and panels, efforts will be focused to meet needs and fill gaps in our understanding of liquid fossil fuels. Very pertinent to improved synfuels processes. o Detailed compositional data, physical property data, and improved methods for temperature greater than 1,000° F will provide information needed to develop processes that will contribute to the more efficient utilization of those difficult resource materials. (Continuous process)
- Thermodynamics Research.	o Rely on private sector to perform and publish research. Most will be kept proprietary. o Charge user fees for private companies to obtain DOE results.	o Remove nitrogen compounds from shale oil and heavy petroleum for economic and environmental considerations.	o This work will aid in the delineation of the most economically acceptable conditions for their removal (continuous process), so that they will not interfere with catalysts in conventional refineries.

TABLE 12-2

UNCONVENTIONAL PETROLEUM TECHNOLOGIES

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
- Processing Research.	o Rely on the private sector to perform & publish the research. Most will be kept proprietary. o Charge user fees for obtaining DOE research results.	o Determine refining characteristics of synthetic crude oils, the type and quality of potential finished products and changes in petroleum refining processes required to yield finished fuels. (Continuous process)	o This effort is conducted cooperatively with the shale oil and coal liquids groups, complements industry efforts, and is supported by industry.
Transfer technical information developed through program to potential users through professional reports, sponsorship of symposia, quarterly reports, and data banks.	o None; DOE must provide the link between its programs and the potential users.	o Transfer technology to industry as developed from prior and new sources for all UPT activities. (Continuous process)	o The hundreds of reports from in-house work and 70 contractors (half universities) are of great significance and interest. Without this technology transfer to the public, the overall UPT effort would lose much of its usefulness. The data banks formed or now forming are of great use internally as well as publicly.

TABLE 13-1

DOMESTIC ENERGY SUPPLY

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$15.3	$22.2	$25.8	$18.1	
Obligation:	$ 8.3	$15.8	$19.1	$13.1	
COAL:					
Support commercial development of coal-based synthetic fuels and advanced coal combustion systems by conducting feasiblity studies of emerging technologies, and by participating with industry in early design of specific projects.		o Marketing studies completed for high-Btu gas, low/medium-Btu gas, and methanol.	o A Notice of Program Interest (NPI) in the low/medium-Btu gas area resulted in 40 proposals, with 14 being funded in 12 different states.	o Attended progress review meetings, made site visits, and offered insight to individual projects based on overview gained from working with many projects simultaneously.	o Program successful in identifying markets and opportunities for syn-fuels products. o Program participation indicated a strong industrial interest in low/medium-Btu gas. o Offered suggestions to assist projects, e.g., EIS and other regulatory issues, several of which were accepted.
Encourage the development of low-sulfur coal supply from small undergound coal mines through administration of the Loan Guarantee program.		o Regulations issued. Programmatic EIS published. Applications printed. o Met with coal group. Met with bankers. o Reviewed 15 applications. o Issued conditional commitment for $653,000.	o Issued conditional commitment for $5.8 million.	o Reviewed 15 applications through FY 81.	o Restrictive regulation prevented program from meeting goals.

TABLE 13-1

DOMESTIC ENERGY SUPPLY

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
SHALE OIL:					
Encourage the development of U.S. shale resources to achieve commercial production levels of 10,000 bbl./day in 1982 and 400,000 bbl./day in 1990 by designing a system of economic incentives.		o Five economic incentives proposed.	o Five economic incentives proposed. o Two companies motivated by economic incentives.	o Two economic incentives proposed. o Two companies motivated by economic incentives.	o A number of economic incentives enacted; financial assistance legislation passed (P.L. 96-126, P.L. 96-304, P.L. 96-294); Production Tax Credit enacted (P.L. 96-223); Energy Investment Tax Credit enacted (P.L. 96-223).
Remove impediments to the granting of Federal, state, and local licenses and permits through interagency arrangements and grants to state and local governments and Indian tribes to resolve socio-economic issues, and through analyses of specific issues.		o Two cooperative agreements initiated. o Three impediments analyzed.	o Two additional cooperative agreements initiated. o Four additional impediments analyzed. o Two socio-economic master plans initiated.	o Two additional impediments analyzed.	o Detailed tax structure analysis completed. o Development of Water Resources Assessment for Colorado River Basin. o Revised leasing policies and proposed statute changes by DOI, following DOE staff initiative. o Joint licensing and permit process implemented in Colorado. o Interagency cooperative agreement with the Department of Agriculture's Soil Conservation Service for feedstock production revegetation. o Interaction of community assistance programs of Housing and Urban Development and Agriculture. Joint DOE-HUD study produced.

TABLE 13-1

DOMESTIC ENERGY SUPPLY

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
					o Master plans by Colorado and Utah with concrete proposals for such projects as water system improvements, streets, transportation management, parks and recreation, public safety, growth monitoring, industrial needs, and public information. o Review by state and local governments of site-specific projects in terms of the potential socio-economic, environmental, and other impacts to the region. o Formation of local task forces to identify and find solutions for impacts, including distribution of available oil shale trust funds stemming from the Federal leasing program.
OIL AND GAS:					
Develop a set of incentives to encourage oil and gas production by new, enhanced, and marginal recovery methods.		o Intervention before the California Air Resources Board on air quality standards for SO_x and NO_x emissions which impact thermal oil recovery operations.	o Development and sponsorship of the tertiary front-end incentive regulation that, when combined with other incentives, has caused the greatest surge in industry enhanced oil recovery activity in history.	o Development of a tar sands definition which will be used for DOE purposes and recommended for use by all Federal agencies.	o Incentives developed.
Identify constraints to increased domestic activity in the exploration, production, and refining of oil and natural gas through a series of cooperative and self-initiated studies.		o Guidance to ERA & FERC on the pricing treatment for marginal oil and gas production such as tight sands, deep formations, or deep ocean waters.	o Technical assistance to the TVA in utilizing unconventional gas for the development of an industrial park.	o Institution of a national unconventional gas demonstration program to prove the feasibility of utilizing natural gas from Devonian shale coalbeds for small community and rural development.	o Constraints identified.

TABLE 13-1

DOMESTIC ENERGY SUPPLY

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
		o Annual (since 1974) publication of Trends in Refinery Capacity and Utilization, a report on future domestic refinery capacity and capability to supply U.S. product demands, as well as on the growth of foreign product export capabilities.	o Assessment of the oil and gas potential of lands being considered for withdrawal by BLM, Forest Service, and NOAA (marine sanctuaries).	o Served as liaison, program manager, and DOE support office for the National Petroleum Council, the Secretary's advisory committee on oil and gas matters.	

TABLE 14-1

ENHANCED GAS RECOVERY

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$29.1	$34.5	$30.6	$27.6	
Obligation:	$28.1	$33.7	$30.6	$26.2	
Thoroughly assess and quantify the potential of unconventional gas resources in the United States by 1985.	o DOE Enhanced Gas Recovery analytical report completed; figures later reaffirmed by independent National Petroleum Council study (1980).	o Six basin reports published on potential of methane from coalbeds.	o Illinois Basin report completed for Devonian shale; three additional methane-from-coal-basin reports completed.	o Resource assessment of Appalachian Basin completed for Devonian shale; resource assessment of Northern Great Plains Province completed; Devonian shale completed; Coalbed 30% complete; Western Sands 30% complete.	o Work on schedule; all technical data being transferred to industry as it becomes available.
Obtain by 1986 comprehensive geologic/reservoir characterization of a representative tight sand reservoir through drilling, stimulation, and testing three close-spaced wells (Multiwell Experiment).			o Site selected in Piceance Basin in Colorado; lease negotiations initiated.	o Preliminary program plan completed; lease negotiations completed. Geologic/reservoir characterization studies initiated at Multiwell site. First test well spudded in early September 1981.	o Work is behind schedule.
Improve recovery of natural gas from Devonian shales by developing hydraulic and/or tailored-pulse fracturing techniques by 1985.	o Completed 29 individual well stimulation tests in 5 states (24 hydraulic fracturing, 5 chemical explosive fracturing).	o Completed 20 well stimulation tests with 30% commercial success.	o Mineback experiments at NTS establish feasibility of tailored-pulse-loading fracturing; stream ratio technique shows areas of natural fracturing; 20,000 feet of core collected from 47 wells.	o Conduct offset-well test program to quantify shale production mechanism and optimum well spacing; three geologic screening reports prepared for key basins. Hydraulic fracturing techniques show recovery efficiency of 2:1 over conventional shooting techniques.	o On schedule; all geologic studies complete. Final evaluation/testing of analytical work and stimulation technology continuing.

TABLE 14-1

ENHANCED GAS RECOVERY

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Develop by 1989 massive fracturing techniques for tight sands by improving the ability to create fractures up to 4,000 feet long.	o Techniques demonstrated for measuring hydraulic fracture azimuth; more than 2,000 feet of core collected in 2 wells; average calculated fracture lengths of 200 to 500 feet.	o Completed 10 hydraulic fracturing tests, 2 chemical explosives fracturing tests; conducted proppant placement experiments at NTS. Calculated fracture of 1,500 feet created.	o Mineback experiments demonstrated in situ stress as key factor controlling fracture geometry; preliminary planning for Multiwell Experiment (MWX) initiated.	o Mineback experiments conducted to test lab-derived rock mechanics theory; research proceeding on light weight proppant (S.O. 1) to reinforce openings for gas extraction and new fracturing fluids; MWX initiated as principal fracturing research effort.	o Engineering geology studies of key basins continuing.
Develop by 1985 improved-precision, directional, and horizontal drilling techniques and hardware to enable routine drilling of holes up to 5,000 feet long in thin coal seams.	o Water-jet drilling system research initiated at Sandia; contract to evaluate methane drainage in thin seams initiated with Occidental Research Corporation.	o Demonstrated ability to drill horizontally within coal seam through surface directional well.	o Field test of cutting head and hydraulic system for water-jet drill; electric power generation using predrainage methane demonstrated.	o Last three field production/utilization tests completed.	o Drilling of holes up to 2,800 feet long demonstrated; workable production/utilization systems proven; final test of water-jet drill system scheduled for FY 82.
Provide by 1985 an accurate, readily accessible technical data base for gas resources in Devonian shales, tight sands, and coalbeds.	o Data collection; second Devonian shales symposium; first annual methane-from-coal symposium; approximately 15% of data base collected.	o Data collection; establishment of EGR technical information system; third Devonian shale symposium; 25% of data base completed.	o Data collection; first of joint DOE/Society of Petroleum Engineers symposia set up; USGS set up open file on western gas sands maps and geologic reports; 40% of data base completed.	o Began setting up computer data base systems for Devonian shales, tight sands, and coalbeds; over 8,000 requests for publications and maps during CY 80; approximately 50% of data base completed.	o Development of accurate, readily accessible data base is proceeding on schedule; industry well represented at symposia.

TABLE 14-2

ENHANCED GAS RECOVERY

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $11.7

Goals/Objectives[1]	Alternative Methods[2]	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Assess and quantify potential of unconventional resources.	o Rely on private sector to develop technology.	o Geologic resource characterization for all three unconventional gases. o Site-specific geologic/engineering studies.	o Regional geologic/engineering data base provided for each resource for full exploration and development by industry.
Complete comprehensive geologic/reservoir characterization of a representative tight sand reservoir through drilling, stimulation, and testing two close-spaced wells (multiwell experiment).	o Rely on private sector to develop technology.	o Empirically derived field data from the multiwell project core, logging, diagnostics, and in-situ stresses. o Development of a logging tool (nuclear magnetic resonance) to accurately measure saltwater saturation. o Improvement in the determination of lens geometry and distribution.	o Continue to develop instruments/diagnostic techniques for precise measurement of key reservoir parameters such as water saturation and permeability. o Predictive modeling capability to greatly reduce technical/economic risk to industry developers needed to fully exploit each resource.
Develop improved massive hydraulic fracturing techniques for tight sands.	o Rely on private sector to develop technology.	o Field test results from the multiwell project-stimulation experiments, fracture diagnostics, and production tests. o Development of an in-situ stress measurement tool. o Improvement in reservoir/stimulation models.	o Empirically derived stimulation/production test data leading to accurate predictive models are needed by industry to help remove much of the economic risk and uncertainty involving recoverable reserves. o Demonstration of more mechanically efficient, cost-effective extraction technology than is presently available to industry, in particular, small independent producers who do not possess the capability to develop their own fracturing tools and techniques.
Develop an accurate, readily accessible technical data base for gas resources in Devonian shales, tight sands, and coalbeds.	o None.	o Transfer all data to computer data base system.	o To ensure widespread dissemination of all data/technology applications to industry to encourage rapid development of unconventional gas resources. o To ensure competition between all operators by making technology advances nonproprietary.

[1] No objectives are established beyond FY82.
[2] The FY 82 program has been sufficiently focused so that there are no efficient alternative methods.

TABLE 15-1

ALTERNATIVE FUELS PRODUCTION

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	--	--	$5,518.0	$5,116.6	
Obligation:	--	--	$ 101.4	$ 504.6	
Implement by June 30, 1981, a $5.5 billion Federal incentive program that included $200 million for feasibility studies, $300 million for cooperative agreements, and $5 billion for other incentives.			o Issued two solicitations for cooperative agreements and feasibility studies. o Received 2,056 proposals. o Evaluated 971 proposals. o Selected 110 proposed projects totaling $200 million.	o Issued two solicitations for other incentives. o Evaluated 1,085 proproposed cooperative agreements and feasibility studies. (No awards were made because funds were rescinded.) o Received and evaluated 25 proposals for other financial incentives. Granted two loan guarantees totaling $3.1 billion and one minimum price product purchase agreement for $400 million.	o Awarded $200 million for feasibility studies and cooperative agreements. o Funding for $300 million in feasibility studies and cooperative agreements rescinded. o Awarded $3.65 billion of the $5 billion allotted for other incentives.

TABLE 16-1

FEDERAL LEASING

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	--	--	$1.2	$2.4	
Obligation:	--	--	$1.1	$2.1	
Develop initial leasing programs to fill DOE statutory requirements for coal and for Outer Continental Shelf (OCS) oil and gas by 1981. Develop initial leasing program for onshore oil and gas, oil tar sands, shale, geothermal, and uranium by 1983.		o Coordinated coal program with DOI to coincide with 7/79 DOI decisions.	o Participated in DOE-DOI Coal Task Force which established tract selection, leasing targets, and leasing sale schedules.	o Completed seven OCS oil and gas bidding systems and one coal bidding system; new coal diligence regulations.	o Coal and OCS oil and gas objectives met.
Develop production forecasts for each resource to evaluate the need for leasing larger tracts and conducting earlier lease sales.	o Initiated coal and OCS production forecasts.	o Completed coal biennial production forecasts.	o Completed OCS oil and gas production forecasts, production updates for new DOI leasing program.	o Initiated biennial update of OCS oil and gas and completed coal and coal synfuels production forecasts.	o Completed coal and OCS production estimates for accelerated lease schedules.
Develop resource analysis and regulatory, economic, and environmental analysis for bidding systems, diligent development, royalty oil, lease competition, and production rates.	o Completed eight OCS oil and gas and three coal resource analyses for alternative bidding systems.	o Completed eight economic and regulatory analyses for OCS oil and gas alternative bidding systems. Initiated draft regs for four OCS bidding systems.	o Initiated OCS diligent development analysis. Completed final regs on four OCS bidding systems. Completed draft bidding systems for three coal and six OCS bidding and royalty oil regs.	o Completed seven OCS and coal bidding systems.	o Completed all original objectives in addition to court-ordered OCS regulations (Energy Action v. Andrus).
Develop production rates for onshore and OCS oil and gas by end of FY 82, for coal and oil shale by end of FY 84, and for geothermal and tar sands by end of FY 85.	o No funds available for program initiation.	o No funds available for program initiation.	o Initiated oil and gas production rates study with Los Alamos National Scientific Laboratory.	o Production rates analysis expanded to include projected demands for coal as a basis of synfuels.	o Production rates remain undeveloped.

TABLE 16-1

FEDERAL LEASING

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Develop resource analyses to identify areas with high energy production potential.	o Completed Forest Service RARE II Analysis. Data provided USFS, EPA, DOE, and OMB guidance to Executive Office.	o Federal lands program initiated in FY 79 and coordinated with Bureau of Land Management for identification of key energy areas.	o Identified geothermal, uranium, coal, oil shale, and tar sands resource areas on Federal lands.	o Completed review of all coal, oil shale, geothermal, oil and gas, tar sands, and uranium areas suitable for development.	o DOE objectives met. All information forwarded to Bureau of Land Management in FY 81.
Approve or disapprove terms and conditions for energy leases.	o Approved DOI emergency coal leases under short-term leasing criteria.	o Reviewed and approved ten coal emergency and hardship and five OCS lease sales.	o Reviewed one new coal program and three OCS lease sales.	o Reviewed three DOI coal and five OCS lease sales.	o All DOI lease sales terms and conditions have been completed.
Review of Coastal Zone Management (CZM) plans submitted by coastal states.	o Reviewed coastal state CZM plans.	o State CZM plans reviewed and comments coordinated with DOI and Department of Commerce.			o All state CZM plans reviewed, with all changes coordinated with DOI and DOC.

TABLE 17-1

URANIUM RESOURCE ASSESSMENT

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$68.5	$72.9	$61.5	$30.8	
Obligation:	$67.9	$72.9	$61.5	$30.5	
Assess by 12/81 the 272 quadrangles most likely to contain uranium deposits. Assess the remaining 349 quadrangles by 12/83.		o 18 quads evaluated; published Interim Report, June 1979.	o 117 more quads evaluated.	o 27 additional quads evaluated; published comprehensive assessment report in October 1980.	o Goal was reduced to assessment of 116 priority quads by FY 80; that goal was exceeded. 46 additional quads were assessed by FY 81 to complete the quad assessments. Known U.S. uranium areas were reassessed completely, and an extensive data base on entire U.S. was developed for continuing resource studies. Reports published on schedule.
Perform radiometric and geochemical surveys of the United States and published reports.	o 433 NURE reports published.	o 469 NURE reports published.	o 323 NURE reports published.	o Published comprehensive Assessment Report in October 1980; 700 NURE reports published.	o Interim and Assessment Reports published on schedule.
Issue quarterly reports of uranium resource estimates based on proprietary industry data and analyses of uranium supply.	o Results published in 4 technical reports.	o Results published in 4 technical reports.	o Results published in 4 technical reports.	o Results published in 4 technical reports.	o All reports published on schedule.
Develop advanced technologies for detection and assessment of uranium resources and publish research results.	o Research results presented in 38 technical reports.	o Research results presented in 37 technical reports.	o Research results presented in 39 technical reports.	o Research results presented in 24 technical reports.	o Reports published on schedule.
Support international uranium resource evaluations and other international activities.	o Participated in 4 programs.	o Participated in 4 programs.	o Participated in 4 programs.	o Participated in 4 programs.	o Work completed on schedule.

TABLE 17-2

URANIUM RESOURCE ASSESSMENT

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $10.0

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Issue reports on uranium resources and supply analyses based on industry-supplied data.	o There are no alternative methods. Because of the proprietary nature of the industry data, only the U.S. Government is trusted to assemble the information.	o Maintain industry confidence in order to continue to obtain proprietary data. o Maintain qualified staff to evaluate data.	o Assess the viability of the U.S. uranium industry in accordance with Atomic Energy Act, sec. 161v. o Provides the only reliable estimates of U.S. uranium resources.
Publish a uranium evaluation report for 162 quadrangles.	o Since only DOE has the information and the expertise to analyze and report on the information, there are no alternative methods.	o Assess the information acquired during the NURE program. o Publish the report by the end of FY 83.	o Completes the evaluation of information that was acquired by the NURE program.
Support international uranium resource evaluations and other international activities.	o Rely on foreign governments to support the evaluations.	o Maintain role in international activities. o Maintain data analyses capability.	o Contributes to the international data base of natural uranium supplies. o This program is proposed for termination in FY 83.

TABLE 18-1

CONVENTIONAL REACTOR SYSTEMS

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$149.4	$114.9	$81.0	$104.4	
Obligation:	$149.2	$113.7	$79.3	$103.8	

Historical Goal: To conduct R&D on plant and fuel technology and transfer technology to the private sector to enhance the role of converter reactors in meeting the energy needs of the United States.

LIGHT WATER REACTOR SYSTEMS:

Goals/Objectives	FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Conduct R&D to improve LWR safety and reduce safety-related institutional barriers.		o Program initiated. Technical Manager installed. Data and research published in five technical reports.	o Ten individual projects completed. Data and research results published in 14 technical reports.	o Five individual projects completed. Data and research results published in 14 technical reports.	o A major generic safety issue has been resolved. Significant transfer of technical information has been achieved. A large effort is still required to resolve institutional problems.
Develop and demonstrate extended burnup fuels to 50,000 megawatt days/metric ton (MWd/mt), (current industry standard is 30,000 MWd/mt) to reduce uranium requirements by up to 15 percent by 1988, and to reduce spent fuel storage requirements by up to 40 percent.	o Cooperative cost-sharing agreements with industry. One project continuing to improve fuel reliability. Two projects initiated to increase burnup.	o Eleven projects initiated involving long-term (2-7 yrs.) irradication in commercial LWR's.	o Eleven projects initiated including three international cooperative projects. Peak burnup of 40,000 MWd/mt achieved.	o Two projects initiated, including one international cooperative project. Two projects completed, including assessment of long-term design improvements.	o Burnup capability of current design fuel demonstrated to greater than 40,000 MWd/mt. Irradiation of advanced design fuel initiated to demonstrate burnups to 50,000 MWd/mt.
Conduct R&D and demonstrate technology to reduce occupational exposure to as low as reasonably achievable while improving availability of nuclear plants. (50% reduction in annual average plant man-rem exposure.)	o Previous projects with electric utilities and vendors continued. Started two projects. Continued one project, and completed 10 projects for reducing maintenance outages.	o Completed two projects; continued two projects to improve plant availability. Started four projects (1-4 yrs. duration) in dose reduction.	o Closed out one project after Phase I. Completed one availability project and continued four dose reduction projects.	o Started two and continued three dose-reduction projects.	o For that part of program where full plant demonstrations were completed, a 10-15% dose reduction will be achieved when fully adopted by industry. Future projects were terminated.

TABLE 18-1

CONVENTIONAL REACTOR SYSTEMS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
HIGH-TEMPERATURE REACTORS:					
Develop high-temperature reactor technology and determine commercial potential. Program emphasis was shifted to different applications.	o Gas-Cooled Reactor Associates formed to serve utility interest in HTR's.	o Steam Cycle work discontinued. Program emphasis on Technology Development for High-Temperature Applications.	o Work redirected to select lead plant among four options: - Gas Turbine - Cogeneration - Reformer - Nuclear Heat Source Demonstration Reactor.	o Selected steam cycle/ cogeneration and high-temperature reformer options for further design and development.	o Technology development on schedule. Lead plant options narrowed. Several potential utility/user sponsors for lead plant identified.
REDUCED-ENRICHMENT RESEARCH AND TEST REACTORS:					
Develop and demonstrate reduced enrichment fuels for research and test reactors (20% U-235 for most reactors) to reduce proliferation potential. Complete demonstrations by 1988.		o Test samples of plate-type fuels up to maximum loading were fabricated. 30 high enriched uranium (HEU) procurement requests were evaluated.	o Data compiled on all U.S. reactors and one half of all foreign reactors. More than 24 foreign nationals trained on conversion of reactors to REU fuels.	o Displaced HEU fuel in Ford Nuclear Reactor with low enriched uranium (LEU) fuel. Reduced enriched uranium (REU) fuel in prototype assemblies inserted in ORR and Petten (Netherlands) Reactor.	o Early program objectives were met on schedule; fuel irradiation demonstration has been deferred subject to changes in Departmental priorities.

TABLE 18-2

CONVENTIONAL REACTOR SYSTEMS

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $106.9

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Current Goal: In cooperation with industry and NRC, to significantly contribute to the resolution of major LWR industry institutional problems particularly those involving regulatory reform and public understanding; to develop and improve 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.			
LIGHT WATER REACTORS SYSTEMS:			
In cooperation with industry and NRC, to significantly contribute to the resolution of major LWR industry institutional problems particularly those involving regulatory reform and public understanding.	o None.	o Provide a technology base for industry and NRC to reach more rational safety decisions. o Provide a framework and basis for more rational LWR safety regulation.	o Initiate tasks consistent with P.L. 96-567 (Nuclear Safety Research & Development Act of 1980). o Development of required data base to ensure adequacy of safety functions. o Define institutional rules for adequate ensurance of safety functions.
Develop and demonstrate extended burnup fuels to 50,000 MWd/mt.	o Rely on private sector and industry to perform R&D. o Utilities to construct additional spent fuel storage facilities.	o Complete demonstration irradiations and development of supporting data base.	o To reduce uranium requirements by up to 15% and reduce spent fuel storage and reprocessing requirements by up to 40%.
Complete demonstration and development of selected technologies for reducing radiation doses.	o Rely on industry to further reduce worker exposure.	o Complete ongoing demonstration projects in FY 82.	o Permits orderly program closeout.

TABLE 18-2

CONVENTIONAL REACTOR SYSTEMS

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification -- and Services Provided
Identify approaches and address institutional impediments to reduce lead times and costs for powerplant construction.	o Rely on private sector to develop approaches and resolve institutional impediments.	o Conduct in-house studies and assessments of promising approaches.	o Permits identification of promising approaches for industry implementation. This program will be completed in FY 82.
THREE MILE ISLAND:			
Develop and improve measures for enhancing safety and reliability of nuclear plants using TMI and other plant information.			
- Acquire and disseminate data that the utility would not collect from TMI cleanup and recovery to improve safety of other LWR's.	o Persuade EPRI to fund data acquisition work.	o Cooperation of GPU for entrance into TMI facility.	o Continue data acquisition, including inspection of instrumentation and electrical components, obtaining and analyzing solid, liquid, and gaseous radioactive samples, planning for offsite examination of selected specimens to be removed from the damaged TMI core, and develop data and specimen storage for future use.
- Begin examination in 1983 of TMI reactor and core components to increase understanding of accident and improve LWR safety.	o Persuade owner (GPU) to fund R&D activities.	o Cooperation of GPU for entrance into TMI facility.	
- Conduct waste management and abnormal waste product immobilization R&D; develop technology for processing and disposing of these wastes.	o Persuade other interested parties to fund waste immobilization R&D activities.	o Cooperation of GPU for use of TMI facilities.	o Examine TMI-2 reactor and core components at TMI, remove and inspect reactor vessel head and plenum, and initiate core and core debris inspection and encapsulation. o In FY 83, provide demonstration of vitrification and other waste immobilization technologies. Beyond FY 83, examine other techniques for treatment of zeolites including alternative concepts, confidence testing, and sample observations to build the data base.

TABLE [illegible]-2

CONVENTIONAL REACTOR SYSTEMS

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
HIGH-TEMPERATURE REACTORS:			
Provide technological base for High-Temperature Reactors, especially for process heat applications.	o Rely on fossil fuels or foreign technology for energy needs of process heat and synfuels market.	o Project Decision Package activities are needed to provide a basis for private sector support. o Federal HTR program requires a utility organization to express an interest in building an HTR lead plant.	o Provide project definition package in FY 82 and finalize arrangements for cooperative government-industry program.
- Conduct focused technology and lead plant design and development program.	o Let private sector fund commercialization of concept exclusively.	o Technical support for the Project Decision Package activities.	o Continue technology program and application-studies.
- In absence of utility commitment, terminate program in last quarter of FY 82.		o Approximately $5 million in close-out costs if program is terminated.	o If program is terminated, mothball facilities, decontaminate hot cells, and write final reports.
REDUCED-ENRICHMENT RESEARCH AND TEST REACTORS:			
Complete development and demonstration of LEU fuels through FY 82. However, Federal support for the program after FY 82 will have to be provided by other than DOE funding authorizations.	o Complementary (not alternative) analyses/test activities initiated by foreign governments.	o Congressional authorization in other Federal agency.	o In FY 82, irradiate full core of reduced enrichment fuels in FNR. Procure and initiate irradiation of prototype assemblies of LEU-silicide fuels in the ORR and SILOE reactors.

TABLE 19-1

REMEDIAL ACTIONS

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$21.2	$24.0	$31.6	$46.4	
Obligation:	$18.7	$20.0	$30.0	$45.4	
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.					
Perform remedial actions on properties formerly used for MED/AEC operations for 14 sites where DOE has authority to proceed.		o Program initiated. o Remedial action partially completed at Kellex site.	o Remedial action partially completed at Kellex site. o Remedial action initiated at Middlesex.	o Remedial action completed at Kellex site. o Remedial action two-thirds completed at Middlesex. o Remedial action initiated at Niagara Falls site.	o Remedial action has been completed only at Kellex site; certification pending. o Remedial action was two-thirds completed at Middlesex. o Remedial action was initiated at Niagara Falls site.
Perform preliminary studies on other formerly used MED/AEC sites.	o Performed radiological surveys.	o Performed radiological surveys and 3 preliminary engineering studies. o Program for remedial action organized and assigned to Oak Ridge for implementation.	o Performed radiological surveys and one environmental assessment. o Program management plan prepared. Draft legislation prepared.	o Performed radiological surveys. o Program management contractor selected and under contract.	o Three remedial action plans were completed. o Radiological surveys were completed for 126 sites.
Carry out the program of remedial action at an estimated 740 occupied contaminated structures in the vicinity of Grand Junction, Colorado, as authorized by P.L. 92-314.	o Total of 93 properties surveyed and designated; undertook remedial action on 37 properties. (About 150 properties surveyed prior to 1978.)	o Total of 136 properties surveyed and designated; undertook remedial actions on 26 properties.	o Total of 161 properties surveyed and designated; undertook remedial actions on 32 properties.	o Total of 250 properties surveyed and designated; undertook remedial actions on 50 properties.	o With remedial actions completed at about 400 of an estimated 740 sites (150 surveys completed prior to 1978 and 250 completed from 1978-81), the program is estimated to be 55 percent complete.

TABLE 19-1

REMEDIAL ACTIONS

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
Maintain surplus commercial-related facilities in a safe condition.	o Surveillance and maintenance conducted for all surplus facilities.				o Objectives met.
Eliminate the backlog of 120 surplus commercial-related facilities under a progressive program to be completed by the year 1992.	o Complete 2 projects; continue 2 ongoing projects; begin 9 projects; develop plans for 10-year program.	o Continue 11 ongoing projects; complete 4 projects.	o Program reduced; 2 projects completed; continue 5 ongoing projects.	o Begin Shippingport Reactor; continue 5 ongoing projects.	o Program organized and administered through Richland Operations Office; program plan prepared; only 8 small projects completed, but overall goal could be met by 1992.
Carry out the program of remedial action at 24 inactive uranium mill tailings sites and at 5,000-6,000 associated vicinity properties as authorized by P.L. 95-604.	o NA	o P.L. 95-604 enacted November 1978. o Implementation plan approved. o Project office established at Albuquerque. o Site surveys initiated.	o Surveyed vicinity properties at Canonsburg, Pa.; Salt Lake City, Utah; and Lawman, Idaho. o NEPA work initiated. o Development of stabilizations technology initiated.	o Completed cleanup of Salt Lake City Fire Station #1. o Initiated assay of 13 tailings piles for reprocessing. o EIS's started for first three high priority sites. o Technical assistance contractor selected.	o Basic planning and contractor acquisition phase nearing completion. o Upon promulgation of EPA standards now scheduled for FY 82, program implementation will begin. o Program plan shows completion in 7-year period mandated by P.L. 95-605.

TABLE 19-2

REMEDIAL ACTIONS

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $43.1

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
FOR MED/AEC SITES:			
Eliminate potential health hazards from changed use of unrestricted property that is slightly contaminated. Eliminate stigma on properties that have been designated for remedial action.	o Institutional controls to limit use and stabilize radioactivity onsite. o Promulgate less stringent radioactivity control and disposal guidelines.	o Perform remedial actions on properties formerly used by MED/AEC operations for 14 sites where DOE has authority to proceed.	o MED/AEC sites work in FY 82 will continue on sites currently authorized for remedial action; cleanup and stabilization actions will be completed for 3 of the 4 high-priority sites, and 2 of the 9 low-priority sites.
Determination of potential health effects. Estimates of remedial action options costs, and schedules.	o Perform radiological surveys but designate only those properties where health effects are possible because of potentially changed use; supply institutional controls to use changes. o Perform preliminary engineering studies only for authorized sites or where Congress requests studies.	o Perform radiological surveys and preliminary engineering studies on other formerly used MED/AEC properties.	o Determination of need for actions on sites which may present possible health effects.
GRAND JUNCTION:			
Carry out the program of remedial action at contaminated occupied structures in the vicinity of Grand Junction, Colorado, in cooperation with the state, as authorized by P.L. 92-314.	o Removal of tailings from beneath and around structures. o Remove structural materials such as concrete and mortar using tailings as aggregate. o Improve ventilation. o Seal structures to deter entry of radon.	o Relieve health hazards in about 350 residences or other occupied structures where tailings have been used in construction. o Consolidate tailings at Grand Junction mill tailings site, from which they were removed, pending remedial action at the site under P.L. 95-604.	o The Grand Junction 75/25% cooperative program with State of Colorado will continue; remedial actions will be completed for 80 structures in FY 83, and 187 will remain to be done.
DOE SURPLUS ACTIVITIES:			
Ensure that the public and the environment are protected from potential hazard.	o Decommission all surplus facilities immediately.	o Continue surveillance and maintenance for surplus commercial-related facilities.	o Maintain facilities in safe condition.

TABLE 19-2

REMEDIAL ACTIONS

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Ensure that best technology is available to DOE and nuclear industry for decommissioning; reduce costs.	o Continue using currently available techniques; rely on private sector to fund development.	o Develop new and improved disposition methods; make available to nuclear industry.	o Make new and improved technology available to reduce costs and facilitate future decommissioning.
Eliminate the potential hazard to public and environment under a planned program.	o Defer all decommissioning; continue surveillance and maintenance for all facilities.	o Eliminate backlog of surplus commercial-related facilities under a progressive program to be completed by FY 92.	o Continue engineering at Shippingport; begin work at Monticello mill tailings site; continue Mound decommissioning project; complete Sodium Reactor Experiment and Westinghouse ARD project. Will meet objective of completing program by FY 82.
Eliminate the potential hazard to the public and environment.	o Defer all decommissioning; continue surveillance and maintenance for all facilities.	o Eliminate the backlog of surplus defense-related facilities under a progressive program to be completed by the year 2000.	o Conduct projects at Hanford, Weldon Spring Site, Niagara Falls Storage Site, and continue projects at ORNL. Objective could be met.
URANIUM MILL TAILINGS:			
Carry out the program mandated by P.L. 95-604, to provide remedial action at 24 designated inactive mill tailings sites in cooperation with affected states and Indian tribes.	o Stabilize tailings in place. o Clean up existing site; transport tailings to new disposal site. o Above or below surface disposal. o Soil or fabricated covers and liners.	o Relieve health hazards at designated vicinity properties where tailings have been used in construction. o Relieve potential health hazards to populations in the vicinity of unstabilized mill tailings piles. o Remove tailings from open lands to prevent future construction on tailings or other prolonged exposure. o Consolidate tailings in safe, permanent, licensed disposal sites.	o Planning studies leading to remedial action concepts. o NEPA activities and documentation. o Engineering design of cleanup and disposal operations. o Performance of remedial action. o Development of more efficient and cost-effective cleanup and dispoal technology. o Acquisition of processing and disposal sites, as required.

TABLE 20-1

BREEDER REACTOR SYSTEMS

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$756.9	$721.8	$693.7	$689.5	
Obligation:	$733.6	$703.4	$688.6	$675.3	
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.					
LIQUID METAL FAST BREEDER REACTOR PROGRAM (LMFBR):					
Design, construct, and test Clinch River Breeder Reactor Plant and operate as part of a utility system; date uncertain due to Administration objections to project. Specific objective: - Continue design and procurement consistent with funding levels provided.	o The following indicates progress in design completion and equipment procurement. Design: 63% complete. Procurement: $400 million of components on order or delivered.	75% complete. $465 million of components on order or delivered.	79% complete. $533 million of components on order or delivered.	86% complete. $600 million of components on order or delivered.	o Due to previous Administration objections, construction activities of the Clinch River Breeder Reactor Plant (CRBRP) were not initiated as planned. This delay stretched out the CRBRP schedule and increased the total estimated cost of the plant. However, the project was funded by Congress, which permitted design and procurement activities to continue. The design work met the required technical specification and most procurement contracts were completed on schedule and within cost.
Develop conceptual design of large (1,000 MWe) LMFBR powerplant and submit report to Congress. Specific objectives: - Initiate Conceptual Design--1978. - Complete Conceptual Design and submit report--March 31, 1981.	o Initiated Phase I technical screening process--October 1978. o Completed Phase I, initiated Phase II Conceptual Design effort--December 1979. o Completed Phase II, issued Large Developmental Plant final report--March 1981. o Initiated Phase III Advanced Conceptual Design--April 1981.				o The original objective was met since the Conceptual Design Study Final Report was submitted to Congress on March 31, 1981. The Conceptual Design met the required technical specifications and was delivered on schedule and within cost.

TABLE 20-1

BREEDER REACTOR SYSTEMS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Conduct a LMFBR R&D program and develop a technology base to support plant design and development projects, including the completion and operation of the Fast Flux Test Facility and operation of other facilities. Specific objectives: - FFTF Sodium Fill--1978. - FFTF Fuel Loading--1979. - FFTF Operation at 100% power--1980.	o Through FY 78-FY 81, the LMFBR R&D program continued to advance U.S. LMFBR technology in the areas of components, safety, physics, fuels, and materials. Important milestones for the Fast Flux Test Facility (FFTF), a 400-MWt sodium-cooled fast reactor designed for testing of LMFBR fuels and components, are noted below: - FFTF Sodium Fill--November 1978. - FFTF Fuel Loading--November 1979. - Initial FFTF criticality--February 1980. - FFTF first operated at 100% power--December 1980.				o The LMFBR R&D program met the required technical specifications and met the objective of maintaining the LMFBR in a state of readiness. Based on the 1975 baseline schedule, the FFTF was completed under estimated cost ($640M vs. $647M), but with a 10-month schedule delay.
	o In addition, the R&D program operates other test facilities including the Experimental Breeder Reactor II, safety facilities such as the Safety Research Experiment Facility, and Fuels and Materials facilities. Testing of large heat transport system components is conducted at the Energy Technology Engineering Center.				o The LMFBR test facilities met the required technical specifications.
GAS-COOLED FAST REACTOR:					
Evaluate and conduct R&D for gas-cooled fast breeder reactor system as a long-term nuclear power option.	o Helium Breeder Assoc. formed to serve utility interests. Single international design selected.	o DOE/utility plan developed for demo plant.	o Conceptual design complete. Program termination initiated.	o Program termination completed.	o Objectives were met. Program terminated at end of FY 81 to concentrate resources on LMFBR program.

TABLE 20-1

BREEDER REACTOR SYSTEMS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
WATER-COOLED BREEDER REACTOR:					
Shippingport Atomic Power Station					
Produce the first commercial electric power through use of nuclear energy in the United States.	o Generation of electrical power recommended in FY 78 after LWBR core installation and has continued since.				o December 2, 1957, the Shippingport Atomic Power Station started operation.
Operate first Light Water Breeder Reactor (LWBR).	o Complete installation and commence reactor operation.		o Continue reactor operation.		o The light water breeder reactor installed in the Shippingport Atomic Power Station was released for routine commercial power distribution December 2, 1977, and has operated for more than 22,800 efph.
Light Water Breeder Reactor (LWBR)					
Develop first Light Water Breeder Reactor.	o Complete manufacture of LWBR core.	o Provide technical support and analysis for LWBR operation.			o The Light Water Breeder Reactor was successfully installed in the Shippingport Atomic Power Station in 1977.
Prove breeding can be achieved in a light water nuclear powerplant using a thorium/U-233 fuel system.	o Plan for LWBR end-of-life effort and design needed equipment.	o Continue preparations, design and procure equipment for end-of-life effort.			o Data gathered from ongoing test programs are confirming technical predictions that breeding in the LWBR core is taking place. After completing operation, the spent fuel will undergo a detailed core examination to verify core performance and breeding characteristics.

TABLE 24-2

SOLAR APPLICATIONS FOR BUILDINGS

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
- Evaluate system effectiveness. Identify and undertake required improvements to develop systems with 20-year lives and annual O&M costs less than 3% of total system costs. - Complete development of uniform test methods and evaluation procedures.		o Private sector has been focusing primarily on components rather than on systems development.	o Evaluation of system effectiveness based on previous demonstration projects, private sector projects, and specifically built prototype systems. o Development of standard systems analysis methods for evaluating any existing or new system.
PASSIVE SOLAR HEATING AND COOLING PROGRAM:			
Residential Buildings			
Complete work on research, analysis, and testing of advanced heating, cooling, and integrated systems (hybrid and mixed) that promise technological feasibility to achieve average performance measurement of $195 per MMBtu annual capacity while contributing an average of 30% of building energy requirements.		o This research seeks to meet the need for passive and hybrid systems by completing multifamily heating work, single and multifamily heating work, single and multifamily cooling, and integrated systems.	o Develop proven and reliable multizone heating system designs. o Develop and test basic cooling and daylighting strategies that are compatible with advanced heat, ventilation, or air conditioning systems. o Collect and analyze actual performance data from experimental integrated system.
Commercial Buildings			
Complete work on research, analysis, and testing of integrated heating, cooling, and lighting prototype systems that can achieve an average technology-feasible performance measure of $375 million Btu annual capacity, at an average potential contribution of 15% of building energy requirements.	o Reliance on the private sector.	o This research will help to ensure that passive solar hybrid systems will be available for light commercial buildings and that systems for complex buildings and integrated systems will be brought on line.	o Develop methods of design and analysis that have been validated against actual field performance and other experimental data. o Develop new materials and components to improve system efficiency, increase year-round system capabilities, and reduce construction costs. o Achieve accelerated use of passive/hybrid technologies in new and retrofit applications.

TABLE 20-2

BREEDER REACTOR SYSTEMS

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $678.1

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
LIQUID METAL FAST BREEDER REACTOR PROGRAM:			
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 inexhaustible nuclear resources of the United States for electrical energy production.	o Import foreign reactors and technology. o Rely on domestic industry to perform R&D and develop base. o Develop cooperative programs with foreign developers.		
- Design, construct, and test Clinch River Breeder Reactor Plant and operate as part of utility system. Secure NRC consideration of remaining safety issues and resolve. Specific objectives include: - Start Site Preparation Activities--FY 82. - Plant Operation--FY 89.		o Requires NRC authorization to start site preparation in 1982.	o Continue finalization of systems designs, including release of virtually all drawings. In FY 82, start site preparation activities. Continue placement of hardware contracts, including polar and building services cranes, expansion tanks, steam generator feed pump, thermal transient valves, and the protected air-cooled condenser.
- Design a Large Developmental Plant (LDP). Advance the LDP conceptual design.		o Private sector cooperative agreement.	o The project scope in FY 82 includes preparation of project management procedures, design of key plant systems, and preparation of specifications for long-lead equipment.

TABLE 20-2

BREEDER REACTOR SYSTEMS

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Conduct LMFBR technology base program to ensure efficient and effective development of LDP, including: component development, test facilities operation, physics measurements and analyses, and fuels and material R&D. Support remaining CRBRP technology requirements. Conduct base program safety research to support CRBRP and LDP plant licensing and safety reviews, emphasizing accident prevention.		o Provide the test facilities and capability to test the technology and components developed in the technology program as well as prototypes of components to be incorporated into plant projects.	o Provide required technology for design, construction, and operation of the CRBRP, and increasingly, the LDP, including steam generator and sodium pump development, high-temperature structural design and materials technology, FFTF fuels systems performance characterization, LDP fuel system work, and LDP physics. o Safety program activities to include continuing work to demonstrate reactor system reliability in preventing the occurrence of accidental events. o Test facilities are required in support of plant projects and breeder technology program elements.
WATER-COOLED BREEDER PROGRAM:			
<u>Shippingport Atomic Power Station</u>			
Terminate reactor operations.	o Rely on the private sector to develop the technology.	o Congressional approval to complete defueling and end-of-life testing.	o End-of-life program allows technical data to be obtained from actual operations of the Light Water Breeder Reactor core.
<u>Light Water Breeder Reactor (LWBR)</u>			
Prove breeding can be achieved in a light water nuclear powerplant using Uranium-233/thorium oxide; confirm a practical way to use thorium.	o Rely on the private sector to develop the technology.	o Completion of proof-of-breeding effort.	o Successful development of this breeder cycle, including confirmation of breeding in the Shippingport LWBR core, will provide the basic technology which would make available for power production about 50% of the energy potential of our Nation's thorium reserves, a source of energy many times greater than known fossil fuels.

TABLE 20-2

BREEDER REACTOR SYSTEMS

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Advanced Water Breeder Applications (AWBA)			
Exploring technical problems and developing and disseminating technical information through published reports.	o Rely on the private sector to develop the technology.	o Test facilities and technology development through FY 82.	o This program will document data to improve breeding performance beyond the Shippingport LWBR core capability, prebreeder concepts, and disseminate technical information to assist industry in evaluating water-cooled breeder technology.
FUEL CYCLE DEVELOPMENT:			
Provide a demonstrated fuel reprocessing technology that enhances safety, environmental protection, safeguards, and operational reliability, and minimizes proliferation risk with acceptable economics.	o Same as above.		
- Complete Hot Experimental Facility Design by 1982. - Demonstrate technical feasibility of operating a secure, remotely operated and maintained prototype reprocessing facility in a safe, clean, and efficient mode by 1983.		o Develop advanced reprocessing equipment components for fuel recovery and effluent control; develop improved electro-mechanical manipulators for total remote maintenance (REMOTEX); and develop advance instrumentation and robotic sampling for process control and safeguards. (Ultimate radioactive demonstration of the reprocessing technology to be done in a Hot Experimental Facility (HEF).)	o Eventual adoption of LMFBR system requires associated fuel cycle development.

TABLE 21-1

ADVANCED NUCLEAR SYSTEMS

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$73.9	$54.5	$39.4	$40.7	
Obligation:	$73.7	$54.2	$39.2	$40.5	
SPACE AND TERRESTRIAL APPLICATIONS PROGRAM:					
To respond to other Federal agencies' requirements for design, development, and delivery of space nuclear power systems and adaptation of applicable technologies to beneficial military terrestrial use.					
- Design, develop, demonstrate, and deliver qualified nuclear thermoelectric isotope power systems for use on Galileo and Solar Polar space missions (Milestones shifted due to launch date changes: in 1979 delivery objective was FY 1982).	o Initiated design of Selenide Isotope Generator (SIG) for the Jupiter Orbiter/Probe mission. o Transferred fuel-form production from Mound Facility to Savannah River and started up.	o Completed multi-hundred watt (MHW) RTG design modification for Galileo. o Completed General Purpose Heat Source (GPHS) RTG conceptual design for International Solar Polar Mission (ISPM). o Initiated line set-up at GE for Silicon Germanium (SiGe) unicouples.	o Completed environmental qualifications test on Q-2 and initiated refurbishment of RTG flight converter for Galileo. o Completed fabrication of SiGe unicouple for engineering unit. o Completed design selection test.	o Completed refurbishment and stored MHW RTG Converter for Galileo. o Complete Hot Test of CET-1. Fabricate Converter Engineering Test unit (CET) for JPL. o Fabricated and tested 18 SiGe unicouple modules. o Completed (GPHS) design verification test. o Initiated heat source (fuel) fabrication for GPHS. o Supported fuel and safety flight requirements. o Initiated shock/vibration test on CET-1 for ISPM and Galileo.	o All technical objectives met. All launch date milestones were met. Intermediate milestones met approximately 90% of time. Objectives met within budget.

TABLE 21-1

ADVANCED NUCLEAR SYSTEMS

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
- Develop and demonstrate various static, dynamic, and reactor nuclear power systems technologies.	o Completed Phase I ground demonstration test on two competing concepts for Dynamic Isotope Power Systems (DIPS) and made selection July 78 for follow on flight development.	o Demonstrated efficiency improvements on selected component for DIPS-below prediction. o Conducted experimental verification tests on RTG materials.	o Fabricated upgraded components for 5,000-hour endurance test for DIPS. Program concluded. o Ground Demonstration System (GDS) demonstrated improved performance. o Tested on all bonded segmented selenide couple.	o Signed contract for advanced thermoelectric materials technology in August 1981.	o Objectives met--technology improvements factored into flight system hardware program elements.
- Demonstrate beneficial uses of radioisotopes in various terrestrial applications such as sewage sludge irradiation; operate pilot sludge irradiation in FY 1979.		o Pilot sludge irradiation began operation.			o Objective was fully met.
SYSTEMS EVALUATIONS: 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 for nuclear power systems and competing technologies.					
- Conduct assessments and evaluations of advanced nuclear technologies and applications including low temperature and waste heat utilization, low-water-use heat rejection systems, and nuclear energy centers; some objectives varied from year to year.	o Completed preliminary phase of intermediate-size nuclear powerplant assessment.	o Completed preliminary technical and economic feasibility study of district heating for Twin Cities (Minnesota).	o Completed design effort on the advanced wet/dry cooling test unit.	o Completed planning phase for St. Paul 200-MWt district heating system. o Completed South Carolina Energy Center Study. o Completed large-scale powerplant tests of the impact of cooling tower heat and moisture releases on meteorology.	o Objectives were fully met.

TABLE 21-1

ADVANCED NUCLEAR SYSTEMS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
	o Completed large plant process heat studies at two industrial sites.	o Achieved full operational capability of the Hanford Engineering Development Laboratory (HEDL) water use/requirements data bank.	o Completed analysis of high-temperature heat transfer mediums for use in cogeneration/process heat systems.	o Completed economic study of nuclear and coal plants for district heating in Twin Cities area.	
				o Completed revised assessment of availability of U.S. water resources for cooling electric generating units considering all competitive uses.	
				o Completed update of Energy Economic Data base to 1981 costs.	
Nonproliferation Alternative Systems Assessment Program					
Recommend to the Administration options for civilian nuclear power systems for increasing resistance to nuclear proliferation. Issue draft report by 7/79. Support U.S. participation in the International Nuclear Fuel Cycle Evaluation Program.	o Program initiated.		o Draft report issued for public comment December 1979. o Final report of the Nonproliferation Alternative Systems Assessment Program issued June 1980.		o Technical objectives of the program were met. Draft report was issued 5 months late due to extensive review process.

TABLE 21-2

ADVANCED NUCLEAR SYSTEMS

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $37.6

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
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.			
SPACE NUCLEAR SYSTEMS PROGRAM:			
Design, develop, demonstrate, and deliver nuclear energy systems for use on U.S. space missions (Galileo, Solar Polar); deliver in 1984. Galileo mission (1985); International Solar Polar Mission (1985/6); Space Power Advanced Reactor decision point (1986); mission: mid-1990's. (Galileo and Solar Polar efforts through FY 1990.)	o None.	o Assembly of the Galileo and Solar Polar qualification radioisotope thermoelectric generators (RTG's) needs to be completed in FY 1982, the three Galileo flight RTG's need to be assembled in FY 1983, the Final Safety Analysis Reports have to be completed in FY 1984 and FY 1985, and flight-accepted RTG's need to be delivered to Cape Canaveral in FY 1985.	o Required for production and test of hardware for NASA Galileo spacecraft (1985) and for NASA International Solar Polar mission (1985/6). Systems are essential for missions.
Develop and demonstrate various static, dynamic, and reactor space power systems technologies to meet above objectives.	o None.		o Required for fabrication, test, and evaluation of materials and components for proposed flight systems; conduct system safety testing, reviews, and analysis. Program element is essential to hardware development above.
TERRESTRIAL ISOTOPE APPLICATIONS PROGRAM:			
Evaluate and develop beneficial terrestrial utilization of isotopes recoverable from reactor wastes. (Krypton-85 self-luminous lights for candidate military applications.)	o Defense applications classified, therefore none.	o Evaluation of candidate applications ongoing. (Defense needs are classified.)	o Support of National Security missions and investigations of advanced terrestrial systems. (Classified) o Cesium-137 sewage sludge program limited support (Albuquerque, New Mexico). o Application studies of krypton-85 self-luminous lights (e.g., military airfield runways).

TABLE 22-1

COMMERCIAL WASTE MANAGEMENT

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$193.4	$211.2	$206.9	$206.1	
Obligation:	$181.2	$173.5	$204.9	$203.5	
Historical Goal: To provide the technology and facilities necessary to meet all applicable safety and environmental requirements for the long-term management of nuclear waste from commercial sources.					
Investigate five alternative geologic formations for the first repository site by early 1980's.	o Regional studies completed and study areas recommended for Salina and Gulf Interior regions.	o Investigations of nonsalt geologies accelerated by initiation of crystalline and argillaceous studies.	o Narrowed site selection at Hanford and Nevada Test Site (NTS). o Conducted site evaluation in six states. o Area characterization studies initiated in 1980 in Paradox Basin, Utah and Colorado.	o Completed area phase field studies in the Gulf Coast.	o Alternative geologic sites investigated. Current plan is that a minimum of 3 exploratory shafts will be initiated in 1983. 1985--select one of three sites for Test and Evaluation (T&E) Facility. 1985-89--design and construct T&E Facility. T&E operational in 1989.
Prepare generic and site-specific studies as required by NEPA for repository program.	o DOE Task Force Report on Nuclear Waste Management issued.	o GEIS for commercial HLW public comment and review.	o Statement of DOE position on Confidence Rulemaking submitted to NRC.	o Environmental conditions for geologic repository defined. Waste package conceptual designs prepared. o Final EIS published and Record of Decision issued for geologic repository.	o Generic and site-specific studies required by NEPA have been accomplished for the present program stage. Future documentation is scheduled as consistent with present geologic exploration program.
Develop in-situ testing activities.	o Initiate cooperative field tests in granite at Stripa, Sweden.	o Prototype salt brine migration tests initiated at Avery Island, La.	o Initiated thermal testing at NSTF Hanford Site and thermal and radiation testing at Climax Facility (NTS).	o Spent fuel emplaced in granite. Full-scale heating tests in granite, basalt, and salt shown to agree with prediction.	o In-situ testing activities have been initiated and are continuing to develop technical information required to support the program.

TABLE 22-1

COMMERCIAL WASTE MANAGEMENT

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Seek public acceptance through Federal/state cooperation and public interaction.	o Established contacts with state and local governments to ensure exchange of information and policy positions.	o Implemented a public information program on the National Waste Terminal Storage Program and funded study panels and conferences attended by industry, government, university and public interest groups to seek areas of agreement.	o Provided assistance to states and regional groups to develop low-level waste plans. o State Planning Council established as advisory group to DOE on state/Federal issues.	o 15 states agree to undertake studies of granites within their boundaries. o Grants provided states for their independent review of DOE program.	o Interaction processes with the states have been developed and are continuing to cooperate with and define the role of the states.
Provide Federal away-from-reactor (AFR) spent fuel storage services by 1983.	o Established continuing data base on storage requirements and determined no commercial interest in providing AFR-type storage services.	o Survey and evaluation of existing fuel storage facilities leading to identification of potential sites.	o Completed environmental impact statement (EIS) on U.S. spent fuel policy.	o The Department discontinued its efforts to provide Federal away-from-reactor spent fuel storage services due to a change of policy and declining need.	o Preparation of site-specific EIS was started and initial discussions with owners of potential AFR facilities were held before program discontinued.
Develop processes for producing alternative high-level waste forms and prepare samples for properties evaluation by 1981.	o Established alternative high-level waste forms program; issued summary plan. Established spent fuel as reference waste form.	o Selected 13 waste forms initiated development. Work continued on alternative forms suitable for defense waste.	o Developed 13 forms, processes, and evaluation methods. Focused on 7 forms.	o Provided standardized samples, test and evaluation data for 7 forms, ranked forms by priority, selected borosilicate glass and crystalline ceramic waste forms for study in FY 1982. o Issued report on engineering feasibility of commercial alternative waste forms processes. Policy revised to allow reprocessing. Efforts on alternative waste form for commercial HLW to be resumed.	o Goal met.

TABLE 22-1

COMMERCIAL WASTE MANAGEMENT

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Prepare two canisters of radioactive high-level waste immobilized in borosilicate glass by 1980.	o Installed large-scale vitrification product demonstration equipment.	o Prepared and solidified two canisters of actual radioactive HLW.	o Established Materials Characterization Centers and Materials Review Board for standardized testing and evaluation of final waste forms.	o Issued report on engineering feasibility evaluations of commercial alternative waste form processes.	o Base technology for a reference process (vitrification) developed and demonstrated for application to specific projects. Standardized testing and evaluation mechanism established. Other candidate processes evaluated on laboratory basis.
In 1980, provide reference design for immobilization of West Valley waste in borosilicate glass.	o Prepared study on disposition of Western N.Y. Nuclear Services Center including technical options for managing the high-level waste.	o Submitted study to Congress with public comments recommending immobilization of HLLW as soon as possible.	o Prepared reference design for immobilization of West Valley waste in borosilicate glass.	o Issued draft EIS.	o Initiation of project activity under way, with DOE assuming responsibility in FY 82 for the HLW at West Valley.
Develop technology for management of LLW and operation of burial sites, and make available to nuclear industry.	o Minimal technology development efforts to support DOE sites.	o Minimal technology development efforts to support DOE sites.	o Reconstituted program to meet needs of the states and industry as well as DOE sites.	o Issued handbook on shallow land burial technology, remedial action, criteria development, and alternatives to shallow land burial.	o Program scope expanded to provide more direct support to states and the industry in establishing regional sites. Technology previously provided in handbooks, criteria, technical reports, and demonstrations.

TABLE 22-2

COMMERCIAL WASTE MANAGEMENT

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $226.1

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
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.			
Investigate three alternative geologic formations for the Test and Evaluation site by 1985.	o Investigate more than 3 sites and accept delays in repository schedule.	o Sinking of exploratory shafts at each of the candidate sites and conduct testing at depth.	o Exploratory shaft design, procurements, and construction at 3 sites. o Testing at depth. o Surface-based site characterization activities. o Complete NEPA documentation/process.
Seek public acceptance of repository program siting decision.	o Federal supremacy.	o Federal/state cooperation and public interaction.	o Grants to states. o Independent review and recommendations. o Public meetings, hearings. o NEPA documentation/process.
Develop a Test and Evaluation Facility at one of the alternate sites by 1989.	o Defer tangible evidence of capability to handle and dispose wastes until first repository.	o Siting and design efforts as required.	o Planning, design, and evaluation of the concept in each of 3 media.
Obtain licensing for a repository.	o None.	o A minimum of 3 sites in at least 2 host rock types have been characterized, and technology in place.	o Continue intensive siting program. o Continue technology development program.
Prevent shutdown of reactors beginning in the 1986-90 time period caused by lack of additional spent fuel storage space.	o Utilities may have to use less-desirable methods of increasing storage capacity such as elimination of full core reserve.	o Alternative storage techniques can provide the needed additional storage capacity by 1986.	o Conduct licensed BWR rod storage test.

TABLE 22-2

COMMERCIAL WASTE MANAGEMENT

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Prevent unseemly delays as utilities enter the licensing process for dry and rod storage.	o Participate in fewer cooperative efforts.	o Utilities are not willing to license dry and rod storage technologies alone. Cooperative efforts are needed.	o Sign cooperative agreement for cask storage in FY 1982.
Minimize Government expense associated with spent fuel storage.	o Participate in fewer cooperative efforts.	o Private industry will participate in the development of alternative storage techniques.	o Participate in cooperative efforts.
Provide technology development for immobilizing HLW acceptable for disposal.	o Continue to provide technology development independent of other programs.	o Waste immobilization will be required when reprocessing of commercial spent fuels begins--documentation of technology and liaison services.	o Documentation of waste form development efforts in the Defense Program with liaison services available for commercial requests.
Demonstrate solidification and preparation of HLW for disposal and cleanup of high-level solidification facilities at West Valley.	o Defer implementation of legislation and maintain maintenance and surveillance.	o Indefinite delay of solidification activities increases potential for tank leakage.	o NEPA documentation, preliminary design efforts, and long-lead procurement is required to proceed with project.
Provide assistance to states in establishing commercial low-level waste management systems at 5 to 7 regional disposal sites in accordance with P.L. 96-573.	o Allow for states to establish regional sites without Federal assistance.	o Technology and information transfer will assist in coordinating state efforts in establishing new sites.	o Public participation workshops, state briefing books.

TABLE 23-1

MAGNETIC FUSION

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$368.3	$364.6	$359.8	$376.3	
Obligation:	$347.6	$355.1	$358.6	$374.8	
Conduct experimental activities aimed at demonstrating and refining methods of heating and containing high-temperature plasmas in tokamak and magnetic mirror systems.	o Achieved plasmic ion temperature of 7.5 keV in PLT device with neutral beam heating.	o Radio Frequency (RF) heating begun in Alcator A and PLT devices.	o RF heating shown effective in PLT devices.	o RF current drive demonstrated in PLT device.	o Substantial progress made toward demonstration of scientific feasibility.
	o Record $n\tau$ (quality of confinement) achieved in Alcator A device.	o Average beta exceeding theoretical limits achieved in ISX-B device.	o Poloidal divertor technology shown effective in PDX device.	o Upgrade of TMX device begun.	
			o Tandem mirror concept verified in TMS device.	o Pumped limiter impurity removal demonstrated.	
Pursue new confinement concepts which may be alternatives to the tokamak and magnetic mirror approaches.		o Favorable scaling demonstrated in EBT-S device.	o Prototype spheromak device operated.	o Favorable confinement achieved in ZT-40 device.	o Promising performance of several alternates demonstrated.
		o ZT-40 device began operation.	o Improved multipole operation achieved.		
Carry out R&D aimed at developing the engineering and technological bases necessary for designing, constructing, and operating increasingly larger and more complex fusion experiments and facilities.	o Published EDP plan.	o Gyrotron microwave generator for RF heating operated.	o First wall, blanket, and shield test plan completed.	o Neutral beam sources for MFTF-B, Doublet III, and TFTR devices operated.	o Steady progress is being made toward establishment of the fusion engineering and technology base.
		o Pellet injector operated on ISX-B device.	o Sputtering data base completed.	o Major structures of Large Coil Test Facility (LCTF) completed.	
		o Published revised EDP plan.		o High-power (200 kW), steady-state gyrotron demonstrated.	

TABLE 23-1

MAGNETIC FUSION

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Pursue experimental and theoretical studies of fusion plasma phenomena needed to understand and predict thermonuclear plasma behavior in confinement systems.	o Modeling of confinement in minimum-B mirrors confirmed. o Large radiation losses predicted from heavy metals.	o Causes of plasma disruption in tokamaks identified.	o RF current drive predicted.	o Institute for Fusion Studies established. o Basis for redesign of MFTF-B device coils for high beta completed.	o Confidence in predictive capability has substantially increased.
Provide for the construction of, and project-specific development for, major new facilities needed to support magnetic fusion research.	o TMX device completed. o Alcator A device completed. o Doublet III device completed.	o PDX device completed. o ZT-40 device completed. o Rotating Target Neutron Source II Facility (RTNS-II) completed.	o TFTR device neutral beam line prototype completed. o MFTF-B device end plug magnet completed. o Fusion Materials Irradiation Test Facility (FMIT) lithium loop design verification testing initiated. o FMIT particle beam accelerator proof-of-principle test completed at FMIT.	o First TFTR device toroidal field coil completed. o Major TFTR device site facilities completed. o Development of all major TFTR device components completed. o All major MFTF-A device hardware completed. o FMIT lithium target test successfully completed.	o Many exceptionally complex developmental projects have been successfully completed and additional more advanced projects are nearing completion.

TABLE 23-1

MAGNETIC FUSION

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
Continue and expand an effort to explore fusion engineering development, including engineering technology options and conceptual design of engineering devices.	o Study of TMR neutral beam hardening completed.	o High Aspect Ratio Tokamak reactor study completed.	o Starfire fusion reactor design study completed.	o FED preconceptual design completed.	o Numerous in-depth studies completed providing innovation and program guidance.
	o Preliminary analysis of Tormac reactor prospects completed.	o Linus reactor study completed.	o Tandem Mirror Reactor Design Study completed.	o Fusion engineering feasibility defined and program to accomplish its demonstration outlined.	
	o High Field Compact Tokamak reactor study completed.	o Torsatron reactor study completed.	o Compact toroid reactor study completed.	o Updated EBT reactor study completed.	
		o Complete TMR maintenance study.		o Deuterium-fueled Tokamak power reactor study completed.	
				o Updated stellarator reactor study completed.	

TABLE 23-2

MAGNETIC FUSION

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $453.8

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Conduct experimental activities for heating confinement in tokamak and mirror systems.	o None.	o Develop methods to contain and heat plasma in mirror and tokamak machines.	o Demonstrate scientific feasibility.
Pursue new confinement concepts.	o None.	o Develop physics and engineering data for new concept machines.	o Alternate concept machine as possible, improved demonstration fusion reactor device.
R&D to develop engineering and technology bases for design of large machines.	o None.	o Develop technology needed to support fusion machines approaching fusion reactor size.	o Provide technology necessary to demonstrate the engineering feasibility of fusion.
Pursue experimental and theoretical studies in plasma physics.	o None.	o Establish the required understanding of the physics of thermonuclear plasma.	o Contribute to all other objectives.
Construction of major new facilities.	o None.	o Perform necessary experiments to develop data base and validate approaches.	o Contribute to all other objectives.
Expand engineering development and conceptual design and engineering devices.	o None.	o Uncover new engineering options to support other objectives. Perform systematic evaluation of reactor concepts.	o Anticipate and solve problems in planned device.

TABLE 24-1

SOLAR APPLICATIONS FOR BUILDINGS

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 8-1	Degree Original Objective Met
Total Obligational Authority:	$171.0	$276.1	$266.3	$206.7	
Obligation:	$142.5	$246.8	$254.2	$199.2	

Assist in the development of viable solar industry to reduce national dependence on non-renewable forms of energy.

ACTIVE SOLAR HEATING AND COOLING PROGRAM:

Goals/Objectives	FY 78	FY 79	FY 80	FY 8-1	Degree Original Objective Met
Reduce costs, improve performance, and improve system reliability					
- Components/material R&D.	o Advanced concentrating collectors developed. o Demonstrated technical feasibility of salt gradient pond for annual storage. o Developed controller that could reduce backup fuel requirement by 10%.	o Completed development of several new collector types. o Compiled and published handbook for designers and builders of thermal storage systems.	o Fabricated and tested zeolite collectors. o Initiated construction of large research pond for studies of gradient control & heat extraction.	o Continued development of low cost plastic collectors. o Analyzed fluids for use in cooling systems.	o Developed and tested collector designs and space conditioning systems with potential for improved performance and reduced cost. Initiated prepackaged concept to aid in improving system reliability.
- Systems R&D.	o Initiated development of advanced solar assisted heat pumps (SAHP). o Developed and tested a modular 3-ton cooling system capable of providing 65% of a typical residential cooling load.	o Demonstrated performance potential of SAHP in 40° to 100° F range. o Installed several solar/Rankins cooling systems in operational test sites.	o Developed 2 heat pumps for solar systems and special test facilities for performance monitoring. o Developed several second generation absorption chillers having 0.75 coefficient of performance with medium-temperature input.	o Developed residential heat pump systems. o Demonstrated feasibility of commercial-sized absorption systems. o Initiated prepackaged heating system solicitation.	

TABLE 24-1

SOLAR APPLICATIONS FOR BUILDINGS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 8-1	Degree Original Objective Met
	o Developed computer codes for modeling various storage options.		o Advanced computer program developed for hot water performance prediction. o Established engineering data base for collector performance prediction.	o Established practical performance levels for current Rankine ~~and absorp~~tion chiller systems in residential and commercial applications.	
o Promote and accelerate the commercialization of active solar technologies in the residential and commercial buildings sector.					o Demonstrated technical feasibility of active solar technologies and provided information to industry and general public on system capabilities. Identified need for further reduction and system reliability improvement to accelerate commercialization.
Demonstrations and field testing.	o Funded 62 space heating and cooling projects under third cycle of commercial demonstration program. o Continued design and construction of an additional 138 projects funded under first and second cycles and under the Hotel/Motel initiatives. o Established National Solar Data Network (NSDN). o Initiated Solar in Federal Buildings Program (SFBP).	o Continued design and construction of demonstration projects. o Increased number of instrumented sites to 75 under NSDN. o Conducted design workshops for Federal Agency personnel under SFBP.	o Continued design and construction of demonstration projects (110 fully operational). o Began selective refurbishment of early projects. o Published SFBP program rule and selected 843 projects for funding.	o Continued design and construction of demonstration projects (170 fully operational). o Included non-Federal projects in National Solar Data Network. o Begin design and construction of SFBP projects (400 completed by end of fiscal year).	

TABLE 24-1

SOLAR APPLICATIONS FOR BUILDINGS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 8-1	Degree Original Objective Met
PASSIVE SOLAR HEATING AND COOLING PROGRAM:					
Market Development.	o Established promotional training and education activities. o Development concensensus collector test standards that were adopted by industry. o Initiated work with industry on model code document.	o Developed interim performance criteria for solar systems. o Prepared draft model code document. o Initiated publication of Solar Law Reporter.	o Initiated Reliability and Maintainability program (R&M). o Initiated development of hot water test procedures. o Initiated program for national voluntary standards including certification testing. o Initiated code official training.	o Published R&M hot water system design guidelines. o Established R&M solar data bank. o Established comprehensive market/industry data base. o Completed pilot program for building code officials and prepared interim model code.	
o Conduct R&D to identify cost & performance, to develop an understanding of physical phenomena, and to document systems, materials and components for passive heating and cooling.	o 12 heating test rooms constructed and direct gain and Trombe wall studied. o 2 Skytherm test buildings completed.	o Test room management of selective-surface Trombe wall. Convective loop studied. o 15 buildings monitored. o 17 cooling systems characterized.	o Construct 2 heating test facilities. Design 1 cooling test facility and begin research. o Study interzone heat transfer.	o Construct 2 cooling test facilities. Set cost and performance goals for systems and components. o Perform comparison studies and thermal comfort simulations.	o Cost/performance goals established. o Good understanding of single zone heat transfer and operation of 3 heating systems.
o Develop analytical methods for rigorous technical & economic assessment of passive solar homes. Successful completion will result in improved ability to predict performance.	o 5 PASOLE simulation models developed. o Design analysis for 29 climates.	o PASOLE validated for direct gain sunspaces and storage roof. o Passive incorporated in DOC-1 BLAST SOLPAS.	o Develop DEROS SUNCAT. Refine computer algorithms. o LANL analysis complete.	o Add cooling algorithms. o Validate computer analysis models (DOE 2.1 Blast 3, DEROS & SUNCAT). o Develop BLAST 4 PEMA model complete.	o Reliable computer codes and models developed and validated; passive solar added to existing heating and cooling load models.

TABLE 24-1

SOLAR APPLICATIONS FOR BUILDINGS

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
o Develop a range of passive components and products which can be easily integrated into conventional practice.	o Developmental work on thermal diode, phase-change materials, heat mirror, and heat pipes.	o Initial product development for glazings, water roof storage, controls, reflectors, and insulators.	o Field test 8 products. o Initiate development of 22 innovative materials and components.	o First components begin production runs. o Start developing cooling components. o Concept development for subsystems.	o 12 component projects reach stage for private sector commercialization. o IR reflective films, moveable insulation, phase-change materials storage all in modest production. Initial improvement in performance as high as 50%.
o Develop marketable designs for new & retrofit residential & commercial buildings.		o Initiate prototype development with 27 firms producing prefabricated buildings. o Initiate house plan development.	o Develop 33 prototype commercial building designs. o Generate 6 MP building designs. o Mid-American Solar Energy Center (MASEC) completes Solar "80" designs.	o Complete 30 commercial building designs. o Complete 13 manufactured building prototypes. o Develop 40 prototypes house plans in 4 regions. o Other regional solar energy centers implement residential design programs.	o Over 300 residential designs available. 33 commercial buildings prototypes developed. o Prototype designs available to "manufactured housing" industry, representing 39% of new homes construction.
o Field test passive heating & cooling systems in new and retrofit residential & commercial buildings as prototypes.	o Initiate passive home awards with HUD. o Publish data on 5 experimental buildings.	o Begin fifth HUD cycle, applications for new construction and retrofit. o Publish data on 15 experimental buildings.	o Complete HUD demo programs. o Design and purchase low-cost data acquisition system. o Test facility construction started.	o Install 30 dataloggers. o Publish results of 300 homes in demo program. o Post-occupancy audits on 400 homes. o Brookhaven house finished. o Denver Metro builders assistance complete.	o More than 300 buildings field tested; more than 400 investigated. o Data on experimental buildings for 4 years collected and disseminated. o Test facilities at National Bureau of Standards, University of Arizona, and Trinity University complete and 3 systems tested. Results for simple heating complete on 24 test cells and 19 instrumented buildings.

TABLE 24-1

SOLAR APPLICATIONS FOR BUILDINGS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
					o Work on design tools for residential heating mostly done; commercial 50% complete. o Design methods for heating systems available for all levels of application, from graphic, manual, and microprocessor to mainframe computer. o 2 design handbooks published; 4 construction notebooks completed.
o Develop and disseminate design tools for architects, builders, designers.	o Begin development of solar load ratio (SLR) analysis.	o Begin development of SOL-GRAF analysis techniques.	o Publish SLR handbook, Vol. I & II. o Publish SOL-GRAF data.	o Form design tools committee. o Develop second version of F-chart. Vol. III of Los Alamos design handbook complete.	
Displace 50,000 barrels per day of oil equivalent (0.11 quad) by the end of FY 83 in the form of 2 million residential installations, 300 million square feet of commercial buildings, and $1 billion in annual sales.	o Program effort plus private sector activity resulting in 500 residential installations.	o Program effort plus private sector activity raised total to 10,000 residential installations.	o Program effort plus private sector activity resulted in cumulative total of 25,000 residential installations.	o Program effort plus private sector activity brought cumulative total to 60,000 residential installations.	o Program effort plus private sector activity resulted in passive solar systems for 9,000,000 square feet of commercial space and 60,000 homes; the industry volume reached $100 million to $150 million.

TABLE 24-1

SOLAR APPLICATIONS FOR BUILDINGS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
PHOTOVOLTAIC ENERGY SYSTEMS:					
Advanced Materials, Cells and Concepts R&D					
Work closely with university and industry organizations, continuing research and development on novel PV materials and devices within a comprehensive R&D base program, to develop the maximum efficiency potential and/or lowest cost potential of PV collectors and systems.	o Programs initiated in emerging materials, thin film polyorystaline silicon, basic mechanisms and amorphous materials. o Ongoing work in cadmium sulfide type cells.	o SERI assumes management as lead center. o Innovative concepts program started. o Advanced Concentrator and Photoelectrochemical programs started.	o 10% thin-film polycrystalline silicon lab cell. o 17% thin-film gallium arsenide cell. o 16% multi-junction cell. o Exploratory development started on thin-films polycrystalline silicon devices.	o Achievement of 10% lab efficiency in three additional thin-film materials. o 10% cadmium zinc sulfide/copper indium diselenide cell with stability without encapsulation. o 6% amorphous silicon cell with 1 cm2 area.	o Several thin-film cells are attractive candidates for meeting lab TF goals. Three expected by '85/'86/'88. o Multijunction concentrator cell likely to achieve 30% efficiency by FY 84.
Photovoltaic Collector R&D					
Develop the materials, devices, structures, encapsulation, etc. of PV collectors (both flat-plate and concentrating needed to establish the technical feasibility (TF) for industry scaleup, as follows:	o Several silicon refinement processess identified with $15/kg cost potential. o 5 silicon ribbons produced simultaneously (11% efficiency).	o JPL Lead Center for Technology Development and Applications assigned management role for balance of PV Program.	o Flat-plate TF at $3.08/Wp demonstrated. o Block 3 modules delivered (217kWp) for test. o Ingot growth with sequential replenishment.	o Automatic assembly of solar cell "strings." o Encapsulation materials and processes show promise of meeting $15/m^2 goal with lifetime of more than 20 years.	TF at $3.08/Wp fully met for flat-plates and concentrators.
- Collector (FOB) Price Target / TF BY $3.08/Wp 1980 0.77/Wp 1982 0.17-0.44/Wp 1986	o New qualifications specs for modules issued, based on results of Block 1 & 2 procurements and testing. o Semi-continuous silicon ingot growth achieved.	o Union Carbide Completes design of low-cost silicon refinement process. o Multikilowatt concentrator arrays by Martin-Marietta and Spectrolab enter testing.	o Three concentrator designs meet $3.08/Wp TF. o Planar junction silicon cells achieve 20% efficiency at 30-70 suns.	o Two contracts awarded for ~~automated~~ cell and module processes. o System experiments using 700 kWp total of concentrating collectors starting field tests.	

TABLE 24-1

SOLAR APPLICATIONS FOR BUILDINGS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
	o Fresnel lenses achieved, with 85% concentrating efficiency.	o Advanced silicon concentrator cells achieve 19% efficiency at high concentration.		o Fresnel lens design optimization and analysis tools developed.	
	o 25% efficiency beam splitter device.			o Indications that several collector approaches may be able to exceed $0.77/Wp goal.	o Progress toward $0.77/Wp collectors; slipped 2 to 3 years to FY 84/85 due to funding reductions.
System and Subsystem R&D					
To develop the balance-of-system (BOS) components (i.e., power conditioning, structures, storage; etc.) needed to couple with PV collectors to establish the technical feasibility of systems cost-competitive with utility electricity as shown: - Installed System Price $6.60-14.30/Wp (by 1980, for Remote Stand-Alone DC) $1.75-2.40/Wp (by 1982, for Residential AC) $1.20-2.00/Wp (by 1986, for Utilitity & Retrofit residential AC)	o Large system conceptual design.	o First flat-plate ground-mounted structure designs. o Residential preferred designs started.	o Installation cost study for small and medium systems started. o Wind effects tests on structures completed. o Two small power conditioning systems (PC) commercially available for test. o First medium-size detailed designs. o Preliminary analysis utlity-interface issues. o Interim performance criteria document.	o Two residential experiment stations operational, 13 prototypes under test. o Modularity study for arrays complete. o Subsystems design and optimization study completed. o Residential plan completed for residential power conditioning (PC) systems. o 62.5 kW PC delivered for test. o Six Residential preferred designs published. o Designs documented for program R&D announcements #35 and #38 (PRDA 35/38). o Study started on utility dynamic interaction; report published on interface issues.	o Small PC performance deficient. Large PC performance and cost will be met. Remaining BOS requires further work, but is on track. o RES testing slipped about 6 months. o Designs on schedule with retrofit and detailed large system designs. o Utility interaction issues largely unresolved.

TABLE 24-1

SOLAR APPLICATIONS FOR BUILDINGS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Systems Experiments					
Work closely with industry (through cost-sharing, industrial automation and systems experiments and demonstrations) to ensure the actual market availability of the collectors at installed system prices--2 years after TF for DC stand-alone remote systems and 4 years after TF for the residential and utility systems.	o 19 remote stand-alone experiments ongoing. o PRDA 35/38 projects started (medium-size systems). o Two college grant projects started in Arkansas and Mississippi (medium size).	o PRDA 35/38 design completed. o Natural Bridges 100 kWp project construction started. o SOLERAS Project[1] 500 kWp concentrator system initiated.	o First-of-kind residences in Florida, Arizona. o Georgetown grant project started. o Italian "Delphos Project" started. o Private PV 75 kW project started for EPCOT Center based on PRDA designs.[2]	o First lived-in residential experiments (4) operational. o Large system experiment proposed. o Phaseout of remote stand-alone started. o California Energy Commission sponsored PV residence started. o 19 experiments started with EEC medium-size system. o First PRDA 35/38 projects operational.	o Remote stand-alone objectives met. Test results used to identify R&D requirements, particularly for modules. o Grid-connected experiments initiated and are on track with scope limited by budget.

[1] Non-DOE funded.
[2] Fifty-fifty U.S./Saudi Arabia funding.

TABLE 24-1

SOLAR APPLICATIONS FOR BUILDINGS

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
Limited Market Development					
Accelerate and facilitate private sector efforts to develop and meet demand for PV systems. Federal Photovoltaic Utilization Program (FPUP) to encourage Federal agency use of PV. Assist Industry in defining markets. Develop limited "market pull" options for domestic and international markets.	o National Energy Conservation Policy Act of 1978; Sec. 563 establishes FPUP.	o Initiate market development activity. o Start FPUP. o PV Research, Development and Demonstration Act (PL 95-590).	o The "Federal Policies to Promote Widespread Utilization of Photovoltaic Systems" report sent to Congress. o The "International Photovoltaics Plan" report sent to Congress.	o Complete $24 million FPUP procurements for 2,772 applications.	o FPUP funded at 25% of authorized level. Twenty-six Federal organizations participated in the four cycles of procurement. Remote stand-alone products developed by contraators are finding wider commercial markets. Federal agencies use of PV increasing.

TABLE 24-2

SOLAR APPLICATIONS FOR BUILDINGS

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $99.1

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
ACTIVE SOLAR HEATING AND COOLING PROGRAM:			
Complete work on developing materials and components and related technical information to enable industry to design and produce low-cost, high-performance components.	o Utility R&D. o Industry R&D.	o Requirement for improved materials and components. o Limited industry activity in high-risk/high-payoff R&D.	o Development of low-cost, light weight, medium-, and high-temperature collectors. o Identify and develop absorption or Rankine chillers with COP less than 1.1.
- Complete development of low-cost collectors (less than $5.00/sq. ft.).			o Complete test and evaluation of SAHP.
- Develop high-performance chillers (COP greater than than 1.1).			o Initiate and construct full scale salt gradient pond.
- Develop high-performance Solar Assisted Heat Pumps (SAHP).			o Identify mechanisms of mechanical, optical, and thermal degradation or corrosion, and relate lab tests to field experience.
- Develop technology data base on materials.			
- Develop low-cost/high-performance storage system.			o Development of instruments and procedures for solar researchers. o Development of low-cost phase-change storage systems.
Complete work on achieving improvements in system design, performance, reliability, and cost/performance.	o Utility system development. o Industry system development.	o Industry needs cost-effective systems to compete in the marketplace successfully (after 1985, when tax credits expire).	o Establishment of operational requirements for advanced space conditioning systems. o Complete evaluation of integrated space conditioning prototypes.
- Develop cost-effective integrated space conditioning systems.		o Private sector lacks required data base on system effectiveness, due to proprietary nature of specific technical data.	o Development of prototype heat pump, absorption, Rankine, and dessicant systems.

TABLE 20-1

BREEDER REACTOR SYSTEMS

Goals/Objectives	Budget Data ($ Millions) Status: FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Advanced Water Breeder Applications (AWBA)					
Develop technology to extend lifetime and power ratings of fuel elements and improve breeding in water-cooled reactors.	o Initiation of feasibility studies for simplifying the fuel fabrication process.	o Initiated irradiation testing of fuel rods incorporating duplex pellets containing a center core of ThO_2 surrounded by UO_2.	o Published technical information on core designs for producing U-233 in commercial Light Water Reactors (LWR's) for use in Light Water Breeder Reactors (LWBR's).	o Completed corrosion testing of grid materials, mechanical and corrosion testing of machined and welded Zircaloy grid sections.	o Development work proceeded as planned. Technical information is being disseminated to U.S. industry to assist in evaluating LWBR technology and deciding if, when, and how it can be applied to their own programs.
FUEL CYCLE DEVELOPMENT:					
To develop alternative fuel cycle technologies for LWFBR fuels; and to defer LWR reprocessing and conduct R&D on alternative fuel cycles for thermal reactors.					
- Perform LWFBR fuel cycle R&D to support existing reactor projects and overall LWFBR development including the demonstration of REMOTEX and the feasibility and demonstration of the Integrated Equipment Test Facility components by 1981.	o Fabricated and installed remote dissolver. o Initiated study of proliferation-resistant pyro-chemical reprocessing concept.	o Fabricated and installed rotary kiln voloxidizer; initiated test program for design of remote voloxidizer. o Completed solvent extraction test facility and conducted tests on irradiated LWR and breeder fuel.	o Completed final design of Integrated Equipment Test (IET) facility. o Completed remote manipulator test stand.	o Completed conceptual design and first phase of the final design for remote head-end reprocessing components. o Completed and operated man/machine interface test facility. o Completed construction of General Plant Facility of the IET. o Completed construction of Remote Operation and Maintenance part of ROMD (by October 1981). o Complete conceptual design of the Hot Experimental Facility.	o All designs, components, tests, and studies were completed satisfactorily within cost and schedule.

TABLE 24-2

SOLAR APPLICATIONS FOR BUILDINGS

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Materials and Components			
Complete work on research, analysis, and testing for material components and assemblies in 6 major areas: collection, storage, retention, rejection, humidity control, and subsystem assemblies, so as to improve thermal performance over conventional alternatives by 30%.		o This research will facilitate the fulfillment of technical needs for residential and commercial buildings and the attainment of cost/performance goals.	o Achieve accelerated acceptance of passive/hybrid systems for commercial structures.
PHOTOVOLTAIC ENERGY SYSTEMS:			
Work closely with university and industry organizations to continue research and development on novel PV materials and devices, within a comprehensive R&D Base Program, to develop the maximum efficiency potential and/or lowest cost potential of PV collectors and systems.	o Leave further R&D entirely to private firms.	o Continuing cost reductions needed to meet foreign competition and maintain efficient contractor teams. o Increase opportunity for significant U.S. utility-connected market.	o Large cost reductions needed to make PV an attractive generating option to utilities require R&D now rather than tax credits.
Develop the materials, devices, structures, encapsulation, etc. of PV collectors (both flat-plate and concentrating) needed to establish the technical feasibility (TF) for industry scaleup.		o Broaden U.S. market potential and build from base of previous accomplishments.	o Private industry is unlikely to pursue development of stand-alone applications.

TABLE 24-2

SOLAR APPLICATIONS FOR BUILDINGS

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Develop the Balance-of-System components (i.e., power conditioning, structures, storage, etc.) needed to couple with the above collectors to establish the technical feasibility of PV systems cost-competitive with utility electricity, as shown: TF Date 1984/1985, for AC residential and intermediate size applications: - Collectors--$0.77/Wp. - Installed Systems--$1.75-$2.45/Wp. TF Date 1988/1989, for AC utility and retrofits for residential and intermediate size applications: - Collectors--less than $0.45/Wp. - Installed Systems--$1.20-2.00/Wp.			o Program conducts critical high-risk R&D to obtain needed large cost reduction for collectors and BOS. Generates technical information about utility interconnection and generic systems design through system testing, thereby reducing the unacceptable risk to subsequent private development and marketing of products for utility-connected market.

TABLE 25-1

SOLAR APPLICATIONS FOR INDUSTRY

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$156.4	$203.8	$222.0	$163.2	
Obligation:	$130.3	$182.2	$211.8	$157.2	
BIOMASS ENERGY SYSTEMS:					
	Aquatics	Aquatics	Aquatics	Aquatics	
Develop technologies to provide energy and petroleum replacements from aquatic biomass at competitive costs.	o Established 1/4 acre test module for sea kelp.	o Completed cost analysis of aquatic biomass systems.		o Transferred off-shore kelp project to private sector.	o Experiments showed that kelp could be farmed; technical obstacles remain.
			o Started preliminary survey on oil yields from marine micro-algae. o Constructed race-way for growing marine microalgae.	o Completed construction of the first fresh water oil-producing microalgal raceway production system.	o Basic screening has yielded microalgae of 50% oil content and high growth rate on saline water.
	Herbaceous	Herbaceous	Herbaceous	Herbaceous	
Screen herbaceous plants to select most promising species for maximum energy yield.	o Tested spacing and energy-efficient production techniques for sugar crops.		o Transferred to Office of Alcohol Fuels.		o Preliminary screening (Phase 1) of 280 species using the best available information was completed in 1979, and 70 species were identified as warranting field research. Four species are being evaluated in 1981. 26 species that produce natural plant hydrocarbons are being screened in FY 81.
	o Initiated research to assess and improve hydrocarbon production potential of three Euphorbia species.	o Analyzed preliminary costs of a process for converting Euphorbia lathryis to oil.	o Characterized and quantified latex composition of Euphorbia lathryis.	o Completed tissue culture studies.	

TABLE 25-1

SOLAR APPLICATIONS FOR INDUSTRY

Goals/Objectives	Budget Data ($ Millions) Status: FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
		o Selected *Euphorbia lathryis* for continued study.	o Completed evaluation of alternative extraction methods.	o Completed toxicity studies of latex.	o Showed technical feasibility of producing hydrocarbons from green plants.
	o Initiated systems study of the potential of semitropical plants under intensive management and year-round mechanization.	o Conducted greenhouse & field plot tests to select promising clones and varieties of sugar canes, napier grass, and Sordan grass.	o Conducted field-scale tests to determine biomass productivity.	o Completed preliminary evaluation of productivity and mechanized systems for producing and harvesting cane and napier grass.	o Obtained 36 dry ton per acre per year for sugar cane, greatly exceeding conventional production.
		o Completed preliminary screening of 280 non-traditional grass species; 70 species recommended for further research.			
		o Conducted state-of-the-art study to identify research needs for developing hydrocarbon-producing plants.	o Initiated species screening & genetic selection studies of promising hydrocarbon producing species.	o Established a 10 acre experimental planting to evaluate the hydrocarbon production potential of milkweed.	o Demonstrated yields for milkweed of 1 ton/acre for second harvest.
	Short-Rotation Woody	Short-Rotation Woody	Short-Rotation Woody	Short-Rotation Woody	
To increase annual yields from short-rotation woody crops from 1.5 dry tons/acre-year to 8 dry tons/acre-year by 1992.	o Initiated 25 regional projects on species selection, stand establishment, cultural treatment, genetic selection, breeding and harvesting.	o Conducted species selection research on 80 species and hybrids within these species. o Obtained preliminary results of survivability and the annual growth rate of selected species.	o Completed preliminary selection of desert shrub species based on biomass production after 2 years growth in the semi-arid Southwest.	o Identified 25 species for further study. o Demonstrated average productivity rates of 5-9 dry ton/acre/year in field plot experiments at different locations after three growing seasons.	o 25 promising species have been identified based on productivity, ease of management, and resistance to pests (after three growing seasons).

TABLE 25-1

SOLAR APPLICATIONS FOR INDUSTRY

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
		o Established field research plots in natural stands of potentially fast growing woody species in various regions to determine base line productivity rates.	o Determined growth rates in natural stands.	o Conducted regrowth studies following harvest of natural stands in different regions.	
	Thermochemical	**Thermochemical**	**Thermochemical**	**Thermochemical**	
Produce medium-Btu gas and methanol from synthesis gas at costs competitive with fossil fuels.	o Began operation at Albany direct liquefaction facility.	o Produced wood oil crude by the Lawrence Berkeley Laboratory process.	o Produced wood oil crude by Pittsburg Energy Research Center process.	o Completed operation at Albany. Started bench-scale continuous liquefaction investigations.	o Proved technical feasibility of oil from woody biomass.
	o Started bench-scale steam gasification tests to produce a medium-Btu gas.	o Conducted tests on multi-solid fluid bed combustion with wood chips.	o Started steam gasification experiments in multi-solid fluid bed process development unit.	o Prepared preliminary techno-economic assessment on producing medium-Btu gas using multi-solid fluid bed technology.	o Preliminary techno-economic assessment indicates medium-Btu gas can be produced at $4.00/million Btu's.
		o Started bench-scale investigations into catalysts capable of converting biomass into specific product gas.	o Started process development unit tests for producing synthesis gas and methane rich gas.	o Completed operations of process development unit at atmospheric conditions; prepared preliminary techno-economic assessment.	o Preliminary techno-economic assessment indicates methanol from biomass at $0.55 a gallon.
		o Conducted tests on wood combustion in swirling 1,000° F air in small combustion model.	o Designed, built, and conducted preliminary tests in a large-scale furnace using swirling air concept.	o Successfully completed large-scale furnace tests.	o Showed concept could be used to retrofit oil and gas boilers and provide potential approach to direct firing of wood in a gas turbine.
	Biochemical	**Biochemical**	**Biochemical**	**Biochemical**	
Develop anaerobic fermentation technologies to produce biogas at $4/MBtu by 1990. Produce petrochemical substitutes by mid-1990's.	o Completed design and feasibility study for an anaerobic digestion test facility at Bartow, Florida.	o Initiated construction of an anaerobic digestion facility for a 10,000 head feedlot.	o Completed construction of Bartow facility.	o Transferred Bartow facility to the private sector.	o Developed anaerobic digestion system for manure which has been turned over to private sector.

TABLE 25-1

SOLAR APPLICATIONS FOR INDUSTRY

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
	o Demonstrated 30% increase in gas yields from corn stover due to pretreatment.	o Initiated testing of a farm-scale crop residue digestion system.	o Initiated bench-scale tests of improved techniques for digesting crop residues.	o Defined the nutritional regimes for methanogens in progress.	o Obtained increased biogas yields for short period of time using selected nutrient enhancement.
		o Initiated conceptual design for a 3 ton/day experimental fermentation unit.		o Identified operating parameters for a biomethanation system.	
		o Completed construction of a plug flow reactor dairy digester.	o Completed evaluation of plug flow dairy digester.		o Showed 50-500 head dairy could produce gas cheaper than propane or fuel oil.
	Photobiological	Photobiological	Photobiological	Photobiological	
Photobiological systems that will produce hydrogen from water and renewable resources: to produce increased supply of hydrogen for fuel and chemical production.	o Initiated search for stable electrodes for producing H_2 by water-splitting.		o Achieved high hydrogen evolution rates with in vitro systems over short duration.	o Concluded cell-free in vitro studies.	o Developed in vitro cell-free system with high photo efficiency.
	o Initiated study of conversion of biomass to H_2 by chemical oxidation using bromine.			o Completed preliminary technical and economic evaluation of bromine oxidation of biomass.	o Projected H_2 cost of $18/million Btu which is less than H_2 from electrolysis.
		o Achieved sustained production of H_2 using blue-green algae.	o Isolated photosynthetic bacteria to achieve hydrogen evolution rates comparable to green and blue-green algae.	o Identified species of green algae with high hydrogen production potential.	o Isolated bacteria and blue-green algae with high photosynthetic efficiency.
		o Initiated genetic engineering to improve H_2 producing organisms.		o Developed preliminary process for production of hydrogen using photosynthetic bacteria.	o Biological systems developed that yield hydrogen for several days at pressure up to 700 psi.

TABLE 25-1

SOLAR APPLICATIONS FOR INDUSTRY

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
SOLAR THERMAL ENERGY SYSTEMS:					
Production of Electricity from a Number of Powerplants on the Order of 1-10 MWe Each					
80-100 mills/kWh by 1990's. - Central Receivers -- System capital cost: $1,000-$2,300/kWe. -- Heliostat cost: $86/m^2 for glass. -- Receiver cost: $50/kWe. -- Annual average system efficiency: 16-20%.	o Central Receiver Test Facility (CRTF) construction completed.	o Heliostat design with $200/m^2 cost in production tested. o Confirmed performance of first-of-a-kind heliostats and EPRI/Boeing receiver at 1 MWe.	o Heliostat field at CRFT maintained at or above 95% operational level. o Confirmed performance of 10-MWe receiver panels.	o Completed construction of 10-MWe Barstow Pilot Plant. o Tested small-scale molten salt receiver and storage concepts, and heliostat design with $100/m^2 cost in production.	o Engineering feasibility of several options will be completed within next 2 years. If present rate of progress continues for next 5 years all objectives can be met.
- Parabolic Troughs	o 30-kWe shallow-well parabolic trough project in operation.	o 30-kW trough operated for 1 year. o 150-kW deep-well system operating.	o Deep-well parabolic trough project in operation for 1 year.	o 150 kWe system operated 94% of the potential operating time.	o Trough technology deemed unlikely to meet original cost objectives for electricity production.
Production of Synthetic Fuels in Commercial Quantities					
Identify feasible processes. Demonstrate technical feasibility of hydrogen production process by 1986.	o Fuels and chemicals project at Georgia Institute of Technology in operation.	o Completed experiments on oil shale retorting and coal gasification using solar. o Developed conceptual designs for solar thermal production of hydrogen.	o Demonstrated conversion efficiency of 50% for Solohem receiver. o Reports on 1,390 processes reviewed. o Completed feasibility experiment for fuels and chemical production.	o Improved hydrogen production electrolysis process.	o A number of candidate processes have been identified. Program is on track to achieve technical feasibility by 1986.

TABLE 25-1

SOLAR APPLICATIONS FOR INDUSTRY

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
Utilization of Thermal and All Other By-Products of Solar Facilities:					
Demonstrate technical feasibility of the solar total energy (both heat and electricity) concept.		o Several cogeneration applications for the central receiver identified and evaluated.	o 4 thermal dish collectors for Shenandoah tested.	o Shanendoah total energy project construction completed.	o Ready to operate system for a number of years.
Develop Hybrid and Small Community Power Systems:					
80-110 mills/kWh by 1990's. - Parabolic Dish -- Solar to electric efficiency: 20-30%. -- System life: 30 years. -- Concentrator cost: $80-120/m^2$. -- Receiver cost: $24-45/kWe. -- Power conversion cost: $120-230/kWe.			o Confirmed performance of steam receiver. o Constructed parabolic dish test site (PDTS). o Test bed concentrators at PDTS achieved energy flux equal to 14,000 suns.	o Completed development of an ORC parabolic dish power module. o Confirmed performance of dish Stirling concept at PDTS. o Confirmed performance of solarized Brayton engine. o Confirmed performance of air receiver.	o Concentrators in development. 20% efficiency possible with 3 engine options 30% efficiencies using either a Brayton or Stirling engine with ceramic components.
Large-Scale Utilization of Solar Energy for Direct Heating:					
$5-$7 MMBtu by 1990's. Average annual solar-to-heat efficiency: 45%. System life: 20 years.		o Confirmed performance of trough made of sheet-molding compound.	o Peak efficiency of 70% (needed to achieve average annual efficiency goal) demonstrated in laboratory.	o Seven industrial process heat (IPH) projects in operation for 1 year. o Five new IPH projects began operation.	o Peak efficiency measurements in field approaching 70%. Performance characteristic goals have been proven achievable for troughs in IPH use.

TABLE 25-2

SOLAR APPLICATIONS FOR INDUSTRY

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $75.5

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
BIOMASS ENERGY SYSTEMS:			
R&D to increase conversion efficiency and meet cost objectives for gaseous and liquid fuels and petrochemical substitutes. Technologies and their specific objectives are:	o Reliance on private sector.	o Develop technologies to convert biomass to energy to meet cost objectives by increasing conversion efficiency.	
- Thermochemical conversion to reduce costs of gaseous fuels and chemical feedstocks to the point where the private sector will take over.	o Reliance on private sector.	o Accelerates advancement of the technology through lab scale, PDU.	o Production of medium-Btu gas by technologies using heat, pressure, and/or catalysts from a variety of biomass sources.
- Biochemical technology (e.g., anaerobic digestion) for conversion of biomass into petrochemical substitutes to understand the biochemistry and microbiology of anaerobic digestion.	o Reliance on private sector.	o Develop methods and equipment for preparation of biomass feedstock for conversion.	o Development of technology for conversion of biomass feedstocks to biogas to replace natural gas as fuel.
- Photobiological systems that will produce hydrogen from water and renewable resources to produce increased supply of hydrogen for fuel and chemical production.[1/]	o Reliance on private sector.	o Develop microorganisms with photosynthetic efficiency greater than 5% and increased stability.	o Development of biological systems and technology to maximize production of hydrogen to various species of biological organisms.

[1/] Specification of quantitative objectives for these program elements is not realistic since many projects are exploratory research expected to yield substantial payoffs, but not before 1995.

TABLE 25-2

SOLAR APPLICATIONS FOR INDUSTRY

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Identify and develop innovative biomass feedstocks without adverse effects on traditional food and fiber markets. Includes development of:	o Reliance on private sector.	o Expands the herbaceous, woody, and aquatic biomass resources base and emphasizes use of currently underutilized arid and marginal lands.	
- Herbaceous energy systems (e.g., to increase productivity of hydrocarbon plants grown on arid lands and grasses on marginal lands).2/	o Reliance on private sector.	o Identifies species capable of biomass production that can be converted into energy by conversion technologies being developed.	o Production of increased biomass from herbaceous sources by identification of high yield species and improved methods.
- Short-rotation woody crops (to increase annual yields from current average yields (from forestry) of 1.5 dry tons/acre-year to 8 dry tons/acre-year by 1992).	o Reliance on private sector.	o Develops optimal growth strategies and production systems, and identifies nutrition requirements of each species.	o Maximization of wood biomass without competition with traditional wood industries.
- Aquatic systems (to identify, improve, and develop promising species of microalgae and emergent plants such as cattails.)3/	o Reliance on private sector.	o Develops harvesting methods, timing, and equipment appropriate to each type and species of biomass.	o Development of viable energy producers with sustained yields.
SOLAR THERMAL ENERGY SYSTEMS:			
Utility-Scale Electric Central Receiver (CR) Systems			
Proof of technical feasibility of heliostats, receivers, and storage subsystems with potential to meet cost targets. Proof of feasibility of the CR concept based on Barstow Pilot Plant and foreign experiments.	o Utility R&D. o Industry R&D.	o Begin initial operation of Barstow to determine performance levels and costs. o Develop low-cost heliostats to exceed previous cost/performance goals. o Initiate repowering design study.	o Developing long-life, low-cost, high-temperature materials for solar thermal components. o Support EPRI Brayton full-system test at the CRTF. o Operate Barstow; gather and analyze data. o Provide support to IEA to ensure access to operations and performance data.

2/ See footnote #1.
3/ See footnote #1.

TABLE 26-1

WIND AND OCEAN SOLAR POWER TECHNOLOGIES

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$77.2	$106.1	$104.1	$100.7	
Obligation:	$64.3	$ 94.8	$ 99.4	$ 97.1	
WIND ENERGY SYSTEMS:					
Prove the feasibility of large wind systems and develop reliable long-lived and economically viable small and large wind machines:			o Reliability, fatigue life-time, maintenance studies conducted; power quality safety, stability, and interconnection issues addressed.	o Component development, product improvement tests at Rocky Flats.	o Technical feasibility of wind energy systems has been well established at all system sizes.
- Develop and test a series of small turbines in the 1-100 kW class.	o 1,2,8, and 40 kW machines developed.	o 4 and 15 kW machines developed. Four low-cost Darrieus developed.	o Tests started on commercial machines at Rocky Flats.		o Nine DOE-developed small machines under test 1979, 1980, 1981. Prototypes field tested in 7 states.
- Develop and test intermediate-scale (200-kW) systems and large machines in the megawatt range.	o MOD-OA tested at Clayton, N.M., and Culebra, P.R.	o MOD-OA tested at Block Island, R.I. o MOD-1 (2 MW) installed at Boone, N.C.	o MOD-OA tested at Oahu, HI. o First MOD-2 (2.5 MW) installed at Goodnoe Hills, WA. (Bonneville Power Administration)	o 3-unit MOD-2 cluster installation completed at Goodnoe Hills, WA. (Bonneville Power Administration)	o Four intermediate and four large machines under 2-year tests by 1981. o 13 Federal/private machines in operation (total 20 MW).
- Complete design, fabrication, and testing of advanced multi-megawatt systems by 1984.				o Multimegawatt MOD-5 conceptual designs started.	o MOD-5 designs to be completed by FY 82. Fabrication/testing cancelled.
Research advanced and innovative system concepts.		o Blade development efforts, dynamic loads studied. Six innovative concepts studied by the Solar Energy Research Institute.		o Diffuser-augmented turbines studied.	

TABLE 26-1

WIND AND OCEAN SOLAR POWER TECHNOLOGIES

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Develop basic wind resources information and related models/ analytical techniques for use in siting design and operation of wind systems:					
- Produce U.S. wind atlas by 1981.		o Northwest region wind atlas published.		o Publication of 12 wind atlases completed.	o National wind resources atlases published for all 50 states and U.S. territories.
- Develop preliminary wind prospecting and forecasting methods by 1982, refined by 1985.					o Wind characteristics research under way in FY 82. Meteorological compendia for systems design and forecasting to be published by FY 82.
- Develop preliminary machine siting methodology by 1982, refined by 1985.			o Siting assistance program initiated.	o Installation of wind measurement equipment completed at 35 utility sites.	o Siting handbooks published for large and small systems.
Promote market development for large and small wind systems by developing the industrial base, increasing user awareness/ acceptance, and reducing barriers to commercialization:					o Program element was phased out in FY 81. Commercialization strategies were developed. 20 to 40 small firms and 6 to 8 large firms actively developing or marketing wind machines. Small wind machine sales at a few thousand annually as a result of tax incentives and maturing technology.
- Undertake studies to identify and ameliorate barriers to wind power application by 1981.	o Wind system siting handbook for electromagnetic interference (radio and television) published.	o Initial technical and economic models developed.	o Models expanded to include a broader class of users. o Small wind system market analysis completed. o Large wind system guide for utilities completed.	o Noise, electromagnetic interference of large wind turbines analyzed.	

TABLE 26-1

WIND AND OCEAN SOLAR POWER TECHNOLOGIES

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
- Sponsor and conduct workshops, meetings, and promotional activities on wind energy development each year.	o Wind Workshop III held Oct. 1977.	o User outreach program initiated.	o Wind Workshop IV held Oct. 1979.	o Two public meetings on the Wind Energy Systems Act of 1980 (P.L. 96-345) held. o Workshops held at Rocky Flats, NASA Lewis, and Pacific Northwest Labs. o Comprehensive Program Management Plan completed. o Loans/grants program procedures developed and published. o Foreign applications study completed. o Federal applications study completed.	
Fulfill the 1988 goals for the program specified in the Wind Energy System Act of 1980 (P.L. 96-345).					o Small machine cost of electricity range 8-15¢/kWh depending on wind characteristics and production rates.
- Reduce cost of electricity from wind to level of conventional sources.					o Large machine cost of electricity range 6-10¢/kWh depending on wind characteristics and production rates.
- 800 MW total U.S. capacity; 100 MW small wind systems capacity.					o 80-MW, 10-MW, 4-MW, and 600-kW wind farms being planned by private sector.
- Accelerate growth of wind industry.					o Two megawatt-scale and three intermediate-scale machines have been purchased by private utilities.

TABLE 26-1

WIND AND OCEAN SOLAR POWER TECHNOLOGIES

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
OCEAN ENERGY SYSTEMS:					
Provide the first estimates of the potential of the basic ocean thermal resource and assemble resources and environmental data required for site selection and plant design.	o Generated global OTEC resource maps.	o Compiled detailed OTEC resource data for 5 U.S. locations and 9 Int'l locations.	o Collected detailed OTEC resource data at 4 U.S. sites.	o Collected OTEC resource data at 4 U.S. sites.	o Significant data have been collected, but OTEC, wave, and current resources remain to be defined in greater detail.
		o Completed OTEC Programmatic Environmental Assessment.	o Completed draft environmental assessment for the Seacoast Test Facility.	o Conducted toxicity studies and studies of the impingement of marine biota on heat exchangers.	o Observation and testing at site-specific operational OTEC plants are required to further assess the environmental and resource characteristics of OTEC.
Perform R&D aimed at technology improvements that reduce risk and improve performance sufficiently to permit the private sector to construct ocean energy systems. Specifically, for an extended period of time to:					
- Operate and maintain high performance OTEC heat exchangers.	o 1-MWt heat exchanger core tested at Argonne National Lab.	o Testing at large heat exchangers developed by industry.	o Installed OTEC-1 heat exchanger test articles and biofouling modules.	o Commenced tests of four heat exchanger core units at Argonne National Labs.	o OTEC heat exchanger performance has been demonstrated but long-term cleanability and performance must be assessed.
	o Biofouling, heat transfer, and corrosion-rate testing conducted near Tampa, Fla.	o Conducted test of biofouling in waters off Hawaii and the Caribbean.		o Performed at-sea tests on OTEC-1 to verify feasibility of biofouling cleaning techniques for a 1-MWe shell-and-tube heat exchanger.	
	o Work began on Seacoast Test Facility in Hawaii.	o Commenced cleaning tests of coast of Fla.		o Commenced first phase of Seacoast Facility biofouling and corrosion test.	
	o Three organizations selected to design OTEC shall-and-tube power systems.	o Three organizations selected to design OTEC power systems exchangers.		o Completed work on candidate OTEC power system designs.	

TABLE 26-1

WIND AND OCEAN SOLAR POWER TECHNOLOGIES

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
- Demonstrate structural integrity of cold water pipes in an ocean environment.		o Conducted at-sea tests of 500-foot cold-water pipe (CWP).	o Completed conceptual/preliminary design studies on OTEC CWP, mooring and position-keeping, and electrical-cable subsystems. o Achieved partial experimental validation of the CWP computer code.	o Started one-third scale, at-sea CWP test.	o Structural integrity of OTEC cold water pipes for actual platform needs to be demonstrated at significant scale.
- Demonstrate integrity of electrical ocean riser cables in an ocean environment.			o Riser cables (40 MWe) design completed.	o 40 MWe riser cable sections fabricated and tests initiated. o Completed engineering development tests of electric cable prototype.	o Structural and electrical integrity of OTEC submarine electric cable must still be proved in at-sea conditions.
- Demonstrate technical feasibility of other ocean energy options: -- Open cycle OTEC -- Waves -- Currents -- Salinity membranes		o Solicited wave device designs.	o Designed wave devices.	o Constructed wave device.	o Wave device requires at-sea test.
- Design appropriate platform.	o Contractor selected to design and construct OTEC-1 platform.	o Completed feasibility design studies of 10-MWe and 40-Mwe landbased plants. o Began modification of a Navy tanker and fabrication of heat exchangers for OTEC-1.	o Completed four conceptual designs for spar, moored floating, grazing, and landbased OTEC plants. o Completed physical model testing of an OTEC pilot plant.	o Deployed and successfully operated OTEC-1 engineering test facility. o Substantial progress achieved in developing computer programs for predicting the behavior of candidate ocean platforms.	o Observation and testing at site-specific operational OTEC plants are required to further assess the technical acceptability of OTEC.

TABLE 26-1

WIND AND OCEAN SOLAR POWER TECHNOLOGIES

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Promote market development for diverse classes of ocean energy systems by increasing user awareness/acceptance, by encouraging expansion of manufacturing capabilities and reducing barriers to commercialization.	o Completed mission analyses that defined potential OTEC markets and permitted the development of market penetration strategies.	o Improved cost projections for commercial OTEC systems.	o Industry/utilities define commercialization issues.	o Defined domestic economic benefit to U.S. of OTEC industrial development.	o Identification of early market penetration points and major barriers to commercialization. Provided assistance to Congress in developing financial incentives.
Assist the private sector in the attainment of the national goals established in P.L. 96-310.			o Issued a Program Opportunity Notice (PON) requesting proposals for OTEC proof-of-concept plants.	o Began OTEC proof-of-concept conceptual design studies. o Documented and disseminated to users the accrued results of program R&D.	

TABLE 26-2

WIND AND OCEAN SOLAR POWER TECHNOLOGIES

CURRENT PROGRAM OBJECTIVES AND BUDGET
(Budget data in FY 82 $ millions)

FY 82: $56.2

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
WIND ENERGY SYSTEMS:			
Prove the feasibility of small and large wind systems, to develop technology that will enable the private sector to design and produce reliable and economically viable wind machines; support the private sector in achieving the objectives of the Wind Energy Systems Act of 1980 (P.L. 96-345).	o Rely on private sector industrial R&D for product improvements, field experiments and system demonstrations on small and large wind machines and innovative concepts research.	o Conduct research and testing of blades and other advanced components leading to lower cost and improved performance and reliability. o Conduct operational experiments on MOD-OA, MOD-2, and advanced small machines to develop data on blade fatigue, machine stress, machine interactions, and tower resonance, as well as machine performance. Complete conceptual design of multimegawatt machines in 1981.	o Provide validated analytical tools, validate performance analysis tools, identify technology problems of advanced and innovative concepts, conduct experiments, and gather operational data from demonstration machines. Publish fatigue data in 1983. o Develop an understanding of operations, economics, and environmental questions particularly for utility grid applications. Continue MOD-OA and MOD-2 testing.
Develop basic wind resource information and related models/analytical techniques for use in site selection and in the design and operation of wind systems.	o Rely on private sector to develop basic site selection and system simulation models and analytical techniques.	o Refine wind energy prospecting and forecasting techniques. o Develop preliminary siting methodology.	o Provide ability to rapidly and economically locate good wind sites. Publish results in 1982.
OCEAN ENERGY SYSTEMS:			
Orderly termination of the program during FY 1982.	o Rely on the private sector.	o Determination and payment of contract closeout costs. o Transfer of Federal facilities and activities to appropriate public or private organizations.	

TABLE 27-1

SOLAR INFORMATION, INTERNATIONAL, AND SERI

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$4.1	$16.5	$16.8	$23.5	
Obligation:	$3.4	$14.7	$16.0	$22.6	
SOLAR INFORMATION SYSTEMS:					
Establish and maintain a renewable energy data base and prepare information products based on user needs.	o Developed and/or monitored 3 data bases--on solar installations, manufacturers, and programs.	o Developed 3 additional data bases, including a list of international firms involved in manufacturing solar equipment and components, a calendar of solar events, and meteorological data.	o Maintained 6 solar data bases and updated them to include the latest material.	o Added 3 more data bases and updated existing 6 data bases.	o 9 data bases established and being continued with emphasis on technical R&D information.
		o Distributed 50,000 documents on solar energy to the scientific and technical community and to consumers.	o Distributed 862,000 documents on solar energy to the scientific and technical community and to consumers.	o Distributed 1,700,000 documents on solar energy to the scientific and technical community and to consumers.	o Objective met satisfactorily.
Respond to information requests by users.	o Answered 179,000 information requests.	o Answered 275,000 information requests.	o Surveyed approximately 1,000 clients by telephone to determine user needs and answered 411,000 information requests.	o Surveyed approximately 50,000 clients by letter to determine user needs and answered 250,000 information requests.	o Objective met satisfactorily.
Sponsor workshops and seminars to disseminate solar information.	o During the period between FY 78 and FY 80, SERI, NSHCIC, and the RSEC's reached more than 24,000 people as a result of holding various workshops and conferences for solar trade and professional groups.				o Completed.

TABLE 27-1

SOLAR INFORMATION, INTERNATIONAL, AND SERI

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
Coordinate solar and renewable energy information activities within DOE and other Federal agencies.	o Not applicable	o Not applicable	o Not applicable	o Completed an inventory of key DOE and other Federal agency information. o Merged SERI and NSHCIC data bases and phased out SERI inquiry and referral service.	o Objective met; activity is continuing.
INTERNATIONAL SOLAR ENERGY PROGRAMS:					
Accelerate the technical and market development of selected technologies by means of five international cooperative agreements involving about 25 specific projects.	o Initiated U.S.-Saudi Arabia programs (SOLERAS) planning for $100 million, 5-year commitment on fifty-fifty cost-sharing basis.	o Prepared solar technical plan for the SOLERAS Program.	o Initiated a 350-kWe solar photovoltaic remote village project. o Initiated four solar cooling projects in southwestern United States.	o Completed and tested a stand-alone 350-kWe village photovoltaic power system in Saudi Arabia.	o System operational.
				o Completed installation and initiated testing of 4 solar cooling systems.	o Systems operational.
				o Initiated solar desalinization and solar-controlled agricultural projects in the United States and Saudi Arabia.	o Project initiated.
Undertake 4 bilateral and 1 multilateral agreements covering 25 projects in the selected solar technology areas.	o Set up agreement for program of information exchange on forestry biomass.	o Began biomass information exchange.	o Exchanged information on biomass systems.	o Twelve countries exchanged R&D information on forestry biomass energy R&D.	o Completed.
	o Set up agreement for cooperative R&D program in solar heating, cooling, and hot water.	o Began cooperative solar heating and cooling activities.	o Established common procedures for predicting, measuring, and reporting performance.	o Published a report on advanced U.S., German, and Japanese evacuated-tube solar collector systems.	

TABLE 27-1

SOLAR INFORMATION, INTERNATIONAL, AND SERI

Goals/Objectives	Budget Data ($ Millions) Status: FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
	o Initiated design of a 500-kWe distributed collector and a 500-kWe central solar receiver at Almeris, Spain (IEA agreement).	o Completed design of two systems for Almeria.	o Began construction of the two experimental solar power systems.	o Completed construction.	o Construction completed, ready for operational testing.
	o Exchanged technical information on wind power with four countries and funded studies and workshops (IEA agreement).	o Conducted workshops on environmental and meteorological aspects of large-scale wind systems.	o Obtained technical data for large wind systems to meet industrial and electric utility needs.	o Analyzed wind flow and uncertainties associated with various terrain sites.	o Completed data exchange.
	o Exchanged technical information on wave power and ocean energy systems.	o Initiated a project for testing a wave-powered turbine on Japan's Kamei buoy.	o Obtained test data on wave-powered machine at Kamei.	o Continued to exchange test data on wave-powered machine operated by the United States.	o Data exchanged.
	o Initiated U.S.-Spanish agreement for cooperative solar program.	o Initiated joint projects for R&D and testing of a 1-MWe solar central receiver system.	o Provided DOE technical support on the design and construction of a Spanish 1-MWe solar power system.	o Participated in the construction of a 1-MWe solar central receiver powerplant in Spain.	o Construction completed and operational testing initiated.
		o Provided assessment and technical cooperation in applying solar energy to Spain's building energy needs.	o Established agreement with Israel for cooperative R&D and information exchange on planar solar collectors and passive climate-control technology.	o Exchanged data on advanced flat-glass optical (luminescent) solar collectors and passive climate controls and instrumentation.	o Data exchange initiated.

TABLE 27-1

SOLAR INFORMATION, INTERNATIONAL, AND SERI

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Assist U.S. industry in developing foreign business in solar technology areas by assessing international market conditions and promoting export opportunities for U.S. products and services.			o Initiated country studies on market potential and opportunities.	o Conducted 30 market analyses, involving the collection and analysis of overseas market information for dissemination to U.S. industry.	o Completed market analyses and disseminated results; promoted exports of U.S. products and services; commercialization activities were discontinued.
			o Sponsored three export management seminars.	o Disseminated market analysis information through SERI newsletter, export management seminars, and publications.	
			o Participated in trade shows and technical seminars in Milan, Italy, and Sao Paulo and Florinapolis, Brazil.	o Promoted U.S solar systems through overseas trade shows, seminars in Europe and the Far East, and projects designed to use commercial equipment abroad.	
SOLAR ENERGY RESEARCH INSTITUTE CONSTRUCTION:					
Build a permanent laboratory and office space for approximately 1,000 SERI employees, demonstrating economic, environmental, and aesthetic use of energy conservation and renewable energy technologies, by third quarter of FY 81.	o Initiated planning for SERI facilities using SERI and DOE overhead funds.	o Initiated work on a conceptual design plan for SERI's permanent facilities that would be 80% energy self-sufficient.	o Completed conceptual facility design. o Completed a revised Title I design that would be more than 50% energy self-sufficient. o Completed Environmental Assessment, which indicated no significant impact.	o Modified role and mission and developed preliminary revised design plan for laboratory and test facilities.	o Design objectives were achieved. Decision made to construct only a test site and support building and continue to use leased space.

TABLE 27-2

SOLAR INTERNATIONAL, INFORMATION, AND SERI

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $10.7

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
SOLAR INFORMATION SYSTEMS:			
Ensure timely dissemination of results from R&D programs in renewable energy and conservation technologies. Prepare high-priority information products based on user needs. Respond to client inquiries. Coordinate solar and renewable energy information activities within DOE and other Federal agencies. Eliminate unnecessary redundancy in dissemination activities.	o Rely on private sector and/or state and local governments to answer inquiries and generate information products.	o Improve the coordination and integration of solar information activities and articulate DOE policy related to gathering, packaging, and dissemination of renewable energy and conservation information. o Using the results of user needs surveys, produce information products that contain useable and accurate results of Federal solar R&D programs. o Maintain the capability to make accurate and timely responses to telephone and mail inquiries on renewable energy research and development programs. o Improve the cost-effectiveness of information transfer operation through centralized data control and decentralized data inputs.	o Provide for the effective transfer of information produced from research and development to the private sector to encourage renewable energy use on a scale consistent with national goals. o Provide for the maintenance and operation of the present information services, which meet the needs of high-priority users (including the R&D community, the financial sector, equipment manufacturers, architects, and engineers). o Provide for continued and improved coordination of DOE and other Federal agencies in order to avoid program duplication.
INTERNATIONAL SOLAR ENERGY PROGRAMS:			
Accelerate the technical development of selected technologies by means of continuing international cooperative activities under the IEA and U.S/Saudi Arabia (SOLERAS) agreements.	o Rely on the private sector to seek international cooperative agreements for technical data exchange and joint projects.	o Joint SOLERAS testing of four different solar cooling systems in southwestern United States. o Experience in the operation of a 350-kWe village photovoltaic power system.	o Permit the United States to continue its commitment to the $100 million, 5-year U.S.-Saudi Arabia (SOLERAS) agreement (fifty-fifty cost-sharing basis).

TABLE 27-2

SOLAR INTERNATIONAL, INFORMATION, AND SERI

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Complete 6 projects initiated under the SOLERAS Agreement; obtain operational data on cooperative R&D projects in five solar technology areas currently active in the IEA agreement. Exchange R&D information with Saudi Arabia, Israel, Italy, Mexico, Korea, and Gabon under existing bilateral agreements. Reduce costs in domestic solar program through technical exchanges with solar program in Israel, Saudi Arabia, Mexico, Italy, and Spain.	o Rely on other government agencies to fulfill agreements.	o Complete scientific data exchange and joint operational testing of solar and wind systems under existing bilateral agreements with Israel, Mexico, and Spain.	o Cost sharing in the construction of two large-scale solar desalination plants (one in United States, one in Saudi Arabia). o Cooperative testing of solar-controlled agricultural environment in United States and Saudi Arabia. o Operational test data on two 500-kWe small solar power systems located at Almeria, Spain, on large wind turbines in the United States, and on wavepower systeems in Japan. o Exchange of scientific data on advanced planar luminescent solar collectors and passive climate-control systems (Israel). o Exchange of performance and operational data on solar thermal and wind systems (Mexico and Spain).
Provide technical assistance in renewable energy technologies to 20 industrial companies interested in international activities, 3 government agencies, and 5 foreign countries.	o Rely on other government agencies (DOS, DOC, AID, and the Trade Development Program) to provide technical and economic solar expertise in support of international agreements and cooperative projects.	o Continue DOE technical and economic analyses support to other government agencies and international institutions (such as the United Nations and World Bank) in the formulation and planning of joint international projects.	o Use of unique DOE solar technical expertise to support international commitments and to provide continued technical and economic services to other Federal agencies and financial institutions.

TABLE 28-1

ALCOHOL FUELS

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
Total Obligational Authority:	$0.0	$0.0	$22.0	$18.0	
Obligation:	$0.0	$0.0	$21.0	$21.3	
To increase domestic capacity to 920 million gal./year by the end of CY 1982 (P.L. 96-294).	o NA	o NA			o Goal will not be met. Current production is approximately 42 million gal./year.
To accelerate production through financial assistance to manufacturers for feasibility studies and cooperative agreements.			o $20.2M awarded for feasibility studies on 47 projects with potential total capacity of 1.2 billion gallons per year (about 0.16 quad/yr.). $34.8M awarded for cooperative agreements on 3 other projects, with actual total capacity of 90 million (about 0.01 quad/yr.).		
Establish loan guarantee program by promulgating regulations and soliciting for loan applicants (P.L. 96-294).			o $274M for loan guarantees on 10 projects with actual total capacity of 350 million gallons per year (about 0.04 quad/yr.).		o Negotiations are in process with 10 projects for loan guarantees.
To encourage technological innovation and technology transfer by providing approximately 200 small grants to small businesses, educational institutions, and individuals.			o $3.5M for 87 grants.	o $1.2M for 27 grants.	o 114 grants awarded; 57% of objective.
By 1981, examine state of art in alcohol production technology and develop an R&D plan with cost reduction goals for a mid- and long-range R&D program.	o NA	o NA			o R&D plan has been developed and is being implemented.
Develop utilization technologies to increase the efficiency possible from alcohol fuels.	o NA	o NA			o First-generation vehicle has been tested and shows 30% improvement in efficiency.

TABLE 28-2

ALCOHOL FUELS

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $10.0

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
To conduct an orderly phase out of the R&D program.			o Complete technology base and transfer to private sector.
By 1983, transfer pressurized oxygen gasifer and catalysis research results to the private sector to allow methanol to be produced for $0.65/gallon when commercialized fully.			
By 1983, develop utilization technologies to increase by 50% the efficiency possible from alcohol fuels.		o Develop dissociated alcohol engine.	

TABLE 29-1

HYDROPOWER

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$10.7	$29.5	$33.7	$11.9	
Obligation:	$10.0	$17.0	$19.0	$11.3	
Demonstrate the commercial feasibility of small hydropower through: - 5 projects and 11 MW by January 1982. - 11 projects and 48 MW by January 1983. - 15 projects and 87 MW by January 1984. - Total of 20 projects and 133 MW by 1985.	o Selected one pilot demonstration project (Idaho Falls).	o Selected remaining projects: average of 15% Federal cost sharing with 7 municipalities, 5 utilities, 3 irrigation districts, 2 industrial sponsors, and other developers.	o Initiated monitoring; first 2 projects on line; considerable attention from industry and public; minimum flow issue uncovered.	o Total of 5 projects and 11 MW on-line; completed funding for all projects; began disseminating "lessons learned."	o Interim objectives have been met; on schedule to complete objectives of commercial power on line by 1985 and monitoring/dissemination of lessons learned by 1987.
Provide loans for feasibility studies and licensing costs. - Use to stimulate developers. - DOE processing time to be 90 days or less. - Award 675 loans, leading to projects totaling 675 MW.		o Loan regulations developed.	o Loan program initiated, using decentralized field offices; 95 loans approved.	o A total of 170 loans approved, with average processing time less than 90 days.	o Loan program suspended in March 1981, after helping to generate considerable activity, particularly by nonprofit entities. Original power-on-line goal will not be achieved although the goal of stimulating developers has been achieved.
Provide technical assistance to bring additional projects on line or under construction by 1985.				o Technical assistance provided by DOE regional offices to stimulate most viable projects.	o Technical assistance has provided assistance to many developers.
Total of first 3 objectives to provide 1,000 MW.					o Overall goal of stimulating small hydro development has been achieved although original program targets have not been.

TABLE 29-1

HYDROPOWER

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Reduce the cost of small hydro development through R&D on: - New techniques for retrofit of existing sites and for ultra low-head sites. - Generic environmental barriers.	o Began resource and environmental assessments. Awarded 54 feasibility study grants.	o Began ultra low-head (ULH) R&D and generic environmental studies; issued feasibility study manual.	o First ULH model lab tested; continued other projects; initiated paper studies on minimum streamflow issue.	o Four more ULH studies completed; began pumps-as-turbines experience profile; began environmental field tests.	o First ULH device (Schneider) installed in 2 locations; 4 of 7 environmental manuals in print, feasibility design manual selling at rate of several dozen per month.
Mitigate (and help states to mitigate) legal, institutional, and technical barriers.		o Initiated contracts to identify state legal and institutional barriers, and grant to National Conference of State Legislatures (NCSL) to assist state legislatures.	o Initiated grants to states and technical assistance to Public Utility Commissions for implementing PURPA incentives.	o Grants provided to total of 40 states for resource assessments, institutional reforms, etc. Technical assistance to 24 legislatures and 16 PUC's. 36 state-specific and 3 generic studies published.	o More than 10 states have approved legislative reforms; states have met initial PURPA requirements.

TABLE 29-2

HYDROPOWER

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $3.0

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Monitor 20 demonstration projects.	o None.	o Maintain minimal monitoring for demonstration projects to ensure that lessons learned are transferred to private sector.	o Demonstration projects begun in previous years will be carried out as planned and results shown.
Complete minimum stream flow requirements R&D.	o Assign to FERC.	o Obtain data to help FERC make regulatory decisions and private developers to design projects.	o Scientific base needed to ensure development of renewable resources.

TABLE 30-1

GEOTHERMAL RESOURCES

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$153.2	$202.3	$194.1	$161.0	
Obligation:	$108.0	$154.0	$150.3	$158.6	
HYDROTHERMAL RESOURCES:					
Confirm the existence and commercial potential of reservoirs suitable for electric power generation and/or direct heat applications to meet Interagency Geothermal Coordinating Council (IGCC) goals.	o Reservoir confirmation drilling initiated with major developers; resources identified in total of 37 states.	o 3 exploratory wells drilled; 3 state maps published.	o 9 deep exploratory wells drilled; assessment activities in 28 states.	o 53 reservoirs identified for 23,383 MWe; assessment activities in 34 states; 6 state resource maps published.	o Reservoir confirmation activity sufficient to meet IGCC goal of 3,000 MWe of electric capacity by 1985.
	o Assisted 59 deep wells to be drilled by private industry.	o Assisted 75 deep wells to be drilled.	o Assisted 68 deep wells to be drilled.	o Assisted 70 deep wells to be drilled.	o Sufficient reservoirs have been identified to meet goals for direct-heat applications through 1983.
Reduce field development costs and capital costs of electric generating facilities to achieve by 1987 an average busbar cost reduction of 10% (from a base of 20 mills/kWh) for high-temperature (greater than 180° C) resources and 30% (from a base of 120 mills/kWh) for moderate-temperature (150° C-180° C) resources.	o Improved drilling bits; direct contact heat exchanger; H_2S control system.	o Improved drilling technology. 100-kWe power systems; 5-MWe gravity-head binary system; descaling technique.	o Drilling using nitrogen gas; 500-kWe binary system test; 3 reservoir stimulation experiments.	o High-temperature drilling mud; cements and logging tool; powerplant control system; binary system field test.	o Technology development is on schedule; total reductions of 7% and 10% in average electric busbar cost achieved for high- and moderate-temp. resources, respectively.
	o Reduction in electric busbar cost: High temp.-1% Mod. temp.-2%	o High temp.-1% Mod. temp.-2%	o High temp.-2% Mod. temp.-2%	o High temp.-3% Mod. temp.-4%	o Results adopted by industry and incorporated into designs for electric power systems.
					o Major improvements achieved in drilling bits, direct contact heat exchangers, low-cost materials, descaling techniques, environmental control system.

TABLE 30-1

GEOTHERMAL RESOURCES

Goals/Objectives	Budget Data ($ Millions) Status: FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Demonstrate the technical feasibility and economic viability of (1) electric power systems for high-temperature resources by 1983 and for moderate-temperature by 1986 and (2) direct-heat applications for low- to moderate-temperature resources by 1982.	o Construction begun on 5-MWe pilot plant (ID).	o Construction continued.	o Construction completed.	o Plant start-up and operation.	o Demonstrated 1-3 MWe wellhead generator systems; flash-steam demonstration under field development; binary demonstration not completed.
	o 50-MWe flash-steam-plant contractor selected (NM).	o Agreement signed with industry.	o Plant design under way; well drilling started.	o Binary cycle plant design started.	
	o Construction begun on 3-MWe wellhead generator system (HI).	o Construction continued.	o Construction continued.	o Construction completed; system start-up; plant dedicated.	o 12 of 23 direct heat applications successfully demonstrated.
	o 1-MWe helical screw expander tested (UT).	o System refurbished for test at foreign sites.	o 34 direct heat application studies completed; 8 new studies.	o 8 direct heat studies completed.	o Industry has ordered more electric power plants (due to be built by 1985) than estimated in 1979 by Electric Power Research Institute (EPRI).
	o 8 direct heat demonstration projects started.	o 15 new projects initiated; reservoirs confirmed at 7 sites.	o 6 direct heat projects became operational.	o 6 additional projects became operational.	
Alleviate legal and institutional barriers to geothermal development.	o National Conference of State Legislatures (NCSL) project initiated to expedite modification of state laws affecting geothermal development.	o NCSL provided research and legal assistance to 6 states; Institutional Barriers Report issued.	o NCSL services extended to 8 additional states; total of 58 bills considered in 12 of 14 states concerned.	o NCSL effort extended to states in eastern U.S.; program to use geothermal energy in Federal buildings; reservior insurance study.	o State laws changed or under active consideration in one-third of states with geothermal resources; state and Federal procedures still need streamlining.
Provide technical assistance to potential geothermal users; keep up technology base and transfer results to the private sector.	o 3 operations research projects initiated.	o State development planning teams initiated in 10 western states.	o 6 additional state planning team efforts initiated, including 1 in East.	o State development plans issued by 16 western states; DOE assistance given to more than 100 viable direct-heat projects.	o Assistance was provided as requested by potential direct-heat users.
		o Technical assistance center established at Idaho Falls, ID, covering 10-state region.	o Technical assistance centers established in Maryland, Utah, and Oregon.	o 5 developed components transferred to industry.	o Several hundred R&D reports distributed; technology transfer on schedule.

TABLE 30-1

GEOTHERMAL RESOURCES

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Coordinate and monitor the geothermal programs of all Federal agencies.	o Second Annual Report to Congress of Interagency Geothermal Coordinating Committee (IGCC) published.	o Third Annual IGCC Report to Congress.	o Fourth Annual IGCC Report to Congress.	o Fifth Annual IGCC Report to Congress.	o A system to monitor geothermal programs has been established and is up to date.
		o IGCC Streamlining Task Force Report.	o 14 recommendations of Streamlining Task Force incorporated in legislation by Congress.	o Market penetration analyses for hydrothermal resources completed.	o All IGCC reports issued as required.
		o Completed design of geothermal progress monitoring system; preliminary report issued.	o Geothermal progress monitoring system established; 3 reports issued. o IGCC Environmental Control R&D Panel Report issued.	o Geothermal Progress Monitor issued.	
Reduce front-end risks in exploring for and developing hydrothermal reservoirs by authorizing guaranteed loans through 1990.	o 12 applications received for guaranteed loans.	o 13 applications in preparation (estimated value of $42.9 million).	o 15 guarantee loan applications in preparation (estimated value of $556 million).	o 11 applications pending for loan guarantees totaling $457.4 million.	o Of the $500 million authorized loan guarantee limit, $136 million was used; program on target and current applications are being processed.
	o 2 projects approved.	o 2 loans guaranteed, totaling $32.6 million.	o 11 loan guaranteed for $49.4 million.	o Guarantees suspended in March 1981 due to policy change.	o 2 loans guaranteed, totaling $54.0 million.
GEOPRESSURED RESOURCES:					
Define the extent and magnitude of the geopressured resource and determine the engineering and economic feasibility of recovering the associated methane, heat, and hydraulic energy by 1986.	o Resource assessments identified for 63 candidate reservoirs in Tex. and La.	o Definition studies produced maps of resources in Tex. and La.	o Arrangements made for short-term testing of 4 wells-of-opportunity.	o 12 oil/gas wells re-entered to date for short-term testing.	o The program is on schedule, and about 50% of the re-entered oil/gas wells and long-term test wells needed for it have been or are being evaluated.
	o Drilling of first geopressured test well in Brazoria County, Tex.	o Brazoria test well completed and made ready for long-term testing.	o Initial testing begun with Brazoria well (high flow rate--40,000 bbl./day).	o Long-term testing of Brazoria well continued; 4 new test wells drilled.	

TABLE 30-1

GEOTHERMAL RESOURCES

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
HOT DRY ROCK RESOURCES:					
Demonstrate the technical and economic feasibility of extracting energy from hot dry rock (HDR) resources by 1990.	o 5-MWt hot dry rock energy-extraction loop operated sucessfully at Fenton Hill, N. Mex.	o Drilling initiated for first well of 20-50 MWt loop at Fenton Hill. o IEA Agreement signed by Federal Republic of Germany for FRG participation in HDR project.	o First well of thermal loop (20-50 MWt) completed; work on second well started. o Site selection analyses begun for second experimental site.	o Second well of HDR thermal loop completed. o Completed IEA agreement with Japan to share cost of experimental work at Fenton Hill.	o Phase I: 5-MWt pilot HDR system successfully operated. o Phase II: near-commercial (20-50 MWt) system being installed on schedule. o Second site not yet selected.

TABLE 30-2

GEOTHERMAL RESOURCES

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $55.4

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
HYDROTHERMAL RESOURCES:			
Continue efforts to reduce field development costs and capital costs of electric generating facilities sufficiently to achieve by 1987 an average busbar cost reduction of 10% for high-temperature (greater than 180° C) resources and 30% for moderate-temperature (150° C to 180° C) resources.	o Reliance on private sector.	o Improved drilling and completion equipment to reduce costs 25% (by 1983). o Advanced reservoir stimulation techniques. o Improved exploration technology and reservoir engineering techniques. o Advanced energy-conversion systems for moderate-temperature resources. o Improved materials for geothermal fluid handling systems. o Advanced pollutant control technology (by 1983).	o Improved drilling technology. o Adaptation of seismic imaging techniques to geothermal exploration. o Improved well-stimulation technology. o Direct contact heat exchanger technology. o Advanced binary power systems.
Establish technical and economic viability of electric power generation from liquid-dominated resources by 1985.	o Reliance on private enterprise.	o Cost-share construction of 50-MWe flash-steam plant (to be completed in 1983). o Operational test of 5-MWe pilot binary cycle plant (by 1982).	o Complete DOE support for construction of 50-MWe plant. o Complete operational test of 5-MWe plant.
Transfer technology to private sector.	o Reliance on private sector.	o National Laboratories develop and maintain data bases and transfer technologies (continuing).	o Results of DOE research and development disseminated to private sector.
Monitor existing projects with guaranteed loans and process applications.		o Review of guarantee loan projects, monitoring of loan repayment activity, and process applications.	o Monitor existing loan projects and meet obligations for current applications.

TABLE 30-2

GEOTHERMAL RESOURCES

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Coordinate and monitor all Federal geothermal activities.		o Annual and ad hoc meetings of IGCC. o IGCC Staff Committee, panels, and working groups (periodic meetings). o Geothermal Progress Monitor (quarterly reports) and IGCC Annual Report.	o IGCC activities supported by DOE staff.
GEOPRESSURED RESOURCES:			
Define geopressured resource by 1984.	o Reliance on private sector.	o Complete long-term testing of design wells (by 1983). o Short-term testing of wells-of-opportunity (by 1983). o Complete evaluation of reservoir data.	o Dissemination to industry of information on extent of resource and economics of energy recovery.
HOT DRY ROCK RESOURCES:			
Determine technical feasibility of extracting energy from hot dry rock resources by 1984.	o Reliance on private sector.	o 20 to 50 MWt energy extraction facility at Fenton Hill (by 1983).	o Complete hydraulic fracturing for interim system (10 MWt).

TABLE 31-1

BUILDINGS AND COMMUNITY SYSTEMS

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$69.1	$94.0	$109.6	$67.8	
Obligation:	$64.3	$87.5	$106.0	$61.0	
BUILDING ENERGY RESEARCH AND DEVELOPMENT:					
To reduce energy consumption by 30% in new buildings by 1985 (from 1978 levels).					
- Develop procedures to measure the energy performance of new and existing buildings, and conduct research on efficient building design.	o Redesigned 168 commercial buildings to maximize energy efficiency. o Began research on wall and roof systems, thermal insulation, windows, daylighting; made performance calculations. o Conducted information programs for architect-engineers and builders to disseminate research results and teach energy efficiency techniques.	o Achieved 67% energy savings in prototype retrofit home. o Constructed lab test facility for HVAC program. o Initiated 6 residential case studies to learn about energy use and savings opportunities.	o Retrofitted 100 homes and constructed Brookhaven House; conducted 5 building pilots and case studies to test and measure energy savings techniques.	o Finalized modification to ASHRAE ventilation standard, making it 30% more efficient, and drafted changes to ASHRAE building standards to make them 40% more energy efficient. o Completed life-cycle cost analysis for mobile homes.	o Accelerated improvements in building energy efficiency by an estimated minimum of 6 years. Redesigns gave the private sector a technical foundation and information for producing more energy-efficient buildings. o Supported development of window systems that are 65-85% more efficient. o Developed rating system to measure performance of residential buildings.
- Develop computer models to simulate building energy use and air infiltration.		o Developed DOE-1 computer capabilities.	o Developed energy-use models; simplified residential model to predict air infiltration rates. o Developed model to test state and local codes.	o Completed handheld energy calculator for home builders.	o Completed computer models now being used by the public.

TABLE 31-1

BUILDINGS AND COMMUNITY SYSTEMS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
- Publish proposed and final rules for building energy performance standards (BEPS) by 1980. (P.L. 94-385, 95-91, and 95-619).	o Issued advance notice for BEPS.	o Proposed BEPS for 18 building types and issued regulatory economic analyses and NOPR for BEPS.			o Issued proposed BEPS rules. Final rules, which will be voluntary for the private sector but mandatory for new Federal buildings, are now due in 1984, as a result of recent legislative changes. o Research for BEPS contributed advances to knowledge of building energy efficiency which are widely applicable, with or without regulations.
To reduce energy consumption by 20% in existing buildings by 1985 (from 1978 levels).					
- Encourage private firms, utilities, and other institutions to provide more effective conservation-related services to building-energy users by developing, testing, and making available technical training and program information.		o Developed generic training materials for the real estate industry. o Analyzed roles for building-energy rating systems as support for financial decision-making.	o Developed separate programs for 3 real estate trade associations (NAR, IREM, SREA). o Developed Low-Cost/No-Cost Program. o Conducted Fuel Oil Marketing Program.	o Completed & evaluated training programs.	o 100,000 real estate agents (13 percent of the Nation's largest trade association) were trained by December 1981--1 year ahead of the original schedule. o Cooperated in Fuel Oil Marketing Program in 10 states, encouraging furnace retrofits.
- Establish regulations, review state plans, and undertake enforcement action necessary to implement the Residential Conservation Service (RCS) and related authorities. (P.L. 95-619 and 96-294)		o Analyzed 800 comments on proposed rule, draft EIS, and Regulatory Analysis.	o Developed motel audit.	o Published proposed rule for Commercial Building and Apartment Conservation Service, draft EIS, and draft Regulatory Analysis.	o 47 states developed RCS plans. o Proposed rules published 4 months after enactment of enabling legislation for RCS and 7 months after enactment for CACS.

TABLE 31-1

BUILDINGS AND COMMUNITY SYSTEMS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
To reduce energy consumption of new building equipment by 30% by 1985 (from 1978 levels). - To develop technologies that can lead (between the years 1985 & 2000) to appliances with 30% increase in efficiencies, space heating equipment with increases of from 50% to 100% in efficiencies, & lighting systems with efficiencies 50% above the 1978 average.	o Demonstrated technological feasibility of a 7.5 ton steam-engine-driven heat pump system for commercial building application. o Developed first-generation heat pump computer design model for industry use in optimizing system design. o Completed first annual-cycle field test for the Annual Cycle Energy System (ACES); demonstrated 50% reduction from energy requirements of standard heat pump system.	o Helped develop, test, & commercialize high-efficiency, no-soot, blue flame oil boiler. o Developed 4 novel atomization techniques for use in oil heating system with low/variable firing rate. o Lab-tested successfully the first free-piston Stirling engine heat pump system.	o Helped develop, test, & commercialize furnace efficiency tester for use in field tuneups. o Helped develop, test, & commercialized an 83% efficient, low pollutant wood-fired boiler. o Conducted first U.S. lab/field test of organic fluid absorption heat pump system.	o Helped develop, test, & commercialize first adjustable-output gas burner for furnace application. o Helped develop and test dynamic coupling seal for novel engine/freon compressor heat pump system. o Helped develop two modulating heat pump compressor concepts that offer low-cost, variable-speed operation.	o R&D program helped to bring high-efficiency products to market 3 to 5 years earlier than expected. o Research concentrated on heating equipment, appliances, and lighting has resulted in energy efficiency increases for each.
	o Conducted proof-of-concept testing of mixed refrigerants, showing 12% saving in the operation of refrigerators & heat pumps. o Published 47 technical reports, papers, & brochures regarding R&D activities.	o Helped develop, test, & commercialize circline lamp, utilizing 1/3 as much energy as equivalent incandescent. o Published 42 technical reports, papers, & brochures regarding R&D activities.	o Helped develop, test, & commercialize heat-pump water heater with 50% increase in operating efficiency over standard electric water heaters. o Helped develop, test, & commercialize solid-state ballast for fluorescent lamp system with 25% system efficiency improvement. o Published 35 technical reports, papers, & brochures regarding R&D activities.	o Helped test-market high-efficiency 18 cu. ft. refrigerator-freezer, using 50% less energy than average refrigerator of same size. o Helped develop & test high-efficiency motor compressor for use in refrigeration appliances. o Helped develop & test prototype of four novel light bulbs offering direct replacement of standard incandescents at 1/3 the power & 10 times the life.	

TABLE 31-1

BUILDINGS AND COMMUNITY SYSTEMS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Origina Objective Met
- To provide consumers with reliable information through appliance labeling.					
--Develop appliance test procedure rules for 13 products by 1978 (P.L. 94-163).	o Promulgated test procedures and proposed rules for energy efficiency improvements targets for 13 types of consumer products.		o Revised test procedures to include methods of test for 5 new design features.		o Test procedures on appliances developed.
--Promulgate energy efficiency targets for 13 appliances by 1978 (P.L. 94-163) and publish proposed and final efficiency standards for 13 appliances by 1981 (P.L. 95-619).		o Promulgated rules for energy efficiency targets for 5 types of consumer products.	o Proposed energy efficiency standards for 9 types of consumer products.	o Received, reviewed, and analyzed over 2,000 comments related to proposed energy efficiency standards. o Revised energy efficiency targets for 13 appliances.	o Issued proposed efficiency standards. Final rules pending.
--Develop and disseminate information explaining FTC appliance labels (P.L. 94-163).		o Promulgated energy efficiency labeling rules for 7 types of consumer products. o Developed brochures, exhibits, library displays, consumer sounding boards, 10 regional training workshops, and a national consumer awareness campaign on appliance labeling.			o Helped achieve a public awareness of appliance efficiency labels.
To reduce, between 1978 and 1985, the average energy consumption in existing Federal buildings by 20% and in new Federal buildings by 45%, by providing technical assistance & monitoring Federal building plans.					

TABLE 31-1

BUILDINGS AND COMMUNITY SYSTEMS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
- Publish proposed and final rules for building energy performance standards (BEPS) by 1980. (P.L. 94-385, 95-91, and 95-619).	o Issued advance notice for BEPS.	o Proposed BEPS for 18 building types and issued regulatory economic analyses and NOPR for BEPS.			o Issued proposed BEPS rules. Final rules, which will be voluntary for the private sector but mandatory for new Federal buildings, are now due in 1984, as a result of recent legislative changes. o Research for BEPS contributed advances to knowledge of building energy efficiency which are widely applicable, with or without regulations.
To reduce energy consumption by 20% in existing buildings by 1985 (from 1978 levels).					
- Encourage private firms, utilities, and other institutions to provide more effective conservation-related services to building-energy users by developing, testing, and making available technical training and program information.		o Developed generic training materials for the real estate industry. o Analyzed roles for building-energy rating systems as support for financial decision-making.	o Developed separate programs for 3 real estate trade associations (NAR, IREM, SREA). o Developed Low-Cost/No-Cost Program. o Conducted Fuel Oil Marketing Program.	o Completed & evaluated training programs.	o 100,000 real estate agents (13 percent of the Nation's largest trade association) were trained by December 1981--1 year ahead of the original schedule. o Cooperated in Fuel Oil Marketing Program in 10 states, encouraging furnace retrofits.
- Establish regulations, review state plans, and undertake enforcement action necessary to implement the Residential Conservation Service (RCS) and related authorities. (P.L. 95-619 and 96-294)		o Analyzed 800 comments on proposed rule, draft EIS, and Regulatory Analysis.	o Developed motel audit.	o Published proposed rule for Commercial Building and Apartment Conservation Service, draft EIS, and draft Regulatory Analysis.	o 47 states developed RCS plans. o Proposed rules published 4 months after enactment of enabling legislation for RCS and 7 months after enactment for CACS.

TABLE 31-1

BUILDINGS AND COMMUNITY SYSTEMS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
- Provide alternative energy planning concepts, methodologies, and techniques to help communities manage their energy resources more efficiently.		o Awarded grants in 25 cities for energy management analysis to local communities.		o Completed reference guidebooks for community energy management.	o Reference guidebook for community energy management completed. o Completed 25 community case studies on role of energy savings in project development, barriers to energy efficiency, and other energy-community issues. o Subdivision redesign experiment showed possible savings of 20-65% of projected energy requirements.
- Establish utility/private sector load management cooperatives.	o Began Operation Powerplay, load management co-op project in Los Angeles.	o First operational power co-op begun by Southern California Edison.		o 2 more Operation Powerplay co-op's in operation.	o 5 Operation Powerplay systems are now running.
- Provide energy management information and technical assistance to 2.8 million small businesses to help reduce their energy consumption by 175,000 BOED by 1990.		o Began development of energy audit guidebooks for cost reduction in small business.	o Developed 12 energy cost reduction guidebooks. o Trained 3,000 SCORE (Service Corps of Retired Executives) volunteers to advise small businesses on energy cost reduction.	o Developed 4 more guidebooks. o Conducted demonstration program in 12 cities to show how local energy experts could transfer knowledge and technology to small businesses.	o Published 16 guidebooks on energy cost reduction for different kinds of small businesses. Over 1 million copies distributed through trade associations.
- Aid communities through Energy Impact Assistance (EIA) program in mitigating socioeconomic strains on community resources from growth due to expanded energy production.		o Awarded 56 planning & 76 site acquisition/development Energy Impact Assistance grants.	o Awarded 79 planning & 155 site acquisition/development EIA grants.	o Awarded 25 planning & 75 site acquisition and development EIA grants.	o 95 energy-impacted areas in 284 counties approved to receive EIA grants: 160 plan grants and 306 acquisition/development grants.

TABLE 31-1

BUILDINGS AND COMMUNITY SYSTEMS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Origir Objective Met
URBAN WASTE PROGRAM:					
Appropriations:	$11.00	$13.75	$13.66	$6.88	
Goal: To achieve the production or conservation of 25,000 BOED (about 0.05 Q/yr) 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.					
Specific objectives are to:					
- Conduct research, development, and demonstrations of waste-to-energy technologies (P.L. 95-238).	o Performed research on refuse conversion to methane (RefCOM), landfill gas recovery, sludge conversion, and thermal, biological, and mechanical systems.	o RefCOM facility at Pompano Beach completed startup.	o RefCOM operated at initial test conditions.	o Conducted Phase I report on preparation and combustion of refuse-derived fuels (RDF).	o 42 technologies were investigated to improve systems' economic, technical, and environmental performance.
		o Tested 2 thermal systems (pyrolysis) and fluidized-bed combustion.			o 25 technologies demonstrated should eventually displace 15,000 BOED (about 0.03 Q/yr)--60% of the 1985 goal.
		o Enzymatic hydrolysis research at U.S. Army Natick R&D Command.	o Continued enzymatic hydrolysis research at U.S. Army Natick R&D Command.		o Leveraged the investment of over $1 billion in private capital for 20 projects which are proceeding to construction.
		o R&D initiated on 2 mechanical separation projects (TROMMEL and Air Classification).		o Completed evaluation of TROMMEL screens.	
	o Initiated development	o Pilot-scale test	o Initiated construction	o Construction of	

TABLE 31-1

BUILDINGS AND COMMUNITY SYSTEMS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Origina Objective Met
- Assess and disseminate technical and economic cost information (P.L. 95-238).	o Held first of annual workshops on methane recovery and project financing.	o Held methane recovery films and workshops.	o Energy user and methane recovery workshops; risk analysis and 2 waste-water conferences.	o Held conferences on European waste-to-energy technology, RDF, and wastewater treatment; sponsored 4 regional workshops on PURPA and an energy-user workshop.	o 66 technical reports were published and disseminated to over 150 municipalities, 56 research institutions, 29 trade associations, 51 interest groups, and 400 engineering consulting firms.
- Develop regulations, conduct institutional barrier analysis, and issue loan guarantees and price support loans (P.L. 96-294 P.L. 95-238).			o Published regulations.	o Initiated report to Congress identifying institutional barriers.	o Issued regulations, and institutional barrier analysis under way.

TABLE 31-2

BUILDINGS AND COMMUNITY SYSTEMS

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $47.7

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
BUILDINGS SYSTEMS:			
Advance the scientific and technical understanding of energy phenomena in buildings. - Envelop Systems and Materials--Determine thermal performance characteristics. Develop analytical models. Determine interaction with other building components. - Ventilation and Controls--Determine minimum rates that will allow an energy-efficient, healthy, and comfortable environment. Develop measurement tools and analytical models. Determine relationship to whole building energy use. - Performance Calculations and Diagnostics--Develop mathematical models that accurately predict energy performance of building components and whole buildings. - Pilot Projects and Case Studies--Determine, in buildings representative of particular types, actual energy flow in components and systems.	o Allow private industry to do the research.	o Expand technology base for use by private sector. o Provide for orderly termination of program and transfer of generic research to ECUT program.	o The buildings industry has not undertaken this research because of: - Fragmentation into many different sectors. - Product rather than whole-building orientation. - Elements of industry are usually small businesses. - Long-term nature of research. - Risks. o Generic buildings research with long-term payoff will be provided by this investment.

TABLE 31-2

BUILDINGS AND COMMUNITY SYSTEMS

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Develop and update standardized industry-accepted test procedures utilized by all appliance manufacturers when complying with the FTC Appliance Labeling Program.	o Allow industry to develop its own testing procedures and to self-police the rules on energy representations and labels.	o Continued modifications to test procedures as new products are introduced to the marketplace; continued technical review of waiver requests.	o An accurate FTC labeling program ensures consumers the right information to make purchase decisions.
FEDERAL ENERGY MANAGEMENT PROGRAM:			
Monitor Federal agency energy plans and develop the Federal 10-year energy plans.	o Some other office or agency could administer, but program would remain the same.	o Receipt of agency 10-year energy efficiency plans for Federal buildings.	o Coordination of energy efficiency and energy conservation activities throughout the Federal Government.
COMMUNITY SYSTEMS:			
Complete district heating projects and studies initiated in prior years.	o Allow local governments to find solutions to their energy problems without further Government assistance.		o Projects and studies already initiated. State and local projects rely on Federal commitment.
URBAN WASTE PROGRAM:			
Complete projects and studies initiated in prior years.	o Rely on private sector.	o Provide for orderly termination of R&D projects.	o Report to Congress identifying institutional barriers. o Termination of all R&D projects by FY 83.

TABLE 32-1

INDUSTRIAL CONSERVATION

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$33.2	$40.3	$65.7	$48.2	
Obligation:	$32.4	$34.9	$58.7	$42.6	

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

Goals/Objectives	FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
- Cost-share research, development, and demonstration of technologies for industrial energy conservation having large potential for saving scarce fuels. Encourage the implementation and deployment of developed and/or demonstrated technologies by the private sector.	o Began cogeneration studies. o Tested air/fuel ratio control. o Feasibility test of waste oil re-refining. o Completed designs for 3 industrial heat pumps. o 77 technology developments supported.	o Completed study on converting discarded tires into fuel or chemical feedstock. o Completed air/fuel ratio control test for oil-fired system. o Designed demonstration of economical O_2 enrichment process to improve combustion. o Developed variably powered hand tools. o Pilot test on inert cathode for use in aluminum refining. o Started use of coal as replacement for fuel gas in aluminum remelt. o Support given to total of 104 technologies.	o Fabrication of O_2 enrichment demonstrations. o Initiated 2 projects for waste tire conversion. o Demonstration of metallic recuperator. o Initiated project for inspection of steel at high temperature during manufacture to avoid reheats after initial cooldown. o Started inert anode development. o Number of technology developments to receive DOE support reaches 150.	o National Academy of Sciences overview completed. o Demonstration of heat pump grain dryer. o Demonstration of waste lube oil recovery. o 3 cogeneration units fabricated. o First full assembly line operating with high-efficiency hand tools.	o A total of 165 new technology developments have been supported to date. Eight of these were in regular use by the end of FY 81. All others continued to be developed. o Estimated annual energy savings from new technologies introduced to date: 0.0065 quads.
	o Completed design for 5 recuperators.	o Completed demonstrations of 5 ceramic recuperators.	o 12 recuperators on line.		o 34 recuperators on line.

TABLE 32-1

INDUSTRIAL CONSERVATION

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
	o Completed study of polypropylene conversion.	o Completed pilot demonstration of polypropylene conversion.	o One full-size polypropylene plant on line.		o Polypropylene waste conversions: 1.
		o First pipe-cross reactor test.	o 12 pipe-cross reactors in operation.		o 28 pipe-cross reactors on line.
	o Completed preliminary test on slot forge.	o 2 slot forges on line.	o 15 slot forges on line.		o 30 new slot forges being used.
			o Contracts awarded for Energy-Integrated Farms.		
		o Test of grain dryer fired with crop residue.			o 28 waste-fired grain dryers in use.
Increase industrial awareness of cost-effective technologies to improve energy efficiency and encourage private sector initiatives resulting in more energy-efficient technologies and practices.					
- Receive, review, and analyze annual efficiency improvement reports from 1,000 energy-intensive corporations, and publish 5 DOE reports to Congress. Establish targets for materials recovery in 4 industries.					o 48 trade associations contacted. Efficiency improvement reports received from 935 corporations. o All specified DOE reports on industrial energy efficiency improvement published. o Recovered-materials targets established.

TABLE 32-1

INDUSTRIAL CONSERVATION

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
- Publish and disseminate technical reports on energy-efficient technologies and practices that are cost effective but presently underutilized. Sponsor workshops and seminars to disseminate information on new and underutilized technologies.	o Conducted workshop on remanufacturing.	o Mandatory and voluntary reporting program integrated. o Targets established for utilization of recovered materials. o Completed 2 technical manuals and 5 brochures.	o Conducted 10 boiler training workshops in New England. o Completed implementation plans for energy conservation in steel, paper, and food industries.		o 31,452 publications disseminated. o 24 workshops and seminars conducted.
- Publish and distribute to Congress legislatively mandated reports on the applicability of the Second Law of Thermodynamics to energy conservation programs (by November 1979) and on the alternatives for improving the energy efficiency of industrial electric motors and pumps (by April 1980).					o Published both reports.
Provide energy audits for small and medium industrial firms. - Through FY 80, operate 3 Energy Analysis and Diagnostic Centers (EADC's), each conducting 40 audits per year.	o Established 3 EADC's. o Conducted 10 audits.	o Continued 3 EADC's. o Conducted 105 audits.	o Expanded to 6 EADC's. o Conducted 115 audits.	o Continued 6 EADC's. o Conducted 139 audits.	o 6 EADC's now operating, each conducting 40 audits annually. Total of 369 audits conducted through FY 81.

TABLE 32-2

INDUSTRIAL CONSERVATION

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $28.8

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
o Conduct cost-shared, high-risk, long-term research and development for increased energy productivity and substitution of abundant for scarce fuels, focusing on selected technologies that the private sector would not be likely to pursue on its own.	o Rely on the private sector. o Use technologies developed overseas.	o Maintain a technology base at a reduced level. o Management by national laboratories of projects that are already funded and that extend beyond FY 82.	o Conduct R&D to increase combustion efficiency by increased flame temperature, decreased excess air, and higher combustion air pre-heat. o Develop slagging coal burners for oil-fired boiler retrofit. o Develop high-temperature, high-effectiveness heat exchangers that are relatively low cost and applicable to hostile environments. o R&D for industrial heat pumps to produce steam from waste heat. o Conversion technology development to use waste materials as fuels and feedstocks. o Develop and test advanced cogeneration systems that utilize waste heat and that have high electrical output.
o Increase industrial awareness of cost-effective technologies to improve energy efficiency and encourage private sector initiatives resulting in more energy efficient technologies and practices.	o Rely on private sector to develop high-risk technologies and to share the results.	o Maintain data base.	o Publish Annual Report on Industrial Efficiency. o In cooperation with the National Association of Manufacturers, develop a manual that firms can use to assess needs for and means to establish internal energy conservation programs.
o Provide energy audits for small and medium-size industrial firms while simultaneously assisting in training future energy managers.	o Rely on universities or the private sector beneficiaries to perform the audits.	o Maintain facilities and operate at a reduced level.	o Continue operation of five energy analysis and diagnostic centers (EADC's) through FY 82 and conduct 240 audits of energy conservation opportunities in small and medium-sized industrial firms.

TABLE 33-1

TRANSPORTATION CONSERVATION

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$69.1	$100.3	$115.2	$98.2	
Obligation:	$67.3	$ 97.5	$110.8	$94.2	
VEHICLE PROPULSION:					
Develop Advanced Propulsion System Technology.					
- Develop new engines that by 1985 could achieve 30-percent fuel economy improvement over comparable spark ignition engines.	o Awarded ceramic applications contract.	o Completed Turbine Concept Design Study.		o Completed most component tests on turbine engines and initiated construction of two turbine MOD I's.	o Simulated turbine rotor coldspun to 134,000 RPM without failure, exceeding acceptable level.
	o Analyzed oil dumping ring seal for Stirling engine.	o Started MOD I Stirling design.	o Completed MOD I Stirling design.	o Completed MOD I engine testing.	o Stirling MOD I engine test achieved 36% peak thermal efficiency.
- Test heavy duty turbine engines in local and intercity bus service by 1981.					o Desired fuel economy was not achieved, emphasizing need for ceramic components. Unacceptable maintenance resulted from inadequate infrastructure for operating advanced equipment.
- Develop waste heat recovery technology for application to pipeline, marine, rail, and truck use.			o Feasibility study completed on pipeline and marine use.	o Completed 10,000 mile road test on Organic Rankine Cycle Bottoming Cycle truck.	o Objective to conduct demonstration in pipeline, marine, and rail not achieved. Truck bottoming completed and had 12% fuel economy improvement for prototype component.
- Identify compatibility of medium-speed diesel engines to use off-spec and alternative fuels.			o Ran laboratory test engine and locomotive engine for #3 diesel low cetane fuels, synthetics (SRC-20 Paramo), and alcohol mixtures.		o The most promising fuels were identified.

TABLE 33-1

TRANSPORTATION CONSERVATION

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
ELECTRIC AND HYBRID VEHICLE RDT&D:					
Perform RDT&E on Electric and Hybrid Vehicles (P.L. 94-413).					o Stimulated GM initial program.
- Introduce, test, and evaluate EV's in fleet operations.	o Promulgated performance and safety standards and 5 site operators selected.	o "2X4" delivery; 57 demo sites selected.	o 68 cost-sharing site operators.	o 4 EV crash tests performed.	o Began introduction of nickel/iron batteries into 26 vehicles, as of September 1981.
- Develop Electric Test Vehicle (ETV-1).				o ETV-1 tested with upgraded batteries. ETV-2 tested.	o Removed barrier presented by CAFE standards not including EV's.
- Develop Hybrid Test Vehicle (HTV).				o Hybrid design completed.	o Encouraged small EV producers, as required by act.
- Provide loan guarantees.	o Promulgated loan guarantee regulations.	o 13 proposals received.	o 2 loans awarded.	o 1 request disapproved.	o 1,000 EV's in operation at 61 sites.
					o Provided $5.5M in commitments to guaranteed loans.
					o Studies and annual reports mandated by act completed on schedule.
					o Entered into joint agreements with DOT, DOD, NASA, and USDA as required by act.
					o Transferred technology development data to industry.

TABLE 33-1

TRANSPORTATION CONSERVATION

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
TRANSPORTATION SYSTEM UTILIZATION:					
Provide conservation information and promote voluntary conservation.					
- Distribute Gas Mileage Guide to all new car dealers (P.L. 94-163).	o Added compact cars to Guide--16 million copies printed.	o Added small truck to Guide--16M printed.	o Conducted survey of Guide's effectiveness--17M printed.	o Analyzed EPA vs. on-road MPG disparity--15M printed.	o An estimated 300,000 auto buyers each year use the Guide to help choose a vehicle.
- Promote efficient vehicle selection, maintenance, and use by fleet and individual drivers (P.L. 93-438).	o Initiated training program for drivers in fuel efficiency (DECAT).	o Distributed fuel economy film.	o 10 regional "teach ins."	o 600th DECAT instructor trained. Started DECAT for truckers.	o 3% of fleet drivers reached by DECAT, resulting in 8% energy savings by average trainee in 1981. o 355 member organizations participate in Voluntary Truck and Bus Program.
- Prepare contingency plans and develop methodology for setting state consumption targets for gasoline use (P.L. 96-102).			o Developed target methodology. Assisted many states.	o Used and modified methodology. Reviewed 26 state plans.	o Developed state gasoline targets. o Satisfied the requirements of the Standby Federal Emergency Energy Conservation Plan required by EECA 1979 (P.L. 96-102). o 26 states received assistance.
ALTERNATIVE FUELS UTILIZATION:					
Work with fuel suppliers and engine manufacturers to optimize fuel/engine interface (P.L. 95-238).					
- Conduct proof-of-concept testing of 3 engine/fuel combinations.		o Initial study of fuel/engine tradeoffs.	o Initiated fleet tests of alcohol blends for durability.	o Completed data base for alcohol and alcohol blends in engines.	

TABLE 33-1

TRANSPORTATION CONSERVATION

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original
	FY 78	FY 79	FY 80	FY 81	Objective Met
- Demonstrate feasibility of using unique fuels in appropriate engines.	o Evaluated straight alcohol.	o Worked to remove problems with ethanol use.	o Tested 3rd generation alcohol vehicle.	o Completed evaluation of liquid hydrogen in baseline vehicle.	o Regular roundtable forums of involved persons.
			o Completed feasibility of modified SRC phenols in gasoline.	o Completed engine modification of Post Office Alcohol Vehicle.	o Technology base established.

TABLE 33-2

TRANSPORTATION CONSERVATION

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $58.9

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
VEHICLE PROPULSION TECHNOLOGY DEVELOPMENT:			
Develop the following technologies and components to be cost-effective solutions to current barriers to advanced fuel efficient engine use: - Utilization of waste heat in diesel engines. - Component technologies (bearings, heads, and pistons) for uncooled diesel engines. Complete research with sufficient documentation for technology transfer for the following engine components: - Low thermo-conductivity ceramic materials. - Ceramic rotor. - Improved reciprocating seals.	o Private sector R&D.	o None,	o Ceramic parts will allow a wide spectrum of engines to operate at higher temperatures (and, therefore at higher fuel-efficiency levels.) Use of waste heat will also cause more fuel-efficient operation.
ELECTRIC AND HYBRID VEHICLE RDT&D:			
Advance the development of electric vehicles: - Increase electric vehicle range. - Increase battery life. Phase out work on hybrid and advanced vehicles by the end of FY 82.	o Private sector R&D. o Market penetration of electric hybrid vehicles can be expected to occur in late 1990's, even without Federal assistance.	o None.	o Increased electric vehicle range and battery life will make electric vehicles more competitive, decreasing reliance on liquid fuels in the transportation sector. o Electric vehicles may help to level out demand loads on utilities by recharging during off-peak hours--making the overall generation system more efficient.

TABLE 33-2

TRANSPORTATION CONSERVATION

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
TRANSPORTATION SYSTEMS UTILIZATION:			
Make Gas Mileage Guide available to all new car dealers for 1982 model year cars (one edition).	o Private publication of EPA test data may occur when Gas Mileage Guide is not published for 1983 model year.	o None.	
ALTERNATIVE FUELS UTILIZATION:			
Complete work on processing of available syncrude or partially processed syncrude to meet established test fuel specifications.	o Development by U.S. Synfuels Corporation or private industry.	o None.	o Research will be phased out by the end of FY 82.
Phase down the testing of ethanol/gasoline blends, methanol/gasoline blends, and methanol/ethanol/gasoline blends.			
Phase down the testing of vehicles on synthetic motor fuel derived from shale and coal.			

TABLE 34-1

MULTI-SECTOR CONSERVATION

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$4.0	$12.2	$19.7	$25.4	
Obligation:	$2.5	$10.0	$18.3	$24.1	
Expand 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.					
ENERGY CONVERSION AND UTILIZATION TECHNOLOGIES:					
To develop validated integrated system models for three innovative internal combustion engine concepts, namely, Direct Injection Stratified Charge (DISC), Dilute Homogeneous Charge (DHC), and Diesel Engines, for use by industry in designing engines which are more efficient than currently used ones.				o Completed development and verification of intake process models for Direct Injection Stratified Charge (DISC) and Dilute Homogeneous Charge (DHC) engine concepts.	o Development and verification of models of intake, fuel preparation, and exhaust processes for DISC, DHC, and diesel engine concepts to be completed by March 1982.
To develop advanced concepts and analytical methods for use by industry in designing Stirling, Rankine, and Brayton Cycle Power Systems whose efficiencies are at least 10% better than currently used technologies.				o Assessment of technology needs for Stirling Engine Technology completed.	o Research priorities for enhanced development of Stirling Engine Technology have been established.

TABLE 34-1

MULTI-SECTOR CONSERVATION

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
To develop computerized data bases and experimentally validated models for use by industry in dsigning innovative, more reliable industrisl heat exchangers which are more effective than 1980 state-of-the-art equipment.				o Data accumulation on flow-induced vibration (FIV) in industrial shell-and-tube heat exchangers analyzed.	o Computerized data bases and models to be completed by 1986.
To generate data and develop techniques which could lead to engineering of bulk chemical feedstock and commodities production that require less energy than currently used processes.				o Research agenda for Chemical Process Project established.	o Low-Temperature and pressure biocatalyzed processes to be developed by 1987.
ENERGY-RELATED INVENTIONS PROGRAM:					
	Inventions evaluated				
To evaluate the technical merits of all submitted energy-related inventions.	3,437	2,713	3,292	1,472	o As many inventions annually are being evaluated as are being submitted.
	Inventions funded by grants/grant funding costs				
To provide assistance for the RD&D of energy-related inventions by individuals and small businesses.	22/1.6	35/2.3	23/1.9	35[1]/3.0	o For NBS, every invention submitted is receiving an evaluation. For DOE, the goal of assisting each inventor recommended is being achieved, within limits of the available resources.

[1] Includes 26 grants in the DOE Procurement System as of 7/1/81.

TABLE 34-1

MULTI-SECTOR CONSERVATION

Goals/Objectives	Budget Data ($ Millions) Status: FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
To encourage inventors and innovation through information dissemination.	Number of workshops held/number of publications distributed				
	0/30K	0/30K	6/210K	4/150K	
To conduct a cost-effective system of technical and progress monitoring of funded inventions.	0	0	0	248K	o Based upon an independent assessment of program functions and needs, ORNL as contractor to the program provided and maintained the monitoring system. Monitoring results will be available in February 1982.
APPROPRIATE TECHNOLOGY SMALL GRANTS PROGRAM:					
To support the RD&D of small-scale, decentralized renewable energy technologies.	Proposals evaluated				o Provide necessary financial assistance to multi-sectoral technology development on national scale. No technical assistance was made available.
	1,110	12,876	19,462	11,059	
	Projects funded				
	108	584	856	850 (est.)	
To encourage the replication of successful projects through the dissemination of information.	o Final Reports Available--150 (estimated)				o Project results are now beginning to be submitted. Only minor efforts to date in this area.

TABLE 34-2

MULTI-SECTOR CONSERVATION

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $16.5

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Expand 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.			
ENERGY CONVERSION AND UTILIZATION TECHNOLOGIES:			
To develop validated integrated system models for two innovative internal combustion engine concepts, namely, Dilute Homogeneous Charge (DHC) and Diesel engines, for use by industry in designing engines which are more efficient than currently used ones.	o Rely on private sector.	o Increased capability for engine combustion analysis. Leads to better engine designs of improved efficiency and decreased pollutants.	o Large-scale multidimensional computer model of engine intake process completed by 1982. o Model for open-cycle engine processes from intake to exhaust completed by 1983.
To develop computerized data bases and experimentally validated models for use by industry in designing innovative, more reliable, industrial heat exchangers that are more effective than state-of-the-art equipment.	o Rely on private sector or foreign-developed technology.	o More effective heat exchangers to improve utilization of energy.	o Design methodology for avoidance of flow-induced vibration failure in shell-and-tube heat exchangers provided by 1983. o Data accumulated on fouling of heat transfer surfaces by industrial process exhaust streams analyzed by 1984.
To generate data and develop techniques that could lead to engineering bulk chemical feedstocks and commodities production that require less energy than currently used processes.		o More energy-efficient chemical processes and techniques.	o Methodology for engineering design of stable support structures for enzymes useful to industry in biocatalyzed processes developed by 1984. o Methodology for engineering design of low-temperature, low-pressure, continuous processes developed by 1985.

TABLE 34-2

MULTI-SECTOR CONSERVATION

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
ENERGY-RELATED INVENTIONS PROGRAM:			
To evaluate the technical merits of all submitted energy-related inventions.	o Rely on private sector to identify and support worthwhile inventions.		o Provides an evaluation of submitted energy-related inventions and grant support for recommended inventions.

TABLE 35-1

STATE AND LOCAL PROGRAMS

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$181.9	$633.0	$603.2	$478.3	
Obligation:	$179.9	$313.5	$537.1	$426.8	
ENERGY EXTENSION SERVICE:					
To develop a pilot EES program to be expanded nationwide.	o Grants awarded to 10 pilot state programs.	o Grants continued to pilot states.	o EES grants awarded to 50 states; 7 territories approved.	o Nationwide program being implemented.	o Nationwide program being implemented.
To provide assistance to small businesses and individual consumers to reduce energy consumption.	o Impacts for both 1978 and 1979 are shown under 1979 column.	o Energy savings: A large, representative sample of various types of clients saved 6,400 barrels of oil equivalent per day (0.01 quad on an annual basis). This was energy they would not have saved otherwise, and the total Federal and private cost per BOE was appreciably less than it would have cost to buy the oil. o Satisfaction: 90% of clients found the services useful; 51% found them more useful than those from other sources.	o No estimate of energy savings available yet.	o No estimate of energy savings available yet.	o Cost-effective energy savings achieved with a high degree of client satisfaction in the pilot program.

TABLE 15-1

STATE AND LOCAL PROGRAMS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
STATE ENERGY CONSERVATION PROGRAM:					
To reduce energy consumption in states by at least 5% of projected 1980 levels.	o SECP plans implemented by 50 states and 5 territories.	o State reported data show projected energy consumption may be down 3.1 quads.	o State reported data show projected energy consumption may be down 3.1 quads.	o Statistics on reduction in energy use not yet available.	o According to state-reported data, national energy consumption may be reduced 4% from projected 1980 level. However these figures have not been validated by DOE and may be substantially lower.
Implement mandatory energy conservation measures in states.	o States develop legislation.	o Most states have adopted most mandatory measures.	o Most states are implementing most mandatory measures.	o Most states are implementing most mandatory measures.	o Most states are implementing most mandatory measures.
Assist state energy offices in facilitating development of state energy conservation capabilities.	o Provided states with onsite technical assistance, program workbooks, and program workshops.	o Provided states with case studies of best practices; held program workshops and several national conferences on individual measures.	o Provided evaluation technical assistance.	o Developed simplified evaluation system.	o Energy conservation capability established in 57 state and territorial offices.
WEATHERIZATION:					
Award annual grants to 50 states, the District of Columbia, and 25 Native American tribal organizations for the purpose of weatherizing low-income homes and reducing national energy consumption.	o 77,500 homes weatherized.	o 123,000 more homes weatherized.	o 265,000 more homes weatherized.	o 292,500 more homes weatherized.	o All 50 states, D.C., and 25 Native American tribal organizations involved.
	o Estimated annual savings of 310,000 BOE (0.017 quad).	o Additional annual estimated savings of 492,000 BOE (0.028 quad).	o Additional annual estimated savings of 1,060,000 BOE (0.006 quad).	o Additional annual estimated savings of 1,170,000 BOE (0.007 quad).	o Weatherized 758,000 low-income homes.
	o Initiate annual grants to 49 states (plus D.C.) and 25 Native American groups.		o Established special projects office to provide visibility and support to DOE.	o Hawaii enters program.	o Total cumulative annual savings estimated at more than 3 million BOE (0.0175 quad) for DOE program.

TABLE 35-1

STATE AND LOCAL PROGRAMS

	Budget Data ($ Millions) Status				Degree Original
Goals/Objectives	FY 78	FY 79	FY 80	FY 81	Objective Met
SCHOOLS AND HOSPITALS/LOCAL GOVERNMENT AND PUBLIC CARE BUILDINGS:					
To assist states to conduct preliminary energy audits (PEA's) to assess numbers, types, and energy use characteristics of eligible buildings and to assist states to provide energy audits (EA's) assisting eligible institutions. To assist states, schools, and hospitals to undertake technical assistance (TA) projects (i.e., engineering studies of conservation potential) and to assist schools, hospitals, and public use buildings to acquire and install energy conservation measures (ECM's).	o Awarded 54 grants to states and territories to conduct PEA's/EA's in schools, hospitals, local government, and public care buildings. TA/ECM grants followed in FY 80 and FY 81.		o Awarded 54 grants to states and territories to conduct PEA's and EA's in schools, hospitals, local government buildings, and public care buildings. This completed PEA and EA grant awards for the program. o Awarded grants for TA's and ECM's for 14,736 buildings. o Achieved estimated energy annual savings of 10.7 million BOE (0.06 quad) through TA's and ECM's.	o Awarded grants for TA's and ECMs for 7,705 buildings. o Achieved estimated annual savings of 7.1 million BOE (0.04 quad) through TA's and ECM's.	o Conducted PEA/EA's in over 125,000 buildings. o Achieved over 14.22 million BOE (0.08 quad) annual energy savings. o Awarded TA/ECM grants for 22,441 buildings. o Achieved 17.8 million BOE (0.1 quad) annual energy savings through TA/ECM grants. These savings should be realized each year hence since these were permanent capital improvements to buildings and equipment.

TABLE 35-2

STATE AND LOCAL PROGRAMS

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $231.9

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
SCHOOLS AND HOSPITALS:			
Provide cost-sharing grants to institutions for: - Technical assistance analyses (i.e., engineering studies of energy conservation potential). - Acquisition and installation of energy conservation measures requiring capital investment.	o Rely on private companies. o Rely on state governments to provide financial assistance. o Use alternative Federal assistance, such as Community Development Block Grants and Federal revenue-sharing funds.	o Allow public institutions to take advantage of energy conservation potential where an incentive presently exists. o Allow public institutions to take advantage of services offered by private sector.	o Provide about 1000 technical assistance analyses and grants for energy conservation measures for schools and hospitals in FY 82.
WEATHERIZATION ASSISTANCE PROGRAM:			
Continue weatherizing low-income homes at a rate consistent with past progress.	o Rely on state governments to provide financial assistance. o Use alternative Federal assistance such as Community Development Block Grants.	o Resources sufficient to reach FY 82 target.	o Retrofit between 124,000 and 145,000 low-income households in FY 82.
STATE ENERGY CONSERVATION PROGRAM--ENERGY EXTENSION SERVICE:			
Continue current program through FY 82.	o Rely on private sector to provide information to consumers and businesses. o Rely on state funds.	o Provide information to consumers and businesses on energy conservation opportunities.	o Combined grants for EES and SECP will total approximately 170 under the FY 1982 funding level.

TABLE 16-1

ELECTRIC ENERGY SYSTEMS

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$43.9	$43.0	$39.3	$37.8	
Obligation:	$42.2	$40.8	$36.4	$37.5	
SYSTEM ARCHITECTURE AND INTEGRATION:					
Complete assessment of dispersed storage and generation (DSG) integration requirements by 1980.	o Preliminary determination of scope and magnitude of integration problem.	o Integration assessment methodology developed.	o Integration issues identified and priorities assigned.	o Detailed R&D Program Plan prepared.	o Assessment completed and documented.
Complete integration studies for solar photovoltaics and wind generation by 1984 and for OTEC by 1990.	o Initiated study of impact of harmonics from DSG on customer equipment.	o Initiated study to determine impact of DSG on distribution system safety and protection.	o Initiated study to determine impact of DSG on distribution system planning and design.	o Initiated study to determine control hierarchy for DSG.	o Objective 60% completed through FY 1981.
Develop communication technology for dispersed generation, storage end-use management in utility distribution systems by 1987.	o Developed measuring equipment to determine circuit communication capability.	o Preliminary investigation of space communication systems.	o Defined communication and control requirements for DSG.	o Completed field tests of first-generation distribution communication equipment.	o Objective 40% completed through FY 1981.
Assess advanced control concepts for energy management in utility distribution systems by 1983.	o Completed negotiation of Interagency Agreement with TVA.	o Completed specification of test bed and selected location.	o Completed review of conventional equipment and practices.	o Completed specification of control system requirements.	o Project specifications completed; implementation dependent upon TVA follow-up.
Improve system efficiency, reliability, and adaptability under normal and emergency conditions.					
- Complete automatic generation control software by 1981 and demonstrate 2% efficiency improvement by 1982.	o Developed computer models of Wisconsin Electric Power system.	o Developed control algorithms for integrated load frequency control/economic dispatch.	o Tested and evaluated control algorithms via computer simulation.	o Prepared operating software, installed programs on control computer, and began [illegible]	o Software debugged and running; evaluation in progress.

TABLE 16-1

ELECTRIC ENERGY SYSTEMS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
POWER DELIVERY:					
Develop 1200 kV semiflex cable technology by 1982.	o Completed economic study of underground alternatives.	o Initiated 1,200 kV gas cable design research.	o Completed feasibility studies.	o Completed cable design, and finished test protocol.	o Concept is sound; cable can be made in laboratory.
Complete OTEC riser cable conceptual design by 1982.	o Outlined project.	o Completed engineering studies.	o Determined electro-mechanical problems for floating platform.	o Completed conceptual designs.	o Concept and designs are feasible in lab tests.
Complete construction of superconducting cable test facility by 1981.	o Completed lab demonstration of high current test; terminated work on rigid and vacuum-insulated superconducting cables after thorough economic analysis.	o Completed test site at BNL. Initiated cable fabrication.	o Tested 100-meter-long cryogenic enclosure at rated temperature (8° K).	o Completed fabrication of 100-meter-long cable.	o Cable concept proven in lab; cryostat and refrigeration tested under field loading.
Resolve electric field effect questions with laboratory experiments and human risk assessment by 1984.	o Completed initial studies on biological effects on small animals.	o Observed significant biological change in blood chemistry of rats in electric fields.	o Published preliminary biological effects on large and small animals.	o Completed general studies of effects on small animals.	o First level effects noted, providing pattern for continued genetic and biological work to determine human risk.
Assess feasibility of amorphous metal applications to transformers and electric motors by 1984.	o Outlined project.	o Feasibility of low-loss material composition and benefits assessment initiated.	o Developed process for amorphous metal flakes.	o Developed feasible process for helical metal ribbon for motors, and evaluated potential for transformers.	o Lab process developed and an evaluation of the benefits of increased efficiency completed.
GENERATION AND STORAGE ANALYSIS:					
Demonstrate benefits of conventional versus advanced batteries by 1983.		o Initiated R&D on Zn/Cl battery (Phase 1) for BEST.	o Completed initial design of Zn/Cl battery load leveling.	o Completed Phase I Zn/Cl battery development.	o Confirmed conceptual feasibility of Zn/Cl battery for load leveling application.
- Complete construction of Battery Energy Storage Test (BEST) laboratory building,	o Planned and began construction of BEST laboratory.	o Continued construction of BEST laboratory.	o Continued construction of BEST laboratory.	o Completed construction of BEST. Dedicated May 1981.	o Baseline BEST lab construction completed. [illegible]

TABLE 36-2

ELECTRIC ENERGY SYSTEMS

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $24.3

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
SYSTEM ARCHITECTURE AND INTEGRATION:			
Initiate phaseout in FY 1982 and complete all contractual work by end of FY 1983.			
- Complete wind and photovoltaic integration methodologies by 1983.	o Rely on electric utilities, EPRI, and trade associations to develop new technology integration methodologies.	o Identify by 1983 key issues to be resolved for successful integration with the electrical system.	o Partial identification of distribution system safety and protection requirements to integrate new technologies into the electric system.
		o Provide limited advanced concepts and data for planning and operating the power systems of the future.	o Complete wind and photovoltaic integration methodologies.
- Develop power-conditioning methods for small cogenerators with cost goal of $200/kW by 1983.	o Rely on private sector to develop power-conditioning equipment for small generating technology.	o Define direct current source interface requirements with the alternating current system, and develop power-conditioning interface hardware.	o Develop power-conditioning methods and hardware specifications for small direct current cogenerators.
- Complete large-scale system simulator by 1983, and phase out development of unified theory in power system control and analysis.	o Rely on private sector and universities to define and complete basic theory.	o Partially identify basic research issues in large electric system control and operation, including human operator characteristics. o Explore some advanced process models and control simulation for highly promising concepts. o Assess improved reliability and control of very large systems.	o Provide power system simulator for use by universities and private sector. o Develop initial theory options for emergency control and analysis of large-scale electric systems and phase out assessment of best options.
POWER DELIVERY:			
Investigate selected technological high-risk transmission options for 1983 utility planning assessments.			
- Phase down development of 1,200 kV technology (semiflexible cable, circuit breaker, gas transformer, direct current transmission).	o Rely on industry to develop technology.	o Partially identify requirements for 1,200 kV transmission technology.	o Initial options for increased electric power transfer over longer distances at improved levels of stability.

TABLE 36-2

ELECTRIC ENERGY SYSTEMS

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
	o Increase reliance on foreign suppliers for advanced transmission technology.	o Perform early investigations of basic studies on insulating gases.	o Identification of some improved insulating gases for underground electric transmission cables.
	o Maintain 500 kV/765 kV system with additional installations and transmission lines.	o Quantify direct current transmission benefits as an overlay to alternating current systems.	
- Complete laboratory tests to determine the technical feasibility of superconductivity for electric transmission and generation in 1982.	o Rely on private sector to initiate superconducting transmission tests. o Increase reliance on foreign suppliers.	o Terminate laboratory tests of superconducting cable.	o Terminate testing of 100-meter-long, 138-kV superconducting cable. o Eliminate development of high-power transfer underground cable systems.
Complete statistical exposure analysis of electric field effects on small animals and terminate by end of 1983.	o Transfer Federal research in transmission lines electric field effects to another Federal agency.	o Publish initial data on objective, unbiased research to identify electric field effects on living organisms.	o Reconcile simulation inconsistencies in interspecies electric field effects. o Complete circadian rhythm studies on rats and mice exposed to electric fields.
GENERATION AND STORAGE ANALYSIS:[1/]			
Phase down integration design of the zinc/chloride battery by 1983 having a minimum electrochemical efficiency of 65% and greater than 250 charge/discharge cycle of stable performance.	o Transfer activity to utilities and EPRI.	o Evaluate advanced load leveling concepts (battery storage) for use by utilities.	o Development of advanced battery design.

[1/] These activities are being accomplished with prior year funding.

TABLE 37-1

ENERGY STORAGE SYSTEMS

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
- Obtain lithium-metal sulfide or sodium-sulfur batteries with following characteristics by 1990:					
Energy Density: 125 Wh/kg Power Density: 150 W/kg Cycle Life: 800 cycles	90 Wh/kg 60 W/kg 80 cycles	69 Wh/kg 55 W/kg 200 cycles	70-80 Wh/kg 80 W/kg 300 cycles	90 Wh/kg 90 W/kg 400 cycles	o Test batteries have reached up to 72% of goals in energy density. 60% in power density, and 50% in cycle life.
- Obtain metal-air batteries with following characteristics by 1995:					
- Energy Density: 260 Wh/kg Power Density: 150 W/kg Cycle Life: 800 cycles		o Laboratory tests have proceeded to the point where energy density of 152 Wh/kg and battery cost of $35 to $40 per kWh of energy storage are projected to be obtained by 1985.			o Metal-air batteries are in the early development stage; battery performance data will be available in 1982.
Develop and improve batteries for utility and solar applications with improved cycle life, decreased cost.					o If current cost reduction trends continue, cost goals will be met. Percentage attainment of cycle life goals are low because these programs are in the early stages.
- Obtain lead-acid batteries with following characteristics by 1985: Life: 10 years		o Lead-acid life testing in progress.			o Lead-acid batteries have achieved 25% of life goals.
- Obtain zinc-bromine, lithium-metal sulfide, redox, or sodium-sulfur batteries with the following characteristics by 1990: Life: 20 years		o Life testing in progress on all these battery types.			o Sufficient data will be accumulated in FY 82 to enable determination of life-times.

TABLE 37-1

ENERGY STORAGE SYSTEMS

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$52.3	$60.0	$66.9	$52.0	
Obligation:	$50.9	$59.3	$66.6	$50.8	
ELECTROCHEMICAL ENERGY STORAGE:					
Provide a technology data base by supporting applied research in electrochemical energy storage and conversion.	o Improved lead-acid batteries into experimental development.	o Zinc-bromine batteries into experimental development.	o Lithium-metal sulfide batteries into experimental development.	o Sodium-sulfur batteries into experimental development.	o Technology base objectives for these systems have been met.
- Develop improved industrial electrolytic processes for chlor-alkali and aluminum industries.				o Improved oxygen electrodes in testing.	o Transfer to chlor-alkali industry in 1982.
			o Hall cell research phase completed.	o Improved Hall cell in scale-up phase.	o Transfer to aluminum industry in 1985.
- Conduct corrosion research and electro-organic syntheses.				o Preliminary assessments in process.	o Laboratory work to begin in FY 82.
Develop and improve batteries for electric vehicles with long life, high energy, and power density, and maintain a technology base.					o Future costs of all electric vehicle batteries in development are projected to fall within cost goals.
- Obtain lead-acid, nickel-iron, or nickel-zinc batteries with following characteristics by 1985:					
Energy Density: 56 Wh/kg Power Density: 104 W/kg Cycle Life: 800 cycles	35 Wh/kg No data No data	41 Wh/kg 90 W/kg 170 cycles	42 Wh/kg 104 W/kg 400 cycles	42 Wh/kg 104 W/kg 600 cycles	o Test batteries have reached up to 75% of their goal in energy density and 100% in power density. Work on cycle life is continuing.

TABLE 37-1

ENERGY STORAGE SYSTEMS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
PHYSICAL AND CHEMICAL ENERGY STORAGE:					
Develop four storage technologies for solar and conventional electric utility applications:					
- Compressed Air Energy Storage (CAES)--Complete conceptual design of system by 1981 and initiate experiments with turbines that use no oil for air reheating by 1984.	o Completed state-of-the-art surveys and formulated reservoir criteria for CAES.	o Completed advanced CAES equipment evaluations; developed preliminary CAES design.	o Completed numerical modeling and laboratory investigations of CAES reservoirs.	o Started field experiments on the injection and storage of compressed air in porous rock media.	o One design completed; baseline technology being transferred to private sector. Conceptual studies on no-oil concepts and field studies on acquifers for CAES in progress.
- Underground Pumped Hydroelectric (UPH)--Complete site exploration and plant design by 1983.	o Completed UPH system and identified turbine and need for improved efficiency and operating head.	o Began studies of improved machinery efficiency and operating head; completed reservoir geology study.	o Completed site exploration study and preliminary design of a UPH storage plant.	o Project completed; results transferred to utilities, EPRI.	o Objectives met: One site explored and design study completed by 1981. The technology for high-head turbines has been transferred to industry and is now supported by EPRI.
- Superconducting Magnetic Energy Storage (SMES)--Proceed with device development and analyze performance tests of a small 30 MJ unit by 1983.	o Performed technical applications analysis of SMES.	o Selected 30 MJ SMES unit for transmission line stabilization; initiated engineering design.	o Completed SMES design for line stabilization and initiated development.	o SMES subunits fabricated and testing begun.	o Fabricated all subunits for 30 MJ system to be integrated into a total system for engineering testing. Site preparation is in progress.
- Thermal Energy Storage (TES)--Develop storage for solar power applications by 1985.	o Completed evaluations of storage media; selected a eutectic salt and transfer fluid.	o Completed conceptual design and evaluation study for utility peaking application.	o Completed design and fabrication of an active heat exchanger system using phase change materials.	o Completed engineering performance testing of molten salt heat storage unit.	o Molten nitrate salt selected as most promising storage medium. Established design and evaluated performance parameters.

TABLE 37-1

ENERGY STORAGE SYSTEMS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Develop storage technologies for both daily and seasonal application in heating and cooling buildings:					
- Daily:					
Chemical Heat Pumps--Confirm feasibility for heating and cooling with storage in large and small buildings by 1981.	o Completed experimental studies on a series of chemical reactions; identified 4 most promising for further research.	o Completed technical and economic evaluation of advanced heat pump systems; selected 2 for further development.	o Completed laboratory testing of 20,000-Btu/hr. (100,000 Btu storage capacity) chloride heat pump (over 100 cycles).	o Completed laboratory testing of 150,000 Btu/hr (1 MM Btu storage capacity) sulfuric acid-water heat pump (over 100 hours of testing).	o Achieved objective: Built prototype methanol-calcuim chloride unit and operated successfully. Ready for transfer to private sector.
Thermal Energy Storage (TES)--Test feasibility of using sensible heat storage for customer-side storage utility load-leveling applications in near term.	o Initiated design and implementation of field test experiment in New England.	o Performed preliminary analysis of system cost and performance.	o Completed experiment; collected 2 seasons' data; performed customers' acceptance survey. o Established calorimeter for full-scale testing of TES device.	o Analysis of 2 seasons' data on cost and performance. o Results from calorimeter measurements used to establish inputs for ASHRAE test procedures for rating TES devices.	o Field tests completed; performance characteristics and costs quantified. Transferred to private sector. Several utilities now promoting with special off-peak rates.
Evaluate phase change materials and technologies for thermal storage at a capital cost of $5/kWht by 1985.	o Developed method to use hydrated salts as a phase-change storage material in "chubs" (sausage-shaped containers).	o Completed a preliminary evaluation of selected advanced thermal energy storage technologies.	o Developed form stable polyethylene pellets for heat storage at an estimated cost of $24/kWht.	o Completed evaluation of available thermal storage units for off-peak power operation in residential heating. o Completed evaluation of industrial waste heat with storage for district heating.	o Cost objective can be met for low temperature applications, lifetime needs improvement.

TABLE 37-1

ENERGY STORAGE SYSTEMS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
- Seasonal:					
Seasonal Thermal Energy Storage--Establish feasibility of heat and chill storage in aquifers (this was unknown technology, tentative objective of 70% recovery efficiency by 1986 was set).	o Conducted experiments with injection and withdrawal of heat and chill.	o Assessed applications and selected regional sites.	o Completed nationwide aquifer storage demonstration site selection.	o Completed field experiments with heated and chilled water, and established that storage capital cost will be less than $0.01/kWh for heat and $0.10/ kWh for chilling.	o First seasonal heat storage experiments completed and functional data collected. One cycle of seasonal cool storage experiment completed; technical problems under investigation. Measured efficiencies of 37-63%, depending on temperature level.
Develop two storage technologies for use in vehicles:					
- Mechanical storage (flywheels and elastomers)--develop 88 Wh/kg flywheel rotors by 1982.	o Determined mechanical energy storage system performance criteria for vehicle applications.	o Evaluated performance of two advanced flywheel regenerative braking prototypes in the laboratory.	o Achieved a 25% increase in electric vehicle range over the urban driving cycle.	o Completed experimental testing of three advanced composite flywheel rotor designs.	o 88 Wh/kg goal met in FY 1981.
- Hydrogen Energy Storage--Develop and evaluate hydrogen storage concepts for vehicle applications.	o Co-selected Fe-Ti stationary storage unit and evaluation requirements for mobile applications.	o Evaluated Mg hydride and Mg/Fe-Ti hydride storage systems. o Identified hydrides as a resource recovery system for obtaining hydrogen from refining and synfuels production waste streams.	o Evaluated glass microspheres for hydrogen storage.	o Program terminated.	o Material studies and evaluations completed; could not meet both cost and performance objectives simultaneously.

TABLE 37-1

ENERGY STORAGE SYSTEMS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Develop three energy technologies for industrial and multipurpose applications:					
- Thermal Energy Storage--Develop materials and components for recovery of industrial process waste heat at cost of less than $5/kWht by 1987.	o Completed assessment of ceramics industry.	o Completed assessment of thermal storage in 5 industrial areas.	o Determined feasibility of carbonate for high-temperature latent heat storage.	o Completed technology transfer of thermal energy storage to paper and pulp industry. Being implemented in 1 plant, evaluated for 5 plants.	o All near-term applications studies are complete. Technology transferred in two industries.
- Hydrogen Production-Design and test efficient (80%) electrolysis for hydrogen production by 1984 at cost of $150/kW and lifetime of 5 years. Evaluate thermochemical cycles for hydrogen production.	o Completed scale up of advanced electrolyzer modules to 2.5 ft^2; completed preliminary analysis of hydride thermochemical cycles.	o Characterized performance of the multicell electrolyzers; operated two complete thermochemical cycles at the laboratory scale.	o Completed construction of advanced SPE (Solid Polymer Electrolyte); established costing model for electrolyzers (200-kW system).	o Tested and evaluated an electrolyzer unit; completed all bench scale units for one thermochemical cycle. DOE program being terminated; work continuing with cosponsors.	o 200 kW test unit operated. Efficiency goals met in single cells for short periods. Lifetime objective not met; cost objective unattainable.
- Hydrogen Storage and Transmission--Determine hydrogen compatibility with existing pipelines and develop improved materials.	o Completed hydride stationary storage unit.	o Completed studies on hydride poisoning and on underground storage.	o Initiated hydrogen embrittlement study for natural gas pipelines.	o Completed first phase of materials study for hydrogen transmission.	o Preliminary materials studies completed.

TABLE 37-2

ENERGY STORAGE SYSTEMS

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $32.2

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Develop and/or transfer improved energy storage technologies in cooperation with industry. Activities include: - Research on new components and materials for batteries. - Development of batteries for use with: --electric vehicles. --photovoltaic systems. - Heating and cooling of buildings using thermal energy storage systems and chemical heat pumps. - Improvement in: --electrolytic and thermo-chemical processes for hydrogen production. --rotor design for flywheels. --magnetic storage systems.	o Rely on private sector to develop needed technology.	o Sufficient resources for transition of some activities to the private sector; and, an orderly termination of the Federal program.	o Orderly closeout of the program.

TABLE 38-1

ENERGY SUPPORTING RESEARCH

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$189.3	$227.1	$247.6	$277.2	
Obligation:	$182.8	$226.3	$247.0	$271.7	
BASIC ENERGY SCIENCES:					
Develop fundamental scientific & technical knowledge to develop options to meet energy goals.	o Initiate Advanced Energy Projects to explore new energy-related concepts.	o Estab. Biological Energy Research subprogram.			
- Identify needs & opportunities.	Number of workshops, panels, assessments				o Fully met; problem of implementing recommendations remains.
	18	19	24	29	
- Support highly competent researchers.	Number of projects at end of year				o Satisfactory; identifiable shifts in program balance to strengthen research base in DOE mission areas.
	880	1,000	1,070	1,120	
	Number of non-DOE lab projects started				
	97	152	171	175	
- Maintain liaison with other DOE programs, agencies, scientific, academic, industrial communities.	Number of meetings of standing committees, working groups, advisory boards, etc. (Also contributes to next objective.)				o Consistent improvement in liaison activities communication.
	70	85	90	90	
- Promote early use of results of basic research.	Research assistance task forces, information meetings				o Partially met; applied program receptivity limited by short-term focus on results.
	14	14	16	17	

TABLE 38-1

ENERGY SUPPORTING RESEARCH

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
	---Milestones---				
Maintain U.S. leadership in areas of unique BES responsibility.					
- Provide for & support specialized research facilities.	o Start decommissioning of Ames Laboratory Research Reactor (ALRR).	o Shutdown of CP-5 reactor at ANL.	o Construction for LBL Atomic Resolution Microscope (ARM) started.	o Completed decommissioning of ALRR.	o Provided adequate funding to complete construction of several high-priority facilities.
				o IPNS-1 operational.	
	o Initiate construction of National Synchrotron Light Source.	o Start construction of Intense Pulsed Neutron Source-1 (IPNS-1).	o Establish lab for analysis of plant polysaccharides.	o Completed construction, Combustion Research Facility (CRF) operational.	o Selected shutdowns required to provide adequate funding levels for BES science.
				o Termination of NRCC project.	
				o Shutdown comparative animal research lab.	
	---Stable isotopes sales program; number of sales---				
	1,910	1,979	1,828	1,500 (projected to end of FY 81)	o Not fully met; inventory depletion reduced ability to meet sales demand.
- Support highly competent researchers.		o Begin major facility user's program.			o Successful; enhanced participation by academic industrial communities.
ENERGY RESEARCH ANALYSES (Formerly Assessment Projects):					
Analyze, assess, and make recommendations concerning selected R&D programs and the adequacy of the basic and applied research programs.	o Superconducting electric generation, robotics, and uranium resources assessed.	o Fossil Energy Research Working Group (FERWG) assessments of coal gasification and liquefaction, NEP-II supply strategies prepared.	o ERAB staff support initiated. OTEC, Battery, and FERWG oil shale assessments conducted.	o Assessed selected DOE programs including OHER, biomass, and synfuels programs.	o Assessments sufficient to make required budget and programming decisions.
Develop and evaluate satellite power concept.	o Initial review meeting.		o Assessed DOE R&D program Technology Base.	o Study completed; DOE work terminated; evaluation activity transferred to NASA.	o Successfully completed as planned.
Develop engineering and economic data in innovative concepts.		o Program initiated.		o Terminated in second half of FY 81.	o Incomplete

TABLE 38-1

ENERGY SUPPORTING RESEARCH

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
UNIVERSITY RESEARCH SUPPORT PROGRAM:					
Strengthen the capabilities of selected major universities to carry out longer range, multi-technology research, and manpower development programs.	o 7 awards 140 faculty 280 grad. students	o 6 awards 120 faculty 240 graduates	o 7 awards 14 faculty 20 students	o 7 awards 140 faculty 280 students	o 11 universities received awards in response to this objective. o 750 exploratory research projects supported; over two-thirds received follow-on support from other DOE programs, industry, etc. o 11 new graduate-level courses on energy R&D subjects developed. o 500 graduate students received support leading to MS/PhD degrees. o Seven joint research programs developed between participating universities and DOE National Labs or industry.
Develop new energy research and manpower development capability at smaller, historically minority universities and colleges.	o 8 awards 24 faculty 48 undergrad./grad. students	o 10 awards 30 faculty 60 students	o 8 awards 20 faculty 40 students	o 10 awards 50 faculty 30 students	o 11 universities received support in response to this objective. Seven projects subsequently received follow-on competitive support from other DOE programs or other agencies. 100 students received support leading to graduate degrees. Five new regionally oriented research programs were developed and received state funding.

TABLE 38-1

ENERGY SUPPORTING RESEARCH

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Maintain university-based nuclear research/training capability.	o Five university nuclear research reactors refueled per year. Average of 10 "university reactor sharing" projects supported per year (increases utilization of nuclear reactors by faculty/students at colleges without research reactors).				o Provided support for average of 200 faculty/500 students per year in nuclear engineering and nuclear science.
Utilize unique research facilities of DOE National Laboratories for faculty/student research and training.	o Support provided 12 laboratories/universities consortia per year averaged 2,000 faculty/student research appointments in the laboratories. Specific activities supported: Undergraduate/graduate student research projects Faculty research Faculty training in energy R&D				o Increased the range of colleges participating in energy R&D. Trained new researchers.
Carryout manpower assessments on supply/demand of manpower for current and future energy programs.	o Initiated support for baseline data analysis on numbers of scientists/engineers involved in energy.	o Initiated support for Construction Labor Demand System (includes info on labor requirements for energy construction projects).	o Carried out three assessments on manpower requirements in conservation, coal, gasification, and renewable energy.	o Initiated (81) assessments in nuclear fission/fusion and geothermal energy.	o Provided comprehensive information on manpower requirements to public/private sector planners.
Provide information on energy R&D to secondary school teachers/students.					
- Support teacher-training institutes.	o 68 institutes (avg. 30 participants)	o 99 institutes	o 97 institutes	o 80 institutes	o Provide training/info on energy R&D to an average of 2,000 teachers per year.
- Develop and disseminate ins[illegible]tional materials on [illegible].	o 30 instructional packages	o 6 packages	o 15 packages	o 5 packages	o Provided examples of energy R&D experiments [illegible]

TABLE 38-1

ENERGY SUPPORTING RESEARCH

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
MULTIPROGRAM GENERAL PURPOSE FACILITIES:					
Rehabilitate/replace unacceptable buildings, temporary facilities, utility systems, roads, and railroads and ensure installations comply with environmental, safety, and health regulations and safeguards and security requirements to ensure continued operation of the DOE multiprogram laboratories. Current backlog of deficiencies totals $2 billion.		o Program initiated in FY 81.			o 13 projects initiated. o $21.6 approp. for buildings. o Fire and safety improvements at Argonne National Laboratory and at the Richland site. o Replacement of deteriorated and inadequate laboratory and office space at Idaho National Engineering Laboratory, Sandia National Laboratory in Albuquerque, N.M., and at Oak Ridge National Laboratory. o Upgraded or replaced unreliable deteriorated and otherwise inadequate roofs and mechanical systems at Argonne National Laboratory, Idaho National Engineering Laboratory, and Lawrence Livermore National Laboratory. o $13.4 approp. for site utilities. o Improved power systems reliability at the Richland site, Oak Ridge National Laboratory, and Idaho National Engineering Laboratory.

TABLE 38-2

ENERGY SUPPORTING RESEARCH

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $305.6

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
BASIC ENERGY SCIENCES:			
Fundamental scientific and technical knowledge to develop options to meet energy goals.	o Reliance on industry; reliance on academia; transfer function to other agency, and/or expand functions of other agencies.	o Continuing midterm and long-term need.	o Critical for maintaining U.S. world leadership; knowledge generated is widely disseminated.
- Identify needs and opportunities.	o Depend on industry and/or OSTP, NAS to meet objective or eliminate objective.	o Important to a coherent approach from a national point of view.	o Needed for program planning and responsiveness.
- Support highly competent researchers.	o Transfer function intact, depend on expansion of other agency functions, or eliminate objective.	o Health of U.S. economy dependent on scientific, technological advances, education of new leaders.	o New data, concepts generated; people trained; U.S. leadership assured; results and trained people available to industry.
- Maintain liaison with other DOE programs, agencies, and scientific, academic, and industrial communities.	o None.	o None if function is terminated.	
- Promote early use of results of basic research.	o Reliance on industry; reliance on academia; eliminate objective or transfer to other agencies.	o Critical to maintain U.S. economy, new technology, production improvements heavily dependent on this objective.	o New concepts explored; data, results widely disseminated.
Maintain U.S. leadership in areas of unique BES responsibility.	o Transfer responsibility to other agencies; or consciously decide to give up U.S. leadership.	o Continuing commitment to maintain U.S. leadership in select areas of science.	o Maintain U.S. leadership in world science; help maintain advantage for U.S. industry in high technology.
- Provide for and support specialized research facilities.	o Transfer responsibility to other agencies; or close down facilities.	o Continuing commitment to operate unique, national facilities.	o No other alternative to obtain the results; results widely disseminated.
- Support highly competent researchers.	o Reliance on industry; reliance on academia; eliminate objective; or transfer to other agencies.	o Health of U.S. economy depends on scientific technological advances. U.S. leadership in advanced fields important to maintain economic leadership.	o New data, concepts generated; people trained; U.S. leadership assured; results and trained people available to industry.

TABLE 38-2

ENERGY SUPPORTING RESEARCH

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
ENERGY RESEARCH ANALYSES (Formerly Assessment Projects):			
Provide the Department with independent, objective analyses and assessments on research and technical needs of existing and planned Departmental R&D programs.	o Use other Government agencies. o Have assessment done by program offices.	o Resolve issues associated with performance of programs and program goals, milestones, and objectives. o Department-wide basic and applied research planning. o Coordinated Federal research in several areas (e.g., materials) essential.	o Approximately 7 major assessments focused on specific objectives of selected programs will be conducted.
UNIVERSITY RESEARCH SUPPORT:			
Stimulate and support cooperative energy research/manpower development programs among universities/industry/National Laboratories.	o Direct funding by industry for university-based energy research.	o Increase dissemination of university research results to industrial application.	o Acceleration of use of university energy research by industrial, Lab groups. o Develop new problem-oriented university research focused on industrial needs (funding for such research would be provided by industry).
Assure operational capability of the major university-based nuclear research/training reactors.	o Rely on industry funding.	o Produce sufficient replacement fuel in FY 1982 to meet reactor fuel needs in FY 1983 while new contractor is developing production capability.	o Continuation of university nuclear research/manpower development programs.

TABLE 38-2

ENERGY SUPPORTING RESEARCH

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Reorient support for National Laboratory-based faculty/student research/training programs towards critical nuclear/fossil technology manpower needs.	o Rely on support from individual technology program offices.	o Develop targeted research/training programs for engineering faculty/students in National Lab nuclear/fossil-oriented programs.	o Increase the numbers of students pursuing energy-related technology careers. Continue support for faculty research participation in high-priority National Laboratory programs.
Help ensure adequate supply of professional level scientists/engineers for involvement in future energy research programs (section 103 (10), P.L. 93-438).	o Cooperative support with industry, other DOE technology programs.	o Ensure availability of graduate level engineers for National Laboratory/industrial R&D programs: - Carried out through support provided for graduate research traineeships in selected engineering disciplines.	o Increase graduate enrollment of U.S. students in critical energy-related engineering disciplines (including nuclear engineering). o Establish cooperative research/training programs in energy with industry.
		o Provide information on energy R&D needs, opportunities for use by secondary school teachers in science/engineering classes: - Increases number of students pursuing professional level science/engineering degrees.	o Continuation of support for energy manpower development efforts related to nuclear/fossil/basic energy sciences.
MULTIPROGRAM GENERAL PURPOSE FACILITIES:			
Rehabilitate/replace unacceptable buildings, temporary facilities, utility systems, roads, and rail-roads and ensure installations comply with environmental, safety, and health regulations and safe-guards and security requirements to ensure continued operation of the DOE multiprogram laboratories.	o Leasing of necessary facilities. Leasing approach is not well suited to providing special laboratory facilities and is constrained due to remote location of DOE installations, need to have facilities on-site for security reasons, and lack of long-term leasing authority of DOE.	o Annual dollar requirement estimated to be $160 million.	o Continuation of project started in previous years. o Start of urgently required new projects.

TABLE 38-2

ENERGY SUPPORTING RESEARCH

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
	o If adequate facilities to house and support programmatic activities are not provided, operations would have to be reduced or would have to continue in unsafe conditions not in compliance with safety and health regulations. Work could be transferred to other performers if available.		
Continue to centrally manage the MGPF program on a Department-wide level.	o Return to process where individual programs fund general use projects in competition with other programmatic requirements. Previously, this approach resulted in extensive backlog and did not ensure that critical deficiencies were corrected.		o Development of uniformed procedures, guidelines, and policies.

TABLE 39-1

ENVIRONMENT AND SAFETY

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$58.2	$65.4	$69.3	$65.8	
Obligation:	$57.0	$64.6	$67.5	$63.4	
Environmental Safety & Health (ES&H) and Quality Assurance actions in DOE programs:					
Provide guidance, assistance, and overview to achieve a high level of Department-wide nuclear and operational ES&H protection and quality assurance in DOE programs through:	o Less than 1% of workers received radiation exposures over 2 rem. o DOE injury and property loss rates were less than 25% of general U.S. industry averages.	o Less than 1% of workers received radiation exposures over 2 rem. o DOE injury and property loss rates were less than 50% of general U.S. industry averages.	o Less than 1% of workers received radiation exposures over a more stringent standard of 1 rem. o DOE injury and property loss rates were less than 50% of general U.S. industry averages.	o 1981 radiation, injury, and loss data not yet available.	o Radiation exposures, injuries, and property losses were kept as low as possible within the limits of resources.
- Issuances of DOE standards and guidelines for both ES&H and quality assurance functions.	o 20 standards/guidelines were revised.	o 3 major orders were completed.	o 15 standards/guidelines were revised.	o All DOE orders were revised and issued.	o All ES&H standards have been revised.
- Annual reviews of:					
--Contractor-operated facilities.	o Over 70 appraisals were conducted.	o Over 80 appraisals were conducted.	o 63 appraisals were conducted.	o To date over 60 appraisals were conducted.	o Appraisals objective substantially achieved.
--DOE program safety analyses.					
- Response to NRC, FEMA, and other agency requests for assistance.	o Responded to over 125 requests.	o Responded to over 150 requests.	o Responded to over 150 requests for assistance.	o Responded to over 130 requests for assistance.	o Request objective achieved.

TABLE 39-1

ENVIRONMENT AND SAFETY

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
- Maintenace of state-of-the-art radiological emergency response to detect and assess releases into the atmosphere.	o Maintained rapid response capability. Conducted 16 background radiometric surveys of nuclear facilities. Completed R&D phase for atmospheric Release Advisory Capability (ARAC). Responded to 86 requests for assistance.	o Maintained rapid response capability. Conducted 24 background radiometric surveys of nuclear facilities. Began implementation of ARAC. Responded to State of Pa. and NRC requests for monitoring and assessment at TMI. Responded to 100 other requests for assistance.	o Maintained rapid response capability. Conducted 35 background radiometric surveys of nuclear facilities. Began planning ARAC as broad Federal resource. Assisted EPA in TMI purge. Responsed to 80 requests for assistance.	o Maintained rapid response capability. Conducted 24 background radiometric surveys of nuclear facilities. ARAC response for a DOE facility is 1/2 hour. Responded to about 100 requests for assistance.	o Responded to all requests for emergency assistance.
Health and Safety related mandates external to current DOE operating facilities:					
Survey, support, and overview safety-related remedial actions at sites and facilities contaminated by past Governmental nuclear operations in accordance with NE/EP schedules.	o Sites involved: 39 Surveys conducted:[1] 69 Reports published: 17	o Sites involved: 39 Surveys conducted: 23 Reports published: 67	o Sites involved: 73 Surveys conducted: 129 Reports published: 57	o Sites involved: 48 Surveys conducted: 93 Reports published: 102	o Substantially achieved program objective.

[1] The magnitude of a survey may involve a residence, a complex facility, or hundreds of acres of land.

TABLE 39-1

ENVIRONMENT AND SAFETY

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Environmental Assessment and Compliance Actions: - Assist the Department in the timely anticipation and resolution of ES&H protection issues related to the development of new energy technologies.	o Established Environmental Coordinating Committee for each technology development program. o Instituted Environmental Development Plans for major technology R&D areas associated with technology development. o Provided basis for control technology aspects of major DOE policies, including sulfur emission standards and New Source Performance Standards for SO_x, NO_x, and particulate emission levels. o Identified need for improved waste-water treatment systems to meet effluent regulations for fossil energy demonstration plant designs. o Identified control technology requirements for addressing global CO_2 problem; provided basis for expanded DOE CO_2 program initiatives.	o Assessed environmental readiness of selected technologies. Prepared Environmental Project Plans for major projects. Completed Environmental Development Plans for major technology programs. o Conducted environmental technology assessments including National Coal Utilization Assessment of large-scale coal use, and community impacts of Solar Energy Systems. o Assisted in redirecting oil shale technology programs to address major environmental issues. o Coal/water slurry transport program provided basis for DOE program position on the environmental readiness of this technology.	o Established special committee and research program on magnetic fusion; extended plans and readiness baseline to over 30 Departmental programs. o Completed geothermal technology assessment for geothermal systems in California. o Completed solar energy assessment for Domestic Policy Review. o Completed assessment on wood combustion which persuaded Department not to request Federal tax credits for residential wood stoves. o Assessments initiated in Magnetic Fusion, Uranium Enrichment, Indirect Liquefaction, Enhanced Oil Recovery, and Direct Heat Geothermal.	o Completed Advanced Isotope Separation ERD; directed attention to possible differences between three competing processes relative to a critical materials usage. o Completed Transportation Programs ERD; instrumental in selection of fluid for Rankine bottoming cycle applications. o ERD and EDP efforts terminated at the end of FY 81. o Completed impact assessment of large-scale solar energy biomass systems. o Completed Urban Transportation Assessment; provided travel demand models to DOE and DOT. o Completed Environmental Characterization Information Reports for 17 energy systems, providing documented reference to DOE environmental data files.	o DOE has fulfilled its programmatic objectives by: - Providing management with objective information on EH&S impacts, control technology strategies, and environmental readiness of energy technologies. - Establishing environmental planning and documentation. - Maintaining an accurate referenced inventory of energy/environmental data. o Assisted in resolution of issues with minimum delays in program implementation, and providing balanced DOE energy-environment policy decisions.

TABLE 39-1

ENVIRONMENT AND SAFETY

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
		o Assisted in establishing program plans in Advanced Environmental Control Technology, coal cleaning, underground coal conversion, synthetic fuels, oil shale and gas clean-up technologies. o Assisted in developing DOE position for control technology aspects, costs, and impacts of new strip mining regulations developed by Department of the Interior. o Identified high ambient levels of carbon monoxide at University of Minnesota Gasifier, alleviating early correction without major incident; assessed the efficiency of other control technologies at the site.	o Completed review and update of environmental data base for 33 energy technology systems. o Prepared technology/environmental handbook for use by energy and environmental community. o The DOE technical programs and the EPA control technology wastewater cleanup development programs were provided information for the development of expanded programs in water cleanup requirements. Identified wastewater and water cleanup problems resulted in more conservation designs for pilot plant facilities. o Completed assessments of control technology and readiness for deployment in geothermal, wind, and urban waste energy systems. o Completed Solar Heating Materials Handbook; provided information to DOC and industry on control technology for solar heating systems.	o Developed synthetic fuels wastewater program, including development of advanced biological and/or physical chemical treatment systems; provided basis for expanded program effort at PETC and METC. o Assessed wastewater treatment requirements and provided control technology alternative for groundwater pollution and related problems from in-situ coal and oil shale technologies. o Confirmed technical feasibility of innovative control options for simultaneous removal of SO_x and NO_x, and enhanced particulate removal, allowing further development as alternative for meeting emission regulations. o Completed assessments of compressed air energy storage, geothermal and biomass energy options; provided judgments on the control technology options and strategies for deployment.	

TABLE 39-1

ENVIRONMENT AND SAFETY

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Assist the Department in the timely anticipation and resolution of ES&H protection issues related to changes in environmental laws and regulations.	o Completed comprehensive national and regional assessments for EIA First Annual Report to Congress, and First National Energy Plan. o Assembled and standardized energy/economic/environmental data base. o Completed issue analyses on water availability for energy development. o Established Environmental Coordinating Issues Committees.	o Completed environmental assessment of Second National Energy Plan, and analyzed energy scenarios in EIA second Annual Report to Congress. o Completed environmental assessments for oil shale tax credit initiatives and building temperature control policies. o Developed new methods for analyzing long-range air pollution problems. o Prepared environmental analyses for light-duty deisel market expansion plans. o Completed 10 regional energy/environmental data bases to improve assessment capability.	o Analyzed future energy scenario in EIA Third Annual Report to Congress. o Conducted environmental assessments for legislative proposals on synfuels, lead in gasoline, light-duty diesels, and Federal leases for coal, oil, and gas production. o Assessed impact of energy initiatives on carbon dioxide and acid rain problems. o Continued to review impacts of new environmental regulations: - Air: prevention of significant deterioration, visibility protection, sulfur oxide and particulate criteria, industrial boiler standards, State Implementation Plans.	o Completed environmental analysis for Third National Energy Policy Plan and analyzed energy scenarios in EIA Fourth Annual Report to Congress. o Completed five assessment handbooks to assist in DOE project evaluation. o Conducted special regional assessments for energy developments in Rocky Mountains, Appalachia and Northeast. o Led DOE study of proposed changes to Clean Air Act. o Participated in interagency acid rain task force and work groups. o Conducted analyses and coordinated DOE responses to several proposed regulations: - Air: visibility, PSD sulfur oxide and particulate criteria, nitrogen oxide standards, industrial boilers.	o Secretarial officers were fully informed of environmental consequences of energy plans and strategies. o Secretarial officers notified of potential impacts of proposed regulations. DOE positions resulted in more realistic and less energy-impacting regulations than those originally proposed.

TABLE 39-1

ENVIRONMENT AND SAFETY

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
	o Conducted regulatory impact analysis on: - Utility new source air pollution controls. - Utility waste disposal regulations. - New surface mining controls.	o Conducted regulatory analyses on: - Utility NSPS. - Hazardous wastes. - Water pollution controls. - Surface mining controls. - Toxic Substances Act. - Industrial Boilers.	- Water: petroleum refinery standards. - Hazardous wastes. - Wilderness Study Review. - Roadless Area Review. - Coastal Zone Management. - State surface mining controls.	- Water: Efflucent guidelines for utilities and refineries. - Hazardous wastes. - Toxic substances. - Continued Environmental Issues Committee coordination process.	
Ensure that DOE programs are not delayed due to failure to comply with environmental requirements, including the National Environmental Policy Act (NEPA) by providing: - Guidelines preparation and training programs. - Determination of NEPA requirements. - NEPA document reviews (i.e., EIS's, EA's). - Assistance to project offices in securing requisite environmental permits and approvals.	o Compliance accomplished on approximately 100 DOE actions; only one action delayed.	o Compliance accomplished on approximately 130 DOE actions; no actions delayed.	o Compliance accomplished on approximately 260 DOE actions; one action delayed.	o Compliance accomplished on approximately 270 DOE actions; no actions delayed.	o Compliance acomplished on approximately 760 DOE actions with very few delays.

TABLE 39-2

ENVIRONMENT AND SAFETY

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $57.3

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Environmental, Safety, and Health (ES&H) and Quality Assurance actions in DOE Programs.	o Rely soley on field offices and technology program reviews.	o Conduct management appraisals.	o Fulfill congressional mandate to assure public health and safety in DOE operations.
Provide guidance, assistance, and overview to achieve a high level of Department-wide nuclear and operational ES&H protection and assurance of quality in DOE programs through:	o Allow NRC, OSHA, EPA to approve DOE operations.	o Provide DOE standards, requirements, and orders to ensure nuclear safety and health protection.	o Provide an independent nuclear overview and advisory capability to senior management.
	o Contract with private sector to have independent assessments performed.	o Revise all ES&H standards and conduct reviews.	o Provide an independent appraisal of field office ES&H programs.
- Issuance of DOE standards and guidelines for both ES&H and Quality Assurance functions.	o Follow lead of private sector.	o Provide ES&H assurance through appraisal visits, reports, etc.	
- Annual reviews of:		o Provide ES&H policies and guidance.	
- Contractor-operated facilities.		o Provide technical advice to DOE contractors, other Federal agencies, and general public.	
- DOE program safety analyses.		o Provide assistance in investigating accidents.	
		o Provide management guidance on ES&H contracts.	
Respond to NRC and other agency requests for assistance.	o Transfer programmatic and assessment responsibilities to other components of DOE, or to other agencies.	o Provide technical support and assistance to other components of DOE and other agencies.	o Assist other agencies as required within resource ceiling.

TABLE 39-2

ENVIRONMENT AND SAFETY

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Maintain state-of-the-art radiological emergency response to detect and assess releases into the atmosphere.	o Develop capability in NRC, FEMA, EPA, or the states.	o Improve state-of-the-art radiological monitoring and assessment capability through: - Procurement of two helicopters for response and radiation surveys. - Development of air-transportation communications capability. - Expansion of ARAC to provide 1/2 hour response for all DOE facilities. o Validate radiological controls and emergency response programs of DOE operations through initiation of comprehensive site-wide exercises of emergency plans.	o Provide emergency response capability for responding to any nuclear accident or incident. o Provide expert assistance to other agencies in planning for and responding to nuclear (or other) emergencies.
Survey, support, and overview safety-related remedial actions at sites and facilities contaminated by past Governmental nuclear operations in accordance with NE/EP schedules.	o Transfer programmatic and assessment responsibilities to other components of DOE, or to other agencies.	o Conduct, evaluate, and document radiological surveys to determine nature and extent of contamination, need for and magnitude of remedial action. o Designate processing sites and vicinity properties for conduct of remedial action, and determine priorities on the basis of potential health effects. o Independently evaluate and concur in National Environmental Policy Act documents and remedial action plans prepared before cleanup operations.	o Respond to the mandates of P.L. 95-604, and the Atomic Energy Acts of 1946 and 1954, as amended.

TABLE 39-2

ENVIRONMENT AND SAFETY

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
		o Conduct independent radiological surveys and radon monitoring networks before, during, and after cleanup operations to determine changes in radiological conditions. o Implement review procedure to certify that cleanup is in compliance with applicable standards and specifications.	
Environmental assessment and compliance actions.	o Transfer function to DOE program offices or other Federal agencies.	o Assure that all necessary ES&H controls are incorporated in the final plant designs, and that the control technologies applied are cost effective and state of the art.	o ES&H and control technology assessment will be extended and expanded to cover nuclear research and operations. Concommitant reduction of effort will be made in the fossil, conservation, and renewable area.
Assist DOE in the timely anticipation and resolution of ES&H protection issues related to changes in environmental laws and regulations, DOE initiatives, and development of new energy technologies.	o Transfer function to DOE program offices. o Eliminate function on assumption that private sector will play stronger role in environmental standard setting and reviews.	o Conduct environmental, health and safety, cost, benefit, risk, and impact assessments for DOE initiatives and strategic actions, e.g., National Energy Plan, deregulation proposals, R&D initiatives. o Provide early warning to technology program offices of potential new environmental, health, and safety regulations to avoid program delays.	o All of the major environmental, safety and health laws enforced by EPA, OSHA, and Interior will be reauthorized and revised over the next 4 years. o Many new regulations will be proposed and promulgated which can severely impact DOE operating facilities' costs and productivity, as well as that of the energy industry.

TABLE 39-2

ENVIRONMENT AND SAFETY

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Ensure that the Department's programs and projects are not delayed due to failure to comply with environmental requirements, including the National Environmental Policy Act (NEPA) by providing: - Guidelines and training programs. - Determinations of NEPA requirements. - NEPA document reviews (i.e., EIS's, IA's). - Assistance to project offices in securing requisite environmental permits and approvals.	o Transfer direct NEPA compliance oversight to other Federal regulatory agencies, such as NRC, OSHA, EPA. o Abolish independent review capability, placing full responsibility on the DOE program offices to prepare adequate, timely NEPA documents.	o Ensure that major DOE actions are in compliance with NEPA.	o NEPA documentation must be reviewed for major DOE program and project actions in order to allow those actions to proceed without delay due to environmental requirements.

TABLE 40-1

HEALTH AND ENVIRONMENTAL RESEARCH

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority: Obligation:	$207.5 $205.6	$197.1 $195.8	$210.1 $208.4	$209.9 $207.3	
Identify, analyze, and reduce health and environmental uncertainties which impede U.S. energy policy.	o Began comprehensive chemical, biological, and ecological data base for early analysis of health impacts of coal liquefaction and high- and low-Btu gasification, surface retort shale oil, and geothermal operations.	o Initiated comparable studies for fluidized-bed combustion vs. conventional combustion, and in situ shale oil operations. o A comprehensive study of the environmental concerns associated with geothermal energy production in the Imperial Valley of California was completed and the results published.	o Initiated multidisciplinary studies on combustion of coal/oil mixtures and coal-derived liquids. o A compilation of environmental data from the Paraho surface oil shale retorting process was published.	o Completed high-Btu gasification evaluation; showed minimal problems.	o Defined key issues and research needs and produced and published sound scientific information for understanding and reducing health and environmental risks of energy options.
- Determine the nature of energy-related materials and radiation to which workers or the general population may be exposed, and improve measurement and dosimetry systems.	o Completed development of a new measurement technique with unprecedented sensitivity called resonance ionization spectroscopy, and demonstrated its capability to detect single atoms. o Completed development of techniques for calibrating measurements of internally deposited radionuclides that are essential for accurate estimation of radiation dosage.	o Completed development of a sensitive monitoring system for fluorocarbon atmospheric tracers which enables studies of pollutant transport over long distances, i.e., ca. 1,000 km. o Development of a nuclear track detector for personal neutron dosimetry was completed.	o In collaboration with other Federal agencies, a portable, programmable mass spectrometer system for measurement of a variety of atmospheric pollutants was developed. o Neutron radiation fields inside the containment of pressurized water reactors were characterized in detail providing improved estimates of potential worker exposure.	o A prototype, personal magnetic field dosimeter system to measure workplace exposure to high fields was developed and field tested. o Instrumentation for detecting chemically contaminated surfaces was developed and field tested to protect personnel in synfuel production facilities from skin exposures. o Annual occupational exposure limits for intake of all significant radionuclides was compiled and published under the auspices of the International Commission [illegible]	o DOE and its predecessor agencies produced most of the radiation dosimetry techniques in use today. o Instrumentation has been developed to measure many of the biologically active substances that may present potential hazards. o Extensive chemical and radiation characterization data has been developed on products, effluents, and emissions from energy-related activities.

TABLE 40-1

HEALTH AND ENVIRONMENTAL RESEARCH

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
- Determine mechanisms that control and influence total ecosystems and the cycling of energy by-products through them.	o Discovered microbial indicator of soil fertility for evaluating disturbed and undisturbed soils, so that level of soil amendments needed can be quickly determined.	o Discovered new dune grass and developed novel planting techniques to stabilize sandy areas on the arctic slope. o Completed model that uses tritium to determine uptake rates of energy by-products in ecosystems.	o Devised a geobotanical mapping system that will assist in decisions on resource development in wilderness areas.	o Completed several models on stressed ecosystems for predicting: aquatic plant productivity, animal population dynamics with ecosystem changes, and optimal plants species for revegetating different regions.	o Discoveries and completions of research have kept pace with the support that the researchers have received.
	o Developed innovative animal traps for population studies that showed many animals listed as "endangered or rare" were only hard to catch.	o Developed ultra sensitive techniques for characterizing chemical form of transuranics in environment so appropriate stabilization methods could be made.	o Completed a synthesis of transuranic research in the environment that is being used extensively for nuclear waste management practices.	o Developed technique for monitoring spent shale leachate as they move into ground water systems.	
	o As a result of new atmospheric transport research findings, atmospheric diffusion parameters were revised which significantly improved estimates of pollutant concentration levels.	o The Atmospheric Release Advisory Capability (ARAC) system provided a definitive forecast of the distribution of radioactivity and population exposures from the Three Mile Island accident.	o Studies of the atmospheric transformations of polycyclic aromatic hydrocarbons released from coal-fired powerplants showed that some are rapidly degraded while others are converted to mutagenic oxides and nitro compounds.	o A three-year field study of atmospheric wind dynamics and tracer dispersion in complex terrain was completed at The Geysers geothermal energy production area in California. This improved data base will be incorporated into better mathematical models.	o Atmospheric transport models have been developed with a reasonable degree of predictive capability in relatively simple situations.
- Quantify human health risks for late effects of acute and chronic exposure.	o Demonstrated that workers with high plutonium body burdens had no excess mortality from any cause.	o Initiated study of workers at nuclear shipyards to evaluate the possibility of increased cancer mortality related to exposure to low-level ionizing radiation.	o Workers from uranium processing plants show no evidence of increased mortality from radiation except for possible increase in lung cancer deaths.	o Initiated cooperative study with Yugoslavia to evaluate the health effects of workers at their Lurgi gasifier plant.	o DOE remains primary supporter of Nation's efforts to define human risk to late effects of both chronic low-level exposures from the nuclear fuel cycle and from acute exposures from weapons testing and use.

TABLE 50-1

HEALTH AND ENVIRONMENTAL RESEARCH

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
	o Centralized all health and mortality studies of DOE personnel and contractor workers to improve data collection efficiency and increase sample size.	o Improved sputum cytology techniques to validate new non-invasive procedures for early detection of lung cancer.	o Identified association between radium/radon exposure and breast cancer initiation among female radium dial painters.	o Chronic exposure to low levels of the highly toxic phosgene in uranium processing plant does not lead to an excess mortality risk.	
	o Life span studies of A-bomb survivors confirms relation between radiation dose and cancer mortality.	o Growth and development in 1st generation offspring of A-bomb survivors show no radiation effects.	o New techniques developed for early detection of pre-cancerous cytological lesions and enzymatic changes in synfuel workers.	o Genetic assays of children of A-bomb survivors suggest mutation risk lower than prior predictions.	
- Provide detailed experimental health effects data useful for predicting risk to humans from realistic exposure levels of energy-related emissions.	o Conducted major programs to develop inexpensive, reliable short-term bioassays for toxicity.	o Applied short-term bioassays to complex mixtures from coal conversion pilot plants.	o Showed that fluidized-bed combustion presents no unique health effects problems.	o Showed that unique class of organic compounds in coal liquids responsible for mutagenicity/carcinogenicity.	o DOE produced most of the short-term bioassays in use in national programs today.
	o Validate by animal tests predictive capability of short-term bioassays for carcinogenic potential of complex mixtures.	o Showed that shale oil is slightly more carcinogenic than natural petroleum but much less so than coal liquids.	o Showed that only high boiling point liquids from coal or shale are hazardous.	o Hazardous chemicals in shale oil and coal liquids can be destroyed by hydrotreatment.	o Major advances made in identifying toxic chemicals and means of mitigating problems created by them.
	o Conducted programs to develop sensitive indicators of disease in humans.	o Produced laboratory-scale system for detecting abnormal proteins associated with disease.	o Identified abnormal proteins in cells and body fluids of chronically ill human beings.	o Put first detection system into commercial production.	o Original objective met with application in DOE programs and national health delivery.
	o Conducted major animal studies to evaluate dose and dose-rate dependence for neutron and gamma ray cancer induction.	o Major reduction in efficiency of gamma ray induction of tumors with reduced dose rate not found for neutrons.	o Data conclude fractional life span reduction per unit dose may be same for several experimental species and for man.	o Analysis of data indicate that the percent increase per unit dose for several types of cancer may be the same in mouse and man, thus simplifying risk prediction.	o Completed one major radiation animal study. Multispecies study will be completed on schedule in FY 87. NAS review (FREIR Report, 1981) found DOE program quality generally good, and with few exceptions, research well conceived and carefully pursued by competent investigators.

TABLE 40-1

HEALTH AND ENVIRONMENTAL RESEARCH

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
- Provide realistic analysis of interactions between energy activities and human health and environment.			o Published analyses of potential health and environmental impacts of the National Energy Plan and three energy technologies (batteries, diesels, photovoltaics).	o Published analyses of 6 more energy technologies (3 synfuels, geothermal, municipal wastes, and fluidized-bed combustion) and 3 analyses of energy-related pollutants (NO_x, hydrocarbons, waterborne organics).	o Analyses to support environmental research and development planning initiated according to program plan.
- Disseminate research results.	o 142 conferences, workshops organized to review and assess progress and identify research needs. 2,697 talks presented at technical meetings to promote early use of results. Data documented in 3,161 articles in open literature.	o Conf.: 144 Talks: 2,778 Publications: 2,995	o Conf.: 160 Talks: 3,107 Publications: 3,370	o Conf.: 198 Talks: 2,479 Publications: 3,080	o Research results promptly and widely disseminated at professional meetings and documented in peer-reviewed journals.
- Develop sound, quantitative knowledge base to aid energy policy decisions on the carbon dioxide issue.	o Nation's leading scientists confirmed CO_2 issue is cause for concern; workshop convened by ERDA defined research questions to get better facts about global carbon cycle and effects of CO_2 on climate. o Established high-level scientific advisory committee.	o Completed research plan for investigating carbon cycle and climate effects of CO_2. o Measurement of atmospheric CO_2 confirms increase of about 1.5 ppm per year; this amount has been increasing since 1958.	o Climate model calculations estimate a 2° to 3°C ± 1.5° global average temperature increase for a doubled atmospheric CO_2; larger temperature change is calculated for the polar region. o Measurement of air/sea exchange of CO_2 in the equatorial Pacific defined magnitude and seasonality of CO_2 outgassing; data from Pacific and Indian Oceans improve knowledge of ocean sources of atmospheric CO_2.	o Precisely defined CO_2 emissions from fossil sources for the past several decades; rate of increase of coal emissions remains unchanged (1.9% per year) but CO_2 emissions rate from oil and gas has decreased threefold. o Better definition of global carbon sources and fluxes represents measurable progress to balance the global carbon budget; upward adjustments in the size of atmosphere and ocean sinks combined with lower estimate of fossil fuel and biosphere emissions narrow the uncertainty surrounding the global carbon cycle.	o Accelerated research is providing information required for timely review of energy policy issues.

TABLE 40-1

HEALTH AND ENVIRONMENTAL RESEARCH

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Develop new medical applications of nuclear technology using radiation, radioisotopes, stable isotopes, and heavy ion beams.	o Fluorine-18 labeled sugars first used to measure glucose metabolism in brain, heart, and tumors.	o A neutron activation analysis technique was developed for monitoring absolute levels of cadmium in industrial workers.	o A markedly improved reagent kit for labeling red blood cells with technetium -99m was distributed worldwide to image spleen and blood pools, assess heart function, and detect gastro-intestinal bleeding.	o Fluorine-18 sugars being utilized for brain disease studies at 6 NIH centers.	o DOE nuclear medicine program world renown and has major impact on clinical medicine.
	o Boronated biomolecules shown to have enough uptake in tumors for use in neutron capture therapy.	o A circulating saline electrode developed by DOE was first utilized to correct vision problems in humans.	o Helium ion radiation used to treat ocular melanoma (an eye cancer) while preserving vision of the eye.	o An automated mass spectrometer system was developed to measure stable isotope ratios nearly 100 times faster than possible earlier.	o Major producer of stable isotopes and unique radioisotopes not feasible for commercialization.
	o A DOE-developed electronic hyper-thermia device for treatment of "cancer-eye" in cattle was commercialized.	o Demonstrated the ability to detect tiny myocardial infarctions using the positron emitter rubidium-82.	o First treatment of human cancer using radioiodinated antibodies attached to cancer-specific antigen.	o Developed fluorescence bronchoscope and imaging system for early detection of lung cancer.	
	o Demonstrated that carbon-13 can be produced in kilogram quantities, as completed construction project to mass produce stable isotopes of carbon, nitrogen, and oxygen.				
Maintain high-quality research facilities and trained scientific man-power.	o 2,028 scientists supported via 1,000 projects in DOE labs and 105 academic in-stitutions. Program helped train 867 graduate students and 445 post-doctoral fellows. Intramural programs attracted $38.0M in "work-for-others" (WFO) to exploit expertise and specialized facilities.	o Scientists: 2,109 Grad. Students: 959 Post-docs: 479 Academic Insti-tutions: 103 WFO: $53.1M	o Scientists: 2,193 Grad. Students: 974 Post-docs: 486 Academic Insti-tutions: 98 WFO: $62.5M	o Scientists: 2,267 Grad. Students: 974 Post-docs: 489 Academic Insti-tutions: 90 WFO: $72.6M	o DOE labs have served as important scientific and technical resource for addressing national research problems and developing scientists for the academic and private sector.

TABLE 40-2

HEALTH AND ENVIRONMENTAL RESEARCH

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $215.0

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Identify, analyze, and reduce health and environmental uncertainties that impede U.S. energy policy.	o Transfer mandate and funding to several other Federal agencies.	o Sound data characterizing energy-related emissions, their fate, and their behavior in the environment and potential impact on humans is critical for the safe development and use of fossil, nuclear, and renewable energy resources with minimum delay and cost.	o Facilitate societal acceptance of new technologies.
- Determine the nature of energy-related materials and radiation to which workers or the general population may be exposed, define their physical-chemical transport in the atmosphere, improve measurement and dosimetry systems.	o Rely upon private sector to provide comprehensive data on chemical, particulate, and radiation emissions, and to improve measurement and dosimetry systems. o Rely upon other agencies for atmospheric research needed to improve models describing transport and transformation of energy-related substances.	o Access to representative materials and operational facilities for new energy technology processes. o Identification of measurement and dosimetry limitations; transfer improved technology to industry.	o Chemical analysis to define biologically active material. o Improve worker safety through early availability of advanced pollutant dosimetry and instrumentation systems. o Enhance description of atmospheric pollutant levels, from better short- and long-range transport/transformation models; thus enabling improved analysis of population exposure and environmental impact.
- Obtain knowledge base for cost-effective environmental protection to allow full-scale expansion of energy development.	o None. This information would not be obtained because it is long-range, multidisciplinary, multi-institutional. It is not funded in any of the dedicated research agencies since they have more specific goals.	o Expand studies on cycling of energy by-products from new technologies in different geographic regions of the U.S. to determine cost-effective control requirements. o Develop methodologies to optimize rehabilitation of disrupted ecosystems. o Refine data base to develop superior predictive models in stress ecology so that habitats can coexist with energy expansion.	o Rapid deployment and expansion of energy systems is heavily dependent on availability of environmental information so that cost-effective methods can be incorporated where necessary.

TABLE 40-2

HEALTH AND ENVIRONMENTAL RESEARCH

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
- Quantify human health risks for late effects of acute and chronic exposure.	o Extrapolate from animal research.	o Epidemiologic studies of worker populations.	o Protect the public and worker health and safety.
		o Development of early disease detection modalities.	
		o Integrating air quality and health effects data bases.	
- Provide early applied research data for evaluating various technologies.	o Relevant industry continues ongoing work and initiates all new work.	o Animal late effects testing should begin FY 1982-83, complete in FY 1985-87 coal liquefaction and gasification, and coal combustion.	o Data base adequate for preliminary estimate of risk and possible mitigating methods for coal conversion and combustion.
			o Final data for risk estimate for widespread use of light duty diesel vehicles.
		o Same for low-medium Btu gasification, shale and diesel vehicles FY 1983-84, complete in FY 1986-88.	
		o Complete by FY 1986 animal late effects testing for low levels of external and internal radiation begun in FY 1966-75.	o Final data on chronic low-level radiation exposure responses to evaluate dose-effect models for risk prediction.
Understand mechanisms of interaction of pollutants and production of damage in order to arrive at generalized concepts.	o Other health-oriented agency takes specific responsibility for program.	o Mechanistic data describing fundamental processes of pollutant interaction with biological systems and production of effects.	o Long-term research on metabolism and fate of unique energy-related chemicals.
		o Basic research leading to a new experimental approach to estimating human risk.	o Data from cellular and molecular level experiments needed to develop generalized models for radiation-induced cancer and mutations.
		o Research leading to better understanding of chemical and biochemical basis for biological damage from agents associated with fossil, nuclear, and renewable resource development and use.	

TABLE 40-2

HEALTH AND ENVIRONMENTAL RESEARCH

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
- Provide realistic analyses of potential impacts of energy activities on human health and the environment.	o Utilize analyses performed by other Federal agencies (OTA, OSTP, OMB, EPA), international organizations (WHO, UNEP), and industry.	o Identification of environmental research needs and priorities. o NEPA compliance. o Formulation and implementation of cost-effective regulations. o Guidance for developing, installing, and operating energy technologies in environmentally acceptable manner.	o Update health and ecosystems risk analyses of energy technologies to reflect new research data and methodology improvements.
- Develop sound quantitative knowledge base to aid energy policy decisions on the carbon dioxide issue. Research objectives are aimed at improving estimates of future levels of atmospheric CO_2 from fossil fuel. Greatly improved understanding of the direct effects of atmospheric CO_2 on climate and vegetation is also needed. Second order effects and mitigation strategies need to be defined.	o None. The carbon dioxide issue is multidisciplinary in scope, and DOE has lead agency responsibility to plan and coordinate government research. The DOE role is to ensure that results lead to an improved understanding of CO_2 effects, and that timely information is provided for energy policy review and decision. DOE provides the majority of direct research support. Investigation of the CO_2 issue is beyond the scope and interest of private sector research.	o Near-term (1982 to 1985) needs include: (1) Improved knowledge of CO_2 fluxes, sources, and sinks in order to balance the carbon budget. This will enable accurate estimates of future atmospheric CO_2. (2) Improved climate models for calculating climate response to changes of atmospheric CO_2. (3) Analysis of possible second-order environmental effects of a CO_2-induced climate change. (4) Assessment of the state of knowledge and an interpretation of what it means in relation to energy policy options.	o Near-term research and assessment will identify preliminary options for energy policy review (1985). Outyear projection needed to evaluate climate and related environmental effects of CO_2 and to begin defining mitigation or control strategies.

TABLE 40-2

HEALTH AND ENVIRONMENTAL RESEARCH

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
		o Long-range (beyond 1985) needs include: (1) Improved knowledge about the direct effect of CO_2 on vegetation in order to state precise benefits of a higher CO_2 world. (2) Significantly improved climate models which justify confidence in predictions of temperature, precipitation responses by regional and seasonal sectors. (3) Scientific basis for policy decisions on future effects of burning fossil fuel.	
Develop new medical applications of nuclear technology using radiation, radioisotopes, stable isotopes, and ion beams.	o Rely on industry and/or health agency initiatives to promote research on nuclide production and labeled-compound synthesis, and instrumentation development, and to exploit the national laboratory accelerator programs and the basic energy science research currently supported by OER.	o To ensure the timely development and transfer of medical applications of nuclear technology for the diagnosis and treatment of human disease.	o Production of new radioisotopes and stable isotopes for medical applications. o Basic research on radiopharmaceutical synthesis and labeling of compounds with stable isotopes. o Studies of the clinical feasibility of various modalities of radiotherapy.

TABLE 41-1

ECONOMIC REGULATORY ADMINISTRATION

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$66.2	$92.8	$132.3	$105.4	
Obligation:	$65.6	$90.2	$128.3	$ 88.2	
To authorize and monitor imports of crude oil and petroleum products.	o Collected $28.3 million in fees. o Issued 2,625 licenses.	o Collected $26.6 million in fees. o Issued 2,910 licenses.	o Collected 0 in fees.1/ o Issued 1,970 licenses.	o Collected 0 in fees.1/ o Issued 2,420 licenses.	o Program accomplished intent.
To authorize imports and exports of natural gas to ensure consistency with public interest and national policy.	o Authorized the importation of 200 Bcf of natural gas. o Issued 14 procedural orders.	o Denied 3 import proposals. o Issued 31 procedural orders.	o Authorized the annual importation of 347 Bcf of natural gas. o Amended 11 existing orders. o Issued 11 procedural orders.	o Authorized the annual importation of 183 Bcf. o Authorized 2 new imports. o Amended 29 existing licenses. o Issued 13 procedural orders.	o Program accomplished intent.
To provide for the equitable distribution and pricing of crude and oil petroleum products.	o Allocated 25.8 million bbls. of domestic crude oil. o Allocated 62.0 million bbls. of Canadian crude oil. o Issued 33,000 gasoline decisions and orders. o Issued 144 aviation fuels decisions and orders.	o Allocated 54.3 million bbls. of crude oil. o Allocated 56.4 million bbls. of Canadian crude oil. o Issued 41,000 gasoline decisions and orders. o Issued 176 aviation fuels decisions and orders. o Decontrolled aviation fuels 2/26/79.	o Allocated 108.9 million bbls. of crude oil. o Allocated 32.2 million bbls. of Canadian crude oil. o Issued 38,000 gasoline decisions and orders.	o Allocated 39.4 million bbls. of crude oil. o Allocated 6.7 million bbls. of Canadian crude oil.	o Crude oil and petroleum products were reallocated in accordance with legislative mandate. However, the inability of the Government to efficiently redistribute products led to pricing allocation inequities.

1/ Fee program made inactive by Presidential order.

TABLE 41-1

ECONOMIC REGULATORY ADMINISTRATION

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
	o Issued 370 propane, butane, and natural gasoline decisions and orders. o Issued 18 decisions and orders to synthetic natural gas plant operators.	o Issued 450 propane, butane, and natural gasoline decisions and orders. o Issued 5 decisions and orders to synthetic plant operators.	o Issued 420 propane decisions and orders. o Butane, natural gasoline decontrolled 1/1/80.	o Issued quarterly crude oil pricing schedules. o Issued 3 crude oil entitlement notices. o SNG Feedstocks decontrolled 12/15/80. o Crude oil and products decontrolled 1/28/81.	
	o Issued monthly crude oil entitlement notices. o Issued quarterly crude oil pricing schedules.	o Issued monthly crude oil entitlement notices. o Issued quarterly crude oil pricing schedules.	o Issued monthly crude oil entitlement notices. o Issued quarterly crude oil pricing schedules.		
To increase domestic crude oil production from high-risk drilling ventures.				o Certified 423 tertiary projects.	o Produced 2.4 million bbls. of additional oil from 284 projects; anticipates eventual 4.5 billion bbls. of additional incremental crude oil recovery.
To assist state utility regulatory commissions in establishing policies to provide for the equitable pricing and efficient use of electricity and to conform with the Public Utility Regulatory Policies Act of 1978.	o Funded 15 cooperative agreements. o Produced 43 reports to assist states.	o Funded 32 cooperative agreements. o Funded 82 support grants. o Produced 65 reports to assist states.	o Funded 38 cooperative agreements. o Funded 94 support grants. o Produced 30 reports to assist states.	o Produced 25 reports to assist states.	o Met congressional objectives.

TABLE 41-1

ECONOMIC REGULATORY ADMINISTRATION

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
To reduce the use of natural gas and petroleum by fostering the use of coal in major fuel-burning installations and in the electric utility industry.		o Issued 4 prohibition orders to burn oil.	o Issued 44 prohibition orders to burn oil. o Finalized 3 orders. o 6 units converted to coal as a result of ERA orders at 7.1 million tons/year displacing 45,000 bbls./day of oil.	o Issued 4 prohibition orders to burn oil. o Finalized 4 orders and rescinded 2. o 5 units converted to coal as a result of ERA orders at 1.1 million tons/year displacing 11,700 bbls./day of oil.	o Objectives generally met, however, only a small number converted from oil to coal during this period.
To displace the use of fuel oil with natural gas transported by interstate pipelines to end-user purchasers.		o 10.2 million bbls. of fuel oil displaced.	o 9.9 million bbls. of fuel oil displaced.	o 2.5 million bbls. of fuel oil displaced (through April).	o Program accomplished the cumulative displacement of 22.6 million bbls.
To perform audits and investigations to ensure compliance with the pricing and allocation regulations and to execute enforcement actions necessary to remedy any violations pertaining to the 35 major refiners.	o Initiated audit of the 35 major refiners for the period 1973 through 1976. o Issued 31 enforcement documents identifying approximately $478 million in overcharges. o Participated in 4 OHA litigation proceedings. o Participated in 33 court litigation proceedings.	o Work toward completion of the 35 major refiners audits for period 1973 through 1976. o Issued 37 enforcement documents identifying approximately $2 billion in overcharges. o Participated in 2 FERC and 10 OHA litigation proceedings.	o Completed audits of 35 major refiners for period 1973 through 1976. o Issued 200 enforcement documents identifying $4.6 billion in overcharges. o Participated in 11 OHA litigation proceedings. o Participated in 24 court litigation proceedings.	o Completed 21 major refiner audits for period 1973 through 1/28/81. Continued audit work on remaining 14 for same period. o Issued over 15 enforcement documents identifying approximately $1.5 billion in overcharges. o Participated in 7 OHA litigation proceedings. o Participated in 17 court litigation proceedings.	o Accomplished objectives and met congressional intent.

TABLE 41-1

ECONOMIC REGULATORY ADMINISTRATION

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
	o Initiated 11 criminal investigations. o Negotiated $59.5 million in settlement agreements.	o Participated in 34 court litigation proceedings. o Initiated 19 criminal investigations. o Negotiated $83.0 million in settlements.	o Initiated 19 criminal investigations. o Negotiated $1.4 billion in settlement agreements.	o Initiated 13 criminal investigations. o Negotiated $2.0 billion in settlement agreements.	
To perform audits and investigations to ensure compliance with the pricing and allocation regulations and to execute enforcement actions necessary to remedy any violations pertaining to those other than 35 major refiners.	o Completed 1,167 audits. o Issued 960 legal documents. o Referred 17 potential willful violators to Department of Justice. o Identified $138,000 of overcharges. o Negotiated $40,000 in settlement agreements.	o Completed 328 audits. o Issued 459 legal documents. o Referred 38 potential willful violators to Department of Justice. o Identified $64,000 of overcharges. o Negotiated $85,000 in settlement agreements. o Deposited $3.6 million in the U.S. Treasury Special Refund account.	o Completed 477 audits. o Issued 407 legal documents. o Referred 18 potential willful violators to Department of Justice. o Identified $1.2 million of overcharges. o Negotiated $142,000 in settlement agreements. o Deposited $76.6 million in the U.S. Treasury Special Refund account.	o Completed 397 audits. o Issued 310 legal documents. o Referred 12 potential willful violators to Department of Justice. o Identified $826,000 of overcharges. o Negotiated $253,000 in settlement agreements. o Deposited $151 million in the U.S. Treasury Special Refund account.	o Accomplished objectives and met congressional intent.

TABLE 41-2

ECONOMIC REGULATORY ADMINISTRATION

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $47.2

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Execute enforcement action for noncompliance with the regulations of the Emergency Petroleum Allocation Act of 1973, as they pertain to the 35 largest refiners.	o Let injured parties seek redress on their own by suing alleged violators for remedies.	o Complete enforcement actions and obtain refunds for injured customers, or when unidentifiable, for the U.S. Treasury by year end FY 82, with residual cleanup by FY 83.	o Resolve all remaining alleged violations by consent settlement or by litigation. Remaining audit inventory approximates 15 companies.
Execute enforcement action for noncompliance with the regulations of the Emergency Petroleum Allocation Act of 1973, as they pertain to those other than the 35 largest refiners, which include small refiners, resellers, wholesalers, and retailers.	o Let injured parties seek redress on their own by suing alleged violators for remedies.	o Complete enforcement actions and obtain refunds for deposit in the U.S. Treasury Special Refund Account by end of FY 82, with residual cleanup activities completed by FY 83.	o Resolve all remaining alleged violations by settlement negotiations by FY 83. Remaining inventory approximates 800 cases.
Facilitate utility conversion to coal; issue exemptions to FUA; review and approve annual utility conservation plans.	o Amend the Clean Air Act to facilitate voluntary coal conversions without the need for a coal conversion regulatory program.	o Continue issuing FUA conversion orders in order to facilitate conversions to coal. Issue exemptions to FUA for new facililties until expiration of legislative authority.	o To comply with FUA, OBRA, and ESECA; facilitate coal conversions through procedural orders; process exemptions; and approve gas conservation plans.
To authorize and monitor imports of crude oil and petroleum products.	o Provide no special import license or requirements for crude oil and petroleum products.	o Continue to apply the licensing mechanism to all imports of crude oil, finished petroleum products, and unfinished oils to maintain an ongoing data control system.	o To comply with the requirements of the Trade Expansion Act of 1962 and Presidential Proclamation No. 3279; controlling and monitoring crude and product imports through a licensing mechanism.
To authorize imports and exports of natural gas to ensure consistency with public interest and national policy.	o Provide no special import or export licenses or requirements for natural gas.	o Continue to monitor and control imports and exports of natural gas through the individual review of company proposals and issuance of Decision and Orders approving or denying such proposals.	o Meet requirements of Natural Gas Act and Natural Gas Policy Act; review of proposals and issuance of related Decisions and Orders.

TABLE 42-1

HEARINGS AND APPEALS

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81 1/	Degree Original Objective Met
Total Obligational Authority:	$2.3	$2.9	$5.9	$8.3	
Obligation:	$2.3	$2.6	$4.7	$6.2	
Expeditiously handle applications for exception from requirements of DOE regulations.	2/	o # Cases Received: 15,166 # Cases Resolved: 7,270	o # Cases Received: 13,306 # Cases Resolved: 18,512	o # Cases Received: 1,383 # Cases Resolved: 4,596	o Speedily resolved over 38,000 adjudications since the beginning of FY 78. Speed of resolution depends upon the quantity and complexity of cases received. For example, in FY 79 OHA used expedited administrative procedures to provide immediate relief to persons adversely affected by the gasoline shortage that year. In FY 81 a greater number of complex entitlements exception cases and refiner remedial order cases were resolved, resulting in an increase in case age at resolution.
Timely processing of appeals of Administrative Orders.	2/	o # Cases Received: 1,223 # Cases Resolved: 361	o # Cases Received: 2,275 # Cases Resolved: 2,855	o # Cases Received: 568 # Cases Resolved: 1,070	
Resolution of contested issues of fact and law in enforcement proceedings.	2/	o # Cases Received: 497 # Cases Resolved: 399	o # Cases Received: 441 # Cases Resolved: 325	o # Cases Received: 387 # Cases Resolved: 404	
Miscellaneous, including Petitions for Special Redress.	2/	o # Cases Received: 69 # Cases Resolved: 65	o # Cases Received: 111 # Cases Resolved: 99	o # Cases Received: 11 # Cases Resolved: 63	
Total # Received:	2,976	16,955	16,583	2,349	
Total # Resolved:	2,670	8,094	21,791	6,133	
Within 60 days:	712	4,454	7,540	1,360	
Within 180 days:	1,515	3,030	9,310	1,643	
Within 300 days:	322	300	3,539	1,485	
Within 360 days:	63	83	726	355	
Within more than 360 days:	58	227	676	1,290	

1/ These figures are as of 8/31/81.
2/ Data by type of case are not available.

TABLE 42-2

HEARINGS AND APPEALS

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $4.8

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Complete analysis of, and issue final orders on, entitlements cases.	o Shift adjudicative responsibility to Department of Justice, FERC, or Federal courts.	o Final adjustments to exception relief previously granted. o Appeals of January 1981 and Final Entitlements Lists. o Adjustments after Final Entitlements Lists.	o Anticipate up to 200 appeals from January 1981 and Clean-up Entitlements Lists. Both lists may not be published until mid-to-late FY 82 because of protracted litigation.
Complete the adjudication of enforcement cases.	o Grant amnesty in all outstanding enforcement cases. o Shift adjudication of these cases to Department of Justice, FERC, or Federal courts.	o Provide for disgorgement and recovery of funds unlawfully obtained through overcharges (end of FY 84).	o ERA had predicted that it could file up to 7,890 new enforcement and refund cases in FY 82 and FY 83. The Office of Hearings and Appeals can resolve 2,040 cases per year at FY 82 level of funding.
Provide for efficient and equitable distribution of funds obtained as a result of enforcement actions.	o Enact legislation permitting deposit of funds directly into U.S. Treasury.	o Return funds to injured parties.	o See above.
Continue providing adjudicative forum for agency.	o Secretary would perform adjudications.	o Provide forum for administrative appeals required by executive and legislative authorities.	o 400 to 700 cases of this type may be filed per year.

TABLE 43-1

FEDERAL ENERGY REGULATORY COMMISSION

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$43.1	$54.0	$71.1	$77.3	
Obligations:	$41.5	$50.5	$67.7	$73.7	
GAS REGULATION:					
Bring pending casework current by FY 85 while maintaining the quality of FERC case reviews.	o Pending Cases: 14,566 o Completions: 22,669 o Receipts: 24,453	o Pending Cases: 13,551 o Completions: 34,905 o Receipts: 33,910	o Pending Cases: 11,877 o Completions: 74,219 o Receipts: 72,545	o Pending Cases: 7,598 o Completions: 52,271 o Receipts: 47,992	o Pending casework has been reduced by almost 50% since FY 78.
Implement requirements of NGPA and PURPA.		o Completed action on PURPA 608; NGPA 201(a), 303(j).	o Completed action on NGPA 202(a)1, 206(a)(2)(A), 206(b).		o Interim Order 83 on NGPA 206(b) - Agricultural Exemptions is in effect while a permanent rule is drafted. Implementation is essentially complete.
Ensure that natural gas is sold in compliance with statutorily established prices.	o Refunds: 991M[1]	o Refunds: 382M	o Refunds: 1,321M	o Refunds: 1,136M	o Through the Commission auditing programs, over $4 billion has been refunded to consumers by FERC orders from FY 78 through FY 81.
	o Exceptions to Uniform System of Accounts: 11	o Exceptions to Uniform System of Accounts: 19	o Exceptions to Uniform System of Accounts: 16	o Exceptions to Uniform System of Accounts: 25	o The Commission's audit program of gas utilities found over 71 exceptions to the Uniform System of Accounts requiring the issuance of audit reports by the FERC.

TABLE 43-1

FEDERAL ENERGY REGULATORY COMMISSION

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
Reduce unnecessary reporting burden placed on industry.					o Since the FERC Energy Data Validation Program began in FY 80, 311,046 hours of reporting burden placed on the gas industry have been eliminated.
HYDROPOWER REGULATION:					
Bring pending casework current by FY 85 while maintaining the quality of FERC case reviews.	o Pending Cases: 641 o Completions: 274 o Receipts: 258	o Pending Cases: 624 o Completions: 358 o Receipts: 341	o Pending Cases: 788 o Completions: 694 o Receipts: 858	o Pending Cases: 1,065 o Completions: 1,386 o Receipts: 1,663	o Receipt of new hydro cases has increased by 660% since FY 78, while completions have increased by 500% during the same period. Additional resources required.
Ensure the safety of licensed dams in operation as well as those under construction.			o Revised operating manual issued.	o Issue final dam safety regs.	o FEMA cited FERC as having the "model" dam safety program in the U.S. FERC has never had a dam failure at the 1,144 sites under FERC license.
Implement requirements of PURPA.		o Completed action on PURPA 405 (Phase I).	o Completed action on PURPA 213, 405 (Phase I).		o Further FERC action is required to prepare status reports and review industry filings.
Reduce unnecessary reporting burden placed on industry.					o Since the FERC Data Validation Program began in FY 80, 46,762 hours of reporting burden placed on the hydropower industry have been eliminated.

TABLE 43-1

FEDERAL ENERGY REGULATORY COMMISSION

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
OIL REGULATION:					
Bring pending casework current by FY 85 while maintaining the quality of FERC case reviews.	o Pending Cases: 139 o Completions: 2,470 o Receipts: 2,535	o Pending Cases: 167 o Completions: 1,976 o Receipts: 2,004	o Pending Cases: 592 o Completions: 1,802 o Receipts: 2,227	o Pending Cases: 425 o Completions: 2,690 o Receipts: 2,523	o Approximately 30% of all tariff and rate change filings have been suspended and are being held in abeyance by Commission order until the final opinion in Williams Phase I is issued. The ratemaking methodology the Commission will ultimately prescribe for the oil industry is undecided.
Ensure that shippers and consumers are not adversely affected by unjustifiably high tariffs.					o All initial rate and tariff filings are either accepted, rejected, or suspended for further hearing within the statutory time limits of 10-30 days.
	0	7	13	23	o The Commission's audit program of oil pipelines found 43 exceptions to the Uniform System of Accounts requiring the issuance of audit reports by FERC.
Reduce unnecessary reporting burden placed on industry.					o Since the FERC Energy Data Validation Program began in FY 80, 832 hours of reporting burden placed on the oil industry have been eliminated.

TABLE 43-1

FEDERAL ENERGY REGULATORY COMMISSION

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
ELECTRIC REGULATION:					
Bring pending casework current by FY 85 while maintaining the quality of FERC case reviews.	o Pending Cases: 499 o Completions: 1,421 o Receipts: 928	o Pending Cases: 437 o Completions: 1,396 o Receipts: 886	o Pending Cases: 646 o Completions: 1,608 o Receipts: 1,154	o Pending Cases: 464 o Completions: 1,726 o Receipts: 1,063	o With receipts up by 25% in FY 80 over the FY 78 level, pending cases at the end of FY 81 were reduced by 7%.
Implement requirements of PURPA.		o Completed action on PURPA Sec. 133, 205(b)2.	o Completed action on PURPA Sec. 201, 205(b)2, 206, 207, 210(a), 250(e), 211.	o Completed action on PURPA 205(6).	o Only PURPA 206 (Continuance of Service) and 208 (Automatic Adjustment Clauses) require further implementation work. Status reporting is an ongoing effort.
Establish just and reasonable rates for the transmission and sale for resale of electric power in interstate commerce.	49	56	43	42	o The Commission's audit program of electric utilities found 190 exceptions to the Uniform System of Accounts requiring the issuance of audit reports by the FERC.
Reduce unnecessary reporting burden placed on industry.					o Since the FERC Energy Data Validation Program began in FY 80, 213,356 hours of reporting burden placed on the electric industry have been eliminated.

TABLE 43-2

FEDERAL ENERGY REGULATORY COMMISSION

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $76.2

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
GAS REGULATION:			
Ensure that natural gas is sold in compliance with the statutorily established prices.	o Rely on state commissions to regulate industry. o Total or partial deregulation of the natural gas industry.	o Give priority attention to critical energy cases providing supplies to the market area faster.	o Issue 610 certificates for construction and operation, transportation, exchange, and storage of natural gas.
Bring pending casework current by FY 85 while maintaining the quality of FERC case reviews.		o Expedite formal casework to minimize the collection of unjust rates, thereby reducing burden to consumers.	o Reduce case processing time and regulatory burden through blanket certificate and delegations of authority.
Reduce unnecessary reporting burdens placed on industry.		o Carry out the requirements of the Natural Gas Policy Act of 1978 (NGPA).	o Complete 26 audits of gas utilities.
		o Reduce the regulatory burden by promoting a policy of gradual decontrol of natural gas while stimulating the industry to further production capabilities.	o Through the rate filing review program, refund an estimated $750 million and $1 billion to consumers in FY 82 and FY 83 respectively.
			o Bring all workload current by the end of 1985 (approximately 5,250 items).
			o Administer the Uniform System of Accounts through a program of financial audits on 26 gas utilities.
			o Propose a reporting burden reduction of 23,000 hours on the gas industry.

TABLE 43-2

FEDERAL ENERGY REGULATORY COMMISSION

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
HYDROPOWER REGULATION:			
Ensure the safety of licensed dams in operation as well as those under construction.	o Rely on state agencies or other government agencies to perform safety inspections.	o Enhance the dam safety inspection program.	o Conduct 1,420 prelicense, construction, and operating inspections of hydro projects.
Bring pending casework current by FY 85 while maintaining quality of FERC case reviews.	o Rely on dam operations to self-administer a safety inspection program.	o Give priority to critical energy projects involving new generating capacity.	o Expedite the licensing of new capacity hydroelectric generating plants to ensure adequacy of power supply and the availability of electric power at the lowest cost. Complete licensing actions on 1,000 preliminary permits in FY 82.
Reduce unnecessary reporting burden placed on hydropower industry.		o Reduce license processing time and eliminate backlog of cases.	
		o Administer a comprehensive enforcement program.	
		o Reduce operating costs of hydro industry by eliminating unnecessary data requirements.	o Determine whether a project whose license has expired will be relicensed to a non-Federal owner or recommended for Federal takeover.
			o Bring all workload current by the end of FY 85 (approximately 450 actions).
			o Provide an environmental review of each application for license to ensure its compliance with the Commission's regulations and the National Environmental Policy Act (NEPA).
			o Carry out an audit program to ensure that licensees are complying with the license conditions, especially where dam safety is a factor.

TABLE 43-2

FEDERAL ENERGY REGULATORY COMMISSION

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
			o Determine the equitable amount an owner of a downstream, non-Federal hydropower development shall pay the United States, or to a license, for benefits provided by a federally owned or licensed headwater improvement.
			o Review and approve rates of Federal Power Marketing Administrations.
OIL REGULATION:			
Ensure that shippers and consumers are not adversely affected by unjustifiably high tariffs.	o Transfer responsibility back to the Interstate Commerce Commission.	o Determine the construction cost and valuation of the Trans Alaska Pipeline System (TAPS).	o Present to the Commission the findings of the financial, management, and engineering audits of the Trans Alaska Pipeline System in FY 83.
Bring pending casework current by FY 85 while maintaining the quality of FERC case reviews.	o Deregulation of the transportation of crude oil and oil products in interstate commerce.	o Reduce the regulatory burden upon the oil pipeline industry while ensuring just and reasonable rates to the consumer.	o Decide the Williams Pipeline case in FY 82 which will establish the oil pipeline ratemaking methodology for the industry.
Reduce unnecessary reporting burdens placed on oil pipelines.		o Resolve the TAPS and Williams proceedings.	o Bring all workload current by the end of FY 85 (approximately 350 cases).
		o Reduce operating costs of oil pipelines by eliminating unnecessary data requirements.	o Determine the just and reasonable transportation tariffs for TAPS in FY 83.
			o Complete all 128 annual valuations for common carrier oil pipelines.
			o Review and decide all initial rate and tariff filings within the statutory time frame of 10 to 30 days.
			o Resolve all formal tariff filing suspension cases (currently over 1,500 pending).

TABLE 43-2

FEDERAL ENERGY REGULATORY COMMISSION

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
			o Complete 20 audits in FY 82 to ensure compliance with Commission regulations and statutory requirements. o Propose reductions of 500 hours of reporting time now placed on industry.
ELECTRIC REGULATION:			
Establish just and reasonable rates for the transmission and sale for resale of electric power in interstate commerce. Bring pending casework current by FY 85 while maintaining the quality of FERC case reviews. Reduce unnecessary reporting burden placed on the electric utility industry.	o Deregulation of the electric utilities. o Transfer ratemaking responsibilities to the state level.	o Meet our statutory requirements. o Reduce the regulatory requirements upon the electric utility industry. o Promote energy-efficient and cost-effective methods for the industry.	o Process all applications within statutory time limits. o Propose regulatory burden of 188,000 hours and streamline processing of applications. o Prohibit anticompetitive business practices in power pooling agreements. o Encourage the development of new power pools. o Carry out legislative mandates of the Pacific Northwest Electric Power Planning and Conservation Act. o Administer the Uniform System of Accounts and complete comprehensive financial audits on 46 utilities in FY 82. o Bring all workload current by the end of FY 85 (approximately 200 items).

TABLE 44-1

ENERGY INFORMATION

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$45.4	$61.5	$90.8	$90.4	
Obligation:	$44.7	$60.9	$88.3	$89.8	
Prepare all three volumes of EIA Annual Report to Congress by May 1 of each year. (Deadline for FY 78 was July; FY 79 was July; and FY 80 was June.)	o Complete report submitted to Congress in July 1978. Utilized by the Administration and by members of Congress during debate on National Energy Act and other energy issues.	o Complete report submitted to Congress in July 1979. Utilized by the Administration and by Congress during debate on Emergency Energy Conservation Act and other energy issues.	o Complete report submitted to Congress in June 1980. Utilized by the Administration and by Congress during debate on Energy Security Act and Utility Oil Backout legislation.	o Complete report submitted to Congress in April 1981. Utilized by the Administration and by Congress in debate on amending the Fuel Use Act.	o EIA has met its self-imposed May 1 deadline in every year. Improved operational efficiency has allowed EIA to publish the report earlier in recent years.
Prepare quarterly national forecasts by October 1, January 1, April 1, and July 1.			o Began production of Short-Term Energy Outlook (STEO) on a quarterly basis.	o Continued production of STEO. Continued praise for timeliness and relative accuracy of information.	o EIA has consistently published the STEO, since its inception, on schedule. o EIA has consistently received compliments on report quality from members of the Senate Energy and Natural Resources Committee and the House Energy and Commerce Committee.
Revise, verify, document, and simplify models/methodologies.	o 2 model documentation reports. Model archive program initiated. All models are revised to reflect changes in the energy situation.	o 3 model documentation reports. 15 models archived. All models are revised to reflect changes in the energy situation.	o 18 model documentation reports. 15 models archived. All models are revised to reflect changes in the energy situation.	o 8 model documentation reports. 13 models archived. All models are revised to reflect changes in the energy situation.	o 31 model documentation reports. (29 models have been documented, and others are in preparation.) EIA has maintained its program of model review, revision, documentation, and simplification, thus providing state-of-the-art projections and making models available to the public.

TABLE 44-1

ENERGY INFORMATION

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Origina Objective Met
Collect, evaluate, assemble, analyze, and disseminate information: - Coal information and data required by P.L. 93-319, and 95-620.	o Maintained 55 data gathering systems: 4 general, 7 coal, 6 electric power, 31 oil and gas, 1 solar and alternative fuels, 6 consumption.	o Maintained 60 data gathering systems: 5 general, 10 coal, 12 electric power, 31 oil and gas, 1 solar and alternative fuels, 1 consumption.	o Maintained 65 data gathering systems: 5 general, 6 coal, 17 electric power, 31 oil and gas, 1 solar and alternative fuels, 1 consumption.	o Maintained 65 data gathering systems: 5 general, 6 coal, 17 electric power, 31 oil and gas, 1 solar and alternative fuels, 1 consumption.	o EIA has maintained data systems to provide information needed to produce basic statistics and to support program and regulatory requirements of other DOE offices.
- Electric power information and data as required by 16 USC 791 a *et seq*. - Petroleum and natural gas data as required by P.L. 95-91, 75-688, 93-159, 93-275, 95-619, 95-621, and 96-102. - Solar and alternative energy sources data as required by Solar RD&D Act, P.L. 95-91, and the Energy Security Act, P.L. 96-294. - Energy consumption information as required by P.L. 96-102.	o Published 83 data reports: 11 general, 11 coal, 24 electric, 30 oil and gas, 3 solar and alternative fuels, 4 consumption. o Published 55 analysis and technical memoranda: 12 general, 4 coal, 34 oil and gas, 1 solar and alternative fuels, 4 consumption.	o Published 88 data reports: 21 general, 10 coal, 20 electric, 31 oil and gas, 1 solar and alternative fuels, 5 consumption. o Published 87 analysis and technical memoranda: 44 general, 5 coal, 6 electric power, 31 oil and gas, 1 solar and alternative fuels.	o Published 80 data reports: 21 general, 8 coal, 13 electric, 33 oil and gas, 1 solar and alternative fuels, 4 consumption. o Published 43 analysis and technical memoranda: 19 general, 1 coal, 8 electric power, 8 oil and gas, 2 solar and alternative fuels, 5 consumption.	o Published 80 data reports: 17 general, 9 coal, 15 electric, 14 oil and gas, 1 solar and alternative fuels, 4 consumption. o Published 40 analysis and technical memoranda: 14 general, 2 coal, 2 electric power, 14 oil and gas, 8 consumption.	o EIA has published data in a series of data reports. For example, EIA has consistently provided timely information on the production and distribution of coal and coal products. EIA provides this information through timely, consolidated sources, such as the Monthly Energy Review, the EIA Annual Report to Congress, the Short-Term Energy Outlook, published quarterly, and various other policy and congressional debates. Further, EIA developed the Weekly Petroleum Status Report (WPSR), which is used as a major information document for petroleum decision-making.

TABLE 44-1

ENERGY INFORMATION

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
					o EIA has consistently provided analysis and projections reports to Congress, the executive branch, and the public. These analyses have been developed through the use of documented mathematical models.
	o Operated and maintained 70 models: 25 general, 1 coal, 11 electric power, 17 oil and gas, 3 solar and alternative fuels, 13 consumption.	o Operated and maintained 58 models: 19 general, 1 coal, 12 electric power, 14 oil and gas, 1 solar and alternative fuels, 11 consumption.	o Operated and maintained 46 models: 13 general, 1 coal, 13 electric power, 8 oil and gas, 1 solar and alternative fuels, 10 consumption.	o Operated and maintained 47 models: 13 general, 1 coal, 13 electric power, 9 oil and gas, 1 solar and alternative fuels, 10 consumption.	
		o 3 systems validated.	o 2 systems validated.	o 3 systems validated.	
		o 3 requirements reviews completed, 29 special validation studies completed.	o 5 requirements reviews completed, 14 model evaluation reports, 21 special validation studies completed.	o 6 requirements reviews completed, 30 model evaluation reports, 5 special validation studies completed.	
	o 19,000 data inquiries handled, 2,200,000 copies of publications disseminated.	o 38,000 data inquiries handled, 2,400,000 copies of publications disseminated.	o 45,000 data inquiries handled, 2,100,000 copies of of publications disseminated.	o 60,000 data inquiries handled, 3,000,000 copies of publications disseminated.	
	o 350 records established on-line in FEDEX.	o 1,400 records established on-line in FEDEX.	o 3,800 records established on-line in FEDEX.	o 6,700 records established on-line in FEDEX.	

TABLE 44-1

ENERGY INFORMATION

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Origin.. Objective Met
Eliminate duplicative Federal energy information collection efforts.	o Reviewed data collection forms from DOE predecessor agencies to consolidate collection efforts. All proposed new and revised requests subject to extensive review on a case-by-case basis.	o All proposed new and revised requests subject to extensive review on a case-by-case basis.	o Annually review data collection forms in preparation of the OMB required information collection budget. All new and revised requests subject to extensive review on a case-by-case basis.	o Annually review data collection forms in preparation of the OMB required information collection budget. All proposed new revised requests subject to extensive review on a case-by-case basis.	o EIA has worked to eliminate duplicative Federal collection efforts. As legislation is changed, EIA will continue to review and revise its collection programs to eliminate duplicative or unnecessary collection efforts.
	o Eliminated 15 forms no longer needed. Eliminated 2 forms through consolidation.	o Eliminated 16 forms no longer needed. Eliminated 5 forms through consolidation.	o Eliminated 30 forms no longer needed. Eliminated 2 forms through consolidation.	o Eliminated 56 forms no longer needed. Eliminated 4 forms through consolidation.	
	o Utilized less burdensome sampling vs. universe collections.	o Utilized less burdensome sampling vs. universe collections.	o Utilized less burdensome sampling vs. universe collections.	o Utilized less burdensome sampling vs. universe collections.	o Through the use of sampling techniques, EIA has been able to decrease the number of respondents who must respond to surveys, thus, in many cases relieving an individual or company from responding to multiple forms.
	o Utilized secondary sources where information collected is consistent and meets EIA quality standards.	o Utilized secondary sources where information collected is consistent and meets EIA quality standards.	o Utilized secondary sources where information collected is consistent and meets EIA quality standards.	o Utilized secondary sources where information collected is consistent and meets EIA quality standards.	
Reduce reporting burden on business and other persons.	o Review of data collection forms has resulted in a net decrease in burden required by existing forms of 1.35 million hours.	o Review of data collection forms has resulted in a net decrease in burden required by existing forms of .76 million hours.	o Review of data collection forms has resulted in a net decrease in burden required by existing forms of 2.24 million hours.	o Review of data collection forms has resulted in a net decrease in burden required by existing forms of 2.48 million hours.	o EIA has worked to decrease the levels of burden placed on the industry and the public. Although total reporting burden has increased since 1977 by 2.94 million hours, or 25%, when viewed in light of the new legislative requirements which were imposed since that time, net burden actually decreased by 6.8 million hours.

TABLE 44-2

ENERGY INFORMATION

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $78.9

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Prepare EIA Annual Report to Congress by May 1 of each year.	o None. Legislative mandate is clear and unequivocal.	o Requires the coordination of all EIA operations, data collection, fuels analysis, and dissemination in order to meet publication deadlines. Also requires technical review to ensure the validity and reliability of information published.	o Provides essential information to decision- and policy-makers to make informed decision on long-term energy issues.
Prepare quarterly national forecasts by October 1, January 1, April 1, and July 1.	o Rely on states, trade associations, and other private sector sources for forecasts.	o Requires coordination and preparation of short-term analysis and constant revision to reflect changes in the energy marketplace in order to project short-term (18 months) impacts, thus aiding decision-makers in the public and private sectors.	o Provides essential information to decision- and policy-makers to make informed decisions on short-term energy issues.
Revise, verify, document, and simplify models/methodologies.	o Rely on states, trade associations and other private sector sources for modeling efforts.	o Requires the review of existing models and methodologies against new developments in the state-of-the-art, comparison of projections with actual marketplace activities, and simplifying equations where possible.	o Provides comprehensive, integrated forecasting capability in a timely manner at the lowest cost.
Collect, evaluate, assemble, analyze, and disseminate data: - Coal information data required by P.L. 93-319 and 95-620. - Electric power information and data as required by 16 USC 791a et seq.	o Rely on trade association representing particular energy source industries to provide data to decision-makers. o Rely on states to collect, evaluate, assemble, analyze, and disseminate data.	o Requires the establishment of sampling of names of respondents; collection and processing of information provided by the respondents; review, verification, and validation of the information provided; and the timely dissemination of this information for use by decision-makers.	o Provides essential data to decision- and policy-makers and the public to make informed decisions on energy issues.

TABLE 44-2

ENERGY INFORMATION

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
- Petroleum and natural gas data as required by P.L. 95-91, 75-688, 93-159, 93-275, 95-619, 95-621, and 96-102. - Solar and alternative energy sources data as required by Solar RD&D Act, P.L. 95-91, and the Energy Security Act, P.L. 96-294. - Energy consumption information as required by P.L. 96-102.	o In the case of consumption information, there is currently no alternative for national-level energy data.		
Eliminate duplicative Federal energy information collection efforts.	o None.	o Requires, in connection with burden reduction activities, the review of data collection forms in preparation of the information collection budget. In addition, all new or revised collection forms are reviewed to ensure against unnecessary duplication and, in some instances, elimination of unnecessary forms.	o Provides greatest amount of energy information in a central location at the lowest budgetary cost.
Reduce reporting burden on businesses and other persons.	o None.	o Requires the preparation of an annual information collection budget which assesses the level of burden placed upon respondents and recommended means of decreasing this burden where possible.	o Provides greatest amount of energy information at the lowest direct cost and impact on respondents' personnel.

TABLE 45-1

NAVAL PETROLEUM AND OIL SHALE RESERVES

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$154.1	$128.1	$76.9	$198.4	
Obligation:[1/]	$149.1	$123.7	$76.5	$197.7	
Develop known reserves of oil and gas to full productive capacity by drilling development wells and constructing petroleum production facilities by the end of 1983.	o 263 development wells drilled. LACT facilities completed at NPR-1. Oil and gas collection system completed at NPR-3.	o 143 development wells drilled. Gas compressor, West End gathering system completed at NPR-1.	o 120 development wells drilled. LTS-1 plant and Carneros gathering system completed at NPR-1. Gas processing plant completed at NPR-3.	o 68 development wells drilled. LTS-2, dry gas zone system, and low-pressure compression facility completed at NPR-1. Depropanization tower and gas sales pipeline completed at NPR-3.	o 594 development wells completed during period out of 1,069 planned through 1987. NPR-1 collection systems and treatment facilities completed for peak production. NPR-3 gas processing plant completed and fully operational.
Complete NPR-1 waterflood projects and enhanced oil recovery tests at NPR-3 by end of 1983.			o Initiated design of Phase I and II Waterflood.	o Initiated construction of Phases I and II of 31S Waterflood at Elk Hills. Design of 7R Waterflood initiated.	o Injector drilling and water injection continuing. Accelerated flow not anticipated prior to 1983. The 31S and 7R Waterfloods will be constructed during FY 81 and FY 82. Water injection wells will be drilled during FY 82 and FY 83, with injection under way throughout this period. Significantly increased production from the waterfloods is not expected before the end of FY 83.
				o EOR Pilot designed and construction initiated.	o Fireflood and water/polymerflood are in pilot stages. Results will be interpreted during 1983.

[1/]The obligations shown for each year represent only obligations of funds appropriated in that specific year and do not include obligations of funds appropriated in prior years. For example, the obligation amount shown for FY 1979 is $123.7 million of FY 1979 funds--$5.0 million of FY 1978 funds were also obligated in FY 1979.

TABLE 45-1

NAVAL PETROLEUM AND OIL SHALE RESERVES

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
Expand known reserves by drilling 47 exploratory wells at NPR-1, and 17 exploratory wells at NPR-3 through FY 1987.	o Three exploratory wells (NPR-1); ten exploratory wells (NPR-3).	o Three exploratory wells (NPR-1); seven exploratory wells (NPR-3).	o One exploratory well (NPR-1); one exploratory well (NPR-3).	o Three exploratory wells NPR-1.	o 28 exploratory wells drilled (21% of NPR-1 exploratory well drilling during period. All NPR-3 exploratory wells drilled).
Produce NPR-1 and NPR-3 at their MER. (Anticipated that production at NPR-1 will peak during 1981.)	o NPR-1--119,138 (average); NPR-3--1,957 (average).	o NPR-1--144,218 (average); NPR-3--5,115 (average).	o NPR-1--159,238 (average); NPR-3--4,393 (average).	o NPR-1--171,400 (average); NPR-3--3,378 (average).	o Production peaked at 179,000 BOPD for NPR-1 in July 1981. NPR-3 production peaked from primary production in 1979.
Sell all recovered petroleum to DOD or private purchasers at competitive prices, or exchange for deliveries to SPR.	o Total Receipts--$505M Average Selling Price--$10.62/barrel.	o Total Receipts--$754M Average Selling Price--$12.72/barrel.	o Total Receipts--$1,589M Average Selling Price--$25.13/barrel.	o Total Receipts--$1,621M Average Selling Price--$30.07/barrel.	o All petroleum not sold to DOD or exchanged for SPR oil was sold to highest qualified private bidders.
				o 33.4 million barrels exchanged for SPR deliveries.	o Met commitments to SPR.
				o 337,000 barrels sold to DOD.	o Received reasonable market value.
Analyze the resource, environmental, technical, and socioeconomic factors required to develop NOSR-1 by March 1982, analyze options for development.			o Draft programmatic EIS.	o Environmental baseline studies.	o Programmatic EIS to be completed in FY 82. Pre-Development Plan will be completed in FY 82.
Assess oil and gas potential at NOSR-2; if potential exists, lease by December 1983.				o Seismic work completed.	o Seismic tests completed in FY 81; analysis of tests, initiated and to be completed in FY 82.

TABLE 45-2

NAVAL PETROLEUM AND OIL SHALE RESERVES

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $213.1

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Develop known reserves of oil and gas to full productive capacity by drilling development wells and constructing petroleum production facilities by the end of 1983.	o None.	o Continued funding for development and facilities programs. Adequate rigs available. Sufficient DOE petroleum engineers available to provide management and supervision.	o Total Receipts--$1.9 billion. Average Production--175,000 barrels (FY 1982) of oil per day. Development Wells--119 development facilities needed to maintain MER.
Complete NPR-1 waterflood projects and enhanced oil recovery tests at NPR-3 by the end of 1983.	o Terminate projects.	o Continued funding to complete NPR-3 EOR pilot projects by 1983. None for NPR-1 waterflood projects.	o Increased production at NPR-1. $11.3 million invested in Enhanced Oil Recovery tests. Potential increase in recoverable oil at NPR-3: 45 to 90 million barrels.
Expand known reserves by drilling 47 exploratory wells at NPR-1 and 17 exploratory wells at NPR-3 through FY 87.	o None.	o Start up program again in FY 84.	o Exploration program continues on target.
Produce NPR-1 and NPR-3 at their MER of recovery.	o None.	o Continued authority and budget to produce at MER. Proper remedial actions.	o Although fields have peaked and now will decline in barrels of oil per day produced, production at MER continues.
Sell all recovered petroleum to DOD or private purchasers at competitive prices or exchange for deliveries to SPR.	o Direct ship small quantities of oil from NPR-1 to SPR.	o Firm requirements list from DOD and SPR. Continued demand for products.	o Average Production--175,000 barrels of oil per day. Estimated total annual receipts--$1.9 billion.
Analyze the resource, environmental, technical, and socioeconomic factors required to develop NOSR-1 by March 1982. Analyze development options. Assess oil and gas potential at NOSR-2; if potential exists, lease by December 1983.	o None.	o Minimum funding for maintenance program. Planning for rapid development should national defense require oil.	o Continue maintenance of reserves. Conduct limited program to monitor changes in air quality, climate, and groundwater elevations.

TABLE 46-1

URANIUM ENRICHMENT ACTIVITIES

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$1,483.2	$1,334.8	$1,122.3	$1,438.5	
Obligation:	$1,279.3	$1,265.7	$1,117.1	$1,402.0	
To meet domestic, foreign and U.S. Government requirements for uranium enrichment services in the most economical, reliable, safe, and environmentally acceptable manner possible.					
PRODUCTION OPERATIONS:					
Produce, at minimum cost, enriched uranium in quantities that meet projected demand.	Production plan*/actual (million SWU)				o The program has met its objective for both production and cost during this period.
	12.5/12.5	13.9/13.9	10.8/10.8	9.6/9.6	
	Costs plan*/actual ($ million)				
	$988/$988	$1,045/$1,045	$929/$929	$972/$972	
Recover all Government costs over a reasonable period of time.	Revenue plan*/actual ($ million)				o Revenue objectives have been achieved.
	$896/$896	$1,217/$1,217	$1,117/$1,117	$1,248/$1,248	
Maintain on stream plant time at 99+%.	Plant time plan/actual				o Objective has been met.
	99%/99%	99%/99%	99%/99%	99%/99%	
Prevent the erosion of DOE's current share of the enriched uranium market and capture new market opportunities.	DOE share of U.S. market				o U.S. share of foreign market has dropped significantly since mid-1970's.
	100%	100%	100%	100%	
	DOE share of foreign market				
	72%	53%	31%	29%	
	DOE share of new market opportunities				
	0%	0%	0%	no opportunities	

* Production, cost, and revenue plan figures were adjusted during the course of the year of the program for various amendments, supplemental appropriations, deferrals, and reprogramming actions which were approved by Congress.

TABLE 46-1

URANIUM ENRICHMENT ACTIVITIES

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
IMPROVED PRODUCTION CAPACITY:					
Complete diffusion plant cascade improvement and uprating programs by the third quarter of FY 1983 within the cost goal of $1.5 billion.	Costs plan/actual ($ million)				o Capacity expansion objectives have been met, while costs will be slightly below estimated.
	$268/$261	$263/$183	$140/$131	$79/$79	
	Increased capacity plan/actual (million SWU)				
	6.3/6.3	8.4/8.4	9.2/9.2	9.7/9.7	
Design and construct a gas centrifuge enrichment plant (GCEP) that will provide an additional 8.8 million separative work units (SWU's) of capacity by 1994.	Design Completed				o GCEP has progressed within cost and schedule targets, although these have changed since 1974. Cost estimates are revised if end date changes (and also annually for inflation). Completion date results from a 5-year slip because of revised demand estimates and a 1-year slip because of budget restrictions.
	5%	30%	55%	68%	
	Construction Completed				
	0%	2%	6%	13%	
	Procurement Completed				
	0%	1%	2%	5%	
Develop Advanced Isotope Separation (AIS) and Advanced Gas Centrifuge (AGC) technologies that produce enriched uranium at a cost less than any present production cost. For AIS choose technology for future scale-up by the end of 1981; complete preprototype testing by 1982; develop engineering module by the mid-1980's. For AGC, develop Set IV machines which have 50 percent more performance than current machines by 1988.	o Initiated AIS preprototype subsystems design activities.	o Major AIS preprototype component bids awarded to private industry. o For Atomic Vapor Laser Isotope Separation (AVLIS) process, completed installation of preprototype copper vapor laser station; significant increase in separate performance demonstrated.	o Preprototype components under fabrication. o Scalable copper vapor laser demonstrated. o Scalable laser demonstrated; product collection concept and requirements in hand.	o Completed fabrication and delivery of all major preprototype hardware. o Initiated engineering program for testing extractors. o Verify process physics at economical enrichment factors.	o There was some schedule slippage in FY 1981 as a result of budget restrictions. Otherwise the program is proceeding as planned. AGC development on schedule.

TABLE 46-1

URANIUM ENRICHMENT ACTIVITIES

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
		o For Molecular Laser Isotope Separation (MLIS) process, minipulser test loop with rapid data reduction capability constructed to address process science issues.			
		o For Plasma Separation Process (PSP), operation of 1/2 system demo of enrichment/depletion.	o Enrichment/depletion demo, using scalable subsystems at 0.2% plant-specific performance.	o Initial operation of preprototype system. Demo 1-5% of plant-specific performance.	
		o AGC Development			
Baseline Centrifuge Design Qualification					
	0	0	start	100%	
Baseline Centrifuge Reliability Testing					
	0	0	0	start	
Advanced Centrifuge Development					
	0	0	0	10%	

TABLE 46-2

URANIUM ENRICHMENT ACTIVITIES

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $1,796.0

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
To meet domestic, foreign, and U.S. requirements for uranium enrichment services in the most economical, reliable, safe, and environmentally acceptable manner possible.			
PRODUCTION OPERATIONS:			
At minimum cost, produce enriched uranium in quantities that meet projected demand.	o Sell to private firm(s) for commercial operation.	o Continued congressional authorization.	o Production of 15.1 million SWU's in FY 1983 needed to meet firm commercial and Government requirements.
Recover all Government costs over a reasonable period of time.	o None.	o Set appropriate enrichment fees.	o Revenues must be collected to meet legislative mandate and to maintain operational viability.
Maintain onstream plant time at 99+%.	o None.	o Plant efficiency to be maintained continuously.	
Prevent the erosion of DOE's current share of the commercial enriched uranium market and capture new market opportunities.	o Withdraw from market and leave future sales to private industry.	o Restore U.S. credibility as reliable supplier of enrichment services.	o Maintain revenues and balance of trade.
IMPROVED PRODUCTION CAPACITY:			
Complete diffusion plant cascade improvement and uprating programs by the third quarter of FY 1983 and within the cost goal of $1.5 billion.	o None. Projects over 95% complete.	o Work fully contracted and nearly complete.	o Improved efficiency and added capacity to meet expected demand.
Design and construct a gas centrifuge enrichment plant (GCEP) that will provide an additional 13.2 million SWU capacity by 1994 (2.2 million on line in 1989).	o Sell to private firm for commercial operation. o Cancel GCEP project and assume the risk that advanced isotope separation technologies will be developed on time and will meet all technical and economic goals.	o Maintain construction and funding requirements for first 2.2 million SWU's.	o Additional capacity will be needed in late 1980's and early 1990's.

TABLE 46-2

URANIUM ENRICHMENT ACTIVITIES

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Develop Advanced Isotope Separation (AIS) and Advanced Gas Centrifuge (AGC) technologies that produce enriched uranium at a cost less than any present production cost. For AIS, choose technology for scale-up in April 1982; complete preprototype testing in 1984; and develop engineering module by 1989. For AGC, develop Set IV machines which have 50 percent more performance than current machines by 1988.	o Proceed with research on only one advanced process, AIS or AGC. o Cancel R&D program and allow market forces to operate.	o One of three AIS processes will be selected in FY 1982 to proceed with construction of an engineering module.	o Advanced processes will provide additional capacity to meet projected demand in 1990's. They will produce SWU's at less cost, require less electric power to operate, and be environmentally more acceptable and operationally more flexible. AIS will also extend the Nation's uranium supply by operating at a lower tails assay. o Complete research on AGC in preparation for use in subsequent GCEP increments.

TABLE 47-1

POWER MARKETING

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Bonneville:					
Apportionment	414.6	467.8	620.0	830.7	
Obligations	376.2	448.6	585.0	783.7	
Other PMAs:					
Total Obligational Authority	162.5	208.6	255.8	317.6	
Obligations	142.9	157.6	188.0	251.7	

Budget Authority and Obligations[1/]

	FY 78	FY 79	FY 80	FY 81
Alaska BA	$2.163	$2.614	$2.660	$3.069
Obligations	2.110	2.376	2.443	2.985
Southeastern BA	1.197	1.303	1.400	1.863
Obligations	1.009	1.198	1.302	1.923
Southwestern BA	25.891	36.077	32.180	28.208
Obligations	13.293	20.773	18.671	34.569
Western Area BA	93.250	105.738	128.152	142.250
Obligations	72.211	71.754	110.854	135.805
Total BA	$122.501	$145.307	$164.392	$175.390
Obligations	88.623	96.101	133.270	175.282
Bonneville				
Gross Receipts	$329.759	$390.683	$572.061	$771.000
Outlays	382.631	449.820	552.917	772.000
Net Outlays	$ 52.872	$ 59.137	$-19.144	$ 1.000

[1/] The detailed budget data shown here includes only new budget authority for each of the fiscal years and obligations against that new authority. It does not reflect total obligational authority for the fiscal year or obligations against this total.

TABLE 47-1

POWER MARKETING

Goals/Objectives		FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
		PROGRAM MEASURES (Billions of kilowatt-hours)				
		FY 78	FY 79	FY 80	FY 81	
I. Market all available power.	Alaska	.3	.2	.3	.3	o Objectives are met each year on a continuing basis.
	Bonneville	76.5	72.0	72.5	81.1	
	Southeastern	7.4	7.7	8.1	5.7	
	Southwestern	5.3	5.8	4.5	3.2	
	Western Area	34.6	36.1	37.9	37.4	
	Total	124.1	121.8	123.3	127.7	
		Revenues ($000,000)				
		FY 78	FY 79	FY 80	FY 81	
II. Market at lowest possible cost	Alaska	$ 3.2	$ 2.8	$ 3.5	$ 3.8	o Objectives are met each year on a continuing basis.
	Bonneville	333.9	296.5	512.4	705.3	
	Southeastern	53.9	58.7	63.8	57.3	
	Southwestern	50.1	60.6	58.8	51.7	
	Western Area	274.0	306.3	330.7	383.8	
	Total	$715.1	$724.9	$969.2	$1,201.9	

Rates per kWh

Alaska	12.5 mills - 15.6 mills
Bonneville	9.9 mills - 32.4 mills
Southeastern	10.0 mills
Southwestern	12.7 mills
Western Area	3.5 mills - 17.0 mills

Cumulative Applications of Revenues in $ Millions Through FY 1980

	Total Revenues	Operating Expenses: O&M	Operating Expenses: Purchased Power	Interest	Return of Capital (Power)
Alaska	$ 45	$ 13	$ 2	$ 17	$ 13
Bonneville	4,442	1,351	727	1,713	651
Southeastern	860	267	20	336	237
Southwestern	867	324	206	289	48
Western Area	3,882	1,359	578	890	1,055
Total	$10,096	$3,314	$1,533	$3,245	$2,004

TABLE 47-1

POWER MARKETING

Goals/Objectives	Degree Original Objective Met

III. Repayment of capital.

Capital Invested and Repaid Through 1980

	Investment on Power ($000)								
	Corps of Engineers	Bureau of Reclamation	Power Administration	International Boundary and Water Commission	Total Power Investment ($000)	Irrigation Investment To Repay ($000)	Total Capital Invested ($000)	Power Investment Repaid ($000)	% Repaid
APA			$ 112,000		$ 112,000		$ 112,000	$ 13,000	11
BPA	$3,232,000	$ 790,000	$1,988,000		$ 6,010,000	$ 596,000	$ 6,606,000	$ 651,000	10
SEPA	$ 999,000				$ 999,000		$ 999,000	$ 237,000	24
SWPA	$ 612,000		$ 66,000		$ 678,000		$ 678,000	$ 48,000	7
WAPA	$ 651,000	$2,265,000	$ 707,000	$7,000	$ 3,630,000	$ 776,000	$ 4,406,000	$1,055,000	24
Total	$5,494,000	$3,055,000	$2,873,000	$7,000	$11,429,000	$1,372,000	$12,801,000	$2,004,000	

IV. Preference to public bodies and cooperatives.

Number of Preference Customers Served

	FY 78	FY 79	FY 80	FY 81
Alaska	4	4	4	4
Bonneville	116	116	116	116
Southeastern	192	191	191	190
Southwestern	56	49	51	51
Western Area	444	444	444	444
Total	812	804	807	807

o Public preference mandate is fully met each year.

Proportion of Energy Sold in 1980 to Preference Customers

Alaska	70
Bonneville	52
Southeastern	94*
Southwestern	90
Western Area	82.5

*Includes TVA.

Objective Met

TABLE 47-1

POWER MARKETING

Goals/Objectives		FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
		PROGRAM MEASURES				
		Miles of Line Maintained				
V. Construct and operate transmission lines.	All PMAs	29,000	30,000	30,200	30,500	o Goals/Objectives are met each year on a continuing basis.
		Miles on Line Energized/Constructed				
	Bonneville	99	181	179	479	
	Western	0	182	0	150	
		Substations Completed/Constructed				
	Bonneville	9	3	7	7	
	Western	1	3	4	2	

Goals/Objectives			Degree Original Objective Met
VI. Market power over large areas at common rates.	Alaska	o Eklutna rate uniform sales area. Snettisham rate uniform in sales area.	o Met each year on a continuing basis.
	Bonneville	o System-wide.	
	Southeastern	o Uniform rates in each major marketing area: Georgia-Alabama; Kerr-Philpott; Cumberland. Separate rates for Jim Woodruff and Laurel projects.	
	Southwestern	o System-wide rate. Sam Rayburn Project.	
	Western Area	o Uniform rates in each major marketing area: Missouri Basin Project, Colorado River Storage Project, Central Valley Project, Parker-Davis Project. Separate rates for several individual projects. Boulder Canyon, Rio Grande, Fryingpan-Arkansas, Collbran.	

TABLE 47-1

POWER MARKETING

	Goals/Objectives		PROGRAM MEASURES FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
			Kilowatt-Hours Produced				
VII.	Operate and maintain Eklutna and Snettisham. Generating Station.	Alaska	276	238	293	313	o Met each year on a continuing basis.
			Studies Completed				
VIII.	Conduct general investigations.	Alaska	5	6	14	13	o Met each year on a continuing basis.
IX.	Acquire resources to meet Administrator's net obligations.	Bonneville	N/A	N/A	N/A	Data Not yet available.	o New program under P.L. 96-501.
			Dollars Invested				
X.	Protect, enhance, mitigate fish and wildlife	Bonneville	$500	$1,300	$1,400	$2,300	o New program under P.L. 96-501.
			Projects Initiated				
		Bonneville	3	6	2	9	

TABLE 47-2

POWER MARKETING

CURRENT PROGRAM OBJECTIVES AND BUDGET

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
			FY 82
I. Market all available power.	o Sell falling water. Non-Federal development of hydro. Would require change in law.	o Contracts with preference customers through rest of 20th century.	APA $ 3.5 SEPA 7.2 SWPA 21.3 WAPA 211.3 $243.3 BPA $ 55.1 (Net Outlays) o To market power from 122 Federal multiple-purpose projects, to operate and maintain 30,000 miles of transmission lines and associated facilities, and to construct needed additions and replacements. o Continuing operations in future years will rise in costs with inflation and higher costs of capital investments.
II. Market at lowest possible price to recover expenses.	o Sell at marginal cost; sell at market price. Would require change in law.	o Rate increases as necessary by each power administration.	o Revenues anticipated in millions: FY 82 APA $ 4.0 BPA 1,579.6 SEPA 65.7 SWPA 62.5 WAPA 370.3 $2,082.1
III. Repayment of Capital Investments.	o Not applicable.	o Required by law.	o No budget required. Estimated repayment: FY 82 ($000) APA $ 1,034 BPA N/A 1/ SEPA 17,000 SWPA 10,500 WAPA 86,581

1/ Figure unavailable pending knowledge of actual revenue and expense amounts at year end.

TABLE 47-2

POWER MARKETING

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
IV. Preference to public bodies and cooperatives.	o None.	o Allocations of new power and some reallocations of existing power to serve preference customers by each PMA.	o See Item I.
V. Construct and operate transmission lines and substations.	o Seek wheeling by non-Federal utilities.	o Additions, rehabilitation, upgrading to improve reliability, interregional interconnections.	o Construction only:[2]

Construction only:

	FY 82 ($000)
APA	$ 0
BPA	190,000
SEPA	0
SWPA	3,538
WAPA	101,400
	$294,938

o Operation and Maintenance:*

	FY 82 ($000)
APA	$ 1,987
BPA	83,300
SEPA	7,200
SWPA	8,521
WAPA	56,174

*Bonneville is self-financed. See Item I.

[2] Contained within total budget numbers in Item I.

TABLE 47-2

POWER MARKETING

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
VI. Market power over large areas.	o Market to nearest preference utilities.	o Consolidation of some isolated projects by SWPA, WAPA.	o See Item I.
VII. Operate and maintain Eklutna and Snettisham generating stations.	o None.	o Continue full range of annual maintenance and operation activities and replacements and improvements as needed and justified.	FY 82 ($000) APA Included in O&M budget above.
VIII. Conduct general investigations.	o Increase non-Federal investments in investigations.	o Transmission, power marketing and operation, and maintenance studies for hydro projects investigated by Corps; investigation of renewable resource alternatives and energy efficiency options.	FY 82 ($000) APA $893
IX. Acquire resources through conservation and other acquisitions sufficient to meet Administrator's net obligations.	o States; Non-Federal utilities; private efforts. Acquire additional energy and capacity.	o Estimated rate of energy savings by 1987. Annual Avg. MW 1,118 MW	FY 82 ($000) BPA $191,800
X. Protect, enhance, mitigate fish and wildlife.	o DOI Fish and Wildlife Service; State Fish and Games Commission.	o NA	FY 82 ($000) BPA $4,200

TABLE 48-1

STRATEGIC PETROLEUM RESERVE

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$3,299.4	$3,551.7	$767.5	$3,768.1	
Obligation:	$2,754.8	$ 780.3	$332.1	$3,702.8	
Acquire oil to fill the reserve expeditiously, while minimizing the effects of SPR purchases on world oil prices and the availability of domestic supply.	---------------Millions of barrels in storage, end of FY--------------- 44*	91.7*	92.8*		o Objective is being achieved and oil fill is currently on schedule.
	(*crude oil acquisition suspended August 1979-September 1980.)				
- Store 168 million barrels by September 30, 1981, and 252 million barrels by 1982. (March 10, 1981, President's budget goals, reflected in Omnibus Reconciliation Act of 1981 funding levels.)				o 199.3 MMB stored on September 30, 1981.	o 1981 storage objective has been exceeded.
- Increase storage in each fiscal year by at least 36.5 million barrels or 100,000 barrels per day. (P.L. 96-294, Energy Security Act, June 1980.)				o 106.5 MMB added in FY 1981 at an average rate of 292 MBD.	
- Seek to acquire oil at a rate of 300,000 barrels per day (the fiscal year 1981 Interior and Related Agencies Appropriation Act and the Omnibus Reconciliation Act).				o 6 months of average daily fill in excess of 300 MBD during FY 1981.	

TABLE 48-1

STRATEGIC PETROLEUM RESERVE

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Develop and operate storage facilities for storage of 750 million barrels by 1990, according to the following schedule:	Cumulative capacity developed (MMB) 150	150	250	256	o Storage objectives are being achieved. Phase I is complete, Phases II and III are under way.
- Completion of Phase I (250 million barrels of capacity) by 1981.				o Completion of Phase I in 1981.	
- Completion of Phase II (290 million barrels of capacity) by 1986.				o Completion of 5 MMB in Phase II capacity in FY 1981 versus 0.8 MMB planned.	
- Completion of Phase III (210 million additional barrels of capacity) by 1990.					
Develop SPR drawdown throughput capability according to the following schedule:					o Drawdown rate achieved according to schedule.
- Drawdown rate of 1.7 million barrels per day by 1981.			o Drawdown rate of 1.7 MMB/D achieved by 1981.		
- Drawdown rate of 3.5 million barrels per day by 1986.					
- Drawdown rate of 4.5 million barrels per day by 1990.					

TABLE 48-1

STRATEGIC PETROLEUM RESERVE

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Maintain Strategic Petroleum Reserve readiness through assessment and testing of drawdown and distribution plans.			o February 27-28, 1980, successful drawdown test involving withdrawal of 316,047 barrels of crude oil from West Hackberry. Withdrawal rate of 448,800 barrels per day sustained. o April 22-23, 1980, successful comprehensive operational test involving simultaneous withdrawal of oil from Bryan Mound, Bayou Choctaw, and West Hackberry.		o Strategic Petroleum Reserve readiness has been successfully maintained based on assessment and testing of drawdown and distribution plans.

TABLE 48-1

STRATEGIC PETROLEUM RESERVE

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
	Cumulative capacity developed (MMB)				
Develop and operate storage facilities for storage of 750 million barrels by 1990, according to the following schedule:	150	150	250	256	o Storage objectives are being achieved. Phase I is complete, Phases II and III are under way.
- Completion of Phase I (250 million barrels of capacity) by 1981.				o Completion of Phase I in 1981.	
- Completion of Phase II (an additional 290 million barrels of of capacity) by 1986.				o Completion of 5 MMB in Phase II capacity in FY 1981 versus 0.8 MMB planned.	
- Completion of Phase III (210 million additional barrels of capacity) by 1990.					
Develop SPR draw-down throughput capability according to the following schedule:					o Drawdown rate achieved according to schedule.
- Drawdown rate of 1.7 million barrels per day by 1981.			o Drawdown rate of 1.7 MMB/D achieved by 1981.		
- Drawdown rate of 3.5 million barrels per day by 1986.					
- Drawdown rate of 4.5 million barrels per day by 1990.					

TABLE 48-2

STRATEGIC PETROLEUM RESERVE

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Develop SPR drawdown throughput capability according to the following schedule: - Drawdown rate of 1.7 million barrels per day by 1981. - Drawdown rate of 3.5 million barrels per day by 1986. - Drawdown rate of 4.5 million barrels per day by 1990.	o See note.	o Continue development of SPR drawdown throughput capability scheduled for 1986 and 1990.	o Provide for continued development of SPR drawdown throughput capability.
Maintain Strategic Petroleum Reserve readiness through assessment and testing of drawdown and distribution plans.	o See note.	o Continue to provide for development of internal Strategic Petroleum Reserve Office readiness. Maintain safety, security, and reliability upgrades.	o Provide for continued maintenance of Strategic Petroleum Reserve readiness through such activities as continued engineering, operations, and maintenance and safety, security, and reliability upgrades.

NOTE: The alternative to provide a strategic emergency petroleum stockpile developed and operated as a Government activity would have been to induce the oil industry and/or major consumers to stockpile an equivalent amount of oil in secured storage in excess of normal operating inventories. This alternative would encompass all of the objectives of the Strategic Petroleum Reserve.

TABLE 48-2

STRATEGIC PETROLEUM RESERVE

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $3,875.4[1/]

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Acquire oil to fill the reserve expeditiously, while minimizing the effects of SPR purchases on world oil prices and the availability of domestic supply. - Store 168 million barrels by September 30, 1981, and 252 million barrels by 1982. - Increase storage in each fiscal year by at least 36.5 million barrels or 100,000 barrels per day. - Seek to acquire oil at a rate of 300,000 barrels per day.	o See note.	o Continue procurement of additional oil supplies.	o Provide for a target cumulative total fill level of 343 million barrels by the end of FY 1983.
Develop and operate storage facilities for storage of 750 million barrels by 1990 according to the following schedule: - Completion of Phase II (290 million additional barrels of capacity) by 1986. - Completion of Phase III (210 million additional barrels of capacity) by 1990.	o See note.	o Continue development of planned oil storage facilities.	o Provide for continued expansion of Phase II sites and funding to initiate activities for Phase III sites.

[1/] $3,684.0 is off-budget funding.

TABLE 49-1

ENERGY EMERGENCY PREPAREDNESS

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$5.8	$7.6	$14.8	$16.5	
Obligation:	$5.8	$7.1	$14.6	$16.2	
Distribute supplies and reduce prices through allocation and price controls.	o Modified regulations to encourage greater production of unleaded gasoline.	o Promulgated Special Rule #9 to ensure adequate distillate supplies to priority users.	o Deregulated kerosene jet fuel & aviation gas.	o Removed price and allocation controls on gasoline, propane, and crude oil.	o Supplies were not distributed efficiently because of government intervention.
Maintain power supply adequacy and reliability through analysis of electric power.	o Prepared winter power supply analysis. o Met with 25% of major electric utilities.	o Prepared winter power supply analysis. o Met with 25% of major electric utilities.	o Completed National Power Grid study. o Met with 25% of major electric utilities. o Prepared need-for-power analysis.	o Completed National Power Grid study. o Met with 25% of major electric utilities. o Prepared need-for-power analysis.	o Objective is being met.
Provide assistance to state and local governments, industry, and the public to reduce hardship of emergencies and improve readiness for emergencies.	o Assisted state and local governments in obtaining supplies of natural gas during shortfall.	o Surveyed state energy emergency requirements. o Completed winter energy emergency planning guide. o Assisted states and DOD in meeting needs for oil products during shortfalls.	o Distributed Energy Emergency Handbook to states, Congress, and private and local groups. o Provided state access to electronic mail system. o Analyzed state energy emergency contingency plans. o Completed DOE Emergency Operations Manual.	o Developed EEMIS-S system to allow state access to aggregate data. o Began analysis of state energy emergency contingency plans. o Maintained liaison with petroleum suppliers, purchasers, and consumers by acting as a clearinghouse for supply availability information.	o Assistance provided to industry and the public to resolve temporary supply problems.

TABLE 49-1

ENERGY EMERGENCY PREPAREDNESS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Develop or operate mandatory Federal supply management restraint measures such as:					
- Gasoline rationing plan to Congress by June 1980.		o Gasoline rationing plan submitted to Congress in March 1979. o Disapproved in April 1979.	o Submitted gasoline rationing plan in May 1980. o Initiated development of gas rationing plan.	o Gasoline rationing activities discontinued.	o Congress approved gasoline rationing plan and the discontinuance of activities.
- State emergency conservation measures for meeting energy demand reduction targets.		o Emergency Building Temperature Restrictions (EBTR) regulations implemented in July 1979.	o EBTR regulations extended in in April 1980. o Standby Federal Emergency Energy Conservation Plan published in February 1980.	o EBTR regulations extended in January 1981. o EBTR program abolished in February 1981. o DOE issued $1,635,000 in grants to states to support development of state energy emergency management plans. o Published a NOPR indicating DOE's intent to withdraw several millions from Standby Federal Plan on February 1981. o Prepared draft studies, analysis regarding EECA-related target setting procedures, data requirements, and technical assistance needs of state and local governments.	o Objective met.

TABLE 49-1

ENERGY EMERGENCY PREPAREDNESS

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
- Presidential permits for international interconnections pursuant to E.O. 14085.	o ------------- Processed permit applications and issued 3 permits per year. --------------				o Objective is being met.
- Oil-to-gas switching through issuance of public interest exemptions.		o Granted 1,067 exemptions, and saved 400,000 barrels/day of oil equivalent between April 1979 to May 1981.			o Objective met.
Develop IEA oil-sharing implementation plan.		o Participated in allocation simulation test AST-2 with industry and members of the IEA.		o Participated in allocation simulation test AST-3 with industry, states, and members of the IEA.	o Objective continues to be met.
Complete DOE plans for continuity of Government during national emergencies and war and submit by January 1982.				o Completed interim Continuity of Government plan by October 1981.	o Objective continues to be met.

TABLE 49-2

ENERGY EMERGENCY PREPAREDNESS

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $10.1

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Redirect national emergency preparedness strategy toward market reliance.	o Continuation of allocation and price control strategy which was detrimental to national welfare.	o Identify impediments to the free market including Federal/state and local regulations, administrative procedures, codes, and information gaps and develop options to remove impediments. o Assess SPR use policies and develop plans to coordinate the efficient use of Reserve stocks and industry stocks. o Encourage the buildup of industry petroleum stocks. o Complete supply vulnerability analysis to mitigate electric generation and transmission system shortfalls. o Complete case studies of critical users.	o Promote the effectiveness of the free market to respond to energy supply disruptions.
Reduce vulnerability of electric power system to disruption from acts of war, sabotage, and terrorism.	o Rely on industry analysis; incentives may be required as industry does not currently conduct such analyses.	o Develop plausible sabotage scenarios. o Evaluate cost effectiveness of mitigation measures.	o Develop industry/Government strategy to prevent and mitigate major power supply interruptions.

TABLE 49-2

ENERGY EMERGENCY PREPAREDNESS

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Analyze power supply adequacy and reliability.	o Rely on industry.	o Update the National Electric Reliability Report.	o Establish an electrical energy operations information base.
		o Evaluate current status of bulk power system.	o Assess technical power system reliability in cooperation with utilities.
Provide Presidential permits for international interconnections, pursuant to E.O. 14085.	o Rely on utility industry to import/export electricity.	o Examine environmental impacts and assess power supply results to issue permits.	o Promote continued adequacy of electric power within the United States.
Develop emergency communication and information procedures to coordinate response plans with other Government agencies and industry.	o Communications would be more informal and less systematic.	o Develop information requirements, system design, implementation and testing procedures.	o Operate emergency communications network with industry and state governments.
		o Develop liaison/coordination with state and local governments, private industry, and the public.	o Develop initial 24-hour energy emergency warning capability.
Ensure operating readiness of Executive Reserve Administrations.	o Rely on marketplace to respond to national security emergencies.	o Activate the standby Emergency Petroleum and Gas Reserve; the Emergency Solid Fuels Reserve; and Emergency Electric Power Reserve in the event of a major fuel supply disruption.	o Augment the market in responding to emergency shortages.

TABLE 49-2

ENERGY EMERGENCY PREPAREDNESS

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
		o Complete regional training and maintain a ready executive reserve cadre. o Maintain electric power defense emergency preparedness plans and programs at Federal, regional, and state levels. o Participate in energy emergency exercises and tests.	
Coordinate DOE responsibilities and represent DOE in exercises and planning meetings with the IEA, NATO, DOD, and FEMA.	o No alternative methods available to carry out international treaty obligations or to ensure that major national programs essential to the national security of the U.S. would be conducted.	o Complete planning to implement DOE/DOD agreement to meet DOD's petroleum product requirements pursuant to the Defense Production Act.	o Provide for U.S. participation in international oil emergency preparedness activities pursuant to international treaty obligations.
		o Test and evaluate existing procedures and implementation plans and revise plans if required. o Continue active support and participation in NATO's Petroleum Planning Committee. o Participate in IEA testing exercises. o Expand efforts to support IEA's efforts to utilize the market mechanism to respond to international supply disruptions. o Conduct and coordinate support for REX-82 BRAVO. o Conduct and coordinate internal support for IEA tests, if any. o Coordinate DOE participation with FEMA in civil emergency management exercises.	o Provide for the capability to ensure that defense and national security energy requirements are satisfied during peacetime energy emergencies and wars.

TABLE 49-2

ENERGY EMERGENCY PREPAREDNESS

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Test and maintain the Continuity of Government Plan, portions of the National Emergency Plan, and the Defense Mobilization Plan.	o Major national programs essential to the national security of the United States would not be conducted.	o Test continuity of Government Plans and FEMA exercises. o Continue support to Emergency Mobilization Preparedness Board efforts. o Update various emergency plans, including the National Emergency Plan and Defense Mobilization Plan. o Evaluate the petroleum requirements of the military, including the defense industrial base.	o Provide the capability to analyze scope, nature, and impacts of a petroleum interruption, and basic available response options.
Develop contingency plans to mitigate energy supply disruptions.	o Rely on ad hoc response during emergencies.	o Develop alternative energy disruption scenarios and assess international and national impacts on the economy, essential services, and national security. o Develop and test models to assess regional economic and supply/demand impacts under various energy scenarios addressing petroleum, natural gas, and coal supply curtailments. o Assess of alternate responses to emergency scenarios.	o Provide the capability to analyze the scope, nature, and impacts of a petroleum interruption, and basic available responses. o Promote the effectiveness of the free market to respond to energy supply disruptions. o Study method to recycle revenue during major supply disruptions.

TABLE 50-1

NAVAL REACTORS DEVELOPMENT

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$255.1	$298.1	$278.4	$304.7	
Obligation:	$253.8	$298.0	$277.0	$303.6	
REACTOR DEVELOPMENT:					
Develop advanced reactors as heat sources with improved power capabilities, increased endurance, and added reliability for nuclear propulsion applications. Ultimately, develop cores that will last the presently projected life of a ship.	o Continue technical support, analysis, and testing of existing core designs. o Continue irradiation test program on established schedule.		o Complete experiments to confirm nuclear properties of advanced control materials.		o Core endurance in submarines has increased from 62,000 miles to 400,000 miles. Presently designing longer life cores including cores that may last the service life of a ship.
- Continue advanced design core development programs including analyses and critical experiments.	o Fabricate the Advanced Submarine Plant (ASP) core to test advanced design.				- The Advanced Submarine Plant (ASP) core will begin operating during this fiscal year.
- Develop new techniques for construction of fuel elements, assemblies, and control rods in advanced cores.	o Continue efforts on new core and fuel concepts. Proceed with Advanced Fleet Core design and development effort as planned. Evolve various new concepts.				- Design efforts have progressed on schedule. Scheduled for installation in prototype in mid-1980's.
- Continue investigations of new fabrication techniques, qualification of alternate heat treated alloys and materials that will facilitate longer life cores.	o Continue efforts to develop core materials such as the Submarine Test Core to test new materials and fuels.				- Materials efforts have allowed development of today's operating reactors as well as designs of advanced cores.
- Continue to develop improved higher power and longer life cores for application to various ship classes.	o Continue to develop and improve the D2W core nuclear design. Resolve structural and militarily significant problems.				- D2W core to be installed in ships built in the 1980's.

TABLE 50-1

NAVAL REACTORS DEVELOPMENT

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
PLANT DEVELOPMENT:					
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.	o Continue work to develop improved primary plant components and component material, including steam generators, pressurizers, pumps, and instrumentation and control equipment.		o Initiate corrosion testing to qualify advanced alloys and alternate materials with improved corrosion properties.		o The USS NAUTILUS, the first nuclear-powered ship, established the basic design approach for nuclear propulsion plants for the currently operating nuclear-powered submarines. Today, nuclear-powered ships constitute more than 40% of the U.S. Navy's combatant fleet. This includes 119 submarines and 12 surface ships.
- Develop and analyze noncore reactor plant materials and conduct research into chemical behavior.	o Complete initial checkout of the Steam Generator Performance Experiment in 1978. Used to test new designs and operating parameters in an effort to minimize failures over the life of steam generators and to assure that specified operational conditions are met.				o Improved steam generators are being installed in the newest classes of ships.
	o Develop and test various instrumentation and control equipment using solid state, micro-electronic features, and initiate installation of this advanced equipment in the prototypes and nuclear fleet.				
- Develop new and upgraded primary plant fluid, mechanical, electrical, and reactor instrumentation, reactor control systems and components, and prototype plant off-hull and steam plant systems and components for resolution of operating ship problems.	o Provide technical support to shipyards on the construction and testing of shipboard reactor plants.			o Conduct sea trials of USS OHIO, the first TRIDENT submarine.	o Commissioned 16 LOS ANGELES Class submarines, the latest class of attack submarines. An additional 31 submarines are authorized or under construction. o Commission the USS OHIO, the first advanced ballistic missile submarine of its class, in FY 1982.

TABLE 50-1

NAVAL REACTORS DEVELOPMENT

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
- Ensure safe, reliable, and environmentally clean operation of fleet and prototypes.	o Conduct environmental monitoring and engineering to further reduce radioactivity.				- 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 release of radioactivity which has had a significant effect on the environment.
REACTOR OPERATION AND EVALUATION:					
Confirm reactor plant performance and determine areas of improvement through testing complete developmental plants over long periods of time for improved reliability, maintainability, and operability.	o Operate land-based prototype nuclear propulsion plants to test complete developmental plants, including individual cores and components.				o Prototype plants are serving their intended purpose by providing needed test data and test facilities.
- First prototype reactor plant--S1W.	o Continue operation to provide significant data for application in developing long-life reactor cores and plants.				- S1W--March, 1953. Attained initial criticality, producing the first significant quantities of useful nuclear power in the world.
- Newest prototype reactor plant--S8G.	o Attain S8G prototype reactor plant criticality.	o Conduct S8G power range testing.	o S8G unrestricted operation.		- S8G--May 1980. Attained engine room steaming mode in the prototype plant of the U.S. Navy's newest strategic ballistic missile submarine.
Service prototype reactor plants.		o Install the ASP core in prototype plant.	o Initiate preparation for refueling the S1C prototype plant.		o The ASP prototype core installation was recently completed.

TABLE 50-1

NAVAL REACTORS DEVELOPMENT

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
PLANT DEVELOPMENT:					
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.	o Continue work to develop improved primary plant components and component material, including steam generators, pressurizers, pumps, and instrumentation and control equipment.		o Initiate corrosion testing to qualify advanced alloys and alternate materials with improved corrosion properties.		o The USS NAUTILUS, the first nuclear-powered ship, established the basic design approach for nuclear propulsion plants for the currently operating nuclear-powered submarines. Today, nuclear-powered ships constitute more than 40% of the U.S. Navy's combatant fleet. This includes 119 submarines and 12 surface ships.
- Develop and analyze noncore reactor plant materials and conduct research into chemical behavior.	o Complete initial checkout of the Steam Generator Performance Experiment in 1978. Used to test new designs and operating parameters in an effort to minimize failures over the life of steam generators and to assure that specified operational conditions are met.				o Improved steam generators are being installed in the newest classes of ships.
	o Develop and test various instrumentation and control equipment using solid state, micro-electronic features, and initiate installation of this advanced equipment in the prototypes and nuclear fleet.				
- Develop new and upgraded primary plant fluid, mechanical, electrical, and reactor instrumentation, reactor control systems and components, and prototype plant off-hull and steam plant systems and components for resolution of operating ship problems.	o Provide technical support to shipyards on the construction and testing of shipboard reactor plants.			o Conduct sea trials of USS OHIO, the first TRIDENT submarine.	o Commissioned 16 LOS ANGELES Class submarines, the latest class of attack submarines. An additional 31 submarines are authorized or under construction. o Commission the USS OHIO, the first advanced ballistic missile submarine of its class, in FY 1982.

TABLE 50-1

NAVAL REACTORS DEVELOPMENT

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Design and develop equipment and procedures to meet all reactor servicing needs.		o Complete detailed design of a refueling machine and other equipment for refueling the AIW-A prototype plant.			o Successfully conducted 180 refuelings in the Naval Nuclear Program.
Train approximately 3,700 personnel per year for the Naval Nuclear Propulsion Program.	o Carry out training program as part of prototype plant operation to avoid duplication of facilities and reduce cost of operating the prototypes.				o Trained over 53,000 personnel to date.

NOTES:

1. There are no other programs that pursue the goals and objectives of the Naval Reactors Development program.
2. Work areas are broadly stated so that efforts can be discussed on an unclassified basis.

TABLE 50-2

NAVAL REACTORS DEVELOPMENT

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $359.2

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Reactor Development			
To develop advanced reactors as heat sources with increased power capabilities, increased endurance, and added reliability for nuclear propulsion applications. Ultimately, to develop cores that will last the presently projected life of a ship.		o The power and lifetime capabilities of the reactors under development must cover a wide range of configurations and ratings suitable for installation in naval combatants. Thus, the design and development of new and advanced reactors will incorporate the latest reactor concepts and technology in developing cores and associated components. Anticipated needs are:	o This level of effort will provide for the continuation of current programs at an efficient and economical level and will maintain the current level of responsiveness to operational and defense requirements.
- Continue investigation of new fabrication techniques and qualification of alternate heat-treated alloys.		- Cores with advanced fuel and propulsion systems having long life and increased power.	
- Continue advanced design core development programs including analyses and critical experiments.		- Cores that will last the projected life of a ship.	
- Develop new techniques for construction of fuel elements, assemblies, and control rods in advanced cores.			
Plant Development			
To make significant improvements in plant reliability through development of improved reactor plant components and systems, alternate plant materials, and new heat and water chemistry treatments.		o The long-term reliability of operating plant components and systems is essential to continuity of power operations. Anticipated needs are:	
- Develop and qualify alternate plant materials.		- Improved performance of plant components.	

TABLE 50-2

NAVAL REACTORS DEVELOPMENT

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
- Design equipment and electrical systems.		- Upgraded plant components and instrumentation and control equipment in prototypes and ships.	
- Investigate materials processes and product conditions.		- Reduced corrosion and improved component life.	
Reactor Operation and Evaluation			
Test developmental plants, including individual cores and components to improve reliability, maintainability, and operability.		o The operation of prototype plants is necessary to test complete developmental plants and individual cores and components to ensure operation of fleet plants. Anticipated needs are:	
- Perform nuclear, thermal, performance, and protection analyses of operating reactor cores.		- Safe operation of the growing U.S. Navy nuclear-powered fleet.	
- Operate prototype plants, perform plant maintenance, overhauls, refuelings, and training to conduct various testing programs.		- Reliable plant operation.	
- Train plant operators as part of prototype plant operations.		- Trained operators for nuclear propulsion plants.	
Design and develop procedures and equipment to service reactor plants.		o Equipment to service and refuel nuclear propulsion plants.	

NOTES:

1. No other programs or laboratories conduct efforts in areas directly relating to naval reactors.

2. Work areas are broadly stated so that efforts can be discussed on an unclassified basis.

TABLE 51-1

MATERIALS PRODUCTION

----------CLASSIFIED----------

(This table will be submitted under separate cover to the appropriate congressional committees.)

TABLE 51-2

MATERIALS PRODUCTION

----------CLASSIFIED----------

(This table will be submitted under separate cover to the appropriate congressional committees.)

TABLE 52-1

NUCLEAR MATERIALS SECURITY AND SAFEGUARDS

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 852-1	Degree Original Objective Met
Total Obligational Authority:	$58.0	$61.3	$63.0	$67.4	
Obligation:	$56.8	$61.3	$61.2	$65.0	
Develop countermeasures to preclude malevolent access to DOE facilities and compromise of classified information, including assurance of personnel reliability (security investigations).	o Conducted Internal Reviews and developed security organization to accomplish transition from ERDA to DOE.	o Security reorganized to address DOE-wide responsibilities.	o Obtained budget resources for start-up of programmatic security tasks.	o Implemented DOE-wide support to functional enhancement of security programs.	o R&D activities to support the Computer Security, Technical Security Countermeasures, and Counter Intelligence Survey programs were successfully met according to planned milestones scheduled well within original cost estimates.
	o Scheduled full field investigations. FBI: 1,600 investigations. OPM: 12,990 investigations.	o Scheduled full field investigations. FBI: 1,037 investigations. OPM: 13,507 investigations.	o Scheduled full field investigations. FBI: 1,353 investigations. OMP: 14,669 investigations.	o Scheduled full field investigations. FBI: 1,461[1] investigations. OPM: 15,879[2] investigations.	o Security investigations were scheduled with FBI and OPM throughout the year as required. Although FY 1981 funds were insufficient, additional funding was provided by classified DOE programs which this activity supports (Weapons, Special Materials Production, and Uranium Enrichment). Authority for appropriations transfers was obtained from Congress. Consequently, appropriate number of investigations were completed to maintain adequate numbers of cleared people.

1/Estimated
2/Estimated

TABLE 52-1

NUCLEAR MATERIALS SECURITY AND SAFEGUARDS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Conduct R&D on physical protection components and systems, SNM control accountability components and systems, and provide systems implementation assistance to program organizations.	o Established test labs for intrusion detection. Initiated major equipment demonstrations. Issued two technology handbooks.	o Established interior test lab. Developed data base for physical protection hardware. Issued two technology handbooks.	o 3 major tasks initiated. 3 minor tasks initiated. o Demonstrated spent fuel safeguards technology. Developed personnel identifiers. Developed SNM measurement standards and instruments. Updated technology handbooks. Initiated mass spec. HE detection development.	o 15 major tasks (3 ongoing, 12 newly initiated); 12 minor tasks (2 ongoing, 1 complete, 10 newly initiated). o Continued base technology development. Develop SNM/contraband detectors. Initiated development of suitable credentials. Complete development of FAST SNM assay systems.	o Provided base technology and implementation assistance to program organizations on schedule in accordance with program milestone plans and within estimated costs.
Perform SNM accountability operations.	o Managed U.S. nuclear materials data base which keeps track of U.S. nuclear materials both domestically and internationally as well as foreign nuclear materials in the U.S.	o Continued management of U.S. nuclear materials data base.	o Continued management of U.S. nuclear materials data base.	o Continued management of U.S. nuclear materials data base.	o All accomplishments from FY 1978 through FY 1981 were planned milestones as appeared in the program's planning process.
			o Initiated a 2-year effort to validate and improve data within the International Nuclear Materials Tracking System (INMTS).	o Revised all Nuclear Materials Management and Safeguards Systems (NMMSS) DOE directives and reporting forms (approved by OMB). o Completed revisions to DOE NMMSS-related directives and to NMMSS software programs.	o All milestones were accomplished as scheduled within resources allocated on a yearly basis.
				o Initiated nuclear materials reporting as required by the U.S./IAEA Safeguards Treaty.	o Reporting schedule successfully met as required by the treaty.

TABLE 52-1

NUCLEAR MATERIALS SECURITY AND SAFEGUARDS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
				o Initiated nuclear materials reporting under U.S.-Australia Bilateral Agreements.	
				o Developed and implemented plan for second generation NMMSS upgrades.	
				o Developed plan for reconciling INMTS data base with foreign government records.	o Because of bilateral Agreement with Australia, U.S. successfully reconciled its INMTS data with Australia as the first planned country under this reconciliation program plan.
				o Continuation of FY 1980 verification effort.	o Already sucessfully completed verification of records for 42 countries out of a total of 50 planned.
Gain a comprehensive understanding of potential adversaries and actions, assess vulnerabilities to and consequences of malevolent acts directed against critical U.S. energy resources/DOE operations, and define DOE threat deterrence and response strategies.	o Assessment - Threat Message program established. o Data/research results published in adversary attributes report.	o Developed instrumentation for Credibility Assessment Threat Communication. (CATCOM) system and operation. o Data/research published in adversary motivations report.	o Review of management effectiveness. o Data/resources on likelihood of actiona developed; research initiated on deterrence, consequences, and insider crime.	o Completed CATCOM project. o Developed plan for hostage countermeasure program.	o All program objectives and tasks were successfully met according to milestone schedules and within planned resources.
				o Initiated development of methods to detect and defeat booby traps (ongoing effort).	o Developing and maintaining a DOE capability is planned for future fiscal years.
				o Initiated development of credibility assessment techniques and information for threat message evaluation.	o Objective met by installation of operational system in the Emergency Operations Center (EOC) (complete implementation projected for future).

TABLE 52-1

NUCLEAR MATERIALS SECURITY AND SAFEGUARDS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
	o Report on Attributes of Potential Criminal Adversaries to Nuclear Programs.		o Report on motivations/intentions of criminal adversaries.	o Report on motivations/actions of potential adversaries.	o Report schedule successfully completed according to program plan milestones and within planned estimated costs.
				o Research initiated on target attractiveness of DOE facilities.	o Technical work successfully completed according to program plan schedule and within funds authorized. Implementation delayed as a result of lengthy coordination within DOE.
				o Coordination of threat policy and sabotage orders throughout DOE initiated.	o Technical work successfully completed according to program plan schedule and within funds authorized. Implementation delayed as a result of lengthy coordination within DOE.
Develop and test 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 Program continuing with FY 81 effort resulting in IAEA inspectors testing procedures at DOE facilities with confidence. Support new Administration policy on nonproliferation and peaceful nuclear cooperation (July 16, 1981), including "development by the IAEA of improved safeguards techniques, procedures and instrumentation, especially those needed for the larger and more sophisticated nuclear facilities that are likely to be deployed in the coming years." DOE research and development priorities extend to demonstrating the breeder and encouraging reprocessing as essential to the breeder (Secretary, July 28, 1981). Developments included concepts, components, systems, inspection strategies, and procedures for evaluation of inspection effectiveness.			o Objectives met within planned milestones as coordinated with the IAEA continued assistance requests. Work accomplished within allocated funds.
Collaborate with other countries to improve effectiveness of safeguards and physical security systems.		o Continuing collaboration under way with degree of acceptance of U.S. methods increasing.			
		o Cooperative Agreement with France and U.S. dealing with nuclear incidents.	o Continuing interaction.	o Understanding with Canada--efforts in response to nuclear terrorist incidents.	o Continuing long-term effort consistent with original cost and program plans. Analyses and exchange meetings accomplished on schedule as jointly agreed.

TABLE 52-2

NUCLEAR MATERIALS SECURITY AND SAFEGUARDS

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $69.1

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided*
Develop countermeasures to preclude malevolent access to DOE facilities and compromise of classified information, including assurance of personnel reliability.	o None	o Continue to schedule security investigations on DOE and DOE contractor employees (and others as appropriate) to ensure that providing these individuals access to classified information, special nuclear materials, or employing them in a Critical Sensitive position is clearly consistent with the national interest.	o Support for DOE classified programs (e.g., Weapons, Special Materials Production, Uranium Enrichment, Naval Reactors, Energy Research, International Affairs) which require, by legislation and Executive order, appropriately cleared personnel in order to conduct their activities. (See Security Investigations Section of the DOE FY 1983 Budget.)
		o Continue to develop operational techniques, equipment, and methodologies to enhance the protection of DOE classified and strategic resources against the threats of sabotage, espionage, compromise, theft, and other malevolent acts.	o Assure minimum risk to critical nuclear and other energy technologies of loss due to hostile intelligence collection activities, sabotage, theft, or other malevolent acts.
Conduct R&D on physical protection components and systems, SNM control accountability components and systems, and provide systems implementation assistance to program organizations.	o OSS R&D organizations could provide on contract. o Private sector could provide on contract.	o Many DOE Defense Program facilities are more than 20 years old and require safeguards upgrades to remedy identified deficiencies and to meet escalating policy requirement. New facility initiatives also require assistance to establish adequate upgrades (target dates vary with DOE facility, new tasks normally require 3-5 years from initiation).	o Funding provides systems implementation assistance to requesting program organizations to remedy identified deficiencies. Absence of program would probably result in inadequately protected facilities with resultant vulnerabilities.
	o Use limited existing technology including: - Extensive use of operating and guard force personnel for physical protection. - Frequent/continuous inventory of SNM. - Reduce SNM throughput/rate of, e.g., production, reprocessing, etc.	o Needed currently for adequate safeguards for DOE facility upgrades and new facility designs.	o Adequate protection of DOE facilities and SNM cannot be maintained without R&D.

TABLE 52-2

NUCLEAR MATERIALS SECURITY AND SAFEGUARDS

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided*
		o Allows integration of safeguards systems into facility and process operations in efficient, cost-effective manner.	o Efforts support U.S./DOE commitments for support of international safeguards. Lack of funding will mean commitments cannot be met.
		o Provides technology which is tailored to operational requirements (e.g., hands-off, remote, and automated SNM measurements).	o Absence of funding and program approval will result in inadequately protected facilities with resultant potential vulnerability for theft and SNM and facility sabotage.
		o Funding is necessary to maintain contractors as centers of expertise for DOE and other Federal agencies.	
Perform SNM accountability operations.	o None.	o Operation of a nuclear materials accounting system to enable U.S. and DOE to meet internal programmatic, statutory, and international reporting requirements (continuing need).	o U.S. and DOE cannot track and provide reports on nuclear material holdings, exports, and imports to meet statutory requirements.
Gain a comprehensive understanding of potential adversaries and actions, assess vulnerabilities to and consequences of malevolent acts directed against critical U.S. energy resources/DOE operations, and define DOE threat deterrence and response strategies.	o Pursue safeguards/security goals in absence of awareness.	o In order to successfully deter potential adversaries to DOE facilities, a data base of adversary capabilities and characteristics must be developed.	o Development of capability to deal with hostage taking of DOE facilities will be limited.
	o Rely on private sector and other Government agency-related information.	o Development of response instrumentation and maintenance, operation and improvement of threat message assessment capability.	o Elements are necessary for effective safeguard/security protection, incident management, and damage mitigation for DOE national assets. Without budgetary support, the U.S. capability to effectively respond to nuclear threat incidents will be seriously jeopardized.
		o Allows DOE to conduct programs and still be responsive to public health and safety concerns.	
		o Development of HQ/Field information exchange system to assemble and analyze criminal-related threat information in a form that can be usefully transmitted to DOE field activities.	o Without support, DOE Headquarters lacks organized information to develop and maintain evolving policy.

TABLE 53-1

NUCLEAR WEAPONS ACTIVITIES

..........CLASSIFIED..........

(This table will be submitted under separate cover to the appropriate congressional committees.)

TABLE 53-2

NUCLEAR WEAPONS ACTIVITIES

..........CLASSIFIED..........

(This table will be submitted under separate cover to the appropriate congressional committees.)

TABLE 54-1

INERTIAL CONFINEMENT FUSION

..........CLASSIFIED..........

(This table will be submitted under separate cover to the appropriate congressional committees.)

TABLE 54-2

INERTIAL CONFINEMENT FUSION

..........CLASSIFIED..........

(This table will be submitted under separate cover to the appropriate congressional committees.)

TABLE 55-1

VERIFICATION AND CONTROL TECHNOLOGY

----------CLASSIFIED----------

(This table will be submitted under separate cover to the appropriate congressional committees.)

TABLE 55-2

VERIFICATION AND CONTROL TECHNOLOGY

----------CLASSIFIED----------

(This table will be submitted under separate cover to the appropriate congressional committees.)

TABLE 56-1

DEFENSE WASTE MANAGEMENT

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$296.3	$274.8	$278.6	$302.2	
Obligation:	$276.3	$271.2	$268.5	$301.2	
Stabilize and isolate single-shell tanks at Richland (RL).	PLANNED o Continue tank construction. Complete sluicing of high heat sludge from old single-shell tanks. Stabilized and isolated 43 single-shell tanks.	o Complete construction of six tanks.	o Complete construction of six tanks (12 total).	o Complete construction of four tanks (16 total). All old single-shell tanks deactivated.	o Stabilization and isolation program to be completed in FY 1988 (no completion date projected in FY 1978 plan). All 149 old tanks have been deactivated. The subsequent process to stabilize and then isolate these 149 single-shell tanks had been extended due to budget limitations and technical problems with pumps. As of FY 1981, 38 tanks have been stabilized and 12 isolated. Construction of 13 new double-shell tanks to receive high-level waste should be completed in FY 1981 (revised from 16 tanks projected to be needed in FY 1978 plan).
	ACTUAL o Continued construction of double-shell waste storage tanks. Completed sluicing of high heat sludge from old single-shell tanks.	o Continued construction of double-shell waste tanks. Continued deactivation of old single-shell tanks.	o Complete construction of six double-shell waste tanks. Continue deactivation of old single-shell tanks.	o Complete construction of seven (13 total) double-shell waste tanks. All 149 old tanks deactivated. Stabilized and isolated 12 additional tanks.	
Transfer from old tanks to new tanks at Savannah River (SR).	PLANNED o Continue tank construction. Begin sludge removal demonstration in Tank 16.	o Complete four new tanks and new F area evaporator. Complete demonstration in Tank 16.	o Complete four new tanks. Complete new H area evaporator.	o Complete six new tanks in FY 1981 and four in FY 1982.	o Transfer program on schedule for completion in 1991 (no completion date projected in FY 1978 plan). Completion of 18 new tanks for

TABLE 56-1

DEFENSE WASTE MANAGEMENT

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
	ACTUAL o Construction under way on 18 new tanks for tank replacement. Salt removal demonstrated in Tank 16. Start of sludge removal deferred to FY 1979.	o Four new tanks and new evaporator completed. Sludge removal demonstration in Tank 16.	o Four new tanks completed. Tank cleaning demonstrated in Tank 16. Major equipment procurement begun.	o Continued construction of ten new tanks. Salt removal operations under way.	transfer program expected by FY 1982 as originally projected. All major processes for waste transfer successfully demonstrated. Equipment procurement under way.
Upgrade high-level waste (HLW) calcining operations at Idaho.	PLANNED o Complete construction of fourth set of calcine storage bins.	o Complete construction of New Waste Calcining Facility (NWCF) Calcine 170K gallons in old calciner.	o Complete construction of NWCF.	o Complete construction of fifth set of bins.	o Old calciner operated and supported waste management operations through FY 1981. Construction of fifth set of bins to receive calcine completed. Construction of NWCF delayed due to labor and scheduling problems. "Hot" operations on schedule to begin in FY 1982.
	ACTUAL o Continued construction of NWCF. Completed fourth set of bins.	o Began construction of fifth set of calcine storage bins. 147K gallons calcined in old calciner. Construction continued on NWCF.	o Continued construction of NWCF and fifth set of bins. 157K gallons calcined in old calciner.	o Construction of NWCF completed and systems testing begun. Fifth set of bins completed. 174K gallons calcined in old calciner. Old calciner shut down. Mission completed.	
Immobilize HLW at SR.	PLANNED o Title I design Equipment Test Facility (ETF). Draft Programmatic Environmental Impact Statement (EIS). Recommend waste form and solidification process.	o Authorize ETF Final Programmatic EIS.		o Complete construction Equipment Test Facility.	o The long-term HLW management program has been phased and focused for implementation at the Savannah River Site. This phasing was required by reduced funding and will allow subsequent sites to

TABLE 56-1

DEFENSE WASTE MANAGEMENT

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
	ACTUAL o Issue draft programmatic EIS. Completed conceptual design and initial cost estimate for Defense Waste Processing Facility (DWPF).	o Issue Final Programmatic EIS and Record of Decision (ROD). Start Title I design DWPF.	o Establish materials Characterization Center (MCC) and Materials Review Board (MRB).	o Issued draft project specific EIS.	learn from the first site's experience and will level out the funding requirements. A significant lengthening of the program was required to develop and evaluate alternative high-level waste forms. A standard testing organization was established to evaluate these alternative waste forms. ETF was not needed, and non-radioactive equipment test of components is being performed in an existing facility at SR. NEPA documentation has been completed to proceed with the design and construction of the staged DWPF which will process the sludge portion of the SR HLW.
Dispose of HLW at Richland and Idaho.	PLANNED - Richland o Criteria imp. prod., preliminary safety assessment, conceptual design retrieval.	o Draft programmatic EIS Conceptual design retrieval system. Final safety assessment.	o Final Programmatic EIS.	o Decision on radionuclide removal. Fabricate prototype retrieval system.	o Implementation of the Richland and Idaho high-level waste long-term management programs have been phased behind

TABLE 56-1

DEFENSE WASTE MANAGEMENT

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
	ACTUAL - Richland o Conceptual design waste retrieval system. Assessed tank integrity.		o Completed prototype retrieval system design.	o Assessed risk of continued in-tank storage.	Savannah River. Work at these sites currently is limited to planning, preparation of environmental documentation, and limited development.
	PLANNED - Idaho o Characterize calcine in bins. Verify salt decontamination Design retrieval demonstration.	o Draft PEIS. Bench scale glass melter tests.	o Final programmatic EIS. Cold pilot plant glass formation verification test.	o Waste form and process recommendation.	
	ACTUAL - Idaho o Initiated development of pelletized ceramic and glass waste forms. Conceptual design prototype waste retrieval system.		o Inventoried and characterized stored calcine.	o Complete draft programmatic EIS.	
Encapsulate separate cesium-137 and strontium-90 at Richland by 1985.	PLANNED o Encapsulate 500 cesium and 133 strontium capsules.	(Specific encapsulation schedule not available in FY 1978 projections.)			o Encapsulation program proceeding which will convert cesium (1,680 capsules total planned) and strontium (660 capsules total planned) to less mobile forms by FY 1985. FY 1978 planned scheduled initiation delayed due to equipment and process problems.
	ACTUAL o Cesium encapsulated process upgraded, tilt-pour melt caster installed to improve performance.	o Prepared 375 cesium capsules and 198 strontium capsules for storage basin.	o Additional 330 cesium capsules produced; strontium process and equipment modified to improve performance.	o Additional 300 cesium capsules (total 1,000) and 35 strontium capsules (total 235) produced.	

TABLE 56-1

DEFENSE WASTE MANAGEMENT

Goals/Objectives		Budget Data ($ Millions) Status				Degree Original
		FY 78	FY 79	FY 80	FY 81	Objective Met
Immobilize Transuranic (TRU) waste at Idaho.	PLANNED	o Complete study on alternatives for buried TRU at Idaho. Develop exhumation technique at Idaho.	o Complete studies verifying retrievability of stored waste. Issue policy decision on Idaho exhumation.	o Issue policy decision on retrieved and exhumed TRU waste treatment. Develop techniques to retrieve stored waste.		o Program to immobilize TRU waste at Idaho proceeding. Techniques to prepare stored waste for disposal demonstration in WIPP are being developed.
	ACTUAL	o Complete alternatives document for TRU at Idaho.	o Completed engineering studies of stored TRU waste retrieval.	o Prepared waste characterization studies on buried and stored TRU waste.	o Prepared evaluation of alternatives for buried TRU at Idaho.	
Dispose of transuranic waste generated at DOE sites.	PLANNED	o Decontamination processes evaluated.	o Demonstration of incineration systems with actual TRU wastes.			o Volume reduction methods demonstrated for application at DOE facilities. Strategy to focus and accelerate disposal alternative at initial site due to funding limitations which would not allow proceeding at all sites on a parallel basis.
	ACTUAL	o Issued alternatives documents for TRU at SR. Decontamination processes evaluated.	o Demonstration of treatment processes to incinerate and reduce waste volumes performed at Rocky Flats and Mound Lab with actual TRU wastes.			

TABLE 56-1

DEFENSE WASTE MANAGEMENT

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
	PLANNED				
Complete construction and operation of Waste Isolation Pilot Plant (WIPP).	o Continued site characterization for bedded salt disposal facility and started EIS and Safety Analysis Report preparation.	o Complete Title I and start Title II. Submit license application to the Nuclear Regulatory Commission.	o Begin WIPP facility construction.	o Continue facility construction.	o Original plan based on prior Administration policy to include commercial spent fuel and have facility licensed by the Nuclear Regulatory Commission. Congressional disagreements on WIPP mission clarified by P.L. 96-164 which mandated WIPP as an unlicensed R&D facility to demonstrate disposal of nuclear waste from Defense programs. Construction now proceeding consistent with P.L. 96-164 with anticipation of 1989 operational date.
	ACTUAL				
	o Continued site characterization for bedded salt disposal facility and started EIS and Safety Analysis Report preparation.	o Complete Title I design.	o P.L. 96-164 authorized WIPP as an unlicensed defense R&D facility. Issued final EIS.	o Began phased construction with drilling of exploratory shaft. Started final design for facility.	
	PLANNED				
Upgrade DOE burial ground operations at all sites.	o Initial disposal criteria issued. New hydrofracture facility construction started.	o Sites begin operational improvements.	o Sites in compliance with initial disposal criteria. Techniques to stabilize burial grounds developed. New Hydrofracture Facility construction completed.		o Interim criteria completed for guide to construct facilities to improve DOE low-level waste (LLW) disposal. Operations of New Hydrofracture Facility in FY 1982 at Oregon will demonstrate improved disposal for LLW.

TABLE 56-1

DEFENSE WASTE MANAGEMENT

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
	ACTUAL				
	o Initiated DOE land burial technology development program, issued summary assessment report on DOE burial grounds, initiated construction of new Oak Ridge Hydrofracture facility.	o Initiated field demonstrations of LLW disposal technology at Oregon.	o Initial background criteria issued, all sites in compliance with new criteria.	o Interim burial ground criteria completed. Waste generation reduction manual completed. Draft manual on remedial actions for shallow land burial completed.	
	PLANNED/ACTUAL				
Ensure the availability of transport systems in support of all defense wastes. Develop standards, data bases, testing methods and facilities, logistics and economic analyses, safety and accident analyses, and a technical information center.	o Provide generic effort for support of all waste transport.	o Complete packaging development for contact-handled TRU waste.		o Complete conceptual design for contact-handled TRU package and HLW cask (for DWPF).	o Generic support for all wastes and design of specific packaging needs has been initiated.
	PLANNED/ACTUAL				
Eliminate the backlog of surplus defense-related facilities by the year 2000.	o Accomplished under Commercial program.	o Develop program plan, initiate projects at ORNL and INEL. Other facilities maintained in safe condition.	o Continue projects at ORNL and INEL. Other facilities maintained in safe condition.	o Continue projects at ORNL and INEL. Other facilities maintained in safe condition.	o Projects initiated to meet objectives; Richland Operations Office assigned lead responsibility.

TABLE 56-2

DEFENSE WASTE MANAGEMENT

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $368.4

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Stabilize and isolate single-shelled tanks at Hanford by 1988.	o Continued use of old single-shelled tanks for liquid waste storage.	o Draining as much interstitial liquid waste as possible from waste tanks. Required piping and other corrections to old tanks need to be sealed pending the implementation of a long-term waste management effort. The Waste Handling and Isolation Facility project will support this effort.	o Old single-shelled tanks are not suitable for indefinite storage; wastes will leak to environment if not removed from old tanks. (See Hanford Interim Waste Operations section of FY 83 Budget.)
Transfer high-level waste (HLW) from old tanks to new tanks by Savannah River (SR) by 1991.	o Continued use of old tanks for liquid waste storage.	o New tanks are required for dissolution of salt cake for transfer. Sludge transfer includes processing to remove excess aluminum to reduce eventual immobilization for disposal.	o Old tanks are not suitable for indefinite storage of liquid wastes; wastes may leak to environment if not removed from old tanks. (See Savannah River Interim Waste Operations section of FY 83 Budget.)
Upgrade HLW Calcining operation at Idaho.	o Continued use of existing calciner.	o Requires checkout and operation of New Waste Calciner Facility by late FY 82 and additional waste storage bins.	o Existing calciner requires consistent maintenance/repairs; upgrade is required to assure waste calcination support for defense fuel reprocessing operations. (See Idaho Interim Waste Operationa section of FY 83 Budget.)
Immobilize HLW at SR.	o Continued use of tanks for waste storage.	o Requires facility to immobilize high-level waste. The Defense Waste Processing Facility, Stage 1, will immobilize the sludge portion of the HLW (containing most of the radionuclides). The facility is expected to be operational in 1990.	o Failure to immobilize HLW would require a major surveillance and maintenance program. (See Long-Term Waste Management--High-Level Waste Section of FY 83 Budget.)
Dispose of HLW at Richland and Idaho.	o Continue storage of HLW in tanks and bins in interim mode.	o Requires development and selection of an alternative to implement the long-term program. Facilities will be required at each site to immobilize the HLW. These activities are not scheduled until the 1990's.	o Indefinite delay will result in continuation of interim mode. Construction of facilities to implement disposal alternative is not expected to be funded in near term. (See Long-Term Waste Management--High-Level Waste section of the FY 83 Budget.)

TABLE 56-2

DEFENSE WASTE MANAGEMENT

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Encapsulate separated Cesium-137 (Cs-137) and Strontium-90 (Sr-90) at Richland by 1985.	o Continued storage as concentrated aqueous solutions in B-Plant at Hanford.	o Requires continued operation of facilities to encapsulate Cs-137 and Sr-90.	o Waste management operations produce separated Cs and Sr which must either be encapsulated or stored as an aqueous solution; continued storage in the aqueous form increases the potential for a leak to the environment. (See Hanford Reservation Interim Waste Operations section of the FY 83 Budget.)
Immobilize transuranic waste (TRU) at Idaho.	o Continued storage of TRU waste on temporary storage pads.	o TRU waste is temporarily stored on asphalt pads and covered with soil which does not provide permanent TRU waste isolation. Requires facility for processing of TRU wastes at Idaho. The Transuranic Waste Treatment Facility to accomplish this requirement is expected to be operational in the early 1990's.	o Immobilization technology includes process development and design input for Transuranic Waste Treatment Facility (TWTF); some wastes must be immobilized prior to disposal (See Long-Term Waste Management--Transuranic Waste Section of FY 83 Budget.)
Dispose of TRU waste generated at DOE sites.	o Continue interim storage of TRU waste at all DOE sites except Idaho.	o Requires development and selection of an alternative to implement long-term disposal program. The specific activities to address the disposal of TRU wastes at DOE sites other than Idaho is not expected until the 1990's.	o Indefinite delay will incur additional repackaging and maintenance costs; selection and implementation of long-term program will follow activities at Idaho. (See Long-Term Waste Management--Transuranic section of the FY 83 Budget.)
Complete construction and operation of Waste Isolation Pilot Plant (WIPP) by 1989.	o Continued use of interim storage techniques for defense waste.	o Requires continued funding in support of construction and operation of WIPP.	o WIPP is an R&D facility to demonstrate the safe disposal of defense waste; continued interim storage of existing waste, coupled with current and anticipated waste generation is environmentally unacceptable for the long term. (See Terminal Storage section of FY 83 Budget.)

TABLE 56-2

DEFENSE WASTE MANAGEMENT

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Upgrade DOE burial ground operations at all sites.	o Continue current burial ground disposal practices at DOE sites.	o Requires funding for upgraded and standardized burial ground procedures needed to assure safe handling and disposal of DOE waste.	o Upgraded and standardized operations will result in safer waste disposal. (See Interim Waste Operations section of FY 83 Budget.)
Assure the availability of transportation systems in support of all defense waste programs. Technology transfer to Commercial and Spent Fuel programs and commercial sector.	o None	o Requires funding for contact handled TRU package for WIPP. o Requires funding for HLW package for Defense Waste Processing Facility (DWPF).	o Transportation packaging systems to support schedule to ship TRU wastes to WIPP and HLW from the DWPF to a repository. (See Transportation R&D section of FY 83 Budget.)
Eliminate the backlog of surplus defense-related facilities under a progressive program to be completed by the year 2000.	o Defer all decommissioning; continue surveillance and maintenance for all facilities.	o Requires funding to continue maintenance and surveillance and accomplish decontamination and decommissioning of sites in priority order in order to allow for alternate or unrestricted use and to recover beneficial materials.	o Continue maintenance and surveillance at DOE defense surplus facilities. Decontamination and decommissioning of defense sites to make available materials and facilities for subsequent use will proceed as funding availability permits. (See Decontamination and Decommissioning section of FY 83 Budget.)

TABLE 57-1

HIGH ENERGY AND NUCLEAR PHYSICS

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$365.2	$394.7	$424.6	$458.8	
Obligation:	$364.6	$388.7	$424.3	$457.3	

GOAL: The goal of the 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 that underlie all physical processes involving transformations of matter and energy.

OBJECTIVES:

Goals/Objectives	FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
- Show progress in obtaining new knowledge and understanding of the fundamental nature of matter and energy. (Accomplishments under this objective were achieved in the FY 78-81 time period.)	o Discovery and confirmation of a new heavier kind of lepton. o Discovery of evidence for a new heavier kind of quark. o Discovery of evidence for the gluon, believed to hold nuclear matter together. o Direct observation of lifetime of heavy lepton and particles containing "charmed" quarks. o Discovery of nuclear quasi-molecular resonances. Quantitative description of the interactions of pi mesons with nuclei. o Indepth understanding of the transfer of energy, mass, charge, and angular momentum in collisions of massive nuclei.				o Outstanding progress.
- Maintain U.S. world leadership in high energy and nuclear physics research to help ensure U.S. competitive position.	Number of Nobel, Fermi, Lawrence, Waterman, and National Medal of Science Awards				
	2	5	5	-	o High degree of leadership.
	U.S. Rapporteurs and Invited Papers at Major International Conferences (% of total)				
	40	46	38	34	o Greater than U.S. share of total worldwide funding.
- Support theoretical and experimental research in high energy and nuclear physics.	Number of Physicists Involved				
	2,000	2,100	2,200	2,300	o Effective level of participation.
- Construct, operate, and maintain the nationally available accelerators and colliding beams and detection and analysis systems required to carry out the research.	Average number of Weeks of Physics operation per Facility				
	High Energy Physics Facilities (3)				
	33	31	28	23	o Limited budget, increasing power costs, and competing program priorities decrease utilization. Highest priority projects accomodated.

TABLE 57-1

HIGH ENERGY AND NUCLEAR PHYSICS

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$365.2	$394.7	$424.6	$458.8	
Obligation:	$364.6	$388.7	$424.3	$457.3	
	Nuclear Physics Large Facilities (3)				
	20	19	20	14	o Limited budgets, increasing power costs, and competing program priorities decrease utilization. Highest priority projects accomodated.
	Nuclear Physics Small Facilities (5):				
	26	26	25	25	o Stable utilization.
	Number of Experiments Running:				
	493	456	474	441	o Decreasing utilization.
	Number of User Groups:				
	222	224	231	224	o Stable community of researchers.
	New Facilities:				o Good progress for future capabilities.
	o PEP electron positron storage ring completed at SLAC (1980).				
	o Holifield Heavy Ion Accelerator completed at Oak Ridge (1981).				
	o Heavy Ion Spectrometer System completed at LBL (1981).				
- Carry out research and development needed to develop new accelerator and detector technologies needed for the continuing progress of the program.	New Technologies:				o Increasing emphasis on research and development.
	o Fermilab superconducting magnets for Energy Saver being fabricated (1979-81).				
	o Argonne Superconducting Prototype Booster completed (1980).				
	o Antiproton source development for Tevatron I at Fermilab (1980-81).				
	o Work on new concept at SLAC for very high energy electron-positron collisions.				

TABLE 57-1

HIGH ENERGY AND NUCLEAR PHYSICS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
- Maintain an adequate source of trained scientific manpower by appropriate support of universities and laboratories.	Institutions Supported:				o Adequate number of universities, university physicists, and graduate students. Recent emphasis on outstanding younger investigators.
	74	85	89	98	
	Number of University Physicists Supported:				
	1,100	1,200	1,300	1,250	
	Number of Graduate Students in Programs:				
	750	800	850	850	
- Identify practical applications resulting from physics research studies for transfer to the appropriate scientific discipline or technology.	Sampling of notable items achieving widespread or new utilization: o Superconducting Materials and Devices. o RF Power Sources. o Synchrotron Light Sources. o Free Electron Lasers. o Materials Analysis Tools. o Neutral Beam Heaters for Fusion. o Medical Applications. o Universal Instrumentation Standards. o Radiation Processing. o National Defense. o Computer Controls. o Fast Electronics.				o Technologies developed find widespread use in other research and in industry.

TABLE 57-2

HIGH ENERGY AND NUCLEAR PHYSICS

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $484.3

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
GOAL:			
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 transformation of matter and energy.	o No reasonable alternative. Shifting to another agency causes disruption to program and offers no economic benefit to Government.	o Quest for knowledge to maintain U.S. society at the forefront.	o Maintain the best possible U.S. program at a reduced level of activity. The U.S. will maintain a strong and competitive program.
OBJECTIVES:			
- Progress in obtaining new knowledge and understanding of the fundamental nature of matter and energy.	o See above.	o Continuing quest for such knowledge.	o National Trust Program of Basic Research in high energy physics and nuclear physics.
- Maintain high quality programs in high energy and nuclear physics research to help ensure U.S. competitive position.	o See above.	o Continuing commitment to lead in these fields.	o U.S. position strongly challenged; available resources focused on highest priority facilities.
- Support theoretical and experimental research in high energy and nuclear physics.	o See above.	o Continuing commitment to established cadre of world leading scientists.	o Provides support for the highest quality research groups.
- Construct, operate, and maintain the nationally available accelerators and colliding beams and detection and analysis systems required to carry out the research.	o See above.	o Facilities required for increased knowledge and for training new scientists.	o The rate at which new facilities are brought on line will be properly phased with the rate with which existing facilities lose their scientific effectiveness.
- Carry out R&D needed to develop new accelerator and detector technologies needed for the continuing progress of the program.	o See above.	o New concepts required for increased capability with reasonable cost.	o Program provides for some future capabilities. At even a very low level of activity new facilities are essential.

TABLE 57-2

HIGH ENERGY AND NUCLEAR PHYSICS

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
- Maintain an adequate source of trained scientific manpower by appropriate support of universities and laboratories.	o See above.	o New young scientists needed for future expertise.	o Program will provide for future expertise.
- Identify practical applications resulting from physics research studies for transfer to the appropriate scientific discipline or technology.	o See above; rely on academia and industry.	o Requires publication of technology developments and cooperation with industry.	o Program publishes advances in technology and works along with industry.

TABLE 58-1

DEPARTMENTAL ADMINISTRATION[1/]

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Total Obligational Authority:	$321.6	$377.4	$430.8	$456.1	
Obligation:	$302.5	$309.6	$396.4	$390.5	
MANAGEMENT AND ADMINISTRATION:					
Management and Support					
Management of Department Telecommunications Systems and Services.					
- Centralized management of Department-wide telephone systems and operation of headquarters systems.	o Developed communication support plans for the SPR, SERI, WAPA; assisted Brookhaven National Lab in acquisition of a new telephone system; & negotiated an agreement with the Air Force for a major telephone replacement system at Kirkland AFB to serve the Albuquerque Operations Office.	o Fully integrated DOE-wide Telecommunications Long Range Plan was implemented. o Improved monitoring programs of long distance & Federal Telecommunications usage resulting in 1/3 reduction in use.	o Modernization of telecommunications system resulting in second lowest cost per telephone in Government. One such conversion will result in $6M savings over next 10 years.	o New systems installed at Bartlesville, Oklahoma; Piketon, Ohio; and Brookhaven National Laboratory. o Supported comprehensive test ban treaty, national seismic system, and joint DOE/DOD MX missile program. o Elimination of Wide Area Telecommunication System at a savings of $140K per year.	o Objectives met.
Headquarters data processing services including operational support, programming analysis support, and the Teleprocessing Services Program.	o Numerous management information systems were reviewed at the formation of the Department resulting in transfer of systems to the in-house computer, modification and expansion of existing systems, and retirement of numerous systems inherited from predecessor organizations.	o Workload increased 60% with no increase in facilities and staff.	o Implementation of the DOE-wide teleprocessing services program at a cost avoidance of approximately $3.5M.	o 44 management information systems moved in-house from commercial timesharing at a cost avoidance of $1.9M per year.	o Objectives met.
				o Implemented computer security program in compliance with OMB Circular A-71.	o Objectives met.

1/Since Departmental Administration spans so many activities, only selected objectives and related criteria are incorporated in this table.

TABLE 58-1

DEPARTMENTAL ADMINISTRATION

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
				o Provided unplanned ADP analytic support to Alternative Fuels, Oil Allocation, Direct Combustion, and Schools and Hospitals Grants Program.	o Objectives met.
				o Established a data base administration function.	o Objectives met.
Provide office space for the operations & support of headquarters consistent with DOE policies & GSA directives.	o Established a space management organization to develop space criteria & renovation procedures.	o Continued.	o Continued.	o Continued.	o Consolidated headquarters from originally 22 buildings into currently 11 buildings ensuring space criteria met GSA utilization criteria.
	o Provided efficient building management and office services response to HQ programs.	o Continued.	o Continued.	o Continued.	
	o Developed a housing plan to consolidate HQ staff.	o Continued.	o Continued.	o Continued.	
Annually increase contract awards to small and disadvantaged businesses.	o $1.1B to Small Business (SB) (14%); $84M to Disadvantaged Business (DB) (1.1%).	o $1.2B to SB (15%); $131M to DB (1.6%).	o $1.5B to SB (20%); $268M to DB (3%).	o $1.6B to SB; $220M to DB (both preliminary statistics).	o Each year both the absolute and percentage of DOE-wide procurement from small or disadvantaged businesses increased (except FY 81 DB awards.)

TABLE 58-1

DEPARTMENTAL ADMINISTRATION

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
Technical Information Services					
Provide central sources of information on world's energy R&D to help eliminate undesirable duplication and overlap in DOE R&D effort.	o Over 1M items available in data bases.	o 2.8M citations used from RECON by DOE programs.	o 53,200 foreign technology reports made available during the year.	o Data bases represent results of over $135B expenditure on R&D.	o Data bases currently provide access to 1.5M R&D-related items which is the most comprehensive energy information resource in the world.
Effectively manage and make available to the DOE community, publications resulting from DOE-funded R&D.	o TIC pioneers printing costs optimization which is adopted by Federal Government.	o All document distribution functions centralized at TIC to improve control and cost-effectiveness.	o 2.5M hard-copy R&D reports distributed on behalf of DOE programs.	o Contract awarded to Engineered Systems to effectively provide R&D reports in microfiche.	o Maintain effective report distribution control system; meets all expressed DOE management needs.
Special services provided to manage classified R&D for Defense and limited applied technology for Nuclear.	o AWDR and ALDR published to announce classified and limited reports to defense and nuclear communities.	o Over 1,000 computer software codes exchanged, primarily in nuclear and defense areas.	o Classified and sensitive information files contain over 40,000 technical reports.	o Defense Programs implements first DOE 4-color process printing at TIC required for identification of sensitive events, processes, and materials.	o Sucessfully manages defense and national security services for program offices. Provides technical information on defense and national security produced within DOE.
Program Management and Project Support					
o Reduce DOE buildings energy consumption by FY 85 by 20%.			o 11.7% reduction through FY 80.	o Unknown.	o The Department has achieved more than 50% of the consumption reduction in the first 4 years of a 9 year goal.
o Reduce DOE fuel oil consumption by 30% by FY 85.	o 6.3% reduction.	o 17.8% reduction.	o 39.5% reduction.	o Unknown.	o Department exceeded FY 85 goal by FY 80 through conservation efforts and initial conversion projects.

TABLE 58-1

DEPARTMENTAL ADMINISTRATION

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
CORPORATE STAFF FUNCTIONS:					
Congressional, Intergovernmental, and Public Affairs					
Public Affairs:					
Ensure that all public affairs activities are justified as economical as possible, and done in a consistent manner. Facilitate constructive and informative interaction with the news media.	o Reached 6.2 million people through travelling exhibits and 3.6 million people through DOE and science museum programs and 320 million viewers through TV and motion picture programs.	o Reached 4.3 million people through travelling exhibits and 4.6 million people through DOE and science museum programs and 249 million through radio, film, and TV. Developed 640 press releases and arranged/suppported 100 news conferences.	o Responded to over 6,000 written public and congressional inquiries, 84,000 visits and telephone requests, and 2,000 speaking engagements for professional, civic, and industrial and other organizations.	o Responded to over 6,000 written public and congressional inquiries, 50,000 telephone requests, and 42,000 people through film loan activities. Published 420 news releases.	o Objectives accomplished by the effective coordination of DOE public information programs to include the use of audio-visual science museum and exhibit programs, press releases, and timely responses to written and telephonic inquiries.
Legislative Affairs:					
Facilitate and encourage constructive communications between the Department and Congress.	o Assisted departmental officials in interaction between the Department concerning congressional hearings, monitored and maintained records of legislation, bills, and resolutions relevant to DOE.	o Provided liaison to departmental officials as well as members of Congress on DOE programs.	o During first session of 96th Congress assisted DOE officials that testified at 383 hearings before 38 full committees and 93 subcommittees. In the second session, assisted in testimony for 255 hearings before 29 full committies and 62 subcommittees.	o Attended congressional hearings markups, briefings, and floor actions; assisted DOE witnesses in preparing for congressional hearings and briefings (600), and coordinated the designation and scheduling of DOE witnesses (500).	o Congressional relations and communications were effectively carried out as evidenced by the confirmation of all departmental Presidential appointees in the Senate and the passage in both the Senate and the House of the energy package in the reconciliation legislation as part of the President's Economic Recovery Program.

TABLE 58-1

DEPARTMENTAL ADMINISTRATION

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
Intergovernmental Affairs:					
Ensure effective communications and liaison with state, local, and tribal governments.	o Ensured incorporation of state, local, and tribal government input to policy formulation on such issues as energy resource development impact assistance, State Energy Management Act, coal strike plan, contingency gasoline rationing plan, and Regulatory Reform Task Force.	o Developed DOE Directive on Intergovernmental Affairs activities. Completed a review of the Atomic Energy Community Assistance Program, recommended to the Secretary future payment methods and implemented Secretary's decisions. Conducted a variety of outreach meetings and public hearings with state, local, and tribal officials.	o Strengthened contacts with state, local, and tribal governments and worked closely with State Energy Offices to enhance their energy management capabilities.	o Ensured the participation of state, local tribal, and territorial governments in the development and implementation of national energy policies which have an impact on them.	o Original objective is being fully met and continues as an ongoing goal.
Consumer Affairs:					
Ensure that consumers, businesses, and institutions are provided with information and given opportunity to comment on policies and programs.	o Conducted program activities such as FY 78 Public Briefing Series; consumer briefing summaries, public transcripts, coordination of May 3, 1978, Sun Day; developed Winter Survival Handbook and coordinated the development of the Human Needs Handbook during the coal strike with the Defense Civil Preparedness Agency.	o Developed DOE Citizen Participation Manual. Coordinated 70 National Energy Act hearings/meetings, conducted 34 workshops on energy programs for low-income citizens, and developed draft Advisory Committee Management Manual/Member Handbook.	o In compliance with Presidential Executive order to increase citizen access to information and participation in Federal agencies, designed a DOE consumer plan for interaction between program offices and consumers.	o Conducted public hearings in the development process of the of the National Energy Policy Plan. Reviewed and began closeout of over 200 grants/contracts.	o Continued long-term goals and changing objectives.
Inspector General					
To promote economy and efficiency and to prevent or detect fraud and abuse in the programs administered or financed by the Department of Energy.	o Objective met.	o Objective met.	o Objective met.	o Objective met.	o 310 audit reports. Inspection reports and programmatic Reviews have been published and issued. These have resulted in substantial savings/cost avoidance.

TABLE 58-1

DEPARTMENTAL ADMINISTRATION

Goals/Objectives	Budget Data ($ Millions) Status FY 78	FY 79	FY 80	FY 81	Degree Original Objective Met
- To supervise, coordinate, and provide policy direction for audit, inspection, and investigation activities.					o Investigative Cases: opened, 931; closed, 572; referred to DOE/FBI, 248; declinations, 116; convictions, 13; disciplinary actions, 67.
- To identify and refer for prosecution participants of fraud and abuse.					
General Counsel					
Provide adequate legal opinions, advice and services to all DOE activities except FERC.	o Objective met.	o Objective met.	o Objective met.	o Objective met.	o Adequate legal support provided.
Policy, Planning, and Analysis					
Analyze specific policy issues affecting the national interest, and provide recommendations to the Secretary, the Cabinet Council, the President and Congress on these issues.	o Conducted 22 analyses and studies covering such areas as natural gas, solar energy, coal conversion technologies, emergency planning, and alcohol fuels.	o Assisted Congress in its deliberations on energy initiatives (e.g., natural gas, fuel use, etc.). o Developed DOE's legislative initiatives (e.g., phaseout of decontrol on domestic crude oil, windfall profits tax, conservation programs for low-income residents, etc.). o Conducted analyses on issues such as solar policy (Domestic Policy Review), oil import reduction, New Source Performance Standards.	o Conducted analyses on oil shale environmental research, state and local policies. o Developed legislative alternatives, e.g., Energy Mobilization Board.	o Conducted oil vulnerability study. o Completed Third National Energy Policy Plan for submission to Congress.	o Completed short-, mid-, and long-range policy studies and analyses and prepared reports for submission to Congress by the President and/or the Secretary.

TABLE 58-1

DEPARTMENTAL ADMINISTRATION

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
Prepare for submission to Congress certain reports mandated by law.	o Prepared DOE Annual Report to Congress.	o Completed Second National Energy Plan to Congress.	o Prepared DOE Annual Report to Congress.	o Conducted studies reviewing coal competition and national coal policy.	o Congressional mandates were met.
	o Completed report on Economic Impact of Energy Actions.	o Completed report on Economic Impact of Energy Actions.	o Completed report on Economic Impact of Energy Actions.	o Completed report on Economic Impact of Energy Actions.	
Coordinate and manage policy-related functions cutting across departmental lines, (e.g., analysis, evaluation resource allocation issues).	o Drafted DOE Order 2030, "Procedures for Developing Regulations, Standards and Guidelines."		o Implemented Departmentwide Policy Planning and Budgeting System (PPBS).	o Revised and implemented FY 83 PPBS cycle.	o Identified major issues and managed resource allocation process for development of 5-year plan.

TABLE 58-2

DEPARTMENTAL ADMINISTRATION[1/]

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $388.3

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
MANAGEMENT AND ADMINISTRATION:			
Management and Support			
Ensure effective analysis and implementation of organizational decisions.	o None.		o Establish and maintain an organizational structure to maximize efficient use of resources.
Improve Department's management of consulting and support service contracts.	o Decentralize to organizational elements.		o Increase oversight of pre-contract practices including comprehensive reviews of individual organizations.
Provide office space for the operations & support of HQ consistent with DOE policies and GSA directives.	o None.	o Required to ensure adequate and safe housing of HQ and to minimize adverse impacts of inadequate housing or misuse by not complying with GSA regulations and directives.	o Provide necessary support services for ongoing programs to HQ organizations.
Continue and improve personnel management policies and programs consistent with laws, regulations, and public policies.	o None.[2/]	o Develop revised merit pay program for mid-managers to implement the Office of Personnel Management revision.	o Develop and conduct training; provide staffing support; continue position management and classification controls; improve performance appraisal system; and provide policy guidance on personnel management.
Improve procedures used and financial systems to provide better service & timely and accurate accounting reports.	o Decentralize specific accounting functions.	o Implementation of integrated and automated accounting systems during FY 82.	o General accounting functions; i.e., administrative control of funds, cash management, payroll, travel, and accounting reporting.

[1/] Since Departmental Administration spans so many activities, only selected objectives and related criteria are incorporated in this table.
[2/] Use of other agency support is not feasible since no entity exists to provide personnel support to other agencies of any size; and contractor personnel cannot perform the function of a personnel office, under Federal law.

TABLE 58-2

DEPARTMENTAL ADMINISTRATION

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
Technical Information Services			
Increase comprehensiveness and effectiveness of data bases covering world's energy R&D literature and DOE publications, research in progress, and computer software.	o Each program responsible for developing info access systems.	o Federally funded R&D becomes smaller percent of energy advances. Continuing need to maintain coverage of non-Federal R&D results for in-house decision-making.	o Undesirable duplication of effort can be avoided if program managers and researchers have comprehensive, timely, and easy access to existing knowledge and ongoing programs in their area of interest.
Effectively manage and provide immediate access to results of DOE R&D through collection, announcement, and distribution of technical reports to program offices and contractors.	o Transfer costs of functions to technical program offices. o Develop decentralized technical R&D information management systems.	o Emphasis on info control systems will increase. o Triennial information management review (IRM) implemented in 1982 as required by P.L. 96-511.	o Improve decision-making support for DOE managers and productivity of DOE researchers consistent with IRM, OMB Bulletin 81-15, and administration goal to promote efficiency and effectiveness in Government operations.
Maintains centralized classified and national security technical information systems for DOE.	o Specific technical program offices would have to develop information systems.	o Increased attention and support of national security and defense programs resulting in increased volume and sensitivity of information.	o Have existing facilities and equipment and over 35 years experience in managing such information in the most cost-effective and secure manner.
Program Management and Project Support			
Reduce DOE buildings' energy consumption by 20% per square foot by FY 85 and retrofit all DOE buildings to minimize life cycle costs by 1990.	o None; early no-cost temperature and lighting reductions already achieved. Capital investment necessary for further energy reductions.	o Permit study to develop and funding of retrofits to improve energy efficiency.	o Reduced utility costs for weapons research, testing, and production, as well as energy research. FY 82 program has about a 3.7-year payback.
Convert major DOE heating plants from oil and natural gas to coal and other more abundant resources such as solid wastes.	o None.	o Permit 3 studies for future conversions and continuation of a conversion of the Pantex Weapons Plant.	o Reduced utility costs for major steam plants. The Pantex plant conversion by utilizing coal and cogeneration techniques has a payback period of 8 years while reducing dependence and consumption of natural gas.

TABLE 58-2

DEPARTMENTAL ADMINISTRATION

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
CORPORATE STAFF FUNCTIONS:			
Congressional, Intergovernmental, and Public Affairs			
Ensure that all public affairs activities are justified, as economical as possible, and done in a consistent manner. Facilitate constructive and informative interaction with the news media.	o None.	o Provide for public awareness of energy programs and activities.	o Improve public perception of energy issues and integrate the public affairs activities of program organizations and field offices.
Facilitate and encourage constructive communications between the Department and Congress.	o None.	o Communicate with Congress in developing respective goals and policies.	o Liaison with Congress on energy legislation and activities.
Ensure effective communications and liaison with state, local, and tribal governments.	o None.	o Communicate frequently with those officials to ensure consistency and input to DOE programs/policies.	o Provide main point of contact for Federal, state, local, and tribal governments on DOE programs and policies.
Assess competitive impacts of departmental policy initiatives and evaluate the structure, conduct, and performance of energy markets.		o Ensure that policy initiatives are consistent with the competitive operation of private markets.	o Help to ensure that Department policies are consistent with the Administration's preference to rely upon competitive market process to the greatest extent possible.
Ensure that consumers, businesses, and institutions are provided with information and given opportunity to comment on policies and programs.	o None.	o Planning, developing, and implementing programs to provide consumers, business, and institutions the opportunity to comment on DOE policies, regulations, and programs.	o Provide direct liaison with these groups to ensure information flow and liaison regarding energy programs.
Inspector General			
To promote economy and efficiency and to prevent or detect fraud and abuse in the programs administered or financed by the Department of Energy.	o None.	o Provide the statutory means whereby fraud, waste, and abuse are identified and corrected.	

TABLE 58-2

DEPARTMENTAL ADMINISTRATION

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
To supervise, coordinate, and to provide policy direction for audit, inspection, and investigation activities.		o Provide an objective overview of DOE operations necessary for economy and efficiency.	
To identify and refer for prosecution participants of fraud and abuse.			
General Counsel			
Provide adequate legal opinions, advice, and services to all DOE activities except FERC.	o None.	o Sufficient funding each year mainly for operating expenses for staffing requirements. Support funding for legal activities also required.	o Budget request includes funding for personnel compensation and benefits and travel. Support funding is requested for domestic and foreign patent activities, law library operations, and for legal transcripts and related services. Outyear projections increase over enacted BA FY 82 is result of expected higher costs of above items only.
Policy, Planning, and Analysis			
Analyze specific policy issues affecting the national interest, and provide recommendations to the Secretary, the Cabinet, the President, and Congress on these issues.	o None.	o Strategic planning.	
Prepare for submission by the Secretary and/or the President to Congress reports mandated by law.		o Long-term analyses and policy statements.	
Coordinate and manage policy-related functions cutting across departmental lines, (e.g., analysis, evaluation resource allocation issues).		o Short-term studies and analyses of interest to the Secretary, the President, and Congress.	

TABLE 59-1

INTERNATIONAL PROGRAMS

PROGRAM ACCOMPLISHMENTS

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
Total Obligational Authority:	$9.6	$9.2	$8.7	$6.4	
Obligation:	$9.6	$9.1	$8.6	$6.3	
Develop and implement U.S. policy on nuclear cooperation and non-proliferation.	o Active negotiation of bilateral and multilateral agreements. o 29 subsequent arrangements.	o Continued negotiation of bilateral and multilateral agreements. o 295 subsequent arrangements. o Same.	o Continued negotiation of bilaterial and multilateral agreements. o 247 subsequent arrangements. o Same.	o Continued negotiation of bilateral and multilateral agreements. o 227 subsequent arrangements. o Same.	o Completed negotiations. Renegotiated agreements with Canada and the IAEA and negotiated new agreements with Morocco, Norway, Peru, Indonesia, Bangladesh, and Egypt.
Arrange technical cooperation to benefit U.S. technical programs.	o 51 agreements. 160 projects. 5-year, $100M jointly funded solar R&D/demo with Saudi Arabia.	o 80 agreements. 240 projects.	o 100 agreements. 260 projects. Expanded breeder cooperation with Europe and Japan.	o 103 agreements. 270 projects. o Modified or terminated about 12% of IEA and bilateral projects in solar, conservation, and fossil to match DOE budget and program changes.	o Existing agreements are 68% bilateral and 32% multilateral. o Agreements cover variety of technology areas, including fossil, nuclear, solar/renewable, conservation, and geothermal.
Provide energy policy and technical advice on export controls, as provided in Nuclear Non-Proliferation Act of 1978 (NNPA) and the Export Administration Act of 1969.	o Rendered 200 advisory opinions on nuclear exports. o Rendered 50 advisory opinions on oil and gas production, equipment and technology exports.	o 218 opinions. o 50 opinions.	o 174 opinions. o 50 opinions.	o About 200 opinions. o 50 opinions.	o Satisfied legislative requirement.

TABLE 59-1

INTERNATIONAL PROGRAMS

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
Assist developing and industrializing countries assess energy resources and develop national energy plans.	o Program initiated. o Preliminary steps in Egypt and Peru.	o Completed Egypt and Peru assessments.	o Initiated assessments in Portugal, Argentina, and Republic of Korea.	o Completed Portugal and Republic of Korea; work necessary for Argentina completed.	o Assessments accepted by host governments and being used as basis for energy planning.
Make cooperative arrangements to reduce vulnerability to supply disruptions and import dependency.	o IEA Ministerial: obtained agreement on establishing a 1985 group import objective. o Bonn Economic Summit: announced U.S. intention to establish 1 billion barrel SPR.	o Demonstrated and extended oil supply agreement with Israel. o Obtained IEA agreement to reduce oil consumption in response to Iranian revolution.	o IEA Ministerial: lowered group's 1985 oil import objective, established individual country 1985 objectives, set individual country oil import ceilings for FY 80. o Signed U.S.-Italy Energy R&D Agreement. o Tokyo Summit: agreed to double coal production, reduce oil share of total energy demand by 1990. o Consulted with oil companies to establish cooperative relationships to encourage market responses for crises. o Established energy cooperation with Republic of Korea.	o IEA Ministerial (Dec): agreed to rely on stocks rather than high-priced Iranian oil; assisted Turks and Portuguese obtain oil. o Successfully tested IEA's emergency sharing system. o IEA Ministerial (June): obtained recognition of need to rely on market mechanism for small disruptions and to increase country stocks.	o Continued participation in IEA, support for annual economic summits, and selective bilateral efforts.

TABLE 59-1

INTERNATIONAL PROGRAMS

Goals/Objectives	Budget Data ($ Millions) Status				Degree Original Objective Met
	FY 78	FY 79	FY 80	FY 81	
Promote secure gas supplies at reasonable prices.	o U.S./Algerian price discussions allowed continuation of LNG imports.	o U.S./Algerian price discussions forestalled higher prices for LNG imports. o Assisted in financing plans for ANGTS.	o U.S./Mexican negotiations permitted Mexican pipeline gas to flow uninterrupted. o Assisted in ANGTS financing plans between producers and sponsors. o Negotiated with Canadians to prebuild ANGTS southern leg.	o U.S./Canadian preliminary discussions precluded export tax on gas by Canadians. o Financing plan for entire ANGTS presented to President. o Construction began on eastern and western legs.	o Efforts continue, as needed, to work out with foreign governments, a framework under which U.S. and foreign companies could conclude contracts for imports. o First gas carried over ANGTS arrives in Los Angeles 9/30/81.

TABLE 59-2

INTERNATIONAL PROGRAMS

CURRENT PROGRAM OBJECTIVES AND BUDGET

FY 82: $4.9

Goals/Objectives	Alternative Methods	Anticipated Needs (for objective target date)	Budget Justification and Services Provided
o Analyze political and price developments and trends in international energy markets.	o Rely on information from other agencies and private sources.	o Provides analytical base for policy formulation.	o Fulfills legislative mandate to develop international energy policy.
o Develop and implement U.S. policy on nuclear cooperation and non-proliferation.	o Rely on private sector or other Federal agency.	o Provides for negotiation of agreements for cooperation in peaceful uses of atomic energy and orderly review of "subsequent arrangements."	o Fulfills mandates of Atomic Energy Act and Nuclear Non-Proliferation Act.
o Arrange technical cooperation to benefit (long-range, high-risk) programs.	o Rely on private sector or other Federal agency.	o Provides programmatic, technical, and financial benefits, and ultimately broadened alternatives to reliance on oil.	o Fulfills legislative mandates for technical cooperation.
o Provide energy policy and technical advice on export controls.	o Rely on private sector or other Federal agency.	o Provides energy policy input to interagency review process.	o Legislative mandates in areas of nuclear exports and oil and gas production equipment and technology exports.
o Pursue cooperative efforts emphasizing market forces to reduce vulnerability to supply disruptions.	o Rely on State Department.	o Pursues market-oriented approaches to reduction in vulnerability to supply disruptions and enhancement of oil-sharing systems among IEA partners and at economic summits.	o International support for Administration energy policy and decisions.
o Promote secure gas supplies at reasonable prices.	o Rely on private sector.	o Provides framework under which U.S. and foreign companies can conclude commercial contracts for importing pipeline gas and LNG to the United States. o Policy and technical contribution to ANGTS.	o Support for U.S. access to world energy markets.

FUNDING DATA TABLES

A control table for all Sunset Report funding data follows. Footnotes indicate variation from the historical baseline for fiscal years 1978, 1979, 1980, and 1981. For fiscal year 1982, shown in the right column of the table, prior year deferrals and unobligated balances were backed out at the summary level so as to tie to the Department's total for new budget authority.

TABLE 1

Summary Of DOE Funding For Title X
(Dollars in Millions)

Date: 12-23-81

CATEGORY		FY 1978	FY 1979	FY 1980	FY 1981	FY 1982
Fossil Energy	TOA	894.00	984.30	6,612.70	6,080.60	417.0
	OBS	682.20	745.20	995.70	1,338.50	
Nuclear Energy (Fission)	TOA	1,263.30	1,199.30	1,114.10	1,117.90	1078.6
	OBS	1,224.30	1,137.70	1,103.50	1,099.00	
Nuclear Energy (Fusion)	TOA	368.30	364.60	359.80	376.30	435.3
	OBS	347.60	355.10	358.60	374.80	
Renewable Energy	TOA	572.60	834.30	859.00	689.10	249.5
	OBS	458.50	709.50	771.70	667.30	
Energy Conservation	TOA	357.30	879.80	913.40	717.90	143.0
	OBS	346.40	543.40	830.90	648.70	
Electric and Storage Systems	TOA	96.20	103.00	106.20	89.80	31.7
	OBS	93.10	100.10	103.00	88.30	
Energy Supporting Reseaarch	TOA	189.30	227.10	247.60	277.20	298.1
	OBS	182.80	226.30	247.00	271.70	
Environment, Safety, and Health	TOA	265.70	262.50	279.40	275.70	272.3
	OBS	262.60	260.40	275.90	270.70	
Regulation and Information	TOA	157.00	211.20	300.10	281.40	168.9
	OBS	154.10	204.20	289.00	257.90	
Energy Production and Power Marketing (Net of Enrichment Revenues)	TOA[1]	1,318.40	922.20	958.00	1,537.10	2103.1
	OBS	1,051.50	778.50	849.60	1,387.00	
Energy Emergency Preparedness Programs	TOA	3,305.20	3,559.30	782.30	3,784.60	3885.5
	OBS	2,760.60	787.40	346.70	3,719.00	

[1] Includes BPA apportioned amounts.

TABLE 1

Summary of DOE Funding For Title X
(Dollars in Millions)

Date: 12-23-81

CATEGORY		FY 1978	FY 1979	FY 1980	FY 1981	FY 1982
Defense Programs	TOA	2,624.50	2,788.10	3,054.70	3,754.30	4,673.2
	OBS	2,516.90	2,710.50	2,970.60	3,706.10	
General Science Programs	TOA	365.20	394.70	424.60	458.80	479.3
	OBS	364.60	388.70	424.30	457.30	
Management Programs	TOA	331.20	386.60	439.50	462.50	225.3
	OBS	312.10	318.70	405.00	396.80	
ADJUSTMENTS						
Bonneville Power Administration 2/	TOA	849.9	768.7	600.6	52.4	-1,376.0 3/
	OBS	0.0	0.0	0.0	0.0	
Uranium Enrichment Revenues 4	TOA	896.0	1,217.1	1,117.0	1,248.1	
	OBS	896.0	1,217.1	1,117.0	1,248.1	
Transfer from SWPA						-9.0
ITEMS NOT INCLUDED IN TITLE X						
Special Foreign Currency	TOA	1.6	3.4	1.4	1.3	
	OBS	0.2	0.0	0.0	0.2	
Other Costs & Credits	TOA	22.7	0.0	0.0	0.2	
	OBS	30.0	-1.2	0.0	-0.1	
Unobligated Balance Unapplied	TOA	64.0	0.1	0.0	0.0	
	OBS	0.0	0.0	0.0	0.0	
TOTAL FOR DEPARTMENT OF ENERGY	TOA	13,942.40	15,106.30	18,170.40	21,205.20	1,3075.8
	OBS	11,683.50	10,481.60	11,088.50	15,931.30	

2/ Reflects the difference between apportionment amounts used in Title X and TOA's from official accounting records.
3/ Reflects the difference between apportionment amounts used in Title X and new borrowing authority of $279.7 million..
4/ Uranium Enrichment Revenues added here to reflect Departmental totals without enrichment revenues.

TABLE 2

Fossil Energy
(Dollars in Millions)

Date: 12-23-81

PROGRAM ANALYSIS UNIT		FY 1978	FY 1979	FY 1980	FY 1981	FY 1982
Coal Mining Research and Development						
	TOA	78.2	78.9	69.1	43.5	14.2
	OBS	67.6	69.1	67.3	41.4	
Coal Liquefaction						
	TOA	199.8	223.1	332.7	363.7	228.4
	OBS	109.8	139.3	246.7	279.3	
Surface Coal Gasification						
	TOA	194.8	181.7	221.4	149.7	53.1
	OBS	115.0	71.8	141.9	131.7	
In Situ (Underground) Coal Gasification						
	TOA	13.0	15.2	10.3	10.1	8.3
	OBS	12.8	14.9	10.2	9.4	
Fuel Cells						
	TOA	35.7	41.5	26.5	32.4	34.5
	OBS	35.7	41.5	26.1	32.4	
Magnetohydrodynamics						
	TOA	73.8	80.9	81.0	61.6	27.8
	OBS	71.1	79.9	80.5	61.3	
Heat Engines						
	TOA	30.6	52.5	50.6	32.2	15.4
	OBS	28.4	52.5	50.2	32.2	
Combustion Systems						
	TOA	79.2	57.4	50.3	44.7	41.0
	OBS	75.1	57.3	43.3	40.1	
Advanced Research and Technology Development						
	TOA	50.6	73.6	64.5	65.1	56.3
	OBS	41.7	66.3	57.7	60.8	
Advanced Environmental Control Technology						
	TOA	0.0	7.0	38.4	34.4	22.0
	OBS	0.0	6.8	36.8	32.4	
Oil Shale						
	TOA	29.0	49.9	43.8	37.4	19.2
	OBS	28.7	34.3	39.5	35.3	

TABLE 2

Fossil Energy
(Dollars in Millions)

Date: 12-23-81

PROGRAM ANALYSIS UNIT		FY 1978	FY 1979	FY 1980	FY 1981	FY 1982
Unconventional Petroleum Technologies						
	TOA	53.7	54.0	35.2	25.3	20.2
	OBS	50.0	50.9	33.1	24.7	
Domestic Energy Supply						
	TOA	15.3	22.2	25.8	18.1	0.0
	OBS	8.3	15.8	19.1	13.1	
Enhanced Gas Recovery						
	TOA	29.1	34.5	30.6	27.6	11.7
	OBS	28.1	33.7	30.6	26.2	
Alternative Fuels Production						
	TOA	0.0	0.0	5,518.0	5,116.6	0.0
	OBS	0.0	0.0	101.4	504.6	
Federal Leasing						
	TOA	0.0	0.0	1.2	2.4	0.0
	OBS	0.0	0.0	1.1	2.1	
Fossil Program Direction[1/]						
	TOA	11.2	11.9	13.3	15.8	14.0
	OBS	9.9	11.1	10.2	11.5	
Use of FY 1981 Deferrals						-149.1
TOTAL FOR FOSSIL ENERGY						
	TOA	894.00	984.30	6,612.70	6,080.60	417.0
	OBS	682.20	745.20	995.70	1,338.50	

[1/] Fossil Program Direction is not treated as a separate Program Analysis Unit in the text of this report.

TABLE 3

Nuclear Energy (Fission)
(Dollars in Millions)

Date: 12-23-81

PROGRAM ANALYSIS UNIT		FY 1978	FY 1979	FY 1980	FY 1981	FY 1982
Uranium Resource Assessment						
	TOA	68.5	72.9	61.5	30.8	10.0
	OBS	67.9	72.9	61.5	30.5	
Conventional Reactor Systems						
	TOA	149.4	114.9	81.0	104.4	106.9
	OBS	149.2	113.7	79.3	103.8	
Remedial Actions						
	TOA	21.2	24.0	31.6	46.4	43.1
	OBS	18.7	20.0	30.0	45.4	
Breeder Reactor Systems						
	TOA	756.9	721.8	693.7	689.5	678.1
	OBS	733.6	703.4	688.6	675.3	
Advanced Nuclear Systems						
	TOA	73.9	54.5	39.4	40.7	37.6
	OBS	73.7	54.2	39.2	40.5	
Commercial Waste Management						
	TOA	193.4	211.2	206.9	206.1	226.1
	OBS	181.2	173.5	204.9	203.5	
Use of FY 1981 Deferrals (ESR&D)						-23.2
TOTAL FOR NUCLEAR ENERGY						
	TOA	1,263.30	1,199.30	1,114.10	1,117.90	1,078.6
	OBS	1,224.30	1,137.70	1,103.50	1,099.00	

TABLE 4

Nuclear Energy (Fusion)
(Dollars in millions)

Date: 12-23-81

PROGRAM ANALYSIS UNIT		FY 1978	FY 1979	FY 1980	FY 1981	FY 1982
Magnetic Fusion						
	TOA	368.3	364.6	359.8	376.3	453.8
	OBS	347.6	355.1	358.6	374.8	
Use of FY 1981 Deferral (ESR&D)						-18.5
TOTAL FOR FUSION ENERGY						
	TOA	368.30	364.60	359.80	376.30	435.3
	OBS	347.60	355.10	358.60	374.80	

TABLE 5

Renewable Energy
(Dollars in millions)

Date: 12-23-81

PROGRAM ANALYSIS UNIT [1]		FY 1978	FY 1979	FY 1980	FY 1981	FY 1982
Solar Applications For Buildings						
	TOA	171.0	276.1	266.3	206.7	99.1
	OBS	142.5	246.8	254.2	199.2	
Solar Applications For Industry						
	TOA	156.4	203.8	222.0	163.2	75.5
	OBS	130.3	182.2	211.8	157.2	
Wind and Ocean Solar Power Technologies						
	TOA	77.2	106.1	104.1	100.7	56.2
	OBS	64.3	94.8	99.4	97.1	
Solar Information, International, and SERI						
	TOA	4.1	16.5	16.8	23.5	10.7
	OBS	3.4	14.7	16.0	22.6	
Alcohol Fuels						
	TOA	0.0	0.0	22.0	22.1	10.0
	OBS	0.0	0.0	21.0	21.3	
Hydropower						
	TOA	10.7	29.5	33.7	11.9	3.0
	OBS	10.0	17.0	19.0	11.3	
Geothermal Resources						
	TOA	153.2	202.3	194.1	161.0	55.4
	OBS	108.0	154.0	150.3	158.6	
Solar Program Support & Program Direction[2]						8.0
Use of FY 1981 Deferral (ESR&D)						-68.3
Use of FY 1981 Deferral (GRDF)						-0.1
TOTAL FOR RENEWABLE ENERGY						
	TOA	572.60	834.30	859.00	689.10	249.5
	OBS	458.50	709.50	771.70	667.30	

[1] The split among Solar PAU's (including Alcohol Fuels) for FY 78-81 was accomplished by AS/CE using control figures developed from official accounting records.

[2] Solar Program Support & Program Direction is not treated as separate Program Analysis Unit (PAU) in this report. Funding for FY 1978 through FY 1981 is included in solar PAU's.

TABLE 6

Energy Conservation
(Dollars in Millions)

Date: 12-23-81

PROGRAM ANALYSIS UNIT		FY 1978	FY 1979	FY 1980	FY 1981	FY 1982
Buildings And Community Systems						
	TOA	69.1	94.0	109.6	67.8	47.7
	OBS	64.3	87.5	106.0	61.0	
Industrial Conservation						
	TOA	33.2	40.3	65.7	48.2	28.8
	OBS	32.4	34.9	58.7	42.6	
Transportation Conservation						
	TOA	69.1	100.3	115.2	98.2	58.9
	OBS	67.3	97.5	110.8	94.2	
Multi-Sector Conservation						
	TOA	4.0	12.2	19.7	25.4	16.5
	OBS	2.5	10.0	18.3	24.1	
State And Local Programs 1/						
	TOA	181.9	633.0	603.2	478.3	231.9
	OBS	179.9	313.5	537.1	426.8	
Use of FY 1981 Deferral						-62.7
Transfer of Prior Year Funds						-178.1
TOTAL FOR ENERGY CONSERVATION						
	TOA	357.30	879.80	913.40	717.90	143.0
	OBS	346.40	543.40	830.90	648.70	

1/ Reflects comparability transfer of $1.9M in FY 80 and $2.4M in FY 81 to Energy Emergency Preparedness PAU.

TABLE 7

Electric and Storage Systems
(Dollars in Millions)

Date: 12-23-81

PROGRAM ANALYSIS UNIT		FY 1978	FY 1979	FY 1980	FY 1981	FY 1982
Electric Energy Systems						
	TOA	43.9	43.0	39.3	37.8	24.3
	OBS	42.2	40.8	36.4	37.5	
Energy Storage Systems						
	TOA	52.3	60.0	66.9	52.0	32.2
	OBS	50.9	59.3	66.6	50.8	
Use of FY 1981 Deferral (ESR&D)						-24.8
TOTAL FOR ELECTRIC AND STORAGE SYSTEMS						
	TOA	96.20	103.00	106.20	89.80	31.7
	OBS	93.10	100.10	103.00	88.30	

TABLE 8

Energy Supporting Research
(Dollars in Millions)

Date: 12-23-81

PROGRAM ANALYSIS UNIT		FY 1978	FY 1979	FY 1980	FY 1981	FY 1982
Energy Supporting Research	TOA	189.3	227.1	247.6	277.2	305.6
	OBS	182.8	226.3	247.0	271.7	
Use of FY 1981 Deferrals (ESR&D)						-7.5
TOTAL FOR ENERGY SUPPORTING RESEARCH	TOA	189.30	227.10	247.60	277.20	298.1
	OBS	182.80	226.30	247.00	271.70	

TABLE 9

Environment, Safety, and Health
(Dollars in Millions)

Date: 12-23-81

PROGRAM ANALYSIS UNIT		FY 1978	FY 1979	FY 1980	FY 1981	FY 1982
Environment and Safety[1]						
	TOA	58.2	65.4	69.3	65.8	57.3
	OBS	57.0	64.6	67.5	63.4	
Health and Environmental Research[1]						
	TOA	207.5	197.1	210.1	209.9	215.0
	OBS	205.6	195.8	208.4	207.3	
TOTAL FOR ENVIRONMENT, SAFETY, AND HEALTH						
	TOA	265.70	262.50	279.40	275.70	272.3
	OBS	262.60	260.40	275.90	270.70	

[1] Reflects comparability transfer for Marshall Islands Health Care of $2.6M in FY 1978, $3.4M in FY 1979, $3.6M in FY 1980, $5.8 in FY 1981 and $6.4M in Fy 1982 from Health and Environmental Research PAU to Environment and Safety PAU.

TABLE 10

Regulation and Information
(Dollars in Millions)

Date: 12-23-81

PROGRAM ANALYSIS UNIT		FY 1978	FY 1979	FY 1980	FY 1981	FY 1982
Economic Regulatory Administration[1/]	TOA	66.2	92.8	132.3	105.4	47.2
	OBS	65.6	90.2	128.3	88.2	
Hearings and Appeals	TOA	2.3[2/]	2.9	5.9	8.3	4.8
	OBS	2.3	2.6	4.7	6.2	
Federal Energy Regulatory Commission	TOA	43.1	54.0	71.1	77.3	76.2
	OBS	41.5	50.5	67.7	73.7	
Energy Information	TOA	45.4	61.5	90.8	90.4	78.9
	OBS	44.7	60.9	88.3	89.8	
Use of FY 1981 Deferral (ERA)						-38.2
TOTAL FOR REGULATION AND INFORMATION	TOA	157.00	211.20	300.10	281.40	168.9
	OBS	154.10	204.20	289.00	257.90	

1/ Reflects comparability transfer for emergency preparedness functions of $9.2M in FY 80, $9.2M in FY 81, and $7.6M in FY 82 from ERA to Energy Emergency Preparedness PAU.

2/ Approximately $2 Million of FY 1978 funding shown for Hearings and Appeals was previously included in ERA

TABLE 11

Energy Production and Power Marketing
(Dollars in Millions)

Date: 12-23-81

PROGRAM ANALYSIS UNIT		FY 1978	FY 1979	FY 1980	FY 1981	FY 1982
Naval Petroleum and Oil Shale Reserves						
	TOA	154.1	128.1	76.9	198.4	213.1
	OBS	149.1	123.7	76.5	197.7	
Uranium Enrichment Activities						
	TOA	1,483.2	1,334.8	1,122.3	1,438.5	1,796.0
	OBS	1,279.3	1,265.7	1,117.1	1,402.0	
Enrichment Revenues						
	TOA	-896.0	-1,217.1	-1,117.0	-1,248.1	-1,805.0
	OBS	-896.0	-1,217.1	-1,117.0	-1,248.1	
Power Marketing 1/						
	TOA	162.5	208.6	255.8	317.6	243.3
	OBS	142.9	157.6	188.0	251.7	
Subtotal for Energy Production and Power Marketing						
	TOA	903.80	454.40	338.00	706.40	
	OBS	675.30	329.90	264.60	603.30	
Bonneville Power Administration						
	Apportionment 2/	414.6	467.8	620.0	830.7	1,655.7
	OBS	376.2	448.6	585.0	783.7	
TOTAL FOR ENERGY PRODUCTION AND POWER MARKETING						
	TOA 3/	1,318.40	922.20	958.00	1,537.10	2,103.1
	OBB	1,051.50	778.50	849.60	1,387.00	

1/ All Power Marketing Administrations except Bonneville. Bonneville is on separate lines.
2/ Apportioned amounts are shown for Bonneville Power Administration (BPA) since they are more representative of program activity levels in a given fiscal year than TOA which, in the case of BPA, includes borrowing authority.
3/ Includes BPA apportioned amounts

TABLE 12

Energy Emergency Preparedness Programs
(Dollars in Millions)

Date: 12-23-81

PROGRAM ANALYSIS UNIT		FY 1978	FY 1979	FY 1980	FY 1981	FY 1982
Strategic Petroleum Reserve 1/						
	TOA	3,299.4	3,551.7	767.5	3,768.1	3,875.4
	OBS	2,754.8	780.3	332.1	3,702.8	
Energy Emergency Preparedness 2/						
	TOA	5.8	7.6	14.8	16.5	10.1
	OBS	5.8	7.1	14.6	16.2	
TOTAL FOR ENERGY EMERGENCY PREPAREDNESS PROGRAMS						
	TOA	3,305.20	3,559.30	782.30	3,784.60	3,885.5
	OBS	2,760.60	787.40	346.70	3,719.00	

1/ Includes $3,684.0M requested in off-budget funding in FY 1982.
2/ Includes estimates for functional transfers from ERA, CE, and PPA for FY 1980, 1981, and 1982.

TABLE 13

Defense Programs
(Dollars in Millions)

Date: 12-23-81

PROGRAM ANALYSIS UNIT		FY 1978	FY 1979	FY 1980	FY 1981	FY 1982
Naval Reactors Development						
	TOA	255.1	298.1	278.4	304.7	359.2
	OBS	253.8	298.0	277.0	303.6	
Materials Production						
	TOA	399.8	452.1	490.3	667.0	913.4
	OBS	392.6	450.4	489.3	665.9	
Nuclear Materials Security and Safeguards						
	TOA	58.0	61.3	63.0	67.4	69.1
	OBS	56.8	61.3	61.2	65.0	
Nuclear Weapons Activities						
	TOA	1,458.3	1,526.2	1,710.1	2,161.9	2,734.0
	OBS	1,381.0	1,457.1	1,642.4	2,121.1	
Inertial Confinement Fusion						
	TOA	130.9	145.7	196.2	211.9	209.1
	OBS	130.6	142.8	193.9	210.1	
Verification and Control Technology						
	TOA	26.1	29.9	38.1	39.2	50.0
	OBS	25.8	29.7	38.3	39.2	
Defense Waste Management						
	TOA	296.3	274.8	278.6	302.2	368.4
	OBS	276.3	271.2	268.5	301.2	
Use of FY 1981 Deferrals						-30.0
TOTAL FOR DEFENSE PROGRAMS						
	TOA	2,624.50	2,788.10	3,054.70	3,754.30	4,673.2
	*OBS	2,516.90	2,710.50	2,970.60	3,706.10	

TABLE 14

General Science Programs
(Dollars in Millions)

Date: 12-23-81

PROGRAM ANALYSIS UNIT		FY 1978	FY 1979	FY 1980	FY 1981	FY 1982
High Energy and Nuclear Physics						
	TOA	365.2	394.7	424.6	458.8	484.3
	OBS	364.6	388.7	424.3	457.3	
Use of FY 1981 Deferral (General Science)						-5.0
TOTAL FOR GENERAL SCIENCE PROGRAMS						
	TOA	365.20	394.70	424.60	458.80	479.3
	OBS	364.60	388.70	424.30	457.30	

TABLE 15

Management Programs
(Dollars in Millions)

Date: 12-23-81

PROGRAM ANALYSIS UNIT		FY 1978	FY 1979	FY 1980	FY 1981	FY 1982
Departmental Administration[1/]						
	TOA	321.6	377.4	430.8	456.1	388.3
	OBS	302.5	309.6	396.4	390.5	
International Programs						
	TOA	9.6	9.2	8.7	6.4	4.9
	OBS	9.6	9.1	8.6	6.3	
Offsetting Revenues						-167.9
TOTAL FOR MANAGEMENT PROGRAMS						
	TOA	331.20	386.60	439.50	462.50	225.3
	OBS	312.10	318.70	405.00	396.80	

[1/] PPA emergency preparedness function transferred to AS/EP in FY 1980. $200,000 transferred in FY 80, FY 81 & FY 82.