

Fossil Energy Research and Development Office of Fossil Energy

Overview

Appropriation Summary by Program

(dollars in thousands)

	FY 2003 Comparable Appropriation	FY 2004 Comparable Appropriation	FY 2005 Base	FY 2005 Request	FY 2005 Request vs Base	
					\$ Change	% Change
Fossil Energy Research and Development						
Coal and Other Power Systems.....	400,622	450,484	450,484	470,000	+19,516	+4.3%
Natural Gas Technologiesy	45,860	42,994	42,994	26,000	-16,994	-39.5%
Petroleum - Oil Technology	40,983	35,078	35,078	15,000	-20,078	-57.2%
Program Direction and Management Support	87,229	106,225	112,599	106,000	-6,599	-5.8%
Plant and Capital Equipment	6,954	6,914	6,914	0	0	0.0%
Fossil Energy Environmental Restoration	9,652	9,595	9,595	6,000	-3,595	-37.5%
Import/Export Authorization.....	2,981	2,716	2,716	1,799	-917	-33.8%
Advanced Metallurgical Processes.....	5,961	9,876	9,876	8,000	-1,876	-19.0%
National Academy of Sciences Program Review.....	497	494	494	0	0	0.0%
Cooperative Research and Development	7,970	8,395	8,395	3,000	-5,395	-64.3%
Energy Efficiency Science Initiative.....	2,440	0	0	0	0	0.0%
Total, Fossil Energy Research and Development.....	611,149	672,771	679,330	635,799	-43,531	-6.4%

Detailed Funding Table

(dollars in thousands)

	FY 2003	FY 2004	FY 2005
Fossil Energy Research and Development			
Coal and Other Power Systems			
President's Coal Research Initiative			
Clean Coal Power Initiative	145,116	178,770	287,000
Central Systems			
Innovations for Existing Plants	21,566	21,729	18,050
Advanced Systems	69,928	68,151	46,450
Total, Central Systems	91,494	89,880	64,500
Sequestration	39,101	40,297	49,000
Fuels			
Transportation Fuels and Chemicals	21,432	21,927	16,000
Solid Fuels and Feedstocks	5,808	5,986	0
Advanced Fuels Research	3,193	3,308	0
Total, Fuels	30,433	31,221	16,000
Advanced Research			
Coal Utilization Science	8,781	11,852	8,000
Materials	8,712	11,111	8,000
Technology Crosscut	11,078	11,326	10,500
University Coal Research	2,904	2,945	3,000
HBCUs, Education & Training	969	981	1,000
Total, Advanced Research	32,444	38,215	30,500
Total, President's Coal Research Initiative	338,588	378,383	447,000
Other Power Systems			
Distributed Generation Systems			
Fuel Cells	59,107	68,644	23,000
Novel Generation	2,927	2,469	0
Total, Distributed Generation Systems	62,034	71,113	23,000
U.S./China Energy and Environmental Center	0	988	0
Total, Other Power Systems	62,034	72,101	23,000
Total, Coal and Other Power Systems	400,622	450,484	470,000

(dollars in thousands)

	FY 2003	FY 2004	FY 2005
Natural Gas Technologies			
Exploration and Production.....	22,712	22,203	17,500
Gas Hydrates	9,218	9,383	6,000
Infrastructure	8,780	8,939	0
Emerging Processing Technology.....	2,593	0	0
Effective Environmental Protection.....	2,557	2,469	2,500
Total, Natural Gas Technologies.....	45,860	42,994	26,000
Petroleum – Oil Technology			
Exploration and Production.....	22,667	18,450	3,000
Reservoir Life Extension/Management.....	8,724	6,914	5,000
Effective Environmental Protection.....	9,592	9,714	7,000
Total, Petroleum – Oil Technology.....	40,983	35,078	15,000
Program Direction			
Fossil Energy Research and Development.....	87,229	91,410	92,000
Clean Coal Technology.....	0	14,815	14,000
Total, Program Direction.....	87,229	106,225	106,000
Plant and Capital Equipment.....	6,954	6,914	0
Fossil Energy Environmental Restoration.....	9,652	9,595	6,000
Import/Export Authorization.....	2,981	2,716	1,799
Advanced Metallurgical Research.....	5,961	9,876	8,000
National Academy of Sciences Program Review.....	497	494	0
Cooperative Research and Development.....	7,970	8,395	3,000
Energy Efficiency Science Initiative.....	2,440	0	0
Total, Fossil Energy Research and Development	611,149	672,771	635,799

Preface

Secure, affordable, and environmentally acceptable energy sources are essential if the people of our Nation and future generations are to maintain a high quality of life. In support of this, the Fossil Energy (FE) Research and Development Program addresses issues related to the supply and use of fossil fuels.

Within the Interior and Related Agencies appropriation, Fossil Energy Research and Development has eleven programs: Coal (two subprograms), Gas (one subprogram), Petroleum (one subprogram), Program Direction (two subprograms), Plant and Capital Equipment, Environmental Restoration, Import/Export Authorization, Advanced Metallurgical Research, National Academy of Science Program Review, Cooperative Research and Development, and the Energy Efficiency Science Initiative.

**Fossil Energy Research and Development/
Overview**

FY 2005 Congressional Budget

This Overview will describe Strategic Context, Mission, Benefits, Strategic Goals, and Funding by General Goal. These items together put the appropriation in perspective. This Overview will also address R&D Investment Criteria, Program Assessment Rating Tool (PART), and Significant Program Shifts.

Strategic Context

Following publication of the Administration’s National Energy Policy, the Department developed a Strategic Plan that defines its mission, four strategic goals for accomplishing that mission, and seven general goals to support the strategic goals. Each appropriation has developed quantifiable goals to support the general goals. Thus, the “goal cascade” is the following:

Department Mission → Strategic Goal (25 yrs) → General Goal (10-15 yrs) → Program Goal (GPRA Unit) (10-15 yrs)

To provide a concrete link between budget, performance, and reporting, the Department developed a “GPRA^a Unit” concept. Within DOE, a GPRA Unit defines a major activity or group of activities that support the core mission and aligns resources with specific goals. Each GPRA Unit has completed or will complete a Program Assessment Rating Tool (PART). A unique program goal was developed for each GPRA Unit. A numbering scheme has been established for tracking performance and reporting.^b

The goal cascade accomplishes two things. First, it ties major activities for each program to successive goals and, ultimately, to DOE’s mission. This helps ensure the Department focuses its resources on fulfilling its mission. Second, the cascade allows DOE to track progress against quantifiable goals and to tie resources to each goal at any level in the cascade. Thus, the cascade facilitates the integration of budget and performance information in support of the GPRA and the President’s Management Agenda (PMA).

Mission

The mission of the Fossil Energy (FE) R&D Program is to create public benefits by enhancing U.S. economic, environmental, and energy security. The program carries out three types of activities: (1) managing and performing energy-related research that reduces market barriers to 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.

Benefits

The extent to which future public benefits are realized from FE R&D activities are a complex function of factors including: success meeting R&D goals; competition from other advanced technologies; future energy prices; and the future regulatory environment. Since the future of markets and regulations are uncertain, alternative, credible scenarios need to be considered. A summary of the methodologies,

^a Government Performance and Results Act of 1993

^b The number scheme uses the the following numbering convention: First 2 digits identify the General Goal (01 through 07); second two digits identify the GPRA Unit; last four digits are reserved for future use.

sensitivities, and assumptions used to develop benefits estimates are important and these estimates should not be cited or referenced without their inclusion. This information will be available on the DOE/Fossil Energy website (<http://www.fe.doe.gov>) by March, 2004. Assessment with the PART revealed that the Department needs to continue to improve the consistency in methodology in estimating benefits for applied R & D programs across the Department.

Strategic Goals

The Department's Strategic Plan identifies four strategic goals (one each for defense, energy, science, and environmental aspect of the mission plus seven general goals that tie to the strategic goals. The Fossil Energy Research and Development appropriation supports the following goals:

General Goal 4, Energy Security: Improve energy security by developing technologies that foster a diverse supply of reliable, affordable and environmentally sound energy by providing for reliable delivery of energy, guarding against energy emergencies, exploring advanced technologies that make a fundamental improvement in our mix of energy options, and improving energy efficiency.

The programs funded by the Fossil Energy appropriation have the following three Program Goals which contribute to the General Goals in the "goal cascade":

Program Goal 04.55.00.00: Zero Emissions Coal-Based Electricity and Hydrogen Production: 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 percent with coal and 75 percent with natural gas.

Program Goal 04.56.00.00: Natural Gas Technologies, Abundant Affordable Gas: The Natural Gas Technologies' goal is to provide technology and policy options capable of ensuring abundant, reliable, and environmentally sound gas supplies.

Program Goal 04.57.00.00: Oil Technology, Energy Security: The goal of the Oil Technology program is to enhance U.S. energy security by managing and funding oil exploration and production (E&P) research and policy which results in development of domestic oil resources in an environmentally sound and safe manner.

Contribution to General Goals

FE contributes to General Goal 4 through its Coal and Other Power Systems, Natural Gas Technologies, and Oil Technology Programs.

The Coal and Other Power Systems Program (\$470 million FY 2005 Request/\$450.5 million FY 2004) contributes by creating 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.

One component of this program is the President's Coal Research Initiative, which includes the Clean Coal Power Initiative (CCPI) and supporting research programs. Beginning in FY 2005, the Clean Coal Power Initiative includes the FutureGen research project designed to establish the capability and feasibility of co-producing electricity and hydrogen from coal with essentially zero emissions, including carbon (sequestration). The Administration's FY 2005 request for FutureGen is \$237 million. The Clean Coal Power Initiative demonstration projects (\$50.0 million FY 2005 Request/\$169.9 million FY 2004), are cost-shared partnerships between the government and industry to demonstrate advanced coal-based power generation technologies (the most advanced example of which will be FutureGen).

The President's Coal Research Initiative also includes a number of important supporting research programs:

- Innovations for Existing Plants (\$18.1 million FY 2005 Request/\$21.7 million FY 2004) supports the President's Clear Skies Initiative by having technologies ready for commercial demonstration between 2005 and 2010 that can achieve substantial reductions in mercury, NO_x, and SO₂ emissions from power plants at significantly lower costs than currently available technology. This includes reductions of: mercury by 50 - 70 percent at 70 percent of today's cost; NO_x to less than 0.15 lb/mmBtu at three-quarters the cost of Selective Catalytic Reduction; and PM2.5 by 99.99 percent for less than \$50-\$70/Kw. By 2010, technologies will be tested for reducing mercury by 90 percent at 70 percent of today's cost.
- Advanced Power Systems (\$46.5 million FY 2005 Request/\$68.2 million FY 2004) supports the development of ultra-high efficiency coal powerplants for central station applications that will significantly reduce greenhouse gases compared to the existing fleet with costs at or below current technology. The primary focus is integrated gasification combined cycle (IGCC) and turbines that can use coal-derived gas. This includes, by 2010, demonstrating technologies at pilot scale which validate the feasibility of an advanced IGCC capable of achieving 50% thermal efficiency at a capital cost of \$1000/kW or less for a coal-based plant.
- Achieving zero carbon emissions will require economic approaches for carbon capture and storage. The goal for Sequestration R&D (\$49.0 million FY 2005 Request/\$40.5 million FY 2004) is to demonstrate, by 2007, technologies to reduce the cost of carbon separation and capture from new coal-based power systems by 75 percent compared to current systems (\$200/tonne carbon in year 2000), as well as creating regional partnerships for investigating potential sites and studies of the needs for essential infrastructure and permitting processes. By 2012, technologies will be developed that result in less than 10 percent increase in the cost of new energy services to separate, capture, transport, and sequester carbon using either direct or indirect systems.
- Making affordable hydrogen fuels available will create a potential pathway to zero emission vehicles, and would be particularly attractive if hydrogen can be generated with minimal emissions. Fossil fuels are considered to be the most cost-effective initial source of hydrogen, and by 2010, the goal for Coal Fuels Research under the President's Hydrogen Fuels Initiative (\$16.0 million FY 2005 Request/\$4.9 million FY 2004) is to complete development of modules capable of co-producing hydrogen from coal at \$30/barrel crude oil equivalent (no incentives or tax credits) when integrated with advanced coal power systems.

- Successful R&D depends on a program to ensure the availability of fundamental enabling technologies. Advanced Research activities (\$30.5 million FY 2005 Request/\$38.2 million FY 2004) contribute to sustaining U.S. preeminence in fossil fuel technology by supporting development of material, computational method, and control system knowledge needed to bridge gaps between science and advanced engineering. This activity will allow development, by 2010, of enabling technologies that support the goals of Vision 21 power systems.

The remaining area under Coal and Other Power Systems Distributed Generation (\$23.0 million FY 2005 Request/\$71.1 million FY 2004) focuses on cost and efficiency improvements for smaller scale electricity generation applications. It seeks, by 2010, to increase the robustness of distributed generation and thereby lower vulnerability of the electricity grid by introducing prototypes of modular fuel cells with 10-fold cost reduction (\$400/kW) with 50% - 60% efficiency, and fuel cell-turbine hybrids with 70% - 75% efficiency adaptable for coal.

The Natural Gas Technologies Program (\$26.0 million FY 2005 Request/\$43.0 FY 2004) contributes to Goal 4 by providing technology and policy options capable of ensuring (more safely and with greater security) abundant, affordable, reliable, and environmentally sound gas supplies. Program elements will develop technologies in the near, mid and long term to increase domestic supplies of conventional gas, and gas from vast unconventional sources such as methane hydrates, and ensure an adequate storage capability. Related policy efforts will provide import/export oversight and authorization to facilitate free natural gas and LNG markets among our international trading partners.

The Oil Technology Program (\$15.0 million FY 2005 Request/\$35.1 million FY 2004) supports General Goal 4 by providing technology and policy options capable of ensuring oil conservation and increasing energy security through development of existing domestic oil resources in an environmentally sound and safe manner.

This program has been realigned to specifically support the President's climate change and energy security goals. The budget delineates program goals such as Enhanced Oil Recovery/CO₂ Injection, Domestic Resource Conservation, and Environmental Science as funding categories. This allows the program to narrow the focus and highlight the program's mission and goals. These investments will maximize public benefit by concentrating solely on activities that require a Federal presence to attain the President's climate change and energy security goals. For the short term, the program focuses on working with domestic suppliers to maintain existing reserves and on diversifying global oil supplies. For the mid- to longer-term, the program seeks better technology that can be applied to locate new horizons. For the long-term, the program is defining frontiers of oil production that can provide a greater amount of the Nation's petroleum needs. This will help to ensure that an adequate supply of reasonably priced oil is available to meet the expected demand while minimizing environmental impact.

Funding by General Goal

(dollars in thousands)

	FY 2003	FY 2004	FY 2005	\$ Change	% Change
Goal 4, Energy Security					
Coal and Other Power Systems					
President's Coal Research Initiative					
Clean Coal Power Initiative.....	145,116	178,770	287,000	+108,230	+60.5%
Central Systems.....	91,494	89,880	64,500	-25,380	-28.2%
Sequestration R&D.....	39,101	40,297	49,000	+8,703	+21.6%
Fuels.....	30,433	31,221	16,000	-15,221	-48.8%
Advanced Research.....	32,444	38,215	30,500	-7,715	-20.2%
Total, President's Coal Research Initiative.....	338,588	378,383	447,000	+68,617	+18.1%
Other Power Systems					
Distributed Generation Systems.....	62,034	71,113	23,000	-48,113	-67.7%
U.S./China Energy and Environmental Center.....	0	988	9	-988	-100.0%
Total, Other Power Systems.....	62,034	72,101	23,000	-49,101	-68.1%
Total, Coal and Other Power Systems.....	400,622	450,484	470,000	+19,516	+4.3%
Natural Gas Technologies.....	45,860	42,994	26,000	-16,994	-39.5%
Petroleum - Oil Technology.....	40,983	35,078	15,000	-20,078	-57.2%
Advanced Metallurgical Processes.....	5,961	9,876	8,000	-1,876	-19.0%
Total Goal 4, Energy Security.....	493,426	538,432	519,000	-19,432	-3.6%
All Other					
Program Direction and Management Support.....	87,229	106,225	106,000	-225	-0.2%
Plant and Capital Equipment.....	6,954	6,914	0	-6,914	-100.0%
Fossil Energy Environmental Restoration.....	9,652	9,595	6,000	-3,595	-37.5%
Import/Export Authorization.....	2,981	2,716	1,799	-917	-33.8%
National Academy of Sciences Program Review.....	497	494	0	-494	-100.0%
Cooperative Research and Development.....	7,970	8,395	3,000	-5,395	-64.3%
Energy Efficiency Science Initiative.....	2,440	0	0	0	-0.0%
Total, All Other.....	117,723	134,339	116,799	-17,540	-13.0%
Total, General Goal 4 (Fossil Energy Research and Development).....	611,149	672,771	635,799	-36,972	-5.5%

R&D Investment Criteria

For the FY 2005 budget process OMB made revisions to its Program Assessment and Rating Tool (PART) to ensure alignment with the R&D Investment Criteria. There was additional information generated under the R&D Investment Criteria for the FY 2004 process, such as years to commercialization and level of risk that was also developed by Fossil Energy in the FY 2005 process. As a result of developing this additional information and using the updated PART, the breadth of items included in the R&D Investment Criteria was fully covered.

The President's Management Agenda identified the need to tie R&D investment to performance and well-defined practical outcomes. One criterion by which the Department's performance is measured involves using a framework in the R&D funding decision process and then referencing the use and outcome of the framework in budget justification material.

The goal is to develop highly analytical justifications for applied research portfolios in future budgets. This will require the development and application of a uniform cost and benefit evaluation methodology across programs to allow meaningful program comparisons.

Program Assessment Rating Tool (PART)

The Department implemented a tool to evaluate selected programs. PART was developed by the Office of Management and Budget (OMB) to provide a standardized way to assess the effectiveness of the Federal Government's portfolio of programs. The structured framework of the PART provides a means through which programs can assess their activities differently than through traditional reviews.

The current focus is to establish out-come and output-oriented goals, the successful completion of which will lead to benefits to the public, such as increased national security and energy security, and improved environmental conditions. DOE has incorporated feedback from OMB into the FY 2005 Budget Request, and the Department will take the necessary steps to continue to improve performance.

Based on application of the PART:

- 1) The oil and natural gas technology programs are rated as ineffective, and these programs lack a rigorous peer review process;
- 2) The fuel cell program is adequate, well designed, planned, and managed.
- 3) The Coal Research Initiative is adequate, with a clear purpose.

In general, the Department needs to improve consistency in methodology and assumptions in estimating potential benefits of all applied R & D programs.

Significant Program Shifts

The most significant shift is the focusing of the Coal and Power Systems funding on the FutureGen research project designed to establish the capability and feasibility of co-producing electricity and hydrogen from coal with essentially zero emissions, including carbon (via sequestration). The \$237 million dollar FY 2005 request is a major commitment by the Administration, and signals the private sector and potential international partners that the Administration is serious about carrying out this project.

In addition, the FY 2005 Request reflects significantly increased funding in support of the President's Hydrogen Fuels Initiative through the development of advanced technology for producing hydrogen from coal. Another area receiving increasing emphasis is carbon sequestration, in part based on activities that will result from the FY 2004 initiation of the Carbon Sequestration Leadership Forum and seven Regional Partnerships.

Congressional Items of Interest

(dollars in thousands)

	FY 2003	FY 2004	FY 2005	\$ Change	% Change
NETL Office/Lab Building	3,974	3,951	0	-3,951	-100.0%
Total, Congressional Items of Interest ..	3,974	3,951	0	-3,951	-100.0%