Corporate Context for
Energy Resources (ER) Programs

This section on Corporate Context that is included for the first time in the Department's budget is provided to facilitate the integration of the FY 2003 budget and performance measures. The Department's Strategic Plan published in September 2000 is no longer relevant since it does not reflect the priorities laid out in President Bush's Management Agenda, the 2001 National Energy Policy, OMB's R&D project investment criteria or the new policies that will be developed to address an ever evolving and challenging terrorism threat. The Department has initiated the development of a new Strategic Plan due for publication in September 2002, however, that process is just beginning. To maintain continuity of our approach that links program strategic performance goals and annual targets to higher level Departmental goals and Strategic Objectives, the Department has developed a revised set of Strategic Objectives in the structure of the September 2000 Strategic Plan.

Energy is the vital force powering business, manufacturing, and movement of goods and services throughout the country. The United States spends over one-half trillion dollars annually for energy, and our economic well-being depends on reliable, affordable supplies of clean energy.

The Energy Resources goal establishes the overarching purpose of the Department's energy programs. Focus of three of the Department's program offices is on energy technology R&D: Office of Fossil Energy (FE), Office of Nuclear Energy, Science and Technology (NE), and the Office of Energy Efficiency and Renewable Energy (EE). In addition to energy technology R&D the Department's Energy Information Administration (EIA) develops and publishes energy statistics and forecasts and the Department also delivers Federal hydroelectric power to consumers though the Power Marketing Administrations (PMAs).

Energy Resources (ER) Goal

Increase global energy security, maintain energy affordability and reduce adverse environmental impacts associated with energy production, distribution, and use by developing and promoting advanced energy technologies, policies and practices that efficiently increase domestic energy supply, diversity, productivity, and reliability.

Strategic Objectives

The Energy Resources business line goal is supported by the following strategic objectives. Offices requesting funding to achieve these objectives are identified with each objective:

ER1: Use public-private partnerships to promote energy efficiency and productivity technologies in order to enhance the energy choices and quality of life of Americans in 2020 relative to 2000

by: reducing the oil intensity of the U.S. economy by 25 percent (compared to 23 percent without EE programs); reducing energy intensity in the U.S. economy by 32 percent (compared to 28 percent without EE programs); and, reducing the need for additional electricity generating capacity by 10 percent (compared to the case without EE programs). (EE)

ER2: Use public private partnerships to bring cleaner, more reliable, and more affordable energy technologies to the marketplace, enhancing the energy choices and quality of life of Americans in 2020 relative to 2000 by: increasing the share of renewable energy to 10% (compared to 8 percent without EE programs); increasing the share of renewable-generated electricity to 12 percent (compared to 8 percent without EE programs); and, doubling the share of capacity additions accounted for by distributed power, which increases distributed generation to 11% of all electricity generation (compared to 8% without EE programs). (EE)

ER3: Reduce the burden of energy prices on low-income families by working with state and local agencies to weatherize at least 123,000 homes per year from 2003 through 2005. (EE)

ER4: Create public-private partnerships to provide technology to ensure continued electricity production from the extensive U.S. fossil fuel resource, including control technologies to permit reasonable-cost compliance with emerging regulations, and ultimately, by 2015, zero emission plants (including carbon) that are fuel-flexible, and capable of multi-product output and efficiencies over 60% with coal and 75% with natural gas. (FE)

ER5: By 2010, add over 1 million barrels a day of domestic oil production and almost 2 TCF per year of additional gas production as a result of technologies and practices from DOE supported research and development. (FE)

ER6: Maintain the Strategic Petroleum Reserve in a state of readiness to supply oil at sustained rate of 4.2 million barrels per day for 90 days within 15 days notice by the President. (FE)

ER7: Expand the capability of nuclear energy to contribute to the Nation's near and long-term energy needs by investing in our Nation's nuclear R&D infrastructure and promoting advanced research, such that by December 2004: the average capacity of existing U.S. nuclear power plants will increase from 90 to 92 percent; a new nuclear power plant construction project will be initiated in the United States; and a conceptual design will be developed for a nuclear energy system that addresses the technology issues hindering the worldwide expansion of nuclear power. (NE)

ER8: Provide national and international energy data, analysis, information and forecasts to meet the needs of the energy decision-makers and the public in order to promote sound policymaking, efficient energy markets and public understanding. (EIA)

ER9: Ensure Federal hydropower is marketed and delivered while passing the North American Electric Reliability Council's Control Compliance Ratings, meeting planned repayment targets, and achieving a recordable accident frequency rate at or below our safety performance standard. (PMA)

Budget Summary table

(dollars in thousands)

	FY 2001 Comparable Appropriation	FY 2002 Comparable Appropriation	FY 2003 Request
Office of Energy Efficiency and Renewable Energy (EE) Programs			
$ Energy Conservation excluding weatherization (272) ER1	$657,178	$685,470	$627,204
$ Renewable Energy Resources (271) ER2	370,453	386,406	407,720
$ Energy Conservation - Weatherization (272) ER3	152,664	230,000	277,100
Total EE	**1,180,295**	**1,301,876**	**1,312,024**
Office of Fossil Energy (FE) Programs			
$ Fossil Energy Research and Development (271), Clean Coal Technology (271), and Alternative Fuels (271) ER4 and ER5	545,982	627,626	534,155
$ Naval Petroleum and Oil Share Reserves (271), Elk Hill School Lands Fund (271), and Strategic Petroleum Reserve (274) ER6	187,312	233,525	281,823
Total FE	**733,294**	**861,151**	**811,509**
Nuclear Energy, Science and Technology (NE) Programs			
Office of			
$ Nuclear Energy Programs (271) ER7	277,105	293,928	250,659
Total NE	**277,105**	**293,928**	**250,659**
Environmental Information Administration (EIA)			
$ National Energy Information System (276) ER8	78,154	81,199	82,801
Total EIA	**78,154**	**81,199**	**82,801**
Power Marketing Administrations (PMA)			
$ Power Marketing Administrations (271) ER9	208,856	214,962	204,750
Total PMA	**208,856**	**214,962**	**204,750**
Total ER	**1,477,704**	**2,753,116**	**2,666,212**

FY 2003 CONGRESSIONAL BUDGET REQUEST
Proposed Appropriation Language

Fossil Energy Research and Development

(Including Transfer of Funds)

For necessary expenses in carrying out fossil energy research and development activities, under the authority of the Department of Energy Organization Act (Public Law 95–91), including the acquisition of interest, including defeasible and equitable interests in any real property or any facility or for plant or facility acquisition or expansion, and for conducting inquiries, technological investigations and research concerning the extraction, processing, use, and disposal of mineral substances without objectionable social and environmental costs (30 U.S.C. 3, 1602, and 1603), [$616,490,000,] $534,155,000, to remain available until expended, [of which $11,000,000 is to begin a 7-year project for construction, renovation, furnishing, and demolition or removal of buildings at National Energy Technology Laboratory facilities in Morgantown, West Virginia and Pittsburgh, Pennsylvania; and for acquisition of lands, and interests therein, in proximity to the National Energy Technology Laboratory, and] of which [$33,700,000] $40,000,000 shall be derived by transfer from funds appropriated in prior years under the heading "Clean Coal Technology", and of which $150,000,000 [and such sums as may be appropriated in fiscal year 2003] are to be made available, after coordination with the private sector, for a request for proposals for a Clean Coal Power Initiative providing for competitively-awarded [demonstrations of commercial scale technologies] research, development, and demonstration projects to reduce the barriers to continued and expanded coal use: *Provided*, [That the request for proposals shall be issued no later than 120 days following enactment of this Act, proposals shall be submitted no later than 150 days after the issuance of the request for proposals, and the Department of Energy shall make project selections no later than 160 days after the receipt of proposals: *Provided further*,] That no project may be selected for which sufficient funding is not available to provide for the total project: *Provided further*, That funds shall be expended in accordance with the provisions governing the use of funds contained under the heading ''Clean Coal Technology'' in [prior appropriations] 42 U.S.C. 5903d: *Provided further*, That the Department may include provisions for royalties or other means of repayment of Government contributions to individual projects [in an amount up to the Government contribution to the project on terms and conditions that are acceptable to the Department,] including repayments from sale and licensing of technologies from both domestic and foreign transactions: *Provided further*, That such repayments shall be retained by the Department for future coal-related research, development and demonstration projects, subject to appropriation in advance: *Provided further*, That any technology selected under this program shall be considered a Clean Coal Technology, and any project selected under this program shall be considered a Clean Coal Technology Project, for the purposes of 42 U.S.C. § 7651n, and Chapters 51, 52, and 60 of title 40 of the Code of Federal Regulations: *[Provided further*, That funds excess to the needs of the Power Plant Improvement Initiative procurement provided for under this heading in Public Law 106–291 shall be made available for the Clean Coal Power Initiative provided for under this heading in this Act:] *Provided further*, That no part of the sum herein made available shall be used for the field testing of nuclear explosives in the recovery of oil and gas [:

Provided further, That up to 4 percent of program direction funds available to the National Energy Technology Laboratory may be used to support Department of Energy activities not included in this account].

DEPARTMENT OF ENERGY
FY 2003 CONGRESSIONAL BUDGET REQUEST
FOSSIL ENERGY PROGRAM

EXECUTIVE BUDGET SUMMARY

Mission

The mission of the Fossil Energy (FE) Program is to enhance U.S. economic and energy security by: (1) managing and performing energy-related research that promotes the reliable, efficient and environmentally sound production and use of fossil fuels; (2) partnering with industry and others to advance clean and efficient fossil energy technologies toward commercialization in the U.S. and international markets; (3) providing the United States with adequate strategic and economic protection against disruptions in oil supplies; and: (4) supporting the development of information and policy options that benefit the public by ensuring access to adequate supplies of affordable and clean energy.

This supports the Energy Resources part of DOE's mission, as stated in the September 2000 USDOE Strategic Plan:

> ".... foster a secure and reliable energy system that is environmentally and economically sustainable....."

It also supports the Energy Resources goal as well as the objectives and strategies. The goal states:

> "Promote the development and deployment of energy systems and practices that will provide current and future generations with energy that is clean, efficient, reasonably-priced, and reliable."

The statutes and other authorities supporting FE R&D mission are listed in Appendix C of the Strategic Plan.

As part of the government-wide effort to streamline and consolidate activities as outlined in the President's Management Agenda and the opening chapters of the President's Budget, all activities related to coal in this budget are consolidated under the *President's Coal Initiative*. For the same reason, the infrastructure activities formerly carried out in the Natural Gas program have been transferred to the Department of Transportation's Office of Pipeline Safety, where a program in pipeline research has existed for many years.

Strategic Objectives, Performance Goals, and Strategies

Strategic Objectives, Program Strategic Performance Goals (PSPGs), and strategies for major FE programs are summarized in the table below.

Energy Resources Strategic Objectives, Program Strategic Performance Goals and Strategies	Related FE Programs
ER 4. Create public/private partnerships to provide technology to ensure continued electricity production from the extensive U.S. fossil fuel resource, including control technologies to permit reasonable-cost compliance with emerging regulations, and ultimately, by 2015, zero emission plants (including carbon) that are fuel-flexible, and capable of multi-product output and efficiencies over 60% with coal and 75% with natural gas	
ER 4-1. By 2005, complete development of mercury control systems capable of reducing mercury emissions by 70% (90% by 2010) in existing plants at half of current (2001) cost for application in over 300 GW of coal-fired plants in the U.S.	Presidential Coal Research Initiative [Central Systems/Innovations for Existing Plants]
Strategy: Develop control technologies that will help to ensure the ability to meet, at reasonable cost, planned or anticipated future regulation governing plants using fossil fuels.	
ER 4-2. By 2008, complete development of a 52% efficient, fuel-flexible Integrated Gasification Combined Cycle system.	Presidential Coal Research Initiative [Central Systems/Advanced Systems]
Strategy. Complete the development of a suite of power systems, including integrated gasification combined cycles, turbines, and combined cycles for application to central power generation	
ER 4-3. By 2005, complete development of options that can achieve CO_2 capture/storage at less than a 25% increase in the cost-of-electricity (COE). (By 2010, 5% increase in COE)	Presidential Coal Research Initiative [Sequestration R&D]
Strategy: Develop low-cost technology options for CO2 management that would include capture, separation, use and storage.	
ER 4-4. By 2010 time frame, introduce a $400/kW solid-state, modular (i.e. SECA) fuel cell having between 40 percent to 50 percent fuel-to-electricity efficiency, and optimal SECA fuel cell-miniturbine hybrid systems utilizing natural gas and hydrogen	Other Power Systems [Distributed Generation Systems/Fuel Cells]
Strategy: Integrate advanced power modules with other advanced fossil systems to achieve a Vision 21 fleet of plants that can maximize economic, energy and environmental efficiency	
Crosscutting Strategy (applies to all PSPGs above): Complete multiple demonstrations under the Clean Coal Power Initiative to ensure transfer to the private sector of technologies developed under the President's Coal Research Initiative	Presidential Coal Research Initiative [Clean Coal Power Initiative]

Energy Resources Strategic Objectives, Program Strategic Performance Goals and Strategies	Related FE Programs
ER4-5. By 2007 complete development of commercial size modules to provide significantly lower cost syngas and hydrogen from natural gas (25% less costly) to produce a variety of end-use fuel products for use in the transportation sector. Strategy. Pursue revolutionary technology (i.e, ITM membrane reactor) in an attempt to leapfrog the performance of existing technology.	Presidential Coal Research Initiative [Fuels]
ER 5. By 2010, add over 1 million barrels a day of domestic oil production and almost 2 TCF per year of additional gas production as a result of technologies and practices from DOE supported research and development.	
ER 5-1. By 2005, demonstrate advanced technologies with potential to reduce exploration and production cost 5-10%.	Natural Gas Technologies [Exploration and Production]
Strategy. Develop, for difficult geologic setting, drilling and completion technologies, and higher resolution imaging and diagnostics tools, that can reduce costs, increase ultimate recovery, and reduce formation damage.	Oil Technology [Exploration and Production]
ER 6. Maintain the Strategic Petroleum Reserve in a state of readiness to supply oil at sustained rate of 4.2 million barrels per day for 90 days within 15 days notice by the President.	
ER 6-1. Between April, 2002, and March 2005, add 108** million barrels to the SPR inventory, thus reaching full capacity of 700 million barrels.	Strategic Petroleum Reserve
Strategy. Work with the Department of the Interior to transfer royalty oil to the SPR.	
ER 6-2. Complete Big Hill (1st site) degassing operations by Aug 2006.	Strategic Petroleum Reserve
Strategy. Install mobile equipment, starting with Big Hill, that can be used to degas SPR sites to acceptable levels on a rotating basis	

Funding Profile

	FY 2001	FY 2002	FY 2003
PRESIDENT'S COAL RESEARCH INITIATIVE			
Clean Coal Power Initiative	0	150,000	150,000
Central Systems	196,864	96,000	86,950
Sequestration R&D	18,363	32,177	54,000
Fuels	22,940	32,200	5,000

Advanced Research (formerly AR&TD)	30,110	28,000	29,650
Total President's Coal Research Initiative	**268,277**	**338,377**	**325,600**
OTHER POWER SYSTEMS			
Distributed Generation Systems	51,274	58,124	49,500
Total Other Power Systems	**51,274**	**58,124**	**49,500**
TOTAL COAL AND OTHER POWER SYSTEMS	**319,551**	**396,501**	**375,100**
GAS			
Natural Gas Technologies	**43,925**	**45,200**	**22,590**
PETROLEUM			
	FY 2001	FY 2002	FY 2003
Oil Technology	**65,095**	**55,999**	**35,400**
PROGRAM DIRECTION & MANAGEMENT SUPPORT	**84,098**	**90,373**	**89,550**
PLANT & CAPITAL EQUIPMENT			
Construction	3,891	13,450	2,000
Total Plt. & Capital Equip.	**3,891**	**13,450**	**2,000**
ENVIRONMENTAL RESTORATION	**9,978**	**9,500**	**9,715**
COOPERATIVE RES. & DEVELOPMENT	**7,858**	**8,240**	**6,000**
IMPORT/EXPORT AUTHORIZATION	**2,295**	**2,400**	**2,500**
ADVANCED METALLURGICAL RESEARCH	**5,214**	**5,200**	**5,300**
SUBTOTAL FOSSIL ENERGY R&D			
Operating Expenses	538,014	613,413	546,155
Construction	3,891	13,450	2,000
SUBTOTAL FE R&D NEW BA	**541,905**	**626,863**	**548,155**
Transfer from SPR Petroleum Acct Applied to Oil Tech.	-12,000	0	0
Transfer from Clean Coal Previous Balances	-95,000	-33,700	-40,000
Use of Prior Year Balances	-4,350	-6,000	-14,000
TOTAL FOSSIL ENERGY R&D	**442,555**	**587,163**	**494,155**

Assistant Secretary for Fossil Energy _____

SUMMARY OF PROGRESS TOWARD PROGRAM STRATEGIC GOALS FOR THE STRATEGIC PETROLEUM RESERVE

ER6-1: Between April, 2002, and March 2005, add 108** million barrels to the SPR inventory, thus reaching full capacity of 700 million barrels.

Performance Indicator: Barrels of oil added to SPR inventory

ER6-2: Complete Big Hill (1st site) degassing operations by August, 2006

Performance Indicator: Barrels of oil degassed versus degassing schedule needed to ensure availability of oil for drawdown

Performance Standards: (apply to both ER6-1 and ER6-2)

Blue: Significantly exceeds annual milestones/targets
Green: Meets all annual milestones/targets
Yellow: Meets all critical milestones/targets, but behind on some others
Red: Failed to meet critical targets/milestones

Annual Performance Results and Targets for ER6-1 and ER6-2

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• *Establish a Northeast Heating Oil Reserve of up to 2 million barrels. (ER1-1)* • *Complete the transfer of Federal Royalty Oil to SPR by November 2000 per the FY 1999 Agreement with Interior Department. (ER1-1)*	• *Complete delivery of exchanged Federal Royalty Oil to SPR that was transferred to DOE in FY1999-2001 per the FY 1999 Agreement with the Interior Department. (ER6-1)*	• *Add 39.8 million barrels (cumulative from April 2002) of royalty oil to the SPR inventory (ER6-1)* • *Complete degas plant design by Oct. 1, 2002 (ER6-2)*

Note: For the FY 2001 revised set of measures, one new measure was added and one edited to reflect new priorities. FY2001 measures are keyed to a previous set of strategic objectives.

SUMMARY OF PROGRESS TOWARD PROGRAM STRATEGIC GOALS
FOR THE OIL AND NATURAL GAS TECHNOLOGIES

ER5-1: By 2005, demonstrate advanced technologies with potential to reduce exploration and production cost 5-10%.

Performance Indicator: Reduction in exploration and production costs relative to costs for currently available technology in comparable geologic settings,

Performance Standards:

Blue: Significantly exceeds annual milestones/targets
Green: Meets all annual milestones/targets
Yellow: Meets all critical milestones/targets, but behind on some others
Red: Failed to meet critical targets/milestones

Annual Performance Results and Targets for ER5-1

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• *Complete demonstration of five advanced secondary and tertiary technologies. Based on models it is estimated these technologies will increase near-term incremental production by 1.7 million barrels of oil, and long-term incremental production by over 2.4 billion barrels of oil. (ER1-2)*	• *Completed in FY01*	• *Complete development of a basin model for the Wind River basin that will assist operators in identifying high production zones and help them avoid areas of high potential water production with the potential to add 1 Tcf of gas to the reserve base. (ER5-1)*
• *Demonstrate the field application of a shoulder mounted, portable video methane leak detection system that can be used to significantly reduce costs of leak monitoring at refineries and other facilities while reducing harmful air emissions. Annual savings of $500,000 per year per refinery, on average, would result from regulatory acceptance and application of this technology. (ER1-2)*	• *Demonstrate safe economic slimhole drilling technology in actual use under Arctic conditions. This technology can significantly reduce cost and environmental impacts. (ER5-1)* • *Develop and demonstrate two technologies to detect and quantify areas of high fracture density in currently uneconomic low permeability gas reservoirs. This program has the near-term commercial potential to double average per-well productivity. (ER5-1)* • *Demonstrate a small-diameter, light-weight composite drill pipe for ultra-short radius drilling that will lower overall exploration/production costs. (ER5-1)*	• *Complete the development and demonstration of Compositie Drill Pipe (CDP) that will weigh less than half of its steel counter part,l increase the lateral distance which can be reached from an offshore drilling platform, and increase drilling depth. (ER5-1)* • *Complete development of an improved exploration and development methodology utilizing an intelligent computing system which, compared using conventional techniques, will increase the success rate for new exploration test wells in the Williston Basin study area by 50 percent (ER5-1)*
• *Quantify a hydrate deposit by correlating core samples with geophysical and well log data. (ER1-2)*	• *Complete laboratory testing and begin field demonstrations of an improved remedial technology for storage wells. This program seeks to reduce the cost of deliverability enhancement by 10% per year for the gas storage industry by 2007. (ER5-1)*	• *Drill and evaluate production potential of the ~600 ft. thick hydrate stability zone in a northern Alaska well. The field data from this well will be used to assess the viability of producing gas from North Slope hydrates. (ER5-1)*

Note: For the FY 2001 revised set of measures, one measure related to demonstration of technologies was deleted because it did not meet the criteria. FY2001 measures are keyed to a previous set of strategic objectives.

SUMMARY OF PROGRESS TOWARD PROGRAM STRATEGIC GOALS
FOR FUELS AND POWER SYSTEM (CENTRAL SYSTEMS)

ER4-1: By 2005, complete the development of mercury control systems capable of reducing mercury emissions by 70% (90% by 2010) in existing plants at half of current (2001) cost for application in over 300 GW of coal-fired plants in the U.S.

Performance Indicator: Reduction in percentage of mercury removed versus cost

ER4-2: By 2008, complete the development of a 52% efficient, fuel-flexible Integrated Gasification Combined Cycle (IGCC) system.

Performance Indicator: Estimated efficiency for IGCC systems based on improvements in subsystems.

Performance Standards: (Apply to ER4-1 and ER4-2)

Blue: Significantly exceeds annual milestones/targets
Green: Meets all annual milestones/targets
Yellow: Meets all critical milestones/targets, but behind on some others
Red: Failed to meet critical targets/milestones

Annual Performance Results and Targets for ER4-1 and ER4-2

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• *Deliver to EPA two years worth of high-quality $PM_{2.5}$ ambient monitoring data from the upper Ohio River Project. (ER2-2)*	• *Complete Phase I report characterizing concentration and composition for ambient PM2.5 emissions as input to the EPA PM2.5 National Ambient Air Quality Standards (NAAQS) review. This data will identify the impact of emission sources on air quality. (ER4-1)*	• *Complete short-term field testing of sorbent injection control technology capable of achieving 50-70% reduction in mercury emissions at 3/4 to ½ the cost of current technology ($30,000 - $70,000 lb. of Hg removed depending on coal type and other plant-specific factors) (ER4-1)*
• *Issue request for proposals for the commercial scale demonstration of technologies to assure the reliability of the Nation's energy supply from existing and new electric generating facilities. (ER2-2)*		
• *Issue request for proposals for the commercial scale demonstration of technologies to assure the reliability of the Nation's energy supply from existing and new electric generating facilities. (ER2-2)*		• *Make selections from CCPI Round 1. Initiate NEPA for all CCPI projects. (ER4-1)* • *Complete NEPA activities for six of eight PPII projects and initiate detailed design efforts. (ER4-1)*
• *Demonstrate hydrogen and CO_2 separation from syngas to meet the long-term goals of providing low-cost hydrogen for high-efficiency fuel cells and for providing concentrated CO_2 streams for sequestration. (ER2-2)* • *Initiate construction of a fixed-bed slagging gasification and fuel cell demonstration project (Kentucky Pioneer Energy Project). (ER2-2)*	• *Complete initial tests of the IGCC transport gasifier to confirm the feasibility of the technology to significantly improve reliability, cost effectiveness, and efficiency for producing electricity and other products. (ER4-2)* • *Complete construction and start operations of Circulating Atmospheric Fluidized Bed demonstration project at Jacksonville, Fl.*	• *Conduct critical tests of the IGCC transport gasifier in an oxygen-blown mode to prepare the way for testing of Vision 21 technologies for concentrating CO_2, prepare a report of results; and evaluate performance to confirm the feasibility of the technology to significantly improve reliability, cost effectiveness, and improved efficiency compared to existing technologies as a long-term goal. Current on line availability performance of IGCC on coal is 75-80%, capital cost is $1200-$1300/kW and thermal efficiency is 38%. This program will improve two of these three parameters by at least 2%. (ER4-2)* • *Complete proof-of-concept operation of fluidized-bed reactor high-temperature fuel gas desulfurization for IGCC systems in the NETL Syngas Generator and Gas Process Development Unit at design operating temperatures (>1000 °F) using a commercially available sorbent. (ER4-2)*

Note: FY2001 measures are keyed to a previous set of strategic objectives.

SUMMARY OF PROGRESS TOWARD PROGRAM STRATEGIC GOALS FOR FUELS AND POWER SYSTEM (CARBON SEQUESTRATION)

ER4-3: By 2005, complete the development of options that can achieve CO_2 capture/storage at less than a 25% increase in the cost-of-electricity (COE). (By 2010, 5% increase in COE)

Performance Indicator: Estimated cost of CO2 capture/storage versus COE

Performance Standards:

Blue: Significantly exceeds annual milestones/targets
Green: Meets all annual milestones/targets
Yellow: Meets all critical milestones/targets, but behind on some others
Red: Failed to meet critical targets/milestones

Annual Performance Results and Targets for ER4-3

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• *For carbon sequestration, expand the number of possible cost-effective, collaborative, multi-national applied R&D options carried to "proof of concept" stage. Complete multiple field experiments on promising technologies. (ER2-2)*	• *Conduct integrated research and field demonstrations of CO_2 sequestration in deep, unminable coal seams and depleted oil reservoirs and develop sufficient data to determine reservoir integrity and fate of injected CO_2. (ER2-2)*	• *Initiate the largest (3000 acre) terrestrial sequestration mined land reclamation project in the U.S. using hardwoods. Approximate-ly 1/3 of the trees will be planted each year for three years.. (ER4-3)* • *Develop a "Best Practices" manual, making initial recommendations on long-term monitoring techniques for use with storage of CO_2 in geologic settings. (ER4-3)*

Note: FY2001 measures are keyed to a previous set of strategic objectives.

SUMMARY OF PROGRESS TOWARD PROGRAM STRATEGIC GOALS FOR FUELS AND POWER SYSTEM (DISTRIBUTED GENERATION SYSTEMS)

ER4-4: By 2010 time frame, introduce a $400/kW solid-state, modular (i.e. SECA) fuel cell having between 40 percent to 50 percent fuel-to-electricity efficiency, and optimal SECA fuel cell-miniturbine hybrid systems utilizing natural gas and hydrogen

Performance Indicator: Estimated cost and efficiency of SECA fuel cells

Performance Standards:

Blue: Significantly exceeds annual milestones/targets
Green: Meets all annual milestones/targets
Yellow: Meets all critical milestones/targets, but behind on some others
Red: Failed to meet critical targets/milestones

Annual Performance Results and Targets for ER4-4

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• *Begin testing of a 300 kW-1MW solid oxide fuel cell/turbine hybrid commercial prototype for distributed power applications. (ER2-2)*	• *Complete demonstration of a commercial-scale, 250 kW Molten Carbonate Fuel Cell (MCFC) power plant system. This test will verify the commercial design for the MCFC technology for the combined heat and power (CHP) or distributed generation (DG) market and, if successful will justify the construction of a MCFC manufacturing facility in the U.S. (ER4-4)*	• *Validate the high current densities for single cell SECA SOFCs in the 650 - 950 Centigrade temperature range as the initial step necessary to achieve the $400/kW cost target.. (ER4-4)*
• *Begin construction of a 1MW Solid Oxide Fuel Cell (SOFC) hybrid. (ER2-2)*	• *Restart and test the 220-kW hybrid solid oxide fuel cell (SOFC)-microturbine powerplant at the National Fuel Cell Research Center. If successful, this test will verify the commercial design for this particular SOFC technology for DG or CHP applications (ER4-4)*	• *Develop solid oxide fuel cell materials that operate at lower temperatures (700°C), thereby assuring with 95% confidence that fuel cell capital costs of $400/kW in 2010 will be achieved. (ER4-4)*

Note: FY2001 measures are keyed to a previous set of strategic objectives.

SUMMARY OF PROGRESS TOWARD PROGRAM STRATEGIC GOALS FOR FUELS AND POWER SYSTEM (FUELS)

ER4-5: By 2007 complete the development of modules to provide significantly lower cost syngas and hydrogen from natural gas (25% less costly) to produce a variety of end-use fuel products for use in the transportation sector.

Performance Indicator: Estimated cost of producing syngas and hydrogen versus current costs.

Performance Standards:

Blue: Significantly exceeds annual milestones/targets
Green: Meets all annual milestones/targets
Yellow: Meets all critical milestones/targets, but behind on some others
Red: Failed to meet critical targets/milestones

Annual Performance Results and Targets for ER4-5

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• *Complete laboratory evaluation of initial set of hydrogen separation membranes. (ER1-3)* • *Begin laboratory scale test operations of a novel syngas ceramic membrane reactor to reduce gas-to-liquid fuel conversion costs and initiate construction of first stage scale-up of the reactor. (ER1-3)* • *Complete negotiations with industrial teams selected to implement the Early Entrance Coproduction Plant (EECP) projects and initiate Phase I of the three-phase activity. (ER1-3)*	• *Complete laboratory scale test operations of novel ITM-syngas ceramic membrane reactor to reduce gas-to-liquid fuel conversion costs. (ER4-5)*	• *Demonstrate, in sustained operation at a syngas flow rate of 24,000 cubic feet per day, that an ITM membrane reactor can meet a competitive oxygen separation performance level at greater than 30% capital cost savings over conventional syngas production technology. (ER4-5)*

Note: For the FY 2001 revised set of measures, one measure related to operation of the LaPorte Slurry Phase Reactor was deleted and one related to hydrogen separation membranes was added. FY2001 measures are keyed to a previous s et of strategic objectives.

DEPARTMENT OF ENERGY
FY 2003 CONGRESSIONAL BUDGET REQUEST

FOSSIL ENERGY RESEARCH AND DEVELOPMENT

Program Mission

The U.S. relies on fossil fuels for about 85% of the energy it consumes. Many forecast that high U.S. reliance on these fuels will continue for decades. For example, the Energy Information Administration's 2001 Annual Energy Outlook projects that fossil fuel reliance could approach 90% by 2020. Accordingly, a key goal of the Department's fossil energy activities is to ensure that economic benefits from moderately-priced fossil fuels, and a strong domestic industry that creates export-related jobs, are compatible with the public's expectation for exceptional environmental quality and reduced energy security risks.

In support of this goal, the mission of the Fossil Energy (FE) Research and Development (R&D) program is to enhance U.S. economic and energy security by: (1) managing and performing energy-related research that promotes the reliable, efficient and environmentally sound production and use of fossil fuels; (2) partnering with industry and others to advance clean and efficient fossil energy technologies toward commercialization in the U.S. and international markets, and: (3) supporting the development of information and policy options that benefit the public by ensuring access to adequate supplies of affordable and clean energy.

To ensure that Federally funded and developed technologies and related analysis are relevant to market and public needs, and are transferred into commercial applications, FE participates in joint partnerships with industry utilizing a variety of mechanisms such as cost-shared contracts, targeted outreach activities, and cooperative research and development agreements with the Department's National Energy Technology Laboratory (NETL) and other National Laboratories.

Program Areas

The FY 2003 request for Fossil Energy R&D is $494.2 million. Comparable activities (i.e., R&D plus demonstrations) were funded at $587.2 million in FY 2002.

FOSSIL ENERGY RESEARCH AND DEVELOPMENT OVERVIEW (Cont'd)

As part of the government-wide effort to streamline and consolidate activities as outlined in the President's Management Agenda and the opening chapters of the President's Budget, all activities related to coal in this budget are consolidated under the *President's Coal Research Initiative*. Technologies related to electricity production using other fuels as their primary energy source, focused on generic technology for electricity production, or novel ways of generating electricity are contained in the *Other Power Systems* program. In aggregate, these two programs address demands of the post-2000 domestic electricity market, including the need for reliable, moderate-cost electricity generation that can reduce emissions consistent with evolving environmental requirements while meeting growing electricity demand. These activities will also help U.S. industry develop options for a large and growing export market, while contributing to national energy security. Based on these priorities, the program is focused on three goals: (1) develop progressively higher efficiency systems with 10-20% lower busbar electricity costs, which will ultimately evolve into a "Vision 21" fleet of new power and energy plants with near zero levels of pollutants as well as CO_2; (2) develop super-clean emission control systems for SO_2, NO_x, air toxics, and particulate matter that can be applied to existing plants; and (3) evaluate economically viable approaches to carbon sequestration to address climate change concerns.

The Vision 21 concept integrates program goals to develop the full potential of our abundant fossil fuel resources while addressing climate change concerns. Vision 21 plants would comprise a portfolio of fuel-flexible systems and modules capable of producing electricity and/or a varied slate of high-value fossil fuels tailored to market demands in the 2010-2015 time frame. Distinguishing features of the Vision 21 fleet are (1) capability to produce cheaper electricity at efficiencies over 60 percent when fueled by coal, and 75 percent when fueled with natural gas; (2) near zero pollutants to meet more stringent emissions standards (less than one-tenth of current New Source Performance Standards) at a lower cost; (3) options for no net CO_2 emissions; (4) fuel flexibility (coal, natural gas, plus opportunity fuels such as municipal and industrial wastes); and (5) a flexible set of integrated modules configured to meet a range of market applications and capable of producing an array of high-value commodities (such as chemicals, high-quality steam, liquid fuels, and hydrogen) at competitive prices in a free market. Many of the coal and power-related technologies, after achieving their performance goals, will be integrated into the Vision 21 concept. FY 2003 activities tied to Vision 21 include achieving ultra-high efficiencies by working toward integrating advanced components such as a coal gasifier, fuel cell and turbine.

Significant progress towards achieving these goals will be made in FY 2003 in the Clean Coal Power Initiative (CCPI) as projects involving gasification, advanced fluidized bed combustion, and fuel cell technology progress. These projects, begun under the Clean Coal Technology program, now carried out under CCPI, are to be complemented by new projects to be funded under the solicitation

in 2002. Supporting CCPI activities, an internet documentation database is available that allows stakeholders interested in the progress and implementation of clean coal technologies to retrieve updated information on complete clean coal projects. The infrastructure provided by CCPI projects is deployed, in certain cases, to advance the R&D program. Similarly, issues addressing systemic improvements in the technologies used in CCPI projects are investigated under the R&D program. Because of the close relationship between the FER&D and the CCT programs, in FY 2003, all balances in the CCT account will be combined with the FER&D account. All existing commitments will continue to be honored, but if funds become available, the Department will have the flexibility to use them within the CCPI program.

President's Coal Research Initiative

The President's Coal Research Initiative includes the Clean Coal Power Initiative, Central Systems, Sequestration, Fuels, and Advanced Research. The requested FY 2003 funding for the President's Coal Research Initiative is $325.6 million, versus FY2002 funding of $338.4 million. Despite modest reductions from last year's enacted level, this represents the largest request for coal reseach by a President in 25 years.

The Administration proposed a new vision in coal research in FY 2002. FY 2003 is the second year of a Presidential Initiative being implemented within the Department of Energy's Fossil Energy program, that combines private investments with federal matching funds to carry out research and development and first-of-a-kind installations of advanced technologies on coal-fired power plants. As part of this initiative, the administration is requesting $150 million in FY 2003 for funding joint government-industry-funded projects exploring new technologies that can enhance the reliability and environmental performance of coal-fired power generators. In FY 2002, $150 million was made available to initiate the Clean Coal Power Initiative. Congress has provided the Department permission to add advance appropriations expected in the future, and the Department expects to issue a Round 1 solicitation in February 2002. This program responds to the National Energy Policy recommendation to invest in the development of clean coal technologies in response to meeting electricity supply and availability. The nation's power generators, equipment manufacturers, coal producers and others will help identify the most critical barriers to coal's use in the power sector. Industry also will be required to share in the costs of the initiative, with the private participants' share rising to more than 50 percent by the time new technologies are ready for testing at demonstration scales.

FOSSIL ENERGY RESEARCH AND DEVELOPMENT OVERVIEW (Cont'd)

Activities included in the $85.0 million Central Systems request for FY 2003 are divided into two major areas. The first is Innovations for Existing Plants. A major thrust of this program area is the development of technology to comply with the requirements of the Clean Air Act Amendments (CAAA) of 1990 and new or pending regulations. The FY 2003 budget request emphasizes: development of retrofit mercury, NO_x, particulate matter, and acid gas (SO_3, HC1, and HF) control technologies, analysis of 316(b) cooling water intake requirements, determining $PM_{2.5}$ source-receptor relationships as they relate to coal-fired power plant emissions, and environmental characterization of coal-combustion and gasification byproducts.

The second area in Central Systems is Advanced Systems, which includes Pressurized Fluidized Bed (PFB) combustion, Integrated Gasification Combined Cycle (IGCC), and Advanced Turbines. The target for coal-fueled, advanced central systems is to achieve efficiencies in the 42-48 percent range in the 2000-2005 period that will provide the engineering foundation for system efficiencies in the 55-60 percent range. These latter improvements could reduce CO_2 emissions by over 40 percent compared to current coal-fired systems.

- PFB is being refocused to emphasize hybrid systems including gasification In FY 2002, the applicable combustion technology for Vision 21 was folded into the Vision 21 gasification/combustion hybrid concepts under IGCC. For PFB, major emphasis in FY 2003 shifts to provide the key scale-up technology for gasification/fluid bed combustion hybrids for Vision 21 concept options.

- IGCC offers the potential for significant increases in thermal efficiency, near-zero emissions of pollutants, and the ability to co-produce electricity and other valuable products. In FY 2003, the program will continue its focus on cost, efficiency and reliability improvements and new concepts for gas conditioning (separation and clean-up) and performance optimization for power generation and co-production applications.

- Funding for Advanced Gas Turbine Program work on utility-scale turbines was completed in FY 2001 with industry having taken over the lead for commercializing this technology. In FY 2003, work will concentrate on adapting turbine systems for use in coal-based systems, as well as integrating turbines into hybrid systems with fuel cells.

Sequestration R&D explores the potential for greenhouse gas capture and isolation from the atmosphere, particularly the capture and isolation of carbon dioxide. FE's sequestration research is being carried out in collaboration with other parts of the Department, other

government agencies, national laboratories, other countries, and industrial firms, and pursues a balanced set of approaches to establish both the environmental acceptability and the required technical and economic performance. The FY 2003 request of $54.0 million for Sequestration R&D will carry to "proof-of-concept" completion a number of applied R&D options being investigated as part of prior solicitations. For example, integrated research and field demonstrations of CO_2 sequestration in deep, unminable coal seams and depleted oil reservoirs will be conducted and sufficient data developed to determine reservoir integrity and the fate of injected CO_2. The long-term program goal is to achieve large-scale carbon sequestration at $10/ton, which could lead to the reduction of carbon emissions by 145 million tons per year in the U.S. and 270 million tons worldwide by 2030.

The Fuels Program, for which $5 million is requested in FY 2003, will focus on new ceramic membranes that would effectively separate oxygen from air. The oxygen is subsequently used to produce synthesis gas from natural gas in a single membrane reactor step. This concept outlines process that, if successful, would be significantly less costly than conventional synthesis gas technology. The resulting synthesis gas produced could be chemically combined to produce clean liquid fuels, hydrogen, or chemicals.

The FY 2003 request for Advanced Research is $31.7 million, which funds two types of activities. The first is a set of crosscutting studies and assessment activities in environmental, technical and economic analyses, coal technology export and international program support. The second includes crosscutting fundamental and applied research programs that focus upon developing the technology base in the enabling science and technology areas that are critical to the successful development of both superclean, very high efficiency coal-based power systems and coal-based fuel systems, with greatly reduced or no net emissions of CO_2. These systems are embodied in the Vision 21 energyplex. A key supporting activity is a Focus Area for Computational Energy Science that will develop advanced simulation techniques to improve and speed development of cleaner, more efficient devices and plants. Advanced Research seeks a greater understanding of the physical, chemical, biological and thermodynamic barriers to achieving economic, technologic, and environmental goals and to identify ways to overcome those barriers. Added emphasis this year will be given to developing sensors and controls for advanced energy systems and enabling technologies for critical areas of Vision 21.

Other Power Systems

The Other Power Systems category encompasses Distributed Generation Systems (Fuel Cells and Novel Generation Systems). The FY 2003 request is $49.5 million. These systems offer the potential to cost-effectively meet peak demand, and in some cases base and

intermediate load, without the need for capital intensive central station capacity or costly investments in transmission and distribution. Fuel cell distributed generation systems have the additional advantage of being capable of reducing criteria pollutants well below current New Source Performance Standard levels, reducing non-criteria pollutants such as CO_2 and acid rain precursors, and reducing thermal emissions to the environment. In FY 2003, in the tubular solid oxide fuel cell (SOFC) area, the effort will be to implement the development of low-cost manufacturing processes for the design of a commercial manufacturing facility for the production of early-commercial systems. In addition, demonstrations of Molten Carbonate Fuel Cell (MCFC) technology will continue in order to achieve significant cost reduction. Successful demonstrations could result in the construction of manufacturing facilities in the U.S. A continuing thrust of the program is development of a low cost 2-10 kilowatt solid state fuel cell for distributed and auxiliary power unit applications. Toward this end, the Solid State Energy Conversion Alliance (SECA) provides a forum for entities interested in low-cost, high power-density, solid state fuel cell systems for distributed generation and auxiliary power unit applications. SECA is committed to developing advanced, modular technology that can be readily customized, while still being mass produced to reduce costs, with a cost target of $400 or less per kilowatt for a complete stationary solid state system. In FY 2003, efforts under SECA will begin to identify and implement technology solutions leading to the design of 2-10 kW SECA modules for mass customization. Novel Generation Systems is targeted at systems that take all-new approaches to electricity generation rather than work to refine existing ideas. These solicitations will be open to any workable technology, not covered in existing programs, that has the potential to improve our electricity system while operating primarily on fossil fuels or waste gases.

Significant potential benefits can be realized from achieving the goals for the coal and power-related activities. For example, combining high efficiency power generation with carbon sequestration technology has the potential to reduce global carbon emissions by more than 500 million tons per year by 2030, and by much more as the existing portfolio of powerplants retires and is replaced by improved technology. Potential savings in cost of electricity is estimated at $0.5 billion per year by 2015, reaching $2.5 billion per year in 2030, and contributing to power plant sales of $10 billion per year in 2030.

Natural Gas Technologies

In FY 2003, $22.6 million is requested for Natural Gas Technologies. In keeping with the goals of the President's Management Agenda to reduce duplication, the infrastructure activities of the Natural Gas Technology program have been transferred to the

Department of Transportation's Office of Pipeline Safety. This transfer will allow for better coordination, planning and management of these activities under one Federal program.
EIA, in its 2001 Annual Energy Outlook (AEO2001), projects over a 60 percent increase in domestic natural gas consumption between 2000 and 2020, with nearly two-thirds of this increase used for electric power generation. This requires increasing gas production from parts of the vast domestic resource base that are not currently economical to recover because of the geological setting, environmental constraints, or location relative to infrastructure. The gas program focuses on technical and market needs, and is closely coordinated with industry. Activities seek to ensure long-term availability and reliability of natural gas in an economic, efficient, and environmentally beneficial manner. Major R&D elements include: Exploration and Production; Gas Hydrates; and Effective Environmental Protection.

The Exploration and Production request for FY 2003 is $15.5 million, and includes a range of activities, foremost of which are:

- Advanced Drilling, Completion, and Stimulation projects to develop and demonstrate tools and techniques that will result in minimum formation damage, reduce costs and improve recovery, and minimize the environmental impact of drilling-related operations and waste disposal. FY2003 activities include development of the world's first microwave-processed drill bit and composite drill pipe and exploration of technologies for drilling deeper than 16,000 feet below the earth's surface, including advanced coatings and hardening of "Smart" systems and sensors, and low friction, wear resistant coatings/materials (formerly know as "Deep Trek"..

- Advanced Diagnostics and Imaging Systems to develop and demonstrate advanced imaging and prediction techniques for locating productive areas within low-permeability and fractured reservoirs, and identify and assess the potential productivity of non-conventional gas reservoirs in priority basins to reduce exploration and production risks. These technologies will reduce the number of dry holes; improve production from fractured reservoirs; increase U.S. exploration through greater industry access to and use of geologic and geophysical basin-scale data; and increase the cost effectiveness of field development, infill drilling, and extraction processes.

- Funding of stripper well revitalization will be expanded.

The request for Gas Hydrates is $4.5 million, which is a long-term effort seeking to convert the potential gas hydrates resource (estimated at up to 320,000 Tcf) into gas reserves while developing technologies to assure safe petroleum operations in hydrate areas, and to define the impact of methane hydrates on the global carbon cycle.

The Effective Environmental Protection program request is $2.6 million, and works to improve the efficiency of environmental protection through a combination of risk assessment technology development, regulatory streamlining, impact analysis, and facilitating dialogue that attempts to achieve consensus among affected parties on ways to balance the need to develop the Nation's energy resources with the maintenance of our environmental values.

Oil Technology

In FY 2003, $35.4 million is requested for the Oil Technology program, which seeks to enhance energy security through increased domestic production, as well as helping the U.S. to be a responsible steward of its oil resources. The combined impact of FE R&D could contribute toward extending the availability of these resources, extending reservoir life, increasing domestic production, and increasing royalties to the government from Federal lands.

Objectives of the oil technology program include: stem the decline in domestic oil production; improve the capability of the Nation's petroleum industry to increase the supply of secure, domestic oil; and reduce and resolve environmental issues associated with domestic oil production and processing. These activities are carried out under the areas of Exploration and Production, Reservoir Life Extension and Management, and Effective Environmental Protection.

The FY 2003 request for Exploration and Production is $16.4 million, which includes work in several areas:

- Advanced Drilling, Completion, and Stimulation work focuses on developing tools and techniques to drill, complete and stimulate oil wells to reduce costs, improve well productivity, and reduce environmental impacts (smaller surface "footprint" and reduced drilling wastes). FY 2003 activities include demonstrating safe, economic slimhole drilling technology under Arctic conditions.

- Advanced Diagnostics and Imaging Systems develops technologies and methodologies that improve the success rates and cost efficiencies for the development of existing fields and the discovery of new fields. Development of multiple imaging technologies through research at the pore-to-field scales is targeted to reduce exploration and production risks by more clearly defining deeper, more geologically complex and fracturing oil reservoirs.

- Reservoir Efficiency Processes include research to develop and demonstrate tools and methodologies that permit oil operators to recover hydrocarbons from known reservoirs not producible by current technology.

- PRIME will focus on fundamental research in exploration and production technologies. The long-term research and development will lead to significant advances in the state-of-the-art, thus reducing finding costs, dry hole risks, and environmental impacts associated with finding and producing petroleum.

The Reservoir Life Extension and Management program request is $9.5 million to encourage recovery of the 350 billion barrels of discovered but unproduced domestic oil resource, and increase recovery of oil from Federal lands. The program will focus on demonstration and improvement of advanced technologies to bridge the gap between the laboratory success and acceptance in the field. The identification and promotion of best practices will continue. Evaluation of past advanced field trials in large, promising Class 1, 2, and 3 reservoirs will be completed. Demonstration and testing of technologies specifically targeted for independent operators will be expanded to focus on the frontier Rocky Mountains and other deep resources.

The Effective Environmental Protection FY 2003 request is $9.5 million for technologies and practices that reduce the threat to the environment and decrease the cost of effective environmental protection and compliance involved in oil exploration, production, and oil processing. The program will focus on detection and control of air emissions from gas and oil equipment and facilities, treatment and reduction of produced water to meet environmental standards, remediation of soils that have been contaminated with hydrocarbons or produced water, treatment and disposal of wastes containing naturally occurring radioactive materials, underground injection of produced water, and other approaches to manage oil and gas field wastes.

Other Program and Crosscutting Areas

FE is taking steps to ensure that the U.S. benefits directly from cooperative research with foreign governments and multilateral institutions as well as enhanced international regulatory coordination. FE is also working with other Departmental groups, Federal

agencies, international organizations and private sector companies to promote the export of domestic fossil fuel technology, including highly efficient processes that can reduce global greenhouse gas emissions.

In the area of Environmental Restoration, FE is working to provide a safe environment at the FE R&D facilities, as well as at off-site locations where R&D projects are sponsored. In addition, FE is responsible for correcting environment, safety and health (ES&H) problems at the Albany Center, a former U.S. Bureau of Mines facility that was transferred to FE in 1997. FY 2003 funding at a level of $9.7 million is targeted at corrective actions to ensure that the FE R&D facilities are operating in compliance with Federal, state and local ES&H requirements, and that the environmental contamination associated with the on-site operations and off-site locations is remediated. The major share of funding will focus on environmental remediation, indoor air quality and ventilation, industrial safety, emergency preparedness, fire protection, control of toxic and hazardous materials, and protection of water and air quality. A sustained commitment to ES&H is an important factor in retaining public trust in the conduct of FE activities.

The FY 2003 request for Program Direction and Management Support is $89.6 million. This provides funding for salaries, benefits and overhead expenses for management of the Fossil Energy program at Headquarters and the National Energy Technology Laboratory (NETL), with sites in Morgantown, WV, Pittsburgh, PA and Tulsa, OK.

The FY 2003 request for the Import/Export Authorization Program is $2.5 million, which promotes the development of interfuel competition and markets for U.S. natural gas and electricity through regulation of natural gas imports and exports, exports of electricity, and the construction and operation of electric transmission lines which cross U.S. international borders.

The Advanced Metallurgical Processes Program at Albany, Oregon , for which $5.3 million is requested in FY 2003, seeks to determine the factors that limit service life of materials in industrial, structural, or engineering applications and provide solutions to service-life problems through new materials technology, to develop and demonstrate technologies that will reduce waste and pollution, and to use capabilities and expertise to provide focused solutions to high priority national problems. The research at Albany provides information on the performance characteristics of materials being specified for the current generation of fossil-fueled power systems, on the development of cost-effective materials for inclusion in Vision 21 systems, and for solving environmental emission problems related to fossil fired energy systems. This program stresses full participation with industry and emphasizes cost sharing to the extent possible.

DEPARTMENT OF ENERGY
FY 2003 CONGRESSIONAL BUDGET REQUEST

FOSSIL ENERGY RESEARCH AND DEVELOPMENT

PROGRAM FUNDING PROFILE
($ in thousands)

Sub-program	FY 2001 Enacted	FY 2002 Enacted	FY 2003 Base	FY 2003 Request	Program Change Request vs. FY 2002 Dollar	Program Change Request vs. FY 2002 Percent
President's Clean Research Initiative						
Clean Coal Power Initiative						
Operating Expenses	$0	$150,000	$150,000	$150,000	$0	0%
Central Systems						
Operating Expenses	$196,864	$96,000	$96,000	$84,950	$-11,050	-12%
Sequestration						
Operating Expenses	$18,363	$32,177	$32,177	$54,000	$21,823	68%
Fuels						
Operating Expenses	$22,940	$32,200	$32,200	$5,000	$-27,200	-84%
Advanced Research (formerly AR&TD)						
Operating Expenses	$30,110	$28,000	$28,000	$31,650	$3,650	13%
Subtotal President's Coal Research Initiative	$268,277	$338,377	$338,377	$325,600	$-12,777	-4%
Other Power Systems						
Distributed Generation Systems						
Operating Expenses	$51,274	$58,124	$58,124	$49,500	$-8,624	-15%

PROGRAM FUNDING PROFILE - FOSSIL ENERGY RESEARCH AND DEVELOPMENT (Cont'd)

Sub-program	FY 2001 Enacted	FY 2002 Enacted	FY 2003 Base	FY 2003 Request	Program Change Request vs. FY 2002 Dollar	Program Change Request vs. FY 2002 Percent
Subtotal Other Power Systems	$51,274	$58,124	$58,124	$49,500	$-8,624	-15%
Gas						
Natural Gas Research						
Operating Expenses	$43,925	$45,200	$45,200	$22,590	$-22,610	-50%
Subtotal Gas	$43,925	$45,200	$45,200	$22,590	$-22,610	-50%
Petroleum						
Oil Technology						
Operating Expenses	$65,095	$55,999	$55,999	$35,400	$-20,599	-37%
Subtotal Petroleum	$65,095	$55,999	$55,999	$35,400	$-20,599	-37%
Program Direction and Management Support						
Operating Expenses	$84,098[a]	$90,373[a]	$85,237	$89,550[a]	$-823	-1%
Plant and Capital Equipment						
Construction	$3,891	$13,450	$13,450	$2,000	$-11,450	-85%
Fossil Energy Environmental Restoration						
Operating Expenses	$9,978	$9,500	$9,500	$9,715	$215	2%

[a] The FY 2001 and FY 2002 column of the FY 2003 Congressional Request includes funding in the amount of $4,012,000 and $4,373,000, respectively, for the Government's share of increased costs associated with pension and annuitant health care benefits. These funds are comparable to FY 2003 funding of $4,850,000.

PROGRAM FUNDING PROFILE - FOSSIL ENERGY RESEARCH AND DEVELOPMENT (Cont'd)

Sub-program	FY 2001 Enacted	FY 2002 Enacted	FY 2003 Base	FY 2003 Request	Program Change Request vs. FY 2002 Dollar	Program Change Request vs. FY 2002 Percent
Cooperative Research and Development						
Operating Expenses	$7,858	$8,240	$8,240	$6,000	$-2,240	0%
Import/Export Authorization						
Operating Expenses	$2,295	$2,400	$2,400	$2,500	$100	4%
Advanced Metallurgical Processes						
Operating Expenses	$5,214	$5,200	$5,200	$5,300	$100	2%
Transfer from SPRO (non-add)	($-12,000)	(- - -)	(- - -)	(- - -)	(- - -)	(- - -)
Prior Year Offsets						
Operating Expenses	$-4,350	$-6,000	$-6,000	$-14,000	$-8,000	0%
Use of previously appropriated clean coal funds	$-95,000	$-33,700	$-33,700	$-40,000		
TOTAL Request	$442,555	$587,163	$582,027	$494,155	$-86,708	-15%
Summary						
Operating Expenses	$438,664	$573,713	$568,577	$492,155	$-75,258	-13%
Construction	$3,891	$13,450	$13,450	$2,000	$-11,450	-85%
Total Program	$442,555	$587,163	$582,027	$494,155	$-93,008	-16%
Staffing (FTEs)						
Headquarters	112	130	147	147		
Field	550	575	624	624		

PROGRAM FUNDING PROFILE - FOSSIL ENERGY RESEARCH AND DEVELOPMENT (Cont'd)

Sub-program	FY 2001 Enacted	FY 2002 Enacted	FY 2003 Base	FY 2003 Request	Program Change Request vs. FY 2002 Dollar	Program Change Request vs. FY 2002 Percent
Total Staffing	662	705	771	771		

Authorizations:
P.L. 95-91, "Department of Energy Organization Act" (1997)

DEPARTMENT OF ENERGY
FY 2003 CONGRESSIONAL BUDGET REQUEST

FOSSIL ENERGY RESEARCH AND DEVELOPMENT

CLEAN COAL POWER INITIATIVE

I. **Mission Supporting Goals and Objectives**:

Coal is the most abundant U.S. energy resource, with domestic coal reserves exceeding the energy potential of the world's oil reserves. About 90% of all coal produced in the U.S. is used for electricity generation, and over half of our Nation's electricity is produced by coal-fired power plants. Meeting our Nation's rising demands for clean, reliable, and affordable electricity will require the use of coal for the foreseeable future. We must therefore develop technologies that will enable the continued use of coal to meet our growing demand for electricity in an environmentally sound manner.

The Bush Administration has proposed a new vision in clean coal research. The Clean Coal Power Initiative (CCPI) is an effort within the Department of Energy's Fossil Energy program that combines industry investments in research and development with federal matching funds for research, development and demonstration of advanced technologies on coal-fired power plants. As part of this Presidential Initiative, the administration is requesting $150 million in FY 2003 to fund joint government-industry-funded demonstrations of new technologies that can enhance the reliability and environmental performance of coal-fired power generators. The CCPI responds to the National Energy Policy call to address the reliability and affordability of the Nation's electricity supply, particularly from its coal based generation, and is a key component of the President's commitment to research on clean coal technologies to meet this challenge.

The first phase of CCPI is a cooperative, cost shared program between the government and industry to rapidly demonstrate emerging technologies in coal-based power generation and to accelerate their commercialization. The Nation's power generators, equipment manufacturers, coal producers and others help identify the most critical barriers to coal's use in the power sector. The CCPI is a ten year Presidential Initiative funded at a total Federal cost of $2 billion with a minimum industry cost share of 50%. Commercially successful technologies will contribute royalties back to a program fund to underwrite future research efforts.

Beginning with the FY 2003 budget the activities formerly carried out under the Clean Coal Technology account will be shifted to CCPI to bring all the coal efforts under one umbrella. This is in keeping with the goals of the President's Management Agenda to

I. **Mission Supporting Goals and Objectives**: CLEAN COAL POWER INITIATIVE (Cont'd)

consolidate programs and eliminate duplication. This change will result in improved coordination and management of the coal R&D efforts. Existing commitments to projects will be carried out under this program. However, in the event of deobligations or other cost savings, funds will be made available to the program for the next round of solicitation.

The CCPI, and its predecessor Power Plant Improvement Initiative (PPII), builds on the successes and lessons learned from the Clean Coal Technology Demonstration and the advances from the coal R&D program. In FY 2003, the first round of projects will commence. NEPA will be completed for six of eight PPII projects and detailed design efforts initiated.

Performance Measures:

Until the selection of specific projects, elaboration of specific project related performance measures cannot be elaborated. However, a goal of the program is to reduce the capital cost of new coal technologies to make them competitive with conventional plants by 2006. In FY 2003, however, project selections from the first round of the CCPI solicitation will be completed. NEPA will be initiated for all projects.

II. A. **Funding Schedule**: ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003	$Change	%Change
Clean Coal Power Initiative	$0	$150,000	$150,000	$0	0%
Total, Clean Coal Power Initiative	$0	$150,000	$150,000	$0	0%

II. B. **Laboratory and Facility Funding Schedule**: ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003	$Change	%Change
All Other	$0	$150,000	$150,000	$0	0%
Total, Clean Coal Power Initiative	$0	$150,000	$150,000	$0	0%

III. **Performance Summary**: ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Clean Coal Power Initiative	No activity. ($0)	Initiate a Clean Coal Power Initiative (CCPI) as a follow-on to the Power Plant Improvement Initiative (PPII) under Central Systems, that will demonstrate the latest advanced clean coal-based technologies beyond PPII , aimed at sustaining enhanced electricity reliability, generation capacity and clean, affordable power. ($148,500)(TBD)	Continue the Clean Coal Power Initiative (CCPI) to demonstrate advanced clean coal-based technologies that enhance electricity reliability, increase generation capacity, and provide clean, affordable power. Issue a second solicitation for improving performance of clean coal-based power generation systems. ($148,500)(TBD)
Clean Coal Power Initiative (Cont'd)	No activity. ($0)	Fund technical and program management support ($1,500)	Fund technical and program management support ($1,500)
Clean Coal Power Initiative (Former Clean Coal Technology Activities)			Former Clean Coal Technology Activities: During FY 2003, McINTOSH 4A and McINTOSH 4B are expected to continue design activities. KY PIONEER will continue construction activities. COAL DIESEL will initiate operation. JEA will continue operation. Coal Proc. for Clean Fuels:

III. **Performance Summary**: CLEAN COAL POWER INITIATIVE (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
			During FY 2003, LPMEOH will complete final reports. Industrial Applications: During FY 2003, CPICOR will continue construction activities.
Clean Coal Power Initiative, Total	$0	$150,000	$150,000

DEPARTMENT OF ENERGY
FY 2003 CONGRESSIONAL BUDGET REQUEST

FOSSIL ENERGY RESEARCH AND DEVELOPMENT

CENTRAL SYSTEMS

I. **Mission Supporting Goals and Objectives**:

As the growing national economy relies increasingly on electronically and digitally controlled processes, electricity supply security and availability become a major concern. This is especially true in the face of concerns over national energy security as well as electricity generation market restructuring. This has resulted in a growing national need for increasingly reliable electricity and reduced emissions from electric power generation plants to replace and augment an aging power generation infrastructure. Electricity demand from both natural gas and coal is projected to increase significantly through the year 2015 to meet increased energy demand in the U.S. and offset the anticipated decline in generation from nuclear power (Annual Energy Outlook, 2001).

Moreover, the National Energy Policy report recognizes the importance of looking to technology to help the Nation meet the goals of increasing electricity generation while protecting our environment. It also recommends that the Department continue to develop advanced clean coal technology.

In response to these needs, the Central Systems Program is focused on improving the existing fleet's performance and on conducting research on innovative technology to support a longer term goal of dramatically improving the efficiency of power systems while reducing emissions of pollutants to near zero levels. In FY 2003 and future years, this core R&D activity will complement the Clean Coal Power Initiative in response to the President's commitment to and investment in clean coal technologies. The near-term focus will continue to develop low-cost technologies that can be developed, demonstrated and deployed in existing and new plants. In support of the long term goal, R&D on a revolutionary approach called "Vision 21" will continue with the aim of developing technology for high efficiency energy plants with practically zero emissions. Vision 21 is a program that will provide the necessary technology in building blocks along with the integration of these building blocks to attain this goal. A fleet of these Vision 21 plants will be flexible enough to use a variety of fossil resources including coal (our most abundant domestic fuel), natural gas, and other feedstocks. They will produce a slate of energy products including electricity, clean fuels and chemicals, and high grade heat. In some cases, these plants will be able to separate and capture CO_2, a greenhouse gas, for subsequent sequestration. The Central Systems

I. **Mission Supporting Goals and Objectives**: CENTRAL SYSTEMS (Cont'd)

program includes several advanced power systems based on coal combustion or coal gasification, advanced environmental control technologies, and advanced gas turbine technology. Many of these technologies will evolve into the high-tech modules that will comprise the Vision 21 pollution-free energy plant of the future.

The program elements for Central Systems include technology developed for existing plants, advanced systems, and Vision 21 are as follows:.

Innovations for Existing Plants - This program element has a near-term focus on developing advanced clean/efficient power systems and highly efficient, cost-effective environmental control technologies for retrofitting to existing powerplants and other coal technologies such as integrated gasification combine cycle (IGCC), with applications to new plants as well. Results of this advanced research are used by those who develop, design, manufacture and operate both existing and advanced systems across the entire spectrum of coal utilization technologies not only to improve efficiencies, but also to improve environmental performance. This program's crosscutting efforts address the cost-effective removal of pollutant causing contaminants from fossil fueled systems. It focuses on the development of emissions control technology for SO_2, NO_x, mercury, air toxics and particulates to address the energy and environmental demands of the post-2000 timeframe; development of high quality scientific information on emerging environmental issues such as the impact of powerplants on water quality and availability, for decision makers; development of emission controls with byproducts that minimize or eliminate the need for liquid/solid waste disposal; and sampling and characterization of advanced power system byproducts and solid residues. A major thrust of this program area is the development of technology to comply with the requirements of the Clean Air Act Amendments (CAAA) of 1990 and new or pending regulations, such as a flexible, multi-pollutant control strategy. The FY 2003 budget request emphasizes development of retrofit mercury, NO_x, particulate matter, and acid gas (SO_3, HC1, and HF) control technologies, technological solutions to emerging energy-water issues such as cooling water intake requirements, determining $PM_{2.5}$ source-receptor relationships as they relate to coal-fired power plant emissions, and environmental characterization of coal-combustion and gasification byproducts.

Integrated Gasification Combined Cycle (IGCC) - The IGCC program conducts research that fosters the development and deployment of fuel flexible gasification-based processes for converting carbon-based feedstocks to electricity, steam, and a broad range of chemicals and clean fuels. Compared with today's technologies for power generation, IGCC offers the potential for significant increases in thermal efficiency as well as significant reductions in capital costs and near-zero emissions of

I. **Mission Supporting Goals and Objectives**: CENTRAL SYSTEMS (Cont'd)

pollutants. IGCC is an advanced power generation technology that can readily co-produce electricity and other valuable products. In order to achieve the full potential of IGCC, significant advances must be made to reduce the capital and operating and maintenance costs and to improve both the reliability and the overall system availability, while targeting efficiencies of greater than 60% and environmental emissions to near-zero levels. In FY 2003, the program will continue its focus on cost, reliability, and efficiency improvements and performance optimization for power generation and co-production applications; gas stream purification to meet quality requirements for use with fuel cells and conversion processes; advanced gasification concepts for feedstock flexibility and CO_2 capture; and the development of technologies for producing oxygen and hydrogen and reducing greenhouse gas emissions, all of which are key technology building blocks for Vision 21. The IGCC program will be coordinated with other Departmental elements focusing on the production of fuels and chemicals from synthesis gas, environmental issues, and the sequestration and utilization of carbon dioxide. The successful accomplishment of these activities will enhance the commercialization prospects of advanced IGCC technologies for the production of electricity for use by utilities, independent power producers, and other industrial stakeholders. It also provides technologies for the coproduction of power and other valuable commodity products that would be characteristic of a Vision 21 plant.

Pressurized Fluidized Bed (PFB) - The PFB program is a research and development program focused on advanced gasification/ combustion hybrid systems in support of Vision 21. In FY 2003 the major emphasis at the Wilsonville Power System Development Facility will be the development of design concepts applicable to combustion technology for Vision 21. This project provides the key technology for gasification/fluid bed combustion hybrids for Vision 21concept options.

Turbines: High Efficiency Engines and Turbines (HEET) - Building on the Advanced Turbines Systems (ATS) Program, this is a follow-on effort to develop the next generation of flexible turbines and engines and to address some of our Nation's most important energy needs: enhancing our energy security, developing and deploying clean energy, leveraging the strength of U.S. science and technology institutions, and maintaining our country's economic competitiveness by building partnerships with the private sector, other government agencies, DOE national laboratories, and universities. The follow-on research for the next generation systems is an investment in secure U.S. electric power production which is clean and efficient and is fuel-flexible, highly reliable, maintainable, durable, affordable, and provide the technology for turbine based power modules for Vision 21.

During FY 2002, DOE will have completed studies to evaluate next generation systems concepts, market applications, public benefits, technical risk, and development needs in order to identify the priority R&D areas. In FY 2003, the R&D will focus on

I. **Mission Supporting Goals and Objectives**: CENTRAL SYSTEMS (Cont'd)

the development of fuel flexible /zero emissions turbine systems, and turbine/fuel cell hybrids. Supporting R&D includes the development of advanced technology for fuel flexible/high efficient combustion, high temperature materials, and durable sensors. This area also includes on-line monitoring, advanced life prediction and analysis tools, and non-destructive evaluation methods to ensure that advanced technologies operate reliably for adoption into the power industry. University and national laboratory consortiums will provide the critical research needed in materials, combustion, computational sciences, and controls/sensors.

The HEET Program is focused on key technologies needed to enable the development of advanced turbines and engine modules for 21st Century energy plants. Developing advanced turbines with fuel flexibility is critical as many of the advanced, coal-fired power generation technologies currently being developed or demonstrated will incorporate modified gas turbine systems.

The **Power Plant Improvement Initiative** (PPII) focuses on demonstrating advanced coal-based power technologies to improve overall plant efficiency, emissions reduction, cost effectiveness and enhanced reliability. The follow-on to this program is being continued as the Clean Coal Power Initiative.

Vision 21 is an extension or continuation of ongoing advanced power systems R&D to lower the cost and improve the environmental performance and efficiency of coal plants. This development effort will lead to the deployment of a family of plants that converts a combination of feedstocks (e.g., coal, natural gas, biomass, and opportunity fuels such as, petroleum coke or heavy oil resid (refinery wastes)) to electricity, heat (e.g., steam), and a suite of high-value products that may include synthesis gas, hydrogen, liquid fuels, chemicals, and by-products (e.g., sulfur and ash or slag). The specific feedstocks and products, and indeed the size and configuration, of each Vision 21 plant will depend on the plant's location, and on the resources, raw materials, and market factors in play at that location. Physically, Vision 21 plants will be a tightly integrated combination of power and fuels processing subsystems or modules that could include advanced combustors and gasifiers; high-temperature heat exchangers; gas separation, reforming, cleanup, and purification systems; turbines; fuel cells; chemical reactors; and advanced control systems. Vision 21 plants will effectively remove environmental constraints as an issue in the use of fossil fuels: emissions of traditional pollutants, including smog and acid rain forming species, will be near zero and the greenhouse gas, carbon dioxide, will be reduced 40-50% by efficiency improvements, and reduced to near zero if coupled with sequestration. Vision 21 plants will be affordable: costs will be compatible with sustained economic robustness, enhanced industrial competitiveness, and jobs creation through the availability of low-cost energy. In FY 2003,

I. **Mission Supporting Goals and Objectives**: CENTRAL SYSTEMS (Cont'd)

Vision 21 will continue research and development on key enabling technologies, supporting R&D, and systems analyses, simulations and integration through the government/industry/laboratory/university cost-shared partnership based on the Vision 21 technology roadmap.

Central Systems FY 2003 Performance Measures:

Innovations for Existing Plants - Technology and science are being developed to enable existing coal-fired power systems to comply with current and future environmental regulations at lower cost.

- Complete short-term field testing of sorbent injection control technology capable of achieving 50-70% reduction in mercury emissions at 3/4 to ½ the cost of current technology ($30,000 - $70,000 lb. of Hg removed depending on coal type and other plant-specific factors).
- Complete pilot-scale (10MW) development of advanced NO_x control technologies capable of achieving 0.15 lb. NO_x/mmBtu at 3/4 or less than the cost of Selective Catalytic Reduction (SCR) technology while also avoiding potential SCR balance-of-plant issues.
- Complete development of $PM_{2.5}$ information management system.

Advanced Systems - Advanced Systems are being developed to significantly reduce emissions by 2015 by: (1) developing market-ready coal power systems with efficiencies over 60 percent and near zero emissions; and (2) integrating advanced turbine and fuel cell technology to achieve market-ready gas-fueled powerplants with efficiencies over 70 percent. Potential benefits from these technologies are potential savings in cost of electricity of $0.5 billion per year by 2015 reaching $2.5 billion per year in 2030; generating more than 400,000 jobs per year by 2030; and contributing to powerplant sales of $10 billion per year in 2030. By 2030, more efficient power plants could reduce greenhouse gas emissions in the U.S. by 35 million tons per year of carbon avoided and 88 million tons of carbon per year avoided worldwide.

- Conduct critical tests of the IGCC transport gasifier in an oxygen-blown mode to prepare the way for testing of Vision 21 technologies for concentrating $CO_{2;}$ prepare a report of results; and evaluate performance to confirm the feasibility of the technology to significantly improve reliability, cost effectiveness, and improved efficiency compared to existing technologies as a

long-term goal. Current on line availability performance of IGCC on coal is 75-80%, capital cost is $1200-$1300/kW and thermal efficiency is 38%. This program will improve two of these three parameters by at least 2%.

- Complete proof-of-concept operation of fluidized-bed reactor high-temperature fuel gas desulfurization for IGCC systems in the NETL Syngas Generator and Gas Process Development Unit at design operating temperatures (>1000° F) using a commercially available sorbent.
- Complete Early Entrance Coproduction Plant feasibility and engineering design project and finalize reports.
- Conduct proof-of-concept test for a 280 kW, 60% efficient turbine fuel cell hybrid.

II. A. **Funding Schedule**: CENTRAL SYSTEMS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003	$Change	%Change
Innovations for Existing Plants	$19,663	$23,500	$21,200	$-2,300	-10%
Advanced Systems					
Indirect Fired Cycle	5,885	0	0	0	0%
Integrated Gasification Combined Cycle	34,337	43,000	40,650	-2,350	-5%
Pressurized Fluidized Bed	11,944	11,000	9,100	-1,900	-17%
Turbines	30,244	18,500	14,000	-4,500	-24%
Subtotal, Advanced Systems	82,410	72,500	63,750	-8,750	-12%
Power Plant Improvement Initiative	94,791	0	0	0	0%
Total, Central Systems	$196,864	$96,000	$84,950	$-11,050	-12%

II. B. **Laboratory and Facility Funding Schedule**: ($ in thousands)

	FY 2001	FY 2002	FY 2003	$Change	%Change
Oak Ridge National Lab	$670	$585	$525	$-60	-10%
Brookhaven National Laboratory	0	200	200	0	0%
Idaho Nat'l Engineering & Environmental Lab	90	180	180	0	0%
Argonne National Lab (East)	1,180	1,524	1,350	-174	-11%

	FY 2001	FY 2002	FY 2003	$Change	%Change
Lawrence Berkeley National Lab	200	200	200	0	0%
Lawrence Livermore National Laboratory	2,000	0	0	0	0%
Los Alamos National Lab	973	1,500	450	-1,050	-70%
National Energy Technology Laboratory	11,996	7,675	10,962	3,287	43%
All Other	179,755	84,136	71,083	-13,053	-16%
Total, Central Systems	$196,864	$96,000	$84,950	$-11,050	-12%

III. **Performance Summary**: CENTRAL SYSTEMS ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Innovations for Existing Plants	Super Clean Systems: Continue development of cost effective retrofittable NO_x control for superclean systems technologies to meet all Clean Air Act Amendment I and IV requirements. ($1,995) (TBD)	Super Clean Systems: Continue development of cost effective retrofittable NO_x control for superclean systems technologies to meet all Clean Air Act Amendment I and IV requirements. ($1,500) (Alsom Power, B&W)	Super Clean Systems: Complete development of cost effective retrofittable NO_x control technology to meet future multi-pollutant control requirements. Initiate development of novel concepts. ($1,485) (Alsom Power, MTI/B&W, REI, TBD)
	Fine Particulate Control/Air Toxics: Determine and model ambient $PM_{2.5}$ concentrations as they relate to sources and receptors of $PM_{2.5}$ from coal-fired power plants, obtain field test data for toxic emissions from powerplants and other sites to optimize cost and efficiency of control technologies. Develop and field test lower-cost retrofit technology for control of precursor emissions which cause fine particulates. ($6,685) (ATS, TBD)	Fine Particulate Control/Air Toxics: Determine and model ambient $PM_{2.5}$ concentrations as they relate to sources and receptors of $PM_{2.5}$ from coal-fired power plants, in order to optimize cost and efficiency of control technologies. Develop and field test lower-cost retrofit technology for control of fine particulates, acid gases, and also for controlling mercury and other air toxics. ($14,565) (ATS, ADA, B&W)	Fine Particulate Control/Air Toxics: Complete ambient $PM_{2.5}$ information management tool. Continue modeling assessment of source-receptor relationships. Complete Phase I field testing of mercury control technology and initiate Phase II. Develop lower-cost retrofit technology for controlling mercury. Develop technology for controlling other air toxics. Initiate research to address energy-water issues and environmental sensors and controls. ($13,860) (CONSOL, ADA, MTI/B&W, TBD)

III. **Performance Summary**: CENTRAL SYSTEMS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Innovations for Existing Plants (Cont'd)	In-House: Conduct supporting research in areas such as super clean emissions control, air toxics and fine particulate control, by-product characterization, and provide for customer service and business activities. ($3,292) (NETL, TBD)	In-House: Conduct supporting research in areas such as air toxics and fine particulate control, by-product characterization, and provide for customer service and business activities. ($3,300) (NETL, TBD)	In-House: Conduct supporting research in mercury control and characterization, by-product characterization, and water-related issues. Provide for customer service and business activities. ($3,663) (NETL, TBD)
	Conduct joint industry/ government R&D activities to maximize use of coal utilization combustion byproducts; develop novel approaches to utilize waste from flue gas desulfurization; conduct evaluations of low NO_x burner and multi-fuel combustion byproducts for market specifications; facilitate technology transfer. ($1,547) (TBD)	Conduct joint industry/ government R&D activities to maximize use of coal utilization combustion byproducts; develop novel approaches to utilize waste from flue gas desulfurization; conduct evaluations of low NO_x burner and multi-fuel combustion byproducts for market specifications; facilitate technology transfer. ($1,500) (TBD)	Assess environmental impacts of coal combustion and gasification byproducts and solid residues. Conduct joint industry/ government R&D activities to maximize use of coal for various market applications, and facilitate technology transfer. Investigate implications of advanced controls on water quality and availability. ($1,980) (TBD)
	Vision 21: Develop advanced materials for enhancing power plant efficiency including supercritical cycles applicable to Vision 21. ($1,991) (TBD)	Vision 21: Develop advanced materials for enhancing power plant efficiency including supercritical cycles applicable to Vision 21. ($2,400) (TBD)	No activity. ($0)

III. **Performance Summary**: CENTRAL SYSTEMS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Innovations for Existing Plants (Cont'd)	**International Clean Energy Initiative**: Transfer best practice of optimizing the performance of coal-fired power plants for mitigation of climate change gases. Further develop technology collaboration and business opportunities between China, Turkey, other countries and U.S. organizations. Develop improvements in plant performance, availability, and maintenance. Disseminate results from U.S. R&D program via publications, workshops and seminars. ($988) (TBD)	No activity. ($0)	No activity. ($0)
	Fund technical evaluations of options for an improved U.S. Capital Power Plant. ($988) (TBD)	No activity. ($0)	No activity. ($0)
	Funding testing of Electrocatalytic Oxidation Technology. ($1,976) (TBD)	No activity. ($0)	No activity. ($0)
	Fund technical and program	Fund technical and program	Fund technical and program

III. **Performance Summary**: CENTRAL SYSTEMS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
	management support. ($201)	management support ($235)	management support. ($212)
	$19,663	$23,500	$21,200

III. **Performance Summary**: CENTRAL SYSTEMS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Advanced Systems-Indirect Fired Cycle	Vision 21: Continue HIPPS development on those components and subsystems that are part of the Vision 21 plant. Mid-term activities include coproduction concepts, hybrid cycles, and advanced system integration. ($5,825) (Foster-Wheeler, UTRC, NETL, TBD)	No activity. ($0)	No activity. ($0)
	Fund technical and program management support. ($60)	No activity. ($0)	No activity. ($0)
	$5,885	$0	$0
Advanced Systems-Integrated Gasification Combined Cycle	Gasification Systems Technology: **Gasification** - Continue development of the transport gasifier and associated particulate control devices and demonstrate long-term performance of both in air-blown operations. Transition the transport gasifier to oxygen-blown operations. Develop and verify computational fluid dynamics (CFD) model for the	Gasification Systems Technology: **Gasification** - Continue development of the transport gasifier and associated particulate control devices and demonstrate long-term performance of both under enriched air conditions. Initiate shake down of facilities for oxygen-blown operations at the Power Systems Development Facility (PSDF) and continue	Gasification Systems Technology: **Gasification** - Continue development of the transport gasifier and associated particulate control devices at the PSDF and demonstrate performance of both under oxygen-blown conditions. Continue validation of the transport gasifier CFD model using data generated from various coal feedstocks. Utilize the

III. **Performance Summary**: CENTRAL SYSTEMS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Advanced Systems-Integrated Gasification Combined Cycle (Cont'd)	transport gasifier. Extend Power Systems Development Facility (PSDF) feedstock database using low-cost alternative feedstocks in combination with coal. Conduct coupon testing of advanced refractories at clean coal technology sites. Continue investigation of alternative temperature measurement instrumentation for high temperature gasifier and conduct development and testing at clean coal technology sites. **Gas Cleaning/Conditioning** - Continue development of high temperature sorbents for fluid bed and transport desulfurization reactors. Develop kinetic data and CFD models for the transport desulfurizer. Perform comparative analysis of fluid bed and transport desulfurization reactors using the Gas Processing Development Unit to provide data for the design of a facility for PSDF. Conduct	evaluation of alternative feedstocks in combination with coal. Modify the transport gasifier computational fluid dynamics (CFD) model for oxygen and enriched air operations and verify performance with data from the PSDF and Transport Reactor Development Unit (TRDU). Continue coupon testing of advanced refractories at suitable gasification sites. Complete initial R&D of advanced temperature instrumentation for high temperature gasifiers and select concepts for scale-up to prototype units for actual gasifier testing. **Gas Cleaning/Conditioning** - Continue development of high temperature sorbents for fluid bed and transport desulfurization reactors with focus on producing ultra-clean gas and removing contaminants from using alternative feedstocks. Continue development of kinetic data and	Transport Reactor Development Unit (TRDU) to pre-screen coal feedstocks and process conditions for testing at the PSDF. Continue development of advanced materials for refractories and thermocouples and begin coupon testing at suitable gasification sites if warranted. Continue development of technologies to improve the reliability, availability, and performance of gasifiers. Investigate fundamental technology needs to improve gasification process performance and reliability through the gasification university consortium. **Gas Cleaning/Conditioning** - Continue development of advanced sorbents for fluid-bed and transport desulfurization reactors that operate at moderate temperature while achieving ultra-low sulfur levels. Continue operation of the Gas Process Development Unit (GPDU) with

III. **Performance Summary**: CENTRAL SYSTEMS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Advanced Systems-Integrated Gasification Combined Cycle (Cont'd)	desulfurization unit design for PSDF. Extend particulate filter development activities to high temperatures, i.e., > 1000° F. Complete baseline environmental monitoring of CCT sites and begin monitoring during hazardous waste processing. **Product/By-Product Utilization** - Continue testing of the direct sulfur recovery process at PSDF and extend testing to include single-step sulfur recovery process. Continue investigation to enhance the quality of gasification ash/slag from co-feed operations and explore new market applications. Explore concepts for converting SO_2 to marketable products. ($17,432) (SCS, NETL, UNDEERC, Fluent, CMU, RTI, KBR, Albany, TECO, Dynegy, Weyerhauser, Texaco, ANL, SRI, Praxis, VPI, IET, FluoreScience)	CFD models for the transport desulfurizer and begin development of a CFD model for a fluid bed desulfurizer. Perform comparative analysis of fluid bed and transport desulfurization reactors using the Gas Processing Development Unit to provide data for CFD model verification and for the design of a facility for PSDF. Continue development of novel sorbent and catalytic techniques for removing sulfur. **Product/By-Product Utilization** - Complete testing of the direct sulfur recovery skid-mounted process unit at PSDF and continue testing of the single-step sulfur recovery process. Expand efforts on ash/slag characterization and marketability, with particular focus on products from gasification of coal with alternative feedstocks. ($22,200) (SCS, NETL, UNDEERC, Fluent, CMU, RTI, KBR, Albany, TECO,	the fluid bed reactors using advanced sorbents of industrial interests operating a moderate reaction temperatures. Provide data for the design of a gas cleanup unit at the PSDF. Verify CFD models for fluid bed and transport desulfurizer using data from the GPDU. Continue development of the novel hydrogen sulfide oxidation process for sulfur removal. Continue characterization of particulate filters utilized at the PSDF to identify fouling and performance characteristics. **Products/By-Products Utilization** - Conclude testing of the advanced single-step sulfur recovery process. ($20,988) (SCS, NETL, UNDEERC, Fluent, RTI, Albany, Texaco, VPI, FluoreScience, IET, ORNL, TBD)

III. **Performance Summary**: CENTRAL SYSTEMS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
		Global, Weyerhauser, Texaco, ANL, SRI, Praxis, VPI, IET, FluoreScience)	
Advanced Systems-Integrated Gasification Combined Cycle (Cont'd)	Systems Analysis/Product Integration: Extend design optimization study to include CO_2 capture and fuel cell technologies. Continue engineering analysis and risk reduction activities associated with the Early Entrance Coproduction Plant. Continue market and system analyses for R&D guidance. Provide funding for product outreach and other program related activities. ($3,981) (NETL, Bechtel, CTC, E2S, Mitretek, Consol, Parsons, Texaco, Dynegy, WMPI, GE, KBR, APCI, Praxair, Dow Corning, Dow Chemical, Siemens-Westinghouse, Methanex, Rentech, SASOL)	Systems Analysis/Product Integration: Complete one Early Entrance Coproduction Plant study and continue the engineering analyses and risk reduction work associated with the remaining two projects. Complete gasification design optimization studies incorporating fuel cells and CO_2 capture. Complete U.S. gasification market study for power generation. Continue systems analyses for research guidance and product outreach activities. Conduct industry interviews and develop a long term strategy/roadmap for gasification technology development. ($3,662) (NETL, Bechtel, CTC, E2S, Mitretek, Consol, Parsons, Texaco, Dynegy, WMPI, GE, KBR, APCI, Praxair,	Systems Analysis/Product Integration: Complete risk reduction R&D for Early Entrance Coproduction Plant and begin update of process design based on R&D results. Continue systems analyses for research guidance and product outreach activities. Complete design optimization study incorporating fuel cells and CO_2 capture. Complete biannual update of worldwide gasification database and publish results. ($2,921) (NETL, CTC, E2S, Mitretek, SFA Pacific, Bechtel, Parsons, Texaco, WMPI, GE, KBR, Praxair)

III. **Performance Summary**: CENTRAL SYSTEMS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
		Dow Corning, Dow Chemical, Siemens-Westinghouse)	
Advanced Systems-Integrated Gasification Combined Cycle (Cont'd)	Vision 21: Develop gasification and combustion high efficiency energy complexes with near-zero emissions and CO_2 management options. Continue development of advanced membrane-based air separation technologies and begin first level of scaleup. Continue development of high temperature membranes for hydrogen separation and CO_2 concentration. Continue development of low temperature technology for hydrogen/CO_2 separation and begin design of skid-mounted test module. Continue development of feed system technologies for co-feeding coal/alternative feedstocks to high pressure gasifiers. Begin shakedown and testing of municipal solid waste processing technology. Continue	Vision 21: Continue development of hybrid gasification/combustion concepts, focusing on high efficiency, near-zero emissions, and alternative fuels processing. Explore advanced gas cleaning technologies required for near-zero emission hybrid facilities. Investigate feasibility of novel gasification concept for producing hydrogen and sequestration-ready CO_2. Continue with scale-up activities for production and testing of the advanced membrane-based air separation technologies. Continue development of improved materials and module design of high temperature membranes for hydrogen/CO_2 separation and explore fabrication methodologies. Develop high temperature barrier	Vision 21: Continue development and testing of larger size ceramic membrane modules for advanced air separation at the 1-5 ton/day scale and investigate potential sites for integrated testing with a gasifier. Continue development of improved membrane materials, fabrication techniques, and module design for hydrogen/CO_2 separations; continue activities related to the development of the low temperature hydrate technology for separating hydrogen and carbon dioxide and develop engineering basis for design of a skid-mounted unit. Complete risk reduction R&D for Early Entrance Coproduction Plant and begin update of process design based on R&D results. Complete initial study on the

III. **Performance Summary**: CENTRAL SYSTEMS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
	development of advanced synthesis gas cleaning technologies to achieve high purity gas for fuel cell and synthesis gas conversion applications. ($12,573) (APCI, Praxair, ANL, NREC, Enertech, Bechtel, LANL, RTI, IGT, Siemens-Westinghouse, NETL, Foster Wheeler, TBD)	filters that are compatible with hydrogen membrane operations. Continue development of low-temperature technology for hydrogen/CO_2 separation, complete construction of a skid-mounted test module, and begin shakedown testing. Begin construction and testing of novel concepts for co-feeding coal/alternative feedstocks to high pressure gasifiers. Complete shakedown and initiate testing of municipal solid waste processing technology. Complete exploratory investigation of novel advanced gas cleaning technologies and begin bench-scale engineering development to achieve high purity synthesis gas for fuel cell and conversion applications. Expand gas cleaning program to include multi-contaminant control concepts and other novel approaches applicable for multi-feed gasification systems.	feasibility of a novel gasification concept for producing hydrogen and sequestration-ready CO_2. Continue with integrated testing of advanced gas cleaning technologies to meet near-zero emission requirements. Complete collaborative efforts to develop Vision 21 models and software for process concepts ($16,334) (SCS, APCI, Praxair, ANL, Concepts NREC, Ceramatec, Texaco, PSU, Penn, Enertech, Bechtel, LANL, RTI, IGT, Siemens-Westinghouse, NETL, REI, NFCRC, GEEERC, Princeton, INT, Eltron, Chevron, Coors, INEEL, Sud Chemie, UC, ORNL, McDermott, Dynegy, WMPI, GE, KBR, TBD)
Advanced Systems-Integrated Gasification Combined Cycle (Cont'd)			

III. **Performance Summary**: CENTRAL SYSTEMS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
		Continue collaborative efforts to develop models and software for process concepts. ($16,708) (APCI, Praxair, ANL, NREC, Ceramatec, Texaco, PSU, Penn, Enertech, Bechtel, LANL, RTI, IGT, Siemens-Westinghouse, NETL, REI, FW, TEKES, NFCRC, GEEERC, Princeton, INT, Eltron, Chevron, Coors, INEEL, UC, ORNL, McDermott, Foster Wheeler, TBD)	
	Fund technical and program management support. ($351)	Fund technical and program management support. ($430)	Fund technical and program management support. ($407)
	$34,337	$43,000	$40,650
Advanced Systems-Pressurized Fluidized Bed	Continue evaluation of hot gas cleanup filter materials, and systems to refine and validate designs. Evaluate FBC sorbents that reduce consumption with subsequent reduction of CO_2. Goal is to significantly enhance performance and reduce cost. Perform supporting research such	Continue evaluation of hot gas cleanup filter materials to refine and validate designs and reduce consumption with subsequent reduction of CO_2. Goal is to enhanced performance, reduce costs, and support hybrid systems for Vision 21 ($690). Continue gas stream cleanup testing at PSDF,	Investigate Fail Safe Designs ($220). Continue gas stream cleanup testing at PSDF, Wilsonville ($4,500). Continue development of gas stream cleanup systems necessary for Vision 21 ($625). Continue hot gas filter materials development ($100) (Total $5,445) (NETL,

III. **Performance Summary**: CENTRAL SYSTEMS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
	as system dynamics, combustion characterization, and cofiring with carbon neutral fuels. ($2,739) (NETL, Siemens-Westinghouse, WVU, TBD)	Wilsonville ($3,500). (Total $4,190) (NETL, Southern Co. Services, TBD)	Southern Co. Services, ORNL, TBD)
	Evaluate previously selected advanced systems users by performing site specific enhancements that lead to reduced cost and efficiency improvements for the repowering studies that promote repowering of an actual electricity producer's site. ($550) (TBD)	No activity. ($0)	No activity. ($0)

III. **Performance Summary**: CENTRAL SYSTEMS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Advanced Systems-Pressurized Fluidized Bed (Cont'd)	Complete studies of environmental performance and efficiency with emphasis on HAPS control strategies and gas turbine integration. Continue cycle improvements through the introduction of other technologies like Fuel Cells and super critical steam cycles will be pursued to achieve Vision 21 goals. ($979) (NETL)	No activity. ($0)	No activity. ($0)
	Continue operation of the APFBC pilot scale project at Wilsonville. ($7,354) (Southern Co. Services, TBD)	Discontinue operation of the APFBC pilot scale module at Wilsonville. ($0) (Southern Co. Services)	No activity. ($0)
	No activity. ($0)	Support the development of design concepts applicable for gasification/fluid bed hybrids to Vision 21. ($3,190) (Southern Co. Services)	Continue to support the development of design concepts (char feed systems and supercritical boilers) applicable to gasification/fluid bed hybrids for Vision 21 ($500). Continue work on partial gasification systems ($600). Continue supercritical boiler design studies ($700). Continue repowering application studies

III. **Performance Summary**: CENTRAL SYSTEMS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Advanced Systems-Pressurized Fluidized Bed (Cont'd)			($300). Develop hybrid combustion system concepts for Vision 21 and repowering applications ($969). (Total $3,069) (Southern Co. Services, FWDC, Alstom, NETL, TBD)
	Complete power systems designs to optimize CO_2 recycle and enrichment for CO_2 capture and reduction. Evaluate fluidized-bed combustion sorbents that reduce consumption with subsequent reduction of CO_2 while reducing cost, increasing temperature and maintaining sulfur capture. ($200) (NETL, TBD)	Evaluate gas conditioning subsystems and concepts for Vision 21 systems. ($3,510) (NETL, TBD)	Vision 21: Continue coal combustion kinetics development ($250). Develop enabling technologies for combustion systems ($245). (Total $495) (Fluent, TBD)
	Fund technical and program management support. ($122)	Fund technical and program management support. ($110)	Fund technical and program management support. ($91)
	$11,944	$11,000	$9,100
Advanced Systems-Turbines	Vision 21: Develop enabling technologies for advanced heat engine and turbine cycles including high temperature materials and zero emissions combustion. R&D program for	Vision 21: Develop enabling technologies for advanced heat engine and turbine cycles including high temperature materials and zero emissions combustion. R&D program for	Activity continued under Next Generation Turbines.

III. **Performance Summary**: CENTRAL SYSTEMS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Advanced Systems-Turbines (Cont'd)	critical technology development, advanced computing, and engine/turbine development. Develop technology for fuel cell/engine hybrid systems, and integration of the ATS into advance coal-fueled power systems. ($4,963) (Rolls-Royce, Honeywell, General Electric, Clean Energy Systems, FuelCell Energy, LLNL, NETL, Reaction Engineering, NFCRC, TBD)	critical technology development, advanced computing, and engine/turbine development. Develop technology for fuel cell/engine hybrid systems, and integration of the ATS into advance coal-fueled power systems. ($2,475) (Honeywell,GE, Clean Energy Systems, FuelCell Energy, LLNL, NETL, Reaction Engineering, NFCRC, TBD)	
	Next Generation Turbines: Continue Next Generation Turbine Systems technology base crosscutting R&D including: Univ./industry Consortium, national laboratory and in-house research, advanced concept development and systems analysis, low emissions combustion, diagnostics and monitoring technologies, sensors/ controls, materials and manufacturing technologies and advanced computing. Conduct R&D and design studies for the next	Next Generation Turbines: Continue Next Generation Turbine Systems technology base crosscutting R&D including: Univ./industry Consortium, national laboratory and in-house research, advanced concept development and systems analysis, low emissions combustion, diagnostics and monitoring technologies, sensors/ controls, materials and manufacturing technologies and advanced computing. Conduct R&D and design studies for the next	Next Generation Turbines (Vision 21): Conduct R&D and design studies for advanced coal-fired power modules. Develop enabling technology base for advanced heat engine and turbine cycles including: high temperature materials, advanced computing for engine/turbine development, zero emissions combustion, fuel cell/engine hybrid systems, and ultra-low emission, reliable, flexible gas turbine systems. Develop and test advanced sensors, diagnostics, and condition

III. **Performance Summary**: CENTRAL SYSTEMS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
	generation turbine systems ($12,842) (Ramgen Power Systems, Siemens-Westinghouse, CFD Research Corp., Rolls Royce, Pratt and Whitney, General Electric, TBD)	generation turbine systems ($15,840) (Ramgen Power Systems, Siemens-Westinghouse, CFD Research Corp., Rolls Royce, Pratt and Whitney, General Electric, TBD)	monitoring technology for improved electricity reliability. ($13,860) (SCIES, NETL, ORNL, TBD)
Advanced Systems-Turbines (Cont'd)	Supporting Technologies: Conduct supporting technology for high performance, ultra-low emission, reliable, flexible gas turbine systems. ($3,320) (SCIES, NETL, ORNL, TBD)	No activity. ($0)	No activity. ($0)
	ATS: Complete full speed engine tests, ATS system integration, and component testing. Initiate technical, economic, and environmental performance system studies. ($8,829) (General Electric, Siemens-Westinghouse)	No activity. ($0)	No activity. ($0)
	Provide technical and program support. ($290)	Provide technical and program support. ($185)	Provide technical and program support. ($140)
	$30,244	$18,500	$14,000
Subtotal, Advanced Systems	$82,410	$72,500	$63,750

III. **Performance Summary**: CENTRAL SYSTEMS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Power Plant Improvement Initiative	The Power Plant Improvement Initiative (PPII) will engage in solicitation and pre-award activities for the program in anticipation of release of funds for obligation on Sept. 30, 2001. ($93,843) (TBD)	The PPII will fund projects that will demonstrate advanced coal-based technologies applicable to existing and new power plants including co-production plants. These demonstrations will focus on technology that can be commercialized to address electricity reliability through improved capacity, efficiency and environmental performance. ($0)	Activities will continue under the Clean Coal Power Initiative program. ($0)
Power Plant Improvement Initiative (Cont'd)	Fund technical and program management support. ($948)	No activity. ($0)	No activity. ($0)
Subtotal, Power Plant Improvement Initiative	$94,791	$0	$0
Central Systems, Total	$196,864	$96,000	$84,950

DEPARTMENT OF ENERGY
FY 2003 CONGRESSIONAL BUDGET REQUEST

FOSSIL ENERGY RESEARCH AND DEVELOPMENT

SEQUESTRATION R&D

I. **Mission Supporting Goals and Objectives**:

Currently, over half of the electricity generated in the U.S. is produced in coal-fired power plants. Including electricity generated by oil and natural gas-fired power plants, this fraction increases to 70%. The U.S. power generation industry needs to maintain a diversified fuel mix to ensure adequate energy supplies at a reasonable price. The continued use of fossil energy, especially coal, will be severely limited unless satisfactory solutions can be found for numerous environmental issues, especially global climate change. Ultimately, to maintain stable concentrations of greenhouse gases in the atmosphere while permitting world-wide economic growth, it will be necessary to sequester (capture and isolate) carbon from the combustion of fossil fuels.

The principal thrust of this activity is to develop the applied science and new technologies for addressing the cost-effective management/sequestration of carbon emissions from the production and use of fossil fuels. This research program compliments the advanced power systems research being pursued in FE, which reduces carbon emissions via higher efficiency energy conversion. Sequestration is focused on cost-effective novel concepts for capturing, reusing or storing, or otherwise mitigating carbon and other greenhouse gas (GHG) emissions. Included in the mix of "direct" control options is the direct capture of CO_2 from fossil fuel conversion systems before it enters the atmosphere and storage in geologic structures such as oil and gas reservoirs, unmineable coal seams, and deep saline reservoirs. It also includes research on technologies for integrating fossil fuel production and use with "indirect" sequestration by enhancing natural sinks. Included in this area are means to achieve integration with terrestrial sequestration and enhanced ocean storage of carbon. The goal of this research is to create technologies capable of offsetting all growth in U.S. GHG after the year 2015. Research activities are geared toward developing strategies that will reduce the cost of sequestration. In addition to being cost-effective, these approaches must be environmentally safe and integrate with both existing and new (such as Vision 21) fossil energy conversion systems. The major thrust in FY 2003 will center around exploratory research on novel and innovative concepts for GHG mitigation, advanced CO_2 separation and capture concepts, geological carbon sequestration, and reducing the cost and environmental uncertainties of large-scale carbon sequestration. Innovative industry/university and government R&D partnerships will also be pursued along with international collaborative R&D. Funding will also provide support for the in-

I. **Mission Supporting Goals and Objectives**: SEQUESTRATION R&D (Cont'd)

house R&D Sequestration Focus Area at the National Energy Technology Laboratory (NETL) with particular emphasis on capture and concentration of CO_2, CO_2 hydrate formation and stability and transport in geologic reservoirs. Close collaboration with the Carbon Management Science Centers on Ocean and Terrestrial Science, and other carbon management basic science activities in the Office of Science will be maintained, providing an integrated approach to advancing the science and technology of carbon sequestration.

The development of carbon dioxide sequestration options is expected to reduce U.S. carbon emissions by 145 million tonnes per year and 270 million tonnes per year worldwide, by 2030.

FY 2003 Performance Measures in furtherance of the above goals include:

- Develop a "Best Practices" manual, making initial recommendations on long-term monitoring techniques for use with storage of CO_2 in geologic settings.
- Initiate the largest (3000 acre) terrestrial sequestration mined land reclamation project in the U.S. using hardwoods. Approximately 1/3 of the trees will be planted each year for three years.
- Select the most promising projects for greenhouse gas control from competitive solicitations conducted in prior years with the goal of reducing the costs of CO_2 capture by 50% in five years.

II. A. **Funding Schedule**: ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003	$Change	%Change
Sequestration R&D	$18,363	$32,177	$54,000	$21,823	68%
Total, Sequestration R&D	$18,363	$32,177	$54,000	$21,823	68%

II. B. **Laboratory and Facility Funding Schedule**: ($ in thousands)

	FY 2001	FY 2002	FY 2003	$Change	%Change
Argonne National Lab	$120	$120	$120	$0	0%
Idaho Nat'l Engineering & Environmental Lab	862	862	862	0	0%
Los Alamos National Lab	1,545	1,545	1,705	160	10%
Lawrence Berkeley National Lab	450	450	1,050	600	133%
Lawrence Livermore National Lab	355	355	350	-5	-1%
National Energy Technology Lab	1,171	1,700	1,964	264	16%

II. B. **Laboratory and Facility Funding Schedule**: SEQUESTRATION R&D (Cont'd) ($ in thousands)

	FY 2001	FY 2002	FY 2003	$Change	%Change
Oak Ridge National Lab	508	633	682	49	8%
Pacific Northwest National Lab	170	170	0	-170	-100%
Sandia National Lab	450	450	900	450	100%
All Other	12,732	25,892	46,367	20,475	79%
Total, Sequestration R&D	$18,363	$32,177	$54,000	$21,823	68%

III. **Performance Summary**: ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Sequestration R&D	Greenhouse Gas Control: Continue efforts consisting of exploratory research, investigations, and/or technology improvements to recover, reuse, and/or store greenhouse gas emissions from fossil fuel-based energy systems. Conduct collaborative R&D with industry and international partners to significantly reduce the costs of CO_2 separation and capture, demonstrate the technical feasibility of geological sequestration, and significantly reduce the uncertainties (cost and environmental) of large-scale carbon sequestration. Examine the technical, economic and environmental impacts of various CO_2, CH_4 and N_2O sequestration alternatives. ($15,205) (TBD)	Greenhouse Gas Control: Continue efforts consisting of exploratory research, investigations, and/or technology improvements to recover, reuse, and/or store greenhouse gas emissions from fossil fuel-based energy systems. This effort will continue to focus on partnerships with industry and international entities for research on innovative and advanced concepts to significantly reduce the costs of CO_2 separation and capture, demonstrate the technical feasibility of geological sequestration, and significantly reduce the uncertainties (cost and environmental) of large-scale carbon sequestration. Examine the technical, economic and environmental impacts of various	Greenhouse Gas Control: Continue efforts consisting of exploratory research, investigations, and/or technology improvements to recover, reuse, and/or store greenhouse gas emissions from fossil fuel-based energy systems. This effort will continue to focus on partnerships with industry and international entities for research on innovative and advanced concepts to significantly reduce the costs of CO_2 separation and capture, field test the technical and environmental acceptability of geological sequestration, and significantly reduce the uncertainties (cost and environmental) of large-scale carbon sequestration. Examine the technical, economic and

III. **Performance Summary**: SEQUESTRATION R&D (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Sequestration R&D (Cont'd)		CO_2, CH_4 and N_2O sequestration alternatives. ($26,856) (NETL, LANL, INEL, SNL, LLNL, LBNL, ANL, ORNL, Batelle, IEM, TDA, McDermott, RTI, UTA, TBD)	environmental impacts of various CO_2, sequestration and CH_4 and N_2O reduction alternatives, develop and field test appropriate monitoring and verification technologies. ($46,035) (NETL, LANL, INEL, SNL, LLNL, LBNL, ANL, ORNL, Battelle, IEM, TDA, McDermott, RTI, UTA, BP, Alstom, Consol, Praxair, Dakota Gasification, ARI, Nature Conservancy, Texas Tech, Univ. Of Utah, Univ. Of Kansas, CMU, MBARI, AL Geo. Survey, TVA, Stephen F. Austin, Univ. Of KY. Ohio Univ., PSI, Univ. Of Hawaii, IEA, TBD)
	Carbon Sequestration Focus Area: Increase research facilities and capabilities to expand research activities on CO_2 stability and transport in geological reservoirs; augment research on the stability of CO_2 injected in deep ocean including hydrate formation. ($2,970) (NETL)	Carbon Sequestration Focus Area: Fully implement research capabilities in the areas of geologic and deep ocean CO_2 sequestration. ($5,000) (NETL, TBD)	Carbon Sequestration Focus Area: Expand innovative research in the areas of geologic and deep ocean CO_2 sequestration to determine mechanisms to permanently sequester CO_2. ($7,425) (NETL, ARC, TBD)
	Fund technical and program management support. ($188)	Fund technical and program management support. ($321)	Fund technical and program management support. ($540)

III. **Performance Summary**: SEQUESTRATION R&D (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Total, Sequestration R&D	$18,363	$32,177	$54,000

DEPARTMENT OF ENERGY
FY 2003 CONGRESSIONAL BUDGET REQUEST

FOSSIL ENERGY RESEARCH AND DEVELOPMENT

FUELS

I. **Mission Supporting Goals and Objectives**:

In compliance with the provisions of EPACT and consistent with the goals of the National Energy Policy, the Fuels Program consists of four related activities: Transportation Fuels and Chemicals, Solids Fuels and Feedstocks, Advanced Fuels Research, and Steelmaking. Program planning is underway to determine the future requirements for this program to meet the mid-to-longer term needs for transportation fuels including transitional fuels which fit the current liquid fuels infrastructure and future fuels such as hydrogen which would require significant modification to the infrastructure but would provide near zero criteria and global emissions when used in advanced engines platforms.

Transportation Fuels and Chemicals - The need for clean liquid fuels is projected to be a critical element of this nation's energy future in the 21st century. The objective of this program component is to develop environmentally superior processes in partnership with industry and other government organizations to help ensure that industry has the technology to provide the ultra-clean transportation fuels needed for the 21st century from both petroleum and non-petroleum based fossil resources.

Natural gas conversion research efforts include cost-shared industrial research and development of ceramic membrane reactors capable of separating oxygen from air, then partially combusting the oxygen with natural gas to produce less costly synthesis gas, and innovative processes to chemically convert natural gas to readily transportable, competitively priced liquid transportation fuels as well as blending agents able to improve the environmental acceptability of petroleum-based fuels.

Coal resources offer the best long-term option for production of the significant quantities of hydrogen that will be required to fuel our transportation systems of the future. In the coal research area, fuels will be products of gasification based coproduction facilities which will produce transportation fuels, hydrogen, chemicals and electricity. These multiple product, coproduction plants will be cost competitive and more efficient then current technology, and produce a concentrated stream of carbon dioxide which could facilitate removal.

I. **Mission Supporting Goals and Objectives**: FUELS (Cont'd)

The Department's efforts currently are focused on generation and production of synthesis gases (i.e. a mixture of carbon monoxide and hydrogen) and the subsequent catalytic conversion of the synthesis gas to liquid fuels and other products. . The goal is to work with industry to develop technologies that will enable the private sector to utilize more effectively, the global fossil resources to produce clean fuels that can meet increasingly stringent vehicle emissions requirements. The activities are also being coordinated with the Office of Transportation Technologies (EE).

Solid Fuels and Feedstocks - This program components funding is directed toward the development of advanced technologies to support the evolution of significant new processes for the production of premium carbon and industrial products.

Advanced Fuels Research - Supporting science and enabling technology pursued under this program component will provide the fundamental knowledge and scientific data needed to produce the future's clean liquid and gaseous fuels. The primary focus here is on hydrogen production with concomitant carbon management, which when used in advanced vehicles, will produce near zero air emissions. As the Nation makes the transition to the use of hydrogen as its primary fuel, fossil feedstocks remain the lowest cost alternative capable of producing hydrogen at the needed scale until a sustainable source of hydrogen is developed.

Steelmaking - Funding for this effort was complete in FY 2001, and the work is expected to be completed at a pilot scale in FY 2002 with prior year funds.

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FY 2003 performance measures in furtherance of the above goals include:

- Continue the development of improved ceramic membranes for synthesis gas production from natural gas. Anticipate 15% increase in separation efficiency at end of FY 2003 compared to 2000.
- Complete preliminary design of integrated facilities that can produce fuels, chemicals, power, etc. from carbon rich feedstocks with prior year funds and support the subsequent industrial effort to commercialize one or more of the three process options developed in the program.
- Demonstrate, in sustained operation at a syngas flow rate of 24,000 cubic feet per day, that an ITM membrane reactor can meet a competitive oxygen separation performance level at greater than 30% capital cost savings over conventional syngas production technology.

II. A. **Funding Schedule**: ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003	$Change	%Change
Transportation Fuels and Chemicals	$7,404	$24,000	$5,000	$-19,000	-79%

Activity	FY 2001	FY 2002	FY 2003	$Change	%Change
Solid Fuels and Feedstocks	5,220	5,000	0	-5,000	-100%
Advanced Fuels Research	3,806	3,200	0	-3,200	-100%
Steelmaking	6,510	0	0	0	0%
Total, Fuels	$22,940	$32,200	$5,000	$-27,200	-84%

II. B. **Laboratory and Facility Funding Schedule**: FUELS (Cont'd) ($ in thousands)

	FY 2001	FY 2002	FY 2003	$Change	%Change
National Energy Technology Laboratory	$4,153	$2,000	$1,699	$-301	-15%
Lawrence Berkeley National Laboratory	0	0	100	100	100%
Los Alamos National Laboratory	0	100	200	100	100%
Pacific Northwest National Laboratory	0	150	0	-150	-100%
Sandia National Laboratories	600	0	0	0	0%
All Other	18,187	29,950	3,001	-26,949	-90%
Total, Fuels	$22,940	$32,200	$5,000	$-27,200	-84%

III. **Performance Summary**: ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Transportation Fuels and Chemicals	Feedstock Conversion: Study of novel concepts for improved conversion efficiency and product quality. ($800) (NETL)	Feedstock Conversion: Conclude all activity in an orderly manner with prior year funds. ($0)	No activity. ($0)
	Reactor/Process Development: Continue bench scale DME at APCI; continue the development of ultra-clean transportation fuels and chemicals for the 21st Century ($2,200). Continue bench scale F-	Reactor/Process Development: Maintain and conduct facility upgrading of the LaPorte alternative fuels facility for production of synthesis gas liquid fuel products. Conduct slurry F-T	No activity. ($0)

III. **Performance Summary**: FUELS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Transportation Fuels and Chemicals (Cont'd)	T iron catalyst development for the production of premium transportation fuels and chemicals ($260).**International Clean Energy Initiative:** Develop and test the feasibility of technical options for hydrogen to make high-value transportation fuels and other products for the international deployment of the technologies ($500). Conduct slurry F-T reactor design data base; continue feasibility study, R&D, and design of the Early Entrance Coproduct-ion Plant with industry consort-ium. ($2,805). (Total $5,765) (Air Products, NETL, CAER, WMPI, Dynergy, Texaco, TBD)	reactor design data base activity ($1,980); continue feasibility study, R&D, and design of the Early Entrance Coproduction Plant with industry consortium with prior year funding ($0). (Total $1,980) (APCI, WMPI, Texaco, TBD).	
	Product Upgrading: Continue research on DME/diesel blends, characterize coal-derived transportation fuels. ($260) (PSU, NETL)	Product Upgrading: Conclude all activity in an orderly manner with prior year funds. ($0)	No activity. ($0)
	Systems Engineering: Continue technical, economic and environmental analyses; engineering support and technical	Systems Engineering: Continue technical, economic, and environmental analyses ($250) (Mitretek, Rand, NETL)	No activity. ($0)

III. **Performance Summary**: FUELS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
	guidance. ($503) (Mitretek, NETL, TBD)		
Transportation Fuels and Chemicals (Cont'd)	Funding for syngas production included in the Natural Gas Technology budget.	Continue exploratory research activities of novel conversion concepts of promising chemical and small-scale physical conversion technology innovations. Continue research and development of a novel syngas ceramic membrane technology to enhance Fischer-Tropsch (F-T) gas conversion for environmentally superior liquid fuels and hydrogen ($3,950). Conduct fundamental supporting fuels research at NETL ($1,000). (Total $4,950) (APCI, NETL, PNNL, LANL, Canmet, Praxair)	Continue exploratory research activities of novel conversion concepts of promising chemical and small-scale physical conversion technology innovations. Continue research and development of a novel syngas ceramic membrane technology to enhance Fischer-Tropsch (F-T) gas conversion for environmentally superior liquid fuels and hydrogen ($3,770). Conduct fundamental supporting fuels research at NETL ($1,180). (Total $4,950) (APCI, NETL, LANL, Univ. Of Alaska, Canmet, Praxair)
	Funding for ultra clean fuels, included in Oil Technology budget.	Continue cost-shared industrial research for the development of ultra-clean fuels technology for fossil resources (natural gas, petroleum, coal) ($15,590). Conduct ultra-clean diesel fuels research at the University of Alaska ($990) (Total $16,580) (Praxair, ICRC/syntroleum,	Conclude cost-shared industrial research for the development of ultra-clean fuels technology for fossil resources (natural gas, petroleum, coal) with prior year funds ($0) (Praxair, ICRC/Syntroleum, Conoco, RTI, Petrostar, Envires, NETL)

III. **Performance Summary**: FUELS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
		Conoco, RTI, Petrostar, Envires, University of Alaska, NETL)	
	Fund technical and program management support. ($76)	Fund technical and program management support. ($240)	Fund technical and program management support. ($50)
	$7,404	$24,000	$5,000
Solid Fuels and Feedstocks	Environmental Technologies: Continue support of the development of a national coal quality data base on trace elements. Tailored Fuels: Conduct research on technologies for enhanced carbon recovery from coal and coal waste products, improved coal fines processing, and the preparation of coal/ biomass/waste for gasification and co-firing applications to lower emissions of greenhouse gases. ($2,452) (NETL, TBD)	Environmental Technologies: Conclude all activity in an orderly manner with prior year funds. ($0)	Environmental Technologies: No activity ($0)
Solid Fuels and Feedstocks (Cont'd)			
	Premium Carbon Products: Conduct technical/economic assessments and laboratory and bench scale research on technologies for the manufacture of carbon products. Conduct research at outside facilities for advanced technologies for the	Premium Carbon Products: Conduct technical/economic assessments and laboratory and bench scale research on technologies for the manufacture of carbon products. Conduct research at outside facilities for advanced technologies for the	Premium Carbon Products: Conclude technical/economic assessments and laboratory and bench scale research on technologies for the manufacture of carbon products with prior year funds. Conclude research at outside facilities for advanced

III. **Performance Summary**: FUELS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
	premium carbon products from coal via an industry-led and cost-shared consortium ($1,615). Advanced Separations: Conduct research in the areas of advanced technologies for solid-solid and solid-liquid separations directed toward fuels production and use ($1,100). (Total $2,715) (NETL, Penn State, TBD)	premium carbon products from coal via an industry-led and cost-shared consortium ($2,000). Advanced Separations: Continue research in the areas of advanced technologies for solid-solid and solid-liquid separations ($2,950). (Total $4,950) (NETL, Penn State, TBD)	technologies for the premium carbon products from coal via an industry-led and cost-shared consortium with prior year funds ($0) (Penn State).
	Fund technical and program management support. ($53)	Fund technical and program management support. ($50)	No activity. ($0)
	$5,220	$5,000	$0

III. **Performance Summary**: FUELS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Advanced Fuels Research	C-1 Chemistry: Cosponsor investigation of the chemistry of monocarbon compounds for the production of hydrogen, syngas, strategic chemicals and transportation fuels with the EE Office of Advanced Automotive Technologies. Investigate advanced clean diesel and diesel additive production technologies and the production of high value chemicals within the Vision 21 concept ($650). Hydrogen Economy Enabling Science: Conduct research on enabling science for the hydrogen economy including production of hydrogen from fossil resources and the study of novel media for physical and chemical hydrogen storage. ($893). (Total $1,543) (NETL, CFFLS, TBD)	C-1 Chemistry: Cosponsor investigation of the chemistry of monocarbon compounds for the production of hydrogen, syngas, strategic chemicals and transportation fuels with the EE Office of Advanced Automotive Technologies. (Total $1,485) (TBD)	C-1 Chemistry: No activity. ($0)
	Molecular Modeling and Catalyst Development: Conduct studies on molecular modeling for the hydrocracking of F-T wax to diesel. Devise technology for application of combinatorial chemistry techniques at high	Molecular Modeling and Catalyst Development: Conclude all activity in an orderly manner with prior year funds. ($0)	Molecular Modeling and Catalyst Development: No activity. ($0)

III. **Performance Summary**: FUELS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
	temperatures and pressures. ($250) (SNL)		
Advanced Fuels Research (Cont'd)	Advanced Concepts: Investigate advanced concepts underlying the production of ultra-clean fuels and chemicals that would provide the scientific basis for new technology. ($1,974) (TBD)	Advanced Concepts: Investigate advanced extraction concepts for producing advanced extraction products from coal. ($1,683) (TBD)	Advanced Concepts: No activity. ($0)
	Fund technical and program management support. ($39)	Fund technical and program management support. ($32)	No activity. ($0)
	$3,806	$3,200	$0
Steelmaking	Steelmaking: Conduct industry cost-shared demonstration of a revolutionary process that produces direct-reduced iron at lower cost and with virtually zero emissions. ($6,443) (TBD)	Steelmaking: Successfully complete activity with prior year funds. ($0)	No activity. ($0)
	Fund technical and program management support. ($67)	No activity. ($0)	No activity. ($0)
	$6,510	$0	$0
Fuels, Total	$22,940	$32,200	$5,000

DEPARTMENT OF ENERGY
FY 2003 CONGRESSIONAL BUDGET REQUEST

FOSSIL ENERGY RESEARCH AND DEVELOPMENT

ADVANCED RESEARCH

I. **Mission Supporting Goals and Objectives**:

The Advanced Research Program funds two types of activities. The first is a set of crosscutting studies and assessment activities in environmental, technical and economic analyses, coal technology export and international program support. The second is a set of crosscutting fundamental and applied research programs which include coal utilization science, materials and components, bioprocessing of coal and university-based coal research. The second set of programs includes an activity focused upon Historically Black Colleges and Universities (HBCU) and other minority institutions and addresses the full spectrum of fossil utilization research and development, technology transfer, outreach, and private sector partnerships.

In the crosscutting studies and assessments subprograms, the thrusts of international program support, environmental activities, coal technology export, and technical and economic analysis are to complement and enhance all Fossil Energy endeavors by providing both financial and technological leverage. International involvement is limited to those selected areas where it has been determined that the U.S. will benefit at least to the extent it contributes. Fossil Energy, through these activities, always attempts to encourage the leveraging of research and development funds while promoting U.S. industrial interests and to use them as opportunities to achieve responsible international consensus and opinion on technical business assessment and policy issues.

The crosscutting fundamental and applied research programs focus upon developing the technology base in the enabling science and technology areas that are critical to the successful development of both superclean, very high efficiency coal-based power systems and coal-based fuel systems with greatly reduced or no net emissions of CO_2. These systems are encompassed in the Vision 21 energyplex. Advanced Research seeks a greater understanding of the physical, chemical, biological and thermodynamic barriers to achieving economic, technologic, and environmental goals and to identify ways to overcome those barriers. The program is unique in that it is directed to specific underlying fundamental scientific and engineering problems closely connected to short-term, mid-term and long-range Fossil Energy objectives.

I. **Mission Supporting Goals and Objectives**: ADVANCED RESEARCH (Cont'd)

In order to achieve these goals, an Advanced Research focus area on Computational Energy Sciences was established at the National Energy Technology Laboratory (NETL). This focus area will conduct simulations and modeling activities to produce a "technology base" from which the energy plants of the future will be designed, built and operated.

The Coal Utilization Science subprogram focuses on research pertinent to all coal utilization systems, with specific attention paid to increasing our knowledge of the principal mechanisms that control coal combustion processes. It will address issues affecting the utilization of coal, and its primary thrust is in support of the development of the Vision 21 concept. It will involve novel concepts for CO_2 capture and sequestration, such as mineral carbonation, and virtual simulations and modeling of components and subsystems. It will also include research on instrumentation and diagnostics to support the need for advanced controls and sensors. High performance Advanced Materials and equipment are essential to advanced coal technologies. Thus, the thrust of the Advanced Materials subprogram is to develop materials for advanced gas separation and particulate removal, as well as to develop solutions to materials performance barriers unique to very high temperature, highly corrosive coal combustion and gasification environments. Exploratory research and innovation to maximize the use of coal in environmentally preferable ways is typified by the bioprocessing of coal subprogram. The focus of the Biotechnology subprogram is to conduct biological research to produce clean fuels and to reduce greenhouse gas emissions (NO_x, SO_x, and CO_2) from existing and new powerplants. The University Coal Research and HBCU Education and Training subprograms support competitively awarded research grants to U.S. universities to address Fossil Energy's highest priority research needs.

The major goal of the Advanced Research Program focus is to develop, by 2015, a series of advanced materials, subsystem technologies, and breakthrough process concepts that are essential to the success of Vision 21.

FY 2003 Performance Measures in furtherance of the above goals include:

- Develop solid oxide fuel cell materials that operate at lower temperatures (700°C), thereby assuring with 95% confidence that fuel cell capital costs of $400/kW in 2010 will be achieved.
- Provide between 15 and 20 grants to teams of university students and professors to perform research ranging from fundamental studies in coal science and utilization, to long range exploratory research that could lead to future breakthroughs.
- Provide between 5 and 7 grants to teams of students and professors at minority institutions.
- Implement computational study of device-level experimental investigation of a critical Vision 21 component.

I. **Mission Supporting Goals and Objectives**: ADVANCED RESEARCH (Cont'd)

- Prepare detailed engineering assessments to design pounds/hour CO_2 mineral sequestration unit.
- Complete research efforts to determine alternate sources and processes for Mg and Ca as potential feedstock for CO_2 sequestration via mineral carbonation. Conduct at least 24 experiments to determine 1 alternative source and 2 alternative processes.
- Demonstrate that biohydrogen generation using extremophiles can be conducted on a production scale. Generate 6000 cu. ft. of hydrogen per hour to supply a 200kW fuel cell.

II. A. **Funding Schedule**: ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003	$Change	%Change
Coal Utilization Science	$6,142	$6,250	$8,000	$1,750	28%
Materials	6,806	7,000	9,000	2,000	29%
Technology Crosscut					
Coal Technology Export	843	800	800	0	0%
Bioprocessing of Coal	1,347	1,350	1,350	0	0%
Environmental Activities	1,996	1,900	2,000	100	5%
Technical & Economic Analyses	1,098	750	1,000	250	33%
International Program Support	998	950	1,000	50	5%
Focus Area for Computational Energy Science	6,993	5,000	3,000	-2,000	-40%
Subtotal, Technology Crosscut Research	13,275	10,750	9,150	-1,600	-15%
University Coal Research	2,915	3,000	4,000	1,000	33%
HBCUs, Education and Training	972	1,000	1,500	500	50%
Total, Advanced Research	$30,110	$28,000	$31,650	$3,650	13%

II. B. **Laboratory and Facility Funding Schedule**: ADVANCED RESEARCH (Cont'd) ($ in thousands)

	FY 2001	FY 2002	FY 2003	$Change	%Change
Argonne National Lab (East)	$978	$988	$988	$0	0%
Idaho Nat'l Engineering & Environmental Lab	570	570	570	0	0%
National Energy Technology Laboratory	5,319	5,420	5,520	100	2%
Los Alamos National Lab	600	600	600	0	0%
Oak Ridge National Lab	4,044	4,435	4,435	0	0%
Pacific Northwest Lab	840	770	770	0	0%
Sandia National Laboratories	550	550	550	0	0%
Ames National Laboratory	140	230	230	0	0%
All Other	17,069	14,437	17,987	3,550	25%
Total, Advanced Research	$30,110	$28,000	$31,650	$3,650	13%

III. **Performance Summary**: ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Coal Utilization Science	Conduct research to enable reduction or elimination of environmental impacts of coal use; focus on greenhouse gases that may affect global climate change. Continue research toward the Virtual Demonstration Plant in support of the Vision 21 power and fuels complex. Continue development of instrumentation, diagnostics and controls for advanced power systems. Conduct systems analysis of Vision 21 concepts to identify	Conduct research to enable reduction or elimination of environmental impacts of coal use; focus on greenhouse gases that may affect global climate change. Continue research for and conduct preliminary model testing and research for Virtual Demonstration Plant. Continue development of instrumentation, diagnostics and controls for advanced power systems. Continue stochastic modeling and systems analysis of Vision 21 concepts. Continue	Conduct research to enable reduction or elimination of environmental impacts of coal use; focus on greenhouse gases that may affect global climate change. Continue research for and conduct preliminary model testing and research for Virtual Demonstration Plant. Continue development of instrumentation, diagnostics and controls for advanced power systems. Issue solicitation for development of new sensor and measurement techniques to control

III. **Performance Summary**: ADVANCED RESEARCH (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Coal Utilization Science (Cont'd)	critical research areas. Continue projects to develop critical enabling technologies for advanced power and fuel systems and in support of Vision 21; and incorporate the results into the Virtual Demonstration. Continue research in basic combustion, contaminant evolution, fundamental carbon studies, and predictive models. Continue research on mineral sequestration of CO_2 at large scale (1 kg). ($5,830) (NETL, SNL, LANL, TBD)	with six projects selected under the Vision 21 solicitation and issue new solicitations to develop critical enabling technologies for advanced power and fuel systems and in support of Vision 21. Continue research in basic combustion, contaminant evolution, fundamental carbon studies, and predictive models. Continue research on mineral sequestration of CO_2 at large scale (1 kg) utilizing a full scale flow loop. ($5,937) (NETL, SNL, LANL, Natl. Fuel Cell Res., Fluent, Reaction Engineering, TBD)	and optimize V 21 plant efficiencies and emission performance. Continue stochastic modeling and systems analysis of Vision 21 concepts. Complete 3 projects and continue other projects selected under Rounds I, II and III of the Vision 21 solicitation to develop critical enabling technologies for advanced power and fuel systems and in support of Vision 21. Continue research in basic combustion, contaminant evolution, fundamental carbon studies, and predictive models. Transfer engineering flow reactor (5# scale) experimental support for mineral sequestration of CO_2 to line program. Continue lab experiments on fundamental mechanisms for process development. ($7,920) (NETL, SNL, LANL, Natl. Fuel Cell Res., Fluent, Reaction Engineering, TBD)
	Initiate collaborative efforts with Basic Energy Science on the	Continue collaborative efforts with Basic Energy Science on the	No activity. ($0)

III. **Performance Summary**: ADVANCED RESEARCH (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
	Strategic Simulation Initiative to develop a new generation of combustion simulation computational models. ($250) (TBD)	Strategic Simulation Initiative to develop a new generation of combustion simulation computational models. ($250) (TBD)	
Coal Utilization Science (Cont'd)	Fund technical and program management support. ($62)	Fund technical and program management support. ($63)	Fund technical and program management support. ($80)
	$6,142	$6,250	$8,000
Materials	Continue those essential activities of the high temperature structural ceramic composites, alloys, and functional materials developments that are enabling elements for the development of economical, high efficiency, and environmentally clean fossil energy power systems. These include resistant coatings; fabrication processes; filters; ceramic membranes; solid state electrolytes; carbon fibers; ceramic heat exchangers; and non-destructive evaluation techniques, high- and very-high temperature intermetallics, and oxide-dispersion-strengthened alloys. ($5,474) (ANL, INEEL, ORNL, PNNL)	Continue those essential activities of the high temperature structural ceramic composites, alloys, and functional materials developments that are enabling elements for the development of economical, high efficiency, and environmentally clean fossil energy power systems. These include resistant coatings; fabrication processes; filters; ceramic membranes; solid state electrolytes; carbon fibers; ceramic heat exchangers; non-destructive evaluation techniques, high- and very-high temperature intermetallics, and oxide-dispersion-strengthened alloys. ($5,015) (ANL, INEEL, ORNL, Eltron, Ames, Huntington Alloys,	Continue those essential activities of the high temperature structural ceramic composites, alloys, and functional materials developments that are enabling elements for the development of economical, high efficiency, and environmentally clean fossil energy power systems. These include resistant coatings; fabrication processes; filters; ceramic membranes; solid state electrolytes; carbon fibers; ceramic heat exchangers; non-destructive evaluation techniques, high- and very-high temperature intermetallics, and oxide-dispersion-strengthened alloys. ($5,015) (ANL, INEEL, ORNL, Eltron, Ames, Huntington Alloys,

III. **Performance Summary**: ADVANCED RESEARCH (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
		NETL)	NETL)
Materials (Cont'd)	Increase support to breakthrough concepts to develop materials for achieving very low cost hydrogen and oxygen separation from mixed gas streams and for stablizing greenhouse gases. These are critical enabling technologies to deploy Vision 21 energy plants. ($1,262) (AMES, NETL, SNL, TBD)	Support development of alloys for supercritical systems. Increase support to breakthrough concepts to develop materials for achieving very low cost hydrogen and oxygen separation from mixed gas streams and for stabilizing greenhouse gases. These are critical enabling technologies to deploy Vision 21 energy plants. ($1,915) (LANL, SNL, ORNL, PNNL, ARC, TBD)	Support development of alloys for ultra supercritical systems. Increase support to breakthrough concepts to develop materials for achieving very low cost hydrogen and oxygen separation from mixed gas streams and for stabilizing greenhouse gases. These are critical enabling technologies to deploy Vision 21 energy plants. ($3,895) (LANL, SNL, ORNL, PNNL, ARC, Energy Industries of Ohio, TBD)
	Fund technical and program management support. ($70)	Fund technical and program management support. ($70)	Fund technical and program management support. ($90)
	$6,806	$7,000	$9,000
Technology Crosscut - Coal Technology Export	Sustain continued support to deploy cleaner coal and power generation systems internationally. Pursue opportunities identified by the World Energy Council Committee on Cleaner Fossil Fuel Systems and the Southern States Energy Board for the international	Sustain continued support to deploy cleaner coal and power generation systems internationally. Intensify the pursuit of opportunities identified by the World Energy Council Committee on Cleaner Fossil Fuel Systems and the Southern States Energy	Sustain continued support to deploy cleaner coal and power generation systems internationally. Intensify the pursuit of opportunities identified by the World Energy Council Committee on Cleaner Fossil Fuel Systems and the Southern States Energy

III. **Performance Summary**: ADVANCED RESEARCH (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Technology Crosscut - Coal Technology Export (Cont'd)	sale of clean technologies and advanced power systems. Promote deployment of cleaner energy systems through training, conferences, and information and technical exchanges on cleaner power systems. ($843) (TBD	Board for the international sale of U.S. clean coal technologies and advanced power systems. Expand the establishment of effective partnerships to advance U.S. interests in environmental protection by promoting deployment of cleaner energy systems through training, conferences, site visits and information and technical exchanges on clean power systems, best practices, privatization with targeted utilities and governments and advising countries on identification and elimination of barriers for deployment of cleaner coal and power systems. ($800) (TBD)	Board for the international sale of U.S. clean coal technologies and advanced power systems. Expand the establishment of effective partnerships to advance U.S. interests in environmental protection by promoting deployment of cleaner energy systems through training, conferences, site visits and information and technical exchanges on clean power systems, best practices, privatization with targeted utilities and governments and advising countries on identification and elimination of barriers for deployment of cleaner coal and power systems. ($800) (TBD)
	$843	$800	$800
Technology Crosscut - Bioprocessing of Coal	Develop biological processes for fuels that have a significantly lower unit content of greenhouse gas than currently available fuel to reduce the impact on global climate change. Continue development of biofiltration for	Develop biological processes for fuels that have a significantly lower unit content of greenhouse gas than currently available fuel to reduce the impact on global climate change. Complete development of biofiltration for	Develop biological processes for fuels that have a significantly lower unit content of greenhouse gas than currently available fuel to reduce the impact on global climate change. Continue field tests to develop toxin to safely

III. **Performance Summary**: ADVANCED RESEARCH (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Technology Crosscut - Bioprocessing of Coal (Cont'd)	removal of NO_x from combustion gases. Initiate larger scale batch testing of toxins from microorganisms to control zebra mussels. Develop new biomineralization techniques for carbon sequestration. Continue to develop biological CO_2 sequestration by conversion into useful products such as liquid fuels and investigate global, natural CO_2 mitigation strategies such as whitings and ocean scale algae sequestration. ($1,333) (ORNL, INEEL, TBD)	removal of NO_x from combustion gases. Conduct field tests to develop toxin to safely control zebra mussels. Continue to develop biological CO_2 sequestration by conversion into useful products such as liquid fuels and investigate global, natural CO_2 mitigation strategies such as whitings and ocean scale algae sequestration. ($1,336) (ORNL, INEEL, U. State of NY, Cal. State U., TBD)	control zebra mussels. Continue to develop biological CO_2 sequestration by conversion into useful products such as liquid fuels and investigate global, natural CO_2 mitigation strategies such as whitings and ocean scale algae sequestration. Investigate biohydrogen generation from carbon containing waste products to determine food sources that will support microbial growth and hydrogen production. ($1,336) (ORNL, INEEL, U. State of NY, Cal. State U., TBD)
	Fund technical and program management support. ($14)	Fund technical and program management support. ($14)	Fund technical and program management support. ($14)
	$1,347	$1,350	$1,350
Technology Crosscut - Environmental Activities	Continue analyses of issues associated with air and water quality, solid waste disposal, and toxic substances, and global climate change. Continue emission trends and forecast studies. ($1,796) (ANL, ICF, Resource Dynamics, TMS, PNNL,	Continue analyses of issues associated with air and water quality, solid waste disposal, and toxic substances, and global climate change. Continue emission trends and forecast studies. ($1,710) (ANL, ICF, Resource Dynamics, TMS, PNNL,	Continue analyses of issues associated with air and water quality, solid waste disposal, and toxic substances, and global climate change. Continue emission trends and forecast studies. ($1,800) (ANL, ICF, Resource Dynamics, TMS, PNNL,

III. **Performance Summary**: ADVANCED RESEARCH (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
	TBD)	TBD)	TBD)
	Provide environmental, safety and health, safeguards and security and National Environmental Policy Act (NEPA) assistance and assessment support to field offices. ($200) (TMS)	Provide environmental, safety and health, safeguards and security and National Environmental Policy Act (NEPA) assistance and assessment support to field offices. ($190) (TMS)	Provide environmental, safety and health, safeguards and security and National Environmental Policy Act (NEPA) assistance and assessment support to field offices. ($200) (TMS)
	$1,996	$1,900	$2,000

III. **Performance Summary**: ADVANCED RESEARCH (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Technology Crosscut - Technical and Economic Analysis	Continue studies supporting multi-year planning, FE strategy and program formulation; conduct contract studies on issues that crosscut FE programs including strategic benefits of and new markets for fossil fuel technology. Conduct critical studies to identify major challenges, "leapfrog" technologies, and advanced concepts that are applicable to fossil energy systems, and have the potential to improve their efficiency, cost, and/or environmental performance. ($1,098) (ANL, ICF, EIA, Resource Dynamics, TMS, TBD)	Continue studies supporting multi-year planning, FE strategy and program formulation; conduct contract studies on issues that crosscut FE programs including strategic benefits of and new markets for fossil fuel technology. Conduct critical studies to identify major challenges, "leapfrog" technologies, and advanced concepts that are applicable to fossil energy systems, and have the potential to improve their efficiency, cost, and/or environmental performance. ($750) (ANL, ICF, EIA, Resource Dynamics, TMS, TBD)	Continue studies supporting multi-year planning, FE strategy and program formulation; conduct contract studies on issues that crosscut FE programs including strategic benefits of and new markets for fossil fuel technology. Conduct critical studies to identify major challenges, "leapfrog" technologies, and advanced concepts that are applicable to fossil energy systems, and have the potential to improve their efficiency, cost, and/or environmental performance. ($1,000) (ANL, ICF, EIA, Resource Dynamics, TMS, TBD)
	$1,098	$750	$1,000
Technology Crosscut - International Program Support	Continue support of Fossil Energy's commitment to the International Energy Agency (IEA) program effort. Provide leadership, direction, cooperation and coordination of office activities with other Federal agencies, state and local governments, energy trade	Continue support of Fossil Energy's commitment to the International Energy Agency (IEA) program effort. Provide leadership, direction, cooperation and coordination of office activities with other Federal agencies, state and local governments, energy trade	Continue support of Fossil Energy's commitment to the International Energy Agency (IEA) program effort. Provide leadership, direction, cooperation and coordination of office activities with other Federal agencies, state and local governments, energy trade

III. **Performance Summary**: ADVANCED RESEARCH (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Technology Crosscut - International Program Support (Cont'd)	associations, and the energy industry. Preserve and enhance active relationships with national and international organizations such as the World Energy Council (WEC), United States Energy Association (USEA), Southern States Energy Board (SSEB) and the National Association of State Energy Officials (NASEO). Implement Environmental Corps activities in China and activities of the U.S.-China Energy and Environmental Center. Focus on expanding cleaner energy technology power systems activities in Southern and Western regional African countries, Eastern Europe, the Pacific Rim, Russia and Newly Independent States, South Asia/Near East, Western Europe, and the Western Hemisphere. Determine opportunities for power systems in targeted countries. ($998) (TBD)	associations, and the energy industry. Preserve and enhance active relationships with national and international organizations such as the World Energy Council (WEC), United States Energy Association (USEA), Southern States Energy Board (SSEB) and the National Association of State Energy Officials (NASEO). Focus on expanding cleaner energy technology power systems activities in Southern and Western regional African countries, Eastern Europe, the Pacific Rim, Russia and Newly Independent States, South Asia/Near East, Western Europe, and the Western Hemisphere. Determine opportunities for power systems and clean fuels from coal in targeted countries. ($950) (TBD)	associations, and the energy industry. Preserve and enhance active relationships with national and international organizations such as the World Energy Council (WEC), United States Energy Association (USEA), Southern States Energy Board (SSEB) and the National Association of State Energy Officials (NASEO). Focus on expanding cleaner energy technology power systems activities in Southern and Western regional African countries, Eastern Europe, the Pacific Rim, Russia and Newly Independent States, South Asia/Near East, Western Europe, and the Western Hemisphere. Determine opportunities for power systems and clean fuels from coal in targeted countries. ($1,000) (TBD)
	$998	$950	$1,000
Technology	Enhance NETL capabilities to	Continue developing NETL's	Continue developing NETL's

III. **Performance Summary**: ADVANCED RESEARCH (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Crosscut - Focus Area for Computational Energy Science Technology Crosscut - Focus Area for Computational Energy Science (Cont'd)	model and conduct dynamic simulations of advanced energy plants. Establish a consortium with industry, national labs and regional universities and collaborate with other DOE programs for simulation, materials, fabrication/ manufacturing research. Expand scientific simulation and computational capability at NETL through installation of a high speed computer data line located at the Supercomputing Center. Complete the conversion of basic and applied science models into a supercomputing environment and conduct runs of simulations to verify codes.($6,923) (NETL)	capabilities to model and conduct dynamic simulations of advanced energy plants. Complete advanced modeling tools for sub-elements in turbines and fuel cells. Continue advanced development of combustion dynamics, pollution formation and separations computational tools. ($4,950)	capabilities to model and conduct dynamic simulations of advanced energy plants. Continue advanced development of combustion dynamics, pollution formation and separations computational tools. Conduct data reduction and data extraction to utilize extensive information from simulation of advanced energy plants. Initiate integration of subsystem component modules and dynamic system models into virtual models. ($2,970) (NETL)
	Fund technical and program management support. ($70)	Fund technical and program management support. ($50)	Fund technical and program management support. ($30)
	$6,993	$5,000	$3,000
Technology Crosscut, Subtotal	$13,275	$10,750	$9,150
University Coal	Support grants at U.S. universities	Support grants at U.S. universities	Support grants at U.S. universities

III. **Performance Summary**: ADVANCED RESEARCH (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Research University Coal Research (Cont'd)	which emphasize longer-term research that will accelerate technology development and identify breakthrough technologies for the next century; focus on scientific and technological issues that are key to achieving FE's strategic objectives; and increase the number of critical key research areas to include global climate change. Collaboration through joint proposals involving university and industry teams will continue. Continue to explore novel approaches and innovative concepts developed in other scientific and technological areas that will assist in developing breakthrough technologies for coal utilization. ($2,845) (TBD)	which emphasize longer-term research that will accelerate technology development and identify breakthrough technologies for the next century; focus on scientific and technological issues that are key to achieving FE's strategic objectives; continue to support critical key research areas to include Vision 21, global climate change, materials, sensors and controls, and by-products from coal. Continue collaboration through joint proposals involving university and industry teams, and teams with three or more universities. Continue to explore novel approaches and innovative concepts developed in other scientific and technological areas that will assist in developing breakthrough technologies for coal utilization. Award Phase 2 grants to last year's most meritorious innovative concept grantees. ($2,930) (TBD)	which emphasize longer-term research that will accelerate technology development and identify breakthrough technologies for the next century; focus on scientific and technological issues that are key to achieving FE's strategic objectives; continue to support critical key research areas to include Vision 21, global climate change, materials, sensors and controls, and by-products from coal. Continue collaboration through joint proposals involving university and industry teams, and teams with three or more universities. Continue to explore novel approaches and innovative concepts developed in other scientific and technological areas that will assist in developing breakthrough technologies for coal utilization. Expand the Innovative Concepts Phase Two Program by providing follow-on support to those previous years' grantees that

III. **Performance Summary**: ADVANCED RESEARCH (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
			hold the most promise of achieving significant research advances. ($3,960) (TBD)
University Coal Research (Cont'd)	Support the undergraduate internship program to allow those junior-level science and engineering majors to experience fundamental research in the areas of environmental science and engineering, and energy, where no graduate course or degrees are offered in their major field of study. ($40) (TBD)	Support the undergraduate internship program to allow students having science and engineering majors to perform fundamental research in the areas of environmental science and fossil energy, where no graduate course or degrees are offered in their major field of study at their institutions. ($40) (TBD)	No activity. ($0)
	Fund technical and program management support. ($30)	Fund technical and program management support. ($30)	Fund technical and program management support. ($40)
	$2,915	$3,000	$4,000
HBCUs, Education and Training	Conduct research activities with HBCU and other minority institutions and support an HBCU annual technology transfer symposium. ($962) (TBD)	Conduct research activities with HBCU and other minority institutions and support an HBCU annual technology transfer symposium. ($990) (TBD)	Conduct research activities with HBCU and other minority institutions and support an HBCU annual technology transfer symposium. ($1,485) (TBD)
	Fund technical and program management support. ($10)	Fund technical and program management support. ($10)	Fund technical and program management support. ($15)

III. **Performance Summary**: ADVANCED RESEARCH (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
	$972	$1,000	$1,500
Advanced Research, Total	$30,110	$28,000	$31,650

DEPARTMENT OF ENERGY
FY 2003 CONGRESSIONAL BUDGET REQUEST

FOSSIL ENERGY RESEARCH AND DEVELOPMENT

OTHER POWER SYSTEMS
DISTRIBUTED GENERATION SYSTEMS

I. **Mission Supporting Goals and Objectives**:

Fuel cells and other innovative power technology systems are being developed in the near-term for distributed generation applications. In contrast to central systems, distributed systems generally imply smaller-scale production of electric power in stationary plants at or near the end user. Fuel cells as small modular resources may be used on a stand-alone basis, or integrated with other units, and even connected to a central system grid. These systems may be owned and/or operated by utilities, utility customers, and third parties.

The deregulation and restructuring of the utility industry is expected to accelerate the adoption of distributed power generation in new markets. Distributed generation systems like fuel cells potentially offer opportunities for cost-effectively meeting peak demand without the need for capital intensive central station capacity or costly investments in transmission and distribution; they could be used to provide clean power to remote end users; and they could provide new business opportunities to both utility and non-utility owners.

By 2010, distributed generation could emerge as an important segment of the world power-generation market, meeting requirements for higher efficiency and environmental protection and also serving as building blocks to ensure sustainable development.

Distributed Generation Systems: Fuel Cells: The Fuel Cells Program is leveraging technical innovation to develop advanced power systems for distributed generation that will improve power quality, boost system reliability, reduce energy costs, and help delay/defray capital investments. The program goal is to develop low-cost, high efficiency, fuel flexible, modular power systems with lower cost, higher quality electricity, and significantly lower carbon dioxide emissions than current plants, as well as near-zero levels of pollutants.

The objectives of the Fuel Cell activity are: (1) to support technology base development of fuel cell systems for electric utility, industrial, and commercial/residential markets; and (2) to provide technologies that improve U.S. international competitiveness in this new manufacturing industry.

I. **Mission Supporting Goals and Objectives**: DISTRIBUTED GENERATION SYSTEMS (Cont'd)

The current strategies to develop clean high efficiency fossil fueled powerplants include: Immediate near-term (to year 2004) - develop and demonstrate high efficiency, environmentally clean, gas-fueled, multi-kilowatt, fuel cell powerplants, and to commercially introduce these powerplants; Near-term (to year 2004-2006) - develop and proof-of-concept test through the Solid State Energy Conversion Alliance (SECA) a potentially low cost 3-10 kilowatt solid state fuel cell module for distributed and auxiliary power unit applications; Mid-term (to year 2010) - develop and demonstrate the advancements in solid state fuel cell technology under SECA and combined cycle fuel cell heat engine technology (fuel cell/turbine hybrids) which will enable industry to significantly penetrate broad markets for high efficiency gas-based systems and commercially introduce coal-fueled, multi-megawatt powerplants at competitive costs; Long-term (2010-2015) - develop and demonstrate the critical high risk technology advancements which will permit U.S. industry to establish commercial availability of advanced, low-cost, ultra-high efficiency, fuel flexible, integrated solid state fuel cell/turbine hybrids systems. Fuel cell systems have specifically identified goals which coincide with coal-based and other fuel-flexible Vision 21 power modules and concepts in the 2010 to 2015 time frame.

The distributed generation systems program also supports the Strategic Center for Natural Gas at the National Energy Technology Laboratory. Natural gas is and will continue in the forseeable future to be the primary fuel used for distributed power applications. The advanced systems developed under this program will provide clean, cost effective distributed power options for the domestic gas industry.

The Advanced Research subactivity supports the program objectives by conducting research to identify new, highly innovative electrochemical technology concepts and by solving fundamental crosscutting electrochemical technology issues.

Fuel Cell Distributed Generation Systems are capable of reducing criteria pollutants well below current New Source Performance Standard levels, reducing non-criteria pollutants such as CO_2 and acid rain precursors, and reducing thermal emissions to the environment. These reductions are achieved through the inherently low emissions and ultra-high efficiency of fuel cell systems. First generation phosphoric acid systems have reached commercial status and are finding applications in premium power markets and locations that require pristine power generation. Higher system efficiencies and lower costs are forecast for advanced molten carbonate and solid oxide fuel cell systems, the second generation systems which will be introduced using natural gas in the near term distributed generation market and later operated on gas and coal in multiple end-use sectors.

Fuel Cell/Turbine Hybrids under Vision 21 provide a more rapid way to deploy the fuel cell technology into broader applications.

I. **Mission Supporting Goals and Objectives**: DISTRIBUTED GENERATION SYSTEMS (Cont'd)

Integration of the fuel cell and turbine into a single system lowers system cost and raises system efficiency. Hybrid efforts include dynamic and detailed modeling, small scale system testing, continued system studies and exploration of integration and market issues. Hybrid power modules are expected to be a key enabling technology for long-term Vision 21 systems.

Innovative Concepts are pursued throught the Solid-State Electricity Conversion Alliance (SECA), a new paradigm for fuel cells development. The objective of the SECA is to drastically reduce fuel cell costs to make them a broadly applicable and more widespread commodity in the competitive, mature distributed generation and auxiliary power markets. The SECA program incorporates an integrated strategy to address the technical barriers of solid-state fuel cell systems within the cost constraint of $400 per kilowatt for a complete system. Work under the SECA core program includes, gas processing (reforming and cleanup), power electronics, controls and diagnostics, heat recovery, modeling and simulation, and material and manufacturing/fabrication research at universities and national laboratories. The SECA industry teams will be engaged in the development of common modules for diverse applications in multiple stationary and mobile market applications.

SECA also focuses research performers on the breakthrough technologies needed to achieve the program goals. SECA includes exploration of designs that combine functions to reduce size, weight, and costs.

Novel Generation Concepts: The Fossil Energy R&D program is committed to searching for promising new ideas for low-cost, low-pollutant power generation. In recent years, Fossil Energy R&D has funded research on the Ramgen engine, an innovative power systems technology. The Ramgen system is capable of utilizing a variety of fuel gasses including waste gases. Ramgen engines are simple and powerful devices that operate a supersonic speed to produce electricity at high efficiencies (40+%) at small sizes, and perhaps up to 60% on larger systems. Fossil Energy will issue a solicitation for novel generation system to help bring to market new ideas like these.

FY 2003 Performance Measures in furtherance of the above goals include:

- Design and test a small industrial scale prototype Ramgen engine.
- Validate the high current densities for single cell SECA SOFCs in the 650 - 950 Centigrade temperature range as the initial step necessary to achieve the $400/kW cost target.

II. A. **Funding Schedule**: DISTRIBUTED GENERATION SYSTEMS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003	$Change	%Change
Fuel Cells					
Advanced Research	$2,721	$4,000	$3,000	$-1,000	-25%
Fuel Cell Systems	30,172	13,500	10,000	-3,500	-26%
Vision 21 Hybrids	14,592	13,500	11,500	-2,000	-15%
Innovative Systems Concepts	3,789	27,124	22,500	-4,624	-17%
Subtotal, Fuel Cells	51,274	58,124	47,000	-11,124	-19%
Novel Generation	0	0	2,500		
Total, Distributed Generation Systems	$51,274	$58,124	$49,500	$-8,624	-15%

II. B. **Laboratory and Facility Funding Schedule**: ($ in thousands)

	FY 2001	FY 2002	FY 2003	$Change	%Change
Argonne National Lab (East)	$800	$1,000	$1,000	$0	0%
Pacific Northwest Lab	2,147	4,450	5,975	1,525	34%
National Energy Technology Laboratory	1,390	1,655	2,000	345	21%
All Other	44,790	46,569	40,500	-6,069	-13%
Total, Distributed Generation Systems	$51,274	$58,124	$49,500	$-8,624	-15%

Fuel Cells-Advanced Research	This program conducts generic research to capitalize on the intrinsic high efficiency and environmentally benign characteristics of advanced fuel cells. Research will be conducted to lower fuel cell costs, to investigate advanced, lower cost and high performance, mid to high temperature solid state fuel cells, to solve fundamental crosscutting materials and design issues, and to pursue thin film advanced cell processing techniques. (Total $2,693) (ANL, PNL, TBD)	This program conducts generic research to capitalize on the intrinsic high efficiency and environmentally benign characteristics of advanced fuel cells. Research will be conducted to identify new highly innovative fuel cell concepts and to solve fundamental crosscutting materials and design issues. ($3,960) (ANL, PNL, TBD)	This program conducts generic research to capitalize on the intrinsic high efficiency and environmentally benign characteristics of advanced electrochemical technology. Research will be conducted to identify new highly innovative electrochemical technology concepts and to solve fundamental crosscutting issues. ($2,970) (TBD)
	Fund technical and program management support. ($28)	Fund technical and program management support. ($40)	Fund technical and program management support. ($30)
	$2,721	$4,000	$3,000

III. **Performance Summary**: DISTRIBUTED GENERATION SYSTEMS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Fuel Cells- Fuel Cell Systems	Continue cost-shared cost reduction and performance improvement on one full molten carbonate system for market entry by the private sector. ($13,500) (TBD)	Continue cost-shared cost reduction and performance improvement on one full molten carbonate system for market entry by the private sector; continue supportive distributed generation infrastructure, economic and market study assessments and system assessments and evaluations. ($13,365) (FCE)	Continue cost-shared cost reduction and performance improvement on one full molten carbonate system for market entry by the private sector; continue supportive distributed generation infrastructure, economic and market study assessments and system assessments and evaluations. ($9,900) (FCE, TBD)
Fuel Cells- Fuel Cell Systems (Cont'd)	**SECA** -Continue distributed generation infrastructure, economic and market study assessments; system assessments and evaluations, materials studies; conduct mid to high temperature Vision 21 fuel cell component and process development, and low cost component development. ($16,363) (ADL, NL, NETL, TBD)	**SECA**-related activity will be continued under the Innovative Systems Concepts area.	
	Continue technical and program management support. ($309)	Continue technical and program management support. ($135)	Continue technical and program management support. ($100)
	$30,172	$13,500	$10,000
Fuel Cells -	Conduct a Vision 21 enabling cost	Conduct a Vision 21 enabling cost	Conduct a Vision 21 enabling cost

III. **Performance Summary**: DISTRIBUTED GENERATION SYSTEMS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Vision 21 Hybrids	reduction and performance enhancement program with Vision 21 fuel cell/turbine hybrid technologies, such as the tubular SOFC hybrid; conduct hybrid follow-on solicitation; conduct system studies and explore integration issues as permitted. ($14,442) (SWPC, NETL, TBD)	reduction and performance enhancement program with Vision 21 fuel cell/turbine hybrid technologies, such as the tubular SOFC hybrid; conduct hybrid follow-on solicitation; conduct system studies and explore integration issues as permitted. ($13,365) (SWPC, NETL, TBD)	reduction and performance enhancement program with Vision 21 fuel cell/turbine hybrid technologies, such as the tubular SOFC hybrid; conduct system studies and explore fuel flexibility and integration issues as permitted. ($11,385) (SWPC, NETL, TBD)
	Continue technical and program management support. ($150)	Continue technical and program management support. ($135)	Continue technical and program management support. ($115)
	$14,592	$13,500	$11,500
Innovative Systems Concepts	**SECA** - Conduct activities leading to development of low-cost fuel cells. Continue Vision 21 multi-layer ceramic technology for fuel cells leading to low-cost SECA fuel cell manufacture. ($3,750) (NETL, NL, TBD)	**SECA** - Conduct mid- to high-temperature SECA-related low-cost solid state fuel cell component and process development; integrate multi-layer ceramic technology for fuel cells leading to low-cost solid state fuel cell manufacture into the SECA activity. ($26,853) (McDermott, ADL, NL, NETL, TBD)	**SECA** - Conduct mid- to high-temperature low-cost SECA solid state fuel cell program; fund multiple SECA industrial teams and a core technology program; conduct coal-based SECA-hybrid integration studies as permitted. ($22,275) (McDermott, ADL, NL, NETL, TBD)
	Fund technical and program management support. ($39)	Fund technical and program management support. ($271)	Fund technical and program management support. ($225)

III. **Performance Summary**: DISTRIBUTED GENERATION SYSTEMS (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
	$3,789	$27,124	$22,500
Subtotal, Fuel Cells	$51,274	$58,124	$47,000
Novel Generation	Ramgen - included under turbines	Ramgen - included under turbines	Issue a solicitation for novel generation systems ($2,475)
	Fund technical and program management support. ($39)	Fund technical and program management support. ($271)	Fund technical and program management support. ($25)
Subtotal, Novel Generation	$0	$0	$2,500
Distributed Generation Systems, Total	$51,274	$58,124	$49,500

DEPARTMENT OF ENERGY
FY 2003 CONGRESSIONAL BUDGET REQUEST

FOSSIL ENERGY RESEARCH AND DEVELOPMENT

NATURAL GAS TECHNOLOGIES

I. **Mission Supporting Goals and Objectives**:

Natural gas consumption in the United States is projected by several leading research organizations to reach or exceed 33 trillion cubic feet (Tcf) per year by 2020, increasing from 22 Tcf in 1997 (projections of EIA, GRI). Gas will play a key role in the 21st century transition to a post-oil economy for transportation fuels. Most of the domestic gas resource base is not yet fully known and is located in such areas as: deep formations, low-permeability sandstones, below basalt formations, hydrates, deep water, and remote areas -- Gulf of Mexico and Alaska.

Federal Roles and Responsibilities: Federal roles and responsibilities in natural gas supply research are to: (1) provide strategic guidance for national energy policy; (2) support efficient and sustainable use of domestic energy resources; (3) protect the environment and public safety; (4) enhance the value of Federal lands (38% of gas production is on Federal lands); (5) enhance global market opportunities for U.S. energy technologies; (6) contribute to U.S. science and technology leadership; (7) apply a unique national perspective to technology development that is independent of company specific and State-specific interests; and (8) ensure that industry maintains the integrity and viability of the Nation's energy infrastructures.

DOE's Role In Gas RD&D: Support national goals to: (1) enhance the efficiency and environmental quality of domestic gas exploration, recovery, and processing operations; (2) focus on high-risk technology that private companies alone won't undertake; (3) provide scientific and technological information and analysis to assist policymakers in their decision making; and (4) contribute to science based improvements in regulations to reduce uncertainties and costs while achieving optimal environmental protection.

The overall goal of the Natural Gas Technologies Program is to improve the Nation's ability to produce and utilize gas in an economic, efficient, and environmentally beneficial manner. In support of DOE's mission, the program funds activities that contribute toward: lowering costs for finding and producing gas; improving the confidence in continued availability of a long-term gas supply, and increasing the efficiency of recovery from existing reservoirs (Exploration and Production); enabling characterization and study of gas

I. **Mission Supporting Goals and Objectives**: NATURAL GAS TECHNOLOGIES (Cont'd)

hydrates (Gas Hydrates) and, developing and ensuring availability of low cost environmental compliance technology, and reducing regulatory barriers to economic and efficient market operations by promoting coordinated and innovative Federal and State regulations (Effective Environmental Protection). Each program area has its own unique mission that contributes to the goals and mission of the overall Natural Gas Technologies Program. The total program will increase the value of the natural gas resource base for gas consumers, for Federal, State, and local governments and for the gas industry. The DOE National Energy Technology Laboratory (NETL) located in Morgantown, West Virginia, Pittsburgh, Pennsylvania, and Tulsa, Oklahoma, manage the gas technology program implementation activities.

Exploration and Production: Advanced Drilling Completion, and Stimulation product line funding is requested to: develop and demonstrate a set of tools and techniques that will: (a) result in minimum damage during the drilling, completion, and fracturing stages to particular formations; (b) develop new concepts in drilling; (c) minimize overall environmental impact of drilling-related operations and waste disposal; and (d) the Deep Trek initiative which is designed to develop technologies that make it economically feasible to produce deep (i.e. > 16,000 ft. below earth's surface both onshore and offshore) oil and gas resources. In the Advanced Diagnostics & Imaging Systems Program funding is requested to develop and demonstrate advanced imaging and prediction techniques for locating productive areas within low-permeability and fractured reservoirs. In addition, the program will continue to identify and assess the potential productivity of non-conventional gas reservoirs in priority basins to reduce exploration and production risks. A stripper gas well enhancement sub-program is attempting to extend the productive life of active low rate wells (currently contributing 5% of the domestic gas supply) by continuing an industry-driven consortium to investigate multiple technologies to improve stripper well production.

Gas Hydrates: Efforts are underway to ensure safe extraction of conventional oil and gas resources located near hydrate deposits, enable safe and economic production of gas from hydrates and assess their impact on the global carbon cycle.

Infrastructure: In keeping with the goals of the President's Management Agenda to reduce duplication, the infrastructure activities previously carried out under this program are transferred to the Department of Transportation's Office of Pipeline Safety. There wil be no activities in the Storage program.

Effective Environmental Protection: Funding for environmental research activities will bring credible scientific information and advanced technologies to address the environmental issues that have been identified by industry, and state and federal regulators as

I. **Mission Supporting Goals and Objectives**: NATURAL GAS TECHNOLOGIES (Cont'd)

highest priority. In FY 2003, the program will focus on detection and control of air emissions from gas equipment and facilities, treatment of produced water to meet environmental standards, remediation of hydrocarbon or produced water contaminated soils, treatment and disposal of wastes containing naturally occurring radioactive materials, and other approaches to manage oil and gas field wastes. The program works to lower the cost of effective environmental protection in these environmental issue areas through a combination of risk assessment, technology development, regulatory streamlining, impact analysis, and facilitating dialogue among the affected parties on ways to balance the need to develop the nation's energy resources with the maintenance of our environmental values.

Performance Measures:

- Complete development of a basin model for the Wind River basin that will assist operators in identifying high gas production zones and help them avoid areas of high water production with the potential to add 1 Tcf of gas to the reserve base.
- Drill and evaluate the production potential of the ~ 600 ft. thick hydrate stability zone in a northern Alaska well. Continuous core will be collected through the hydrate stability zone, and preliminary production testing will be conducted. The field data from this well will be used to: 1) verify geological, geophysical and geochemical models of methane hydrates in the North Slope of Alaska, and 2) assess the viability of producing gas from North Slope hydrates.
- Complete the development and demonstration of Composite Drill Pipe (CDP). The CDP will weigh less than half of its steel counterpart and will increase the lateral distance which can be reached from an offshore drilling platform as well as increasing the depth of water in which drilling and production operations can be carried out.

II. A. **Funding Schedule**: ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003	$Change	%Change
Exploration and Production	$13,866	$20,500	$15,450	$-5,050	-25%
Gas Hydrates	9,703	9,800	4,500	-5,300	-54%
Infrastructure	7,914	10,050	0	-10,050	-100%
Emerging Processing Technology	9,897	2,250	0	-2,250	-100%
Effective Environmental Protection	2,545	2,600	2,640	40	2%

I. **Mission Supporting Goals and Objectives**: NATURAL GAS TECHNOLOGIES (Cont'd)

Activity	FY 2001	FY 2002	FY 2003	$Change	%Change
Total, Natural Gas Technologies	$43,925	$45,200	$22,590	$-22,610	-50%

II. B. **Laboratory and Facility Funding Schedule**: NATURAL GAS TECHNOLOGIES (Cont'd) ($ in thousands)

	FY 2001	FY 2002	FY 2003	$Change	%Change
Argonne National Lab (East)	$231	$231	$226	$-5	100%
Idaho National Engineering Lab	200	100	0	-100	0%
Lawrence Berkeley Lab	1,355	900	555	-345	-38%
Lawrence Livermore National Laboratory	245	95	0	-95	-100%
Los Alamos National Laboratory	650	0	0	0	0%
National Energy Technology Laboratory	1,695	540	540	0	0%
Oak Ridge National Laboratory	204	200	0	-200	-100%
Pacific Northwest Laboratory	975	443	0	-443	-100%
Sandia National Laboratories	914	872	175	-697	-80%
All Other	37,456	41,819	21,094	-20,725	-50%
Total, Natural Gas Technologies	$43,925	$45,200	$22,590	$-22,610	-50%

III. **Performance Summary**: ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Exploration and Production	Advanced Drilling, Completion, and Stimulation (DCS): Continue development and field testing of high rate-of-penetration, slimhole, directional, and underbalanced drilling products; and of advanced completion technologies. Continue testing, deployment, and technology transfer of underbalanced drilling technology and minimum formation damage drilling and fracturing. Continue fluid fracture research with the	Advanced Drilling, Completion, and Stimulation (DCS): Complete development of world's first microwave-processed drill bit as a new drilling concept. Commercialize composite drill pipe in onshore and offshore applications. Conclude field testing of advanced directional mud hammer and commercialization of associated high speed data communications system. Continue development of	Advanced Drilling, Completion, and Stimulation (DCS): Complete development and testing of a real-time fracture height growth diagnostic tool. Complete development of ultra-light weight cement for deep water applications. Complete development of high-pressured coiled tubing drilling system. Complete mud hammer evaluation and development. Continue research on long-term,

III. **Performance Summary**: NATURAL GAS TECHNOLOGIES (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Exploration and Production (Cont'd)	GRI at Oklahoma University. Continue development of a revolutionary drilling system. ($5,233) (NETL, Novatek, Mauer, Tempress, ACPT, Tech Int., TBD)	advanced and underbalanced drilling concepts to reduce cost and footprint and increase capability of drilling industry. Initiate research to integrate deep drilling technologies for field demonstrations in the Rocky Mts. ($5,309) (NETL, PSU, Novatek, Mauer, Tempress, ACPT, Tech Int., TBD)	revolutionary technologies such as laser drilling and perferations. Continue research to integrate deep drilling technologies for field demonstrations in the Rocky Mts. ($4,700). Continue and expand development of technologies for drilling deeper than 16,000 feet. Develop high performance drilling and completion systems, advanced coatings and hardening of "Smart" systems and sensors. ($3,815) (Total $8,515) (NETL, Novatek, Mauer, Tempress, Tech Int., GTI, DCS, TBD)
	Advanced Diagnostics and Imaging Systems: Continue research in low-permeability reservoir field development with industry in priority basins. Continue development of diagnostics for imaging and predicting gas in naturally fractured reservoirs, conducting advanced geoscience measurements including seismic processing and interpretation, and	Advanced Diagnostics and Imaging Systems: Complete testing and validation of natural fracture detection technologies in five major U.S. tight gas basins. Several projects for development and validation of the next generation of fracture detection technologies to reduce dry hole rates will be terminated. Complete a second infill drilling optimization study. Improved	Advanced Diagnostics and Imaging Systems: Complete infill drilling optimization project in the San Juan basin and Delaware basin of New Mexico. Continue field testing and analysis of next generation of fracture detection technologies to reduce dry hole rates. Continue long-term sustainability of gas supply study in Rocky Mt. basins. Continue studies of improved completion

III. **Performance Summary**: NATURAL GAS TECHNOLOGIES (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Exploration and Production (Cont'd)	use of advanced National Laboratory capabilities. Continue analysis of deep gas potential in priority basins. ($5,375) (NETL, LBL, SNL, USGS, Marine Board, ARI, N. Mex. Tech., TBD)	recovery solicitation issued in FY 2001 will be scaled back, but not eliminated. Conduct a long-term sustainability of gas supply study in Rocky Mt. basins. ($5,242) (NETL, GeoSpectrum, ARI, Stanford, LBL, SUNY, SNL, USGS, N. Mex. Tech.)	technologies and studies to identify high water production problems in tight sand regions. Conduct research and develop super high resolution seismic tools. Develop tools for shear wave imaging. ($4,580) (NETL, ARI, Stanford, LBL, SUNY, SNL, USGS, N. Mex. Tech.)
	Multi NL/Industry Partnership: Support R&D in exploration and production technologies in projects identified by industry partners. ($970) (National Labs)	Multi NL/Industry Partnership: Support R&D in exploration and production technologies in projects identified by industry partners. ($3,000) (National Labs)	Multi NL/Industry Partnership: No activity. ($0)
	Secondary Gas Recovery: Continue tests of methodologies in the Appalachian Basin and the offshore Gulf Coast. ($798) (BEG, WV Consortium)	Secondary Gas Recovery: Continue tests of methodologies in the offshore Gulf Coast. ($800) (BEG)	Secondary Gas Recovery: Complete program. ($500) (TBD)
	Stripper Wells Revitalization: Continue engineering assessments of wells to determine candidate areas for restimulation; test and evaluate impact of revitalization techniques on the productive life	Stripper Wells Revitalization: National, industry-driven consortium to investigate multiple technologies to improve stripper well production. ($748) (PSU)	Stripper Wells Revitalization: expand National, industry-driven consortium to investigate multiple technologies to improve stripper well production. ($1,200) (PSU)

III. **Performance Summary**: NATURAL GAS TECHNOLOGIES (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
	of wells. ($748) (TBD)		
	Technology Transfer: Support industry led efforts in technology transfer. ($599) (PTTC)	Technology Transfer: Support industry led efforts in technology transfer. ($599) (PTTC)	Technology Transfer: Support industry led efforts in technology transfer. ($500) (PTTC)

III. **Performance Summary**: NATURAL GAS TECHNOLOGIES (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Exploration and Production (Cont'd)	No activity. ($0)	Deep Trek: Develop technologies for drilling deeper than 16,000 feet below earth's surface. Develop high performance drilling and completion systems, advanced coatings and hardening of "Smart" systems and sensors, low friction, wear resistant coatings/materials. ($3,400) (SNL, TBD)	Activity combined with Advanced Drilling, Completion and Stimulation.
	No activity. ($0)	Coal Bed Methane Water Filtration Research: Conduct stratagraphic work to determine location of constructed wetlands in association with large scale coal bed methane production facility. ($950) (TBD)	No activity. ($0)
	Arctic Research: Establish an Arctic Research program for peer reviewed research; coordinate research conducted through Fossil Energy and Energy Efficiency; conduct outreach and serve as a liaison between the State and DOE. ($250 provided from Energy Efficiency appropriation.) (TBD)	Arctic Research: Continue Arctic Research program for peer reviewed research; coordinate research conducted through Fossil Energy and Energy Efficiency; conduct outreach and serve as a liaison between the State and DOE. ($247) (TBD)	Arctic Research: No activity. ($0)

III. **Performance Summary**: NATURAL GAS TECHNOLOGIES (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
	Provide technical and program management support. ($143)	Provide technical and program management support. ($205)	Provide technical and program management support. ($155)
	$13,866	$20,500	$15,450
Gas Hydrates	Continue resource characterization and seismic survey activities in onshore and offshore areas. Work will concentrate on hydrate issues in the Gulf of Mexico and the Alaskan North Slope including safe drilling, seafloor stability, characterization and production. ($9,603) (U. WY, CMRET, Clarkson, CGS, USGS, NRL, TBD)	Continue characterization of Arctic and offshore hydrate resources. Research in areas that are currently important to the Nation–safety and seafloor stability and hydrates role in global climate change. ($9,702) (U. of Wyo., CMRET, Clarkson, CGS, USGS, NRL, TBD)	Continue some industry-led field activities to collect samples of naturally occurring hydrate from Alaska permafrost and Gulf of Mexico. Continue characterization of Arctic and offshore hydrate resources. Continue research in safety and seafloor stability and hydrates role in global climate change. ($4,455) (CMRET, Chevron, Maurer, BP Amoco, USGS, NRL, TBD)
	Provide technical and program management support. ($100)	Provide technical and program management support. ($98)	Provide technical and program management support. ($45)
	$9,703	$9,800	$4,500
Infrastructure	Storage Technology: Continue support to industry for deliverability enhancement, reservoir management, gas metering and measurement, and advanced storage concepts engineering studies. Initiate	Storage Technology: Complete ongoing activities in deliverability enhancement and reservoir management. Continue support to industry for metering and measurement, and advanced storage concepts. These activities	No activity. ($0)

III. **Performance Summary**: NATURAL GAS TECHNOLOGIES (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Infrastructure (Cont'd)	proof-of-concept research on large storage capacity alternatives in non reservoir rock for regions of the U.S. without conventional storage options. Accelerate development of short-term, high deliverability storage systems to serve future distributed gas power systems. Develop high deliverability gas storage system model to serve the power generation marketplace. ($3,015) (ARI, TBD)	include development of a direct energy meter for storage applications, and support of large capacity, high deliverability storage in granitic rock. ($2,480) (ARI, Schlumberger-Holditch, Furness-Newburge, NYSEG, TBD)	
	Infrastructure Technology: Initiate research directed to ensure the reliability of the gas transmission and distribution network and increase the efficiency of the pipeline system, advance development of longer life, high-strength, non-corrosive pipeline materials, develop smart automated inside pipeline inspection sensor systems and repair technology, conduct research on obstacle detection systems for horizontal boring applications for laying distribution	Infrastructure Technology: Continue research directed to ensure the reliability and integrity of the gas transmission and distribution network, develop smart automated inside pipeline inspection sensor systems, conduct research on obstacle detection systems for horizontal boring applications for laying distribution pipelines, develop systems capable of detecting external force damage, develop technology to improve the efficiency for reciprocating and turbo	In keeping with the goals of the President's Management Agenda to reduce duplication, the infrastructure activities have been transferred to the Department of Transportation's Office of Pipeline Safety.

III. **Performance Summary**: NATURAL GAS TECHNOLOGIES (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Infrastructure (Cont'd)	pipelines, develop portable real-time video imaging technology to detect natural gas leaks, develop gas system reliability analysis and distributed resource system integration model. Studies will also be undertaken on the overall reliability of the system in its increasing integration with the electric grid. ($4,818) (TBD)	compressors, and develop advance technology capable of determining pipeline wall integrity. ($7,470) (SWRI, Tuboscope, NYGAS, GTI, Battelle, CSU, ARC, ANL, INEEL, LLNL, SNL, ORNL, PNNL, NETL, TBD)	
	Provide technical and program management support. ($81)	Provide technical and program management support. ($100)	No activity. ($0)
	$7,914	$10,050	$0
Emerging Processing Technology	Gas-to-Liquids: Continue process and economic evaluation of GTL conversion options and feasibility studies for remote gas in Alaska, Gulf of Mexico and other domestic locations. Continue exploratory research activities of novel conversion concepts, and support cost-shared development and field testing of promising chemical and small-scale physical conversion technology innovations. Build and begin test operations of a laboratory-scale,	Activity continued under Fuels program.	No activity. ($0)

III. **Performance Summary**: NATURAL GAS TECHNOLOGIES (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Emerging Processing Technology (Cont'd)	novel ITM-Syngas ceramic membrane reactor to enhance Fischer-Tropsch (FT) gas conversion for environmentally superior liquid fuels and hydrogen. Initiate design and component manufacture for first stage scale-up of ITM syngas ceramic reactor incorporating initial laboratory test results. Continue development and validation of GTL catalysts, reactor and process designs. Accelerate process delineation and development for ultra clean, high performance, gas-derived liquid motor fuel products for the 21st Century suitable for deployment in Alaska, the Gulf of Mexico, and other remote sites. ($5,990) (U.of AK-Fairbanks, LANL-Cryenco, LBL, Air products, PNNL, PSU, CAER, NETL, TBD)		
	Gas Tech Information: Continue support of an international center for information on natural gas technologies. ($317) (GTI)	Gas Tech Information: Continue support of an international center for information on natural gas technologies. ($247) (GTI)	Gas Tech Information: No activity. ($0)
	Gas Upgrading: Continue research	Gas Upgrading: Terminate low-	No activity. ($0)

III. **Performance Summary**: NATURAL GAS TECHNOLOGIES (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
	in low-quality gas upgrading, including development of improved sulfur, CO_2, water, and nitrogen removal technologies. Continue development of advanced hybrid gas separation and dehydration technologies for onshore and offshore applications. Continue multi-strat upgrading and utilization. ($1,612) (SNL, NETL, Texas A&M, TBD)	quality gas upgrading activities. ($0)	
Emerging Processing Technology (Cont'd)	Continue Phase III of coal mine methane projects. ($1,876) (TBD)	Continue Phase III of coal mine methane projects. ($1,980) (TBD)	No activity. ($0)
	Provide technical and program management support. ($102)	Provide technical and program management support. ($23)	No activity. ($0)
	$9,897	$2,250	$0

III. **Performance Summary**: NATURAL GAS TECHNOLOGIES (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Effective Environmental Protection	Program Planning Data Analysis: Continue data collection and the development of analytical tools for program planning, for outreach and technology transfer, including the capability to quantify environmental costs and assess constraints to gas resource recovery, collection and distribution. Continue to perform legislative and regulatory impact analysis related to both upstream and downstream gas environmental issues. ($355) (TBD)	Program Planning Data Analysis: Continue data collection and the development of analytical tools for program planning, for outreach and technology transfer, including the capability to quantify environmental costs and assess constraints to gas resource recovery, collection and distribution. Continue to perform legislative and regulatory impact analysis related to both upstream and downstream gas environmental issues. ($424) (TBD)	Program Planning Data Analysis: Continue data collection and the development of analytical tools for program planning, for outreach and technology transfer, including the capability to quantify environmental costs and assess constraints to gas resource recovery, collection and distribution. Continue to perform legislative and regulatory impact analysis related to both upstream and downstream gas environmental issues. ($426) (TBD)
Effective Environmental Protection (Cont'd)	Technology Development: Continue to develop and demonstrate technologies and methods for improving the economics and environmental performance of all facets of gas supply including defining options and costs of alternative environmental compliance strategies, application of advanced research and new methods of detecting and controlling air emissions from gas equipment and facilities. Continue development	Technology Development: Continue efforts to develop and demonstrate technologies and methods for improving the economics and environmental performance of all facets of gas supply. This includes defining options and costs of alternative environmental compliance strategies, application of advanced research and new methods of detecting and controlling air emissions from gas equipment and facilities. Emphasize technologies	Technology Development: Continue efforts to develop and demonstrate technologies for improving the environmental performance of all gas E&P. ($1,000) (TBD)

III. **Performance Summary**: NATURAL GAS TECHNOLOGIES (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
	of treatment and disposal technologies for gas exploration and wastes. Continue cooperative efforts to establish scientifically based regulations. ($1,725) (Natl. Labs, Waterloo, TBD)	that will improve responsible development of gas resources on public lands, consistent with current multiple-use policies of Federal Land management agencies. Continue development of treatment and disposal technologies for gas exploration and wastes. Continue cooperative efforts to establish scientifically based regulations. ($1,711) (Natl. Labs, SNL, WU, TBD)	
	Outreach and Technology Transfer: Continue outreach and technology transfer efforts on environmental issues affecting natural gas supply, including compliance efforts with industry, states, and others to identify and address environmental challenges to expanded natural gas production. ($439) (TBD)	Outreach and Technology Transfer: Continue outreach and technology transfer efforts on environmental issues affecting natural gas supply, including compliance efforts with industry, states, and others to identify and address environmental challenges to expanded natural gas production. ($439) (TBD)	Outreach and Technology Transfer: Continue outreach and technology transfer efforts on environmental issues affecting natural gas supply, including compliance efforts with industry, states, and others to identify and address environmental challenges to expanded natural gas production. ($1,188) (IOGCC, Natl. Labs, TBD)
Effective Environmental Protection (Cont'd)	Provide technical and program management support. ($26)	Provide technical and program management support. ($26)	Provide technical and program management support. ($26)
	$2,545	$2,600	$2,640

III. **Performance Summary**: NATURAL GAS TECHNOLOGIES (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Natural Gas Technologies, Total	$43,925	$45,200	$22,590

DEPARTMENT OF ENERGY
FY 2003 CONGRESSIONAL BUDGET REQUEST

FOSSIL ENERGY RESEARCH AND DEVELOPMENT

OIL TECHNOLOGY

I. **Mission Supporting Goals and Objectives**:

The oil research program, in partnership with industry and its stakeholders, will develop cutting edge technologies to better find and produce petroleum while minimizing waste production and environmental damage. This program will demonstrate the effectiveness of these technologies in supporting the Nation's energy security and science and technology leadership goals. This leadership is supplemented by teacher training programs, student and faculty internships, and a broad program of university research. Minority participation in science is addressed through the Minority Education Initiative.

Federal Roles and Responsibilities in Oil Technology Research are to: (1) provide technology options for national energy policy makers; (2) conserving production of domestic energy resources; (3) protect the environment and public safety; (4) enhance the value of Federal lands and future supply (27% of oil production is on Federal lands); (4) enhance global market opportunities for U.S. energy technologies; (5) contribute to U.S. science and technology leadership; (6) apply a unique national perspective to technology development that is independent of company-specific or State-specific interests; and (7) foster the use of new technology through a nationwide technology transfer network.

The key sections of this program are: (1) Exploration and Production; (2) Reservoir Life Extension and Management; and (3) Effective Environmental Protection. Program planning and support, as well as technology transfer are integral components of each of the key areas. The DOE National Energy Technology Laboratory (NETL), located in Tulsa, Oklahoma, manages all oil technology program implementation activities.

Because reliable domestic energy supplies are vital to the Nation's economy, this program conducts projects designed to enhance the efficiency and environmental performance of domestic oil operations. These R&D programs are conducted in partnership with industry, universities, National Laboratories, State and local governments, and other organizations. Private sector participation is emphasized through industry cost-sharing with individual companies and consortia to ensure market relevance and to facilitate the

I. **Mission Supporting Goals and Objectives**: OIL TECHNOLOGY (Cont'd)

transfer of technology to the private sector while leveraging Federal R&D investment. Near-term efforts are focused on transferring state of the art technologies to independents and long-term efforts focus on research and development of novel technology advances.

Exploration and Production research consists of Advanced Drilling, Completion, and Stimulation systems (ADCS), Advanced Diagnostics and Imaging Systems (ADIS), Reservoir Efficiency Processes, PRIME, and Analysis and Planning efforts. The Drilling, Completion, and Stimulation (DSC) program focuses on developing enabling technologies related to fluid flow in drilling, stimulation, cementing and state-of-the-art subsurface monitoring systems using acoustics and fiber optics. This provides a portfolio of technologies designed to match diverse geologic formation-targets, approach technologically challenging environments, increase exploration success, improve producibility of wells, minimize environmental impact, reduce operating costs, and improve flowability.

The ADIS program focuses on the development of technologies and methodologies that more clearly define petroleum reservoirs and associated reservoir rock, fluid distributions and rock-fluid interactions that impact producibility. The development and application of advanced diagnostic and imaging systems improves the success rates and cost effectiveness for new field discoveries and the development of existing fields. The program conducts research to develop technologies to better define oil reservoirs in increasingly complex geologically environments.

Reservoir Efficiency Processes program conducts research to develop and demonstrate tools and methodologies that permit oil operators to recover hydrocarbons from known reservoirs not producible by current technology. The main areas of research are chemical methods, gas flooding methods, microbial methods, heavy oil methods, novel methods and reservoir simulation. This predominately university research program enables the training of students to ensure the supply of competent technologists.

Analysis and Planning supports the program by providing accurate data on the oil resource, supply and utilization trends, industry activities and R&D needs, assuring that legislative, regulatory and policy initiatives in oil supply, environmental and processing are based on the best available information to support program goals. This area also supplies analytical systems used to prioritize RD&D efforts and evaluate oil recovery and utilization over a wide range of technological and economical conditions.

PRIME will focus on fundamental research in exploration and production technologies. The longer-term research and development will lead to significant advancements in the state-of-the-art over 5 to 10 years, reducing cost of finding, risk of dry holes, and

I. **Mission Supporting Goals and Objectives**: OIL TECHNOLOGY (Cont'd)

environmental impacts of finding and producing oil and gas. Specific upstream exploration and production areas for technology development will be further refined through stakeholder input.

The **Reservoir Life Extension/Management** programs create the link between the laboratory and use by industry in the field. The focus is on the application of advanced technologies for the specific requirements of independent producers to improve domestic production efficiency and environmental protection. The goal is reached by partnering with independent producers, Federal land managers, and tribal resource managers to demonstrate technologies under real world conditions and track the operations benefits that result from using best practices and advanced technology rather than business as usual. Successful projects reduce risk for other producers and encourage them to adopt the technology.

The Reservoir Practices and Technology program expects to increase domestic production through projects with Independents in three ways: 1) The cost shared program targeted to smaller independents. 2) An ongoing competitive program will address technological solutions specific to the independents operating in the shallow offshore and the Rocky Mountain Frontier. 3) The program will target critically underdeveloped resources owned and managed by Native American Tribes and Corporations. A critical analysis of past demonstration projects will be continued to capture the benefits, identify factors critical to project and program success, and to provide recommendations to improve program design and implementation in the future.

Project achievements/results are conveyed to domestic stakeholders through technology transfer and outreach programs. Project results are widely distributed to industry, universities, other government agencies and the general public in multiple formats. Tutorial workshops on the application of oil technologies are conducted throughout the United States. Software related to improved reservoir management; exploration and development; risk assessment; and streamlined permitting activities is developed and distributed.

The Preferred Petroleum Upstream Management Practices (PUMP) subprogram is designed to provide a short-term supplement to long-term R&D. PUMP assists producing groups and operators to identify regional barriers to production and the best practices to address these problems. PUMP is focused on advanced oil recovery, and data management with minimal environmental impact. Documentation of the entire PUMP program results will be placed in a comprehensive, Internet-accessible database.

Effective Environmental Protection research focuses on technologies and practices that reduce the environmental impact of oil exploration, production, and processing while minimizing the cost of effective environmental protection and compliance. The

I. **Mission Supporting Goals and Objectives**: OIL TECHNOLOGY (Cont'd)

activities are distributed into four program elements: program planning and analysis, regulatory streamlining, risk assessment, and technology development. The program planning and analysis activity is designed to monitor environmental trends and technologies and ensure that the funding for the environmental program is used effectively. Environmental regulations on solids, liquids, and gasses are made by Federal, State, Local, and Tribal governments. Since these regulations can sometimes be conflicting and redundant, the regulatory streamlining activity is designed to provide scientific data for evaluating regulatory needs and examining the regulatory structure to minimize unnecessary regulations. Risk assessment activities are designed to determine the environmental impacts of producing/processing crude oil, the extent of the impact, and the extent of the needed clean-up. Environmental remediation takes place on both production and processing sites. The technology development activity is designed to optimize the clean up by developing/adapting cost effective tools. The overall objective of the Effective Environmental Protection program is to help balance the need to develop the Nation's energy resources while maintaining our environmental values. This program fills critical information and technical gaps in the areas of regulatory streamlining, risk assessment, and technology development that are needed to produce and process the Nation's energy needs without sacrificing environmental quality.

Performance Measures:

- Hold a geomechanical studies workshop on recent advances in oil reservoir rock permeability
- Determine the suitability of two advanced biotechnologies as a tool to upgrade (i.e., lower nitrogen content, sulphur content, or viscosity) heavy oil prior to entering the refinery
- Conduct at least two reviews of state waste management programs as part of the effort to ensure that full and accurate scientific information is available to the RCRA determination process.
- Complete development of an improved exploration and development methodology utilizing an intelligent computing system which integrates exploration data and provides correlations via fuzzy logic and neural net processes. Success rate for new exploration test wells in the Williston Basin study area will increase by 50 percent when using this new methodology versus conventional techniques
- Complete exploration and production "best practices" database availability on the internet
- Hold at least two workshops to transfer successful RD&D technology to independent producers

II. A. **Funding Schedule**: ($ in thousands)

I. **Mission Supporting Goals and Objectives**: OIL TECHNOLOGY (Cont'd)

Activity	FY 2001	FY 2002	FY 2003	$Change	%Change
Exploration and Production	$28,088	$32,350	$16,400	$-15,950	-49%
Reservoir Life Extension/Management	14,278	12,949	9,500	-3,449	-27%
Effective Environmental Protection	10,513	10,700	9,500	-1,200	-11%
Emerging Processing Technology Applications	2,500	0	0	0	0%
Ultra Clean Fuels	9,716	0	0	0	0%
Total Oil Technology	$65,095	$55,999	$35,400	$-20,599	-37%

II. B. **Laboratory and Facility Funding Schedule**: OIL TECHNOLOGY (Cont'd) ($ in thousands)

	FY 2001	FY 2002	FY 2003	$Change	%Change
Argonne National Lab (East)	$250	$100	$0	$-100	0%
Brookhaven National Lab	200	0	0	0	0%
Idaho Natl. Engineering & Environmental Lab	807	60	150	90	100%
Lawrence Berkeley Lab	1,190	200	0	-200	0%
Lawrence Livermore National Lab	700	200	0	-200	0%
Los Alamos National Laboratory	250	0	0	0	0%
National Energy Technology Lab(in-house)	100	300	500	200	67%
Oak Ridge National Laboratory	1,702	275	100	-175	-64%
Pacific Northwest National Lab	200	0	0	0	0%
Sandia National Laboratories	300	0	0	0	0%
All Other	59,396	54,864	34,650	-20,214	-37%
Total, Oil Technology	$65,095	$55,999	$35,400	$-20,599	-37%

III. **Performance Summary**: ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Exploration and Production	Advanced Drilling, Completion, Stimulation: Continue capability upgrades in Phase 4 of the unique Advanced Cuttings Transport Facility that allow research on high temperature/high pressure experimentation for prediction of the rheology of and cuttings transport in energized fluids (air, mist, gas assisted, foam, etc.) in	Advanced Drilling, Completion, Stimulation and Operations: Continue capability upgrades in Phase 5 of the unique Advanced Cuttings Transport Facility that allow research on HT/HP experimentation on energized fluids (air, mist, gas assisted, foam, etc.) and synthetic drill fluids in horizontal and inclined	Advanced Drilling, Completion, Stimulation: Complete the capability upgrades to the unique Advanced Cuttings Transport Facility allowing research on high temperature/high pressure experimentation on energized fluids (air, mist, gas assisted, foam, etc.) and synthetic drill fluids, cements, and transport of

III. **Performance Summary**: OIL TECHNOLOGY (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Exploration and Production (Cont'd)	horizontal and inclined wellbores using the DOE HP/HT Flow Loop. Complete development and field testing of advanced downhole sensor technology using fiber optics. Initiate new projects in Stimulation. Add to the current suite of risk-based decision-making tools. ($2,502) (PRRC, Univ of Tulsa, Va Polytech, WU, LANL, Univ of Houston, TBD)	wellbores onshore and offshore. Complete the risk based decision-marking software. Continue research efforts in Completion and Stimulation with the national labs. Support specific consortia and joint industry collaborations that enhance the Program goals. ($2,500) (PRRC, Univ of Tulsa, Natl. Labs, TBD)	fluids in horizontal and inclined wellbores. Continue work on enhancing the flowability of fluids, on the surface, in pipes and in transport. ($1,500) (NETL, TU, TBD)
	Advanced Diagnostics and Imaging Systems: Continue advanced reservoir diagnostics and imaging systems work including; relationships between seismic measurements and reservoir properties; and EM process sensing to optimize oil recovery. Technology development including NMRI and Cat-Scan for quantitative analysis of reservoir rock architecture and fluids distribution to quantify understanding of how wettability, imbibition, in-situ relative permeability, as well as other engineering parameters are	Advanced Diagnostics and Imaging Systems: Continue development of advanced reservoir diagnostics and imaging systems work to optimize oil discovery and recovery. Develop quantitative engineering parameters that control rock-fluid interactions which impact oil production. Develop larger scale remove sensing techniques and the integration of multiple geological, geophysical and engineering data, at the field- to basin-scales for the development of more accurate geologic and engineering models needed in exploration and in	Advanced Diagnostics and Imaging Systems: Continue efforts to develop advanced reservoir diagnostics and imaging systems to optimize oil discovery and recovery. Develop quantitative engineering parameters that control rock-fluid interactions which impact oil production. Continue fundamental geoscience efforts focusing on geoscience/engineering reservoir characterization on naturally fractured reservoirs. ($4,500) (CalTech, NAS, FE-PS Contracts, TBD)

III. **Performance Summary**: OIL TECHNOLOGY (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Exploration and Production (Cont'd)	controlled by rock-fluid interactions and impact oil production. Continue developing integrated geological, geophysical and engineering data and methods for upscaling these varied databases, to predict areal and vertical distributions of the reservoir architecture and fluid flow patterns for more accurate geologic and engineering modeling and simulation to optimize development, production, and EOR/IOR activities. Continue Fundamental Geoscience procurement involving the geoscience/ engineering reservoir characterization of fractured reservoirs to optimize oil recovery. Continue development and testing of a hydrocarbon prediction tool for exploration; sedimentary modeling programs using advanced algorithms, expert theory, and importing climatic models to complete detailed lithostratigraphic models; and a model for hydrodynamic fluids transport in the Uinta and Paradox	simulation of production/EOR/ IOR activities. Continue fundamental geoscience efforts focusing on geoscience/ engineering reservoir characterization on naturally fractured reservoirs. Continue development of hydrocarbon predictive tools for exploration, sedimentary modeling, development of lithostratigraphic models and fluid transport models in selected U.S. basins. ($6,532) (FE-PS contracts, CalTech, PRIME, National Laboratories, TBD)	

III. **Performance Summary**: OIL TECHNOLOGY (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
	Basins. ($7,029) (LLNL, LBNL, ORNL, ANL, INEEL, RERI, Stanford, Cal Tech, 8 MegaPRDA contracts, PRDA-TBD)		
Exploration and Production (Cont'd)	Multi National Lab/Industry Partnership: Continue to adapt and transfer technologies that advance understanding of the characteristics and producibility from oil reservoirs, optimize the performance of production tools and processes, reduce environmental footprint and waste emissions and improve reservoir management resulting in higher oil recovery through leveraging of industrial, oil program and other public funds. Continue to integrate high performance National Lab computational capabilities to address difficult problems such as subsalt imaging, testing of advanced exploration concepts and multiphase flow in subsea pipelines. ($7,400) (NL-TBD)	Multi National Lab/Industry Partnership: Continue to adapt and transfer technologies that advance understanding of the characteristics and producibility from oil reservoirs, optimize the performance of production tools and processes, reduce environmental footprint and waste emissions and improve reservoir management resulting in higher oil recovery through leveraging of industrial, oil program and other public funds. Continue to integrate high performance National Lab computational capabilities to address difficult problems such as subsalt imaging, testing of advanced exploration concepts and multiphase flow in subsea piplelines. ($6,000) (NL-TBD)	No activity. ($0)
	Reservoir Efficiency Processes:	Reservoir Efficiency Processes:	Reservoir Efficiency Processes:

III. **Performance Summary**: OIL TECHNOLOGY (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Exploration and Production (Cont'd)	Issue a solicitation to develop recovery processes for mature reservoirs. Continue development of improved sweep techniques, and state-of-the-art reservoir simulation models. Continue to develop microbial methods. Continue mechanistic studies to reduce surfactant adsorption and advance the state-of-the-art in development of new polymers and gels. Continue to advance thermal methods for heavy oil extraction and novel processes which will aid oil recovery from naturally fractured reservoirs. ($6,440) (Univ of Kansas, Columbia Univ, Univ of Pittsburgh, Univ of Texas, Univ of Utah, Geo-Microbial, Univ of Southern California, Univ of Oklahoma, Stanford Univ, LBNL, INEEL, Univ of Kansas, Columbia Univ, Univ of Pittsburgh, Univ of Texas, Univ of Utah, Geo-Microbial, Univ of Southern California, Univ of Oklahoma, Stanford Univ, TBD)	Continue to develop recovery processes for mature reservoirs. Continue to support a Novel Surfactant Industry/University consortium for development of novel surfactants. Continue development of improved sweep techniques, and state-of-the-art reservoir simulation models. Continue to develop microbial methods. Continue to advance the state-of-the-art in reservoir simulation. Continue mechanistic studies to reduce surfactant adsorption and advance the state-of-the-art in development of new polymers and gels. Continue to advance thermal methods for heavy oil extraction and screen potential heavy oil recovery processes. Continue to advance thermal methods for heavy oil extraction and novel processes which will aid oil recovery from naturally fractured reservoirs. ($6,052) (National Labs, FE-PS contracts, TBD)	Continue efforts to improve gas flooding recovery methods and to advance the state-of-the-art in reservoir simulation. Continue development of improved sweep techniques. Continue to support development of novel surfactants. Continue mechanistic studies to reduce surfactant adsorption and advance the state-of-the-art in development of new polymers and gels. Initiate molecular modeling studies of complex surfactants. Continue to develop microbial EOR methods. Continue to advance thermal methods for heavy oil extraction processes. ($4,236) (FE-PS Contracts, TBD)
	Analysis and Planning: Continue	Analysis and Planning: Continue	Analysis and Planning: Continue

III. **Performance Summary**: OIL TECHNOLOGY (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Exploration and Production (Cont'd)	technical planning and analysis support for implementing and evaluating effective and efficient oil research programs. Conduct producibility assessment of major reservoirs, maintain and update the oil resource information base, enhance and maintain metrics capabilities for the Oil Program, enhance and maintain statistical data, models, and supporting systems for effective planning and continue technical and analytical support tasks. Continue project impact/oversight/analysis efforts. Support the contractor review workshop for program evaluation. ($3,436) (RMC, TRW, Univ. of Tulsa, TBD)	technical planning and analysis support for implementing and evaluating effective and efficient oil technology research programs. Enhance and maintain statistical data, models and supporting systems to evaluate petroleum policy options and to enhance metrics capabilities. Conduct efforts to validate the effectiveness of the oil technologies to meet programmatic and agency goals. ($3,200) (RMC, TRW, IOGCC, TBD)	technical planning and analysis support for implementing and evaluating effective and efficient oil technology research programs. Enhance and maintain statistical data, models and supporting systems to evaluate petroleum policy options and to enhance metrics capabilities. Conduct efforts to validate the effectiveness of the oil technologies to meet programmatic and agency goals. ($2,500) (IOCC, TRW, TBD)
	Sonication: Conduct research benefitting the recovery of petroleum through the use of sonication or ultrasonic technology from other industries. ($993) (TBD)	No activity. ($0)	No activity. ($0)
	No activity. ($0)	Fundamental Research - PRIME Initiate pre-application research	Fundamental Research - PRIME Initiate pre-application research

III. **Performance Summary**: OIL TECHNOLOGY (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
		focused on the development of exploration and production technologies. General areas include remote sensing/geochemical survey and improved resolution of 3-component seismic, slimhole tools for logging and testing, remote wireless monitoring and control tools, and advanced petroleum recovery technologies. ($4,000) (TBD)	focused on the development of exploration and production technologies. General areas include remote sensing/ geochemical survey and improved resolution of 3-component seismic, slimhole tools for logging and testing, remote wireless monitoring and control tools, and advanced petroleum recovery technologies. ($3,500) (TBD)
Exploration and Production (Cont'd)	Arctic Research: Establish an Arctic Research program for peer reviewed research; coordinate research conducted through Fossil Energy and Energy Efficiency; conduct outreach and serve as a liaison between the State and DOE. ($750 provided from Energy Efficiency appropriation.) (TBD)	Arctic Research: Continue Arctic Research program for peer reviewed research; coordinate research conducted through Fossil Energy and Energy Efficiency; conduct outreach and serve as a liaison between the State and DOE. ($3,742) (TBD)	No activity. ($0)
	Fund technical and program management support. ($288)	Fund technical and program management support. ($324)	Fund technical and program management support. ($164)
	$28,088	$32,350	$16,400
Reservoir Life	Reservoir Practices and	Reservoir Practices and	Reservoir Practices and

III. **Performance Summary**: OIL TECHNOLOGY (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Extension/ Management	Technology Transfer: Extend reservoir life to maximize oil recovery and improve environmental performance from our initial investment by revisiting major reservoir groups to address key production problems identified in previous work ($4,344). Identify the successes from previous Independents projects. Identify the most promising technologies identified in the Class Revisit or research with Independents projects and commence advanced research on two or three technologies ($1,979). Expand research and development with independents program to accelerate field testing and use of effective technologies by domestic oil industry. Identify best practices and lessons learned for aggressive technology transfer in the PUMP program ($538). Complete the targeted research projects initiated with the tribes in 1999 to benefit Native Americans, and prepare for the second round of projects. Continue successful	Technology Transfer: Evaluate and identify the most promising technologies in the Class, Class Revisit, and Research with Independents programs. Report the results to the public. Initiate competitive projects that specifically partner with independent producers. ($6,627) Support PTTC regional workshops with publications, software and technical expertise; increase dissemination of information on independent operator participation in oil field demonstration program; support Minority Education Initiative through internships; and provide science teacher training in oil technology. These efforts will improve the ability to meet the technological and environmental information needs of domestic producers, support service industry elements, academic researchers, technical associations, and the public sector ($2,793). Compile results from the first round PUMP projects in specific producing regions of the	Technology Transfer: Analyze past projects to capture their benefits. Select competitive projects that partner with independents to accelerate field testing and use of effective technologies. Address critically underdeveloped resources owned and managed by Native American Tribes and Corporations ($4,905). Disseminate petroleum RD&D results to domestic stakeholders. Develop mechanisms that foster communication between industry and researchers. Continue to expedite the use of cost effective, more efficient, environmental friendly technologies that increase recovery. Continue support of Minority Education Initiative; continue to provide other energy related educational opportunities ($2,500). Populate the Internet-accessible database of "best practices" resulting from the PUMP projects and conferences. Solicitation for "PUMP" projects to address short-term demonstrations of critical
Reservoir Life Extension/ Management (Cont'd)			

III. **Performance Summary**: OIL TECHNOLOGY (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Reservoir Life Extension/ Management (Cont'd)	training initiative for Native American decision makers ($500). Continue technology outreach by supporting regional workshops providing complete packages of applicable results from Class Demonstration and other projects to assist oil producers in extending reservoir life in an environmentally acceptable manner; improve efficiency and coverage in electronic and hardcopy dissemination of publications and software; continue training initiative for Native Americans; continue teacher training program for elementary/secondary petroleum energy education; expand schedule of exhibits at professional meetings and upgrade display materials and equipment. These efforts will improve the ability to meet the technological and environmental needs of major and independent producers, support service industry elements, academic researchers, technical associations, and the public sector	Nation for the interactive, Internet-based DOE database of "preferred practices" ($3,400). (Total $12,820) (PTTC, RMC, TBD)	technologies in specific regions ($2,000). (Total $9,405) (PTTC, INEL, TBD)

III. **Performance Summary**: OIL TECHNOLOGY (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Reservoir Life Extension/ Management (Cont'd)	($3,178). Expand the FY 2000 Preferred Petroleum Upstream Management Practices (PUMP) work to include the creation of a database of "best practices" used successfully in areas such as 3-D and 4-D seismic, well logging, well design, enhanced oil recovery, risk assessment, and other oil recovery areas. Aggressively transfer these practices to industry through a proactive program of direct contact with producers. The environmental problem solving and regulatory streamlining activities will be targeted to address key regional constraints in two regions using PUMP advanced oil recovery technology ($3,592). (Total $14,131) (Binger, Michigan Tech, Luff, U. of KS, TU, Plains-IL, UGS, U. of Alabama, Conoco, Golder, Oil & Gas Consultants, Ft. Peck, PTTC, RMC, TBD)		
	Fund technical and program management support. ($147)	Fund technical and program management support. ($129)	Fund technical and program management support. ($95)
	$14,278	$12,949	$9,500

III. **Performance Summary**: OIL TECHNOLOGY (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Effective Environmental Protection	Program Planning and Analysis: Continue analysis of industry environmental trends and available technologies. Maintain performance measure data for program planning and technology transfer. Continue coordination with states, EPA and other Federal agencies to perform and provide energy and economic analyses for legislative and regulatory initiatives related to oil environmental issues. ($823) (ANL, ICF, PERF, KWT/Aspen, TBD)	Program Planning and Analysis: Continue analysis of industry environmental trends and available technologies. Maintain performance measure data for program planning and technology transfer. Provide energy and economic analyses for legislative and regulatory initiatives related to oil environmental issues. ($823) (PERF, Natl. Labs, TBD)	Program Planning and Data Analysis: Continue analysis of industry environmental trends and available technologies. Maintain performance measure data for program planning and technology transfer. Provide energy and economic analyses for legislative and regulatory initiatives related to oil environmental issues ($825). Provide analysis of refinery related environmental issues and regulations ($75). (Total $900) (Natl. Labs, EPA, TBD)
Effective Environmental Protection (Cont'd)	Streamline State/Tribal/Federal Regulations: Continue and enhance cooperative efforts with the states, tribes, and Federal agencies to streamline environmental regulations and regulatory processes with emphasis on public lands. Enhance on-line expert environmental reporting and permitting systems to reduce costs to producers and regulators ($775). Generate independent quality scientific data to help	Streamline State/Tribal/Federal Regulations: Continue cooperative efforts with the states, tribes, and Federal agencies to streamline environmental regulations and regulatory processes ($855). Generate scientific data to facilitate policy makers' ability to develop and implement regulations ($660) (Total $1,515) (Natl. Labs, Univ. of Tulsa)	Streamline State/Tribal/Federal Regulations: Continue cooperative efforts with the states, tribes, and Federal agencies to streamline environmental regulations and regulatory processes with special emphasis on reducing permitting times on federal lands while maintaining environmental protection ($1,832). Generate scientific data to facilitate policy makers' ability to develop and implement regulations. Provide scientific support for a

III. **Performance Summary**: OIL TECHNOLOGY (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
	implement national policy in streamlining and improving existing regulations and laws ($590). (Total $1,365) (ORNL, U. of KY, Nat'l Labs, TBD)		comprehensive approach to environmental permitting and regulations of the refining industry ($873). (Total $2,705) (Natl. Labs, Univ. of Tulsa, IOGCC, TBD)
Effective Environmental Protection (Cont'd)	Risk Assessment: Provide credible scientific data for regulatory decision making. Continue research to assess and mitigate environmental risks posed by exploration and production, including risks posed by injection, spills, oil emissions, and management of drilling and production wastes. Assist States to support risk-based regulatory decisions consistent with stakeholder's objectives of streamlining and improving environmental regulations ($3,300). Develop credible scientific environmental and/or health information to assist EPA and States in implementing proposed regulations affecting fuel characteristics and composition end points for remediation of cleanup sites, and analysis of	Risk Assessment: Provide credible scientific data for regulatory decision making in exploration and production, including risks posed by injection, spills, oil emissions, and management of drilling and production wastes ($3,250). Develop credible scientific environmental analysis of effects of fine particulate from petroleum processing and fuels ($642). (Total $3,892) (Natl. Labs, BLM, PERF, GWPC, TBD)	Risk Assessment: Continue efforts to provide credible scientific data for regulatory decision making in exploration and production, including risks posed by injection, spills, oil emissions, and management of drilling and production wastes ($1,453). Develop tools and methods for improving ecological risk assessment at refinery sites. ($347) (Total $1,800) (Natl. Labs., GWPC, TBD)

III. **Performance Summary**: OIL TECHNOLOGY (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
	effects of fine particulate from petroleum processing and fuels. ($554). (Total $3,854) (GWPC, Natl. Labs, INEEL, ANL, BLM, LBNL, PERF, IGT, DynCorp, ORNL, KW Tunnell, TBD)		
	Technology Development: Continue to develop and field test more cost-effective environmental compliance technologies in the areas of produced water treatment, remediation, air emissions control and monitoring, and oil field waste management and disposal ($1,441). In keeping with PCAST recommendations, perform research to make fuels that have fewer pollutants and fewer emissions affecting global climate change ($2,922). (Total $4,363) (TBD, Natl Labs, ORNL, INEEL, PNL, OERB, TU, TBD-PS)	Technology Development: Continue to develop more cost-effective environmental compliance technologies for oil field waste management and disposal ($1,469). Perform research to reduce environmental impacts of processing this hemisphere's heavy crude oil to make high-quality fuels ($2,894). (Total $4,363) (Natl. Labs, TU, GEER)	Technology Development: Continue to develop more cost-effective environmental compliance technologies for oil field waste management and disposal. Special emphasis will be placed on technologies that will provide cost-effective protections in sensitive environments on federal lands ($1,443). Perform research to reduce environmental impacts of processing heavy crude oil to make high-quality fuels. Develop new lower-cost technologies for characterizing and cleaning up refinery contamination. Provide scientific data that can be used to optimize processes so that they can operate at maximum efficiency with minimum energy use. Examine
Effective			

III. **Performance Summary**: OIL TECHNOLOGY (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Environmental Protection (Cont'd)			innovative processing technology ($2,557). (Total $4,000) (NETL, Natl. Labs., TBD)
	Fund technical and program management support. ($108)	Fund technical and program management support. ($107)	Fund technical and program management support. ($95)
	$10,513	$10,700	$9,500
Emerging Processing Technology Applications	The R&D activity will provide stat to validate viability of biodesulfurization of diesel fuel for application in small refineries. Initiate innovative processes research through competitive solicitation. Conduct in-house processing research at NETL. ($2,474) (PetroStar, NETL, TBD)	No activity. ($0)	No activity. ($0)
	Fund technical and program management support. ($26)	No activity. ($0)	No activity. ($0)
	$2,500	$0	$0
Ultra Clean Fuels	Ultra Clean Fuels: Initiate research through both competitive solicitations and the National Laboratory Partnership to develop technology to overcome current limitations for making very low sulfur, clean burning transportation fuels. ($9,616)	Activity continued under Fuels budget.	No activity. ($0)

III. **Performance Summary**: OIL TECHNOLOGY (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Ultra Clean Fuels (Cont'd)	(PetroStar, Research Triangle Inst., Phillips Petro, Parxair, ICRC, Envires, Conoco, Ford, 4 national laboratories)		
	Fund technical and program management support. ($100)	No activity. ($0)	No activity. ($0)
	$9,716	$0	$0
Oil Technology, Total	$65,095	$55,999	$35,400

DEPARTMENT OF ENERGY
FY 2003 CONGRESSIONAL BUDGET REQUEST

FOSSIL ENERGY RESEARCH AND DEVELOPMENT

PROGRAM DIRECTION AND MANAGEMENT SUPPORT

I. **Mission Supporting Goals and Objectives**:

This activity provides funding for salaries, benefits and overhead expenses for management of the Fossil Energy (FE) program at Headquarters and the National Energy Technology Laboratory (NETL), with sites in Morgantown, WV, Pittsburgh, PA and Tulsa, OK. The Headquarters staff is responsible for overall direction of the programs that includes implementing DOE policy, communicating guidance consistent with that policy to the FE field offices, establishing program objectives, developing program plans and evaluating alternative program strategies, developing and defending budget requests to the Office of Management and Budget and to Congress, reviewing procurement plans, monitoring work progress, and approving revisions in work plans as required to attain program goals. The NETL performs the day-to-day project management functions of assigned programmatic areas that include monitoring Fossil Energy contracts and National Laboratory activities, developing project budgets, implementing procurement plans, and other program and site support activities necessary to achieve program objectives.

In FY 2003, all program direction and management support costs associated with the Clean Coal Technology program have been combined with those of Fossil Energy Research and Development under this account.

II. A. **Funding Schedule**: ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003	$Change	%Change
Headquarters Program Direction					
Salaries and Benefits	$11,680[a]	$12,993[a]	$12,692[a]	$-301	-2%
Travel	488	538	660	122	23%
Contract Services	5,765	6,262	7,680	1,418	23%

[a] The FY 2001 and FY 2002 column of the FY 2003 Congressional Request includes funding in the amount of $1,003,000 and $1,093,000, respectively, for the Government's share of increased costs associated with pension and annuitant health care benefits. These funds are comparable to FY 2003 funding of $1,212,000.

Activity	FY 2001	FY 2002	FY 2003	$Change	%Change
Subtotal, Headquarters Program Direction	17,933	19,793	21,032	1,239	6%

II. A. **Funding Schedule**: PROGRAM DIRECTION AND MANAGEMENT SUPPORT

Activity	FY 2001	FY 2002	FY 2003	$Change	%Change
Field Program Direction					
Salaries and Benefits	34,026[b]	36,778[b]	37,943[b]	1,165	3%
Travel	1,394	1,520	1,434	-86	-6%
Contract Services	30,745	32,282	29,141	-3,141	-10%
Subtotal, Field Program Direction	66,165	70,580	68,518	-2,062	-3%
Total, Program Direction and Management Support[c]	$84,098	$90,373	$89,550	$-823	-1%

c/ **If CCT program direction were included in FY 2001 the total would be $98,098,000 and $104,373,000 in FY 2002**.

II. B. **Laboratory and Facility Funding Schedule**: ($ in thousands)

	FY 2001	FY 2002	FY 2003	$Change	%Change
National Energy Technology Laboratory	66,165	70,580	68,518	-2,062	-3%
All Other	17,933	19,793	21,032	1,239	6%
Total, Program Direction and Management Support	$84,098	$90,373	$89,550	$-823	-1%

III. **Performance Summary**: ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Headquarters Program Direction - Salaries and Benefits	Provide funds for 82 FTE's (does not include 17 FTE's funded in CCT account) at Headquarters. This staff implements and	Provide funds for 110 FTE's (does not include 17 FTE's funded in CCT account) at Headquarters. This staff implements and	Provide funds for 127 FTE's (includes 17 FTE's transferred from the CCT account) at Headquarters. This staff

[b] The FY 2001 and FY 2002 column of the FY 2003 Congressional Request includes funding in the amount of $3,009,000 and $3,280,000, respectively, for the Government's share of increased costs associated with pension and annuitant health care benefits. These funds are comparable to FY 2003 funding of $3,638,000.

III. **Performance Summary**: PROGRAM DIRECTION AND MANAGEMENT SUPPORT (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Headquarters Program Direction - Salaries and Benefits (Cont'd)	communicates policy to the ETC's, sets program objectives, develops program plans and evaluates alternative strategies; develops and defends budget requests; approves procurement plans; and monitors work progress. ($11,680)	communicates policy to the ETC's, sets program objectives, develops program plans and evaluates alternative strategies; develops and defends budget requests; approves procurement plans; and monitors work progress. ($12,993)	implements and communicates policy to the ETC's, sets program objectives, develops program plans and evaluates alternative strategies; develops and defends budget requests; approves procurement plans; and monitors work progress. ($12,692)
	$11,680	$12,993	$12,692
Travel	Provide funds for travel in support of the activities stated above. Both domestic and international travel are conducted. ($488)	Provide funds for travel in support of the activities stated above. Both domestic and international travel are conducted. ($538)	Provide funds for travel in support of the activities stated above. Both domestic and international travel are conducted. ($660)
	$488	$538	$660
Headquarters Program Direction - Contract Services	Provide for contractual services that are generic to the entire FE program. Included are items such as computer services, technical and management support services. ($1,425) (TBD)	Provide for contractual services that are generic to the entire FE program. Included are items such as computer services, technical and management support services. ($1,845) (TBD)	Provide for contractual services that are generic to the entire FE program. Included are items such as computer services, technical and management support services. ($3,180) (TBD)
	Fund SBIR in the amount of $7,473 from prior year and/or various R&D program funds within the Fossil Energy R&D account. ($0)	Fund SBIR in the amount of $11,561 from prior year and/or various R&D program funds within the Fossil Energy R&D account. ($0)	Fund SBIR in the amount of $7,512 from prior year and/or various R&D program funds within the Fossil Energy R&D account. ($0)

III. **Performance Summary**: PROGRAM DIRECTION AND MANAGEMENT SUPPORT (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Headquarters Program Direction - Contract Services (Cont'd)	Fund the Small Business Technology Transfer (STTR) in the amount of $447 from prior year and/or various R&D program funds within the Fossil Energy R&D account. ($0)	Fund the Small Business Technology Transfer (STTR) in the amount of $695 from prior year and/or various R&D program funds within the Fossil Energy R&D account. ($0)	Fund the Small Business Technology Transfer (STTR) in the amount of $497 from prior year and/or various R&D program funds within the Fossil Energy R&D account. ($0)
	Provide for the operation, maintenance and upgrading of FE headquarters-wide network and desktop workstation computer systems and televideo units. ($748)	Provide for the operation, maintenance and upgrading of FE headquarters-wide network and desktop workstation computer systems and televideo units. ($800)	Provide for the operation, maintenance and upgrading of FE headquarters-wide network and desktop workstation computer systems and televideo units. ($1,000)
	Provide for printing services. ($50) (TIC)	Provide for printing services. ($0) (TIC)	Provide for printing services. ($0) (TIC)
	Upgrade electronic records management systems. ($100)	Upgrade electronic records management systems. ($0)	Upgrade electronic records management systems. ($0)
	Provide working capital fund. ($3,442)	Provide working capital fund. ($3,617)	Provide working capital fund. ($3,500)
	$5,765	$6,262	$7,680
Headquarters Program Direction, Subtotal	$17,933	$19,793	$21,032

III. **Performance Summary**: PROGRAM DIRECTION AND MANAGEMENT SUPPORT (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Field Program Direction Salaries and Benefits	Provide funds for NETL staff of 339 FTEs (does not include 49 FTE's funded in CCT account). Activities of the staff include project management, product development, contract management, and other service activities related to program and site support. It is anticipated that 9 FTEs of the 339 FTEs will be paid via reimbursable agreements, therefore, salaries and benefits associated with these FTEs are not included in the budget estimate. ($34,026)	Provide funds for NETL staff of 339 FTEs (does not include 49 FTE's funded in CCT account) . Activities of the staff include project management, product development, contract management, and other service activities related to program and site support. It is anticipated that 9 FTEs of the 339 FTEs will be paid via reimbursable agreements, therefore, salaries and benefits associated with these FTEs are not included in the budget estimate. ($36,778)	Provide funds for NETL staff of 330 FTEs (includes 49 FTE's transferred from the CCT account). Activities of the staff include project management, product development, contract management, and other service activities related to program and site support. It is anticipated that 9 FTEs of the 330 FTEs will be paid via reimbursable agreements, therefore, salaries and benefits associated with these FTEs are not included in the budget estimate. ($37,943)
	$34,026	$36,778	$37,943
Travel	Provide funds for travel in support of the above activities in the attainment of program goals, both on the domestic front and abroad. ($1,394)	Provide funds for travel in support of the above activities in the attainment of program goals, both on the domestic front and abroad. ($1,520)	Provide funds for travel in support of the above activities in the attainment of program goals, both on the domestic front and abroad. ($1,434)
	$1,394	$1,520	$1,434

III. **Performance Summary**: PROGRAM DIRECTION AND MANAGEMENT SUPPORT (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Contract Services	Provide substantial funding of facility operations, maintenance, finance, information automation, administrative, management and technical support. ($30,745)	Provide funding for facility operations, maintenance, finance, information automation, administrative, management and technical support. ($32,282)	Provide funding for facility operations, maintenance, finance, information automation, administrative, management and technical support. ($29,141)
	$30,745	$32,282	$29,141
Field Program Direction, Subtotal	$66,165	$70,580	$68,518
Program Direction and Management Support, Total	$84,098	$90,373	$89,550

DEPARTMENT OF ENERGY
FY 2003 CONGRESSIONAL BUDGET REQUEST

FOSSIL ENERGY RESEARCH AND DEVELOPMENT

FOSSIL ENERGY ENVIRONMENTAL RESTORATION

I. **Mission Supporting Goals and Objectives**:

The objectives of the Fossil Energy (FE) Environmental Restoration activities are to ensure protection of workers, the public, and the environment in performing the mission of the National Energy Technology Laboratory (NETL) at the Morgantown (MGN), West Virginia, Pittsburgh (PGH), Pennsylvania, and Tulsa, Oklahoma sites, and the Albany Research Center (ARC) at Albany, Oregon. Activities include those necessary to protect workers and the public from exposure to hazardous conditions and materials (e.g., fires, carcinogens, asbestos, lead, etc.), identify and correct safety and health hazards, improve workplace monitoring and industrial safety programs, achieve compliance with Federal, state and local safety and health requirements, including Department of Energy (DOE) initiatives, and implement initiatives related to achieving best-in-class status in environment, safety and health (ES&H) performance. Activities also include environmental protection, and cleanup activities on-site, and at several former off-site research and development locations. Groundwater and soil monitoring/remediation is also required at the NETL and ARC sites to ensure compliance with Federal, state and local requirements.

FY 2003 performance measures are listed below that support the overarching goal of making consistent and measurable progress in reducing and eliminating injuries, incidents and environmental releases.

- Implement specific ES&H plans and programs to achieve objectives and targets of VPP and ISO 14001 systems.
- Complete a series of lead and asbestos abatement actions at NETL, including Building 921 (PGH) exterior asbestos removal and Building 86 (PGH) asbestos and lead removal.
- Complete a series of indoor quality/ventilation fixes for the NETL R&D buildings, including indoor air quality fixes in Building 86 (PGH) and a series of small-scale sitewide fixes in MGN.
- Continue decontamination/decommissioning of selected NETL-PGH R&D buildings.
- Continue to implement NETL chiller replacement (to eliminate ozone-depleting substances) activities in Building 94 (PGH).
- Implement NETL emergency power systems for ES&H-critical operations.
- Upgrade gas alarm systems in five NETL buildings.

I. **Mission Supporting Goals and Objectives**: ENVIRONMENTAL RESTORATION (Cont'd)

- Conduct full-scale remediation activities at Rock Springs and Hoe Creek, WY sites.
- Perform surveillance audits and other activities related to achieving/maintaining environmental management system certification.
- Conduct environmental monitoring and surveillance activities (air, water, wastewater) in support of permit maintenance.
- Implement risk management/maintenance programs at NETL, i.e., hazardous waste management, emergency preparedness, workplace violence, fire protection, occupational medicine, and environmental quality programs.
- Conduct ES&H training, according to the job hazard analyses.
- Implement additional activities at NETL and ARC to meet waste minimization and energy efficiency goals.
- Complete a series of lead and asbestos abatement actions and remove hazardous materials at ARC.
- Upgrade the emergency and security programs at ARC.
- Continue with equipment/facility upgrades and infrastructure repairs, including facility evaluations/upgrades at ARC.
- Reduce sanitary waste from routine operations at ARC.
- Maintain programs for purchasing environmentally preferable products and services.

II. A. **Funding Schedule**: ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003	$Change	%Change
CERCLA Remedial Actions	$3,756	$2,049	$2,000	$-49	-2%
RCRA Remedial Actions	1,988	2,125	2,300	175	8%
Other ES&H Actions	4,234	5,326	5,415	89	2%
Total, Fossil Energy Environmental Restoration	$9,978	$9,500	$9,715	$215	2%

I. B. **Laboratory and Facility Funding Schedule**: ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003	$Change	%Change
All Other	$9,978	$9,500	$9,715	$215	2%
Total, Fossil Energy Environmental Restoration	$9,978	$9,500	$9,715	$215	2%

III. **Performance Summary**: ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003

III. **Performance Summary**: ENVIRONMENTAL RESTORATION (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
CERCLA Remedial Actions	Continue cleanup of Rock Springs sites. ($569) (Army Corps of Engineers)	Continue cleanup of Rock Springs sites. ($800) (Army Corps of Engineers)	Continue full-scale cleanup of Rock Springs sites. ($800) (Army Corps of Engineers)
CERCLA Remedial Actions (Cont'd)	Continue cleanup of Hoe Creek site. ($300) (Army Corps of Engineers)	Continue cleanup of Hoe Creek site. ($300) (Army Corps of Engineers)	Continue full-scale cleanup of Hoe Creek site. ($300) (Army Corps of Engineers)
	Continue Hannah Site revegetation. ($50)	Continue Hannah Site revegetation. ($70)	Continue Hannah Site revegetation. ($70)
	Implement new CERCLA site investigations and project closeouts. ($100) (TBD)	Implement new CERCLA site investigations and project closeouts. ($200) (TBD)	Implement new CERCLA site investigations and project closeouts. ($300) (TBD)
	Continue cleanup of soil and groundwater at former NETL liquefaction sites. ($75) (TBD)	No activity. ($0)	No activity. ($0)
	Perform onsite CERCLA-type remediation assessments at NETL. ($60) (TBD)	Perform onsite CERCLA-type remediation assessments at NETL. ($30) (TBD)	Perform onsite CERCLA-type remediation assessments at NETL. ($30) (TBD)
	Implement CERCLA PRP Response Activities, e.g., Connecticut coal gasification site. ($2,602) (TBD)	Implement CERCLA PRP Response Activities. ($649) (TBD)	Implement CERCLA PRP Response Activities. ($500) (TBD)
	$3,756	$2,049	$2,000
RCRA Remedial	Continue NETL on-site	Continue NETL limited on-site	Continue NETL limited on-site

III. **Performance Summary**: ENVIRONMENTAL RESTORATION (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Actions RCRA Remedial Actions (Cont'd)	remediation activities such as lead and asbestos abatement; waste-minimization and pollution prevention activities; toxic chemical management program upgrades; stormwater system design; chemical management software implementation; hazardous material and waste compliance activities; surface water compliance; and site support contractor RCRA related activities. ($1,310) (TBD)	remediation activities such as wastewater treatment plant upgrades; toxic chemical management program upgrades; stormwater system design; chemical management software implementation; hazardous material and waste compliance activities; surface water compliance; and site support contractor RCRA related activities. ($1,355) (TBD)	remediation and improvement activities such as; lead and asbestos abatements; waste minimization and pollution prevention; environmental management plan implementation required for maintenance of ISO 14001 certifications; hazardous material and waste compliance; surface water compliance; and site support contractor RCRA related activities. ($1,550) (TBD)
	Continue RCRA cleanup actions at Albany Research Center including asbestos removal, characterizing and resolving chemical storage and labeling; soil and groundwater monitoring; fume hood and scrubber upgrades; air emission management; and materials handling and disposal activities. ($678) (TBD)	Continue RCRA cleanup actions at Albany Research Center including lead and asbestos abatement, characterizing and resolving chemical storage and labeling; soil and groundwater monitoring; fume hood and scrubber upgrades; air emission management; and materials handling and disposal activities. ($770) (TBD)	Continue RCRA cleanup actions at Albany Research Center including lead and asbestos abatement, characterizing and resolving chemical storage and labeling; soil and groundwater monitoring; fume hood and scrubber upgrades; air emission management; and materials handling and disposal activities. ($750) (TBD)
	$1,988	$2,125	$2,300
Other ES&H Actions	Continue ES&H activities at the NETL sites requiring corrective action and related activities	Maintain NETL's regulatory and standards based ES&H programs (e.g., emergency management,	Maintain regulatory and Integrated Safety Management/ISO 14001 programs (emergency

III. **Performance Summary**: ENVIRONMENTAL RESTORATION (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Other ES&H Actions (Cont'd)	including monitoring and surveillance; indoor air quality fixes; resolution of life safety code deficiencies; fire protection compliance actions; ergonomics; training improvements; structural safety fixes; emergency preparedness activities and site support contractor ES&H related activities. ($3,408) (TBD)	safety, environmental management, safety, ergonomics, fire protection, and training) including site support contractor ES&H related activities. Perform corrective actions re: indoor air quality and ventilation fixes, emergency notification system improvements, and gas alarm upgrades. Begin to execute environmental action plans to achieve objectives and targets under NETL's environmental management system (EMS)/ISO-14001 initiatives. ($4,300) (TBD)	management, safety, environmental management, ergonomics, training, and fire protection) at NETL. Implement corrective actions based on assessments conducted. Continue to execute environmental objectives and targets under NETL's ISO 14001 programs. Conduct indoor and CFC-related air quality fixes. (MGN, PGH, Tulsa). ($4,310) (TBD)
	Continue ES&H program activities at NPTO including inspections, emergency management and drills, training, etc. ($15) (TBD)	Continue ES&H program activities at NPTO including inspections, emergency management and drills, training, etc. ($15) (TBD)	Continue ES&H program activities at NPTO including inspections, emergency management and drills, training, etc. ($15) (TBD)
	Continue site-wide safety and health programs and corrective actions at Albany Research Center including monitoring and surveillance; indoor air quality and ventilation upgrades; medical and industrial hygiene; fire detection and suppression systems; walking surface repairs; personal protective	Continue site-wide safety and health programs and corrective actions at Albany Research Center including monitoring and surveillance; indoor air quality and ventilation upgrades; medical and industrial hygiene; fire detection and suppression systems; walking surface repairs; personal protective	Continue site-wide safety and health programs and corrective actions at Albany Research Center including monitoring and surveillance; indoor air quality and ventilation upgrades; medical and industrial hygiene; fire detection and suppression systems; walking surface repairs; personal protective

III. **Performance Summary**: ENVIRONMENTAL RESTORATION (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
	equipment maintenance; and training. ($711) (TBD)	equipment maintenance; and training. ($911) (TBD)	equipment maintenance; facility seismic evaluations/upgrades; and training. ($990) (TBD)
	Technical and management support. ($100)	Technical and management support. ($100)	Technical and management support. ($100)
	$4,234	$5,326	$5,415
Fossil Energy Environmental Restoration, Total	$9,978	$9,500	$9,715

DEPARTMENT OF ENERGY
FY 2003 CONGRESSIONAL BUDGET REQUEST

FOSSIL ENERGY RESEARCH AND DEVELOPMENT

COOPERATIVE RESEARCH AND DEVELOPMENT

I. **Mission Supporting Goals and Objectives**:

The Cooperative Research and Development program supports activities of federal/industry/research institute endeavors and federal/state/industry partnerships. It was originally created in FY 1989 and provided the federal share of support for Jointly Sponsored Research Programs (JSRP) at the Western Research Institute (WRI) and the University of North Dakota Energy and Environmental Research Center (UNDEERC). The research projects under the JSRP at those centers receive at least 50 percent cost sharing from non-federal partners. The Department anticipates that these centers can compete successfully for Fossil Energy funding through the competitive solicitation process.

In FY 2001, $1 million was appropriated under the Department's Office of Energy Efficiency account to initiate a cooperative program at the University of Alaska to conduct research on fossil resources in an Arctic environment.

II. A. **Funding Schedule**: ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003	$Change	%Change
Cooperative Research and Development	$7,858	$8,240	$6,000	$-2,240	100%
Total, Cooperative Research and Development	$7,858	$8,240	$6,000	$-2,240	100%

I. B. **Laboratory and Facility Funding Schedule**: ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003	$Change	%Change
All Other	$7,858	$8,240	$6,000	$-2,240	100%
Total, Cooperative Research and Development	$7,858	$8,240	$6,000	$-2,240	100%

III. **Performance Summary**: COOPERATIVE RESEARCH AND DEVELOPMENT (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Cooperative Research and Development	Provide support for cooperative research programs at WRI ($3,909) and UNDEERC ($3,909) which are 50-50 cost-shared with non-federal clients. ($7,818) (WRI, UNDEERC)	Provide support for cooperative research programs at WRI ($4,100) and UNDEERC ($4,100) which are 50-50 cost-shared with non-federal clients. ($8,200) (WRI, UNDEERC)	Provide support for cooperative research programs at WRI ($2,980) and UNDEERC ($2,980) which are 50-50 cost-shared with non-federal clients. ($5,960) (WRI, UNDEERC)
	Fund technical and program management support. ($40)	Fund technical and program management support. ($40)	Fund technical and program management support. ($40)
Cooperative Research and Development, Total	$7,858	$8,240	$6,000

DEPARTMENT OF ENERGY
FY 2003 CONGRESSIONAL BUDGET REQUEST

FOSSIL ENERGY RESEARCH AND DEVELOPMENT

IMPORT/EXPORT AUTHORIZATION

I. **Mission Supporting Goals and Objectives**:

The Office of Import/Export Authorization (OIEA) manages the regulatory review of natural gas imports and exports, exports of electricity, and the construction and operation of electric transmission lines which cross U.S. international borders; and exercises regulatory oversight of the conversion of existing oil and gas-fired powerplants, processes exemptions from the statutory provisions of the Powerplant and Industrial Fuel Use Act of 1978 (FUA), as amended, and processes certifications of alternate fuel capability pursuant to the provisions of the amended FUA. These regulatory activities help promote the national energy strategy goal of securing future energy supplies by helping to ensure: the availability of reliable, competitively priced natural gas; that surplus domestic gas supplies can be marketed internationally in a competitive and environmentally sound manner; and that exports of electric energy and the construction of new international electric transmission lines do not adversely impact on the reliability of the U.S. electric power supply system. The program promotes the use of alternate fuels in new baseload electric powerplants; and assumes that international gas and electricity trade occurs in the freest possible marketplace. The OIEA's activities help deregulate energy markets and reduce international trade barriers, and to create an integrated North American energy market. OIEA encourages greater exchange of technical and regulatory information among our trading partners. Through its publications, OIEA increases public awareness of energy issues and the advantages of competition in the marketplace.

II. A. **Funding Schedule**: ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003	$Change	%Change
Import/Export Authorization	$2,295	$2,400	$2,500	$100	4%
Total, Import/Export Authorization	$2,295	$2,400	$2,500	$100	4%

II. B. **Laboratory and Facility Funding Schedule**: ($ in thousands)

III. **Performance Summary**: IMPORT/EXPORT AUTHORIZATION (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003

Activity	FY 2001	FY 2002	FY 2003	$Change	%Change
All Other	$2,295	$2,400	$2,500	$100	4%
Total, Import/Export Authorization	$2,295	$2,400	$2,500	$100	4%

Import/Export Authorization	Modify or rescind 3 conversion orders. Process 50 certifications of coal capability and 3 exemptions. ($50)	Modify or rescind 3 conversion orders. Process 50 certifications of coal capability and 3 exemptions. ($50)	Modify or rescind 3 conversion orders. Process 50 certifications of coal capability and 3 exemptions. ($50)
	Process 200 gas import/export applications. Provide support for consultations with U.S. trading partners. Provide regulatory compliance and industry monitoring. Participate in FERC proceedings and international studies. Provide petroleum policy support for ASFE. NEPA compliance activities. (20 FTEs) ($1,479)	Process 100 gas import/export applications. Provide support for consultations with U.S. trading partners. Provide regulatory compliance and industry monitoring. Participate in FERC proceedings and international studies. Provide petroleum policy support for ASFE. NEPA compliance activities. (20 FTEs) ($1,450)	Process 200 gas import/export applications. Provide support for consultations with U.S. trading partners. Provide regulatory compliance and industry monitoring. Participate in FERC proceedings and international studies. Provide petroleum policy support for ASFE. NEPA compliance activities. (20 FTEs) ($1,550)
	Process 100 electricity export applications and 10 construction permits. Monitor and analyze international and domestic electricity trade. Participate in FERC proceedings. Participate in international studies and trade negotiations. NEPA compliance	Process 50 electricity export applications and 5 construction permits. Monitor and analyze international and domestic electricity trade. Participate in FERC proceedings. Participate in international studies and trade negotiations. NEPA compliance	Process 100 electricity export applications and 10 construction permits. Monitor and analyze international and domestic electricity trade. Participate in FERC proceedings. Participate in international studies and trade negotiations. NEPA compliance

III. **Performance Summary**: IMPORT/EXPORT AUTHORIZATION (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
	activities. ($630)	activities. ($800)	activities. ($800)
	Provide management and administrative support. ($136)	Provide management and administrative support. ($100)	Provide management and administrative support. ($100)
Import/Export Authorization, Total	$2,295	$2,400	$2,500

DEPARTMENT OF ENERGY
FY 2003 CONGRESSIONAL BUDGET REQUEST

FOSSIL ENERGY RESEARCH AND DEVELOPMENT

ADVANCED METALLURGICAL PROCESSES

I. **Mission Supporting Goals and Objectives**:

The Advanced Metallurgical Processes program conducts inquiries, technological investigations, and research concerning the extraction, processing, use, and disposal of mineral substances under the mineral and materials science program at the Albany Research Center (ARC) in Oregon.

The program's goals are to address the full life cycle of materials production and cost-effective processing of improved materials through to their disposal and recycling. The program seeks to determine the factors that limit service life of materials in industrial, structural, or engineering applications and to provide solutions to service-life problems through new materials technology, to develop and demonstrate technologies that will reduce waste and pollution, and to use capabilities and expertise to provide focused solutions to high priority national problems. The research at ARC directly contributes to Fossil Energy's objectives by providing information on the performance characteristics of materials being specified for the current generation of power systems, on the development of cost-effective materials for inclusion in Vision 21 systems, and for solving environmental emission problems related to fossil fired energy systems. The program at ARC stresses full participation with industry through partnerships and emphasizes cost sharing to the fullest extent possible. All FY 2002 performance measures were met. FY 2003 performance measures include:

- Complete a summary report identifying mechanisms of degradation of coal gasification refractory materials. Initiate investigations on methods that might be used to monitor the corrosion of refractories during slag attack testing and possible use of these techniques in industrial applications.
- Construct and operate a continuous bench scale reactor, 5 lbs. an hour, to demonstrate the mineral carbonation process.

II. A. **Funding Schedule**: ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003	$Change	%Change
Advanced Metallurgical Processes	$5,214	$5,200	$5,300	$100	2%
Total, Advanced Metallurgical Processes	$5,214	$5,200	$5,300	$100	2%

II. B. **Laboratory and Facility Funding Schedule** ADVANCED METALLURGICAL PROCESSES (Cont'd) ($ in thousands)

	FY 2001	FY 2002	FY 2003	$Change	%Change
All Other	$5,214	$5,200	$5,300	$100	2%
Total, Advanced Metallurgical Processes	$5,214	$5,200	$5,300	$100	2%

III. **Performance Summary**: ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
Advanced Metallurgical Processes	Continue research identified during FY 2000 to contribute to Fossil Energy's Vision 21 Systems to include reducing greenhouse gas emissions through CO_2 sequestration, and advanced refractory research. Continue research efforts by developing partnerships with industry and with State and Federal agencies to build viable domestic commercial capabilities in waste-free environmentally benign materials production, energy production system by-product processing and materials development. Continue research efforts to achieve better understanding of wear, corrosion, and fracture, resulting in an improved understanding of component structure and properties for better performance in Vision 21 System components, in powerplant infrastructure, and	Continue research to contribute to Fossil Energy's Vision 21 Systems to include reducing greenhouse gas emissions through CO_2 sequestration, and advanced refractory research. Continue research efforts by developing partnerships with industry and with State and Federal agencies to build viable domestic commercial capabilities in waste-free environmentally benign materials production, energy production system by-product processing and materials development. Continue research efforts to achieve better understanding of wear, corrosion, and fracture, resulting in an improved understanding of component structure and properties for better performance in Vision 21 System components, in powerplant infrastructure, and in mining and minerals processing	Continue research to contribute to Fossil Energy's Vision 21 Systems to include reducing greenhouse gas emissions through CO_2 sequestration, and advanced refractory research. Continue research efforts by developing partnerships with industry and with State and Federal agencies to build viable domestic commercial capabilities in waste-free environmentally benign materials production, energy production system by-product processing and materials development. Continue research efforts to achieve better understanding of wear, corrosion, and fracture, resulting in an improved understanding of component structure and properties for better performance in Vision 21 System components, in powerplant infrastructure, and in mining and minerals processing

III. **Performance Summary**: ADVANCED METALLURGICAL PROCESSES (Cont'd) ($ in thousands)

Activity	FY 2001	FY 2002	FY 2003
	in mining and minerals processing equipment. ($5,162) (ARC)	equipment. ($5,148) (ARC)	equipment. ($5,247) (ARC)
	Fund technical and program management support. ($52)	Fund technical and program management support. ($52)	Fund technical and program management support. ($53)
Advanced Metallurgical Processes, Total	$5,214	$5,200	$5,300