DOE/ME-0052
Volume 7

Department of Energy
FY 2006 Congressional Budget Request

Interior & Related Agencies

Fossil Energy Research & Development

Naval Petroleum & Oil Shale Reserves

Elk Hills School Lands Fund

Energy Conservation

Economic Regulation

Strategic Petroleum Reserve

Energy Information Administration

Clean Coal Technology

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The Department of Energy's FY 2005 Congressional Budget justification is available on the Office of Management, Budget and Evaluation/CFO homepage at http://www.mbe.doe.gov/budget/

Department of Energy
Appropriation Account Summary
(dollars in thousands - OMB Scoring)

	FY 2004 Comparable Approp	FY 2005 Comparable Approp	FY 2006 Request to Congress	FY 2006 vs. FY 2005	
Interior And Related Agencies					
Fossil energy research and development	658,981	571,854	491,456	-80,398	-14.1%
Naval petroleum and oil shale reserves	17,995	17,750	18,500	750	+4.2%
Elk Hills school lands fund	36,000	36,000	84,000	48,000	+133.3%
Energy conservation	867,967	868,234	846,772	-21,462	-2.5%
Economic regulation	1,034	——	——	——	——
Strategic petroleum reserve	170,948	169,710	166,000	-3,710	-2.2%
Northeast home heating oil reserve	4,939	4,930	——	-4,930	-100.0%
Energy information administration	81,100	83,819	85,926	2,107	+2.5%
Subtotal, Interior Accounts	1,838,964	1,752,297	1,692,654	-59,643	-3.4%
Clean coal technology	-98,000	-160,000	——	160,000	+100.0%
Total, Interior And Related Agencies	**1,740,964**	**1,592,297**	**1,692,654**	**100,357**	**+6.3%**

Department of Energy
Appropriation Account Summary
(dollars in thousands - OMB Scoring)

	FY 2004 Comparable Approp	FY 2005 Comparable Approp	FY 2006 Request to Congress	FY 2006 vs. FY 2005	
Energy And Water Development					
Energy Programs					
Energy supply	794,897	932,319	902,674	-29,645	-3.2%
Non-Defense site acceleration completion	167,272	157,316	172,400	15,084	+9.6%
Uranium enrichment D&D fund	414,027	495,015	591,498	96,483	+19.5%
Non-Defense environmental services	307,795	288,966	177,534	-111,432	-38.6%
Science	3,536,373	3,599,546	3,462,718	-136,828	-3.8%
Nuclear waste disposal	188,879	343,232	300,000	-43,232	-12.6%
Departmental administration	109,276	119,284	130,259	10,975	+9.2%
Inspector general	39,229	41,176	43,000	1,824	+4.4%
Total, Energy Programs	5,557,748	5,976,854	5,780,083	-196,771	-3.3%
Atomic Energy Defense Activities					
National nuclear security administration:					
Weapons activities	6,447,159	6,583,350	6,630,133	46,783	+0.7%
Defense nuclear nonproliferation	1,367,709	1,422,103	1,637,239	215,136	+15.1%
Naval reactors	761,872	801,437	786,000	-15,437	-1.9%
Office of the administrator	352,949	357,051	343,869	-13,182	-3.7%
Total, National nuclear security administration	8,929,689	9,163,941	9,397,241	233,300	+2.5%
Environmental and other defense activities:					
Defense site acceleration completion	5,433,423	5,725,935	5,183,713	-542,222	-9.5%
Defense environmental services	895,015	845,704	831,331	-14,373	-1.7%
Other defense activities	675,824	672,590	635,998	-36,592	-5.4%
Defense nuclear waste disposal	387,699	229,152	351,447	122,295	+53.4%
Total, Environmental & other defense activities	7,391,961	7,473,381	7,002,489	-470,892	-6.3%
Total, Atomic Energy Defense Activities	16,321,650	16,637,322	16,399,730	-237,592	-1.4%
Defense EM privatization (rescission)	-15,329	——	——	——	——
Power marketing administrations:					
Southeastern power administration	5,070	5,158	——	-5,158	-100.0%
Southwestern power administration	28,431	29,117	3,166	-25,951	-89.1%
Western area power administration	176,873	171,715	53,957	-117,758	-68.6%
Falcon & Amistad operating & maintenance fund	2,625	2,804	——	-2,804	-100.0%
Total, Power marketing administrations	212,999	208,794	57,123	-151,671	-72.6%
Federal energy regulatory commission	——	——	——	——	——
Subtotal, Energy And Water Development Appropriation	22,077,068	22,822,970	22,236,936	-586,034	-2.6%
Uranium enrichment D&D fund discretionary payments	-449,333	-459,296	-451,000	8,296	+1.8%
Excess fees and recoveries, FERC	-19,000	-15,000	-13,000	2,000	+13.3%
Colorado River Basins	1,458	-23,000	-23,000	——	——
Total, Energy And Water Development	**21,610,193**	**22,325,674**	**21,749,936**	**-575,738**	**-2.6%**
Total, Discretionary Funding	**23,351,157**	**23,917,971**	**23,442,590**	**-475,381**	**-2.0%**

Fossil Energy Research and Development

Fossil Energy Research and Development

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Fossil Energy Research and Development

Proposed Appropriation Language

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), [$579,911,000] *$491,456,000*, to remain available until expended, of which [$4,000,000 is to continue a multi-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: *Provided*, That of the amounts provided,] ; $18,000,000 is to continue a multi-year project coordinated with the private sector for FutureGen, without regard to the terms and conditions applicable to clean coal technology projects: *Provided further*, That the initial planning and research stages of the FutureGen project shall include a matching requirement from non-Federal sources of at least 20 percent of the costs: *Provided further,* That any demonstration component of such project shall require a matching requirement from non-Federal sources of at least 50 percent of the costs of the component: *Provided further*, That of the amounts provided, $50,000,000 is available, after coordination with the private sector, for a requires for proposals for the Clean Coal Power Initiative providing for competitively-awarded research, development, and demonstration projects to reduce the barriers to continued and expanded coal use: *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 42 U.S.C. 5903d: *Provided further*, That the Department may include provisions for 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: *Provided further*, That any technology selected under this program shall be considered a Clean Coal Technology, and any project selected this program shall be 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 shall be expended in accordance with the provisions governing the use of funds contained under the heading "Clean Coal Technology" in prior appropriations: *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]. *In addition, $257,000,000 to become available on October 1, 2006 and remain available until expended, to continue the FutureGen project, subject to the terms and conditions under this heading.*

Explanation of Change

..... $4,000,000 is to continue a multi-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:…

Language is eliminated in the FY 2006 budget request. Sufficient prior year funding is available to continue these projects through FY 2006.

.....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.…

Language is eliminated in the FY 2006 budget request. Adequate funding is provided in the program direction account to accommodate these activities.

…..$257,000,000 to become available on October 1, 2006 and remain available until expended, to continue the FutureGen project, subject to the terms and conditions under this heading.

The proposed language provides for an advance appropriation of $257,000,000 of new budget authority for FY 2007 and is to be used for FutureGen under the Clean Coal Power Initiative program to continue a public-private partnership to prove out technologies leading to zero emission plants. In conjunction with this request, it is proposed that an advance appropriation of $257,000,000 be permanently reduced under the Clean Coal Technology account in FY 2006.

Fossil Energy Research and Development
Office of Fossil Energy

Overview

Appropriation Summary by Program

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Fossil Energy Research and Development						
Coal and Other Power Systems	439,057	351,130	351,130	351,000	-130	-0.0%
Natural Gas Technologies	41,836	44,839	44,839	10,000	-34,839	-77.7%
Petroleum - Oil Technology	34,107	33,921	33,921	10,000	-23,921	-70.5%
Program Direction and Management Support	106,225	104,528	106,068	98,941	-7,127	-6.7%
Plant and Capital Equipment	6,914	6,902	6,902	0	-6,902	-100.0%
Fossil Energy Environmental Restoration	9,595	9,467	9,467	8,060	-1,407	-14.9%
Import/Export Authorization	2,716	1,774	1,774	1,799	+25	+1.4%
Advanced Metallurgical Processes	9,876	9,861	9,861	8,000	-1,861	-18.9%
National Academy of Sciences Program Review	494	493	493	0	-493	-100.0%
Special Recruitment Programs	0	656	656	656	0	+0.0%
Cooperative Research and Development	8,161	8,283	8,283	3,000	-5,283	-63.8%
Total, Fossil Energy Research and Development	658,981	571,854	573,394	491,456	-81,938	-14.3%
Clean Coal Technology						
Advance Appropriation	87,000	97,000	97,000	257,000	+160,000	+164.9%
Rescission	-88,000	0	0	-257,000	-257,000	-100.0%

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Deferral of Unobligated Balances	-97,000	-257,000	-257,000	0	+257,000	+100.0%
Total, Clean Coal Technology	-98,000	-160,000	-160,000	0	+160,000	+100.0%
Strategic Petroleum Reserve	170,948	169,710	170,048	166,000	-4,048	-2.4%
Northeast Home Heating Oil Reserve	4,939	4,930	4,930	0	-4,930	-100.0%
Naval Petroleum Reserves	17,995	17,750	17,895	18,500	+615	+3.4%
Elk Hills School Lands Funds	36,000	36,000	36,000	84,000	+48,000	+133.3%
Total, Office of Fossil Energy	790,863	640,244	642,267	759,956	+117,689	+18.3%

Detailed Funding Table

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Fossil Energy Research and Development			
Coal and Other Power Systems			
President's Coal Research Initiative			
Clean Coal Power Initiative			
Clean Coal Power Initiative	165,171	49,305	50,000
FutureGen	8,640	17,750	18,000
Total, Clean Coal Power Initiative	173,811	67,055	68,000
Central Systems			
Innovations for Existing Plants	21,238	19,081	23,850
Advanced Systems	66,502	66,415	74,450
Total, Central Systems	87,740	85,496	98,300
Sequestration	39,375	45,361	67,200
Fuels			
Transportation Fuels and Chemicals	21,340	23,470	22,000
Solid Fuels and Feedstocks	5,820	5,916	0
Advanced Fuels Research	3,216	2,761	0
Total, Fuels	30,376	32,147	22,000

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Advanced Research			
Coal Utilization Science	11,581	17,552	8,000
Materials	10,809	10,848	8,000
Technology Crosscut	11,326	10,355	10,500
University Coal Research	2,863	2,958	3,000
HBCUs, Education & Training	954	986	1,000
Total, Advanced Research	37,533	42,699	30,500
Total, President's Coal Research Initiative	368,835	272,758	286,000
Other Power Systems			
Distributed Generation Systems			
Fuel Cells	66,833	74,428	65,000
Novel Generation	2,401	2,958	0
Total, Distributed Generation Systems	69,234	77,386	65,000
U.S./China Energy and Environmental Center	988	986	0
Total, Other Power Systems	70,222	78,372	65,000
Total, Coal and Other Power Systems	439,057	351,130	351,000
Natural Gas Technologies			
Exploration and Production	21,590	23,666	10,000
Gas Hydrates	9,150	9,368	0
Infrastructure	8,695	8,354	0
Effective Environmental Protection	2,401	3,451	0
Total, Natural Gas Technologies	41,836	44,839	10,000
Petroleum – Oil Technology			
Exploration and Production	17,939	18,736	10,000
Reservoir Life Extension/Management	6,723	5,916	0
Effective Environmental Protection	9,445	9,269	0
Total, Petroleum – Oil Technology	34,107	33,921	10,000
Program Direction			
Fossil Energy Research and Development	91,410	90,722	84,949
Clean Coal Technology	14,815	13,806	13,992
Total, Program Direction	106,225	104,528	98,941
Plant and Capital Equipment	6,914	6,902	0
Fossil Energy Environmental Restoration	9,595	9,467	8,060

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Import/Export Authorization	2,716	1,774	1,799
Advanced Metallurgical Research	9,876	9,861	8,000
National Academy of Sciences Program Review	494	493	0
Special Recruitment Programs	0	656	656
Cooperative Research and Development	8,161	8,283	3,000
Total, Fossil Energy Research and Development	658,981	571,854	491,456
Strategic Petroleum Reserve	170,948	169,710	166,000
Northeast Home Heating Oil Reserve	4,939	4,930	0
Naval Petroleum Reserves	17,995	17,750	18,500
Elk Hills School Lands Funds	36,000	36,000	84,000
Total, Office of Fossil Energy	790,863	640,244	759,956

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 use of fossil fuels.

In addition to the traditional uses of Fossil Fuels, the Fossil Energy Research and Development Program is a participant in the Administration's Hydrogen Fuel Initiative. The program is proceeding through the coordinated activities of the Department's major R&D Offices.

Within the Interior and Related Agencies appropriation, Fossil Energy Research and Development has eleven programs: Coal and Other Power Systems, Natural Gas Technologies, Oil Technology, Program Direction, Plant and Capital Equipment, Environmental Restoration, Import/Export Authorization, Advanced Metallurgical Research, Special Recruitment Programs, Cooperative Research and Development, and the Special Recruitment Program. Other programs which make up the Office of Fossil include the Clean Coal Technology Program, the Strategic Petroleum Reserve, the Northeast Home Heating Oil Reserve, the Naval Petroleum and Oil Shale Reserves, and the Elk Hills School Lands Funds. Natural Gas Technologies and Oil Technology are being terminated in FY 2006 and are discussed elsewhere in this budget document.

This Overview will describe Strategic Context, Mission, Benefits, Strategic Goals, and Funding by General Goal. These items together put the appropriation in perspective. The Annual Performance Results and Targets, Means and Strategies, and Validation and Verification sections address how the goals will be achieved and how performance will be measured. Finally, this Overview will 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).

Another important component of our strategic planning – the President's Management Agenda – includes use of the Administration's R&D investment criteria to plan and assess programs and projects. The criteria were developed in 2001 and further refined with input from agencies, Congressional staff, the National Academy of Sciences, and numerous private sector and nonprofit stakeholders.

The chief elements of the R&D investment criteria are quality, relevance, and performance. Programs must demonstrate fulfillment of these elements. For example, to demonstrate relevance, programs are expected to have complete plans with clear goals and priorities. To demonstrate quality, programs are expected to commission periodic independent expert reviews. There are several other requirements, many of which R&D programs have and continue to undertake.

An additional set of criteria were established for R&D programs developing technologies that address industry issues. Some key elements of the criteria include: the ability of the programs to identify the appropriateness and need for Federal assistance; relevance to the industry and the marketplace; identification of transition points to industry commercialization (or of an off-ramp if progress does not meet expectations), and; the potential public benefits, compared to alternative investments, that accrue if the technology is successfully deployed.

The OMB-OSTP guidance memo to agencies dated June 5, 2003, describes the R&D investment criteria fully and identified steps agencies should take to fulfill them. (The memo is available on line at www.ostp.gov/html/fy05developingpriority.pdf.) Where appropriate throughout these justification

[a] Government Performance and Results Act of 1993

[b] The number scheme uses 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.

materials, especially in Significant Program Shifts and Explanation of Funding Changes subheadings, specific R&D investment criteria and requirements are cited to explain the Department's allocations of resources.

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 use of fossil fuels for power generation and conversion to other fuels such as hydrogen; (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, sensitivities, and assumptions used to develop benefits estimates are important, and must be considered before drawing conclusions based on benefits estimates.

FE, in coordination with other Department R&D programs has developed benefit estimates for its applied R&D programs. The Department is working to improve consistency across programs in the methodology and assumptions used in estimating program costs and benefits. The assumptions and methods underlying the modeling efforts have significant impact on the estimated benefits. Results could vary significantly if external factors, such as future energy prices, differ from the baseline case assumed for this analysis. Using the EIA's National Energy Modeling System (NEMS), with assumptions based on EIA's Annual Energy Outlook 2004 Reference Case, FE's preliminary estimates show economic benefits of the FE R&D portfolio range from $164 to $242 billion dollars, cumulative to 2025 in year 2002 dollars, non-discounted. These estimates are appropriate for providing relative "order of magnitude" estimates, while the Department continues to refine and standardize its methodology. This benefit is the sum of both the savings in cost of electricity due to lower cost generation options, as well as reduced natural gas prices to consumers. Reduced natural gas prices are based on the deployment of improved coal and gas-fueled generation options that have the effect of lowering the demand for and price of natural gas. The ranges are based on outputs from different scenarios, including one with higher oil and gas prices, and another with a moderate carbon emission constraint. Benefits from advanced technology deployment beyond 2025 are not considered, since NEMS is currently limited to a 2025 time frame. Other types of benefits may also occur, such as reduced mercury emissions, and derivative technology and products. In addition, there may be economic benefits, particularly from longer-term activities such as those from the hydrogen program, and portions of the sequestration program which are not currently modeled in NEMS and are therefore not included in these reported benefits.

FE is continuing to work on important methodological challenges affecting benefits estimates. One of the most important challenges concerns finding a generally acceptable approach for reflecting the

impacts of technology risk. This is critical since high-risk R&D is characteristic of much of the Government-supported energy portfolio. Risk is one of the areas that the National Research Council is expected to focus on as part of its ongoing study of the prospective benefits of Government-supported energy R&D.

Strategic, General and Program Goals

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

Energy Strategic Goal: To protect our national and economic security by promoting a diverse supply and delivery of reliable, affordable, and environmentally sound energy.

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 R&D 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 generation and hydrogen 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 energy efficiencies over 60 percent with coal and 75 percent with natural gas.

Program Goals 04.56.00.00 and 04.57.00.00 cover oil and gas activities, and will not be achieved with the termination of these program in FY 2006.

Contribution to General Goal

FE contributes to General Goal 4 through its Coal and Other Power Systems Program ($351.0 million FY 2006 Request/$351.1 million FY 2005) pursues Goal 04.55 above and encompasses the following activities:

- The Clean Coal Power Initiative ($50 million FY 2006 Request; $49.3 million FY 2005 – this does not include FutureGen funding) by 2010 will initiate demonstration of advanced coal-based power generation technologies capable of achieving: 45 percent electrical efficiency; greater than 90 percent Hg removal at a cost of 70 percent of current technology; and 0.15 lb/MMBtu NO_x at 75 percent of the cost of current technology (selective catalytic reactors). These technologies can be configured to co-produce heat, fuels, chemicals or other useful byproducts, and provide a deployment-ready suite of advanced technologies that can produce substantial near-, mid-, and long-range economic and environmental public benefits.

- The FutureGen research prototype facility ($18 million FY 2006 Request; $17.8 million FY 2005) within the Clean Coal Power Initiative subprogram, will demonstrate the technical feasibility and economic viability of the zero emission (including carbon) coal concepts.
- Innovations for Existing Plants ($23.9 million FY 2006 Request; $19.1 million FY 2005), within the Central Systems subprogram, supports the President's Clear Skies Initiative by having technologies ready for commercial demonstration by 2007 with the potential to reduce, from all coals: mercury by 50-70 percent at 70 percent of the 2003 reference cost of $50,000-$70,000/lb of mercury; NO_x to less than 0.15 lb/MMBtu at three-quarters of the cost of selective catalytic reactors (SCR), which is currently $80-$100/Kw; $PM_{2.5}$ by 99.99 percent for less than $50-$70/kW; and acid gases by 95 percent. By 2010, test technologies for advanced cooling, mercury reduction by 90 percent at 70 percent of the 2003 reference cost of $50,000-$70,000/lb. of mercury; and a 66 percent increase in byproducts utilization.
- Advanced Power Systems ($74.5 million FY 2006 Request; $66.4 million FY 2005), within the Central Systems subprogram will, by 2010, complete R&D for advanced gasification combined cycle technology that can produce electricity from coal at 45-50 percent efficiency (HHV) at a capital cost of $1,000 per kilowatt or less. By 2012, R&D will be completed to integrate this technology with CO_2 sequestration, capture and sequestration into a zero-emissions configuration(s) that can provide electricity with less than a 10 percent increase in cost.
- The Sequestration R&D activity ($67.2 million FY 2006 Request; $45.4 million FY 2005), by 2007, will demonstrate, at a pilot plant scale, technologies that result in less than 20 percent increase in the cost of electricity. By 2012, develop technologies to separate, capture, transport, and sequester carbon using either direct or indirect systems that result in less than 10 percent increase in the cost of electricity.
- The Fuels activity ($22.0 million FY 2006 Request; $32.1 million FY 2005), by 2010, will 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.
- Advanced Research ($30.5 million FY 2006 Request; $42.7 million FY 2005) sustains U.S. preeminence in fossil fuel technology by supporting development of materials, computational methods, and control system knowledge needed to bridge gaps between science and advanced engineering. Advanced Research efforts will allow development, by 2010, of enabling technologies that support the goals of zero-emissions energy systems.
- Distributed Generation Systems ($65.0 million FY2006 Request; $77.4 million FY 2005), by 2010, will increase the robustness of distributed generation and thereby lower vulnerability of the electricity grid by introducing prototypes of 3-10 kilowatt solid oxide fuel cell modules with a 10-fold cost reduction to $400 per kilowatt (versus a 2003 baseline of $4500 per kilowatt), with 40-60 percent electrical efficiency and adaptable to zero-emission coal systems.

The Natural Gas Technologies and Oil Technology Programs ($20.0 million FY 2006 Request; $78.8 million FY 2005) are being terminated in FY 2006. The $20 million in new budget authority requested in FY 2006 will be used for legal obligations incurred by the termination process. Prior year funds will be used to conduct ongoing projects.

Funding by General and Program Goal

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Goal 4, Energy Security			
Program Goal 04.55.00.00, Zero Emissions Coal-Based Electricity and Hydrogen Production	439,057	351,130	351,000
Program Goal 04.56.00.00, Natural Gas Technologies, Abundant Affordable Gas	41,836	44,839	10,000
Program Goal 04.57.00.00, Petroleum - Oil Technology, Abundant Oil	34,107	33,921	10,000
Total Goal 4, Energy Security	515,000	429,890	371,000
All Other			
Program Direction and Management Support	106,225	104,528	98,941
Plant and Capital Equipment	6,914	6,902	0
Fossil Energy Environmental Restoration	9,595	9,467	8,060
Import/Export Authorization	2,716	1,774	1,799
Advanced Metallurgical Processes	9,876	9,861	8,000
National Academy of Sciences Program Review	494	493	0
Special Recruitment Programs	0	656	656
Cooperative Research and Development	8,161	8,283	3,000
Total, All Other	143,981	141,964	120,456
Total, General Goal 4 (Fossil Energy Research and Development)	658,981	571,854	491,456

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 outcome 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 2006 Budget Request, and the Department will take the necessary steps to continue to improve performance.

Based in part on their “Ineffective” rating of the PART for the FY 2005 budget, the Oil and Natural Gas Technology programs will be terminated in FY 2006. In the PART for the FY 2005 budget, the Fuel Cell program and the Coal Research Initiative were rated as “Adequate”.

The PART recommended that the program participate in the development of a consistent framework for the Department to analyze the costs and benefits of its R&D investments, and to apply this guidance as part of FY 2006 Budget Development. FE has made a major commitment to improve the quality of its

benefits estimates. This commitment includes adapting EIA's National Energy Modeling System (NEMS) to provide estimates of program benefits, incorporation of comments by national experts who reviewed the benefits methodology, working closely with DOE's Office of Energy Efficiency and Renewable Energy to develop common energy-related scenarios for NEMS and approaches for exploring technology risk, and working intensively with a National Research Council Committee as part of an ongoing study of methodologies to estimate the prospective benefits of DOE energy R&D. The Department prepared preliminary benefits estimates for its applied R&D programs, but still needs to improve consistency across programs in the methodology and assumptions used in estimating program costs and benefits.

Significant Program Shifts

Budget discipline necessitated close scrutiny of all Fossil Energy programs, using strict guidelines to determine their effectiveness and compare them to other programs offering more clearly demonstrated and substantial benefits. As a result, the 2006 Budget proposes to conduct orderly termination of the Oil and Gas programs in FY 2006.

Other significant budget increases will ensure that R&D supporting the FutureGen project is completed on schedule. FutureGen will employ advanced generation coal gasification technology integrated with combined cycle electricity generation, hydrogen production, and capture and sequestration of carbon dioxide (CO_2). The aim of FutureGen is to prove out the technical feasibility and potential economic viability of a zero emission coal energy system deployable by 2020. Supporting technologies with significant R&D funding increases include the Fuel Cell program, which is now entirely refocused on the $400/kw SECA fuel cell and would allow plants evolving from FutureGen to reach their ultimate performance goals on schedule with reasonable risk; advanced mercury controls, where field testing will be required to demonstrate 90% recovery, and: carbon sequestration, where increased funding is needed for Phase II of the Regional Partnerships Program and pilot testing of capture technologies. All of these increases are justified through application of the R&D investment criteria (e.g. FutureGen is a Presidential Initiative as well as a key potential contributor to the President's Global Climate Change Initiative).

Congressional Items of Interest

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
NETL Office/Lab Building	3,951	3,944	0	-3,944	-100.0%
Total, Congressional Items of Interest	3,951	3,944	0	-3,944	-100.0%

Fossil Energy Research and Development
Office of Fossil Energy

Funding by Site by Program

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Chicago Operations Office					
Ames National Laboratory					
Coal and Power Systems	500	520	510	-10	-1.9%
Argonne National Laboratory (East)					
Coal and Other Power Systems	3,582	3,550	3,663	+113	+3.2%
Natural Gas Technologies	560	210	0	-210	-100.0%
Total, Argonne National Laboratory (East)	4,142	3,760	3,663	-97	-2.6%
Brookhaven National Laboratory					
Coal and Other Power Systems	200	100	0	-100	-100.0%
Natural Gas Technologies	0	150	0	-150	-100.0%
Total, Brookhaven National Laboratory	200	250	0	-250	-100.0%
Total, Chicago Operations Office	4,842	4,530	4,173	-357	-7.9%
Idaho Operations Office					
Idaho National Engineering and Environmental Lab					
Coal and Other Power Systems	760	690	570	-120	-17.4%
Natural Gas Technologies	250	200	0	-200	-100.0%
Total, Idaho National Engineering and Environmental Lab	1,010	890	570	-320	-36.0%
Total, Idaho Operations Office	1,010	890	570	-320	-36.0%

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Livermore Site Office					
Lawrence Livermore National Laboratory					
Coal and Other Power Systems	140	0	0	0	0.0%
Natural Gas Technologies	250	250	0	-250	-100.0%
Petroleum – Oil Technology	200	175	0	-175	-100.0%
Total, Lawrence Livermore National Laboratory	590	425	0	-425	-100.0%
Total, Livermore Site Office	590	425	0	-425	-100.0%
Los Alamos Site Office					
Los Alamos National Laboratory					
Coal and Other Power Systems	1,898	1,428	1,100	-328	-23.0%
Natural Gas Technologies	740	250	0	-250	-100.0%
Petroleum – Oil Technology	50	305	0	-305	-100.0%
Total, Los Alamos National Laboratory	2,688	1,983	1,100	-883	-44.51%
Total, Los Alamos Site Office	2,688	1,983	1,100	-883	-44.51%
National Energy Technology Laboratory					
National Energy Technology Laboratory					
Coal and Other Power Systems	413,499	325,920	324,092	-1,828	-.0.6%
Natural Gas Technologies	34,999	40,218	9,900	-30,318	-75.4%
Petroleum – Oil Technology	31,769	31,760	9,900	-21,860	-68.8%
Program Direction and Management Support	79,196	77,757	74,202	-3,555	-4.6%
Plant and Capital Equipment	6,914	6,902	0	-6,902	-100.0%
Fossil Energy Environmental Restoration	7,309	6,781	6,352	-429	-6.3%
Cooperative Research and Development	8,121	8,244	2,970	-5,274	-64.0%

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Advanced Metallurgical Research	9,876	9,861	8,000	-1,861	-18.9%
Total, National Energy Technology Laboratory.....	591,683	507,443	435,416	-72,027	-14.2%
NNSA Service Center					
Lawrence Berkeley National Laboratory					
Coal and Other Power Systems	580	150	100	-50	-33.3%
Natural Gas Technologies	850	330	0	-300	-100.0%
Petroleum – Oil Technology	200	125	0	-125	-100.0%
Total, Lawrence Berkeley National Laboratory	1,630	605	100	-505	-83.5%
Total, NNSA Service Center	1,630	605	100	-505	-83.5%
Oak Ridge Operations Office					
Oak Ridge National Laboratory					
Coal and Power Systems	6,089	6,951	7,074	+123	+1.8%
Natural Gas Technologies	510	448	0	-448	-100.0%
Total, Oak Ridge National Laboratory	6,599	7,399	7,074	-325	-4.4%
Total, Oak Ridge Operations Office	6,599	7,399	7,074	-325	-4.4%
Richland Operations Office					
Pacific Northwest Laboratory					
Coal and Power Systems	3,817	3,240	5,490	+2,250	+69.4%
Natural Gas Technologies	690	478	0	-478	-100.0%
Total, Pacific Northwest Laboratory	4,507	3,718	5,490	-1,772	-47.7%
Total, Richland Operations Office	4,507	3,718	5,490	-1,772	-47.7%

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Sandia Site Office					
Sandia National Laboratories					
Coal and Power Systems	900	820	700	-120	-14.8%
Natural Gas Technologies	690	0	0	0	0.0%
Total, Sandia National Laboratories	1,590	820	700	-120	-14.6%
Total, Sandia Site Office	1,590	820	700	-120	-14.6%
Washington Headquarters					
Coal and Power Systems	8,094	8,151	7,693	-458	-0.6%
Natural Gas Technologies	1,746	2,792	100	-2,692	-96.4%
Petroleum – Oil Technology	1,888	1,556	100	1,456	-93.6%
Program Direction and Management Support	27,029	26,771	24,739	-2,032	-7.6%
Fossil Energy Environmental Restoration	1,835	1,809	1,716	-93	-5.1%
Import/Export Authorization	2,716	1,774	1,799	+25	+1.4%
Special Recruitment Programs	0	656	656	0	0.0%
National Academy of Sciences Program Review	494	493	0	-493	-100.0%
Cooperative Research and Development	40	39	30	-9	-23.1%
Total, Washington Headquarters	43,842	44,041	36,833	+792	-2.2%
Total, Fossil Energy Research and Development	658,981	571,854	491,456	-80,398	-14.1%

Site Description

Ames National Laboratory

The Ames National Laboratory is located in Ames, Iowa.

Coal and Other Power Systems
Ames National laboratory conducts advanced research on virtual simulations and high temperature materials.

Argonne National Laboratory (East)

The Argonne National Laboratory (ANL), located in Argonne, Illinois, is a major multi-program laboratory managed and operated for the U.S. Department of Energy (DOE) by the University of Chicago under a performance-based contract.

Coal and Other Power Systems
Argonne research supports concepts for various technologies for Central Systems; supports DOE strategies to capture CO_2 from existing and advanced fossil fuel conversion systems in Sequestration R&D; supports DOE strategies to develop non-destructive testing examination of materials and mineral sequestration kinetics in the Advanced Research; and supports the DOE-SECA core technology program in Distributed Generation Systems.

Natural Gas Technologies
Argonne research for the Fossil Energy Natural Gas Technologies program in FY 2004 supported Drilling, Completion and Stimulation technology development and Environmental Science R&D. No activities are planned in FY 2005 and FY 2006.

Brookhaven National Laboratory

The Brookhaven National Laboratory (BNL) is located on Long Island, New York.

Coal and Other Power Systems
The Brookhaven National Laboratory conducts research on various technologies for central systems.

Natural Gas Technologies
Brookhaven research for the Fossil Energy Natural Gas Technologies program in FY 2005 supports Drilling, Completion and Stimulation technology development and Environmental Science R&D. No activities were performed in FY 2004 or planned in FY 2006.

Idaho National Engineering and Environmental Laboratory

The Idaho National Engineering and Environmental Laboratory (INEEL) is locate outside of Idaho Falls, Idaho.

Coal and Other Power Systems
Research conducted at INEEL supports concepts for various technologies for Central Systems; conducts research on breakthrough concepts to separate and capture CO_2 in Sequestration R&D; and conducts research and development on materials development and bio-processing research in Advanced Research.

Natural Gas Technologies
Research conducted in FY 2004 supported environmental technology development, drilling technology and microbial analysis of gas hydrates, and small pipe development. In FY 2005 and FY 2006 no activity is planned.

Lawrence Berkeley National Laboratory

The Lawrence Berkeley National Lab (LBNL) is located in Berkeley, California.

Coal and Other Power Systems
The Lawrence Berkeley National Lab conducts research which supports concepts for various technologies for Central Systems; and conducts research and development on geologic sequestration approaches and measurement, monitoring, and verification protocols in Sequestration R&D.

Natural Gas Technologies
Research conducted in FY 2004 and FY 2005 supports environmental analysis and modeling, heavy oil upgrading, reservoir characterization, and gas hydrates characterization. No new activity is planned in FY 2006.

Petroleum – Oil Technology
Research supports enhanced oil recovery (EOR) and environmental modeling.

Lawrence Livermore National Laboratory

The Lawrence Livermore National Lab (LLNL) is located in Livermore, California.

Natural Gas Technologies
Research conducted in FY 2004 supported environmental emissions analysis, reservoir geophysics, and hydrates properties, and hyperspectral remote leak detection. No activity is planned in FY 2005 or FY 2006.

Petroleum – Oil Technology
Research supports environmental and reservoir modeling. No new activity is planned in FY 2006.

Los Alamos National Laboratory

The Los Alamos National Laboratory (LANL) is located in Los Alamos, New Mexico.

Coal and Other Power Systems
Research conducted by the Los Alamos National Laboratory supports concepts for various technologies for Central Systems; conducts research and development in the area of Sequestration R&D to lower the costs of

CO_2 capture, provide fundamental scientific information on engineered terrestrial sequestration approaches, and develop advanced instrumentation to measure and validate terrestrially sequestered carbon; and conducts research and development in the area of Advanced Research to model mineral sequestration and develop hydrogen separation membranes.

Natural Gas Technologies
Research conducted in FY 2004 supported multi-purpose energy meter. No activity is planned in FY 2005 or FY 2006.

Petroleum – Oil Technology
Research conducted in FY 2004 supported seismic and drilling research. No activity is planned in FY 2005 or FY 2006.

National Energy Technology Laboratory

The National Energy Technology Laboratory (NETL), located in Morgantown, West Virginia, Pittsburgh, Pennsylvania, and Tulsa, Oklahoma, is a multi-purpose laboratory, owned and operated by the U.S. Department of Energy. NETL conducts and implements science and technology development programs for the Department in energy and energy-related environmental systems. NETL's key functions are to shape, fund, and manage extramural (external) RD&D projects, conduct on-site science and technology research, and support energy policy development and best business practices within the Department.

Coal and Other Power Systems

Scientists and engineers at the National Energy Technology Laboratory (NETL) conduct basic and applied research and development in support of the Office of Coal and Power Systems programs. In-house research in the coal gasification area involves advanced materials testing; gas-stream pollutant removal; sorbents development; particulate removal; and membrane separations. NETL researchers are also working to improve the next generation of gas turbines, fuel cells, and coupled turbine-fuel cell systems. In-house emissions control research focuses on the problems of Hg and $PM_{2.5}$ because these will be regulated in the relatively near future, while the by-product utilization in-house research solves environmental problems related to wastes and by-products formed during combustion processes. Research in carbon sequestration science studies the scientific basis for carbon sequestration options for large stationary sources of CO_2. Finally, research in computational energy science is being conduced to utilize advanced simulation techniques to improve and speed the development of cleaner, more efficient energy devices and plants.

Natural Gas Technologies
Within the Natural Gas Program, NETL has capability in hydrogen testing, computational chemistry, laser ignition development, and plastic pipe defect detection and these functions will continue in FY 2004 and FY 2005. No new activity is planned in FY 2006.

Petroleum – Oil Technology
Specific onsite expertise in enhanced oil recovery (EOR), environmental science, computational chemistry, and policy analysis supports the Oil Technology Program. No new activity is planned in FY 2006.

Program Direction and Management Support
This activity provides funding for salaries, benefits and overhead expenses for management of the Fossil Energy (FE) program at the National Energy Technology Laboratory (NETL), with sites in Morgantown, WV, Pittsburgh, PA, and Tulsa, OK.

Plant and Capital Equipment
This activity provides funding for general plant projects at the National Energy Technology Laboratory (NETL), with sites in Morgantown, WV, Pittsburgh, PA, and Tulsa, OK; and the Albany Research Center. In FY 2004 and FY 2005 funding is included for construction, renovation, furnishing, and demolition or removal of buildings at NETL facilities in Morgantown, West Virginia, and Pittsburgh, Pennsylvania. No new activity is planned in FY 2006.

Fossil Energy 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, West Virginia, Pittsburgh, Pennsylvania, and Tulsa, Oklahoma sites, and the Albany Research Center at Albany, Oregon.

Oak Ridge National Laboratory

The Oak Ridge National Laboratory (ORNL) is located in Oak Ridge, Tennessee.

Coal and Other Power Systems
The Oak Ridge National Laboratory conducts research on advanced materials that are applicable to advanced coal based power generation systems such as Vision 21 in Central Systems; conducts research and development in the area of Sequestration R&D to further geologic sequestration concepts, including measurement, monitoring and verification, and to understand the important soil parameters that facilitate terrestrial sequestration; and conducts research and development in the area of Advanced Research to develop materials and perform bio-processing research.

Natural Gas Technologies
Research conducted in FY 2004 supported oil processing environmental mitigation technologies and characterization of gas hydrates. ORNL has capabilities in petroleum product physical measurements, and EMAT sensor development. No activity is planned in FY 2005 or FY 2006.

Pacific Northwest Laboratory

The Pacific Northwest Laboratory (PNNL) is located in Richland, Washington.

Coal and Other Power Systems
The Pacific Northwest Laboratory conducts research and development in the area of Advanced Research to perform materials research and environmental analyses; and conducts research and development in the area of Distributed Generation Systems in support of the DOE-SECA program.

Natural Gas Technologies
Research conducted in FY 2004 supported reservoir geophysics, hydrate characterization, and ultrasonic strain detection. No activity is planned in FY 2005 or FY 2006.

Sandia National Laboratories

The Sandia National Laboratory (SNL) is located in Albuquerque, New Mexico, and Livermore, California.

Coal and Other Power Systems
The Sandia National Laboratories conducts research and development in the area of Sequestration R&D on injection of CO_2 into depleted oil and gas formations, and advanced monitoring methodologies based on advanced seismic concepts; and conducts research and development in the area of Advanced Research to develop hydrogen separation membranes and conduct fundamental combustion research.

Natural Gas Technologies
Research conducted in FY 2004 supported air emissions detection, measurement while drilling technology, reservoir geomechanical analysis, and airborne leak detection. No activity is planned in FY 2005 or FY 2006.

Washington Headquarters

Coal and Other Power Systems
This funding provides program support and technical support for each of the program within the Coal and Other Power Systems Program.

Natural Gas Technologies
The funding provides program support and technical support.

Petroleum – Oil Technology
The funding provides program support and technical support.

Program Direction and Management Support
This activity provides funding for salaries, benefits and overhead expenses for management of the Fossil Energy (FE) program at Headquarters.

Fossil Energy Environmental Restoration
The funding provides program support and technical support.

Import/Export Authorization
The Office of Import/Export Authorization 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.

National Academy of Sciences Program Review
This program provide for a study, in FY 2004, by the National Research Council (NRC) of prospective future benefits of Fossil Energy R&D.

Cooperative Research and Development
The funding provides program support and technical support.

Other

Coal and Other Power Systems

- The Clean Coal Power Initiative subprogram funds research at major performers at non-DOE locations. Examples of these performers include Wisconsin Electric Power Company, Western Greenbrier Co-Generation, LLC., Great River Energy, University of Kentucky Research Foundation, and Neuco, Inc. at Dynergy Midwest Generation.

- The Central Systems subprogram funds research at major performers at non-DOE locations. An example of these performers include the Albany Research Center focusing on various advanced materials and process-related concepts.

- The Sequestration R&D subprogram funds research at major performers at non-DOE locations. Examples of these performers include the CO_2 Capture Project (CCP), a collaborative effort involving nine major international energy companies, that has the goal of developing advanced technologies to significantly (75%) reduce the costs of capturing CO_2 from fossil fuel energy systems, an advanced fossil fuel conversion process with inherent CO_2 capture (Alstom), development of a combined membrane-fossil fuel combustion system that would produce a pure stream of CO_2 for sequestration (Praxair), and testing a regenerable sobent system capable of capturing CO_2 from advanced coal gasification systems (RTI). The Sequestration R&D subprogram also funds research at major colleges and universitiesBdeveloping an accurate cost and performance model for CO_2 capture systems (CMU); using hardwoods to restore mine lands (University of Kentucky); developing a carbon management geographic information system (MIT)Band at non-governmental organizations such as the Nature Conservancy who is developing a carbon accounting system for large forest ecosystems.

- The Fuels subprogram funds research at major performers at non-DOE locations. Examples of these performers include: Eltron Research, Inc. scaleup development of dense-phase hydrogen separation membrane; Gas Technology Institute development of high-temperature, hydrogen selective membrane reactor; SouthWest Research Institute development of manufacturing techniques for producing thin, dense, self-supporting Pd alloy membranes for improved hydrogen separation; University of California-Davis investigation into the production of hydrogen from coal-based methanol; and Ohio State University development of a high-temperature CO_2 sorbent process for producing high-purity hydrogen from synthesis gas and capturing CO_2.

- The Advanced Research subprogram funds research at major performers at non-DOE locations. An example of these performers include, the Albany Research Center which conducts research on materials and mineralization sequestration processes.

- The Distributed Generation Systems subprogram funds research at major performers at non-DOE locations. Examples of these performers include the SECA industry teams and SECA core technology teams.

Natural Gas Technologies
The Department's Natural Gas Technologies program, within the Fossil Energy and Development program, funds research at major performers at non-DOE locations. The budget proposes to conduct orderly termination of this program in FY 2006.

Petroleum – Oil Technology
The Department's Oil Technology program, within the Fossil Energy and Development program, funds research at major performers at non-DOE locations. The budget proposes to conduct orderly termination of this program in FY 2006.

Fossil Energy Environmental Restoration
Activities include environmental protection, and cleanup activities at several former off-site research and development locations.

Advanced Metallurgical Processes
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 in Oregon.

Cooperative Research and Development
Provides 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).

Coal and Other Power Systems

Funding Profile by Subprogram

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Coal and Other Power Systems						
President's Coal Research Initiative						
Clean Coal Power Initiative	173,811	67,055	67,055	68,000	+945	+1.4%
Central Systems	87,740	85,496	85,496	98,300	+12,804	+15.0%
Sequestration	39,375	45,361	45,361	67,200	+21,839	+48.1%
Fuels	30,376	32,147	32,147	22,000	-10,147	-31.6%
Advanced Research	37,533	42,699	42,699	30,500	-12,199	-28.6%
Total, President's Coal Research Initiative	368,835	272,758	272,758	286,000	+13,242	+4.9%
Other Power Systems						
Distributed Generation Systems	69,234	77,386	77,386	65,000	-12,386	-16.0%
U.S./China Energy and Environmental Center	988	986	986	0	-986	-100.0%
Total, Other Power Systems	70,222	78,372	78,372	65,000	-13,372	-17.1%
Total, Coal and Other Power Systems	439,057	351,130	351,130	351,000	-130	-0.0%

Mission

The mission of the Coal and Other Power Systems program is to assure the availability of abundant low cost, domestic energy (including hydrogen) to fuel economic prosperity and strengthen energy security.

Benefits

The Coal and Other Power Systems program supports DOE's mission to achieve national energy security in an economic and environmentally sound manner by developing the technological capability to dramatically reduce air pollution from coal-fueled electricity generation plants and carbon emissions to achieve essentially zero emissions. In the near term this means providing the capability to meet all existing and anticipated environmental regulations at low cost and to increase the power generation efficiency for existing and new plants. In the longer term, the aim is to nearly double energy plant efficiencies (from 33% to 60%), create the capability to achieve zero-emissions in producing low cost

hydrogen from coal and sequester (capture and store) all carbon from future coal plants at affordable costs of electricity, allowing coal to remain a key, strategic fuel for the Nation. The program mission is carried out in support of several Presidential Initiatives including the Coal Research Initiative, Clear Skies Initiative, Global Climate Change Initiative, Hydrogen Fuel Initiative, and the FutureGen Initiative.

Background

President's Coal Research Initiative

The goal of the President's Coal Research Initiative is to produce public benefits by conducting research and development on coal-related technologies that will improve coal's competitiveness in future energy supply markets. The Administration strongly supports coal as an important part of our energy portfolio. This request carries out the President's campaign commitment to invest $2 billion on clean coal research over 10 years.

The President's Coal Research Initiative consists of the Clean Coal Power Initiative, which embodies both an industry-led, cost-shared research and development program, and FutureGen, a prototype facility that will produce electricity and hydrogen while sequestering one million metric tons of carbon dioxide per year; Central Systems, targeting central station power generation equipment including low cost emissions control technology (especially mercury), turbines, and gasification technology; Sequestration R&D, researching ways to mitigate or separate and dispose of greenhouse gas from combustion; and Advanced Research, a set of cross-cutting long-term research projects that can potentially contribute to many aspects of the coal research program. Each of these programs is described in detail in separate sections below.

Other Power Systems

Distributed generation is the strategic application of relatively small generating units (typically less than 30 MWe) at or near consumer sites to meet specific customer needs, to support economic operation of the existing power distribution grid, or both. Power line losses are considerably reduced. Reliability of service and power quality is enhanced by proximity to the customer and efficiency can be improved in some on-site applications by using the heat from power generation.

The Distributed Generation Program contributes to two of the energy challenges that are being addressed in the National Energy Strategy: (1) improving the environmental acceptability of energy production and use by improving the efficiency and economics of power generation through the use of advanced technologies, and (2) increasing the competitiveness and reliability of U.S. energy systems. This is achieved through the strategy of encouraging the development and deployment of distributed power technologies to satisfy market forces for smaller, modular power technologies that can be installed quickly, close to consumer demand centers.

The technology developed in the Distributed Generation program is expected to be scaled-up for use in the FutureGen project, and eventually to provide ultra-high, ultra-clean, large scale modules for zero emissions plants.

Strategic and Program Goals

The Department's Strategic Plan identifies four strategic goals (one each for defense, energy, science, and environmental aspects of the mission) plus seven general goals that tie to the strategic goals. The Coal and Other Power Systems program supports the following goal:

Energy Strategic Goal

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 Coal and Other Power Systems program has one program goal which contributes to General Goal 4 in the "goal cascade".

Program Goal 04.55.00.00: Create public/private partnerships to provide technology to ensure continued electricity generation and hydrogen production from the extensive U.S. fossil fuel resource (especially coal), 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.

Contribution to Program Goal 04.55.00.00 (Zero Emissions Coal-Based Electricity and Hydrogen Production)

- The Clean Coal Power Initiative subprogram by 2010 will initiate demonstration of advanced coal-based power generation technologies capable of achieving 45 percent electrical efficiency, with environmental and economic performance capable of achieving greater than 90 percent Hg removal at a cost of 70 percent of current technology, less than 0.15 lb/MMBtu NO_x at 75 percent of the cost of current technology (selective catalytic reactors), that can be configured to co-produce heat, fuels, chemicals or other useful byproducts; and, provide a deployment-ready suite of advanced technologies that can produce substantial near-, mid-, and long-range economic and environmental public benefits.
- The FutureGen research prototype facility, within the Clean Coal Power Initiative subprogram, will prove the technical feasibility and economic viability of the zero emissions (including carbon) coal concept.
- The Innovations for Existing Plants activity, within the Central Systems subprogram, supports the President's Clear Skies Initiative by having technologies ready for commercial demonstration by 2007 with the potential to reduce, for all coals: mercury by 50-70 percent at 70 percent of today's cost of $50,000-$70,000/lb of mercury; NO_x to less than 0.15 lb/mmBtu at three-quarters of the cost of selective catalytic reactors (SCR), which is currently $80-$100/Kw; $PM_{2.5}$ by 99.99 percent for less than $50-$70/Kw; and acid gases by 95 percent. By 2010, test technologies for advanced cooling, mercury reduction by 90 percent at 70 percent of today's cost of $50,000-$70,000/lb. of mercury; and a 66 percent increase in byproducts utilization.

- The Advanced Power Systems activity, within the Central Systems subprogram, will, by 2010, complete R&D for advanced gasification combined cycle technology that can produce electricity from coal at 45-50% efficiency (HHV). By 2012, complete R&D to integrate this technology with CO_2 separation, capture and sequestration into a zero-emission configuration(s) that can provide electricity with less than a 10% increase in cost.
- The Sequestration subprogram, by 2007, will demonstrate at a pilot plant scale, 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). By 2012, develop technologies 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.
- The Fuels subprogram, by 2010, will 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.
- The Advanced Research subprogram sustains U.S. preeminence in fossil fuel technology by supporting development of materials, computational method, and control system knowledge needed to bridge gaps between science and advanced engineering. Advanced Research efforts will allow development, by 2010, of enabling technologies that support the goals of zero-emissions energy (FutureGen) systems.
- The Distributed Generation Systems subprogram, by 2010, will increase the robustness of distributed generation and thereby lower vulnerability of the electricity grid by introducing prototypes of 3-10 kilowatt solid oxide fuel cell modules with 10-fold cost reduction versus 2003 baseline ($400/Kw), with 40-60 percent electrical efficiency adaptable for zero-emission coal systems.

Annual Performance Results and Targets

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Targets	FY 2005 Targets	FY 2006 Targets
Program Goal 04.55.00.00 Zero Emissions Coal-Based Electricity and Hydrogen Production					
Clean Coal Power Initiative					
No targets reported	No targets reported	Complete CCPI Round 1 solicitation, proposal evaluations and project selections to assemble the initial portfolio of advanced technologies capable of improving the economic and environmental performance of coal-based electric power generation facilities. (MET GOAL) Complete NEPA process for 3 out of the 6 active PPII projects and initiate construction or operations phases for several of the projects. (NOT MET) Complete sufficient implementation activities on remaining projects to resolve any barrier issues. (MET GOAL)	Make go/no go decisions regarding award of cooperative agreements for up to 5 Round 1 CCPI projects and issue a Round 2 CCPI solicitation. (GPRA 4.55.6.1 – MET GOAL)	Initiate 100% of the active industrial projects selected under the first round of the competitive CCPI solicitation and make project selections from the second round CCPI solicitation. (GPRA 4.55.6.1)	Make go/no go decisions regarding award of cooperative agreements for all projects selected under Round 2 CCPI. Issue/release the FutureGen Project Draft Environmental Impact Statement.
Central Systems					
Deliver to EPA 2 years worth of high-quality $PM_{2.5}$ ambient monitoring data from the upper Ohio River Project. (MET GOAL) 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 generation facilities. (MET GOAL)Demonstrate hydrogen and CO_2 separation from syngas to meet the long-term goals of providing low-cost hydrogen	Complete Phase I report characterizing concentration and composition of ambient $PM_{2.5}$ emissions as input to the EPA $PM_{2.5}$ National Ambient Air Quality Standards (NAAQS) review. This data will help identify the impact of emission sources on air quality. (MET GOAL) Complete initial tests of the IGCC transport gasifier to confirm the feasibility of the technology to significantly improve reliability, cost effectiveness, and efficiency for	Initiate projects for developing technologies to address emerging electric utility/water issues and combustion byproducts utilization and disposal. (MET GOAL) Complete preliminary field testing of alternative mercury control technologies representing two approaches for achieving 50% or greater removal. (MET GOAL) Complete fine particulate monitoring in the Upper Ohio River Valley region; complete	Complete bench- and pilot-scale testing of five novel mercury control concepts capable of achieving $\geq$90% mercury capture by 2010 and initiate seven new projects under second phase of field testing of mercury control technology capable of achieving 50-70% mercury capture. (GPRA 4.55.1.1 – MET GOAL) Complete Ion Transport Membrane (ITM) designs with target oxygen production of 95% purity, to obtain engineering data for further	Develop field performance and cost data for emission control technologies and establish baseline for emissions transport from coal-fired boilers in support of proposed mercury and air quality regulations. (GPRA 4.55.1.1) Begin construction of slipstream test units, test planning, and testing of advanced gas cleanup concepts using real coal-derived synthesis gas. In FY 2005, the Gasification Technologies program will move ultra-clean cleanup, including economical	Conduct initial pilot scale slipstream field test of at least one technology capable of 90% mercury removal. Begin construction and testing of advanced gas separation technologies. In FY 2006, the Gasification Technologies program will move gas separation, including ceramic membrane, hydrogen separation, CO2 hydrate formation and ceramic membrane air separation, closer to commercialization, eventually leading to capital

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Targets	FY 2005 Targets	FY 2006 Targets
for high-efficiency fuel cells, and for providing concentrated CO_2 streams for sequestration. (MET GOAL) Complete design and continue construction of Circulating Atmospheric Fluidized Bed demonstration project at Jacksonville, Florida. (MET GOAL)	producing electricity and other products. (MET GOAL)	field testing of alternative particulate matter collection technologies representing at least two approaches for achieving 99.99% removal; initiate research on $PM_{2.5}$ and mercury transport and deposition. (MET GOAL) Initiate developmental testing of SCR catalysts for reducing NO_x emissions from alternatively fueled boilers. (MET GOAL) Establish a 1-5 tpd facility capable of determining engineering feasibility, defining technical performance, and establishing operating costs for oxygen separation using membrane technology. (MET GOAL) Complete initial laboratory-scale performance testing of hydrogen separation membranes using simulated gas streams. (MET GOAL) Complete initial laboratory tests to determine performance capabilities of sorbents, sieves, and membranes for removing mercury, sulfur, nitrogen, and CO_2 from gas streams. (MET GOAL) Conduct gasification support tests on leachability of gasifier residues, improved refractories, and oxygen-blown gasification of alternative fossil fuel feedstocks, and develop a simulator for a Vision 21 plant. (MET GOAL)	technology scale-up, ultimately leading to cost reductions of $75-$100/KW, and efficiency improvements of 1-2 points by 2010. (GPRA 4.55.2.1 – NOT MET) Complete at least 250 hours of high efficiency desulfurization process units operating with coal-derived synthesis gas. Eventual process units improvements are targeted to contribute a 60-80 $/KW capital cost reduction and a 1 point efficiency gain to the gasification system performance by 2010. (GPRA 4.55.2.3 – NOT MET) Initiate testing on advanced hydrogen separation membranes in simulated coal gasification product streams and complete design of a hydrate pilot-scale slipstream test unit. Advanced hydrogen separation technologies target eventual sequestering of CO_2 with a less than 10% increase in electricity cost by 2012. (GPRA 4.55.2.2 – MET GOAL) Perform modeling, facility modifications, and conduct pilot-scale tests for identifying technology opportunities to increase reliability, improved performance and increased feed flexibility of advanced gasifiers. Gasification improvements target eventual capital cost reductions and a 90% single train availability by 2010. (GPRA 4.55.2.4 – MET GOAL)	and efficient sulfur removal and/or multi-contaminant cleanup, a significant step closer to commercialization, eventually leading to capital cost reductions of $60-$80 kW and efficiency improvements of >1 efficiency points and the turbine technology area of Advanced Power will show progress towards the contribution of 2-3 percentage points improvement in combined cycle turbine efficiency. (GPRA 4.55.2.1)	cost reductions of $60-$80 per kW from the baseline of $1200/kW for IGCC systems and efficiency improvements of >1 efficiency points. Initiate a prototype combustor module test for large frame engines of low NOx combustion technology (trapped vortex, catalytic, lean premix, or modified diffusion flame) using simulated coal based synthesie gas to demonstrate progress towards a 3 ppm NOx emissions goal.

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Targets	FY 2005 Targets	FY 2006 Targets
		Develop technical and cost information sufficient for DOE decision-making on the viability of proceeding with plans for construction of a co-production plant. (MET GOAL) In the area of advanced systems initiated work on gas turbine combustor and nozzle systems for fuel flexible low-NO_x performance in IGCC applications for designs that are capable of meeting Vision 21 performance requirements. (MET GOAL) Continued technology base development in the areas of thermal barrier coatings, emission reductions, combustion stability, heat transfer and aerodynamics in turbines for coal derived synthesis gas. (MET GOAL)	Perform a thermal analysis of syngas turbine blades, initiate testing of an H2 delivery system, and perform a systems study of an optimized IGCC turbine design. Ultimately by 2008 these and follow-on efforts will reduce IGCC NOx emissions to less than 3 ppm, reduce turbine cost by 10-20% by increasing specific power output, increase turbine firing temperature and combined cycle integration to improve efficiency by 2-3 percentage points and reduce emissions associated with high hydrogen fuels. (GPRA 4.55.2.5 – MET GOAL)		
Sequestration R&D For carbon sequestration, expand the number of possible cost effective, collaborative, multi-national applied R&D options carried to the Aproof-of-concept@ stage. Complete multiple field experiments on promising technologies. (MET GOAL)	Complete the injection of 2,500 tons of CO_2 into a depleted oil reservoir to monitor the transport of CO_2 and verify predictive geologic models on reservoir integrity. (NOT MET)	Complete initial set of field tests of advanced monitoring and verification methods for carbon inventories on natural and engineered terrestrial systems and establish a database for mid-continent planning of geological storage projects. (MET GOAL) Initiate evaluations of three novel concepts, comprising integrated sequestration with enhanced coal bed methane recovery, mineral carbonation, and CO_2 flooding during enhanced oil recovery and establish initial recommendations for long-term	Design and test multiple concepts for efficient, low-cost, advanced CO2 separation and capture including on oxy-fuel combustion, membranes, and hydrates for CO2 separation. Conduct field activities that evaluate sequestration opportunities in depleted oil reservoirs and saline aquifers. Collaboratively explore with the National Academy of Sciences novel and revolutionary means of storing greenhouse gases. This portfolio of over 22 projects targets reducing the cost of carbon dioxide separation and capture by 75% by 2012 compared to year 2000	Complete at least two pilot scale tests on emerging advanced capture technologies related to oxyfuel, sorbents, membranes or hydrates. (GPRA 4.55.3.1)	Select and award two or more Phase II Regional Carbon Sequestration Partnerships that will begin to evaluate regional infrastructure and technologies to permanently sequester greenhouse gas emissions through small scale validations tests.

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Targets	FY 2005 Targets	FY 2006 Targets
		monitoring of CO_2 geological storage to assure acceptability as a safe, long-term storage option. (MET GOAL) Complete initial planning, field testing, or analyses of sequestration concepts involving saline aquifer storage, ocean storage, and scientific feasibility of CO_2 storage as hydrate on the ocean floor, and complete initial comparative evaluation of energy technology scenarios to identify promising concepts for CO_2 sequestration. (MET GOAL)	systems. (GPRA 4.55.3.1 – MET GOAL) Develop instrumentation and initiate field tests of advanced monitoring and verification methods for carbon inventories for geologic and terrestrial sequestration. Complete a database for mid-continent geological storage projects and initiate a framework for U.S. wide project planning. Through regional partnerships, begin U.S.-wide infrastructure development of MMV protocols for carbon accounting to ensure permanence of long-term storage of CO_2. (GPRA 4.55.3.2 – MET GOAL)		
Fuels					
No targets reported.	Tests to determine ceramic membrane performance in laboratory-scale apparatus are complete. The ITM H_2/Syngas project has now tested five membranes, each of which has been operated for over six months at high pressure. Tests confirmed the selection of membrane materials and provided data for performance models. Additional laboratory-scale testing of catalysts and membrane stability will continue in support of pilot-scale operations and future commercialization. (MET GOAL)	Complete development and communication of a hydrogen program and implementation plans. (MET GOAL)	Prepare and communicate a Hydrogen from Coal R&D program strategy and develop solicitation research guidance for technology innovation to reduce the cost of producing hydrogen from coal. (GPRA 4.55.5.1 – MET GOAL)	Complete analysis and continue compilation of data derived from hydrogen separations research and document in the Hydrogen from Coal RD&D Plan. These will be in a format that can be used as the basis for developing industry standards needed to design and operate commercial-scale separation technology. (GPRA 4.55.5.1)	Develop industry standards for the design and operation of a commercial-scale advanced hydrogen separation system, identify such standards and requirements in the RD&D plan, and conduct initial tests of a prototype unit to validate design parameters.
Advanced Research					
No targets reported.	No targets reported.	Prepare and evaluate novel sensors and new materials for high temperature, oxidative environments to improve control, increase efficiency and performance, and/or achieve	No targets reported.	No targets reported.	No targets reported.

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Targets	FY 2005 Targets	FY 2006 Targets
		lower emissions of CO_2 and other pollutants. (MET GOAL)			
Distributed Generation Systems Begin testing of a 300 kw - 1 MW solid oxide fuel cell/turbine hybrid commercial prototype for distributed power applications (MET GOAL) Begin construction of a one MW solid oxide fuel cell (SOFC) hybrid. (NOT MET)	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. (MET GOAL)	Communicate fuel cell program objectives and results and conduct peer-reviews through conferences, workshops, and web-site tools. Manage the PSPG R&D portfolio through assessment of results and selection of new projects to fill portfolio gaps. (MET GOAL) Conduct field tests necessary to establish feasibility of high temperature fuel cell hybrids and novel systems, including design, procurement, construction, and testing. (MET GOAL) Conduct cost reduction R&D programs involving near-term developers, Siemens Westinghouse and Fuel Cell Energy, for the fuel cells, including manufacturing and balance of plant (BOP) components. (MET GOAL) The SECA industrial teams shall conduct stack design and testing, including manufacturing approaches, and materials and balance of plant (BOP) systems optimization leading to the demonstration of prototypes. (MET GOAL) Conduct contracted and in-house SECA core technology of crosscutting and proof-of-concept R&D for transfer to one or more industrial teams, including know-how, patents,	Relative to FY 2003 baseline of 145mWatt/cm2 power density @800C, demonstrate a 20% improvement in fuel cell stack power density for Solid State Energy Conversion Alliance (SECA) system design. (GPRA 4.55.4.1 – MET GOAL) Relative to FY 2003 baselines of 900 for cathode performance and 174 for interconnect performance in area specific resistance units of mohms-cm2 @750C, complete 20% improvements in cathode performance and in the service life of electrical interconnect s and transfer technology advances to the SECA industry teams to facilitate systems cost reduction and efficiency goals of $400/kW and 40-60 percent. Annual stakeholder workshops and semi-annual peer reviews will communicate progress and define future R&D requirements. (GPRA 4.55.4.2 – MET GOAL)	Begin prototype validation of technical requirements for low-cost SECA fuel cell systems. Test at least one prototype capable of achieving SECA cost reductions and efficiency Phase I goals. (GPRA 4.55.4.1) Under the SECA Core Program, validate one new sealing concept; 20% improvement in metallic interconnect performance relative to FY 2004; and 20% sulfur tolerance relative to FY 2004. These validations will aid SECA industry teams in achieving cost reduction and energy efficiency goals. (GPRA 4.55.4.2)	One or more SECA industry teams complete phase I prototype validation demonstrating SECA phase I efficiency and cost goals. Incorporate seal and interconnect concepts into fuel cell stacks and perform initial tests.

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Targets	FY 2005 Targets	FY 2006 Targets
		licenses, reports, papers in peer reviewed journals, etc. (MET GOAL)			
					Program direction will not exceed 18 percent of the total Fossil Energy R&D budget during any fiscal year.[a]

[a] This efficiency goal applies to total Fossil Energy R&D funding, of which Coal and Other Power Systems is a part.

Means and Strategies

The Coal and Other Power Systems program will continue to promote a strategy in power systems R&D that incorporates a focused and collaborative effort between government and industry to achieve the environmental and economic goals of the technologies. It will continue its dissemination of information and data and build on government-industry partnerships to commercialize clean coal technologies. For carbon sequestration, the program will continue to work with domestic and international partners to complete field experiments on promising options.

The Coal and Other Power Systems program will use various means and strategies to achieve its program goals. However, various external factors may impact the ability to achieve these goals. The program also performs collaborative activities to help meet its goals.

For all activities, DOE will work collaboratively with other government and industry partners, and participate cooperatively with other countries, for example, through the International Energy Agency in the Greenhouse Gas (IEAGHG) R&D Program and the Clean Coal Technology Center. Significant cost-sharing opportunities are possible through existing and new research agreements.

Program results may be affected by: world prices for competitive feedstocks and energy technologies; new and evolving environmental regulations; or any new legislation, in particular, new legislation related to CO_2 and air pollutants that affect coal and gas use. Also, industry restructuring/deregulation issues and uncertainties will continue to challenge coal use. Program results may be particularly affected by both evolutionary and revolutionary approaches to carbon sequestration.

Validation and Verification

The program and projects contained within this goal will be evaluated by peer review at annual contractor meetings and other forums. In addition, program benefits are estimated using macroeconomic and detailed industry-specific models. Modeling assumptions and methods are reviewed externally and the results are compared to results from other programs to determine the best application of R&D resources.

To validate and verify program performance, FE will conduct various internal and external reviews and audits. FE's programmatic activities are subject to continuing review by the Congress, the General Accounting Office, the Department's Inspector General, the National Research Council, the U.S. Environmental Protection Agency, state environmental and health agencies, , and the Department's Office of Engineering and Construction Management. Each year, the Office of Engineering and Construction Management conducts external independent reviews of selected projects. In addition, various Operations/Field Offices commission external independent reviews of site baselines or portions of the baselines. Additionally, FE Headquarters senior management and Field managers conduct quarterly, in-depth reviews of cost, schedule, and scope to ensure projects are on-track and within budget.

Program Assessment Rating Tool (PART)

The Department implemented a tool to evaluate selected programs. PART was developed by 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 Coal and Other Power Systems program has incorporated feedback from OMB into the FY 2006 Budget Request and has taken or will take the necessary steps to continue to improve performance.

The Coal and Other Power Systems program had the President's Coal Research Initiative and Other Power Systems areas PART reviewed separately. In the Purpose, Strategic Planning, and Program Management sections of the PART, OMB gave the Other Power Systems relatively high scores of 80, 70, and 88 respectively while the President's Coal Research Initiative score some what lower at 60, 67, and 75 respectively. In both the FY 2004 and FY 2005 PARTs, most points have been lost in the Program Results/Accountability section.

The Coal and Other Power Systems program has incorporated feedback from OMB during into the FY 2006 Budget Request. In additional to working at the Fossil Energy level to develop a framework for analyzing cost and benefits for R&D investments (see Overview section), the program has provided OMB with briefings and reports on assumptions used to calculate projected benefits. OMB chose not to review the FY 2006 PART for the Coal and Power Systems program.

Funding by General and Program Goal

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
General Goal 4, Energy Security			
Program Goal 04.55.00.00, Zero Emissions Coal-Based Electricity and Hydrogen Production			
Clean Coal Power Initiative	173,811	67,055	68,000
Central Systems	87,740	85,496	98,300
Sequestration R&D	39,375	45,361	67,200
Fuels	30,376	32,147	22,000
Advanced Research	37,533	42,699	30,500
Distributed Generation Systems	69,234	77,386	65,000
U.S./China Energy and Environmental Center	988	986	0
Total, General Goal 4 (Coal and Other Power Systems)	439,057	351,130	351,000

Clean Coal Power Initiative

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Clean Coal Power Initiative					
Clean Coal Power Initiative/FutureGen	165,171	49,305	50,000	+695	+1.4%
FutureGen	8,640	17,750	18,000a	+250	+1.4%
Total, Clean Coal Power Initiative	173,811	67,055	68,000	+945	+1.4%

Description

The mission of the Clean Coal Power Initiative (CCPI) is to enable and accelerate deployment of advanced technologies to ensure that the United States has clean, reliable, and affordable electricity. The CCPI is a cost-shared partnership between the government and industry to develop and demonstrate advanced coal-based power generation technologies (the most advanced example of which will be FutureGen). The mission of the FutureGen project is to establish the technical capability and potential economic feasibility of co-producing electricity and hydrogen from coal with essentially zero emissions, including carbon (sequestration).

Benefits

The Clean Coal Power Initiative subprogram by 2010 will initiate demonstration of advanced coal-based power generation technologies capable of achieving 45 percent electrical efficiency, with environmental and economic performance capable of achieving 90 percent Hg removal at a cost of 70 percent of current technology by 2010, 0.15 lb/MMBtu NO_x at 75 percent of the cost of current technology (selective catalytic reactors), that can be configured to co-produce heat, fuels, chemicals or other useful byproducts; and, provide a deployment-ready suite of advanced technologies that can produce substantial near-, mid-, and long-range economic and environmental public benefits. The CCPI subprogram will 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, demonstrate zero emission plants (including carbon) that are fuel-flexible, and capable of multi-product output with gross efficiencies in the 60 percent range.

The FutureGen research and development project is aimed at establishing the technical capability and potential economic feasibility of co-producing electricity and hydrogen from coal with essentially zero emissions. The project enhances the continued and expanded use of our most abundant and lowest cost domestic energy resource, coal. FutureGen will require integration of subsystems and components yet to

[a] The FY 2005 Appropriation defers $257,000,000 of old Clean Coal funds for future use. The Department proposes canceling those funds in FY 2006 and providing them as an advance appropriation in FY 2007 for future use in the FutureGen project.

be developed, such as gasification with low cost CO_2 capture and storage technology, and thus involves considerable risk. However, the public benefits when we succeed will be enormous. In order to assure that FutureGen is successful, it will be supported by a clean coal R&D effort focused on all the key technologies needed - such as carbon sequestration, membrane technologies for oxygen and hydrogen separation, advanced turbines, fuel cells, coal to hydrogen conversion, gasifier related technologies, and other technologies, funding for which is included in the Administrations FY 2006 budget request. CCPI demonstrations directly support the FutureGen project by driving down the costs and risks of IGCC systems and other coal-based power and emissions control technologies whose extensions are critical to the success of FutureGen.

Coal is the most abundant U.S. energy resource, with domestic reserves equal to 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 and demonstrate technologies that will enable the continued use of coal to meet our growing demand for electricity in an environmentally sound manner.

The Bush Administration is advancing its 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. The Administration is requesting $50 million in FY 2006 to fund joint government-industry-funded demonstration projects to reduce risks on new technologies that can enhance the reliability, efficiency, and environmental performance of coal-fired power generators. This FY 2006 funding will support the third round of demonstration projects under the Clean Coal Power Initiative, incorporating the latest advances in clean coal technologies. The FutureGen project and the CCPI demonstrations respond 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 are a key component of the President's commitment to research and development of clean coal technologies to meet this challenge. By enabling advanced technology to overcome technical risks and bringing them to the point of commercial readiness, the CCPI accelerates the development of power and hydrogen production using coal while proving the feasibility of integrating carbon sequestration and power production and facilitates the movement of technologies into the market place that are emerging from the core research and development activities and directly responds to President's Clear Skies Initiative and Global Climate Change Initiative to reduce emissions of air pollutants (particularly NO_x and mercury) and carbon dioxide.

Currently there are six ongoing projects selected under the CCPI Round 1 solicitation, and four projects were recently selected under the second round of CCPI: two advanced IGCC projects, one integrated emissions reduction project, and one neural-network based plant control and optimization project. In FY 2003, the first round of CCPI projects commenced and NEPA was initiated including the conduct of public scoping meetings for three of the projects that will require Environmental Impact Statements. NEPA was completed for four of six Power Plant Improvement Initiative (PPII) projects and those projects are under construction or in operation. In FY 2004, five out of the six CCPI projects selected in the first round commenced and sufficient CCPI funding existed to support a solicitation for a second round of projects. FY 2005 funding enables the second round of CCPI projects to be awarded. In FY

2005, four projects were selected from the second round solicitation. FY 2006 funding will go towards supporting the solicitation of a third round of projects.

Detailed Program Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
▪ **Clean Coal Power Initiative**.....	**163,471**	**48,812**	**49,500**

For FY 2006, in support of the President's Coal Research Initiative, continue the Clean Coal Power Initiative (CCPI) to research, develop and demonstrate commercial readiness advanced clean coal-based technologies that enhance electricity reliability, increase generation capacity, and provide clean, affordable power. Projects selected under the second solicitation will be negotiated for award and initiation. For projects selected under the first solicitation, continue operation for two projects and initiate operation for We Energies' TOXECON sorbent injection project. Initiate construction for Western Greenbrier's fluidized-bed co-generation and fly-ash utilization project and the University of Kentucky Research Foundation's coal-ash beneficiation processing project. Continue design of the Gilberton coal-to-clean fuels project. *Participants include: University of Kentucky Research Foundation, Neuco, Inc., Great River Energy, Western Greenbrier Co-Generation, LLC, Waste Management Processors, Incl., PTY, LLC, Wisconsin Electric Power Company, Peabody Energy and Airborne Clean Energy, Southern Company, Excelsior Energy Inc., ConocoPhillips, and Pegasus Technologies, Inc.*

For FY 2006, within the Power Plant Improvement Initiative (PPII) program, initiate construction of CONSOL Energy's multi-pollutant Circulating Dry Scrubber system and TIAX's advanced hybrid system for NO_x control. *Participants include: CONSOL Energy, Inc., and TIAX, LLC.*

For FY 2005, in support of the President's Coal Research Initiative, continue within the Clean Coal Power Initiative (CCPI) to research, develop, and demonstrate commercial readiness advanced clean coal-based technologies that enhance electricity reliability, increase generation capacity, and provide clean, affordable power. Initiate negotiations with the second round of projects under the CCPI. For projects selected under the first solicitation, initiate operation for two projects, Neuco's plant-wide optimization system employing neural networks Great River Energy's coal dryer. Initiate construction activities for the We Energies' TOXECON sorbent injection system project for multi-pollutant control and Western Greenbrier's fluidized-bed co-generation and fly-ash utilization project. Award and initiate design activities for the University of Kentucky Research Foundation project and Gilberton coal-to-clean fuels project. *Participants include: University of Kentucky Research Foundation, Neuco, Inc., Great River Energy, Western Greenbrier Co-Generation, LLC, Waste Management Processors Inc., PTY, LLC, , and Wisconsin Electric Power Company, Peabody Energy and Airborne Clean Energy, Southern Company, Excelsior Energy Inc., and Conoco Phillips, and Pegasus Technologies, Inc.*

For FY 2005, within the Power Plant Improvement Initiative (PPII) program, complete four of six active projects including: Tampa Electric's Neural Network-Sootblower Optimization project; Sunflower Electric's optimized control system project; Universal Aggregates' ash utilization

project; and Otter Tails' advanced particulate collector demonstration. Award and initiate design activities for CONSOL Energy's multi-pollutant Circulating Dry Scrubber system and TIAX's advanced hybrid system for NO_x control. *Participants include: Otter Tail Power Corp. with UNDEERC and W. L. Gore & Associates, Tampa Electric Co., Universal Aggregates, LLC, Sunflower Electric Power Corp., CONSOL Energy, Inc., and TIAX, LLC.*

For FY 2004, within the Clean Coal Power Initiative (CCPI) program, provided funding to support issuing a second solicitation leading to expanding the portfolio of demonstration projects. Awarded and initiated design activities for Neuco's optimization software project; We Energies' TOXECON sorbent injection system project for multi-pollutant control; Western Greenbrier's fluidized-bed co-generation and fly-ash utilization project; and Great River Energy's lignite coal dryer project. Continued negotiations for the Gilberton coal-to-clean fuels and power project. Initiated evaluation of proposals submitted from the second solicitation. *Participants included: University of Kentucky Research Foundation, Neuco, Inc., Great River Energy, Western Greenbrier Co-Generation, LLC, LG&E Energy Corp; Waste Management Processors, Inc., PTY, LLC, Colorado Springs Utilities, and Wisconsin Electric Power Company.*

For FY 2004, within the Power Plant Improvement Initiative (PPII) program, initiated operation for Tampa Electric's Neural Network-Sootblower Optimization project; Sunflower Electric's optimized control systems project; and Universal Aggregates' ash utilization project to product lightweight aggregate. Continued demonstration testing of the Advanced Hybrid Particulate Collector at Otter Tail Power's Big Stone Station. Continued negotiation of CONSOL Energy's multi-pollutant Circulating Dry Scrubber system and TIAX's advanced hybrid system for NO_x control. *Participants include: Otter Tail Power Corp. with UNDEERC and W. L. Gore & Associates, Tampa Electric Co., Universal Aggregates, LLC, Sunflower Electric Power Corp., CONSOL Energy, Inc., and TIAX, LLC.*

- **FutureGen** **8,640** **17,572** **17,820**

For FY 2006, the FutureGen project will continue. The Environmental Impact Statement and Record of Decision will be completed, site characterization and monitoring activities will continue for various candidate sites, and technology assessments and preliminary design activities will continue. Permitting activities will be initiated during FY 2006 and must be completed before start of construction. Ordinarily, only a few permits (e.g., air, water, construction) require long lead times and/or public hearings. However, a large project such as FutureGen will require many state and local permits, and their issuance will therefore be staggered between FY 2006 and FY 2007. The Department also proposes an advance appropriation for FY 2007 of $257 million from balances in the Clean Coal Technology account for FutureGen.

For FY 2005, under the FutureGen project, NEPA activities will continue. Site monitoring and characterization will be initiated during FY 2005. Information gleaned from design/engineering studies will be incorporated into detailed design activities, as appropriate. Typically, baseline environmental monitoring data must be gathered to support not only NEPA and Permitting activities, but also Design/Engineering. Candidate technologies will be considered and

(dollars in thousands)

FY 2004	FY 2005	FY 2006

evaluated. Options will be considered in terms of success potential and leading edge characteristics. Preliminary design activity will include conceptual design of the plant's power train, air separation units, turbine and steam cycles and other generic balance of plant auxiliary systems. *Participants include: TBD.*

For FY 2004, the NEPA process was initiated along with the conceptual plant design. Assessments of the availability of key cutting edge technologies were conducted. Analyses were conducted to establish critical site requirements. Detailed project schedules and competitive procurement plans for key components and technologies were developed. *Participants include:TBD.*

▪ **Program Support**	**1,700**	**671**	**680**
Fund technical and program management support.			
Total, Clean Coal Power Initiative	**173,811**	**67,055**	**68,000**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Clean Coal Power Initiative/FutureGen	
▪ The FY 2006 request for CCPI is comparable to the FY 2005 enacted budget before reductions	+688
FutureGen	
▪ The FY 2006 request for FutureGen is comparable to the FY 2005 enacted budget before reductions	+248
Program Support	+9
Total Funding Change, Clean Coal Power Initiative	**+945**

The following tables provide projected funding profiles for the FutureGen project.

Table 1. FutureGen Project Funding by Fiscal Year.

FutureGen Project Funding Profile ($M)					
FY	Cash Flows				
	DOE Direct	DOE Sequestration*	FutureGen Consortium	International	Total
2004	9		2		11
2005	18		7		25
2006	18		7		25
2007	50		20	5	75
2008	100		38	6	144
2009	89	24	43	8	164
2010	57	24	32	10	123
2011	33	4	18	10	65
2012	23	34	18	12	87
2013	26	34	19	12	91
2014	34		19	7	60
2015	39		24	7	70
2016-2018	4		3	3	10
Total	500	120	250	80	950
* $120 million of funding from the Sequestration program will be used to partially fund the sequestration aspects of the FutureGen project.					

Table 2. FutureGen Project Funding by Major Cost Element.

FutureGen Major Cost Elements by Fiscal Year ($'s millions)														
Major Cost Elements	FY 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012	FY 2013	FY 2014	FY 2015	FY 2016-2018	Total
Plant Def. & NEPA	11	25	25	20										81
Base Plant Proc. & Const.				55	140	134	79	15			27	30		480
Shakedown & Operation								40	35	40	33	40		188
Sequestration					4	30	44	10	52	51				191
Monitoring													10	10
FY Totals	11	25	25	75	144	164	123	65	87	91	60	70	10	950

Central Systems

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Central Systems					
Innovations for Existing Plants	21,238	19,081	23,850	+4,769	+25.0%
Advanced Systems	66,502	66,415	74,450	+8,035	+12.1%
Total, Central Systems	87,740	85,496	98,300	+12,804	+15.0%

Description

As part of the President's Coal Research Initiative, FutureGen is a Presidential Initiative to create an advanced, full-scale integrated facility that will utilize advanced coal gasification technology to produce electric power and hydrogen while capturing and sequestering carbon dioxide. The Central Systems Programs is to provide critical research for FutureGen and to dramatically reduce coal power plant emissions (especially mercury) and significantly improve efficiency to reduce carbon emissions, leading to essentially a viable zero-emission coal energy system.

Benefits

The Central Systems subprogram supports DOE's mission to advance national energy security in an economic and environmentally sound manner by developing a cost-effective, high-efficient technological capability to dramatically reduce air pollution from coal-fueled electricity generation plants and carbon emissions to achieve essential zero emissions. In the near term this means having the ability to meet all existing and anticipated environmental regulations at low cost. In the longer term, the aim is to nearly double coal plant efficiencies (from 33% to 60%) at affordable costs of electricity while working towards zero emissions, allowing coal to remain a key strategic fuel for the Nation. The program mission is carried out in support of several key Presidential initiatives including the Coal Research Initiative, Clear Skies Initiative, Global Climate Change Initiative, and the FutureGen Initiative.

Background

The National Energy Policy recommends that the Department continue to develop advanced clean coal technology with a goal of deploying high efficiency coal power plants achieving zero emissions. Further, the President's Clear Skies Initiative is supported by the development of advanced emission control technology and related byproducts as part of the research portfolio under Central Systems. The President's Climate Change Initiative over the longer term is supported through technology for advanced power plants that can nearly double the average efficiency of today's fleet of coal power plants, thereby significantly reducing carbon emissions. The growing national economy relies increasingly on electricity supply that is secure, affordable, and reliable. This is especially true in the face of concerns over national energy security as well as electricity generation market restructuring. In

addition, compliance with more stringent environmental regulations requires reduced emissions from and improved management of freshwater resources used by electric power plants. Further, new technology is needed to develop much cleaner and more efficient 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. (Annual Energy Outlook, 2004).

The program elements for Central Systems include technology developed for existing plants, advanced systems, and zero-emission plants (e.g., FutureGen) are as follows:

- Innovations for Existing Plants (IEP) - The IEP program element has a near- to mid- term focus on improving overall power plant efficiency (thereby reducing carbon emission) and developing advanced cost-effective environmental control technologies for retrofitting to existing powerplants and other coal technologies including those developed in support of the FutureGen initiative such as Integrated Gasification Combined Cycle. The research is also directed at the environmentally sound use and disposal of coal byproducts and at advanced systems and technologies to minimize the impact of electricity production on fresh water availability and quality. The IEP program directly supports the goals and objectives of the President's Clear Skies Initiative that calls for substantial reductions in mercury, NO_x, and SO_2 emissions from power plants. The research also specifically addresses calls for reductions in mercury, NO_x, and SO_2 embodied in recent Clean Air Act proposals by the Environmental Protection Agency. 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 air pollutants from fossil fueled systems while maximizing the efficient recycling of all by products.

- Integrated Gasification Combined Cycle (IGCC) - The IGCC program supports both the President's Clear Skies Initiative and Climate Change Initiative by enhancing the thermal efficiency of converting coal to electricity, providing the potential for over 50% reduction in CO_2 compared to today's technologies, and through its performance goals of achieving near-zero emissions of SO_2, NO_x, mercury, and other pollutants. The IGCC program conducts research that fosters the development and deployment of zero emission, fuel-flexible gasification-based processes for converting carbon-based feedstocks to electricity, steam, and a broad range of chemicals, including ultra-clean transportation fuels like hydrogen. In order to achieve the full potential of IGCC, significant advances must be made to increase efficiency and reduce the capital and operating and maintenance costs and to improve both the reliability and the overall system availability. In FY 2006, the program will continue to develop technologies for gas stream purification to meet quality requirements for use with fuel cells and conversion processes; to enhance process efficiency; to reduce costs for producing oxygen, and to reduce the cost of hydrogen/carbon dioxide separation. 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.

- Combustion Systems - This program was redirected in prior years to support advanced combustion hybrid concepts for zero-emission compatible plants (FutureGen). In FY 2006, specific technologies

from this category are included in the IGCC activity to enhance the integration of hybrid combustion/gasification concepts, including support for the test activity at the Wilsonville Power Systems Development Facility (PSDF).

- Turbines - The Turbines Program is designed to enable the low cost implementation of the President's Climate Change, Clear Skies, and FutureGen initiatives. The current focus is on developing enabling technology for high efficiency turbines for advance gasification systems that can produce electricity from coal at 45-50 percent efficiency, and creating the technology base for hydrogen turbines that will permit the design of zero emission FutureGen plants with carbon capture and sequestration. The focus is on key technologies needed to enable the development of advanced turbines that will operate with zero emissions, and higher efficiency when fueled with coal derived hydrogen fuels. Developing turbines with superior performance that operate on coal derived synthesis gas and hydrogen is critical to the deployment of advanced power generation technologies such as FutureGen plants. The Turbine Program is an investment in secure U.S. electric power production which is clean, efficient, affordable and is fuel-flexible. These advances in turbine technology will help retain coal's strategic value as a low-cost, abundant, domestic fuel. In FY 2006 work will continue to address technical issues and ultimately provide turbine designs capable of burning up to 100% hydrogen in the 2008 time frame. Funding for the operation of the fuel cell/turbine hybrid simulation facility (HYPER Project) will continue under the Turbines Program.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Innovations for Existing Plants	**21,238**	**19,081**	**23,850**

The FY 2006 request emphasizes field testing and evaluation of low cost retrofit mercury technology capable of 50-70% mercury capture and removal. In addition, new research will be carried out in the development of advanced combustion and post-combustion NO_x control technologies, as well as the characterization of mercury and other trace metals in coal utilization byproducts from pulverized coal and expanding markets for IGCC materials. Research will continue to focus on technologies and concepts to better manage how power plants use and impact freshwater resources. This research directly supports the goals of both the President's Clear Skies and FutureGen initiatives and recent Clean Air Act emission reduction proposals.

- **Super Clean Systems** **1,466** **1,465** **1,000**

  In FY 2006, the Super Clean Systems activities will focus on several new projects initiated in FY 2005 to carry out bench and pilot-scale development of advanced combustion and post-combustion NO_x control technology to achieve ultra-low emissions. This research will address operational issues associated with Selective Catalytic Reduction systems to achieve these stringent emission reductions as well as provide options for smaller, older coal-fired boilers in meeting future NO_x regulations under the Clear Skies Initiative and proposed interstate transport

regulations. Research will also be performed to control and optimize the speciation of mercury in the combustion zone. *Participants include: REI, ALSTOM, Fossil Energy Research, and Babcock & Wilcox.*

In FY 2005, Super Clean Systems research focuses on reducing nitrogen oxide (NO_x) emissions from coal-based power plants in direct support of the Clear Skies Initiative. Work will continue on development of ultra low-NO_x combustor for integrated gasification combined cycle systems resulting from FY 2002 Broad Based solicitation. Research will also continue under FY 2004 targeted solicitation to develop advanced combustion NO_x control technology, novel catalysts and non-ammonia reagents for SCR systems, and advanced "smart systems" to achieve a mid-term (2010) emission target of <0.10 lbs/mmBtu and a long-term (2020) target of <0.01 lbs/mmBtu. *Participants include: Argonne National Lab, Precision Combustion, TBD.*

In FY 2004, Super Clean Systems research focused on reducing emissions of primary oxides associated with NO_x and SO_x pollution in support of the Clear Skies Initiative. The work will complete Ultra-low NO_x Burner development, and continue development and pilot-scale testing of novel NO_x control technology concepts selected under the FY 2002 Broad Based Solicitation and under an FY 2003 targeted solicitation. *Participants include: Argonne National Lab, GTI, Praxair, Wiley, Precision Combustion, TBD.*

- **Fine Particulate Control/Air Toxics**..... **13,198** **11,080** **16,211**

The FY 2006 effort will be directed at a comprehensive portfolio of projects to field test advanced mercury control technologies at operating power plants. These technologies, which include sorbent injection, chemical additives, and oxidation catalysts, are capable of achieving 50-70% mercury removal and will focus on units burning low-rank coals. In addition, a third phase of field testing will be initiated, contingent upon the success of ongoing bench and pilot development, involving technologies capable of +90% mercury removal. *Participants include: ADA-ES, UNDEERC, Sorbtech, URS, ALSTOM, EPRI, GE-EERC, Brookhaven National Lab, Argonne National Lab, Lawrence Berkeley National Lab, ATS, TBD.*

In FY 2005, the effort focused on continuation of Phase II field testing of advanced mercury control technologies selected under FY 2003 targeted solicitation capable of achieving 50-70% mercury removal in direct support of Clear Skies Initiative, including a second round of awards made in late FY 2004. Research is directed at lower-rank coals and balance-of-plant issues. Complete pilot-scale testing of novel mercury/multi-pollutant control concepts capable of >90% mercury capture. *Participants include: Brookhaven National Lab, Argonne National Lab, Lawrence Berkley National Lab, ATS, SRI, University of Utah, TVA, TBD.*

FY 2004, In support of Clear Skies Initiative, continued Phase II field testing of advanced mercury control technologies to achieve 50-70% mercury removal directed at lower rank coals and balance-of-plant issues. Continued bench- and pilot-scale development of novel technology to achieve 90%+ mercury capture. Developed fine particulate and acid gas control and sensor

technology selected under FY 2002 solicitation. Continued with more comprehensive modeling assessment of fine particulate and mercury source-receptor relationships. Continued projects selected in FY 2003 to address energy-water issues. *Participants include: Brookhaven National Lab, Argonne National Lab, Lawrence Berkley National Lab, ATS, CONSOL, URS, CMU, SRI, Powerspan, Apogee, TVA, UMD, BNL, LBL, RBD.*

- **In-House Research** **3,911** **3,905** **3,900**

  In FY 2006, mercury sorbents and oxidizing agents to enhance the capture of mercury will be tested at the laboratory scale. Work will also continue in developing a CFD model of mercury emission and control. In addition, the environmental characterization of coal utilization byproducts from the field testing of mercury control technologies will continue. These research activities are in direct support of FutureGen and Clear Skies. *Participants include: NETL.*

  In FY 2005, continue development of novel mercury control concepts and mercury emission characterization using 500 lb/hour combustion unit. Continue CFD modeling of mercury emission and control, issue analysis, by-product characterization, and water-related research in support of FutureGen and Clear Skies. *Participants include: NETL.*

  FY 2004, Research and systems analysis was conducted on novel multi-pollutant control, mercury control and characterization, by-product characterization, and water-related issues in support of zero-emissions for FutureGen and Clear Skies. *Participants include: NETL.*

- **Waste and Water Management** **2,445** **2,440** **2,500**

  In FY 2006, continue assessment of the fate of mercury and other metals, and coal combustion and advanced combustion/gasification byproducts including evaluation of fly ash and scrubber solids from the Phases II Hg Field Testing program, in support of both FutureGen and Clear Skies. Complete advanced concepts and technologies related to power plant use and impacts on quality selected under the FY 2003 targeted solicitation to manage power plant water use, as well as initiate new water management research under a FY 2005 targeted solicitation focused on advanced power plant cooling technology, use of impaired waters, and water recovery and reuse technology. Conduct joint industry/government R&D activities to maximize recycle use of coal utilization byproducts for various market applications, and facilitate technology transfer. *Participants include: USGypsum, UNDEERC, EPRI, Argonne National Lab, TBD.*

  In FY 2005, assess potential environmental impacts of coal combustion and advanced combustion/gasification byproducts and solid residues, focusing on mercury and other trace metals, in support of both FutureGen and Clear Skies. Continue characterization of coal byproducts from Phase II mercury control technology field testing initiated under FY 2004 targeted solicitation. Conduct joint industry/government R&D activities to maximize recycle use of coal utilization byproducts for various market applications, and facilitate technology transfer. Complete development of byproduct treatment and separation technology selected under FY 2003 Broad Based solicitation. Continue advanced concepts and technologies selected under the FY

(dollars in thousands)

FY 2004	FY 2005	FY 2006

2003 targeted solicitation to manage power plant water use. *Participants include: Argonne National Lab, WVU, PPL, UNDEERC, University of Kentucky.*

FY 2004, Continued assessment of environmental impacts of coal combustion and gasification byproducts and solid residues, focusing on mercury and other trace metals. Conducted joint industry/government R&D activities to maximize recycle use of coal utilization byproducts for various market applications, and facilitate technology transfer. Continued development of byproduct treatment and separation technology selected under FY 2003 Broad Based solicitation. Initiated projects selected under the FY 2003 targeted solicitation to maximize water utilization efficiency with minimal environmental impact. *Participants include: WVU, PPL, UNDEERC.*

- **Program Support**..... **218** **191** **239**

Fund technical and program management support.

Advanced Systems..... **66,502** **66,415** **74,450**

Advanced Systems focus on the development of critical enabling technologies and systems for new, cost-competitive plants with increasingly higher efficiencies and inherent ultra-low emissions that support the President's Clear Skies and Global Climate Change, and FutureGen initiatives, leading ultimately to near-zero emission power plants compatible with carbon sequestration.

Integrated Gasification Combined Cycle..... **49,115** **45,805** **56,450**

- **Gasification Systems Technology**..... **28,513** **26,809** **34,341**

Gasification: In FY 2006, the Power Systems Development Unit (PSDF) will focus on assessing the performance of a new char recycle system, a continuous coarse ash disposal system, the Stamet dry coal feeder, and the newly installed synthesis gas recycle system, all focused on improving the reliability and availability of the gasification system with the capability of producing hydrogen. NETL's Transport/Circulating Fluidized Bed facility will be used to support the development of the transport chemical looping gasifiers by evaluating the impact of particle size and size distribution on fluidization characteristics, attrition, and elutriation. Testing of advanced gasification concepts will be continued. Work will continue on developing the chemical looping concept and will focus on optimizing the operating conditions for the various reactor vessels. Testing of advanced feed injectors and the channel wall cooling system will be completed, and the design of the compact gasifier will begin. Novel gasifier/process concepts for enhancing hydrogen and methane yields will continue to be explored at the bench scale. Testing of the optical pyrometer for high temperature measurement device at Tampa Electric's IGCC plant will be completed. Testing of the optical fiber high temperature measurement device will be completed at the Wabash River IGCC plant. Bench-scale testing of an engineering prototype acoustic high temperature measurement device will be conducted in preparation for full-scale

testing at the Wabash River IGCC plant. Complete post mortem analysis of a novel thermocouple assembly removed from service in a commercial coal gasifier and develop 2nd generation device based upon findings. Complete fabrication of commercial size 2nd generation high chromia refractory and install in a commercial coal gasifier. Complete evaluation of metal coatings and coupon tests at the Wabash River IGCC plant.

Gas Cleaning/Conditioning: In FY 2006, R&D will focus on achieving essentially zero emissions from gasification-based systems. Performance tests will be conducted on the Transport Reactor Development Unit (TRDU) to evaluate the improvements in particulate removal efficiency using an electrostatic barrier filter and newly developed sorbents for removal of mercury and other trace metals. Sorbent materials for chloride removal will be identified and prepared in an industrial scale unit in collaboration with a catalyst manufacturer and will be subjected to bench-scale testing to determine performance for achieving near-zero contaminant levels. In conjunction with an industrial partner, a new sulfur sorbent will be tested in a bench-scale unit to evaluate its ability to achieve <500 ppb sulfur. A promising mercury sorbent will be subjected to absorption/regeneration cycling in simulated synthesis gas to determine its ability to achieve >90% removal at moderate process temperatures. Continue development of the second generation catalyst for the Selective Catalytic Oxidation of Hydrogen Sulfide (SCOHS) technology to achieve <500 ppb sulfur. The detailed design of a skid-mounted unit for testing of the SCOHS technology will be completed. The CFD model for sorbent regeneration in a transport desulfurizer will be completed, integrated with the absorption model, and the combined model validated using data from slipstream testing at Eastman Chemical. Testing of the hot cyclone-filter hybrid concept for particulate control on a slipstream from the Wabash River IGCC plant will be completed. Continue development of multi-contaminant control technologies to reduce capital cost through reduction of process units. *Participants include: SCS, NETL, UNDEERC, ConocoPhillips, Boeing, ALSTOM, GTI, CrystaTech, Entertechnix, VPI, ARC, SRI, Eastman, GE.*

Gasification: In FY 2005, the primary focus of the Power Systems Development Unit (PSDF) will be on preparation of the facility for testing advanced zero-emission compatible (Vision 21) modules while continuing to characterize the operation of the oxygen-blown transport gasifier on a range of coal feedstocks including lignite. Validation of the CFD model for the transport gasifier will continue using performance data from the PSDF, the Transport Reactor Development Unit (TRDU), and the cold model at NETL.

Gas Cleaning/Conditioning: In FY 2005, R&D will focus on achieving near-zero emissions from gasification-based systems. Operation of the Gas Process Development Unit for obtaining scale-up data for the design of transport desulfurizer using the RT13 sorbent at moderate temperatures will be completed. Validation of the transport desulfurizer CFD model will be completed using performance data from the GPDU and integrated testing with a 2.5 ton/day pilot-scale coal gasifier. Continue R&D to develop advanced concepts for removing mercury,

ammonia, and chlorides to near-zero levels suitable for use in fuel cell and synthesis gas conversion applications. Construction of a skid-mounted unit of the Selective Catalytic Oxidation of Hydrogen Sulfide (SCOHS) process will be initiated. A go/no decision on field testing of the Single-step Sulfur Reduction Process (SSRP) will be made based on prior experimental and economic performance. *Participants include: SCS, NETL, UNDEERC, Fluent, RTI.*

Gasification: In FY 2004, continued to develop and test the oxygen-blown transport gasifier and associated particulate control devices at the PSDF to reduce cost and improve reliability of gasifier technology. Primary focus at the PSDF was on oxygen-blown operations to provide options for producing hydrogen and capturing CO_2 and multi-fuel capability to enhance the applicability of the technology. Validated the oxygen-blown transport gasifier CFD model using data generated from the PSDF and the Transport Reactor Development Unit (TRDU) using various coal feedstocks. Utilized the TRDU to pre-screen coal feedstocks, alternative feed systems, and process conditions to provide guidance for testing at the PSDF. Developed advanced materials for refractories and thermocouples to improve refractory performance and improve gasifier reliability. Tested prototype refractory bricks in a commercial coal gasifier to demonstrate performance under actual operating conditions, and begin to install a novel high temperature measurement device to demonstrate improved gasifier performance and process control. Continued development of other advanced technologies such as burner flame monitoring, refractory wear monitoring, diffusion coatings, etc. to improve the reliability, availability, and performance of gasifiers. Investigated fundamental pre-competitive technology issues and needs to improve gasification process performance and reliability through the Gasification Technology Research Consortium.

Gas Cleaning/Conditioning: In FY 2004, efforts were directed to obtaining near-zero emissions from gasification based systems including construction of a gas cleanup module at PSDF to pave the way for testing of advanced modules for carbon capture and near-zero emission gas cleaning technologies. Developed advanced sorbents for achieving ultra-low sulfur levels of all contaminants at moderate temperatures. Operated the Gas Process Development Unit's (GPDU) using the RT13 sorbent at moderate temperatures in the transport mode to provide design data for scale-up of the technology. Continued validation of the transport desulfurizer CFD model using data from the GPDU and data generated in a pilot-scale test facility integrated with a coal gasifier. Developed the novel Selective Catalytic Oxidation of Hydrogen Sulfide (SCOHS) technology and begin bench-scale evaluations for proof-of-concept testing of the technology to demonstrate ultra-low sulfur emissions at reduced cleanup costs. *Participants include: SCS, NETL, UNDEERC, Fluent, RTI, Albany, Alstom, GE, Boeing, VPI, SRI, Entertechnix.*

- **Systems Analysis/Product Integration** **3,706** **3,944** **3,944**

In FY 2006, work will continue on assessing the economics of advanced process concepts such as chemical looping and advanced gasification concepts, multi-contaminant control technologies,

etc. The economics of the Transport Reactor Integrated Gasification (TRIG) process with CO_2 capture will be developed. Studies will be conducted to establish performance targets for novel process concepts in the R&D program such as alternative systems that can potentially capture carbon dioxide along with raw gas impurities without the need for gas clean up system to reduce cost. Engineering support will be provided as needed for the development and evaluation of the FutureGen project. *Participants include: NETL, RDS, TAMS, Mitretek, Parsons, SCS, GTC.*

In FY 2005, work will continue on assessing the economics of advanced near-zero emissions process concepts and establishing performance targets for novel process concepts in the R&D program. Work at the PSDF will focus on developing integration strategies for advanced process concepts and developing experimental programs, cost, and schedules for testing the various technologies. The final engineering designs for the Early Entrance Coproduction Plant project for the production of electricity, fuels, and hydrogen will be prepared. The standardized design of a 25 MWe bituminous coal IGCC plant for industrial applications and a 250 MWe lignite IGCC for utility applications will be completed. Engineering support will be provided as needed for the development and evaluation of the FutureGen project. The update of the worldwide gasification database with the latest plant project announcements will be completed, and the sixth gasification environmental workshop will be held in Knoxville, TN. *Participants include: NETL, RDS, Mitretek, SCS, Childress, GTC.*

In FY 2004, completed engineering designs of Early Entrance Coproduction Plants for clean fuels like hydrogen and high efficiency power productions as pre-Vision 21 concepts. Continued systems analyses for research guidance and product outreach activities. Updated the worldwide gasification database. Established size of standardized IGCC plants from market analysis and begin design of modular unit to reduce plant cost, shorten plant startup schedule, and improve system reliability. *Participants include: NETL, CTC, E2S, Mitretek, SFA, Pacific, Texaco, Parsons, WMPI, GE, KBR, Praxair.*

- **Vision 21** **16,392** **14,594** **17,600**

In FY 2006, the planar design advanced air separation membranes will be demonstrated at the 3-5 tons per day using full-size modules and achieving 95% purity. Enhanced reliability of the full-size modules will be enhanced through advanced process control techniques. The detailed design of the 25 TPD pre-commercial unit will be completed. The PSDF will focus on preparing the facility to test advanced hydrogen production and separation technologies. Discussions will be held with appropriate technology developers to establish process requirements and costs for evaluating their technologies with coal-derived synthesis gas. Technologies to be considered for testing include advanced water gas shift, K25 membrane, the CO_2 hydrate process, and a polymer membrane for bulk CO_2 and H_2S removal. New metal alloy materials and cermet membrane materials will be developed for H_2/CO_2 separation and subjected to lab-scale permeation tests. The design of an engineering scale process development unit to test the tubular H_2/CO_2 membranes at commercially relevant operating conditions will commence. The K25 H_2

membrane will begin scale-up in preparation for testing at a gasification site. Continue construction of the 2.5 megawatt equivalent CO_2 hydrate slipstream test for testing on coal-derived synthesis gas. Bench-scale testing of novel ionic liquids for the separation of CO_2 from fuel gas will be conducted to evaluate solubility and mass transfer of CO_2 into the liquids. Field testing of first generation ammonia, arsenic, and mercury removal sorbents will be completed at a gasification site on coal-derived synthesis gas at moderate temperatures to demonstrate ability to achieve near-zero contaminant levels. Additionally, a H_2/CO_2 membrane that selectively removes CO_2 and H_2S will also be demonstrated on coal-derived synthesis gas. A process unit to demonstrate the novel sorbent-based polishing technology will be designed for integrated testing with a coal gasifier to demonstrate performance for achieving near-zero levels of contaminants. Additionally, innovative concepts to reduce the potential plant investment costs, such as development of raw syngas shift and separation will be assessed. *Participants include: APCI, Concepts NREC, Ceramatec, GE, PSU, Penn, Nexant, RTI, Medal, Protech, Eastman, SRI, , NETL ORNL, Eltron, Coorstech, Noram, Sud Chemie, SCS.*

In FY 2005, efforts will focus on the development of novel technologies that lead to ultra-high efficiencies, the production of hydrogen for ultra-clean fuels, and the elimination of all environmental issues that present barriers to the continued use of coal, including reductions of SO_2, NO_x, CO_2 particulates, and trace elements such as mercury, arsenic, cadmium, and selenium. Laboratory testing of improved materials for membrane-based air separation technologies and life testing of commercial membrane elements will be completed. The construction of the 1-5 ton/day air separation membrane unit will be completed, and testing of full-scale membrane modules will commence. Development of novel process concepts for the production of hydrogen and the capture of CO_2 for sequestration will continue. Work on developing improved membranes for hydrogen/ CO_2 separation will continue with focus on developing and optimizing the membrane fabrication process and addressing performance characteristics under actual process conditions. The K25 membrane will begin further development and scale-up for testing at PDSF and Eastman Chemical on coal-derived synthesis gas. A polymer-based membrane unit for bulk CO_2 and H_2S removal will be designed an constructed for testing at Eastman Chemical. An engineering analysis of the CO_2 hydrate process will be completed, and experimental work will focus on achieving equilibrium in the separation reactor. Testing of an advances sulfur sorbent in a transport reactor as a slipstream from the coal gasifier at Eastman Chemical will commence to prove long-term performance and stability of the sorbent. The design and construction of skid-mounted units for mercury, ammonia, and chloride control will begin for testing at Eastman Chemical. Continuous unit testing of the Unmixed Fuel Processor will begin to demonstrate integrated performance of the gasifier. *Participants include: APCI, Praxair, ANL, Concepts NREC, Ceramatec, GE, PSU, Penn, Nexant, RTI, Medal, Protech, IGT, Siemens-Westinghouse, NETL, Eltron, Coorstech, Noram, Sud Chemie, SIR, KBR.*

In FY 2004, to achieve the Vision 21 program goals, developed novel technologies that lead to ultra-high efficiencies, near-zero emissions, carbon capture for sequestration and the production

(dollars in thousands)

FY 2004	FY 2005	FY 2006

of hydrogen for ultra-clean fuels and powers. Scaled-up and tested ceramic membrane modules for advanced air separation at the 1-5 ton/day scale to reduce the cost of oxygen and pave the way for the economical capture of CO_2. Began initial planning of 50 ton/day membrane modules for integration with a gasifier and gas turbine. Investigated improved membrane materials, fabrication techniques, and module design for H_2/CO_2 separations to address capture of CO_2 and for producing low-cost hydrogen from coal. Conducted life testing of advanced ceramic hydrogen membranes and develop conceptual process designs. Constructed a polymer hydrogen membrane module for integrated testing with a pilot-scale coal gasifier to address performance under actual process conditions. Constructed skid-mounted unit for the development of the low temperature hydrate technology to demonstrate effective carbon management by separating hydrogen and carbon dioxide and begin preliminary site evaluation for integration with a gasifier. Investigated advanced gas cleaning technologies to meet near-zero emission requirements in response to the Clean Skies Initiative. Began testing of an advanced sulfur cleanup technology integrated with a pilot-scale coal gasifier to evaluate process performance under realistic conditions. Constructed skid-mounted process units for mercury, ammonia, and chloride control for possible integrated testing with a pilot-scale coal gasifier. Completed conceptual design and economic analysis of a novel coal gasification concept for producing hydrogen and sequestration-ready CO_2 that has potential for cost reductions over conventional approaches. *Participants include: APCI, Praxair, ANL, Concepts NREC, Ceramatec, GE, PSU, Penn, Bechtel, LANL, RTI, Medal, Protech, IGT, Siemens-Westinghouse, NETL, GEERC, ITN, Eltron, Coors, INEEL, Sud Chemie, SRI, ORNL, McDermott, KBR.*

- **Program Support**..... **504** **458** **565**

  Fund technical and program management support.

Combustion Systems **4,812** **5,227** **0**

- **Gas Stream Cleanup** **1,312** **0** **0**

  In FY 2006 and FY 2005, there are no activities planned.

  In FY 2004, completed projects including qualification of candle filters for pressurized applications; design of bench scale CFBC unit for coal/biomass/solid waste feeds; and optimization of catalyst and furnace operations to achieve low-NO_x emissions.

- **Advanced Hybrid Combustion**..... **3,450** **5,175** **0**

  In FY 2006, there are no activities planned.

  In FY 2005, efforts will be re-focused on the development of novel technologies in oxygen combustion; catalytic unmixed combustion of coal; high pressure coal combustion kinetics and continuous pressure feeds for solid feedstocks needed to meet the requirements of advanced zero

emissions power generation systems. *Participants include: ALSTOM, GEGR, Stamet, Fluent, Inc., Western Kentucky University, General Electric.*

In FY 2004, efforts focused on the development of novel technology in hybrid combustion-gasification; catalytic unmixed combustion of coal; high pressure coal combustion kinetics and continuous pressure feeds for solid feedstocks to validate the engineering, economic and environmental viability to meet Vision 21 performance targets. *Participants include: Foster Wheeler, ALSTOM, GEGR, Stamet, Fluent, Inc.*

▪ **Program Support**	**50**	**52**	**0**

Fund technical and program management support.

Turbines	**12,575**	**15,383**	**18,000**
▪ **Next Generation Turbines**	**12,447**	**15,229**	**17,820**

In FY 2006, the Turbine Program will continue with work initiated in FY 2004 and FY 2005 to address technical issues and ultimately provide turbine designs capable of burning 100% hydrogen in the 2012 time frame. Through the FY 2005 Hydrogen Turbine solicitation, new work will continue to optimize machine performance for FutureGen that results in higher efficiencies and lower emissions of NO_x. NO_x reduction through catalytic combustion and fuel premixing will continue and should be approaching single combustor-can tests applicable to large frame machines. In addition, new work will continue on advanced turbine designs and subsystems for zero-emission, sequestration-ready power systems suitable for FutureGen applications. Work will continue and new work initiated through the University Turbine Systems Research Consortium concerning aerodynamics, materials, heat transfer and combustion of coal derived syngas and hydrogen fuels. NETL will continue the simulation and validation of combustion phenomena associated high hydrogen content fuels. *Participants include: GE, Siemens Westinghouse, Clemson-University Turbine Systems Research Consortium, NETL, ORNL, TBD*

In FY 2005, the Office of Fossil Energy will transition the Turbine Program, which is focused on modifying the designs of existing advanced turbines for applications to coal derived synthesis gas, to a Hydrogen Turbine Program. The Hydrogen Turbine Program is designed to support the successful deployment of FutureGen type power systems. FutureGen plants will enhance the continued use of coal our Nation's largest source of fossil fuel and provide options for the capture and sequestration of carbon dioxide. The technical performance challenges of coal-based sequestration ready power plants that use and produce hydrogen create new opportunities for turbine based power systems. These opportunities will be identified and explored through the FY 2005 Hydrogen Turbine Solicitation.

The FY 2005 program will build upon work initiated in FY 2004 to address technical issues and ultimately provide turbine designs capable of burning up to 100% hydrogen in the 2012 time

frame. The relevant technical issues are driven by the need to increase machine efficiency while at the same time reducing NO_x emissions. The lower heat content, higher flame speed and high post combustion moisture content of hydrogen present significant technical challenges to development of highly efficient and clean burning combustion turbines for FutureGen applications. New work will be initiated to further resolve technical issues associated with the use of hydrogen fuels from FutureGen power plants. Technology development requirements for highly efficient, zero emission and sequestration ready coal-based power plants presents a challenging set of technical issues. The program is positioned to focus resources on these issues which require a better understanding of materials, aerodynamics, heat transfer and combustion fundamentals. Ultimately, as these issues are resolved, full-scale components and systems can be tested in FutureGen type facilities.

FY 2005 work will focus on turbine performance improvement by resolving technical issues that can then be applied to F- or G-class machines for high (>65%) hydrogen combustion. Part of this performance enhancement will consider the full integration with the balance of plant subsystems such as the air separation unit and steam cycle. It is expected that work to improve efficiency will address better thermal barrier coatings, better methods for blade cooling, fuel premixing, optimizing the mass throughput, and aerodynamics, and extending or realizing the full torque limitations of existing machines. Work will continue with GE, Siemens Westinghouse, Precision Combustion, Inc., and others to resolve NO_x emissions and efficiency improvements for turbines operated in FutureGen type plants. Work will continue and new work will be initiated through the University Turbine Systems Research Consortium concerning aerodynamics, materials, heat transfer and combustion of coal derived syngas and hydrogen fuels. NETL will continue the simulation and validation of combustion phenomena associated with high hydrogen content fuels. Funding for the operation of the fuel cell/turbine hybrid simulation facility (HYPER Project) will continue under the Turbines Program. *Participants include: GE, Siemens Westinghouse, Precision Combustion, Clemson-University Turbine Systems Research Consortium, NETL, ORNL, TBD.*

Work initiated in FY 2004 continued on high hydrogen fuel combustion for NO_x reduction and efficiency improvements. This work included GE's efforts to assess premixing issues for NO_x reduction associated with high hydrogen fuels and integration issues of F-class machines in coal-based plants. Work by Siemens Westinghouse and Precision Combustion, Inc., continued to explore catalytic combustion for NO_x reduction in high hydrogen fuels applications. GE continued to identify opportunities for system efficiency improvements for FutureGen type plants through the optimization of turbine operation and integration. Work continued and new work was initiated through the University Turbine Systems Research Consortium concerning aerodynamics, materials, heat transfer and combustion of coal derived syngas and hydrogen fuels. NETL continued the simulation and validation of combustion phenomena associated with high hydrogen content fuels. Funding for the operation of the fuel cell/turbine hybrid simulation facility (HYPER Project) continued under the Turbines Program. P*articipants include: GE,*

(dollars in thousands)

FY 2004	FY 2005	FY 2006

Siemens Westinghouse, Praxair, Florida Turbine Tech., EPRI, NETL, Clemson-University Turbine System Research Consortium, NETL, ORNL, TBD.

▪ **Program Support**	**128**	**154**	**180**
Fund technical and program management support.			
Total, Central Systems	**87,740**	**85,496**	**98,300**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Innovations for Existing Plants	
▪ **Super Clean Systems**	
An emphasis on increasing funding for mercury removal research as a priority will stretch out the research pace on NO_x	-465
▪ **Fine Particulate Control/Air Toxics**	
Increased funding reflects the emphasis in mercury control research as a high priority area in IEP and includes a large portfolio of projects to field test advanced technologies at operating power plants. In addition, a third phase of field testing will be initiated involving technologies capable of +90% mercury removal. This program directly supports the President's Clear Skies Initiative by developing advanced, low-cost mercury control technologies that will be needed to achieve the goals of the initiative	+5,131
▪ **In-House Research**	-5
▪ **Waste and Water Management**	
As water usage increasingly becomes an issue for plant operations (especially in the West) competitive research on advanced technologies to minimize water usage will be pursued. Increase in funding will be used to support selections under FY 2006 solicitation directed at advanced technologies and concepts to minimize freshwater use by coal-fired power plants	+60
▪ **Program Support**	+48
Total, Innovations for Existing Plants	**+4,769**

	FY 2006 vs. FY 2005 ($000)
Advanced Systems	
Integrated Gasification Combined Cycle (IGCC)	
▪ **Gasification Systems Technology**	
Increase in Gasification Systems Technology includes increased level of effort in testing of advanced process components at the PSDF; increased effort on the development of advanced gasifier components and instrumentation, and increased efforts on the development of novel multi-contaminant control technologies. This program supports the goals of the President's Clear Skies and Global Climate Change Initiatives and his National Energy Plan, goals that require technological advanced in gasification technology and cannot be resolved with legislation or regulation alone	+7,532
▪ **Systems Analysis/Product Integration**	
Increase in level of effort on testing of hydrogen production and separation technologies at the PSDF as part of the Hydrogen Initiative and complete testing of gas cleaning technology at Eastman Chemical	+3,006
▪ **Program Support**	+107
Total, Integrated Gasification Combined Cycle	**+10,645**
Advanced Combustion	
▪ **Advanced Hybrid Combustion**	
The program will come to an orderly termination using prior year funding	-5,175
▪ **Program Support**	-52
Total, Advanced Combustion	**-5,227**
Turbines	
▪ **Next Generation Turbines**	
Increase in Turbines includes additional work needed to address technical issues for turbines designed with the capability to burn up to 100% hydrogen.	+2,591
▪ **Program Support**	+26
Total, Turbines	**+2,617**
Total, Advanced Systems	**+8,035**
Total Funding Change, Central Systems	**+12,804**

Sequestration R&D

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Sequestration R&D					
Greenhouse Gas Control	32,128	38,074	59,400	+21,326	+56.0%
Focus Area for Carbon Sequestration Science	6,844	6,834	7,128	+294	+4.3%
Program Support	403	453	672	+219	+48.3%
Total, Sequestration R&D	39,375	45,361	67,200	+21,839	+48.1%

Description

The mission of the Sequestration R&D program is to create public benefits by discovering and developing ways to economically separate and permanently store (sequester), and to offset, greenhouse gas emissions from the combustion of fossil fuels.

Benefits

The Global Climate Change Initiative (GCCI) has defined a metric goal of an 18 percent reduction in greenhouse gas intensity from an estimated 183 metric tons per million dollars of GDP in 2002, to 151 metric tons per million dollars of GDP in 2012. The Sequestration Program will show substantial contributions toward meeting greenhouse gas intensity reduction goals of the GCCI and provide a portfolio of "commercially ready" technologies to support the decision making process for future action (if required) in 2012, as mandated by GCCI.

Technology developments will occur such that by the 2012 timeframe, carbon sequestration technologies will be available that result in less than 10 percent increase in cost of energy services for direct capture technologies (including capture and separation of CO_2 from flue gas) and less than $10/ton carbon sequestered for indirect capture technologies (reforestation of power plant sites and unproductive mine lands). Current capture and sequestration technology options result in at least a 30 percent increase for new plants and a 70 percent increase for retrofit plants. Using results from an FE/NETL analysis, the Sequestration Program has estimated the contribution that various options will make toward meeting the future greenhouse gas emissions reduction needs. Sequestration technologies have the potential to account for more than 30 MMtCE (million metric tons of carbon equivalents) greenhouse gas reductions in 2012 or about a 30 percent direct contribution to the President's GCCI goals. Sequestration technologies could potentially account for more than 90 MMtCE of greenhouse gas reduction in 2020 and up to 1025 MMtCE in 2050.

Background

A successful research and development effort will allow the continued use of economical fossil fuels during the transition to a hydrogen economy.

About 90 percent of coal produced in the United States is used for electricity generation and over half of all electricity is produced by coal-fired power plants. Including electricity generated by oil and natural gas-fired power plants, approximately 70% of all electricity produced in the United States is generated from fossil fuels. The continued use of fossil fuels to generate affordable electricity is critically important to the United States economy and the power generation industry needs to maintain a diversified fuel mix to ensure adequate energy supplies at a reasonable price. The continued use of fossil fuels has many environmental challenges, and sustained use could be severely limited unless satisfactory solutions can be found to overcome these environmental challenges, especially with regard to global climate change and the ability to substantially reduce carbon dioxide (CO_2) emissions in the United States.

Since electric generation is expected to grow and fossil fuels will continue to be the dominant fuel source, there is growing recognition that the public/private collaboration must be part of the solution to curbing greenhouse gas emissions by capturing and permanently sequestering carbon dioxide. The President's climate change goal is to significantly reduce the greenhouse gas intensity of the United States economy over the next 10 years, while sustaining the economic growth needed to finance investment in new, clean energy technologies. The Carbon Sequestration Program directly supports these and several National Energy Policy (NEP) goals targeting the development of new technologies, market mechanisms, and international collaboration to reduce greenhouse gas intensity and greenhouse gas emissions. The development of carbon capture and sequestration technologies must play a key role if the United States is to set a path to slow the growth of greenhouse gas emissions, and -- if the emerging science justifies -- to stop and then reverse that growth.

The DOE's Office of Fossil Energy is developing a portfolio of technologies and mitigation strategies designed to reduce the emissions of greenhouse gases using a two-prong approach: (1) Making energy systems more efficient, and; (2) Capture and sequestration of greenhouse gases. The first approach is being addressed by the core fossil energy programs for coal and other power systems that seek to increase efficiency from the 2003 level of 40% to 60% HHV efficiency by 2020 while reducing the cost from 3.5 cents/kWh to less than 3 cents/kWh, excluding capture and sequestration. The second approach is being addressed by the Carbon Sequestration R&D Program. The Carbon Sequestration Program is developing a portfolio of technologies that hold great potential to reduce greenhouse gas emissions. The Program will focus primarily on the following area:

- Developing capture and separation technologies that dramatically lower the costs of reducing carbon dioxide emissions from fossil fuel processes.
- Improve the understanding of factors affecting the fate and permanence of carbon dioxide storage in geologic and terrestrial storage sinks and establish the lines of evidence (protocols) for the secure and effective storage of carbon dioxide.
- Develop technologies and methodologies to accurately measure, verify and mitigate leakage (if needed) for geologic, or underground, and terrestrial, or biological, storage sinks.
- Investigate revolutionary approaches to capture and storage that could provide "leap frog" benefits over currently pursued options.
- Develop technologies to capture non-CO_2 greenhouse gases, focused on fugitive methane emissions from energy systems.

- Develop the infrastructure required for wide scale deployment of sequestration concepts, should they be needed, through the following:
  - Cataloguing regional CO_2 sources and sequestration opportunities
  - Validating sequestration technologies under a variety of storage scenarios
  - Establishing the regulatory and permitting requirements for sequestration
  - Engaging the public through effective education and outreach

The programmatic time line is to develop to a state of commercial readiness (i.e., pilot scale testing has been successful) a portfolio of safe and cost effective greenhouse gas capture, storage and mitigation technologies by 2012, leading to substantial market penetration beyond 2012. Technology developments within the Sequestration Program are expected to significantly contribute to the President's goal of reducing greenhouse gas intensity by 18% by 2012.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
▪ **Greenhouse Gas Control**	**32,128**	**38,074**	**59,400**

In FY 2006, numerous technologies in the area of CO_2 capture will be either continuing or entering pilot scale testing phases to validate substantial potential for cost reduction and performance improvement. Example technologies include the Nexant/Simteche CO_2 hydrate, Research Triangle Institute dry sorbent, University of Texas piperazine solvent, Alstom Power oxygen based combustion process, Foster Wheeler oxygen based combustion process, and the LANL, INEEL/Pall CO_2/H_2 separation membrane. Sequestration field tests will be entering the injection phases of small quantities of CO_2 or scaling up existing injection efforts to investigate larger sections of geologic formation. Weyburn project will be entering Phase II efforts to continue development of measurement, mitigation & verification (MMV) technologies. Texas Bureau of Economic Geology (BEG) will be looking to expand injection into Frio saline formation to appropriate near-by locations. American Electric Power & Battelle are considering the possibility of a small scale capture and sequestration experiment at the Mountaineer power plant in the FY 2006 timeframe. Consol Energy will be completing injection of 26,000 tons of CO_2 using a horizontal injection well into an unmineable coal seam to produce coalbed methane. Monterey Bay Aquarium Research Institute (MBARI) will be performing a several-day field test to further understanding of ocean sequestration feasibility. In the area of breakthrough CO_2 capture concepts, projects selected with the National Academy of Sciences will be approaching their final year. Researchers will be completing laboratory tests of novel membranes and sorbents to determine their applicability for pilot scale development. In the novel area of converting CO_2 to solid carbonates, researchers will be studying fundamental reaction mechanisms and rates, and experimentally testing the novel idea of storing CO_2 together with SO_2 in standstones containing feldspar and iron oxide. Terrestrial sequestration projects will be completing reforestation experiments on hundreds of acres of previously unproductive reclaimed mine lands. Recommended mined land reclamation practices will be developed as well as summary of costs required to optimize carbon sequestration through the reforestation of these lands. Testing will be conducted on different land use types and protocol development for two advanced soil carbon sampling technologies capable of measuring carbon at

less than 10% of the cost of conventional methods. Guidelines will be provided on the optimum forest management practices for the major commercial tree species in the United States taking into account a market established for different carbon prices. Finally, approximately 7 Phase II Regional Carbon Sequestration Partnerships will be established to evaluate through small scale validation tests their ability to sequester carbon efficiently, safely, and permanently. The partnerships will validate all infrastructure concepts and begin regulatory compliance, permitting, liability approaches for selected projects as well as implement public outreach and education mechanisms to engage the public and other stakeholders. All FY 2006 activities will provide critical support for FutureGen, Carbon Sequestration Leadership Forum (CSLF) and the President's Global Climate Change Initiative. *Participants include: Montana State University, UNDEERC, Univ. of Kansas, Battelle, AEP, Alstom Power, CMU, Foster Wheeler, Texas BEG, Virginia Tech, Univ. of Minnesota, UOP, Notre Dame, Harvard, Arizona State, Univ. of Georgia, Velocys, Praxair, Dakota Gasification, ARI, Nature Conservancy, Univ. of KY, Univ. of TX, MIT, Princeton University, Consol, MBARI, IEA, Univ. of Illinois, SSEB, Uni. Of NM, California Energy Commission, NETL, LANL, SNL, LLNL, LBNL, PNNL, ORNL, TBD.*

In FY 2005, continue core R&D program toward meeting the goals in the following areas: Developing efficient, low-cost, advanced CO_2 separation and capture concepts; identifying issues associated with carbon sequestration in differing geologic formations, and reducing the cost, and environmental uncertainties (including storage stability, permanence, rates and characteristics of migration) of large-scale carbon sequestration through innovative Public-Private R&D partnerships. Close collaboration with the carbon management science programs and activities in the Office of Science will be maintained for the purposes of applying promising basic science principles to novel concepts, thereby providing an integrated approach to advancing the science and technology of carbon sequestration. Complete pilot tests on advanced capture technologies related to membrane and hydrate configurations. Complete field tests for non-CO2 greenhouse gas mitigation related to fugitive methane emissions from coalmines. Complete field tests for geologic sequestration combined with enhanced coal bed methane recovery. Complete study of carbon dioxide/limestone sequestration in the ocean. Finally, Regional partnerships (1) identified regional opportunities and benefits; (2) established a baseline and characterized a region by matching source and sink opportunities; (3) established preliminary monitoring and verification protocols; (4) identified appropriate regulatory framework for sequestration options; and (5) communicated with stakeholders through education and outreach programs. Launch technology validation phase of the regional carbon sequestration partnerships. *Participants include: NETL, LANL, Battelle, Praxair, Dakota Gasification, ARI, Nature Conservancy, Univ. of KY, Univ. of TX, VA Tech, MIT, Princeton University, Consol, IEA, University of Massachusetts, TBD.*

In FY 2004, refocused core R&D program toward meeting the goals of the following areas: developing efficient, low-cost, advanced CO_2 separation and capture concepts; identifying issues associated with carbon sequestration in differing geologic formations, and reducing the cost, and environmental uncertainties (including storage stability, permanence, rates and characteristics of migration) of large-scale carbon sequestration through innovative Public-Private R&D partnerships. Closed collaboration with the carbon management science programs and activities in the Office of

(dollars in thousands)

FY 2004	FY 2005	FY 2006

Science will be maintained for the purposes of applying promising basic science principles to novel concepts, thereby providing an integrated approach to advancing the science and technology of carbon sequestration. *Participants include: NETL, LANL, Battelle, Praxair, Dakota Gasification, ARI, Nature Conservancy, Univ. of KY, Univ. of TX, VA Tech, MIT, Princeton University, Consol, IEA, TBD.*

- **Focus Area for Carbon Sequestration Science** **6,844** **6,834** **7,128**

In FY 2006, the Focus Area for Carbon Sequestration Science will continue to develop, test and demonstrate a suite of surface and near surface MMV technologies at sequestration field sites and develop first hand knowledge of the strengths and weaknesses of each technique. Testing of MMV technologies will continue at the Frio site, the Kansas EOR site and at the Strata Productions site in New Mexico. This will result in a well tested suite of tools that can be used to detect CO_2 leaks and quantify leak rates should any leakage occur. The Focus Area will attempt to show that some of the MMV tools can detect and quantify CO_2 leakage in amounts less than 0.01% per year from a geologic sequestration reservoir. The Focus Area will develop an improved understanding of the physical, chemical, thermodynamic and mineralogical phenomenon that occur (including coal swelling/shrinkage and mineral dissolution) when CO_2 is injected into a coal seam by incorporating key data into the coal formation sequestration computer simulator. This simulator will assist in developing the theoretical basis for understanding field results from both the Burlington Resources and Consol projects. The Focus Area will continue to study the interactions between CO_2 brine and rock samples from the Frio site and the AEP/Battelle site. Collaboration will be emphasized with Carbon Sequestration Regional Sequestration Partnerships. System Analysis studies will be performed on candidate sorbents based on kinetic and thermodynamic studies completed in FY 2005. As warranted, design process scale test of candidate sorbents in Modular Carbon Capture Facility (MCCF), and procure needed material. Investigate chemistry of aqueous ammonia service life in the presence of flue gas contaminents. Investigate the chemistry of aqueous ammonia multi-pollutant control. Based on systems studies in FY 2005, use detailed models to select CO_2 sorbents or membranes for continued development and scale-up testing. Conduct testing of selected sorbent or membrane at representative scale and operating conditions for IGCC applications. Fabricate and test novel CO_2 separation membranes based on laboratory analyses that predict both high permeability and high selectivity for CO_2 separation. These include new classes of membranes based on nanotube and metal organic framework (MOF) technologies. Apply simulation and visualization techniques to support the development of advanced geological sequestration options. Develop detailed models for capture technologies in pilot or full-scale installations to provide important system and scale-up related information such as sorbent regeneration and pressure drop. *Participants include: NETL.*

In FY 2005, the most advanced CO_2 capture sorbent known, $LiSiO_4$, will be tested in the flexible Modular CO_2 Capture Facility (MCCF) in the fuel gas mode. Several other sorbents will also be evaluated in the MCCF with particular emphasis on support to FutureGen or other large scale demonstrations. Measurement, monitoring & verification activities will continue to develop, evaluate, demonstrate and test new low cost surface and near surface methods for monitoring and verification of the integrity of geologically sequestered CO_2 at domestic sequestration sites, and

(dollars in thousands)

FY 2004	FY 2005	FY 2006

possibly some foreign sites. NETL will continue to develop the theoretical basis for understanding field results from both the Burlington Resources and the CONSOL CO_2-enhanced coalbed methane recovery projects. New insights and confirmation of previously developed hypotheses that are central to the continued development of coal seam sequestration will be developed. Key laboratory experiments will be conducted that confirm or deny previously developed insights. NETL's geological sequestration core flow laboratory (GSCFL) will obtain drilling core samples from the AEP/Battelle Mountaineer project in New Haven, WV, and begin evaluating the rock's permeability and porosity. The effects of CO_2 injection upon the host rock mineralogy and petrography will be investigated. *Participants include: NETL.*

In FY 2004, refocused activities toward the areas of capture, geologic and deep ocean CO_2 sequestration, establish the scientific and technical bases needed to cost-effectively capture and permanently sequester CO_2. *Participants include: NETL*

▪ **Program Support**.....	**403**	**453**	**672**
Fund technical and program management support.			
Total, Sequestration R&D	**39,375**	**45,361**	**67,200**

Explanation of Funding Changes

FY 2006 vs. FY 2005 ($000)

Greenhouse Gas Control

- Increase will fund Phase II activities for the Carbon Sequestration Regional Partnerships (CSRP) and to support pilot scale testing of capture technologies that are emerging from the R&D portfolio. The CSRP will begin the field verification stages for testing sequestration technologies and infrastructure concepts throughout unique regions of the United States. These field verification tests require a substantial funding commitment to ensure successful completion of Phase II activities among the CSRP. Increased funding will also ensure that the CSRP provides complete coverage throughout the United States. Bench scale capture technologies (such as hydrates, oxygen combustion and advanced sorbents) will begin entering the pilot scale testing phases of their development. This testing is critical to ensure achievement of programmatic cost reduction goals and readiness for commercialization. If the program were to be funded at a lesser level, the result would be fewer field verification tests for sequestration technologies. CSRP activities in 2004 have identified amenable sequestration locations, but multiple field test are crucial to proving actual sequestration capability and capacities, testing MMV technologies, and ensuring the ultimate

	FY 2006 vs. FY 2005 ($000)
success of sequestration technologies. Decreased funding would also limit the number of pilot-scale capture tests performed. Promising capture technologies have been developed at the bench scale, but absent pilot scale testing; will never develop to the point of commercialization. These additional activities are critical to providing sufficient technological capabilities and proven sequestration options to the enable the United States to commit to significant future carbon reductions, should they be needed. Additionally, both the CSRP and pilot scale capture testing are critical components to meeting the objectives for FutureGen and the President's Global Climate Change Initiative as well as programmatic and National Energy Policy goals	+21,326
Focus Area for Carbon Sequestration Science	
▪ Increase will fund continued development, testing and demonstration of a suite of surface and near surface MMV technologies at sequestration field sites and development of first hand knowledge of the strengths and weaknesses of each technique. Collaboration will be emphasized with the Carbon Sequestration Regional Partnerships	+294
Program Support	+219
Total Funding Change, Sequestration R&D	**+21,839**

Fuels

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Fuels					
Transportation Fuels and Chemicals	21,340	23,470	22,000	-1,470	-6.3%
Solid Fuels and Feedstocks	5,820	5,916	0	-5,916	-100.0%
Advanced Fuels Research	3,216	2,761	0	-2,761	-100.0%
Total, Fuels	30,376	32,147	22,000	-10,147	-31.6%

Description

The mission of the Fuels program is to create public benefits by conducting the research necessary to promote the transition to a hydrogen economy. Research will target reducing costs and increasing efficiency of deriving hydrogen from coal feedstocks as part of the President's Hydrogen Fuel Initiative.

Benefits

Achievement of Hydrogen from Coal RD&D goals within the Hydrogen Fuel Initiative will help the U.S. improve energy security and achieve a sustainable hydrogen economy. This will be done by reducing imports of oil and using abundant domestic coal reserves. U.S. coal reserves nearly equal to three quarters of the total proved world conventional oil reserves (on an energy equivalent basis) and represent hundreds of years of supply at today's domestic consumption rate.

In addition, the use of hydrogen from coal can reduce environmental concerns associated with energy use in automotive and stationary power applications through the clean production of hydrogen from coal in tandem with carbon sequestration. Gasification technologies have shown the potential to produce clean synthesis gas from coal with virtually zero pollutant emissions. Carbon sequestration technologies are providing the means to cost-effectively use concentrated CO_2 streams, for example, in enhanced oil recovery. Finally, the use of coal-derived hydrogen in fuel cells can provide efficient, emission-free power from hydrogen in both automotive and stationary power applications. The emissions and energy benefits that can be realized with successful Hydrogen from Coal RD&D to enable low-cost hydrogen from coal production with sequestration, and use in fuel cell vehicles, compared to internal combustion engine vehicles are discussed below.

Benefits have been evaluated by Fossil Energy (FE) staff and consultants using a well-to-wheel analysis prepared by Argonne National Laboratory (ANL) (GREET model) and expanded to include coal. The analysis conservatively assume that in 2025 20% of all fuel cell vehicle (FCV) hydrogen demand in the United States is produced from coal based on preliminary analyses performed by ANL that addressed resource availability and costs to produce hydrogen. The FE staff and consultant analysis shows that by 2025, using the hydrogen fuel cell vehicle market penetration detailed in DOE's Hydrogen Posture Plan, annual hydrogen demand will reach 1.5 quadrillion British thermal units (10^{15} Btu or 1.5 quads) that will

power 50.9 million light-duty fuel cell vehicles, 10.2 million of which (20%) are assumed to be powered by hydrogen from coal for this analysis.

In 2025, this scenario analysis estimates that hydrogen from coal and use in FCVs will save 370 thousand barrels per day of imported oil, 0.15 trillion cubic feet of imported natural gas per year, while increasing coal consumption by over 22 million tons per year, an amount equal to just over 2% of 2001 annual coal demand. These results represent our best judgments and FE continues the analysis with its consultants and NETL staff to ensure their consistency.

In addition, the analysis estimates that this technology will reduce the cost of our Nation's fossil fuel consumption by almost $4 billion per year, reduce nitrogen oxides (NO_x) emissions by 20 thousand metric tons per year, sulfur oxides (SO_x) emissions by 5.3 thousand metric tons per year and CO_2 emissions by 67 million tons if CO_2 from coal is sequestered when hydrogen is produced. FCVs are assumed 2.5 times more efficient than internal combustion engine vehicles (ICEVs). A modified Argonne National Laboratory GREET 1.6 model was used to estimate energy use and emissions associated with resource extraction, conversion and hydrogen consumption in FCVs, while the Energy Information Administration's (EIA) Annual Energy Outlook (AEO) 2004 was used for year 2025 fossil fuel values ($2002 basis).

Background

Currently, the United States imports approximately 11 million barrels per day of petroleum crude and finished products (55% of consumption). By 2025 imports are projected to rise to 19.8 million barrels per day of crude and refined products (68% of consumption). Coal-derived hydrogen can be an important part of a strategy to diversify and expand our domestic fuel resource base, reduce emissions from the transportation sector, and help limit our reliance on imported oil.

In addition to energy security issues, major challenges facing transportation are urban and regional air pollution and emissions of greenhouse gases. EIA 2000 data indicates that of man-made emissions, the U.S. transportation sector is responsible for nearly 80 percent of the carbon monoxide (CO), over one half of the nitrogen oxides (NO_x), and 40 percent of the volatile organic compounds (VOC). Vehicles are responsible for about 35% of the U.S. energy sector's carbon dioxide production. As the Nation transitions toward advanced engine platforms, ultra-low emission vehicles and eventually to near-zero emission vehicles, such as through the Administration's FreedomCAR partnership, the demand for hydrogen will increase dramatically. The Administration's Hydrogen Fuel Initiative is a coordinated effort among the Department's Offices (EERE, FE, NE, Science) to provide the technology for the private sector to meet the anticipated hydrogen demand and the infrastructure needed to provide the hydrogen to the end-user. Our large domestic resources of coal can provide high volume, low-cost, hydrogen for fuel cells in the longer term.

Research will address the development of technologies to produce, distribute and store hydrogen as an affordable, safe fuel for consumers. Specifically, this research activity will encompass a technology envelope that includes the separation of hydrogen from mixed gas streams and provides the hydrogen to fuel cells and other end-use systems. In FY 2006, research will continue to target the development of technologies capable of economically producing large quantities of pure hydrogen from coal-derived synthesis gas, which will enable hydrogen from coal feedstocks to play a major role in the transition to sustainable hydrogen based energy systems.

Centralized production of hydrogen from coal feedstocks will produce a concentrated stream of carbon dioxide, which will facilitate its economic capture and sequestration. There are two routes to supplying hydrogen from these advanced coal gasification facilities. A portion of the hydrogen can be separated from the mixed gas stream (i.e. synthesis gas) which is produced during the gasification process and then stored for distribution. The other alternative is to produce, via synthesis gas conversion processes, zero-sulfur, high hydrogen content coal-derived fuels that can be moved through the present distribution system, then reformed at facilities in close proximity to the customer or directly on-board the vehicle.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Transportation Fuels and Chemicals	**21,340**	**23,470**	**22,000**

This program conducts laboratory and process research to develop advanced technology for producing ultra clean fuels and hydrogen from coal by use of gasification technology possibly with coproduction of electricity and other products.

- **Reactor/Process Development** **1,491** **0** **0**

  No funding is requested for this activity in FY 2006 and FY 2005.

  In FY 2004, continued the coproduction feasibility studies to establish optimal marketable products and plant configurations for specific facilities for production of clean synthesis gas derived liquid fuels, clean electric power and heat based on coal gasification.

- **Syngas Membrane Technology** **5,965** **5,174** **0**

  In FY 2006 no funds are requested for this activity.

  In FY 2005, conduct work on novel syngas ceramic membrane development targets for the production of environmentally superior liquid fuels and hydrogen. *Participant: APCI*

  FY 2004 funding continued exploratory research activities of novel conversion concepts of promising chemical and small-scale physical conversion technology innovations. Continued 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. Conducted fundamental supporting fuels research at NETL. *Participants included: APCI, NETL, LANL, Univ. Of Alaska, Canmet, Praxair.*

- **Ultra Clean Fuels** **8,786** **976** **0**

  In FY 2006 no funds are requested.

  In FY 2005, conduct studies to establish the usability of the small footprint syntroleum pilot plant in Tulsa, Oklahoma to process coals to produce a synthesis gas for catalytic conversion to zero

sulfur, high cetane number Fishcer-Tropsch liquid transportation fuels. *Participant: ICRC/Syntroleum.*

FY 2004 funding continued cost-shared industrial research for the development of ultra-clean fuels technology for fossil resources (natural gas, petroleum, coal). Projects will continue to develop advanced technology for the production of natural gas derived synthesis gas and ultra-clean fuels. Funding will also be provided for the completion of a novel, molten metal reactor for production of hydrogen with a concentrated stream of carbon dioxide for capture from coal-based feedstock.

- **Hydrogen from Coal Research**..... **4,879** **17,085** **21,780**

In FY 2006, continue research for the development of novel technology for: 1) separating hydrogen from mixed gas streams including polishing technology to remove remaining impurities prior to utilization; 2) producing high hydrogen content coal-derived liquids for subsequent reforming at distributed generation facilities, 3) storing and delivering hydrogen/liquid hydrogen carriers; 4) utilizing hydrogen in non-fuel cell powered applications; 5) small-scale hydrogen production systems with CO_2 capture/sequestration capability; and utilize NETL's computation science expertise to provide the technical foundation upon which to facilitate the development of advanced system components associated with the production, delivery, storage and utilization of hydrogen from coal; and initiate systems engineering studies: 1) to develop more efficient and less costly concepts for liquid fuels reforming; and 2) to determine optimum strategies for scale-up of advanced separation membrane modules.

In FY 2005, perform research for the development of novel technology for: 1) separating hydrogen from mixed gas streams (continuation) including polishing technology to remove remaining impurities prior to utilization (new); 2) producing high hydrogen content coal-derived liquids for subsequent reforming on-board vehicles and/or at distributed generation facilities (continuation); 3) storing and delivering hydrogen/liquid hydrogen carriers (continuation); 4) utilizing hydrogen in non-fuel cell powered applications (new); 5) small-scale hydrogen production systems with CO_2 capture/sequestration capability (new), and utilize NETL's computation science expertise to provide 6) the technical foundation upon which to facilitate the development of advanced system components associated with the production, delivery, storage and utilization of hydrogen from coal. Conduct a study of hydrogen pathways for the production from low rank coal.

In FY 2004, FE began hydrogen from coal initiative by competitive procurement. Identified appropriate organizations to (1) establish the feasibility of emerging alternate coal-based hydrogen technologies, (2) investigate advanced separation technologies, and (3) utilize a combination of experimental and advanced computational methods to determine optimal reaction chemistries for producing hydrogen from coal-derived fuels.

Participants include: SouthWest Research Institute, U. Of Calif.-Davis, Gas Technology Institute, Media & Process Technology, Ohio State Univ, Wright-Patterson AFB, Eltron Res., Inc., Oak Ridge National Lab, Los Alamos National Lab, Argonne National Lab, NETL, UNDEERC, TBD.

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
▪ **Program Support**.....	**219**	**235**	**220**
Fund technical and program management support.			
Solid Fuels and Feedstocks.....	**5,820**	**5,916**	**0**
Research provided advanced technologies to produce clean high value carbon products from coal such as high purity carbon electrodes and specialty graphite. Composite fuels comprised of coal and waste biomass for greenhouse gas reduction and separation technology for producing additional clean coal from wastes.			
▪ **Premium Carbon Products**.....	**966**	**976**	**0**
No funding requested in FY 2006.			
In FY 2005 and FY 2004, conduct work on development of novel processes to produce high value graphite, activated carbon, carbon fibers for high strength materials, carbon foams for military applications and carbon electrodes for batteries and fuel cells. *Participants include: Penn State.*			
▪ **Advanced Separation**	**2,874**	**2,928**	**0**
No funding requested in FY 2006.			
In FY 2005 and FY 2004, conduct work on developing processes for reclamation of coal fines to monetize coal from waste coal sites and mitigate potential environmental issues associated with these sites; and to develop solid-liquid coal separation processes that have crosscutting applicability the mineral industry. *Participants include: Virginia Tech, WVU.*			
▪ **Coal-Derived Jet Fuels**.....	**1,920**	**1,953**	**0**
No funding requested in FY 2006.			
In FY 2005, conduct work on the FY 2004 research and development to determine the technical requirements and cost implications of integrating the coal-derived jet fuel production and by-product processes into refinery operations. *Participant: Penn State*			
▪ **Program Support**.....	**60**	**59**	**0**
Fund technical and program management support.			
Advanced Fuels Research.....	**3,216**	**2,761**	**0**
Provide the scientific underpinning for the development of advanced ultra clean liquid fuels and hydrogen technology from coal.			

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
▪ **Advanced Research**	**3,183**	**2,733**	**0**

No funding is requested for this activity in FY 2006.

In FY 2005, conduct work on supporting research that will facilitate the development of high-efficiency, affordable processes for converting coal to high value fuels, including hydrogen and hydrogen precursors; and to develop a coal extraction process that provides precursor chemicals suitable for production of premium coal-derived materials.

FY 2004 funding is to provide supporting science that will facilitate the development of high-efficiency, affordable processes for converting coal to high value fuels, including hydrogen and hydrogen precursors; and to develop a coal extraction process that provides precursor chemicals suitable for production of premium coal-derived materials. These products are intended to augment and eventually replace carbon products derived from petroleum or coke-oven byproducts. *Participants include: Univ of Kentucky et at, WVU*

▪ **Program Support**	**33**	**28**	**0**

Fund technical and program management support.

Total, Fuels	**30,376**	**32,147**	**22,000**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Transportation Fuels and Chemicals	
▪ **Syngas Membrane Technology**	
Discontinued research and development of a novel syngas ceramic membrane technology produce synthesis gas for environmentally superior liquid fuels and hydrogen since these are improvements to commercial technology which industry could do on their own	-5,174
▪ **Ultra Clean Fuels**	
Conclude studies to establish the usability of the small footprint syntroleum pilot plant in Tulsa, Oklahoma to process coals to produce a synthesis gas for catalytic conversion to zero sulfur, high cetane number Fishcer-Tropsch liquid transportation fuels	-976

	FY 2006 vs. FY 2005 ($000)
▪ **Hydrogen from Coal Research** Continue Hydrogen from Coal Research to developed improved, novel technology for the production of hydrogen and its separation, delivery, storage and utilization at lower cost including the initiation of studies for advanced concepts for simultaneous separation of carbon dioxide, H_2S and other trace components from hydrogen	+4,695
▪ **Program Support**	-15
Total, Transportation Fuels and Chemicals	**-1,470**
Solid Fuels & Feedstocks	
▪ **Premium Carbon Products** Discontinue development of novel processes to produce high value carbon materials because of lower priority	-976
▪ **Advanced Separation** Discontinue development of processes for separations to reclamation of coal fines, mitigate potential environmental issues associated with these sites; and development of solid-liquid coal separation processes that have crosscutting applicability to the mineral industry because of lower priority	-2,928
▪ **Coal-Derived Jet Fuels** Discontinue research and development to determine the technical requirements and cost implications of integrating the coal-derived jet fuel production and by-product processes into refinery operations because of lower priority	-1,953
▪ **Program Support**	-59
Total, Solid Fuels & Feedstocks	**-5,916**
Advanced Fuels Research	
▪ Conclude science for converting coal to high value fuels, including hydrogen and hydrogen precursors and coal extraction process that provides precursor chemicals suitable for production of premium coal-derived materials	-2,733
▪ **Program Support**	-28
Total, Advanced Fuels Research	**-2,761**
Total Funding Change, Fuels	**-10,147**

Advanced Research

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Advanced Research					
Coal Utilization Science	11,581	17,552	8,000	-9,552	-54.4%
Materials	10,809	10,848	8,000	-2,848	-26.3%
Technology Crosscut	11,326	10,355	10,500	+145	+1.4%
University Coal Research	2,863	2,958	3,000	+42	+1.4%
HBCUs, Education & Training	954	986	1,000	+14	+1.4%
Total, Advanced Research	37,533	42,699	30,500	-12,199	-28.6%

Description

The mission of the Advanced Research subprogram is to serve as a bridge between basic and applied research to foster the development and deployment of innovative systems for improving efficiency and environmental performance, while reducing costs, of Advanced Coal and Power Systems.

Benefits

Advanced Research provides the means by which advanced concepts are transformed into future working technologies. It is crosscutting in nature and supports all Fossil Energy Coal and Power Systems in its development of highly efficient power plants with zero emissions and also FutureGen. Improvement of our energy infrastructure, which includes power plants, power transmission systems, environmental protection and remediation efforts, is dependent on research. This research must produce technologies that meet the performance specifications for hostile operating conditions, economic constraints of advanced industrial applications, and public demand for a cleaner environment, reliability, and low consumer cost. These constraints require that Advanced Research develop fundamental understandings of relationships among energy processes, their performance requirements, and the environment through a greater understanding of the physical, chemical, biological and thermodynamic barriers to achieving these goals. Especially important research is being conducted in the areas of materials research, sensors and controls, and computational energy science that is expected to reduce the requirement for constructing many expensive pilot plants.

Background

The Advanced Research Program works to create public benefits through 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 public benefits from these activities because the improvement of programs and regulatory activities will help to maximize their benefits and lower their costs. The second is a set of crosscutting fundamental and applied research programs which include coal utilization science, materials, bioprocessing of coal, and university-based

research. The public benefits from these activities because the long-term, high-risk activities target areas where industry is not able to invest.

These high risk research activities can produce public benefits such as increased energy efficiency, reduced pollution, or more reliable power supplies. For example, the university-based research programs include the University Coal Research program and the Historically Black Colleges and Universities and Other Minority Institutions (HBCU/OMI) program, address 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 Zero-emission compatible energyplexes and the FutureGen initiative. Advanced Research seeks a greater understanding of the physical, chemical, biological and thermodynamic barriers to achieving economic, technologic, and environmental goals and identifies ways to overcome those barriers. The program is directed to specific underlying fundamental scientific and engineering problems closely connected to long-range Fossil Energy objectives.

An Advanced Research focus area on Computational Energy Sciences has been 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 conversion processes. It will address issues affecting the utilization of coal, and its primary thrust is in support of the development of the Zero-emission compatible 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 development of 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/OMI subprograms are both education and training programs that support competitively awarded research grants at U.S. colleges and universities to address Fossil Energy's highest priority research needs.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Coal Utilization Science	**11,581**	**17,552**	**8,000**
▪ **Coal Utilization Science (Core)**	**6,762**	**13,116**	**7,620**

In FY 2006, conduct research that supports development of highly efficient and clean power plants, focusing on the reduction or elimination of adverse environmental impacts of coal use. Sensors and Controls: Continue to develop a new class of sensors selected through a FY 2003/2004 BBFA solicitation that are capable of monitoring under the harsh operating conditions of ultra-clean fossil energy systems including FutureGen. Proceed to prototype development of sensor projects based on feasibility test evaluations. Enabling Technologies: Initiate projects selected under FY 2005 solicitation targeting critical areas of power plants with near-zero emissions and FutureGen. Continue mechanistic 3D modeling and stochastic modeling and model integration development for advanced power systems. Continue to investigate basic combustion and gasification chemistry to discern rates and mechanisms that control emissions behavior of coal under advanced and conventional combustion/gasification conditions to minimize NO_x, SO_x, air toxics, and other pollutants in support of clear skies initiative. Develop conceptual geochemical model of magnesium silicate carbonation for CO_2 sequestration and demonstrate CO_2 brine carbonation with core geological reservoir host rocks. No funds is requested for the Arctic Energy Office. *Participants include: NETL, SNL,CMU,ARC,Ohio State U., Uof Fla, MSU, Nuonics, Prime Photonics, REI, SRI, Miss. State U., SRD, TBD*

In FY 2005, conduct research that supports the development of highly efficient and clean power plants, focusing on the reduction or elimination of adverse environmental impacts of coal use. Sensors and controls: Complete prototype development and testing of sensors critical to enhancing and controlling plant efficiencies and emissions. Continue to develop new class of sensors based on projects selected through FY 2002, FY 2003, and FY 2004 solicitations that are suitable for monitoring in harsh conditions that will enable the operation of ultra-clean fossil energy systems. Enabling Technologies: Complete development of computational workbench for Zero-emission compatible systems. Initiate mechanistic 3D modeling of Zero-emission compatible plant. Continue to investigate basic combustion and gasification chemistry to discern rates and

mechanisms that control emissions behavior of coal under advanced and conventional combustion/gasification conditions to efficiently minimize NO_x, SO_x, air toxics, and other pollutants in support of the clear skies initiative. Complete integration of mechanical, chemical, and chemico-mechanical pretreatment into CO_2 mineral carbonation process. Continue support for the Arctic Energy Office. *Participants included: NETL, SNL, CMU, U. of Pittsburgh, ARC, Ohio State U., REI, U. of FL, MSU, U. of Alaska..*

In FY 2004, conducted research to enable reduction or elimination of environmental impacts of coal use; focus on greenhouse gases that may affect global climate change. Sensors and Controls: Completed pilot-scale tests of select gasification and combustion sensors; complete feasibility tests of other sensor development projects selected under FY 2002 solicitations. Selected fewer projects for award under FY 2003 solicitations for fundamental sensor devices including applications of nanotechnology. Continued stochastic modeling and systems analysis for zero emissions power plants concepts and FutureGen. Completed Round 2 course grid simulations and computational workbench projects and continued projects selected under round III of broad-based agency Vision 21 solicitation to develop critical enabling technologies for advanced zero emissions power and fuel systems. Investigated basic combustion and gasification chemistry to discern rates and mechanisms that control emissions behavior of coal under advanced and conventional combustion gasification conditions to efficiently minimize NO_x, SO_x, air toxics, and other pollutants in support of the Clear Skies Initiative. Developed predictive models as a tool for designers of Vision 21 plants. Demonstrated the feasibility of the in-situ CO_2 mineral sequestration concept through laboratory tests of drill-core samples and maintained minimum levels of fundamental lab-scale research to addresses process design issues. Continued support for the Arctic Energy Office Activities. *Participants included: NETL, SNL, CMU, U. of Pittsburgh, Princeton, ARC, University of Alaska.*

- **Mercury Control**..... **1,800** **300** **300**

In FY 2006, continue projects selected under FY 2004 solicitation for fundamental mechanisms that effect mercury control. Continue to develop real time mercury emissions monitor with capability for speciation. *Participants include: SNL, Purdue U., GTI, U. of Arizona, URS.*

In FY 2005, implement projects selected under FY 2004 solicitation. Continue to develop real time mercury emissions monitor with capability for speciation. *Participants included: Purdue U., GTI, U. of Arizona, URS, SNL.*

In FY 2004, conducted fundamental research on mercury formation and control. As part of a new sensors and control solicitation, developed sensors to detect and monitor mercury emissions. Developed atmospheric modeling (plume chemistry and deposition) with a focus towards mercury. *Participants to be determined.*

(dollars in thousands)

FY 2004	FY 2005	FY 2006

- **Center for Zero Emissions Coal Research** **2,900** **3,960** **0**

  In FY 2006, no new funding requested. Support for the Strategic Center for Zero Emissions Coal Research will continue with funds made available in FY 2005.

  In FY 2005, continue to conduct research for advanced coal programs and FutureGen at the Strategic Center for Zero Emissions Coal Research. Funds provided in FY 2005 are sufficient to support this effort through FY 2006. *Participants included: Montana State U., WVU, PNNL, LANL, NETL.*

  In FY 2004, created a Strategic Center for Zero Emission Coal Research at the High-Temperature Electrochemistry Center (HiTEC) to conduct research in support of advanced coal programs and FutureGen, and to enhance collaboration between Universities and National Labs. *Participants included: Montana State Univ., NETL.*

- **Program Support**..... **119** **176** **80**

  Fund technical and program management support.

Materials..... **10,809** **10,848** **8,000**

- **High Temperature Materials Research**..... **5,394** **5,899** **4,596**

  In FY 2006, develop strong, tough and oxidation resistant materials capable of service temperatures approaching 1600°F. Apart from the environmental aspects of the effluent from coal combustion, major concern from the systems standpoint is the aggressiveness of the combustion environment toward structural components. This experimental program will be aimed at developing a scientific understanding of corrosion mechanisms as a function of alloy composition and deposition chemistry, and at quantitatively determining the scaling and internal penetration of sulfur and oxide species into the alloys. *Participants include: ANL, INEEL, ORNL, Ames.*

  In FY 2005, develope a new generation of corrosion resistant high temperature alloys and refractories that will be used as hot components in advanced fossil energy combustion and conversion systems. Perform laboratory research accompanied by testing of the alloys in actual power plant conditions. Novel nano-science approaches were developed for separating hydrogen from product streams that are generated during coal gasification, methane partial oxidation, and water-gas shift reactions. A substantial part of the nano-science for separation is research on materials and their microstructure, for example, the development of materials used as molecular sieves to separate hydrogen from the test of the gas. Demonstrate stability of proton-conducting ceramics in atmosphere of coal-derived gas and operated membrane reactor to produce low cost hydrogen from coal. *Participants included: ANL, INEEL, ORNL, Ames, LBNL, TBD.*

(dollars in thousands)

FY 2004	FY 2005	FY 2006

In FY 2004, continued to develop improved materials for high-temperature, high-pressure heat exchangers, high-temperature inorganic membranes, refractories, and activated carbons for next generation, ultra clean fossil energy power systems. Continued to develop new alloys to include intermetallics, advanced austenitic alloys, advanced ferritic alloys, and oxide-dispersion-strengthened alloys. Functional materials research addressed hot-gas particulate filters, and physical absorbents, i.e, advanced carbons and non-destructive evaluation techniques. *Participants included: ANL, INEEL, ORNL, Ames, NETL, LBL.*

- **Materials for Ultra Supercritical and Gas Separation Systems** **4,489** **4,841** **3,324**

In FY 2006, develop alloys (e.g., for boiler tubing materials) for ultra supercritical (USC) systems with operating temperatures raised to 1460^{o}F and ensure the weldability of these high temperature materials. The lack of materials with the necessary fabricability, fracture toughness, and adequate resistance to creep, oxidation, corrosion, and thermal fatigue at these higher steam temperatures and pressures currently limit the operation of pulverized coal-fired plants at the higher efficiency advanced USC steam conditions. Pursue breakthrough concepts to develop materials (to include membranes) for achieving very low cost hydrogen and oxygen separation from mixed gas streams and for stabilizing greenhouse gases for next generation energy plants such as FutureGen. *Participants include: ORNL, PNNL, Energy Industries of Ohio, ARC, ANL, INEEL, Ames, LANL, Siemens-Westinghouse.*

In FY 2005, identify improved alloys, fabrication processes and coating methods that will permit boiler operation of steam temperatures up to 1400^{o}F and steam pressures up to 5400 psi. Work with alloy developers, fabricators, equipment vendors and power generation plant operators to obtain cost targets for the commercial deployment of alloys and processes developed. Define issues impacting designs that can permit power generation at steam temperatures greater than or equal to 1460^{o}F. Identify materials needed to develop steam turbines capable of operating at ultra supercritical temperature and pressure conditions and developed a plan to evaluate and qualify materials for the critical components of such turbines. Increase permeance of new membrane materials for achieving very low cost hydrogen and oxygen separation from mixed gas streams achieving repeatability with defect-free membranes, and employed techniques that can be used to manufacture on a large scale. Study impact of new materials and processes for stabilizing greenhouse gases for next generation energy plants (such as oxygen-fired combustion). *Participants included: LANL, ORNL, ARC, UCSD, PNNL, Energy Industries of Ohio, Siemens-Westinghouse.*

In FY 2004, developed alloys for ultra supercritical systems with operating temperatures raised to 1400^{o}F; ensure the weldability of these high temperature materials, and developed the base materials technology needed to develop steam turbines capable of operating at the ultra supercritical temperature and pressure conditions which are critical to increasing the efficiency via ultra supercritical cycles. Pursued breakthrough concepts to develop materials for achieving very

low cost hydrogen and oxygen separation from mixed gas streams and for stabilizing greenhouse gases for Zero-emission plants. Accomplishments include the screening and identification of potential ceramic and other class materials and processes (e.g., clathrates, and a declassified uranium enrichment process that applies gaseous diffusion techniques in uranium separation to hydrogen separation) for hydrogen separation, and ionic transport membrane materials for oxygen separation. *Participants included: LANL, ORNL, PNNL, ARC, Energy Industries of Ohio, Ames, UCSD.*

- **Materials for Mercury Control** **500** **0** **0**

  In FY 2006 and FY 2005, no funding is requested for this activity.

  In FY 2004, evaluated novel materials for the conversion or removal of mercury from process streams.

- **Materials for Advanced Fuel Cell Concepts** **315** **0** **0**

  In FY 2006 and FY 2005, no funding is requested for this activity.

  In FY 2004, developed advanced concepts that utilize carbon material from coal directly in a fuel cell. Such a concept will permit high and intermediate temperature fuel cells to directly convert carbon to electrical power without the need of an intermediate coal gasification step. National Laboratories may also contribute materials research in support of other advanced fuel cell concepts.

- **Program Support** **111** **108** **80**

  Fund technical and program management support.

Technology Crosscut **11,326** **10,355** **10,500**

- **Coal Technology Export** **988** **986** **1,000**

  In FY 2006, intensify the facilitation of the development and deployment of Zero Emissions Technologies for fossil fuels internationally working with IEA Headquarters. Increase emphasis on pursuing opportunities identified by the World Energy Council Committee on Cleaner Fossil Fuel Systems and the Southern States Energy Board for the international sale and deployment of U.S. clean coal technologies and advanced power systems. Strengthen established partnerships and pursue the establishment of additional effective partnerships to advance U.S. interest 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. Promote the deployment of carbon capture and storage technologies worldwide. Initiate the

implementation of Clean Energy/Industrial Ecology Projects in developing countries as a means of Mitigating CO_2 emissions growth as these countries expand electrification. *Participants to be determined.*

In FY 2005, intensify the facilitation of the development and deployment of Zero Emissions Technologies for fossil fuels internationally working with IEA Headquarters. Continue compounding the pursuit of opportunities identified by the World Energy Council Committee on Cleaner Fossil Fuel Systems and the Southern States Energy Board for the international sale and deployment of U.S. clean coal technologies and advanced power systems. Strengthen established partnerships and pursue the establishment of additional effective partnerships to advance U.S. interest 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. Promote the deployment of carbon capture and storage technologies worldwide, and provided support for the Carbon Sequestration Leadership Forum. Initiate the implementation of Clean Energy/Industrial Ecology Projects in developing countries as a means of Mitigating CO_2 emissions growth as these countries expand electrification. *Participants to be determined.*

In FY 2004, sustained continued support for collaboration of zero emission technologies internationally. Intensified the pursuit of opportunities identified by the World Energy Council Committee on Cleaner Fossil Fuel Systems and the Southern States Energy Board for the international sale and deployment of U.S. clean coal technologies and advanced power systems. Continue pursuit of 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. This funding level supported fewer conferences and site visits when compared to FY 2003. *Participants to be determined.*

- **Bioprocessing of Coal** **1,482** **1,480** **1,500**
  - **Bioprocessing of Coal** **1,467** **1,465** **1,485**

    In FY 2006, complete testing at large scale (power plant) toxin process to safely control zebra mussels as a means of improving the efficiency and reliability of existing power plants. (Transfer technology to innovation for existing plants program for further development). Complete development of technical protocol for screening marine microalgae for maximum biofixation and its conversion into alternative fuels. Evaluate processes for generating hydrogen from fossil fuels. Continue to investigate global and natural CO_2 sequestration. Continue bioremediation of coal to reduce mercury emissions from power plants. Investigate

novel bioprocessing research focusing on investigations of influence of microorganisms on the fate of mercury from coal ash. Initiate development of biosensors for detections of pollutants using light emitting proteins. *Participants include: ORNL, INEEL, NY Museum, NETL.*

In FY 2005, continue testing at large scale (power plant) toxin process to safely control zebra mussels as a means of improving the efficiency and reliability of existing power plants. Continue development of technical protocol for screening marine microalgae for maximum biofixation and its conversion into alternative fuels. Complete development of bench scale testing of biohydrogen from carbon containing waste products to determine food sources that will support microbial growth and hydrogen production. Continue to investigate global, and natural CO_2 sequestration. Demonstrate whitings catalyzed CO_2 fixation at pilot scale. Investigate production value of added chemicals via nonaqueous biocatalysis. Continue bioremediation of coal to reduce mercury emissions when burned in power plants. *Participants include: ORNL, INEEL, PNNL, NY State U., NETL.*

In FY 2004, initiated large scale testing to develop toxin to safely control zebra mussels as a means of improving the efficiency and reliability of existing power plants. Initiated development of technical protocol for screening marine microalgae for maximum biofixation and its conversion into alternative fuels. Investigated global, natural CO_2 mitigation strategies such as whitings and ocean scale algae sequestration. Continued development of biogeochemical environmental remediation of ammonia discharges associated with coal wastes from existing power plants. In furtherance of launching the hydrogen economy, investigated biohydrogen generation from carbon containing waste products to determine food sources that will support microbial growth and hydrogen production, conduct tests at bench scale. Investigated novel bio-environmental remediation processes related to coal conversion technology. *Participants include: ORNL, INEEL, U. State of NY, Cal. State U.*

- **Program Support**..... **15** **15** **15**

  Fund technical and program management support.

- **Environmental Activities**..... **1,975** **1,972** **2,000**

In FY 2006, continue analysis of issues associated with air and water quality, solid waste disposal, and toxic substances, and global climate change. Continue emission trends and forecast studies. *Participants include: ANL, ICF, Resource Dynamics, TMS, PNNL.*

In FY 2005, 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. *Participants include: ANL, ICF, Resource Dynamics, TMS, PNNL*

(dollars in thousands)

FY 2004	FY 2005	FY 2006

In FY 2004, continued analyses of issues associated with air and water quality, solid waste disposal, and toxic substances, and global climate change. Continued emission trends and forecast studies. *Participants include: ANL, ICF, Resource Dynamics, TMS, PNNL.*

- **Technical and Economic Analyses** **988** **986** **1,000**

In FY 2006, continue studies supporting multi-year planning FE strategy and program formulation; conduct studies on issues that crosscut FE programs including strategic benefits of and new markets for fossil fuel technology. Conducted 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. *Participants include: ANL, ICF, EIA, Resource Dynamics, TMS.*

In FY 2005, continue studies supporting multi-year planning FE strategy and program formulation; conduct 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. *Participants include: ANL, ICF, EIA, Resource Dynamics, TMS.*

FY 2004 funding continued studies supporting multi-year planning FE strategy and program formulation; conducted studies on issues that crosscut FE programs including strategic benefits of and new markets for fossil fuel technology. Conducted 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. *Participants include: ANL, ICF, EIA, Resource Dynamics, TMS.*

- **International Program Support** **988** **986** **1,000**

In FY 2006, continue Fossil Energy's commitment to the International Energy Agency (IEA) program support. Continue to provide leadership, direction, cooperation and coordination of office activities with other Federal agencies, state and local governments, energy trade associations, and the energy industry. Continue preservation and enhancement of 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 universities and other non-governmental organizations. Enhance the expansion of 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. Promote the deployment of carbon capture and storage technologies worldwide. Influence opportunities for cleaner power systems and clean fuels from coal in selected countries. Initiate the implementation of Clean Energy/Industrial Ecology Projects in developing countries as a means of mitigating CO_2 emissions growth as these countries expand electrification. *Participants to be determined.*

(dollars in thousands)

FY 2004	FY 2005	FY 2006

In FY 2005, continue Fossil Energy's commitment to the International Energy Agency (IEA) program support. Continue to provide leadership, direction, cooperation and coordination of office activities with other Federal agencies, state and local governments, energy trade associations, and the energy industry. Continue preservation and enhancement of 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 universities and other non-governmental organizations. Enhance the expansion of 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. Promote the deployment of carbon capture and storage technologies worldwide. Influence opportunities for cleaner power systems and clean fuels from coal in selected countries. Initiate the implementation of Clean Energy/Industrial Ecology Projects in developing countries as a means of mitigating CO_2 emissions growth as these countries expand electrification. *Participants to be determined.*

FY 2004 funding continued 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 associations, and the energy industry. Preserved and enhanced 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 universities and other non-governmental organizations. Focused 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. Determined opportunities for cleaner power systems and clean fuels from coal in targeted countries. *Participants to be determined.*

- **Focus Area for Computational Energy Science**..... **4,905** **3,945** **4,000**

  - **Focus Area for Computational Energy Science**..... **4,856** **3,906** **3,960**

    In FY 2006, NETL will continue the development of virtual simulations capability to model the performance of advanced power plant systems using mathematical computational simulations and computer-based models. This capability will greatly accelerate development time and significantly reduce the costs required to design viable zero-emissions coal energy options. NETL will continue to apply, analyze and evaluate simulators of high efficiency and near-zero emission processes at both the individual component level and at the integrated overall system level to assist in their design and establish performance parameters. Continue the application of steady-state process simulations that use coal gasification, gas turbines, and fuel cell subsystems. Using these capabilities, initiate analyses of fuel cell-gas turbine hybrid systems to provide detailed information on the complex interaction between fuel cells and gas turbines that have been coupled together to achieve ultra high efficiency in electrical

generation. Continue to extend these steady-state capabilities to develop simulations of dynamic or time-varying models. The ability to study these advanced power generation systems as they vary in time will help in optimizing operations such as startup, shutdown, and system upsets. At a reduced level of effort, continue the Superconducting Science Consortium support activities for advanced simulations by providing high performance computing, internet access, technical support and visualization development. *Participants include: NETL, CMU, West Virginia U, State of WV, PSC, and U of Pittsburgh.*

In FY 2005, NETL continue development of virtual simulations capability using mathematical computational simulations and modeling to accelerate development time and reduce costs of technology systems that have high efficiencies with near-zero emissions. Begin to apply the virtual integrated simulators of high efficiency and near-zero emission processes to study proposed systems and evaluate their design and performance. Analyze and evaluate these advanced processes, using the advanced simulation capability, at both the individual component level and overall system level. Complete the initial application of process simulation of high efficiency and near-zero emission process incorporating MFIX-based component model describing an advanced gasification process to provide detailed information describing the gasification process. Complete the initial application of process simulation of high efficiency and near-zero emission process based on fuel cell/gas turbine hybrid system which incorporates a detailed fuel cell component model that will provide detailed information describing fuel cell stack performance. At a reduced level of effort, continue the Supercomputing Science Consortium support activities in advanced simulations by providing high performance computing, internet access, technical support and visualization development in direct support of virtual integrated simulators. Complete a virtual integrated simulation of a high efficiency and near-zero emission process, such as a hybrid or advanced gasifier, to demonstrate the ability to simulate a dynamic coupled system. *Participants included: NETL, CMU, U. of WVU, State of WV, PSCC, U. of Pittsburgh.*

In FY 2004, NETL continued development of virtual demonstration capability using mathematical simulations and modeling to improve the speed and reduce the costs of technology systems that have high efficiencies with near-zero emissions. Developed simulations that couple fluid flow, chemical reactions, heat generation, heat transfer, and electrochemistry for modeling multi-dimensional transients in fuel cells, heat engines, gasifiers, and other crucial unit processes in advanced Zero-emission compatible plants. Completed CFD models of fuel cells, turbines, and gasifiers. Enhanced multi-phase flow models (MFIX) with meshing, large eddy simulations and chemistry and heat transfer improvements. Integrated subsystem component modules and dynamic system models to simulate a first case Zero-emission compatible plant. Continued to perform data reduction and data extraction on extensive information available from simulations of advanced energy plants for incorporation into codes being developed. Continue supercomputing Science Consortium supporting activity in advanced simulations by providing high speed computing, technical

support, and visualization simulations. *Participants include: Carnegie Mellon University, West Virginia University, Pittsburgh Supercomputing Center, University of Pittsburgh.*

- **Program Support**..... **49** **39** **40**

  Fund technical and program management support.

University Coal Research..... **2,863** **2,958** **3,000**

- **University Coal Research** **2,833** **2,928** **2,970**

  In FY 2006, the University Coal Research (UCR) Program plans to continue to support grants at U.S. colleges and universities by emphasizing longer-term research for achieving Fossil Energy's strategic objectives. Critical key research areas that accelerate technology development and seek to identify breakthrough technologies for the next century will be supported. Key research areas that will be supported will include: advanced power systems including FutureGen, the hydrogen from coal initiative, global climate change, control of coal-based mercury emissions, development of advanced materials, sensors and controls, fuel cells, and the utilization of coal-by-products.

  As in past years, support will continue in all three areas of the UCR Program: the Core, Innovative Concepts Phase-I and, Innovative Concepts Phase-II areas. Under the Core area, the program will continue to encourage collaboration through joint proposals involving university/industry teams. Core Program grants from about $200,000 to $400,000 each will be awarded. The number of grants will be determined by the number of meritorious proposals submitted.

  Exploration of novel approaches and innovative concepts developed in other scientific and technological areas that assist in developing breakthrough technologies for coal utilization will also be continued in the Innovative Concepts Phase-I and Phase-II areas. Approximately six, $50,000, one year, Innovative Concepts Phase I grants could be awarded. Further, plans are to continue the Innovative Concepts Phase II Program where one or more Phase I projects can be selected for a $200,000 Phase-II grant award. *Participants to be determined.*

  In FY 2005, the University Coal Research (UCR) Program will continue to support grants at U.S. colleges and universities by emphasizing longer-term research for achieving Fossil Energy's strategic objectives. Critical key research areas that accelerate technology development and seeking to identify breakthrough technologies for the next century will be supported. The key research areas that will be supported will include: Zero-emission plants, hydrogen initiative, global climate change, coal-based mercury emissions, materials, sensors and controls, and coal by-product utilization for the measurement, characterization, and the development of cost-effective control technologies. *Participants to be determined.*

  FY 2004, funding supported grants at U.S. universities which emphasize longer-term research that will accelerate technology development and identify breakthrough technologies for the next

(dollars in thousands)

FY 2004	FY 2005	FY 2006

century; focus on scientific and technological issues that are key to achieving FE's strategic objectives in the areas of: the Core, Innovative Concepts Phase-I and Innovative Concepts Phase-II. Support is continuing in many critical key research areas which include: FutureGen, global climate change, materials, sensors and controls, and fuel cells. Breakthrough technologies for the measurement, characterization, and the development of cost-effective control technologies for fossil coal-based carbon dioxide and mercury emissions are also being supported. The breakthrough technologies identified included materials for hydrogen storage, high temperature material coatings, computer-aided design of high temperature materials, advanced gas sensors using carbon nanotubes, diode laser sensors for temperature and gas composition for gasifiers, novel materials for carbon dioxide and hydrogen separation, and novel solid oxide sealing systems. Twenty-two universities in 18 states were involved as part of the $2.8 million grant program in FY 2004. *Participants: Various colleges and universities.*

Exploration of novel approaches and innovative concepts developed in other scientific and technological areas that assist in developing breakthrough technologies for coal utilization will be continued in the Innovative Concepts Phase-I and Phase-II areas. Approximately six, $50,000, one year, Innovative Concepts Phase-I Projects could be awarded. Further, plans are to continue the Innovative Concepts Phase II program. *Participants: Various colleges and universities.*

▪ **Program Support**	**30**	**30**	**30**

Fund technical and program management support.

HBCUs, Education and Training	**954**	**986**	**1,000**
▪ **HBCUs, Education and Training**	**944**	**976**	**990**

FY 2006 funding will be used to conduct research activities with HBCU and other minority institutions and support an HBCU annual technology transfer symposium. *Participants to be determined.*

FY 2005 and FY 2004 funding continued research activities at HBCU and other minority institutions and supported HBCU annual technology transfer symposium. *Participants included: Various colleges and universities.*

▪ **Program Support**	**10**	**10**	**10**

Fund technical and program management support.

Total, Advanced Research	**37,533**	**42,699**	**30,500**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Coal Utilization	
▪ No funding is requested for the Arctic Energy Office and the Center for Zero Emission Coal Research. Activities in support of the Strategic Center for Zero Emissions Coal Research will continue in FY 2006 with funds that were forward funded in FY 2005	-9,552
Materials	
▪ Decreased funding for developing advanced materials for ultra supercritical boilers and steam turbines	-2,848
Technology Crosscut	
▪ Activities continued at an increased level of effort	+145
University Coal Research	
▪ Increased funding for research grants	+42
HBCUs, Education & Training	
▪ Increased funding for education and training	+14
Total Funding Change, Advanced Research	**-12,199**

Distributed Generation Systems

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Distributed Generation Systems					
Fuel Cells	66,833	74,428	65,000	-9,428	-12.7%
Novel Generation	2,401	2,958	0	-2,958	-100.0%
Total, Distributed Generation Systems	69,234	77,386	65,000	-12,386	-16.0%

Description

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

Benefits

Distributed generation (DG) complements electricity supply from central generation systems by providing another source of energy through 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 generators, and even connected to a central system grid. These systems may be owned and/or operated by utilities, utility customers, and third parties. Fuel cell 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. Fuel cell systems provide important carbon management options because of their inherently low emissions and ultra-high efficiency, and they can be operated in areas where water resources are scarce since they do not require water for operations, but rather produces water as a by-product.

Fuel cell applications in distributed generation systems offer potential opportunities for cost-effectively meeting peak demand without the need for costly investments in transmission and distribution. They can be used to provide clean power to remote end users; and can provide new business opportunities to both utility and non-utility owners.

Fuel cell modules in IGCC and FutureGen systems have the potential to double the efficiency of coal-based systems and achieve near-zero emissions. Fuel cells can concentrate CO_2 which lends itself to removal by separation or other capture means. Fuel cells provide a bridge to the hydrogen economy by using coal derived hydrogen to produce power efficiently and by offering the potential to produce hydrogen, as well as electricity, from coal. By the electrochemical reaction similar to the phenomenon that takes please in a battery, a fuel cell can operate continuously when it is fed hydrogen that reacts with oxygen to product electrons for making electricity. By the reversal of this process, i.e., the input of electricity through a fuel cell operating in “reverse”, one can also produce hydrogen.

Background

Fuel cells and other innovative power systems are being developed for distributed generation applications that can create public benefits by enhancing the overall efficiency, security and reliability of the Nation's energy supply. The Fuel Cells Program supports the President's climate change goals by increasing the efficiency of electricity production, creating the potential for over 50% reduction in CO_2. It supports the Clear Skies Initiative with near zero emissions of NO_x, SO_x, and no mercury emissions, and it supports energy security goals by providing distributed generation alternatives to grid-based power and through multi-fuel capability (less dependence on one fuel). High-temperature fuel cells can operate on hydrogen and hydrogen carriers such as methane and syngas. Low-cost, ultra-high efficiency, fuel flexible, integrated fuel cell and fuel cell/turbine hybrids systems for synfuel and hydrogen-based plants will provide essential power modules for FutureGen projects and zero emissions concepts in the 2010 to 2015 time frame. Hence, the Distributed Generation Program is a bridge to the hydrogen economy of the future envisioned in the FreedomCAR and Hydrogen Fuel Initiatives.

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 current strategy is to develop clean high efficiency fossil fueled power plants: Immediate near-term (2006-2007) - validate successful Solid State Energy Conversion Alliance (SECA) Phase I achievements and initiate Phase II SECA low-cost, 3-10 kilowatt solid-state fuel cell modules for distributed and auxiliary power unit applications; Validation of target achievements will be done via testing of the first prototype fuel cells to confirm the first plateau of performance (current density, hours of operation) and analyzing the design and cost reduction potential using the system components. If the fuel cell prototype passes the first "gate" it will qualify for a second phase development aimed at further performance improvements and cost reduction designs that will be tested and analyzed at the end of the second phase before: Mid-term (2007-2010) - develop and test SECA fuel cell prototype modules capable of manufacture of $400 per kilowatt (a ten-fold reduction from the 2004 cost); and Long-term (2010-2015) - scale-up 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 fuel cell and fuel cell/turbine hybrids systems for synfuel and hydrogen-based plants. Fuel cell systems have specifically identified goals which coincide with coal-based and other fuel-flexible zero emissions power modules and concepts in the 2010 to 2015 time frame.

The Innovative Concepts subactivity includes the Solid-State Electricity Conversion Alliance (SECA), the Department's major initiative for stationary fuel cells development. The Department is consolidating all fuel cell efforts under the Innovative Concepts subactivity, in support of the $400/kW SECA fuel cell system, because it is the most promising long-term, high-risk, high-gain area for fuel cell research, in accordance with the R&D Investment Criteria. The objective of the SECA is to drastically reduce fuel cells 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. The benefits of SECA, from only the distributed generation market sector, are projected by NEMS to include up to $29 billion in savings through Clear Skies and Climate Change emissions reductions by 2025 - from up to 87 GW of SECA fuel cell capacity. Significant additional savings and installed capacity result from SECA fuel cells being incorporated into advance coal gasification plants over this same time period. Additional management benefits can be expected to accrue with the introduction of SECA hybrid systems. Work under SECA core program include, 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 highest priority core technology work is focused on seals and interconnects. SECA industry teams are engaged in the development of common modules for diverse applications in multiple and mobile market applications. SECA includes exploration of designs that combine functions to reduce size, weight, and costs. A new effort began in FY 2005with a solicitation to develop mega watt-scale SECA systems work in support of FutureGen. Fuel cell and fuel cell hybrid systems are expected to be available for testing at FutureGen and other sites in the 2010 to 2015 time frame.

Molten carbonate and tubular solid oxide programs are no longer funded since they have reached conclusion. The Department considers these technologies at a point of development where industry can pursue their commercial development without further Federal funding.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Fuel Cells	**66,833**	**74,428**	**65,000**

The focus of the Fuel Cells program is to reduce cost by an order of magnitude enabling the widespread deployment of clean reliable fuel cells and fuel cell hybrids for distributed generation, FutureGen, and Vision 21 applications through low-cost, ultra-clean, and ultra-high efficiencies.

Advanced Research	**9,611**	**12,205**	**0**
▪ **Advanced Research**	**9,513**	**12,083**	**0**

In FY 2006, no additional work is planned in this category. Funds have been redirected to the $400/kW SECA fuel cell under the Innovative Concepts subactivity.

In FY 2005, complete work on high temperature electrochemical research will be conducted at HiTEC at PNNL, Montana State University and the University of Florida. *Participants included: PNNL, Montana State University, University of Florida, NETL, TBD.*

In FY 2004, funded research to develop a fundamental understanding of processes that limit the performance of high temperature electrochemical systems. Such systems have applications in fossil energy conversion, energy storage, and electrolysis. Parallel experimental and modeling activities, research conducted by HiTec will eventually lead to new concepts and technologies in fossil fuel utilization. *Participants included: PNL, NETL, Ion America, Cal Tech.*

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
▪ **Program Support**	**98**	**122**	**0**
Fund technical and program management support.			
Fuel Cell Systems	**10,567**	**2,958**	**0**
▪ **Fuel Cell Systems**	**10,459**	**2,928**	**0**
In FY 2006, no additional work is planned in this category. Funds have been redirected to the $400/kW SECA fuel cell under the Innovative Concepts subactivity.			
In FY 2005, FCE will complete its work on the Montana Hybrid project. *Participants include: Fuel Cell Energy, NETL.*			
In FY 2004, with the conclusion of molten carbonate fuel cells stack development in FY 2003, this subactivity will support advanced fuel cell systems development and testing in a variety of crosscutting areas in FY 2004. *Participants included: Fuel Cell Energy, NETL.*			
▪ **Program Support**	**108**	**30**	**0**
Fund technical and program management support.			
Vision 21 Hybrids	**12,488**	**5,029**	**0**
▪ **Vision 21 Hybrids**	**12,360**	**4,979**	**0**
In FY 2006, no additional work is planned in this category. Funds have been redirected to the $400/kW SECA fuel cell under the Innovative Concepts subactivity.			
In FY 2005, the work on tubular SOFC at SWPC will complete its transition to SECA.			
In FY 2004, conduct a redirected Vision 21 enabling cost reduction and performance enhancement program with low-cost Vision 21 fuel cell/turbine hybrid technologies; explore Vision 21 zero-emissions system concepts; conduct system studies and explore fuel flexibility and integration issues as permitted. *Participants include: NETL, GE, FCE, Siemens.*			
▪ **Program Support**	**128**	**50**	**0**
Fund technical and program management support.			
Innovative Systems Concepts	**34,167**	**54,236**	**65,000**
▪ **Innovative Systems Concepts**	**33,816**	**53,694**	**64,350**
In FY 2006, complete prototype tests, validating successful industrial team achievement of SECA Phase I technical requirements for low-cost fuel cell systems; continue SECA core technology R&D to resolve any remaining crosscutting technical issues, such as seals and interconnects and to enhance individual subsystem components and overall system performance to position teams to achieve Phase II intermediate goals and the final SECA system 2010 goal of $400/Kw; continue			

(dollars in thousands)

FY 2004	FY 2005	FY 2006

MW-scale SECA fuel cell and fuel cell hybrids work in support of coal-derived gas-based, FutureGen Fuel Cell systems under the Fuel-Cell Based Central Power System Development solicitation. *Participants include: GE, Siemens Westinghouse, Delphi, FCE/MSRI, Acumentrics, Cummins-SOFCo, PNNL, ANL, NETL, and other core technology participants.*

In FY 2005, begin prototype validation of Phase I technical requirements for low-cost SECA fuel cell systems; enhance individual components and systems performance; conduct SECA core technology R&D to resolve crosscutting technical issues; develop innovative reformers, sensors, and controls; initiate designs of coal-derived gas-based SECA systems as permitted. Initiate MW-scale SECA hybrids work in support of coal-derived gas-based, FutureGen Fuel Cell systems under Fuel-Cell Based Central Power System Development solicitation. *Participants include: GE, Siemens Westinghouse, Delphi, FCE/MRI, Acumentrics, Cummins-SOFC, PNNL, ANL, NETL, and other core technology participants.*

In FY 2004, **SECA** - Developed four concept designs for prototype mid- to high-temperature low-cost solid state fuel cell systems; developed SECA core technology for materials to reduce manufacturing costs, enhance performance, and develop innovative sensors and converters; initiated designs of hybrid coal-based SECA systems. *Participants include: GE/Honeywell, Siemens Westinghouse, FCE/Versa Power, Acumentrics, Delphi, Cummins-SOFC, ANL, PNNL, NETL, and other core technology participants.*

▪ **Program Support**	**351**	**542**	**650**

Fund technical and program management support.

Novel Generation	**2,401**	**2,958**	**0**
▪ **Ramgen**	**2,376**	**2,928**	**0**

In FY 2006, no funding is requested. In accordance with the RU&D Investment Criteria, Ramgen will no longer be funded through direct sourcing. Ramgen is eligible for funding through a competitive, merit-based process under the Turbines program.

In FY 2005, complete work on the RamPressor. *Participants include: Ramgen.*

In FY 2004, continue to openly solicit new fossil-fuel based power generation technology that shows promise of improving efficiencies and/or lower emissions through the novel concepts program. *Participants to be determined.*

▪ **Program Support**	**25**	**30**	**0**

Fund technical and program management support.

Total, Distributed Generation Systems	**69,234**	**77,386**	**65,000**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Fuel Cells	
Advanced Research	
▪ Work ended at HiTEC in FY 2005	-12,083
▪ Program Support	-122
Total, Advanced Research	-12,205
Fuel Cell Systems	
▪ Montana hybrid effort completed in FY 2005; no additional funding required	-2,928
▪ Program Support	-30
Total, Fuel Cell Systems	-2,958
Vision 21 Hybrids	
▪ Tubular SOFC work at SWPC transitioned to SECA; no additional funding required	-4,979
▪ Program Support	-50
Total, Fuel Cell Systems	-5,029
Innovative Systems Concepts	
▪ Increase will maintain SECA program on schedule	+10,656
▪ Program Support	+108
Total, Innovative Systems Concepts	+10,764
Novel Generation	
• Work at Ramgen concluded in FY 2005	-2,928
• Program Support	-30
Total, Novel Generation	-2,958
Total Funding Change, Distributed Generation Systems	**-12,386**

U.S./China Energy and Environmental Center

Funding Schedule by Activity

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
U.S./China Energy and Environmental Center	988	986	986	0	-986	-100.0%
Total, U.S./China Energy and Environmental Center ...	988	986	986	0	-986	-100.0%

Description

The U.S./China Energy and Environmental Technology Center (EETC) is co-funded by the DOE and China's Ministry of Science and Technology. The EETC works to facilitate the export of American goods and services to China's growing power industry, with its focus on increasing the market share of U.S. clean coal technologies.

Benefits

China's growing power industry represents a huge potential market for U.S. goods and services valued at billions of dollars. The adaptation of U.S. clean coal technologies can, in addition to generating export revenue, minimize the global environmental impact of China's growth.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
U.S./China Energy and Environmental Technology Center.....	**988**	**986**	**0**

No funding is request for FY 2006.

In FY 2005, the EETC has a baseline set of activities that includes maintenance of its facilities, support of industrial partners meetings and activities related to the U.S./China Fossil Energy Protocol, and emissions reductions in China. One meeting will include plant tours for Chinese attendees, where they will observe U.S. clean coal technologies in commercial operations. In FY 2005, the EETC is assisting in a study that will result in NO_x reductions from China's largest thermal power plant. Toward this end, the EETC is providing information to plant management on the performance of NO_x control technologies, including those that were developed and demonstrated under the Clean Coal Technology Program. Additionally, the EETC is assisting its Chinese partners in the development of a coal quality management plan for the City of Beijing. Beijing will use the results of this plan in the

(dollars in thousands)

FY 2004	FY 2005	FY 2006

implementation of its planned air quality improvement program which is being undertaken prior to the 2008 Olympic Games. This project is part of an overall EETC program to adapt U.S. techniques for the reduction of emissions from industrial and municipal heating plants in China. These plants emit hundreds of millions of tons of CO_2 annually as well as enormous amounts of pollutants.

In FY 2004, the EETC had a baseline set of activities that included maintenance of its facilities, support of industrial partners meetings and activities related to the U.S./China Fossil Energy Protocol, and emissions reductions in China. Two industrial partners meetings were held in FY 2004, one in February 2004, and the other in the summer of 2004. The summer meeting included plant tours for Chinese attendees, where they observed U.S. clean coal technologies in commercial operations. In FY 2004, the EETC assisted in a study that resulted in NO_x reductions from China's largest thermal power plant. Toward this end, the EETC provided information to plant management on the performance of NO_x control technologies, including those that were developed and demonstrated under the Clean Coal Technology Program. Additionally, the EETC assisted its Chinese partners in the development of a coal quality management plan for the City of Beijing. Beijing used the results of this plan in the implementation of its planned air quality improvement program which is being undertaken prior to the 2008 Olympic Games. This project was part of an overall EETC program to adapt U.S. techniques for the reduction of emissions from industrial and municipal heating plants in China. These plants emit hundreds of millions of tone of CO_2 annually as well as enormous amounts of pollutants.

Total, U.S./China Energy and Environmental Technology Center	**988**	**986**	**0**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
U.S./China Energy and Environmental Center	
It is anticipated that activities will continue into FY 2006 with existing funds	-986
Total, U.S./China Energy and Environmental Center	**-986**

Natural Gas Technologies

Funding Profile by Subprogram

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Natural Gas Technologies	41,836	44,839	44,839	10,000	-34,839	-77.7%
Total, Natural Gas Technologies	41,836	44,839	44,839	10,000	-34,839	-77.7%

Mission

The mission of the Natural Gas Technologies Program has been to develop policies and environmentally friendly technologies that would have stimulated a diverse supply of natural gas, both in North America and around the world, so that the market can function to the benefit of all Americans. Budget discipline necessitated close scrutiny of all Fossil Energy programs, using strict guidelines to determine their effectiveness and compare them to other programs offering more clearly demonstrated and substantial benefits. As a result, the 2006 Budget proposes to conduct orderly termination of the program in FY 2006.

The Program Assessment Rating Tool (PART) was developed by 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. A PART assessment of the Natural Gas R&D program was conducted for the FY 2004 Budget and a reassessment was conducted for the FY 2005 Budget. These programs were rated "Ineffective" in the PART analysis, based primarily on not demonstrating clear results of the research efforts.

Benefits

Improving the ability to supply and deliver needed natural gas to the consumer had economic, national security, and environmental benefits for the country. Economic benefits included (1) savings to consumers, through price reductions that would have accompanied supply expansion, as well as (2) increased profitability to industry through more efficient operations. Environmental benefits would have been realized through more efficient E&P activities and the expanded use of gas to displace less-clean burning fuels in a variety of end-use applications. Increased national security would have been realized through strengthening of the nation's energy supply and further diversification of energy supply sources.

Preliminary benefit modeling was conducted by the Department as part of an integrated program benefits analysis of all the Department's major R&D programs to develop Department-wide program benefits estimates, as part of the effort to conform to the President's Management Agenda. The Department is working to improve consistency across programs in the methodology and assumptions used in estimating program costs and benefits.

Background

DOE's efforts were to expand and diversity the available gas resource base through environmentally-friendly technologies and improved policy options for conventional and unconventional gas supply, methane hydrates, expanded LNG capacity and infrastructure assurance. Although the resource is large, a growing proportion is locked away in complex and deep reservoirs that are not economic to find and produce.

The Natural Gas Technologies program specifically targeted R&D opportunities in existing wells and fields that are operating at the margins of economic viability and unconventional gas resources, most of which exists beyond the margins of current economic feasibility. The program also focused on fundamental, long-term R&D for frontier resources such as Methane Hydrates and ultra-deep gas.

Strategic and Program Goals

The Department's Strategic Plan identified four strategic goals (one each for defense, energy, science, and environmental aspects of the mission) plus seven general goals that tie to the strategic goals. The Natural Gas Technologies program supports the following goal in FY05:

Energy Strategic Goal

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 Natural Gas Technologies program has one program goal, which contributed to General Goal 4 in the "goal cascade".

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.

Contribution to Program Goal 04.56.00.00 Natural Gas Technologies, Abundant Affordable Gas

The Program Goal was to support General Goal 4. In FY 2006, the Natural Gas Technologies program's goal is to conduct orderly termination of this program. The only remaining benefit will be that reflected in the FY 2005 Joule submission to "complete four of the prototype near-term products or field tests in advanced drilling, stripper-well enhancement, and gas storage and define gas hydrate deposits through laboratory analysis." This work will be conducted utilizing FY 2005 and prior year funds.

Annual Performance Results and Targets

FY 2001 Results	FY2002 Results	FY 2003 Results	FY 2004 Results	FY2005 Targets	FY2006 Targets
Program Goal 04.56.00.00 Natural Gas Technologies, Abundant Affordable Gas					
Exploration and Production					
	Demonstrate safe economic slimhole drilling technology in actual use under Arctic conditions. This technology can significantly reduce cost and environmental impacts. (MET GOAL) 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. (MET GOAL)	Complete basin model for the Wind River basin and well site selection in Greater Green River Basin to evaluate integrated remote sensing, seismic surveys and basin structural analysis to differentiate gas-bearing from uneconomic fractured reservoirs, complete a conceptual model of regional water distribution to help operators avoid poor production areas, and build and have field ready an initial prototype of a 400-geophone receiver array to improve seismic resolution necessary to locate economically productive gas zones. (MET GOAL) Conduct 2 field tests of improved drilling technology that will improve the productivity of gas reservoirs and reduce drilling costs and 2 field tests of technologies to improve natural fracture detection to increase the percentage of economically producing wells of all wells drilled. (MET GOAL)	Conduct laboratory studies and feasibility analyses necessary to justify the next stage of R&D for a drilling vibration monitoring and control system, a novel mud hammer, high-temperature high-pressure cements, gas resources in the Uinta and Anadarko basins, and high- temperature electronics. This is accomplished by completing prototype development and validation testing of data fusion algorithms, a power amplifier, and simulating software for fractured reservoirs prior to field trials.(MET GOAL) (4.56.1) Complete field tests and analysis of stripper well technologies, a jet assisted drilling system, advanced fracture stimulation designs, natural fracture predictions, and downhole power and communications systems to determine the overall technical and cost efficiency of the technology and the next step(s) to be taken, i.e., commercialization, additional modifications and testing, or termination. (MET GOAL) (4.56.2)	Complete four of the prototype near-term products or field tests from the following critical technology areas: advanced drilling, and stripper-well enhancement, and gas storage.. When these technologies are fully transferred to industry, they will substantially reduce costs or increase efficiency in gas exploration and, production and storage. Benefits will be based on modeling estimates. The prototype projects can be found on the program's website. (4.56.1)	Conduct orderly termination of all activities.
Gas Hydrates					
Quantify a hydrate deposit by correlating core samples with geophysical and well log data. (MET GOAL)		Exchange information and coordinate effort between government agencies. Award subprojects under Joint Industry Projects for Gulf of	Hold interagency meetings to exchange hydrate information and coordinate hydrate efforts between government agencies; issue newsletters; and hold		

FY 2001 Results	FY2002 Results	FY 2003 Results	FY 2004 Results	FY2005 Targets	FY2006 Targets
		Mexico seafloor stability and monitoring programs. Issue newsletters, publish available technical reports on the methane hydrate website, and hold 2 workshops to communicate program results to researchers. Conduct annual Federal Advisory Committee meeting. (MET GOAL)	workshops to communicate program results to stakeholders. (MET GOAL) (4.56.3)		
		Complete hydrate modeling for Alaska drilling program. Report strength and thermal property tests at national labs, this is fundamental data needed to model production and seafloor stability of hydrates. Develop prototype Raman Spectroscopy to use lasers to define hydrate molecular structure. (MET GOAL)	Complete laboratory analysis of core samples from the Malik research well and the Hot Ice No. 1 well, thermal property and thermal conductivity measurements, and complete installation of a 12-liter hydrate cell to obtain the necessary data for modeling and characterizing hydrate deposits. (MET GOAL) (4.56.4)	Conduct an ocean expedition to retrieve gas hydrate samples for laboratory analysis. This will increase the understanding of sub-sea resources, which is a prerequisite for development of safe production technologies. (4.56.2)	Conduct orderly termination of all activities.
		Complete initial report of improved hydrate coring device on Ocean Drilling Program, Leg 204. Study of oceanic samples is essential to understanding the distribution and properties of hydrates in nature. Drill 1 test well to determine aerial extent of hydrate occurrence in Alaska. Complete evaluation of hydrate occurrence in Gulf of Mexico to understand the interaction of hydrate and seafloor stability. (MET GOAL)	Complete field tests of hydrate logging and coring operations in the Gulf of Mexico, and drilling and coring Hot Ice No. 1, and analyze results and publish reports on ODP leg 204 and Malik well to advance our understanding of seafloor stability and production potential. (MET GOAL) (4.56.5)		
Infrastructure					
		Complete laboratory testing and begin field demonstration of an improved remedial technology for storage wells. (MET GOAL)			Conduct orderly termination of all activities.

FY 2001 Results	FY2002 Results	FY 2003 Results	FY 2004 Results	FY2005 Targets	FY2006 Targets
Effective Environmental Protection					
		Analyze results of bench-scale reverse osmosis in produced water treatment equipment. Develop kinetics for model compounds to be used in enzymatic and biomimetic catalysts for upgrading heavy crude oils. Construct greenhouse prototype for phytoremediation for methane (natural gas) from coal beds (CBM) water. Collect data on fine particulate matter emission factors. These studies will provide the scientific basis for lower-cost commercial-scale environmental technologies. (MET GOAL)	Ensure that refining and gas production and use are safe for the environment and the public by conducting field tests and data analysis for remediation, produced water treatment, and synthetic mud technologies. Also preparing baseline characterization of impacts of Wyoming and Montana coalbed methane (gas from coal seams) production on groundwater systems and utilizing laser-coupled technology to identify natural gas distribution system leaks. (MET GOAL) (4.56.6)		Conduct orderly termination of all activities.

Means and Strategies

For FY 2006, the strategy will be to conduct orderly termination of the program. Funding in FY 2006 will be used for legal obligations incurred by the termination process.

Validation and Verification

The program was a major supporter of DOE's performance measures tracking system (Joule) and pioneered many of the system's tracking and reporting tools. GPRA reporting requirements were handled through the Joule system, and the program also used the same Joule software to track performance on a number of additional measures covering the full breath of the program's activities (FE Joule) including efforts to track the status of key outreach milestones into Joule. In FY 2004, the program achieved a "Green".

To validate and verify program performance, FE conducts various internal and external reviews and audits. FE's programmatic activities are subject to continuing review by the Congress, the General Accounting Office, the Department's Inspector General. In addition, various Operations/Field Offices commission external independent reviews of site baselines or portions of the baselines. Additionally, FE Headquarters senior management and Field managers conduct quarterly, in-depth reviews of cost, schedule, and scope to ensure projects are on-track and within budget.

Collaboration Activities: The impact of the Domestic Gas Supply program was expanded by: performing R&D activities in partnership with universities, State and local governments, industry, and other stakeholders; using cost-share projects and diverse technology paths to improve chances of success, and to create a direct technology transfer component; seeking synergy of the capabilities of multiple governmental agencies and industry, including the unique capabilities of National Laboratories; collaborating with other agencies to effectively promulgate domestic production technologies; investing jointly with other groups in promising technologies for target resource areas; conducting, with input from National Laboratories, field demonstrations in collaboration with industry, academia, and others; and transferring technologies in cooperation with State and industry organizations.

External Factors Affecting Performance: Access to pubic land is the single most important factor impacting the supply of domestic natural gas. Additional factors include world oil prices, corporate mergers and acquisitions, availability and cost of capital, and new and evolving environmental legislation and regulation may affect gas program results.

Planned Program Evaluation: The Office of Natural Gas and Petroleum Technology annually performed an internal review of the R&D portfolio as an integral part of annual budget preparation. Projects were evaluated periodically at contractor review conferences and as part of road-mapping workshops to determine R&D gaps. National Energy Technology Laboratory (NETL) individually monitored projects with status and major milestone reporting documented in a NETL project database. NETL in-house R&D projects were peer reviewed by external experts from academia and industry. DOE has recently developed specific metrics to better quantify and value R&D results. In addition, program benefits were estimated using the National Energy Modeling System (NEMS) supported by macroeconomic and detailed industry-specific models. Modeling assumptions and methods were reviewed externally, and the results are compared to results from other programs to determine the best application of R&D resources.

Program Assessment Rating Tool (PART)

PART was developed by 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. A PART assessment of the Natural Gas Technologies program was conducted for the FY 2004 Budget and a reassessment was conducted for the FY 2005 Budget. The program was rated "Ineffective" in the Program Assessment Rating Tool analysis, based primarily on not demonstrating clear results of the research efforts.

The Department has developed preliminary baseline benefit estimates for its applied R&D programs, but needs to improve consistency across programs in the methodology and assumptions used in estimating program costs and benefits.

Funding by General and Program Goal

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
General Goal 4, Energy Security			
Program Goal 04.56.00.00, Natural Gas Technologies, Abundant Affordable Gas			
Exploration and Production	21,590	23,666	10,000
Gas Hydrates	9,150	9,368	0
Infrastructure	8,695	8,354	0
Effective Environmental Protection	2,401	3,451	0
Total, General Goal 4 (Natural Gas Technologies)	41,836	44,839	10,000

Natural Gas Technologies

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Natural Gas Technologies					
Exploration and Production	21,590	23,666	10,000	-13,666	-57.7%
Gas Hydrates	9,150	9,368	0	-9,368	-100.0%
Infrastructure	8,695	8,354	0	-8,354	-100.0%
Effective Environmental Protection	2,401	3,451	0	-3,451	-100.0%
Total, Natural Gas Technologies	41,836	44,839	10,000	-34,839	-77.7%

Detailed Justification

	(dollars in thousands)		
	FY 2004	FY 2005	FY 2006
Exploration and Production.....	**21,590**	**23,666**	**10,000**

The program focused on technology to find and produce gas from non-conventional and deep gas reservoirs with minimal environmental impact. Also included were resource assessments in new basins, advanced diagnostics and imaging, and drilling completion and stimulations.

- **Conclude Program**..... **0** **0** **9,900**

  In FY 2006, conduct orderly termination of the Natural Gas Technology Program activities in Exploration and Production, Gas Hydrates, Infrastructure, and Effective Environmental Protection. Funding in FY 2006 will be used for legal obligations incurred by the termination process**.** *Participants: NETL, TBD.*

  In FY 2005 and FY 2004 no funding was requested.

- **Advanced Drilling, Completion and Stimulation** . **9,501** **7,306** **0**

  In FY 2006, closeout activities included above.

  In FY 2005, Deep Trek projects for high temperature electronics, super cement, and advanced MWD will complete prototype development. Research in enhanced telemetry and active drilling vibration dampeners will be completed. Benchmarking of drilling fluids and bits for extreme HT-HP environments will be completed. *Participants include: NETL, APS Technologies, MASI Technologies, Honeywell, Schlumberger, E-Spectrum, Novatek, Mauer, Cementing Solutions, Terra Tek, GTI, TBD*

  FY 2004 funding continued development of real-time fracture height growth diagnostic tool, ultra-light weight cement for deep water applications, high-pressured coiled tubing drilling system, mud hammer, long-term, revolutionary technologies such as laser drilling and perforations, technologies for drilling deeper than 16,000 feet including high performance drilling and completion systems, advanced coatings and hardening of "Smart" systems and sensors. *Participants included: NETL, Honeywell, Schlumberger, E-Spectrum, Novatek, Mauer, Tempress, Tech Int., Cementing Solutions, Real-Tme Zone, Terra Tek, GTI, TBD*

- **Advanced Diagnostics and Imaging Systems** **3,846** **3,777** **0**

  In FY 2006, closeout activities included above.

  In FY 2005, conduct work on projects selected in the Advanced Diagnostics and Imaging area, which investigate improved methods of imaging deep gas targets to improve industries success rate of finding new gas. A geologic play book for the Trenton-play in the Appalachian basin will be completed and work on resource assessments of deep plays in Alabama will be conducted. *Participants include: 3DGeo, Paulsson Geophysical, WVU Research Corp, RSI, Technology Intl., U. Alabama, U. Texas (BEG), TBD.*

(dollars in thousands)

FY 2004	FY 2005	FY 2006

FY 2004 funding continued development of infill drilling optimization in the San Juan basin and Delaware basin of New Mexico, next generation of fracture detection technologies, long-term sustainability of gas supply study in Rocky Mt. basins, improved completion technologies, solutions to high water production problems in tight sand regions, super high resolution seismic tools and shear wave imaging. *Participants included: NETL, ARI, Stanford, LBL, SUNY, SNL, Paulsson Geophysical, University of Texas, Cementing Solutions, N. Mex. Tech.*

- **Multi National Laboratory/ Industry Partnership** **1,922** **1,464** **0**

In FY 2006, closeout activities included above.

In FY 2005, funding will conduct work on projects focused on advanced drilling, and MWD and LWD tools.

FY 2004 funding continued research in 10 projects focused on advanced drilling, completion, and stimulation technologies and advanced diagnostics and imaging technologies.

- **Stripper Well Revitalization** **1,153** **1,100** **0**

In FY 2006, closeout activities included above.

In FY 2005, DOE will conduct work on the National Stripper Well Consortium involving industry and the research community to investigate multiple technologies to improve stripper well production topreventabandonment. In addition, DOE will support industry-led efforts in technology transfer through workshops and publications focused on the small- to mid-sized independents. *Participants: Penn St. University*

FY 2004 funding continued National, industry-driven consortium to investigate multiple technologies to improve stripper well production. *Participants included: Penn St. Univ.*

- **Technology Transfer** **494** **493** **0**

In FY 2006, closeout activities included above.

In FY 2005, funding will conduct work on industry led efforts in technology transfer. *Participants included: PTTC.*

FY 2004 funding continued industry led efforts in technology transfer. *Participants included: PTTC, Hart Publications.*

- **Deep Trek** **1,481** **1,479** **0**

In FY 2006, closeout activities included above.

In FY 2005, conduct research on developing critical high temperature electronic components and an advanced high temperature MWD system needed by industry to drill and complete deep gas wells. *Participants included: Honeywell, Schlumberger.*

FY 2004 funding continued development of technologies for drilling deeper than 16,000 feet below the earth's surface, including high performance drilling and completion systems, advanced coatings and hardening of "Smart" systems and sensors, low friction, wear resistant coatings/materials. *Participants included: SNL, Honeywell, Schlumberger.*

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
▪ **Liquefied Natural Gas**	**0**	**3,896**	**0**

In FY 2006, closeout activities included above.

In FY 2005, DOE will conduct analyses of the economic impact of LNG supplies in the U.S. market and specific safety and security issues related to the delivery of LNG to terminals in the U.S. A federal task force will be established to streamline the LNG terminal approval process. *Participants include: Conversion Gas Imports, GTI/University of Arkansas, New York State Electric and Gas,DOT/OPS, Coast Guard, MMS, FERC TBD*

No funding was requested in FY 2004.

▪ **Arctic Research**	**2,917**	**3,914**	**0**

In FY 2006, closeout activities included above.

In FY 2005, conduct work supporting the Arctic Energy Office.

FY 2004 funding supported the Arctic Energy Office and a study concerning the natural gas pipeline.

▪ **Program Support**	**276**	**237**	**100**

Fund technical and program management support.

Gas Hydrates	**9,150**	**9,368**	**0**

Gas Hydrates, located in Alaska and the Gulf of Mexico and other offshore locations of the U.S., contain huge resources of natural gas (if only 1% were economically producible, we could triple our resource base). In addition to their potential as a resource, hydrates appear to have implications for the global climate. Significant research is needed to provide the knowledge and technology to understand the fundamental characteristics of hydrates by 2010, and commercially produce gas from hydrates starting in 2015-2020, when more conventional resources decline. Because this research is high risk and long-term, and could potentially lower the value of current reserves, there is little incentive for industry to take the lead in hydrate development

▪ **Gas Hydrates**	**9,057**	**9,274**	**0**

In FY 2006, closeout activities included above.

In FY 2005, the program will conduct work on its assessment of gas hydrates to analyze seafloor stability and safety issues and the potential resource in the Gulf of Mexico through an ongoing joint industry project to collect deep stratigraphic cores from hydrate formations as well as continue the development of instrumented arrays for future deployment in the GoM. Characterization well sites will be prioritized in Alaska to assess the hydrate resource. Scientists at NETL and other national labs will conduct work on hydrate characterization. *Participants include: Chevron Texaco, U. Mississippi, BP, U. Alaska, USGS, MMS, NOAA, NSF, NETL, National Labs.*

In FY 2004 the program will support one ongoing joint industry project needed to drill initial coring wells in the Gulf of Mexico in order to assess the potential resource in the Gulf of Mexico. In addition, one Alaska hydrate project funded in FY 2003 will be continued to assess the extent of gas resources locked in hydrate formations in Alaska. Main emphasis will be on taking stratigraphically

deep cores from hydrate formations in the Gulf of Mexico. *Participants include: TBD, Chevron Texaco*

- **Program Support** **93** **94** **0**

  Fund technical and program management support.

Infrastructure **8,695** **8,354** **0**

This program developed technology to ensure the operational reliability and integrity of transmission and utility distribution pipeline systems. The research was focused on five categories: inspection technologies, remote sensing, materials development, operational technologies, and storage. Benefits of the program were expected to be reduced greenhouse methane emissions, increased pipeline capacity, improved pipeline assessment techniques, more efficient pipeline operations, and increased safety and security.

- **Storage Technology** **1,908** **1,185** **0**

  In FY 2006, closeout activities included above.

  In FY 2005, DOE will conduct work on an industry-led consortium in gas storage and conduct work on developing an advanced method for developing cavernous storage in carbonate formations. *Participants: Penn State University and Clemson University.*

  FY 2004 funding was used to continue development of an energy meter, to establish an industry driven underground gas storage consortium, initiate bedded salt and electronic flow meter data modeling efforts, and initiate field testing of critical components of a novel LNG process. *Participants included SwRI, Terralog, Schlumberger, Conversion Gas Imports, Furness-Newbruge, Penn State University.*

- **Delivery Reliability** **6,649** **7,085** **0**

  In FY 2006, closeout activities included above.

  In FY 2005, conduct research on ensuring the reliability and integrity of the gas transmission and distribution network, developing smart automated inside pipeline inspection sensor systems, obstacle detection systems for horizontal boring applications for laying distribution pipelines, developing systems capable of detecting external force damage, developing technology to improve the efficiency for reciprocating and turbo compressors, and developing advance technology capable of determining pipeline wall integrity. *Participants included SwRI, Tuboscope, NYGAS, GTI, Battelle, CSU, ARC, ANL, INEEL, LLNL, SNL, ORNL, PNNL, NETL..*

  In FY 2004, 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 compressors, and develop advance technology capable of determining pipeline wall integrity. *Participants included SwRI, Tuboscope, NYGAS, GTI, Battelle, CSU, ARC, ANL, INEEL, LLNL, SNL, ORNL, PNNL, NETL.*

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
▪ **Program Support**	**138**	**84**	**0**
Fund technical and program management support.			
Effective Environmental Protection	**2,401**	**3,451**	**0**
This program sought to reduce the environmental impacts of gas operations and reduce the cost of environmental compliance through a combination of technology development, risk assessment, and regulatory streamlining. The program emphasized research that would improve access to onshore public lands.			
▪ **Environmental Science**	**2,376**	**3,416**	**0**
In FY 2006, closeout activities included above.			
In FY 2005 and FY 2004, conduct work on targeted initiatives to define and solve specific problems in key focus areas, specifically: 1) environmental barriers to coal bed methane production, and 2) air quality issues affecting natural gas production. Develop objective, credible data for regulatory decisions as part of a program-wide environmental strategy for maintaining sustainable supplies of natural gas. *Participants include: NETL, National Labs, TBD.*			
▪ **Program Support**	**25**	**35**	**0**
Fund technical and program management support.			
Total, Natural Gas Technologies	**41,836**	**44,839**	**10,000**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Exploration and Production	
• Budget discipline necessitated close scrutiny of all Fossil Energy programs, using strict guidelines to determine their effectiveness and compare them to other programs offering more clearly demonstrated and substantial benefits. As a result, the 2006 Budget proposes to conduct orderly termination of the program in FY 2006	-34,839
Total Funding Change, Natural Gas Technologies	**-$34,839**

Oil Technology

Funding Profile by Subprogram

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Oil Technology	34,107	33,921	33,921	10,000	-23,921	-70.5%
Total, Oil Technology	34,107	33,921	33,921	10,000	-23,921	-70.5%

Mission

The mission of the Oil Technology Program has been to implement a policy and technology research and development program to resolve the environmental, supply, and reliability constraints of producing oil resources. Budget discipline necessitated close scrutiny of all Fossil Energy programs, using strict guidelines to determine their effectiveness and compare them to other programs offering more clearly demonstrated and substantial benefits. As a result, the 2006 Budget proposes to conduct orderly termination of the program.

The Program Assessment Rating Tool (PART) was developed by 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. A PART assessment of the Oil R&D program was conducted for the FY 2004 Budget and a reassessment was conducted for the FY 2005 Budget. These programs were rated "Ineffective" in the PART analysis, based primarily on not demonstrating clear results of the research efforts.

Benefits

Each year Fossil Energy estimates the benefits of program activities to support Government Performance and Results Act (GPRA) reporting. Methods are complex and vary by program. The Oil and Gas Programs have traditionally used two separate economic and engineering modeling systems to calculate selected economic and energy security benefits. In 2004, as part of the effort to better conform to the President's Management Agenda, Fossil Energy undertook an integrated program benefits analysis of oil, natural gas, coal and power systems research within Fossil Energy to develop Fossil Energy-wide program benefits estimates. This analysis was to examine all Fossil Energy research programs on a common basis with respect to modeling assumptions and should have enabled aggregate and comparative assessments of the benefits of Fossil Energy research programs.

The Department is working to improve consistency across programs in the methodology and assumptions used in estimating program costs and benefits.

Background

The Oil Technology program budget delineated program goals, such as Enhanced Oil Recovery/CO_2 Injection, Domestic Resource Conservation, and Environmental Science, as funding categories. When appropriate, collaborations with other Federal agencies, industry, academia, and states were used to meet program goals.

The Oil Technology Program included research to support technology development and policy decision-making and to allow greater access to energy resources with minimal environmental impact.

Strategic and Program Goals

The Department's Strategic Plan identified four strategic goals (one each for defense, energy, science, and environmental aspects of the mission) plus seven general goals that tie to the strategic goals. The Oil Program supported the following goal:

Energy Strategic Goal

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 Oil Technology program has one program goal, which contributed to General Goal 4 in the "goal cascade".

Program Goal 04.57.00.00: Oil Technology, Abundant Oil: 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 Program Goal 04.57.00.00: Oil Technology, Abundant Oil

In FY 2006, with program closeout, the only remaining benefit will be that reflected in the FY 2005 Joule submission to "develop technologies through 4 projects which will contribute to increased domestic oil supplies in an environmentally friendly manner." This work will be conducted utilizing FY 2005 and prior year funds.

Annual Performance Results and Targets

Program Goal 04.57.00.00 Oil Technology, Abundant Oil

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Results	FY 2005 Targets	FY 2006 Targets
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. (NEARLY MET GOAL) 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. (BELOW EXPECTATIONS)	Demonstrate a small-diameter, lightweight composite drill pipe for ultra-short radius drilling. (MET GOAL)	Increase access to the domestic oil resources remaining in the reservoir due to lack of advanced technology. Focus on high risk research (award 6 projects and issue 1 solicitation - Micro-hole technologies) for future applications on state and federal lands and waters, and on addressing nearer-term barriers. Select and award 4 projects with independents, and on a regional basis award 4 projects-PUMP. Award 2 projects in Advanced Technologies and select band award projects under the Broad Funding Announcement. (MET GOAL) Advance the state-of-the-art in oil recovery processes by conducting bench tests (in surfactant behavior, and in paraffin deposition) and develop conceptual models and techniques related to chemical flooding, reservoir and flow simulation, reservoir characterization for enhanced oil recovery technologies to increase the amount of oil that can be recovered from discovered reservoirs (MET GOAL) Reduce the number of dry holes drilled in frontier areas, and increase near-term energy security through field testing (3 projects) improved oil recovery techniques, seismic (1 project), data acquisition (2 projects), and interpretation (1 project) in existing light and heavy oil reservoirs at sites ranging from Alaska to Utah. Initiate full-scale test of newly developed	Enhance access to remaining domestic oil resources using advanced technology by focusing on high-risk research (award 3 projects—Micro-hole technology); issuing competitive solicitation and awarding three projects. Initiate Russian cooperative Research Program; and conduct model integration peer review and industry strategic program review. (MET GOAL) (4.57.1) Advance the state-of-the-art in oil recovery processes by conducting bench tests in surfactant behavior (2 projects); modeling on-conventional reservoirs, studying gel control of water production, developing seismic algorithms to better identify hydrocarbon targets; testing 2 prototypes (3-phase separator and micro-hole completion), modeling sweep efficiency for enhanced oil recovery technologies to increase the amount of oil that can be recovered from discovered reservoirs, and completing tundra modeling and pond work, conducting wettability studies as well as initiating fracture development study. (MET GOAL) (4.57.2)	Develop technologies through 4 projects which will contribute to increasing domestic oil supplies in an environmentally friendly manner. (4.57.1)	Orderly terminate all activities.

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Results	FY 2005 Targets	FY 2006 Targets
		vibration sonic tool. (NEARLY MET GOAL) Stimulate current production through accelerated transfer of technology to U.S. producers, especially small independent companies that have limited exposure to the technology needed to increase the oil resource base through 66 regional workshops, including one on micro-hole technologies, publish 2 newsletters, and 2 reports. (MET GOAL)			

Means and Strategies

For FY 2006, the strategy will be to conduct orderly termination of the program Funding in FY 2006 will be used for legal obligations incurred by the termination process.

Validation and Verification

The Oil Program has impacted the domestic oil supply by performing R&D activities in partnership with universities, State and local governments, industry, and other stakeholders; using cost-share projects and diverse technology paths to improve chances of success, and to create a direct technology transfer component and seeking synergy of the capabilities of multiple governmental agencies, including the unique capabilities of National Laboratories and industry collaborating with other agencies to effectively promulgate and transfer domestic production technologies to the public.

Planned Program Evaluation:
The Office of Natural Gas and Petroleum Technology annually performs an internal review of the R&D portfolio as an integral part of annual budget preparation. Projects are evaluated periodically at contractor review conferences and as part of road-mapping workshops to determine R&D gaps. National Energy Technology Laboratory (NETL) technology managers individually monitor projects with status and major milestone reporting documented in a NETL project database. NETL in-house R&D projects are peer reviewed by external experts from academia and industry.

To validate and verify program performance, FE conducts various internal and external reviews and audits. FE's programmatic activities are subject to continuing review by the Congress, the General Accounting Office, the Department's Inspector General. In addition, various Operations/Field Offices commission external independent reviews of site baselines or portions of the baselines. Additionally, FE Headquarters senior management and Field managers conduct quarterly, in-depth reviews of cost, schedule, and scope to ensure projects are on-track and within budget.

Program Assessment Rating Tool (PART)

PART was developed by 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. A PART assessment of the Oil Technology program was conducted for the FY 2004 Budget and a reassessment was conducted for the FY 2005 Budget.

The program was rated "Ineffective" in the Program Assessment Rating Tool analysis, based primarily on not demonstrating clear results of the research efforts

The Department has developed preliminary baseline benefit estimates for its applied R&D programs, but needs to improve consistency across programs in the methodology and assumptions used in estimating program costs and benefits.

Funding by General and Program Goal

	FY 2004	FY 2005	FY 2006
General Goal 4, Energy Security			
Program Goal 04.57.00.00, Oil Technology, Abundant Oil			
Exploration and Production	17,939	18,736	10,000
Reservoir Life Extension/Management	6,723	5,916	0
Effective Environmental Protection	9,445	9,269	0
Total, General Goal 4 (Petroleum – Oil Technology)	34,107	33,921	10,000

Oil Technology

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Oil Technology					
Exploration and Production.....	17,939	18,736	10,000	-8,736	-46.6%
Reservoir Life Extension/ Management.....	6,723	5,916	0	-5,916	-100.0%
Effective Environmental Protection.....	9,445	9,269	0	-9,269	-100.0%
Total, Oil Technology.....	34,107	33,921	10,000	-23,921	-70.5%

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Exploration and Production	**17,939**	**18,736**	**10,000**

The program focused on development of technologies to economically recover the oil remaining in mature fields by expanding the technology options for enhanced oil recovery. In FY 2006, the program will orderly terminate all Oil Technology activities.

- **Conclude Program** **0** **0** **9,900**

  In FY 2006, conduct orderly termination of the Oil Technology Program activities in Exploration and Production, Reservoir Life Extension and Effective Environmental Protection. Funding in FY 2006 will be used for legal obligations incurred by the termination process. *Participants: NETL, TBD.*

  No activities in FY 2004 and FY 2005.

- **EOR/CO_2 Injection** **1,975** **2,386** **0**

  FY 2006 closeout activities included above.

  In FY 2005, conduct work on short and long term efforts to enhance utilization of industrial CO_2. The strategy is to increase the adoption of 'best practices' to opportunities existing in the near-term. Specifically, basin-wide strategies will be examined to identify ways to lower cost and accelerate infrastructure development to cost effectively deliver CO_2 from industrial sites to candidate oil fields; this effort includes resolving potential permitting and regulatory issues. *Participants include LBNL, LANL, NETL, TBD.*

(dollars in thousands)

FY 2004	FY 2005	FY 2006

In FY 2004, reservoirs will be identified based upon economics, technological issues, and feasibility for benefit from CO_2 injection. Technology to make CO_2 flooding applicable to a wider class of reservoirs will be pursued. Oil reservoirs will be mapped with locations of existing industrial sources and the price and/or incentives for CO_2 that would be needed to make the project economical. Flooding scenarios will be considered to leave maximum CO_2 in the reservoir. Program success will offer options for future carbon management policy choices. *Participants: NETL, Northrop Grumman, National Labs, TBD.*

- **Diversity of Global Oil Supply** **0** **976** **0**

FY 2006, closeout activities included above.

In FY 2005, conduct work on diversification of international sources of oil supplies through bilateral activities with nations that are expanding their oil industry, including Norway, Canada, Mexico, and others. Bilateral and multi-lateral work will include technology exchanges and joint research, development and demonstration under the Administration's North American Initiative and other international agreements. *Participants to be determined.*

No funding was requested for this activity in FY 2004.

- **Advanced Drilling, Completion and Stimulation** **1,972** **2,071** **0**

FY 2006 closeout activities included above.

In FY 2005 conduct work on upgrades to the Advanced Cuttings Transport Facility that allow high-temperature/high-pressure experimentation on energized fluids (air, mist, gas assisted, foam, etc.) and synthetic drill fluids, cements, and transport of fluids in horizontal and inclined wellbores. *Participants included: Northrop Grumman, University of Tulsa, DEA, APS Technology, Impact Technologies, National Labs, NETL.*

In FY 2004 funding continued upgrades to the Advanced Cuttings Transport Facility that allowed high-temperature/high-pressure experimentation on energized fluids (air, mist, gas assisted, foam, etc.) and synthetic drill fluids, cements, and transport of fluids in horizontal and inclined wellbores. *Participants included: Northrop Grumman, University of Tulsa, DEA, APS Technology, Impact Technologies, National Labs, NETL.*

- **Advanced Diagnostics and Imaging Systems**..... **4,939** **4,832** **0**

FY 2006 closeout activities included above.

In FY 2005, conduct work on development of 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. Complete work on fundamental geoscience efforts focusing on geoscience/engineering reservoir characterization on naturally fractured reservoirs. *Participants included: Cal Tech, Northrop Grumman, Univ of Houston, Univ of Kansas, CSM, Stanford Univ, Univ of TX @ Austin, Mich Tech, Univ of Illinois, MT BOM, NMIMT, Western Michigan Univ, Adv Resources, Wm Marsh Rice Univ, NETL.*

(dollars in thousands)

FY 2004	FY 2005	FY 2006

In FY 2004, funding continued development of advanced reservoir diagnostics and imaging systems to optimize oil discovery and recovery. Developed quantitative engineering parameters that control rock-fluid interactions which impact oil production. Continued fundamental geoscience efforts focusing on geoscience/engineering reservoir characterization on naturally fractured reservoirs. *Participants included: Cal Tech, Northrop Grumman, Univ of Houston, Univ of Kansas, CSM, Stanford Univ, Univ of TX @ Austin, Mich Tech, Univ of Illinois, MT BOM, NMIMT, Western Michigan Univ, Adv Resources, Wm Marsh Rice Univ, NETL.*

- **Multi-National Laboratory/Industry Partnership and National Laboratory Supporting Research**..... **1,975** **1,479** **0**

FY 2006, closeout activities included above.

In FY 2005, conduct work on the transfer of technologies that advance understanding of the characteristics and producibility from oil reservoirs. *Participants included: National Labs*

In FY 2004, funding continued the transfer of technologies that advance understanding of the characteristics and producibility from oil reservoirs. *Participants included: National Labs*

- **Reservoir Efficiency Processes**..... **4,432** **3,875** **0**

FY 2006 closeout activities included above.

In FY 2005, conduct work on development of improved gas flooding recovery methods and advanced the state-of-the-art in reservoir simulation. *Participants included: NETL, Northrop Grumman, NMIMT, Univ of TX, Cal Tech, Univ of OK, Univ of Kansas, Univ of TX @ Austin, Stanford Univ, Correlations Company, Adv Resources Intl, Univ of Utah, Univ of Pitts, Univ of Houston, Univ of Oklahoma, TBD.*

In FY 2004, funding continued development of improved gas flooding recovery methods and advanced the state-of-the-art in reservoir simulation. *Participants included: NETL, Northrop Grumman, NMIMT, Univ of TX, Cal Tech, Univ of OK, Univ of Kansas, Univ of TX @ Austin, Stanford Univ, Correlations Company, Adv Resources Intl, Univ of Utah, Univ of Pitts, Univ of Houston, Univ of Oklahoma, TBD.*

- **Arctic Research**..... **1,481** **1,954** **0**

FY 2006, closeout activities included above.

In FY 2005, conduct research on the oxygen transport membrane being conducted at the University of Alaska, Fairbanks. Complete research in oil-related projects through the Office of Arctic Energy including tundra travel model for the North Slope of Alaska, characterization and alteration of wettability states of Alaskan reservoirs, and physical, biological and chemical implications of mid-winter pumping of tundra ponds. Participants included UAF, AK Dept. Natural Resources, TBD.

(dollars in thousands)

FY 2004	FY 2005	FY 2006

In FY 2004, research continued on the oxygen transport membrane being conducted at the University of Alaska, Fairbanks. Other research was conducted in oil-related projects through the Office of Arctic Energy including tundra travel model for the North Slope of Alaska, characterization and alteration of wettability states of Alaskan reservoirs, and physical, biological and chemical implications of mid-winter pumping of tundra ponds. *Participants included UAF, AK Dept. Natural Resources, TBD.*

- **Russia Technology Program**..... **988** **976** **0**

  FY 2006 closeout activities included above.

  In FY 2005, conduct work on the Russian Cooperative Research Program including one or more of the following technology focus areas: USGS-Russian Offshore Arctic Resource Assessment; World Bank Global Gas Flaring Initiative; Arctic Construction and Operations Technology Transfer Initiative; "Full Value Chain" Oil Spill Restoration; Prevention, and Response Program; and/or, U.S.-Russia Commercial Energy Summit Education Initiative. Participants: TBD

  In FY 2004, the Russian Cooperative Research Program will include the following technology focus areas: USGS-Russian Offshore Arctic Resource Assessment; World Bank Global Gas Flaring Initiative; Arctic Construction and Operations Technology Transfer Initiative; "Full Value Chain" Oil Spill Restoration; Prevention, and Response Program; and/or, U.S.-Russia Commercial Energy Summit Education Initiative. Participants: TBD

- **Program Support**..... **177** **187** **100**

  Fund technical and program management support.

Reservoir Life Extension/Management **6,723** **5,916** **0**

- **Domestic Resource Conservation** **6,653** **5,857** **0**

  FY 2006 closeout activities included above.

  In FY 2005, conduct work on the following elements: 1) Key technology prototype development, such as micro-hole technologies, for enabling improved access and minimizing environmental impact; 2) Technology transfer with special emphasis on independents; and 3) Policy analysis and planning to prioritize program efforts and provide policy evaluations to maximize impact on domestic oil recovery over a wide range of technological and economic conditions. *Participants include PTTC, Northrop Grumman, CDO, Univ of Kansas, Penn State, NETL and TBD.*

  In FY 2004, elements include: 1) Key technology prototype development, such as micro-hole technologies, for enabling improved access and minimizing environmental impact; 2) Technology transfer with special emphasis on independents; and, 3) Policy analysis and planning to prioritize program efforts and provide policy evaluations to maximize impact on domestic oil recovery over a wide range of technological and economical conditions. *Participants: Bandera Petroleum, Western Well Tool Company, Baker Hughes, Schlumberger, Northrop Grumman, Penn State Stripper Well Consortium, Veneco, Dennis Tool, CDO, Stolar Research, Gas Production Specialists, NETL, TBD.*

	(dollars in thousands)		
	FY 2004	FY 2005	FY 2006
▪ **Program Support**.....	**70**	**59**	**0**

Fund technical and program management support.

Effective Environmental Protection.....	**9,445**	**9,269**	**0**

The Effective Environmental Protection has focused 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 program has supported energy security by helping to overcome the environmental barriers that limit access to domestic resources. The program also has supported the President's Clear Skies Initiative by reducing emissions from oil production and processing. In addition, the program has supported the recommendations of the National Energy Policy by encouraging additional recovery from existing wells, providing technology to allow additional oil development on Federal lands and providing answers to environmental questions that are limiting oil exploration and production in the National Petroleum Reserve - Alaska. Activities have provided a complete examination of specific impact of produced water and the more general problem of water management. A detailed roadmap of the necessary actions has been presented in a public workshop for discussion and inclusion of stakeholder views. The overall objective has been to help balance the need to develop the Nation's energy resources while maintaining our environmental values. This program has filled critical information and technical gaps that are needed to meet the Nation's energy needs without sacrificing environmental quality.

▪ **Environmental Science**	**9,349**	**9,176**	**0**

FY 2006 closeout activities included above.

In FY 2005, conduct work on targeted activities to define and solve specific problems in key areas, specifically: 1) management of produced water and technology development that makes produced water a resource for beneficial uses; and 2) ensuring maximum sustainable access to oil resources on Federal lands. *Participants include: KS State Univ, Northrop Grumman, TX -EES, Univ of N Carolina, Univ of TX at Austin, IOGCC, GWPC, CSM, CDO, NETL, LBNL, LLNL TBD.*

In FY 2004, targeted activities were conducted to define and solve specific problems in key focus areas, specifically: 1) management of produced water and technology development that makes produced water a resource for beneficial uses; and, 2) ensuring maximum sustainable access to oil and gas resources on Federal lands. An outreach program was conducted to ensure that accurate information about the impacts of oil and gas development is presented to the public. Develop objective, credible data for regulatory decisions as part of a program-wide environmental strategy for maintaining U.S. oil production capacity. *Participants: NETL, LANL, NIST, IOGCC, KS State Univ, Northrop Grumman, TX-EES, Univ of N Carolina, Univ of TX at Austin, Aera Energy, GWPC, LBNL, LLNL, BLM, and TBD*

▪ **Program Support**.....	**96**	**93**	**0**

Fund technical and program management support.

	(dollars in thousands)		
	FY 2004	FY 2005	FY 2006
Total, Petroleum - Oil Technology	**34,107**	**33,921**	**10,000**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Exploration and Production	
• Budget discipline necessitated close scrutiny of all Fossil Energy programs, using strict guidelines to determine their effectiveness and compare them to other programs offering more clearly demonstrated and substantial benefits. As a result, the 2006 Budget proposes to conduct orderly termination of the program in FY 2006	-23,921
Total Funding Change, Oil Technology	**-23,921**

Program Direction and Management Support

Funding Profile by Category

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Headquarters					
Fossil Energy Research and Development					
Salaries and Benefits	15,043	14,989	12,544	-2,445	-16.3%
Travel	530	614	600	-14	-2.3%
Support Services	6,616	6,830	7,200	+370	+5.4%
Total, Fossil Energy Research and Development	22,189	22,433	20,344	-2,089	-9.3%
Clean Coal Technology					
Salaries and Benefits	2,717	2,711	2,750	+39	+1.4%
Travel	183	183	180	-3	-1.6%
Support Services	1,940	1,444	1,465	+21	+1.4%
Total, Clean Coal Technology	4,840	4,338	4,395	+57	+3.9%
Headquarters Program Direction					
Salaries and Benefits	17,760	17,700	15,294	-2,406	-13.6%
Travel	713	797	780	-17	-2.1%
Support Services	8,556	8,274	8,665	+391	+4.7%
Total, Headquarters	27,029	26,771	24,739	-2,032	-7.6%
Full Time Equivalents	127	127	123	-4	-3.1%
National Energy Technology Laboratory					
Fossil Energy Research and Development					
Salaries and Benefits	37,002	37,232	35,855	-1,377	-3.7%
Travel	1,432	1,475	1,475	0	0.0%
Support Services	30,787	29,582	27,275	-2,307	-8.6%
Total, Fossil Energy Research and Development	69,221	68,289	64,605	-3,864	-5.9%
Clean Coal Technology					
Salaries and Benefits	6,543	6,535	6,625	+90	+1.4%
Travel	118	118	117	-1	-0.8%
Support Services	3,314	2,815	2,855	+40	+1.4%
Total, Clean Coal Technology	9,975	9,468	9,597	+129	+1.4%

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
National Energy Technology Laboratory					
Salaries and Benefits	43,545	43,767	42,480	-1,287	-2.9%
Travel	1,550	1,593	1,592	-1	-0.0%
Support Services	34,101	32,397	30,130	-2,267	-7.0%
Total, National Energy Technology Laboratory	79,196	77,757	74,202	-3,555	-4.6%
Full Time Equivalents	397	427	397	-30	-7.3%
Total Program Direction Headquarters Fossil Energy Research and Development					
Salaries and Benefits	15,043	14,989	12,544	-2,445	-16.3%
Travel	530	614	600	-14	-2.3%
Support Services	6,616	6,830	7,200	+370	+5.4%
Total, Headquarters Fossil Energy Research and Development	22,189	22,433	20,344	-2,089	-9.3%
National Energy Technology Laboratory Fossil Energy Research and Development					
Salaries and Benefits	37,002	37,232	35,855	-1,377	-3.7%
Travel	1,432	1,475	1,475	0	0.0%
Support Services	30,787	29,582	27,275	-2,307	-7.8%
Total, National Energy Technology Laboratory Fossil Energy Research and Development	69,221	68,289	64,605	-3,684	-5.4%
Clean Coal Technology					
Salaries and Benefits	9,260	9,246	9,375	+129	+1.4%
Travel	301	301	297	-4	-1.3%
Support Services	5,254	4,259	4,320	+61	+1.4%
Total, Clean Coal Technology	14,815	13,806	13,992	+186	+1.3%
Total, Program Direction					
Salaries and Benefits	61,305	61,467	57,774	-3,693	-6.0%
Travel	2,263	2,390	2,372	-18	-0.7%
Support Services	42,657	40,671	38,795	-1,876	-4.6%
Total, Program Direction	106,225	104,528	98,941	-5,587	-5.3%
Total Full Time Equivalents	524	554	520	-34	-6.3%

Mission

Program Direction and Management Support provides the Federal staffing resources and associated costs required to provide overall direction and execution of the Fossil Energy Research and Development program.

As stated in the Departmental Strategic Plan, DOE's Strategic and General Goals will be accomplished not only through the efforts of the major program offices in the Department but with additional effort from offices which support the programs in carrying out the mission. Fossil Energy performs critical functions which directly support the mission of the Department. Headquarters staff provide functions including 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 2006, Fossil Energy will be conducting the orderly termination of the Natural Gas Technologies and Oil Technology Programs. This request reflects the anticipated cost savings from this activity.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Headquarters	**27,029**	**26,771**	**24,739**
Salaries and Benefits	**17,760**	**17,700**	**15,294**

In FY 2006, provide funds for 123 FTEs (includes 17 FTEs transferred from the CCT account) at Headquarters. This staff implements and communicates policy to the NETL's and other field offices, sets program objectives, develops program plans and evaluates alternative strategies; develops and defends budget requests; approves procurement plans; and monitors work progress.

FY 2005 and FY 2004 funds provided for 127 FTEs (includes 17 FTEs transferred from the CCT account) at Headquarters. This staff implements and communicates policy to the NETL's and other field offices, sets program objectives, develops program plans and evaluates alternative strategies; develops and defends budget requests; approves procurement plans; and monitors work progress.

Travel	**713**	**797**	**780**

In FY 2006, provide funds for travel in support of the activities stated above. Both domestic and international travel are conducted.

(dollars in thousands)

FY 2004	FY 2005	FY 2006

FY 2005 and FY 2004 funding provided for travel in support of the activities stated above. Both domestic and international travel was conducted.

Support Services **8,556** **8,274** **8,665**

- **Technical and Management Support Services** **4,113** **3,416** **3,136**

  In FY 2006, provide for contractual services that are generic to the entire FE program. Included are items such as computer services, technical and management support services.

  FY 2005 and FY 2004 funding provided for contractual services that are generic to the entire FE program. Included are items such as computer services, technical and management support services.

- **Computer Systems and Support** **988** **1,012** **1,000**

  The Headquarters information technology investment includes costs associated with general information technology infrastructure support including LAN, internet and intranet networking, cyber security, desktop support, televideo, information architecture planning and systems support.

- **E-Government Initiatives** **0** **0** **429**

  Beginning in FY 2006, E-Government initiatives will become financially self-sustaining via fee for service contracts. The requested funding will provide for the costs associated with Government-wide E-Government initiatives and Lines of Business.

- **Working Capital Fund**..... **3,455** **3,846** **4,100**

  In FY 2006, provides funding for the Departments working capital fund.

  In FY 2005 and FY 2004, provided funding for the Department's working capital fund.

- **Small Business and Innovative Research (SBIR)** **0** **0** **0**

  In FY 2006, fund SBIR in the amount of $11,212,000 from prior year and/or various R&D program funds within the Fossil Energy R&D account.

  In FY 2005, funded SBIR in the amount of $11,873,000 from prior year and/or various R&D program funds within the Fossil Energy R&D account.

  In FY 2004, funded SBIR in the amount of $12,311,000 from prior year and/or various R&D program funds within the Fossil Energy R&D account.

- **Small Business Technology Transfer (STTR)**..... **0** **0** **0**

  In FY 2006, fund STTR in the amount of $1,027,000 from prior year and/or various R&D program funds within the Fossil Energy R&D account.

  In FY 2005, funded STTR in the amount of $1,299,000 from prior year and/or various R&D program funds within the Fossil Energy R&D account.

(dollars in thousands)

FY 2004	FY 2005	FY 2006

In FY 2004, funded STTR in the amount of $1,479,000 from prior year and/or various R&D program funds within the Fossil Energy R&D account.

National Energy Technology Laboratory	**79,196**	**77,757**	**74,202**
Salaries and Benefits	**43,545**	**43,767**	**42,480**

In FY 2006, provide funds for NETL staff of 397 FTEs (includes 49 FTEs 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 50 FTEs of the 397 FTEs will be paid via reimbursable agreements, therefore, salaries and benefits associated with these FTEs are not included in the budget estimate

In FY 2005, provided funds for NETL staff of 427 FTEs (includes 49 FTEs 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. Of the 427 FTEs, 50 FTEs were paid via reimbursable agreements, therefore, salaries and benefits associated with these FTEs are not included in the budget estimate.

FY 2004 funding provided for NETL staff of 397 FTEs (includes 49 FTEs 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. Twenty of the FTEs in FY 2004 were paid via reimbursable agreements, therefore, salaries and benefits associated with these FTEs are not included in the budget estimate.

Travel	**1,550**	**1,593**	**1,592**

In FY 2006, provide funds for travel in support of the above activities in the attainment of program goals, both on the domestic front and abroad.

In FY 2005, provided funds for travel in support of the above activities in the attainment of program goals, both on the domestic front and abroad.

FY 2004 funding provided for travel in support of the above activities in the attainment of program goals, both on the domestic front and abroad.

Support/Contractual Services	**34,101**	**32,397**	**30,130**

The NETL information technology investment is funded in this budget line. This investment includes costs associated with general information technology infrastructure support including LAN, internet and intranet networking, cyber security, desktop support, televideo, telecom, information architecture planning and systems support. Additionally, this investment covers specific mission related systems support including the TORIS and PROMIS systems.

In FY 2006, provide funding for facility operations, maintenance, finance, information automation, administrative, management and technical support.

(dollars in thousands)

FY 2004	FY 2005	FY 2006

In FY 2005, provide funding for facility operations, maintenance, finance, information automation, administrative, management and technical support.

FY 2004 funding provided for facility operations, maintenance, finance, information automation, administrative, management and technical support.

Total, Program Direction and Management Support	**106,225**	**104,528**	**98,941**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Headquarters Program Direction	
▪ **Salaries and Benefits**	
Decrease in salaries and benefits attributable to cost saving realized by buyouts completed in FY 2005 and the orderly termination of the Natural Gas Technologies and Oil Technology programs	-2,406
▪ **Travel**	
Decrease to travel attributable to cost savings realized by the orderly termination of the Natural Gas Technologies and Oil Technology programs	-17
Support Services	
▪ **Technical and Management Support Services**	
Decrease to technical and management support attributable to cost savings realized by the orderly termination of the Natural Gas Technologies and Oil Technology programs and to help offset requirement to fund E-Government initiatives and other Department-wide initiatives	-280
▪ **Computer Systems and Support**	
Decrease to computer systems and support attributable to consolidation of services and use of new cost saving systems such as "Smart Buy"	-12
▪ **E-Government Initiatives**	
Increase to provide funding for Government-wide E-Government Initiatives	+429
▪ **Working Capital Fund**	
Increase in Working Capital Fund to provide for Fossil Energy's costs associated with new Department-wide accounting systems (STARS), IT project management certifications costs, and miscellaneous Department-wide budget systems costs	+254
Total, Support Services	+391
Total, Headquarters Program Direction	**-2,032**

	FY 2006 vs. FY 2005 ($000)
Field Program Direction	
▪ **Salaries and Benefits**	
Decrease in salaries and benefits attributable to cost saving realized by buyouts completed in FY 2005 and the orderly termination of the Natural Gas Technologies and Oil Technology programs	-1,287
▪ **Travel**	
Decrease to travel attributable to cost savings realized by the orderly termination of the Natural Gas Technologies and Oil Technology programs	-1
▪ **Support/Contractual Services**	
Decrease to technical and management support attributable to cost savings realized by the orderly termination of the Natural Gas Technologies and Oil Technology programs and to help offset requirement to fund E-Government initiatives and other Department-wide initiatives	-2,267
Total, Field Program Direction	**-3,555**
Total Funding Changes, Program Direction	**-5,587**

Plant and Capital Equipment

Funding Profile by Subprogram

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	% Change	% Change
GPP at NETL and ARC	2,963	2,958	0	-2,958	-100.0%
NETL Office/Lab Building	3,951	3,944	0	-3,944	-100.0%
Total, Plant and Capital Equipment	6,914	6,902	0	-6,902	-100.0%

Mission

The mission of the Plant and Capital Equipment program is to maintain the facilities necessary to safely and effectively carryout the mission of the Fossil Energy R&D program.

Benefits

General plant projects include repairs, improvements, alteration and additions that are essential to the safe, environmentally acceptable and efficient operations of NETL sites and ARC.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
GPP at NETL and ARC	**2,963**	**2,958**	**0**

Provides no funding in FY 2006 for General Plant Projects (GPP) at the National Energy Technology Laboratory and the Albany Research Center.

NETL Office/Lab Building	**3,951**	**3,944**	**0**

Provides no funding for facilities and infrastructure renovation at the National Energy Technology Laboratory.

FY 2005 and FY 2004 funding provided for building design for facilities at both the Pittsburgh and Morgantown sites; renovation of several buildings; demolition of several buildings and subsequent site preparation; expand parking facilities; and enhanced security measures.

Total, Plant and Capital Equipment	**6,914**	**6,902**	**0**

Explanation of Funding Changes

	FY 2006 vs FY 2005 ($000)
GPP at NETL and ARC – Eliminates funding for this activity	-2,958
NETL Office/Lab Building – It is anticipated that prior year funding will be sufficient to continue this activity	-3,944
Total, Plant and Capital Equipment	**-6,902**

Fossil Energy Environmental Restoration

Funding Profile by Subprogram

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Fossil Energy Environmental Restoration						
CERCLA Remedial Actions	1,843	1,807	1,807	1,175	-632	-35.0%
RCRA Remedial Actions	2,039	2,011	2,011	1,903	-108	-5.4%
Other ES&H Actions	5,713	5,649	5,649	4,982	-667	-11.9%
Total, Fossil Energy Environmental Restoration	9,595	9,467	9,467	8,060	-1,407	-14.9%

Mission

The objectives of the Fossil Energy (FE) Environmental Restoration activities are to ensure protection of workers, the public, and the environment in performing the FE mission of the National Energy Technology Laboratory (NETL) at the Morgantown (MGN), West Virginia, Pittsburgh (PGH), Pennsylvania, and Tulsa, Oklahoma and Fairbanks, Alaska sites, and the Albany Research Center (ARC) at Albany, Oregon.

Benefits

Environment, Safety and Health 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 environment, safety, and health requirements (e.g., permit maintenance), including Department of Energy (DOE) initiatives, and implement initiatives related to achieving best-in-class performance (e.g., ISO-14001). 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 2006 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.

- Maintain Environment, Safety, and Health (ES&H) risk management programs and Federal, state, and local permit compliance status at NETL and ARC.
- Conduct NETL's remediation activities at Rock Springs and Hoe Creek, WY sites.
- Conduct NETL's and ARC's environmental monitoring and surveillance activities (air, water, wastewater) in support of permit maintenance.

- Conduct ES&H training at NETL and ARC according to job hazard analyses.
- Conduct lead asbestos abatement actions at NETL and ARC as required by maintenance, construction, and projects.
- Conduct very limited on-site infrastructure fixes at NETL and ARC related to resolving ES&H issues (e.g., ventilation).
- Implement continuity of operations program at NETL and ARC.
- Conduct limited pollution prevention and energy efficiency activities in support of ISO-14001 certification maintenance at NETL and ARC.
- Remove hazardous materials at ARC.
- Maintain emergency response and security program capabilities at ARC.
- Continue with ES&H-related equipment/facility upgrades and infrastructure repairs, including facility evaluations at ARC.
- Conduct groundwater monitoring and remediation activities at ARC.
- Reduce sanitary waste from routine operations at ARC.
- Implement limited activities to meet waste minimization and energy efficiency goals.
- Maintain programs for purchasing environmentally preferable products and services.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
CERCLA Remedial Actions	**1,843**	**1,807**	**1,175**
▪ **Rock Springs Sites**	**592**	**583**	**500**

In FY 2006, operate (full scale operation) and maintain the *In-Situ* Aeration Bioremediation Systems at Rock Springs Sites at Sites 4, 9, and 12 to remove BTEX compounds from Tipton aquifer ground water, as required by the Wyoming Department of Environmental Quality (WDEQ). Conduct periodic ground water sampling events to determine progress in removing contaminants. *Participants include: Army Corps of Engineers.*

In FY 2005, operate and maintain the *In-Situ* Aeration Bioremediation Systems at Rock Spring Sites to remove BTEX compounds from Tipton aquifer ground water, as required by the WDEQ. Conduct periodic ground water sampling events to determine progress in removing contaminants from the Tipton aquifier. *Participants include: Army Corps of Engineers.*

In FY 2004, continue second year of full-scale cleanup of Rock Springs sites (~7 year active remediation program, begun in FY 2002). *Participants include: Army Corps of Engineers.*

▪ **Hoe Creek Site**	**306**	**302**	**250**

FY 2006, phase into "shut-down" mode at the Hoe Creek Site, which includes conducting limited sparging operations at three locations. Perform periodic ground water surveillance activities to ensure stabilization of background BTEX concentrations. *Participants include: Army Corps of Engineers.*

FY 2005, seal and abandon all wells, except long-term monitoring wells to be used in contaminant rebound evaluations, as required by the WDEQ. *Participants include: Army Corps of Engineers.*

(dollars in thousands)

FY 2004	FY 2005	FY 2006

In FY 2004, continue third year of full-scale cleanup of Hoe Creek site (~7 year active remediation program, begun in FY 2001). *Participants include: Army Corps of Engineers.*

- **Hannah Site Revegetation**..... **25** **25** **25**

  In FY 2006, closeout activities include submittal of bond release document to WDEQ, providing information to general public, and obtaining land owner final approval of reclamation results.

  FY 2005, closeout active operations with respect to revegetation initiatives.

  In FY 2004, continue Hannah Site revegetation (~10 year program, begun in 1993).

- **NETL Preliminary Site Investigations** **439** **433** **150**

  In FY 2006, continue to investigate/support two sites in which NETL may have current and future environmental liability (e.g., typically associated with hazardous waste disposal operations) as determined through EPA and State environmental agency interactions.

  In FY 2005, initiate the discovery and investigation of one former FE Research and Development (R&D) site. Conduct preliminary assessments (PA) at two sites (four locations) if necessary to determine environmental risk prior to contract closeout.

  In FY 2004 implement three additional off-site investigations and remediations related to project closeouts, based on results of risk analyses.

- **NETL Site Remediation**..... **30** **20** **0**

  In FY 2006, no funding is requested for this activity.

  In FY 2005 perform on-site building and soil type remediation assessment at NETL (re-assessment).

  In FY 2004 perform on-site building and soil type remediation assessments at NETL (re-assessment).

- **CERCLA PRP Response Activities** **451** **444** **250**

  In FY 2006, conduct remedial investigations, feasibility studies, and address environmental claims for two sites found to be contaminated and requiring cleanup under Federal CERCLA and State cleanup standards.

  In FY 2005, conduct remedial investigations and feasibility studies on two sites found to be contaminated and requiring cleanup under Federal CERCLA and State cleanup standards.

  In FY 2004, implement CERCLA PRP Response Activities.

	(dollars in thousands)		
	FY 2004	FY 2005	FY 2006
RCRA Remedial Actions	**2,039**	**2,011**	**1,903**

- **NETL On-Site Remediation** **1,398** **1,379** **1,378**

  In FY 2006, continue NETL RCRA-related on-site regulatory, corrective, and preventive activities such as: lead and asbestos abatement; waste minimization and pollution prevention activities including managing residual wastes which represent activities beyond baseline programs required to accommodate new/changing DOE requirements and conditions and/or risk reduction and improvement initiatives; performing activities to better achieve and maintain compliant wastewater treatment plant operations (especially at Pittsburgh site) in order to address past notices of violations, and supporting site support contractor RCRA-related risk management and maintenance activities. Also, implement chemical- and pollutant-related environmental management plans under NETL's ISO-14001 program.

  In FY 2005, continue NETL on-site regulatory and corrective, activities such as: lead and asbestos abatement; waste minimization and pollution prevention activities including managing residual wastes; achieving/maintaining compliant wastewater treatment plant operations, and site support contractor RCRA-related maintenance activities.

  In FY 2004, continue NETL on-site corrective, preventive, and improvement activities such as; lead and asbestos abatement; upgrading chemical handling facilities; waste minimization and pollution prevention activities including managing residual wastes; environmental management plan implementation required for maintenance of ISO 14001 certifications; surface water compliance; and site support contractor RCRA related maintenance activities.

- **Albany Research Center RCRA** **641** **632** **525**

  In FY 2006, continue ARC RCRA cleanup actions including abating lead and asbestos exposures; resolving chemical storage and labeling; monitoring soil and groundwater; investigation and interim measure actions concerning groundwater, upgrading ventilation and air pollution systems; and improving air emission management, materials handling, and waste disposal activities.

  In FY 2005, continue ARC RCRA cleanup actions including abating lead and asbestos exposures; resolving chemical storage and labeling; monitoring soil and groundwater; upgrading ventilation and air pollution systems; and improving air emission management, materials handling, and waste disposal activities.

  In FY 2004, continue ARC RCRA cleanup actions including abating lead and asbestos exposures; resolving chemical storage and labeling issues; monitoring soil and groundwater; upgrading ventilation and air pollution control system; implementing environmental management system plan required for ISO 14001 certification; and improving air emission management, materials handling, and waste disposal activities.

	(dollars in thousands)		
	FY 2004	FY 2005	FY 2006
Other ES&H Actions	**5,713**	**5,649**	**4,982**
▪ **Other ES&H Actions at NETL**	**4,494**	**4,447**	**3,776**

In FY 2006, implement baseline regulatory and Integrated Safety Management/ISO 14001 programs (emergency management, occupational medicine and health, industrial hygiene, safety, environmental management, ergonomics, training, and fire protection) at NETL. Implement limited actions in support of achieving DOE's pollution prevention and energy management goals. Implement limited actions in support of correcting ES&H deficiencies associated with infrastructure (e.g., ventilation systems; waste pads; gas cylinder storage areas). Implement non-CERCLA related corrective actions that may occur at off-site locations.

In FY 2005, implement baseline regulatory and Integrated Safety Management/ISO 14001 programs (emergency management, occupational medicine and health, safety, environmental management, ergonomics, training, and fire protection) at NETL. Implement limited actions in support of achieving DOE's pollution prevention and energy management goals.

In FY 2004, maintain regulatory and Integrated Safety Management/ISO 14001 programs (emergency management, occupational medicine and health, safety, environmental management, ergonomics, training, and fire protection) at NETL. Identify safety improvements required to achieve external OSHA-type certifications. Identify and implement safety-related security improvements. Continue to execute environmental objectives and targets under NETL's ISO 14001 programs, including incremental and continued achievement of DOE's pollution prevention and energy leadership goals. Conduct highest priority indoor and CFC-related air quality fixes.

▪ **ES&H Corrective Action at NETL Tulsa Site**	**25**	**25**	**15**

In FY 2006, implement ergonomics corrective actions, provide site-specific ES&H training, conduct emergency drills, and perform infrastructure inspections.

In FY 2005, perform ES&H-related training and an ergonomics review to determine personnel at risk of ergonomic injury. Perform testing of and maintenance on fixed fire protection systems. Conduct emergency management drills.

In FY 2004, continue ES&H program activities at NPTO including inspections, emergency management and drills, training, etc. Expand environmental management system to Tulsa site.

▪ **ES&H Corrective Action at ARC**	**1,098**	**1,082**	**1,111**

In FY 2006, continue ARC safety and health programs and corrective actions including industrial hygiene monitoring and surveillance, occupational medicine, emergency preparedness and drills, ergonomics, training, fire protection, and security improvements. Maintain indoor air quality and ventilation systems, walking/working surfaces, personal protective equipment maintenance, and facility seismic evaluations. Continue incremental progress toward DOE's pollution prevention and energy management goals. Costs also include contracted security, Integrated Safety Management System (ISM) and Environmental Management Systems (EMS) support.

(dollars in thousands)

FY 2004	FY 2005	FY 2006

In FY 2005, continue ARC safety and health programs and corrective actions including monitoring and surveillance, emergency preparedness and drills, and security improvements. Maintain indoor air quality and ventilation systems, walking surfaces, personal protective equipment maintenance, facility seismic evaluations, and training. Continue incremental progress toward DOE's pollution prevention and energy management goals. Costs also include contracted security, ISM, and ISO 14001 support.

In FY 2004, continue ARC safety and health programs and corrective actions including monitoring and surveillance; emergency preparedness and drills; and security improvements. Upgrade indoor air quality and ventilation systems; medical and industrial hygiene services; fire detection and suppression systems; walking surfaces; personal protective equipment maintenance; facility seismic evaluations; and training. Continue to execute revised environmental objectives and targets under ARC's ISO 14001 programs, including incremental and continued achievement of DOE's pollution prevention and energy leadership goals. Costs also include contracted security, ISM, and ISO 14001 support.

▪ **Program Support**.....	**96**	**95**	**80**
Fund technical and program management support.			
Total, Fossil Energy Environmental Restoration	**9,595**	**9,467**	**8,060**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
CERCLA Remedial Actions	
▪ Action would not be taken on additional, new CERCLA-type sites attributable to NETL's off-site operations or hazardous waste disposal requiring remediation as required under Federal, state, and private sector investigations. Potential sites include: University of Tennessee Space Institute site, and Lake Calumet, Illinois	-632
RCRA Remedial Actions	
▪ Decrease in funding will cause reductions in RCRA cleanup actions at ARC including upgrading of material/chemical handling; monitoring of soil and groundwater cleanup and investigation and interim measure actions concerning on-site groundwater contamination	-108

	FY 2006 vs. FY 2005 ($000)
Other ES&H Actions	
▪ ES&H infrastructure-related corrective actions at NETL (e.g., resolving ventilation, mold, egress, and pest control issues) would be deferred. Replacement of smaller chiller units with less than 150 tons cooling capacity containing ozone-depleting substances would not occur. Corrective actions in the safeguards and security area would be reduced or eliminated	-666
Total Funding Change, Fossil Energy Environmental Restoration.....	**-1,406**

Import/Export Authorization

Funding Profile by Subprogram

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Import/Export Authorization	2,716	1,774	1,774	1,799	+25	+1.4%
Total, Import/Export Authorization	2,716	1,774	1,774	1,799	+25	+1.4%

Mission

The Office of Import/Export Authorization (OIEA) manages the regulatory review of natural gas imports and exports. In addition, the program 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.

Benefits

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; and that surplus domestic gas supplies can be marketed internationally in a competitive and environmentally sound manner.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Import/Export Authorization	**2,445**	**1,600**	**1,619**

In FY 2006, modify or rescind 3 conversion orders. Process 50 certifications of coal capability and 3 exemptions. Process 226 gas import/export applications. Provide support for consultations with U.S. trading partners. Provide regulatory compliance and industry monitoring. Provide petroleum policy support for ASFE.

In FY 2005, modify or rescind 3 conversion orders. Process 50 certifications of coal capability and 3 exemptions. Process 226 gas import/export applications. Provide support for consultations with U.S. trading partners. Provide regulatory compliance and industry monitoring. Provide petroleum policy support for ASFE. The electricity regulatory functions of this program have been transferred to the Office of Electricity Transmission and Distribution.

(dollars in thousands)

FY 2004	FY 2005	FY 2006

In FY 2004, modify or rescind 3 conversion orders. Process 50 certifications of coal capability and 3 exemptions. Process 220 gas import/export applications. Provide support for consultations with U.S. trading partners. Provide regulatory compliance and industry monitoring. Provide petroleum policy support for ASFE. Process 103 electricity export applications and 11 construction permits. Monitor and analyze international and domestic electricity trade. Participate in FERC proceedings, international studies, and trade negotiations. Perform NEPA compliance activities.

Program Support	**271**	**174**	**180**
Fund technical and program management support.			
Total, Import/Export Authorization	**2,716**	**1,774**	**1,799**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Import/Export Authorization	
▪ No significant change in funding	+25
Total Funding Change, Import/Export Authorization	**+25**

Advanced Metallurgical Research

Funding Profile by Subprogram

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Advanced Metallurgical Research	9,876	9,861	9,861	8,000	-1,861	-18.9%
Total, Advanced Metallurgical Research	9,876	9,861	9,861	8,000	-1,861	-18.9%

Mission

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.

Projects are focused on areas where there are large potential public benefits, but where industry would not invest on its own. The program addresses the full life cycle of materials production and cost-effective processing of improved materials through to their disposal and recycling. For example, 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. Since this research has application to a range of materials being used, its collective benefits are applied to a broad cross-section of the industry that could result in better products across a wide spectrum, thus improving U.S. competitiveness.

Another focus is to develop and demonstrate technologies that will create public benefits by reducing waste and pollution. For example, for the last four years the Program has sought ways to sequester CO_2, a greenhouse gas, by converting it to a stable mineral form; such a process, if proved practical and economic, could contribute to Fossil Energy's goal of a zero emission power plant. Thus, 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 FutureGen 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.

Benefits

The Advanced Metallurgical Program creates public benefits by carrying out long-term, high-risk research on materials that are key to the energy industry. Another focus is to create public benefits through the development of technologies that reduce waste and pollution.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Advanced Metallurgical Research	**9,777**	**9,762**	**7,920**

In FY 2006, continue research contributions to Fossil Energy's FutureGen Systems in the area of increased component service life. Service improvement research by development of new materials, protection of current materials, and real-time corrosion sensors, and refractory repair techniques will be conducted for gasifier operating temperatures and pressures. Carbon dioxide containment through enhancement of natural geologic formation seals research will be performed. The Albany Research Center's support to the Solid State Energy Conversion Alliance (SECA) through material development, fabrication, and performance evaluation will continue for solid oxide fuel cell applications. *Participants include: ARC.*

In FY 2005, continue research to contribute to Fossil Energy's zero-emission energy systems by extending component service lifetimes through the improvement and protection of current materials, by the design of new materials, and by defining the service operating conditions for new materials in order to ensure their safe and effective use. Emphasis is placed on high-temperature erosion testing and modeling in environments anticipated for near zero emissions concepts, on the development of sulfidation/oxidation resistant materials, and development and repair of refractory materials, for coal gasifiers. The Albany Research Center will participate in an effort to develop, fabricate and evaluate the performance of materials to be used in solid oxide fuel cell applications. These could include metallic interconnects, seals, heat exchanger materials and reformer materials to support the SECA fuel cell goal of significantly reducing the cost of producing commercial, environmentally friendly solid oxide fuel cells. Continue research focused on developing an economically and environmentally acceptable integrated process for disposal of carbon dioxide. Redirect emphasis to application of mineral carbonation reactions to address leakage/sealing issues in geological sequestration approaches. *Participants include: ARC.*

FY 2004 funding continued development of advanced refractories for IGCC applications, CO_2 sequestration via mineral carbonation, advanced austenitic steels, and microchannel reactors for reformer and heat exchanger applications. In addition, efforts to support materials development for solid oxide fuel cell applications were initiated. *Participants included: ARC*

Program Support	**99**	**99**	**80**

Fund technical and program management support.

Total, Advanced Metallurgical Research	**9,876**	**9,861**	**8,000**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Advanced Metallurgical Research	
Decrease in funding is the result of consolidation of some research on mineralization for sequestration under the expanded Sequestration R&D program, and consolidation of some materials research for SECA fuel cell applications under the expanded Fuel Cells program	-1,842
Program Support	-19
Total Funding Change, Advanced Metallurgical Research	**-1,861**

National Academy of Sciences Program Review

Funding Profile by Subprogram

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
National Academy of Sciences Program Review....	494	493	493	0	-493	-100.0%
Total, National Academy of Sciences	494	493	493	0	-493	-100.0%

Mission

This program provides for a study by the National Research Council (NRC) of prospective future benefits of Fossil Energy R&D. In FY 2003, FY 2004, and FY 2005 funding was appropriated to the Department's Office of Energy Efficiency and Renewable Energy (EERE), which will be combined with Fossil Energy (FE) funding for the NRC study. The study will focus on methodology and case studies. Past attempts at measuring future R&D benefits revealed that benefits assessments need to be better quantified using a more comprehensive methodology. The NRC study will address these needs. Once a methodology has been developed, a subset of FE and EERE technologies will be selected to test and showcase the methodology.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
National Academy of Sciences Program Review	**494**	**493**	**0**

No funding is requested for this activity in FY 2006.

In FY 2005 and FY 2004, a study by the National Research Council (NRC) of prospective future benefits of Fossil Energy R&D was conducted.

Total, National Academy of Sciences Program Review	**494**	**493**	**0**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
No funding requested in FY 2006	-493

Special Recruitment Programs

Funding Profile by Subprogram

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Special Recruitment Programs	0	656	656	656	0	0.0%
Total, Special Recruitment Programs	0	656	656	656	0	0.0%

Mission

The Office of Fossil Energy has developed two programs to help attract minority and other highly qualified technical and engineering students to work in the development of fossil fuels. They are the "Pipeline Universities" program, and the Mickey Leland Energy Fellowship program.

The intent of the Pipeline Universities program is to collaborate with the Nation's top earth science and engineering universities to provide a "pipeline" of future employees who will become the successor managers and technical scientists of the future.

The Mickey Leland Energy Fellowship program is a 10 week summer internship program that offers minority students majoring in math, science and engineering an opportunity to learn about fossil energy programs and initiatives. Fossil Energy is working closely with historically black colleges and universities, Hispanic serving institutions and Tribal colleges and universities to encourage minority students who are studying in academic disciplines needed in the execution of the Fossil Energy mission, to pursue careers with the Federal government.

In August 2003, the Assistant Secretary for Fossil Energy, Carl Michael Smith, announced that he had chosen the Colorado School of Mines and Penn State University as the first two educational institutions to participate in the new pipeline program. In addition, students from the Mickey Leland Energy Fellowship program will also be considered for participation in this program.

The first year, 2004, three students were selected to participate in the Pipeline program. At the end of the internship, students judged to have high potential will be offered part time employment with the Department of Energy/Office of Fossil Energy. The amount of pay and/or authorized work hours will be adjusted between a participants junior and senior years to reflect increasing commitment to the Fossil Energy program.

Benefits

The benefit of these programs for the Office of Fossil Energy is that it provides a steady flow of diverse, technically trained personnel who are familiar with the balance between applying science to energy security problems and who can enter Federal service prepared to deal with the complex technical and policy issues associated with U.S. economic and energy security.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Special Recruitment Programs	**0**	**656**	**656**

In FY 2006, applicants will be recruited and selected to participate in the technical career intern program and the Mickey Leland Energy Fellowship program.

In FY 2005, applicants were recruited and selected to participate in the technical career intern program and the Mickey Leland Energy Fellowship program.

In FY 2004 these activities were funded under the Fossil Energy Program Direction Account.

Total, Special Recruitment Programs	**0**	**656**	**656**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
There are no funding changes between FY 2006 and FY 2005.	

Cooperative Research and Development

Funding Profile by Subprogram

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Cooperative Research and Development	8,161	8,283	8,283	3,000	-5,283	-63.8%
Total, Cooperative Research and Development	8,161	8,283	8,283	3,000	-5,283	-63.8%

Mission

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.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Cooperative Research and Development	**8,161**	**8,283**	**3,000**
▪ **Cooperative Research and Development**	**8,121**	**8,244**	**2,970**
In FY 2006, continue support for cooperative research programs at WRI and UNDEERC which are 50-50 cost-shared with non-federal clients. Funding will be split evenly between the two participants.			
FY 2005 and FY 2004 funding provided support for cooperative research programs at WRI and UNDEERC which are 50-50 cost-shared with non-federal clients. Funding was split evenly between the two participants.			
▪ **Program Support**	**40**	**39**	**30**
Fund technical and program management support.			
Total, Cooperative Research and Development	**8,161**	**8,283**	**3,000**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Cooperative Research and Development	
▪ The Department anticipated that these centers can compete successfully for Fossil Energy funding through the competitive solicitation process	-5,274
Program Support	-9
Total Funding Changes, Cooperative Research and Development	-5,283

Naval Petroleum & Oil Shale Reserves

Naval Petroleum & Oil Shale Reserves

Naval Petroleum and Oil Shale Reserves

Proposed Appropriation Language

For expenses necessary to carry out naval petroleum and oil shale reserve activities, [$18,000,000], $18,500,000 to remain available until expended: Provided, That, notwithstanding any other provision of law, unobligated funds remaining from prior years shall be available for all naval petroleum and oil shale reserve activities.

Explanation of Change

The change reflects an increase in environmental restoration activities at NPR-1 and increased production activities at NPR-3.

Naval Petroleum and Oil Shale Reserves
Office of Fossil Energy

Overview

Appropriation Summary by Program

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Naval Petroleum and Oil Shale Reserves……	21,092	17,750	17,895	18,500	+605	+3.4%
Use of Prior-Year balances …….	-3,097	0	0	0	0	0%
Total, Naval Petroleum and Oil Shale Reserves…..	17,995	17,750	17,895	18,500	+605	+3.4%

Detailed Funding Table

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Naval Petroleum and Oil Shale Reserves (NPOSR)			
Production & Operations			
Production Operations …….	3,457	1,429	3,559
Environmental Restoration ……...	4,779	4,168	4,483
Rocky Mountain Oilfield Testing Center ……	2,963	2,958	2,169
Total, Production & Operations ……	11,199	8,555	10,211
Management			
Program Direction ……	4,073	5,319	5,076
Equity ……..	2,923	1,726	1,502
Business Management and Support ……	2,897	2,150	1,711
Total, Management ……..	9,893	9,195	8,289
Subtotal, NPOSR …….	21,092	17,750	18,500
Use of Prior-Year balances……..	-3,097	0	0
Total, NPOSR……	17,795	17,750	18,500

Preface

Since the Naval Petroleum and Oil Shale Reserve (NPOSR) no longer served the national defense purpose envisioned in the early 1900s, the National Defense Authorization Act for Fiscal Year 1996 (P.L. 104-106) required the sale of the Government's interest in Naval Petroleum Reserve 1 (NPR-1). To comply with this requirement, the Elk Hills field in California was sold to Occidental Petroleum Corporation in 1998. Subsequently, the Department transferred two of the Naval Oil Shale Reserves (NOSR-1 and NOSR-3), both in Colorado to the Department of the Interior's (DOI) Bureau of Land Management. In January 2000, the Department also returned the NOSR-2 site to the Northern Ute Indian Tribe. Following the sale of Elk Hills and the transfer of the oil shale reserves, DOE retains two Naval Petroleum Reserve properties:

The Naval Petroleum Reserve 3 (NPR-3) in Wyoming (Teapot Dome field) - A stripper well oil field that the Department will maintain until it reaches its economic production limit. Environmental remediation efforts are underway, and the field is being used as the Rocky Mountain Oilfield Testing Center (RMOTC). Activities performed at RMOTC include field testing of new technology, evaluation of new equipment, and demonstration of new processes.

The Buena Vista Hills Naval Petroleum Reserve 2 (NPR-2) in California - A checkerboard pattern of government and privately owned tracts adjacent to the Elk Hills field. Of the 30,181 acres, 10,446 acres are owned by the government and leased by private oil companies. Discussions have begun with the Department of Interior (DOI) on transfer of this asset.

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).

[a] Government Performance and Results Act of 1993

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

Mission
The NPOSR mission has evolved to complete environmental remediation activities and determine the equity finalization of NPR-1, manage NPR-2, and operate NPR-3 while providing RMOTC as a field demonstration facility.

Benefits
The Department continues activities to finalize its Elk Hills equity interests with ChevronTexaco, co-owner of Elk Hills. Under the *Equity Redetermination Process Agreement*, the ASFE is to impartially determine final equity shares between ChevronTexaco and the Department of Energy. The final equity determinations will be based on all four of the NPR-1 producing zones. Financial settlements will occur after final decisions, by the end of FY 2007.

RMOTC offers a place to perform hands-on, applied research (testing and demonstration) that is tailored to the U.S. independent oil producers helping speed new technology to the market place. Responding to the needs of industry, academia, and other research organizations on a case-by-case basis, RMOTC leverages government investment heavily with industry partnership and cost sharing. Based on historical data, RMOTC expects to complete an average of 15 projects per year with an average industry contribution of about 70 percent of the total project cost. Incidental benefits from RMOTC are realized by Naval Petroleum Reserve 3, including reduced operating costs and increased production through technologies and techniques tested. RMOTC's value is validated through the continuous and recurring use of the facility by industry and the large cost share that industry contributes.

Strategic Goal
The Department's Strategic Plan identifies four strategic goals: one each for defense, energy, science, and environmental aspects of the mission plus seven general goals that tie to the strategic goals. The Naval Petroleum and Oil Shale Reserves appropriation supports the following goal:

Energy Strategic Goal: To protect our national and economic security by promoting a diverse supply and delivery of reliable, affordable, and environmentally sound energy.

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 within the Naval Petroleum and Oil Shale Reserves appropriation have one Program Goal that contributes to the General Goals in the "goal cascade". This goal is:

Program Goal 04.58.00.00: Maintain operational readiness of the SPR to drawdown at a sustained rate of 4.4 million barrels per day for 90 days, within 15 days notice by the President. Maintain a 2 million barrel reserve of home heating oil in the U.S. Northeast. Utilize the NPR #3 as a testing and demonstration field for the Rocky Mountain Oilfield Testing Center's ongoing research. Continue closeout and equity finalization activities related to NPR #1, and finalize settlement to the State of California with respect to its claims to "school lands".

Contribution to General Goal

The programs within the NPOSR appropriation contribute to General Goal 4 by : 1) Ensuring completion of environmental remediation, cultural resource activities, equity determination, and school lands compensation required as a result of the Elk Hills sale agreements; and 2) Managing NPR-2 leases.

RMOTC project focus areas include: oil and gas exploration and production; coalbed natural gas development; drilling and well completions; remote sensing. These projects will contribute to increased energy assurance, environmental restoration and remediation, renewable energy, and beneficial use of produced water.

Funding by General and Program Goal

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
General Goal 4, Energy Security			
Program Goal 04.48.00.00, Petroleum Reserves	21,092	17,750	18,500
Total, General Goal 4 (Naval Petroleum & Oil Shale Reserves)	21,092	17,750	18,500

Means and Strategies
NPOSR will use various means and strategies to continue its mission and achieve program goals. The program continues work to close the remaining environmental findings, as required by the agreement between DOE and the California Department of Toxic Substance Control (DTSC). RMOTC will provide to industry a secure, low-risk environment to field evaluate, test, and validate their developing technologies.

Validation and Verification
NPOSR manages detailed, operational measures that are implemented by the contractors. Action plans are reviewed and analyzed at Program Reviews. These reviews provide an opportunity to discuss performance. Budget formulation/ execution assessments are regularly conducted throughout the year, including annual budget validations.

Significant Program Shifts
To meet the deadline set in the Authorization Act, it was necessary for the Department to commit to a number of activities after closing the sale of the Elk Hills site. The commitments were formalized in several legal agreements. A human health and an ecological Risk Assessment on the 131 DTSC areas of concern are primary activities supported by this budget. Following completion of the Risk Assessments, the program will complete appropriate Corrective Action Studies to determine cleanup in the field. Completion of Risk Assessments and Corrective Action Studies is scheduled for FY 2009.

Since 1996, the NPR-3 field in Wyoming has been focused on producing to its economic limit and pursuing a phased environmental restoration and equipment salvage program at those parts of NPR-3 that are no longer needed for operation. RMOTC provides industry with a secure, low risk environment to field evaluate, test and validate their developing technologies. Incidental benefits are realized by NPR-3 through reduced operating costs and increased production through technologies and techniques tested.

Naval Petroleum and Oil Shale Reserves

Funding by Site by Program

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$Change	%Change
Naval Petroleum & Oil Shale Reserves					
NPR California ……	6,550	5,534	6,516	+982	+17.7%
NPOSR – Colorado, Utah, Wyoming	9,632	8,836	9,004	+168	+1.9%
Washington Headquarters ……	4,910	3,380	2,980	-400	-11.8%
Total, Naval Petroleum and Oil Shale Resrve…….	21,092	17,750	18,500	+750	+4.2%

Site Description

Naval Petroleum Reserve – California
The NPR-California field office, located in Bakersfield, California, is responsible for completing closeout activities, environmental remediation, and cultural resource assessment from the sale of the Elk Hills site.

Naval Petroleum and Oil Shale Reserve -Colorado, Utah and Wyoming
The NPOSR – Colorado, Utah, and Wyoming (CUW), located in Casper, Wyoming supports activities to produce NPR-3 at the maximum efficient rate. This site is co-located with the Rocky Mountain Oilfield Testing Center - a testing and demonstration facility.

Washington Headquarters
The headquarters office located in Washington, DC supports the independent evaluation and recommendation of final equity for Elk Hills as well as the geologic, petrophysical and reservoir engineering services required to prepare and support the Government's equity position before an Independent Petroleum Engineer and the Assistant Secretary for Fossil Energy (ASFE). Program Direction funding for the NPR Headquarters staff (11 FTEs) in Washington, DC is also included in this category.

Production & Operations

Funding Profile by Subprogram

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Production & Operations						
Production Operations ……..	3,457	1,429	1,429	3,559	+2,130	+149.1%
Environmental Restoration …….	4,779	4,168	4,168	4,483	+315	+7.6%
Rocky Mountain Oilfield Testing Center …….	2,963	2,958	2,958	2,169	-789	-26.7%
Total, Production & Operations ……...	11,199	8,555	8,555	10,211	+1,656	+19.4%

Public Law Authorization:
P. L. 94-258, "Naval Petroleum Reserves Production Act" (1976)

Mission

The mission of the Production and Operations subprogram includes:

- Environmental remediation and cultural resource activities required as a result of the Elk Hills sale agreement. To meet the deadline set in the Authorization Act, it was necessary for the Department to commit to a number of activities after closing the sale. The commitments were formalized in several legal agreements between DOE, Occidental, Chevron, and the State of California. Activities include completing environmental and archaeological work; assessing sites where remediation was not completed before the sale; and concluding any lawsuits related to the operation of Elk Hills that had been brought by third parties against the Government and/or its contractors.

- Ongoing conventional oil field management and operations at NPR-3. Since 1996, the program's primary focus has been to operate NPR-3 in Wyoming to its economic limit. Initial estimates projected that the field would be shut-in by 2003, however, the favorable oil prices and application of new oil field strategies and technologies have arrested the decline in production. It is expected that profitable operations at NPR-3 will continue.

- Field testing and demonstration of upstream and environmental products at the Rocky Mountain Oilfield Testing Center (RMOTC), which is co-located with NPR-3.

- Management of leases associated with Naval Petroleum Reserve 2 in California (Buena Vista Hills).

Benefits

Revenue from production and operation of the Naval Petroleum Reserve 3 in Wyoming (Teapot Dome field) is estimated to be over $6 million dollars in FY 2006. Associated revenues from the NPR-2 leases are estimated at approximately $3 million dollars.

The RMOTC program offers a place to perform hands-on, applied research (testing and demonstration) that is tailored to the U.S. independent oil producers helping speed new technology to the market place. Incidental benefits from RMOTC are realized by Naval Petroleum Reserve 3, including reduced operating costs and increased production through technologies and techniques tested. RMOTC projects will contribute to increased energy assurance, environmental restoration and remediation, renewable energy, and beneficial use of produced water.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Production and Operations ……	**11,199**	**8,555**	**10,211**
▪ **Production Operations** ……	**3,457**	**1,429**	**3,559**

Continue to maintain and produce approximately 670 stripper wells at NPR-3 (expected to produce 440 barrels of oil and 1,400 gallons of natural gas liquids per day). Includes routine O&M activities for production facilities, well maintenance, electricity, utilities, buildings, roads, heavy field equipment, motor vehicles and capital projects where warranted to maximize production.

FY 2004 and FY 2005 funding continued routine O&M activities at NPR-3 for production facilities, well maintenance, electricity and utilities, buildings, roads, heavy field equipment, motor vehicles and capital projects to be undertaken provided oil prices warrant such expenditures.

	(dollars in thousands)		
	FY 2004	FY 2005	FY 2006
▪ **Environmental Restoration** ……	**4,779**	**4,168**	**4,483**

Continue Elk Hills environmental and archeological closeout activities. Continue work to clean close 3 inactive permitted landfills. Perform a human health and an ecological Risk Assessment on the 131 California Department of Toxic Substances Control (DTSC) areas of concern. Following completion of Risk Assessments, complete appropriate Corrective Action Studies to determine cleanup in the field. Completion of Risk Assessments and Corrective Action Studies is scheduled for FY 2009. Continue negotiations with ChevronTexaco on the disposition of sites listed on Exhibit H of the Unit Plan Contract Termination Agreement.

FY 2004 and FY 2005 funding continued efforts to document the results of cultural resource work scheduled for completion in FY 2004. Released information to the public and curated artifacts at a facility meeting Federal curation standards. Continued plugging and abandonment of uneconomic wells and closing surface facilities at NPR-3 that were no longer required to support production operations.

▪ **Rocky Mountain Oilfield Testing Center** …….	**2,963**	**2,958**	**2,169**

Continue field testing and demonstration of upstream petroleum and environmental products.

FY 2004 and FY 2005 funding supported RMOTC programs including Carbon Management, Produced Water Management, Energy Assurance, Production Technology and Drilling Technology.

Total, Production and Operations……	**11,199**	**8,555**	**10,211**

Explanation of Funding Changes

Production and Operations

Increase in production activities at NPR-3 and environmental remediation activities at NPR-1 ..... +2,445

Decrease in RMOTC field testing and demonstration projects ..... -789

Total Funding Change, Production and Operations ..... +1,656

Management

Funding Profile by Subprogram

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Management						
Program Direction……..	4,073	5,319	5,464	5,076	-388	-7.1%
Equity……..	2,923	1,726	1,726	1,502	-224	-13.0%
Business Management & Support…….	2,897	2,150	2,150	1,711	-439	-20.4%
Total, Management	9,893	9,195	9,340	8,289	-1,051	-11.3%

Public Law Authorization:
P. L. 94-258, "Naval Petroleum Reserves Production Act" (1976)

Mission

The mission of the Management subprogram is to support business management activities for all active sites, NPR-1 closeout, and NPR-2 lease management. Support for the settlement of equity shares with ChevronTexaco, the minority owner of Elk Hills, is a major activity for which geologic, petrophysical and reservoir engineering services are required to prepare and support the Government's equity position before an Independent Petroleum Engineer and the Assistant Secretary for Fossil Energy (ASFE).

Benefits

The final equity determinations will be made on all four of the NPR-1 producing zones. Financial settlements will occur after final decisions have been made, by the end of FY 2007.

Detailed Justification

	(dollars in thousands)		
	FY 2004	FY 2005	FY 2006

- **Program Direction** …… **4,073** **5,319** **5,076**
  Provides salaries, travel, contractor support services and other related expenses required for management and execution of the NPOSR program.

  - **Salaries and Benefits …… 3,618 3,906 3,777**
    Staff of 32 FTEs (11 at Headquarters and 21 in the field) performs policy and planning, equity determination, petroleum engineering, financial management, procurement, environment and safety, and administration of reimbursable work programs.

  - **Travel …….. 238 240 212**
    Provides travel to assure the accomplishment of program mission.

  - **Support Services …….. 0 226 199**
    Provide analytic support for policy decisions. FY 2004 requirements were offset with available carryover. FY 2005 and FY 2006 reflect full funding requirements.

  - **Other Related Expenses …….. 217 947 888**
    Major elements are communications, utilities, building leases, supplies and materials. FY 2004 requirements were offset with available carryover. FY 2005 and FY 2006 reflect full funding requirements.

- **Equity** …… **2,923** **1,726** **1,502**
  The Dry Gas Zone, Carneros Zone and Stevens Zone are finalized. A provisional recommendation for the Shallow Oil Zone was issued by the independent petroleum engineer in May 2003. The final recommendation is not expected until early 2005. The process could take until 2007 for final ASFE decision.

  FY 2004 and FY 2005 funding supported the independent petroleum engineer, legal support, and expert technical analysis/ consultation required to support the final Fossil Energy decision.

	(dollars in thousands)		
	FY 2004	FY 2005	FY 2006
▪ **Business Management & Support** …. Continue payments for post-employment medical and dental benefits to former Management & Operating (M&O) contractor employees. For NPR-2, ensure compliance of the 17 lease agreements expected to generate $3.0 million in royalty revenues. Continue general operational and administrative support at the field sites.	**2,897**	**2,150**	**1,711**
Total, Management ……	**9,893**	**9,195**	**8,289**

Explanation of Funding Changes

Management

Mandatory increase for Cost of Living adjustment and general pay raise	+145
Decrease in equity finalization support activities	-224
Decrease in travel and other related expenses	-388
Decrease in operational and administrative support activities	-439
Total Funding Change, Management	**-906**

Program Direction

Funding Profile by Category

(dollars in thousands/whole FTEs)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
NPR - California					
Salaries and Benefits.....	734	756	770	+14	+1.9%
Travel.....	28	28	25	-3	-10.7%
Support Services	0	0	0	0	0%
Other Related Expenses	217	257	260	+3	+1.2%
Total, NPR - California.....	979	1041	1055	+14	+1.3%
Full Time Equivalents	4	4	4	0	0%
NPOSR – Colorado, Utah, Wyoming					
Salaries and Benefits.....	1844	1950	1,950	0	0%
Travel.....	160	160	141	-19	-11.9%
Support Services	0	0	0	0	0%
Other Related Expenses	0	513	452	-61	-11.9%
Total, NPOSR – Colorado, Utah, Wyoming	2004	2,623	2,543	-80	-3.0%
Full Time Equivalents	15	17	17	0	0%
Headquarters					
Salaries and Benefits.....	1040	1,200	1,057	-143	-11.9%
Travel.....	50	52	46	-6	-11.5%
Support Services	0	226	199	-27	-11.9%
Other Related Expenses	0	177	176	-1	-0.1%
Total, Headquarters.....	1,090	1,655	1,478	-177	-10.7%
Full Time Equivalents	10	11	11	0	0%
Total Program Direction					
Salaries and Benefits.....	3,618	3,906	3,777	-129	-3.3%
Travel.....	238	240	212	-28	-11.7%
Support Services	0	226	199	-27	-11.9%
Other Related Expenses	217	947	888	-59	-6.2%
Total Program Direction ……	4,073	5,319	5,076	-243	-4.6%
Total Full Time Equivalents …...	29	32	32	0	0%

NAVAL PETROLEUM AND OIL SHALE RESERVES
PROJECTED FEDERAL REVENUES
(Dollars in thousands)

	FY 2004			FY 2005			FY 2006		
Naval Petroleum Reserve No. 3									
	Production	Price	Revenues ($000)	Production	Price	Revenues ($000)	Production	Price	Revenues ($000)
Crude Oil	466 BOPD	$35.39	$6.319	432 BOPD	$40.00	$6,307	399 BOPD	$41.00	$5,971
Liquid Products	1,150 GPD	$.67/gal	$283	1,400 GPD	$.60/gal	$307	1,400 GPD	$.65/gal	$332
Total NPR-3			**$6,602**			**$6,614**			**$6,303**
Naval Petroleum Reserve Number 2 (Royalties from 17 Lease Agreements)									
	Production	Price	Revenues ($000)	Production	Price	Revenues ($000)	Production	Price	Revenues ($000)
Crude Oil	162 BOPD	35.95	$2,126	168 BOPD	$41.34	$2,535	174 BOPD	$42.34	$2,689
Natural Gas	640 MCF/D	2.30	$534	660 MCF/D	$2.30	$554	683 MCF/D	$2.30	$573
Liquid Products	408 GPD	$.30/gal	$45	424 GPD	$.30/gal	$46	439 GPD	$.30/gal	$48
Total NPR-2			**$2,705**			**$3,135**			**$3,310**
TOTAL NPOSR REVENUE			**$9,307**			**$9,749**			**$9,613**

NAVAL PETROLEUM AND OIL SHALE RESERVES
PROJECTED FEDERAL REVENUES
(Dollars in thousands)

	FY 2007			FY 2008			FY 2009		
Naval Petroleum Reserve No. 3									
	Production	Price	Revenues ($000)	Production	Price	Revenues ($000)	Production	Price	Revenues ($000)
Crude Oil	353 BOPD	$42.00	$5,626	338 BOPD	$43.00	$5,305	310 BOPD	$44.00	$4,979
Liquid Products	1,300 GPD	$.70/gal	$332	1,300 GPD	$.75/gal	$358	1,200 GPD	$.80/gal	$350
Total NPR-3			**$5,958**			**$5,661**			**$5,329**
Naval Petroleum Reserve Number 2 (Royalties from 17 Lease Agreements)									
	Production	Price	Revenues ($000)	Production	Price	Revenues ($000)	Production	Price	Revenues ($000)
Crude Oil	180 BOPD	$43.34	$2,847	180 BOPD	$44.34	$2,907	180 BOPD	$45.34	$2,979
Natural Gas	707MCF/D	$2.30	$593	707 MCF/D	$2.40	$619	707 MCF/D	$2.40	$619
Liquid Products	456 GPD	$.30/gal	$50	456 GPD	$.31/gal	$52	456 GPD	$.31/gal	$52
Total NPR-2			**$3,490**			**$3,578**			**$3,650**
TOTAL NPOSR REVENUE			**$9,448**			**$9,239**			**$8,979**

Elk Hills School Lands Fund

Elk Hills School Lands Fund

Elk Hills School Lands Fund

Proposed Appropriation Language

For necessary expenses in fulfilling installment payments under the Settlement Agreement entered into by the United States and the State of California on October 11, 1996, as authorized by section 3415 of Public Law 104-106, [36,000,000, to become available on October 1, 2005] $48,000,000, for payment to the State of California for the State Teachers' Retirement Fund from the Elk Hills School Lands Fund. (Department of the Interior and Related Agencies Appropriations Act, 2005.)

Explanation of Change

The change reflects new budget authority of $48.0 million, in addition to the FY 2005 advance appropriation of $36.0 million for a total of $84.0 million for the seventh installment payment. The amount of the final payment cannot be determined until the equity determination process is completed and all associated cost are known.

Elk Hills School Lands Fund

Overview

Appropriation Summary by Program

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
California Teachers' Pension Fund Payment	0	0	0	48,000	+48,000	+100.0%
Advance Appropriation	36,000	36,000	36,000	36,000	0	0.0%
Total, Elk Hills School Lands Fund ……	36,000	36,000	36,000	84,000	+48,000	+133.3%

Detailed Funding Table

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Elk Hills School Lands Fund			
Teachers' Pension Fund Payment	0	0	48,000
Advance Appropriation	36,000	36,000	36,000
Total, Elk Hills School Lands Fund	36,000	36,000	84,000

Public Law Authorization:
Public Law 104-106, National Defense Authorization Act for FY 1996

Preface

The Elk Hills School Lands Fund provides a source of funding for a settlement with the State of California with respect to its longstanding claims to two parcels of land within NPR-1.

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 Elk Hills School Lands Fund's mission is to provide a source of funding to fulfill the Settlement Agreement between DOE and the State of California with respect to its longstanding claims to two parcels of land within NPR-1.

Benefits

The agreement calls for payment from the contingent fund to the State of California, subject to appropriation, of 9% of the net proceeds from the sale of the Government's interest in NPR-1.

Strategic Goal

The Department's Strategic Plan identifies four strategic goals: one each for defense, energy, science, and environmental aspects of the mission plus seven general goals that tie to the strategic goals. The Elk Hills School Lands Fund appropriation supports the following goal:

Energy Strategic Goal: To protect our national and economic security by promoting a diverse supply and delivery of reliable, affordable, and environmentally sound energy.

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 within the Elk Hills School Lands Fund appropriation have one Program Goal that contributes to the General Goals in the "goal cascade". This goal is:

Program Goal 04.58.00.00: : Maintain operational readiness of the SPR to drawdown at a sustained rate of 4.4 million barrels per day for 90 days, within 15 days notice by the President. Maintain a 2 million

[a] Government Performance and Results Act of 1993

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

barrel reserve of home heating oil in the U.S. Northeast. Utilize the NPR-3 as a testing and demonstration field for the Rocky Mountain Oilfield Testing Center's ongoing research. Continue closeout and equity finalization activities related to NPR-1, and finalize settlement to the State of California with respect to its claims to "school lands".

Contribution to the General Goal

The Elk Hills School Lands Fund contributes to General Goal 4 by fulfilling the settlement agreement between DOE and the State of California with respect to its longstanding claims to parcels of land within NPR-1.

Funding by General and Program Goal

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
General Goal 4, Energy Security			
Program Goal 04.48.00.00, Petroleum Reserves	36,000	36,000	84,000
Total, General Goal 4 (Elk Hills School Lands Fund)	36,000	36,000	84,000

Elk Hills School Lands Fund

Funding by Site by Program

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$Change	%Change
Elk Hills School Lands Fund					
State of California	36,000	36,000	84,000	+48,000	+133.3%
Total, Elk Hills School Lands Fund	36,000	36,000	84,000	+48,000	+133.3%

Site Description

State of California
The Agreement calls for payment from the contingent fund to the State of California, subject to appropriation, of nine percent of the net sales proceeds, with respect to its longstanding claims to two parcels of land ("school lands") within NPR-1.

Elk Hills School Lands Fund

Funding Profile by Subprogram

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
California Teachers' Pension Fund Payment	0	0	0	48,000	+48,000	+100%
Advance Appropriation	36,000	36,000	36,000	36,000	0	0.0%
Total, Elk Hills School Lands Fund ……	36,000	36,000	36,000	84,000	+48,000	+133.3%

Mission

The first installment payment was appropriated in FY 1999. No appropriation was provided in FY 2000, but the FY 2000 Interior and Related Agencies Appropriations Act provided an advance appropriation of $36 million, which was paid in FY 2001 (second installment). The third through sixth installments of $36 million were paid at the beginning of FY 2002, FY 2003, FY 2004, and FY 2005 respectively. The FY 2005 Appropriations Act contained an advance appropriation for an installment payable on October 1, 2005. In light of the delays in equity finalization, the Department consulted with the State of California in 2004 to discuss future payments. Discussions are ongoing.

Benefits

The agreement calls for payment from the contingent fund to the State of California, subject to appropriation, of 9% of the net sales proceeds, with respect to its longstanding claims to two parcels of land ("school lands") within NPR-1.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Elk Hills School Lands Fund……..……..	36,000	36,000	84,000

Continue installment payments to fulfill the settlement agreement between DOE and the State of California with respect to its longstanding claims to parcels of land within NPR-1. In light of the delays in equity finalization, the Department consulted with the State of California in 2004 to discuss future payments. Discussions are ongoing.

Explanation of Funding Changes

FY 2006 vs. FY 2005 ($000)

Elk Hills School Lands Fund

The change reflects new budget authority of $48.0 million, in addition to the FY 2005 advance appropriation of $36.0 million for a total of $84.0 million for the seventh installment payment. The amount of the final payment cannot be determined until the equity determination process is completed and all associated cost are known.....+48,000

Total Funding Change, Elk Hills School Lands Fund.....+48,000

Energy Conservation

Energy Conservation

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Energy Conservation

Proposed Appropriation Language

For necessary expenses in carrying out energy conservation activities, [$649,092,000] $*846,772,000* to remain available until expended: *Provided*, That $*230,000,000 is for weatherization assistance grants program pursuant to 42 U.S.C. 6861 et seq., and $41,000,000* [$44,798,000] for the State energy program grants pursuant to 42 U.S.C. 6323, notwithstanding section 3008(d)(2) of Public Law 99-509. *(Department of Interior and Related Agencies Appropriations Act, 2005.)*

[SEC. 101. For an additional amount for the Department of Energy for the weatherization assistance program pursuant to 42 U.S.C. 6861 et seq. and notwithstanding section 3003(d)(2) of Public law 99-509, $230,000,000, to remain available until expended.] *(Miscellaneous Appropriations and Offsets Act, 2005.)*

Explanation of Change

This FY 2006 appropriation request includes $230,000,000 for the weatherization assistance program that was appropriated for FY 2005 in the Miscellaneous Appropriations and Offsets Act, 2005, Public Law 108-447.

Energy Conservation
Office of Energy Efficiency and Renewable Energy

Overview

Appropriation Summary by Program[a]

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Energy Conservation						
Vehicle Technologies.....	172,395	165,409[b]	165,409	165,943	+534	+0.3%
Fuel Cell Technologies	63,782	74,944[c]	74,944	83,600	+8,656	+11.5%
Weatherization and Intergovernmental Activities.....	307,932	309,005[d]	309,005	298,157	-10,848	-3.5%
Distributed Energy Resources.....	59,684	60,416[e]	60,416	56,629	-3,787	-6.3%
Building Technologies.....	57,799	65,464[f]	65,464	57,966	-7,498	-11.5%
Industrial Technologies.....	90,450	74,801[g]	74,801	56,489	-18,312	-24.5%
Biomass and Biorefinery Systems R&D.....	6,966	7,253[h]	7,253	21,805	+14,552	+200.6%

[a] For Energy Conservation, SBIR/STTR funding in the amount of $10,017,000 was transferred to the Science Appropriation in FY 2004. Estimates for SBIR/STTR budgeted in FY 2005 and FY 2006 are $9,290,000 and $9,014,000 respectively. For Energy Supply, SBIR/STTR funding in the amount of $5,199,000 was transferred to the Science Appropriation in FY 2004. Estimates for SBIR/STTR budgeted in FY 2005 and FY 2006 are $5,871,000 and $6,704,000 respectively.
[b] Reflects the 0.594% and 0.80% rescissions of -$1,005,000 and -$1,346,000 respectively and comparability adjustment for National Energy Technology Laboratory Support of -$1,496,000.
[c] Reflects the 0.594% and 0.80% rescissions of -$452,000 and -$604,000 respectively.
[d] Reflects the 0.594% and 0.80% rescissions of -$491,000, -$657,000 respectively, comparability adjustment for National Energy Technology Laboratory Support of -$624,000, and $230,000,000 reduced by 0.80% (-1,840,000) for the Weatherization Assistance Program.
[e] Reflects the 0.594% and 0.80% rescissions of -$365,000 and -$489,000 respectively and comparability adjustment for National Energy Technology Laboratory Support of -$210,000.
[f] Reflects the 0.594% and 0.80% rescissions of -$404,000 and -$542,000 respectively and comparability adjustment for National Energy Technology Laboratory Support of -$1,674,000.
[g] Reflects the 0.594% and 0.80% rescissions of -$454,000 and -$608,000 respectively and comparability adjustment for National Energy Technology Laboratory Support of -$548,000.
[h] Reflects the 0.594% and 0.80% rescissions of -$46,000 and -$61,000 respectively and comparability adjustment for National Energy Technology Laboratory Support of -$320,000.

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Federal Energy Management Program	19,420	17,931[a]	17,931	17,147	-784	-4.4%
Program Management	92,362	93,011[b]	93,011	89,036	-3,975	-4.3%
Subtotal, Energy Conservation	870,790	868,234	868,234	846,772	-21,462	-2.5%
Use of prior year balances	-2,823	0	0	0	0	0.0%
Total, Energy Conservation	867,967	868,234	868,234	846,772	-21,462	-2.5%
Energy Supply						
Hydrogen Technology	80,412	94,006[c]	94,006	99,094	+5,088	+5.4%
Solar Energy	80,731	85,074[d]	85,074	83,953	-1,121	-1.3%
Wind Energy	39,803	40,804[e]	40,804	44,249	+3,445	+8.4%
Hydropower	4,673	4,862[f]	4,862	500	-4,362	-89.7%
Geothermal Technology	24,625	25,270[g]	25,270	23,299	-1,971	-7.8%
Biomass and Biorefinery Systems R&D	84,608	80,846[h]	80,846	50,359	-30,487	-37.7%
Intergovernmental Activities	14,673	16,776[i]	16,776	11,910	-4,866	-29.0%

[a] Reflects the 0.594% and 0.80% rescissions of -$109,000 and -$146,000 respectively and comparability adjustment for National Energy Technology Laboratory Support of -$214,000.
[b] Reflects the 0.594% and 0.80% rescissions of -$530,000 and -$709,000 respectively and comparability adjustment for National Energy Technology Laboratory Support of +$5,086,000.
[c] Reflects the 0.80% rescission of -$753,000 and comparability adjustment for Cross-Cutting Planning, Analysis and Evaluation -$566,000.
[d] Reflects the 0.80% rescission of -$685,000 and comparability adjustment for Cross-cutting Planning, Analysis and Evaluation of -$774,000.
[e] Reflects the 0.80% rescission of -$329,000 and comparability adjustment for Cross-Cutting Planning, Analysis and Evaluation -$467,000.
[f] Reflects the 0.80% rescission of -$40,000 and comparability adjustment for Cross-Cutting Planning, Analysis and Evaluation of -$98,000.
[g] Reflects the 0.80% rescission of -$203,000 and comparability adjustment for Cross-Cutting Planning, Analysis and Evaluation of -$327,000.
[h] Reflects the 0.80% rescission of -$646,000 and comparability adjustment for Cross-Cutting Planning, Analysis and Evaluation of -$655,000.
[i] Reflects the 0.80% rescission of -$134,000 and comparability adjustment for Cross-Cutting Planning, Analysis and Evaluation of -$90,000.

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Departmental Energy Management Program	1,963	1,951[a]	1,951	2,019	+68	+3.5%
Renewable Program Support	8,493	5,954[b]	5,954	2,901	-3,053	-51.3%
Facilities and Infrastructure	12,950	11,389[c]	11,389	16,315	+4,926	+43.3%
Program Direction	16,490	19,064[d]	19,064	19,043	-21	-0.1%
Subtotal, Energy Supply	369,421	385,996	385,996	353,642	-32,354	-8.4%
Use of prior year balances	-17,126	-5,648	-5,648	0	+5,648	+100.0%
Total, Energy Supply	352,295	380,348	380,348	353,642	-26,706	-7.0%
Total, Energy Supply and Energy Conservation	1,220,262	1,248,582	1,248,582	1,200,414	-48,168	-3.9%

[a] Reflects the 0.80% rescission of -$16,000.
[b] Reflects the 0.80% rescission of -$23,000 and comparability adjustment for Cross-Cutting Planning, Analysis and Evaluation of +$2,977,000.
[c] Reflects the 0.80% rescission of -$91,000.
[d] Reflects the 0.80% rescission of -$147,000.

Detailed Funding Table

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Energy Conservation			
Vehicle Technologies			
Vehicle Systems			
Heavy Vehicle Systems R&D			
Vehicle Systems Optimization	9,831	8,764	8,888
Truck Safety Systems	385	99	100
Total, Heavy Vehicle Systems	10,216	8,863	8,988
Ancillary Systems	1,155	1,268	1,300
Simulation and Validation	2,504	3,218	3,500
Total, Vehicle Systems	13,875	13,349	13,788
Innovative Concepts			
Graduate Automotive Technology Education	494	494	500
Total, Innovative Concepts	494	494	500
Hybrid and Electric Propulsion			
Energy Storage			
High Power Energy Storage	16,535	17,430	17,675
Advanced Battery Development	1,445	1,479	1,500
Exploratory Technology Research	4,357	4,164	6,525
Total, Energy Storage	22,337	23,073	25,700
Advanced Power Electronics	13,182	13,168	13,900
Subsystem Integration and Development			
Light Vehicle Propulsion and Ancillary Subsystems	3,020	3,644	3,735
Heavy Vehicle Propulsion and Ancillary Subsystems	4,851	5,353	5,486
Total, Subsystem Integration and Development	7,871	8,997	9,221
Total, Hybrid and Electric Propulsion	43,390	45,238	48,821
Advanced Combustion Engine R&D			
Combustion and Emission Control	21,845	27,087	24,500
Light Truck Engine	12,618	0	0
Heavy Truck Engine	11,534	13,832	12,148
Waste Heat Recovery	2,407	3,435	2,000

	(dollars in thousands)		
	FY 2004	FY 2005	FY 2006
Off-Highway Engine R&D	3,369	3,451	0
Health Impacts	963	1,951	2,500
Total, Advanced Combustion Engine R&D	52,736	49,756	41,148
Materials Technology			
Propulsion Materials Technology			
Automotive Propulsion Materials	2,766	1,972	2,000
Heavy Vehicle Propulsion Materials	5,633	4,858	4,926
Total, Propulsion Materials Technology	8,399	6,830	6,926
Lightweight Materials Technology			
Automotive Lightweight Materials	16,214	16,465	19,000
Heavy Vehicle High Strength Weight Reduction Materials	8,617	7,691	7,799
Total, Lightweight Materials Technology	24,831	24,156	26,799
High Temperature Materials Laboratory	5,392	6,015	4,500
Total, Materials Technology	38,622	37,001	38,225
Fuels Technology			
Advanced Petroleum Based Fuels	9,901	5,876	6,500
Non-Petroleum Based Fuels and Lubricants			
Medium Trucks	1,171	1,282	0
Heavy Trucks	1,349	690	0
Fueling Infrastructure	1,155	1,183	0
Renewable and Synthetic Fuels Utilization	385	2,733	7,147
Total, Non-Petroleum Based Fuels and Lubricants	4,060	5,888	7,147
Environmental Impacts	1,926	986	0
Total, Fuels Technology	15,887	12,750	13,647
Technology Introduction			
Legislative and Rulemaking			
State and Fuel Provider Fleet	746	887	1,000
Private and Local Fleet	199	99	300
Fuel Petitions	105	0	314
Federal Fleets	507	507	700
Regulatory Support	37	0	200

	(dollars in thousands)		
	FY 2004	FY 2005	FY 2006
Total, Legislative and Rulemaking	1,594	1,493	2,514
Testing and Evaluation			
Vehicle Evaluation	2,221	2,416	2,450
Infrastructure Testing	98	49	50
Total, Testing and Evaluation	2,319	2,465	2,500
Advanced Vehicle Competitions	889	986	1,300
Total, Technology Introduction	4,802	4,944	6,314
Technical/Program Management Support	2,095	1,877	2,500
Biennial Peer Reviews	494	0	1,000
Total, Vehicle Technologies	172,395	165,409	165,943
Fuel Cell Technologies			
Transportation Systems	7,317	7,495	7,600
Distributed Energy Systems	7,249	6,902	7,500
Stack Component R&D	24,551	32,541	34,000
Fuel Processor R&D	14,442	9,721	9,900
Technology Validation	9,828	17,750	24,000
Technical/Program Management	395	535	600
Total, Fuel Cell Technologies	63,782	74,944	83,600
Weatherization and Intergovernmental Activities			
Weatherization Assistance Grants			
Weatherization Assistance	223,759	224,738	225,400
Training and Technical Assistance	3,407	3,422	4,600
Total, Weatherization Assistance Grants	227,166	228,160	230,000
State Energy Program Grants	43,952	44,176	41,000
State Energy Activities			
Planning and Evaluation Support for State and Local Grant Programs	2,324	2,320	500
Total, State Energy Activities	2,324	2,320	500
Gateway Deployment			
Rebuild America	9,823	8,641	6,571

	(dollars in thousands)		
	FY 2004	FY 2005	FY 2006
Energy Efficiency Information and Outreach	1,292	1,064	350
Building Codes Training and Assistance	4,145	5,597	4,550
Clean Cities	10,873	10,626	6,510
ENERGY STAR®	3,654	4,091	5,776
Inventions and Innovations	4,318	3,945	2,400
Technical/Program Management Support	385	385	500
Total, Gateway Deployment	34,490	34,349	26,657
Total, Weatherization and Intergovernmental Activities	307,932	309,005	298,157
Distributed Energy Resources			
Distributed Generation Technology Development			
Industrial Gas Turbines	3,950	2,958	2,500
Microturbines	6,704	6,201	5,685
Advanced Reciprocating Engines	13,408	13,608	10,000
Technology Based – Advanced Materials and Sensors	7,999	9,150	8,300
Fuel Combustion (formerly Fuel Flexibility)	0	739	1,000
Thermal Energy Technologies (formerly Thermally Activated Technologies)	7,436	6,666	8,000
Total, Distributed Generation Technology Development	39,497	39,322	35,485
End-Use System Integration and Interface			
Distributed Energy Systems Applications Integration			
Distributed Energy Systems Applications Integration	7,026	7,751	8,500
Congressionally Directed Activity, Distributed Energy Systems Applications Integration	988	986	0
Total, Distributed Energy Systems Applications Integration	8,014	8,737	8,500
Cooling, Heating and Power (CHP) Integration	11,662	11,834	12,000
Total, End-Use System Integration and Interface	19,676	20,571	20,500
Technical/Program Management Support	511	523	644
Total, Distributed Energy Resources	59,684	60,416	56,629
Building Technologies			
Residential Buildings Integration			
Research and Development: Building America	12,354	15,972	17,721

	(dollars in thousands)		
	FY 2004	FY 2005	FY 2006
Residential Building Energy Codes	583	828	590
Total, Residential Buildings Integration	12,937	16,800	18,311
Commercial Buildings Integration			
Research and Development	3,905	4,345	4,000
Commercial Building Energy Codes	535	780	541
Total, Commercial Buildings Integration	4,440	5,125	4,541
Emerging Technologies			
Lighting R&D	10,798	13,855	13,000
Space Conditioning and Refrigeration R&D	4,875	4,846	2,919
Appliances and Emerging Technologies R&D	1,934	1,682	1,708
Building Envelope R&D			
Thermal Insulation and Building Materials	3,152	2,762	0
Window Technologies	4,511	5,512	4,929
Total, Building Envelope R&D	7,663	8,274	4,929
Analysis Tools and Design Strategies	3,016	2,763	2,802
Total, Emerging Technologies	28,286	31,420	25,358
Equipment Standards and Analysis	10,265	10,147	8,256
Oil Heat Research for Residential Buildings	494	493	0
Technical/Program Management Support	1,377	1,479	1,500
Total, Building Technologies	57,799	65,464	57,966
Industrial Technologies			
Industries of the Future (Specific)			
Forest and Paper Products Industry	7,419	6,233	3,000
Steel Industry	6,529	5,606	3,767
Aluminum Industry	6,415	5,505	2,704
Metal Casting Industry	3,949	3,944	2,000
Glass Industry	3,217	2,564	1,763
Chemicals Industry	12,848	10,239	7,075
Mining Industry	4,574	3,394	1,060
Supporting Industries	708	691	718
Total, Industries of the Future Specific (Specific)	45,659	38,176	22,087

	(dollars in thousands)		
	FY 2004	FY 2005	FY 2006
Industries of the Future (Crosscutting)			
Industrial Materials of the Future	12,222	10,847	11,286
Combustion	1,925	1,577	1,642
Gasification Programs	4,790	0	0
Robotics	1,975	1,972	0
Sensors and Automation	3,593	3,057	3,181
Industrial Technical Assistance			
Industrial Assessment Centers	6,443	7,051	6,500
Beat Practices	7,926	8,381	8,000
Total, Industrial Technical Assistance	14,369	15,432	14,500
Total, Industries of the Future (Crosscutting)	38,874	32,885	30,609
Technical/Program Management Support	5,917	3,740	3,793
Total, Industrial Technologies	90,450	74,801	56,489
Biomass and Biorefinery Systems R&D			
Utilization of Platform Outputs R&D	6,570	6,859	21,205
Technical/Program Management Support	396	394	600
Total, Biomass and Biorefinery Systems R&D	6,966	7,253	21,805
Federal Energy Management Program			
Project Financing	7,830	7,133	6,827
Technical Guidance and Assistance			
Direct Technical Assistance	6,165	6,286	5,780
Training and Information	1,975	1,874	1,940
Total, Technical Guidance and Evaluation	8,140	8,160	7,720
Planning, Reporting, and Evaluation	2,571	2,638	2,600
Technical/Program Management Support	879	0	0
Total, Federal Energy Management Program	19,420	17,931	17,147
Program Management			
Program Direction			
Salaries and Benefits	50,882	56,007	60,802

	(dollars in thousands)		
	FY 2004	FY 2005	FY 2006
Travel	2,440	3,098	3,144
Support Services	14,823	10,642	8,907
Other Related Expenses	9,344	9,404	9,628
Total, Program Direction	77,489	79,151	82,481
Planning, Analysis, and Evaluation	4,944	4,935	5,005
Information, Communications, and Outreach	1,531	1,530	1,550
Congressionally Directed Activities			
Cooperative Programs with States	4,938	3,944	0
National Academy of Sciences Program Review……..	497	493	0
Energy and Research Consortium of the Western Carolinas….....	2,963	2,958	0
Total, Congressionally Directed Activities	8,398	7,395	0
Total, Program Management	92,362	93,011	89,036
Subtotal, Energy Conservation	870,790	868,234	846,772
Use of Prior Year Balances	-2,823	0	0
Total, Energy Conservation	867,967	868,234	846,772

Preface

The Department of Energy seeks to protect national and economic security by promoting a diverse supply of reliable, affordable, and environmentally sound energy through promotion of energy conservation and clean, renewable domestic energy resources. The balanced research, development, demonstration and deployment programs supported by the Office of Energy Efficiency and Renewable Energy (EERE) are at the forefront of that effort developing the technologies and processes consumers can use in their homes, schools, businesses, factories and vehicles to make their energy use more productive.

The President's Hydrogen Fuel Initiative will work through partnerships with industry to develop the technologies and infrastructure needed to produce, store, and distribute hydrogen, and to use it in stationary, portable, and vehicular applications. Key elements of the Initiative are supported by the Fuel Cell Technologies Program and partnered with the Vehicle Technologies Program in this budget and directly funded by the Hydrogen Technology Program within the Energy Supply appropriation.

Overall, EERE is comprised of 12 main programs:

Hydrogen, Fuel Cells and Infrastructure Technology; Solar Energy; Wind Energy; Hydropower Technologies; Geothermal Technology; Biomass and Biorefinery Systems R&D Technology; Weatherization and Intergovernmental Activities; the Federal Energy Management Program; Vehicle Technologies; Distributed Energy Resources; Building Technologies; and Industrial Technologies. EERE also supports Program Management activities to effectively carry out these program responsibilities. These programs are funded through the Energy Conservation and the Energy Supply appropriations. Activities in the Energy Supply appropriation are discussed in a separate budget.

Within the Energy Conservation appropriation, EERE has eight programs: Vehicle Technologies (nine subprograms), Fuel Cell Technologies (six subprograms), Weatherization and Intergovernmental Activities (WIP) (four subprograms), Distributed Energy Resources (three subprograms), Building Technologies (six subprograms), Industrial Technologies (three subprograms), Biomass and Biorefinery Systems R&D (two subprograms), and the Federal Energy Management Program (four subprograms). Four programs have complementary funding in both Energy Conservation and Energy Supply. They are: Biomass and Biorefinery Systems R&D; Federal Energy Management; Fuel Cells, and Weatherization and Intergovernmental Activities.

This summary document is organized to present the reader with an understanding of the multi-year strategic planning used by EERE to develop this fiscal year budget request. The budget format is responsive to the key themes of the President's Management Agenda, integrating performance and budget so that the public can readily see the "plan and results" nature of its investment in renewable energy.

This Overview will describe Strategic Context, Mission, Benefits, Strategic Goals, and Funding by General Goal. These items together put the appropriation request in perspective. The Annual Performance Results and Targets, Means and Strategies, and Validation and Verification sections address how the goals will be achieved and how performance will be measured. Finally, this Overview will 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. 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).

Another important component of our strategic planning – and the President's Management Agenda – is use of the Administration's R&D Investment Criteria to plan and assess programs and projects. The criteria were developed in 2001 and further refined with input from agencies, Congressional staff, the National Academy of Sciences, and numerous private sector and nonprofit stakeholders.

The chief elements of the R&D investment criteria are quality, relevance, and performance. Programs must demonstrate fulfillment of these elements. For example, to demonstrate relevance, programs are expected to have complete plans with clear goals and priorities. To demonstrate quality, programs are expected to commission periodic independent expert reviews. There are several other requirements, many of which R&D programs have and continue to undertake.

An additional set of criteria were established for R&D programs developing technologies that address industry issues. Some key elements of the criteria include: the ability of the programs to articulate the appropriateness and need for Federal assistance; relevance to the industry and the marketplace; identification of a transition point to industry commercialization (or of an off-ramp if progress does not meet expectations); and the potential public benefits, compared to alternative investments, that may accrue if the technology is successfully deployed.

The OMB-OSTP guidance memo to agencies dated June 5, 2003, describes the R&D Investment Criteria fully and identifies steps agencies should take to fulfill them. (The memo is available on line at www.ostp.gov/html/fy05developingpriority.pdf.) Where appropriate throughout these justification materials, especially in Significant Program Shifts and Explanation of Funding Changes subheadings, specific R&D Investment Criteria and requirements are cited to explain the Department's allocation of resources.

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[a] Government Performance and Results Act of 1993

[b] The numbering scheme uses 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.

Mission

The mission of the Office of Energy Efficiency and Renewable Energy is to strengthen America's energy security, environmental quality, and economic vitality through public-private partnerships that promote energy efficiency and productivity, bring clean, reliable, and affordable energy technologies to the marketplace, and make a difference in the everyday lives of Americans by enhancing their energy choices and quality of life.

Benefits

EERE pursues this mission through a balanced portfolio of research, development, demonstration and deployment efforts that are aimed at decreasing energy demand and increasing the use of domestic renewable energy resources. Making greater use of our abundant, clean domestic renewable energy resources and using all of our energy resources more productively provides significant economic, environmental, and security benefits to the United States. Energy bills are lower and consumers are less susceptible to energy price fluctuations. Emissions of Clean Air Act criteria pollutants (sulfur dioxide, nitrogen oxide, carbon monoxide, and particulates), mercury, and carbon dioxide are lower. Energy security is enhanced as dependence on imported petroleum (and, increasingly in the future, natural gas) is reduced and the mix of domestic energy resources increases. Security is also enhanced as reduced demands lower the loads on our energy infrastructure so that there is less potential for wide-spread energy outages. Distributed energy resources also increase the reliability of energy supplies.

EERE has demonstrated its ability to deliver results. EERE has been awarded 33 R&D 100 awards – known as the "Oscars of Innovation" – between 2001 and 2004. Research sponsored by EERE has won more R&D 100 awards than universities such as Massachusetts Institute of Technology, companies such as Dupont and Dow Chemical, and nations such as Germany and Great Britain. The most recent independent review of EERE programs, a study of a sample of EERE energy efficiency portfolio over more than 20 years by the National Academy of Science's National Research Council demonstrated one of the values of a portfolio approach. It found that some of these programs (similar to the subprograms in this budget) have yielded significant economic, environmental, and security benefits. The Council estimated the total net realized economic benefits (predominately from a few of the programs in the sample portfolio) associated with the DOE energy efficiency programs that it reviewed had already returned approximately $30 billion (valued in 1999 dollars, from the roughly $7 billion (1999 dollars) total Federal energy efficiency RDD&D investment over that period. The study also indicated there were yet unrealized benefits likely to be achieved. Consistent with the PMA, additional work is underway to enable the programs to more effectively measure and estimate past and potential benefits.

With respect to future benefits based on EIA/EERE benefits estimation models, EERE estimates that U.S. consumption of non-renewable energy resources would, given current policies, business-as-usual energy future, stable investment, and achievement of technology plans, be over 12 Quads lower in 2025 and over 30 Quads lower in 2050 as a result of being able to realize the energy efficiency and renewable energy improvements proposed in this budget. Those benefits will offset more than 50 percent of the expected growth in energy consumption through 2050. More detailed, integrated and comprehensive economic, and energy security benefits estimates and their sensitivities are provided in the Expected Program Integrated Outcomes section at the end of this Overview and in individual program sections.

Strategic, General, and Program Goals

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

Energy Strategic Goal: To protect our national and economic security by reducing imports and promoting a diverse supply of reliable, affordable, and environmentally sound energy.

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 Energy Conservation appropriation have the following ten Program Goals which contribute to the DOE General Goals in the "goal cascade":

- Program Goal 04.02.00.00: Vehicle Technologies. The Vehicle Technologies Program goal is to develop technologies that enable cars and trucks to become highly efficient, through improved power technologies and cleaner domestic fuels, and to be cost and performance competitive. Manufacturers and consumers can then use these technologies to help the Nation reduce both energy use and greenhouse gas emissions thus improving energy security by reducing dependence on oil.
- Program Goal 04.01.00.00: Hydrogen/Fuel Cell Technologies: Develop fuel cell and hydrogen production, storage, and delivery technologies to the point that they are cost and performance competitive and are being used by the Nation's transportation, energy, and power industries. Development of these technologies will also make our clean domestic energy supplies more flexible, dramatically reducing or even ending dependence on foreign oil.
- Program Goal 04.09.00.00: Weatherization. The goal of the Weatherization Assistance Grants Program within WIP is to increase the energy efficiency of dwellings occupied by low-income Americans, thereby reducing their energy costs. DOE works directly with states and local governments, which contract with local governmental or non-profit agencies to deliver weatherization services.
- Program Goal 04.10.00.00: State Energy Programs. The goal of State Energy Programs within WIP is to strengthen and support the capabilities of States to promote energy efficiency and to adopt renewable energy technologies, helping the Nation achieve a stronger economy, a cleaner environment and greater energy security.
- Program Goal 04.11.00.00: Intergovernmental Activities (Gateway Deployment). The goal of Intergovernmental Activities within WIP is to fund activities that facilitate the movement of energy efficient and renewable energy products into the market place and the integrated deployment of efficiency and renewable resources to communities and customers.
- Program Goal 04.59.00.00: Distributed Energy Resources. The Distributed Energy Resources Program goal is to develop a diverse array of cost competitive integrated distributed generation and thermal energy technologies and facilitate market adoption in homes, businesses, industry, communities, and electricity companies, increasing the efficiency of electricity generation, delivery, and use, improving electricity reliability, and reducing environmental impacts.
- Program Goal 04.04.00.00: Building Technologies. The Building Technologies Program goal is to develop cost effective tools, techniques and integrated technologies, systems and designs for buildings that generate and use energy so efficiently that buildings are capable of generating as much energy as they consume.
- Program Goal 04.60.00.00: Industrial Technologies. The Industrial Technologies Program goal is to partner with our most energy-intensive industries in strategic planning and energy-specific RD&D to develop the technologies needed to use energy efficiently in their industrial processes and cost-

effectively generate much of the energy they consume. The result of these activities will save feedstock and process energy, improve the environmental performance of industry, and help America's economic competitiveness.

- Program Goal 04.08.00.00: Biomass. Develop biorefinery-related technologies to the point that they are cost- and performance-competitive and are used by the Nation's transportation, energy, chemical and power industries to meet their market objectives. This helps the Nation by reducing fossil energy consumption, our dependence on foreign oil, and greenhouse gas emissions, while also expanding domestic energy supplies and improving the Nation's energy infrastructure.
- Program Goal 04.13.00.00: Federal Energy Management Program. The Federal Energy Management Program goal is to provide technical and financial assistance to Federal agencies and thereby lead the Nation by example in use of energy efficiency and renewable energy. Through the Federal Government's own actions, FEMP's target is to reduce energy intensity in Federal buildings by 35 percent by 2010 (relative to the 1985 statutory baseline level of 138,610 Btu per gross square foot).

Contribution to General Goal

Vehicle Technologies, Fuel Cell Technologies, Weatherization and Intergovernmental Activities (includes State Energy Program Grants), Distributed Energy Resources, Building Technologies, Industrial Technologies, Biomass and Biorefinery Systems R&D, and the Federal Energy Management Programs contribute to General Goal 4 by working together with supply programs to reduce the probability and magnitude of energy based disruptions.

These integrated programs directly contribute to the departmental goal by: (1) reducing demand-side pressure (mitigates costs) on our energy markets; (2) reducing energy imports; (3) diversifying the mix of domestic energy production; (4) providing smaller and decentralized sources of electricity generation that are inherently less susceptible to interruption or attack; and (5) increasing our ability to adjust demand loads as needed, particularly those that can help reduce peaks and shift power readily during energy emergencies.

EIA/EERE expectations, assumptions and caveats about future energy technologies and markets, are described briefly in the Benefits and in greater detail in the Expected Integrated Program Outcomes that follows. EERE's modeling of the benefits of its integrated portfolio, including activities funded by the Energy Supply and Energy Conservation Appropriations, which incorporates those elements, indicates the portfolio can be expected to contribute directly to the DOE Strategic Plan goal for 2025 and beyond. Specifically, our modeling estimates the integrated portfolio is expected to: (1) reduce future demand for traditional energy sources by approximately 12 Quads in 2025 and over 30 Quads in 2050 (beyond the efficiency and renewable investments expected in the absence of these programs); and (2) reduce the need for new electricity capacity by nearly 140 gigawatts (GW) in 2025. Oil savings would be roughly 2.3 million barrels per day (mbpd) in 2025 and over 10 mbpd in 2050. Individual program activities planned for and funded by this appropriation would contribute to these improvements in the following ways under these business-as-usual conditions:[a]

- Vehicle Technologies would contribute to this goal by developing technologies that enable highly efficient cars and trucks and include power technologies, clean domestic fuels, and lightweight materials. 2010 technology goals include reducing high power battery cost to $500 and improving advanced light-duty engine combustion efficiency to 45 percent which when sustained and combined

[a] Individual program contributions are not strictly additive because of overlap in the markets addressed.

with other vehicle technologies will enable overall Vehicle Technologies oil savings of 1.8 mbpd by 2025 and more than 8 mbpd in 2050 under expected market conditions.

- Fuel Cell Technologies would contribute to this goal by integrating hydrogen, fuel cell and infrastructure technology research and development resulting in lower cost and higher efficiency fuel cells. The key intermediate technology goal is reducing the production cost of the fuel cell power system to $45/kW by 2010. If this target and technology path is sustained and the development of the means to produce large quantities of competitively produced hydrogen from natural gas and renewables is successful, it will enable the integrated program to displace 0.2 mbpd of oil in 2025 and as technologies enter the market in significant numbers will approach 3 mbpd in 2050 under business-as-usual conditions. This technology development also provides the country with the option for substantially faster growth in hydrogen use if circumstances warrant.
- Weatherization and Intergovernmental Activities would contribute to this goal by accelerating adoption of cost-effective efficient technologies through weatherization, state energy grants, technology demonstration, building code improvements, technical assistance, and education which will help reduce energy intensity in all sectors of the economy. A key intermediate goal is the addition of more than a million weatherized homes by 2012. If this and the other program targets are met and sustained it will result in improved quality of life for millions and energy savings of 1.2 Quads in 2025.
- Distributed Energy Resources would contribute to this goal by making available by 2015 a diverse array of integrated distributed generation and thermal energy technologies with significant energy conversion efficiency improvements at market competitive prices, which can provide more than 60 GW of additional distributed generation by 2025.
- Building Technologies would contribute to this goal by developing advanced lighting and appliances, which when coupled with improved building system integration and design, will provide marketable technologies that can reduce energy use by up to 70 percent in homes by 2020 and 60-70 percent in commercial buildings by 2025. Improvements in equipment standards, building codes, and consumer access to these technologies will also facilitate marketable improvements in the efficiency of existing buildings by 20 percent, which can reduce building energy use by 1.2 Quads per year in 2025 and more than 4 Quads by 2050.
- Industrial Technologies would contribute to this goal by developing more efficient industrial processes in energy intensive industries, two or more a year, coupled with wider best practice application of these technologies in 200 or more plants a year, will reduce industrial energy use by an additional 2.2 Quads per year by 2025.
- Biomass and Biorefinery Systems R&D would contribute to this goal by developing by 2010 validated cost- and performance-competitive biorefinery technologies that co-produce bio-based fuels, products, and power which will displace 0.1 Quad of conventional fuels in 2025, more than 1 Quad by 2050, and potentially more with fully integrated approaches.
- Federal Energy Management Program would contribute to this goal by project financing, technical assistance, and project evaluation which will reduce energy intensity in Federal buildings by 35 percent in 2010 from 1985 levels.
- EERE is also working to implement the President's Management Agenda through management efficiencies. The first phase of the EERE 2002 reorganization realigned and consolidated Headquarters organizational and business management structures to improve how EERE programs are managed at Headquarters. In the fall of 2003, EERE began the second phase of the

reorganization – designing and implementing common project management practices across EERE field organizations. In October 2004, EERE implemented the Project Management Center (PMC) which provides improved and more cost effective project management, procurement, and financial management services to EERE programs engaged in financial assistance and formal contracts activities in FY 2005.

Funding by General and Program Goal

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
General Goal 4, Energy Security			
Program Goal 04.02.00.00, Vehicle Technologies	172,395	165,409	165,943
Program Goal 04.01.00.00, Fuel Cell Technologies	63,782	74,944	83,600
Program Goal 04.09.00.00, Weatherization Assistance Grants Program	227,166	228,160	230,000
Program Goal 04.10.00.00, State Energy Program Grants	46,276	46,496	41,500
Program Goal 04.11.00.00, Intergovernmental Activities	34,490	34,349	26,657
Program Goal 04.12.00.00, Distributed Energy Resources	59,684	60,416	56,629
Program Goal 04.04.00.00, Building Technologies	57,799	65,464	57,966
Program Goal 04.60.00.00, Industrial Technologies	90,450	74,801	56,489
Program Goal 04.08.00.00, Biomass and Biorefinery Systems R&D	6,966	7,253	21,805
Program Goal 04.13.00.00, Federal Energy Management Program	19,420	17,931	17,147
Total, General Goal 4, Energy Security	778,428	775,223	757,736
All Other			
Program Management	92,362	93,011	89,036
Total, All Other	92,362	93,011	89,036
Total, General Goal 4, Energy Conservation	870,790	868,234	846,772

Major FY 2004 Achievements

EERE works closely with the industry, laboratories, Federal agencies, state energy offices, universities, non-government organizations and other stakeholders to develop and deploy its R&D and programs. Some examples of how the investment and collaboration has provided public benefits are provided in the following achievements:

- Vehicle Technologies. Working with a government industry partnership, the program recently completed development of advanced clean diesel engines for pickup trucks, vans, and SUVs that demonstrated a 50 percent fuel economy improvement over comparable gasoline-fueled vehicles. Industry is reported to be negotiating the use of their advanced clean diesel engine with a major vehicle manufacturer. These vehicles are the largest segment of personal use vehicles, consuming more than half the petroleum used in personal transportation, improved efficiency of this magnitude could lead to significantly reduced oil consumption.
- Distributed Energy Resources. In 2004 the natural gas fired Mercury 50 electric generation turbine, based upon DOE-sponsored R&D, was offered as commercial product. Under the program, the

Mercury 50 demonstrated 40 percent efficiency and emissions of less than 9 parts per million of NO_x. This R&D enables "mission-critical" operations when grid-connected power is not available and improves the use of distribution assets by reducing the peak or altering the shape of energy demand. While saving energy directly, cost effectively providing significant levels of reliability for the investor, this suite of technologies provide much broader benefits by taking demand pressure off of the electricity grid and improving reliability.

- Industrial Technologies. Plans have been completed to build the first few Mesabi Nugget commercial ironmaking facilities, which will be constructed in Indiana and Minnesota. These plants will decrease the need for coke imports and relieve both domestic coke and quality steel scrap shortages. This commercial scale-up was made practical through EERE support of the development of this technology through the pilot plant stage in a partnership with the State of Minnesota. It is estimated these ironmaking facilities can reduce energy needs by 29 percent, sulfur dioxide emissions by 80 percent and particulates by over 90 percent. While contributing directly to our energy and environmental goals, this accomplishment also stems an industry trend in migrating jobs and manufacture of cornerstone components of the economy offshore.

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 outcome- 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 2006 Budget and the Department will take the necessary steps to continue to improve performance.

For FY 2006, two new programs, Vehicle Technologies and State Energy Program were assessed. The Building Technologies, Weatherization and Intergovernmental Activities, and Distributed Energy Resources Programs were last assessed using the PART to support the FY 2005 Budget. These programs have taken action to address all PART findings and recommendations within their direct control.

EERE's FY 2006 performance targets are more consistent with PART measures and targets this year than in previous years, and work continues to make them as uniform as possible. EERE has corporately addressed a recommendation common to all DOE applied R&D PART, which is to improve consistency of methods and assumptions used to estimate benefits. Although benefits estimates calculated to support this budget are not yet comparable, DOE continues to improve consistency of various programs' methods and assumptions. EERE is addressing this challenge through the consolidation of planning, budget and analysis into one organization whose mission is: To support sound and effective EERE strategic, programmatic and fiscal decision-making through efficient processes that result in high quality representation, reporting, plans, analyses, budgets, performance management and program evaluations. The Department has used the existing R&D investment criteria to inform the development of the FY 2006 budget.

EERE is addressing the findings outside of EERE's direct program control such as Departmental allocation of costs by providing full internal accounting allocation of program direction, and is working with Departmental and OMB staff to incorporate R&D Investment Criteria as appropriate, expand the lessons learned in EERE benefits framework methodology to the applied Energy R&D programs. We

also continue to interactively improve PART processes, systems and scoring consistency to enable our performance to be more accurately portrayed by PART. The individual program responses are provided in their respective budgets.

Significant Program Shifts

These program shifts and resulting budget prioritization decisions were guided by the R&D Investment Criteria (RDIC). Key RDIC are noted in the individual program discussions.

- Fuel Cells. In FY 2004, the Department made a decision to discontinue on-board vehicle fuel processing (RDIC 2e – Off Ramps). The decision was based on several key conclusions: current fuel processing technologies did not meet the technical and economic targets; there was no clear path forward to meet the more difficult criteria necessary for full implementation/integration in fuel cell vehicles; there was no interest from the U.S. auto industry; and competing technologies available today (e.g. gasoline, hybrid-electric vehicles) offer similar efficiency and emissions to a fuel cell vehicle operating on gasoline that is reformed on-board the vehicle. Use of an independent review panel using technical evaluation of status, progress, and potential on-board fuel processing R&D was used to arrive at this decision (RDIC 2f – External Review). Funds in the FY 2006 request are reallocated to stationary and auxiliary power applications which offer the best remaining options for moving successfully forward and meeting the 2015 commercialization decision (RDIC Section 3 Performance).
- Biomass and Biorefinery Systems R&D. Based on the use of R&D Investment Criteria (specifically 2b - the criteria dealing with industry's involvement in planning and prioritization and 2i - the level of technical risk that warrant Federal participation), the program will provide increased support to partnership activities, for: (a) new partnerships to develop forest-based biorefineries and improve the process efficiencies within the existing forest products industry; and (b) partnerships scheduled for selection in 2005 to develop core bio-based products technologies.

Congressional Items of Interest

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Distributed Energy Resources					
National Accounts Energy Alliance.....	988	986	0	-986	-100.0%
Building Technologies					
National Fenestration Rating Council....	262	100	200	+100	+100.0%
Solid State Lighting	7,234	11,777	11,000	-777	-6.6%
Total, Building Technologies	7,496	11,877	11,200	-677	-3.6%
Program Direction					
National Academy of Sciences Program Review.....	495	493	0	-493	-100.0%
Energy and Research Consortium of the Western Carolinas.....	2,963	2,958	0	-2,958	-100.0%
Total, Program Direction.....	3,458	3,451	0	-3,451	-100.0%
Total, Congressional Items of Interest.....	11,942	16,314	11,200	-5,114	-31.3%

Expected Integrated Program Outcomes

The program pursues its mission through an integrated portfolio of research, development, demonstration and deployment activities that improve the Nation's energy security, energy efficiency and productivity of our economy while minimizing environmental impacts. Figure 1 below depicts the related potential shift in nonrenewable energy consumption. We expect the energy efficiency and renewable energy components of these energy savings to result in lower energy bills and reduced susceptibility to energy price fluctuations; reduced EPA criteria and other pollutants; enhanced energy security as petroleum and natural gas dependence is reduced and domestic fuel supplies increase; and greater energy security and reliability from improvements in energy infrastructure. Indicators of some of these program benefits are provided in the tables below. The results shown in the long-term benefits tables are preliminary estimates based on initial modeling of some of the possible program production technologies.

The assumptions and methods underlying the modeling efforts have significant impact on the estimated benefits. Results could vary significantly if external factors, such as future energy prices, differ from the baseline case assumed for this analysis (essentially the EIA business as usual outlook for components of the economy affecting energy use -- this modeling includes competing technologies). In addition, possible changes in public policy and disruptions in the energy system which may affect estimated benefits are not modeled. The external factors such as unexpected changes in competing technology costs, identified in the Means and Strategies sections in each of the individual contributing programs, could also affect EERE's ability to achieve its strategic goals as could persistent directed funding. Projections of future benefits also depend on assumptions relating to how the economy will evolve over time and how rapidly energy efficient technologies will be developed and adopted among other variables. The estimated benefits presented here are predicated on the assumptions included in EIA's Annual Energy Outlook 2004 Reference Case projections.

Some key assumptions about macroeconomic activity, energy demand, and technology results include the following "business-as-usual" outputs:

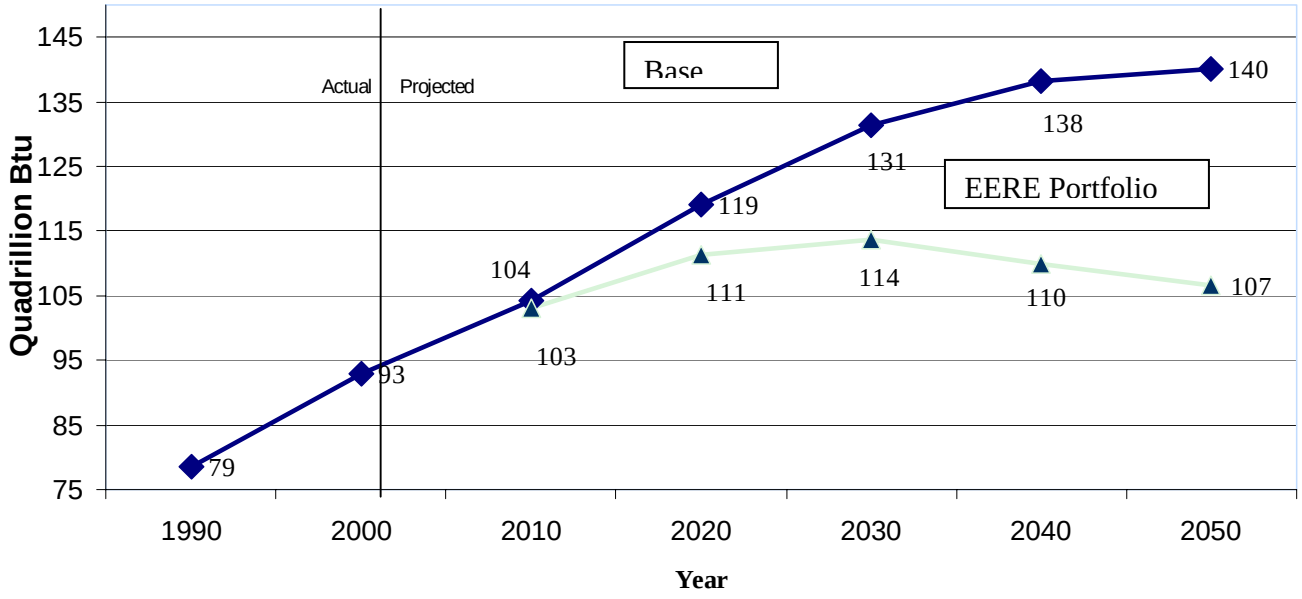
- Economic growth of 3.1 percent annually;
- Price per barrel of oil of about $28 (2003 dollars) in 2003, rising to $35 in 2004, then dropping to $25 in 2010, then rising slowly to $30 in 2025. In nominal dollars, the price of oil in 2025 would be about $52; and
- Price per thousand cubic feet of natural gas of $4.98 (2003 dollars) in 2003, dropping to $3.64 in 2010, then rising slowly to $4.79 by 2025. In nominal dollars, the price of natural gas in 2025 would be about $8.20.

EIA also provides projections under alternative economic assumptions ranging from 2.4 to 3.5 percent annual growth between 2002 and 2025. Across this range, total energy consumption may grow by anywhere from 29 to 49 percent between 2002 and 2025. EIA also offers a range of technology assumptions. Across these cases total energy consumption may grow by anywhere from 46 percent between 2002 and 2025 if technology does not improve at all to 32 percent if technology improves rapidly. Changing assumptions on important variables such as these would likely affect the estimated benefits in this budget.

The results shown in the long term benefits tables are preliminary estimates based on initial modeling of some of the possible program production technologies; uncertainties are larger for longer term estimates, nonetheless, they provide a useful picture of the potential change in national benefits over time if the technology, infrastructure and markets evolve as expected. Estimated benefits which follow assume that

individual technology plans and market assumptions obtain. A summary of the methods, assumptions, and models used in developing these benefit estimates that are important for understanding these results are provided at www.eere.energy.gov/office_eere/budget_gpra.html. Final documentation is estimated to be completed and posted by March 31, 2005.

Figure 1. U.S. Nonrenewable Energy Consumption, 1990-2000, and Projections to 2050



EERE's portfolio includes a mix of efforts intended to produce short-, mid-, and long-term benefits. The size of these benefits depends not only on the success of the EERE program efforts funded in this budget request, but on how future energy markets and policies evolve. EERE estimates a sub-set of these benefits assuming a continuation of current policies and business-as-usual development of energy markets. These estimates do not include the underlying, base case improvements in energy efficiency and renewable energy use that could be expected in the absence of continued funding of EERE's programs.[a]

[a] Benefits reported are annual, not cumulative, for the year given. Estimates reflect the benefits that may be possible if all of the programs' technical targets are met and funding continues at levels consistent with assumptions in the FY 2006 Budget through the program completion year, which varies by program.

Mid-term Benefits[a]		(calendar year) 2010	2015	2020	2025
Energy Displaced	Primary nonrenewable energy savings (Quads)	1	3	8	12
Economic	Energy bill savings (billion 2002$)	12	37	87	123
Environment	Carbon emissions reductions (MMTCE)	22	67	160	262
Security	Oil savings (mbpd)	0.1	0.6	1.3	2.3
	Natural gas savings (Quads)	0.5	1.1	1.9	1.8
	Reduced need for additions to central conventional power (GW)	5	49	96	137

The table shows that if successful and the assumptions obtain, EERE's programs could provide mid-term benefits in 2025 of over $100 billion in annual energy bill savings; a reduction of about 250 million metric tons of annual carbon emissions (MMTCE); a savings of over 2 million barrels of oil per day; and a reduction of nearly 2 Quads of natural gas consumption. A combination of reduced peak demand for electricity and additional renewable and distributed generation capacity reduces the need for more than 130 GW of additional conventional central power generation, thereby increasing the flexibility and diversity of our electricity system while reducing the potential for a shortage of new generating capacity.

EERE's portfolio includes a number of efforts to develop fundamental breakthroughs in technologies that promise major changes in how we will produce, and the ways we use energy in the decades to come. If these breakthroughs succeed, benefits could continue to grow in the long term. By 2050, benefits may include reductions in the overall annual cost of our energy systems approaching $300 billion; reductions in annual carbon dioxide emissions of nearly 700 MMTCE; reductions in oil demand of over 10 million barrels per day; and annual savings in natural gas demand of over 2 Quads.

Long-Term Benefits[b]		(calendar year) 2030	2040	2050
Energy Displaced	Primary nonrenewable energy savings (Quads)	18	28	34
Economic	Overall energy cost savings (billion 2002$)	102	188	282
Environment	Carbon emissions reductions (MMTCE)	364	568	699
Security	Oil savings (mbpd)	4.6	9.0	11.0
	Natural gas savings (Quads)	2.8	3.6	2.4

[a] Mid-term program benefits, assuming technological success of the entire EERE portfolio, were estimated utilizing the GPRA06-NEMS model, based on the Energy Information Administration's (EIA) National Energy Modeling System (NEMS) and utilizing the EIA's Annual Energy Outlook (AEO) 2004 Reference Case.

[b] Long-term benefits, assuming technological success of the entire EERE portfolio, were estimated utilizing the GPRA06 - MARKAL developed by Brookhaven National Laboratory (BNL). Results can differ among models due to differences in their structure. In particular, the two models estimate economic benefits in different ways, with the MARKAL model reflecting the cost of additional investments required to achieve reductions in energy bills.

These mid- and long-term estimates are derived utilizing a similar baseline case, but different modeling techniques and, as a result, are not directly comparable. While point estimates are presented, both mid-term and long-term modelings are dependent upon the methodology and assumptions used. Many of the key variables affecting the benefits estimates are listed as the external factors that could affect expected results in the means and strategy sections of the individual programs and include variables, such as market and policy interactions and the future price of oil, natural gas and electricity generation. Long-term estimates should be considered preliminary as EERE refines its analytical approaches for the 2030-2050 timeframe.

These benefits result from the mix of interrelated investments supported by EERE's budget request. For instance, more efficient buildings and factories provide the basis for distributed energy resources, such as building solar photovoltaic systems and combined heat and power cogeneration. In addition to these "business-as-usual" benefits, EERE's portfolio would provide the technical potential to reduce conventional energy use even further if warranted by future energy needs. The development of wide-spread sources of wind, solar, geothermal, biomass, and hydropower energy sources; new ways of using energy through hydrogen and distributed power; and technologies that would fundamentally improve the basic efficiency of our homes, businesses, factories, and vehicles could allow us, if desired, to make substantial reductions in our oil use and convert a larger portion of our electricity system to decentralized capacity and renewable energy sources to improve security and reliability.

GPRA 2006 Estimate of Potential Benefits by Program

	Primary Non-Renewable Energy Savings (Quads)		Energy Bill Savings (Billion 2002$)	Energy System Cost Savings (Billion 2002$)	Carbon Emission Reductions (MMTCE)		Oil Savings (mbpd)	
	2025	2050	2025	2050	2025	2050	2025	2050
Energy Supply (EWD):								
Hydrogen, Fuel Cells & Infrastructure Program (1)	0.2	4.3	2	26	5	60	0.2	2.7
Solar Energy Program	0.3	1.7	2	2	8	36	ns	ns
Wind Energy Program	3.3	3.7	4	4	81	87	0.1	ns
Geothermal Technologies Program	0.3	2.4	ns	5	8	59	ns	ns
Biomass & Biorefinery Systems R&D Program (2)	0.1	1.1	ns	1	3	19	0.0	0.4
Intergovernmental Activities Program (3)								
Federal Energy Management Program (4)	0.1	--	0	--	1	--	0.0	--

	Primary Non-Renewable Energy Savings (Quads)		Energy Bill Savings (Billion 2002$)	Energy System Cost Savings (Billion 2002$)	Carbon Emission Reductions (MMTCE)		Oil Savings (mbpd)	
	2025	2050	2025	2050	2025	2050	2025	2050
Energy Conservation (INT)								
Vehicle Technologies Program	4.0	18.9	61	177	76	365	1.8	8.8
Hydrogen, Fuel Cells & Infrastructure Program (1)	0.2	4.3	2	26	5	60	0.2	2.7
Weatherization & Intergovernmental Activities Program	1.2	--	10	--	27	--	0.1	--
Distributed Energy Program	0.3	--	2	--	11	--	ns	--
Building Technologies Program	1.2	4.2	12	62	28	92	0.0	0.1
Industrial Technologies Program	2.2	0.5	13	3	44	8	0.2	0.0
Biomass & Biorefinery Systems R&D Program (2)	0.1	1.1	ns	1	3	19	0.0	0.4
Federal Energy Management Program (4)	0.1	--	0	--	1	--	0.0	--

EERE's portfolio approach to RD&D affects benefits and the way they are calculated. The total benefits reported for EERE's entire portfolio are usually less that the sum of the individual programs due to competition between these technologies and the resulting tradeoffs. For instance, efficiency improvements reduce the future need for new electricity generating capacity, including the potential size of the renewable electric market. In addition, a research failure in one area will not necessarily reduce the technology's overall benefits, as the lack of market penetration by the failed technology may create a market opportunity elsewhere in the EERE portfolio. An integrated benefit total may be higher than the individual sums because of the additive impact of multiple EERE programs.

(1) Benefits were estimated jointly for the Hydrogen Technology (Energy Supply) and Fuel Cell Technologies (Energy Conservation) Programs. The estimates are repeated under each appropriation and are not additive.

(2) Benefits were estimated jointly for the Energy Supply and Energy Conservation components of the Biomass & Biorefinery Systems R&D Program. The estimates are repeated under each appropriation and are not additive.

(3) An estimate of renewable electricity generation stimulated by the Renewable Energy Production Incentive is included in the section for Intergovernmental Activities. Because this is not one of the common benefits estimated for all programs, it is not included in this table.

(4) Benefits were estimated jointly for the Departmental Energy Management (Energy Supply) and the Federal Energy Management (Energy Conservation) Programs. The estimates are repeated under each appropriation and are not additive.

ns = not significant; -- long-term benefits were not estimated for the Distributed Energy, Federal Energy Management, and Weatherization & Intergovernmental Programs

Funding Summary by Program

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Request	FY 2006 vs FY 2005 $ Change	FY 2006 vs FY 2005 % Change
Biomass Program					
Biomass and Biorefinery Systems R&D (EWD)	84,608	80,846	50,359	-30,487	-37.7%
Biomass and Biorefinery Systems R&D (INT)	6,966	7,253	21,805	+14,552	+200.6%
Total, Biomass Program	91,574	88,099	72,164	-15,935	-18.1%
Building Technologies (INT)	57,799	65,464	57,966	-7,498	-11.5%
Distributed Energy Resources (INT)	59,684	60,416	56,629	-3,787	-6.3%
Facilities and Infrastructure (EWD)	12,950	11,389	16,315	+4,926	+43.3%
Federal Energy Management Program					
Departmental Energy Management Program (EWD)	1,963	1,951	2,019	+68	+3.5%
Federal Energy Management Program (INT)	19,420	17,931	17,147	-784	-4.4%
Total, Federal Energy Management Program	21,383	19,882	19,166	-716	-3.6%
Geothermal Technology (EWD)	24,625	25,270	23,299	-1,971	-7.8%
Industrial Technologies (INT)	90,450	74,801	56,489	-18,312	-24.5%
Hydrogen, Fuel Cells, and Infrastructure Program					
Hydrogen Technology (EWD)	80,412	94,006	99,094	+5,088	+5.4%
Fuel Cell Technologies (INT)	63,782	74,944	83,600	+8,656	+11.5%
Total, Hydrogen, Fuel Cells, and Infrastructure Program	144,194	168,950	182,694	+13,744	+8.1%
Renewable Program Support (EWD)	8,493	5,954	2,901	-3,053	-51.3%
Solar Energy (EWD)	80,731	85,074	83,953	-1,121	-1.3%
Vehicle Technologies (INT)	172,395	165,409	165,943	+534	+0.3%

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Request	FY 2006 vs FY 2005 $ Change	FY 2006 vs FY 2005 % Change
Weatherization and Intergovernmental Activities					
Intergovernmental Activities (EWD)	14,673	16,776	11,910	-4,866	-29.0%
Weatherization and Intergovernmental Activities (INT)	307,932	309,005	298,157	-10,848	-3.5%
Total, Weatherization and Intergovernmental Activities	322,605	325,781	310,067	-15,714	-4.8%
Wind Energy and Hydropower					
Wind Energy (EWD)	39,803	40,804	44,249	+3,445	+8.4%
Hydropower (EWD)	4,673	4,862	500	-4,362	-89.7%
Total, Wind Energy and Hydropower	44,476	45,666	44,749	-917	-2.0%
Program Direction					
Program Direction (EWD)	16,490	19,064	19,043	-21	-0.1%
Program Management (INT)	92,362	93,011	89,036	-3,975	-4.3%
Total, Program Direction	108,852	112,075	108,079	-3,996	-3.6%
Subtotal, Energy Supply and Energy Conservation	1,240,211	1,254,230	1,200,414	-53,816	-4.3%
Use of prior year balances (EWD)	-17,126	-5,648	0	+5,648	+100.0%
Use of prior year balances (INT)	-2,823	0	0	0	0.0%
Total, Energy Supply and Energy Conservation	1,220,262	1,248,582	1,200,414	-48,168	-3.9%

Energy Conservation

Office of Energy Efficiency and Renewable Energy

Funding by Site by Program

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Central Regional Office					
Program Management	3,569	3,400	3,600	+200	+5.9%
Chicago Operations Office					
Ames Laboratory					
Vehicle Technologies	293	297	300	+3	+1.0%
Argonne National Laboratory (East)					
Vehicle Technologies	22,966	21,045	19,225	-1,820	-8.6%
Fuel Cell Technologies	8,829	6,275	6,860	+585	+9.3%
Weatherization and Intergovernmental Activities	50	0	0	0	0.0%
Distributed Energy Resources	1,800	775	775	0	0.0%
Building Technologies	15	0	0	0	0.0%
Industrial Technologies	2,770	1,081	2,600	+1,519	+140.5%
Biomass and Biorefinery Systems R&D	0	0	500	+500	NA
Program Management	712	651	651	0	0.0%
Total, Argonne National Laboratory (East)	37,142	29,827	30,611	+784	+2.6%
Brookhaven National Laboratory					
Vehicle Technologies	1,245	1,067	600	-467	-43.8%
Fuel Cell Technologies	300	390	400	+10	+2.6%
Building Technologies	964	888	395	-493	-55.5%
Program Management	300	275	275	0	0.0%
Total, Brookhaven National Laboratory	2,809	2,620	1,670	-950	-36.3%

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Lawrence Berkeley National Laboratory					
Vehicle Technologies	5,181	7,844	7,370	-474	-6.0%
Fuel Cell Technologies	450	753	1,050	+297	+39.4%
Weatherization and Intergovernmental Activities	500	500	500	0	0.0%
Distributed Energy Resources	200	200	200	0	0.0%
Building Technologies	11,440	9,317	8,327	-990	-10.6%
Industrial Technologies	2,886	50	1,750	+1,700	+3,400.0%
Federal Energy Management Program	2,594	2,300	2,200	-100	-4.3%
Program Management	456	400	400	0	0.0%
Total, Lawrence Berkeley National Laboratory	23,707	21,364	21,797	+433	+2.0%
National Renewable Energy Laboratory					
Vehicle Technologies	18,594	16,247	11,817	-4,430	-27.3%
Fuel Cell Technologies	1,911	2,750	1,950	-800	-29.1%
Weatherization and Intergovernmental Activities	4,450	4,450	2,750	-1,700	-38.2%
Distributed Energy Resources	1,814	1,814	1,814	0	0.0%
Building Technologies	3,657	5,559	5,083	-476	-8.6%
Industrial Technologies	5,284	138	1,400	+1,262	+914.5%
Biomass and Biorefinery Systems R&D	1,165	305	1,500	+1,195	+391.8%
Federal Energy Management Program	5,276	3,200	3,300	+100	+3.1%
Program Management	1,654	1,660	1,660	0	0.0%
Total, National Renewable Energy Laboratory	43,805	36,123	31,274	-4,849	-13.4%
Pacific Northwest National Laboratory					
Vehicle Technologies	6,273	7,251	7,712	+461	+6.4%
Fuel Cell Technologies	1,315	620	500	-120	-19.4%
Weatherization and Intergovernmental Activities	3,400	3,400	3,500	+100	+2.9%
Distributed Energy Resources	200	200	200	0	0.0%
Building Technologies	4,907	2,872	3,271	+399	+13.9%

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Industrial Technologies	1,368	740	1,500	+760	+102.7%
Biomass and Biorefinery Systems R&D	150	2,100	2,500	+400	+19.0%
Federal Energy Management Program	2,612	2,000	2,000	0	0.0%
Program Management	994	816	816	0	0.0%
Total, Pacific Northwest National Laboratory	21,219	19,999	21,999	+2,000	+10.0%
Total, Chicago Operations Office	128,975	110,230	107,651	-2,579	-2.3%
Golden Field Office					
Vehicle Technologies	2,200	0	0	0	0.0%
Program Management	7,455	9,321	9,816	+495	+5.3%
Total, Golden Field Office	9,655	9,321	9,816	+495	+5.3%
Idaho Operations Office					
Idaho National Engineering and Environmental Laboratory					
Vehicle Technologies	2,573	3,979	3,320	-659	-16.6%
Weatherization and Intergovernmental Activities	50	50	0	-50	-100.0%
Industrial Technologies	398	190	200	+10	+5.3%
Biomass and Biorefinery Systems R&D	0	0	500	+500	NA
Total, Idaho Operations Office.	3,021	4,219	4,020	-199	-4.7%
Livermore Site Office					
Lawrence Livermore National Laboratory					
Vehicle Technologies	3,218	3,695	2,610	-1,085	-29.4%
Fuel Cell Technologies	175	300	175	-125	-41.7%
Industrial Technologies	132	140	400	+260	+185.7%
Total, Livermore Site Office	3,525	4,135	3,185	-950	-23.0%

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Los Alamos Site Office					
Los Alamos National Laboratory					
Vehicle Technologies	885	407	723	+316	+77.6%
Fuel Cell Technologies	5,348	7,011	8,090	+1,079	+15.4%
Building Technologies	250	250	0	-250	-100.0%
Industrial Technologies	350	678	750	+72	+10.6%
Total, Los Alamos Site Office	6,833	8,346	9,563	+1,217	+14.6%
Mid-Atlantic Regional Office					
Program Management	2,440	2,384	2,544	+160	+6.7%
Midwest Regional Office					
Program Management	2,551	2,664	2,700	+36	+1.4%
National Energy Technology Laboratory					
Weatherization and Intergovernmental Activities	680	820	1,800	+980	+119.5%
Distributed Energy Resources	2,400	1,500	1,300	-200	-13.3%
Industrial Technologies	0	300	303	+3	+1.0%
Biomass and Biorefinery Systems	0	0	250	+250	NA
Federal Energy Management Program	857	300	300	0	0.0%
Program Management	9,380	9,400	8,550	-850	-9.0%
Total, National Energy Technology Laboratory	13,317	12,320	12,503	+183	+1.5%
National Nuclear Security Administration's Service Center (NNSA)					
NNSA Service Center					
Vehicle Technologies	500	500	500	0	0.0%
Northeast Regional Office					
Program Management	2,842	2,525	2,703	+178	+7.0%

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Oak Ridge Operations Office					
Oak Ridge Institute for Science and Education					
Vehicle Technologies	320	0	0	0	0.0%
Oak Ridge National Laboratory					
Vehicle Technologies	6,465	4,992	4,100	-892	-17.9%
Fuel Cell Technologies	2,298	1858	1763	-95	-5.1%
Weatherization and Intergovernmental Activities	3,752	3823	3450	-373	-9.8%
Distributed Energy Resources	27,077	26367	29692	+3,325	+12.6%
Building Technologies	6,280	3776	2337	-1,439	-38.1%
Industrial Technologies	11,739	4140	4800	+660	+15.9%
Biomass and Biorefinery Systems	45	0	0	0	0.0%
Federal Energy Management	4,071	2800	2700	-100	-3.6%
Program Management	4,216	1146	1146	0	0.0%
Total, Oak Ridge National Laboratory	65,943	48,902	49,988	1,086	2.2%
Oak Ridge Operations Office					
Vehicle Technologies	5,423	1175	1162	-13	-1.1%
Total, Oak Ridge Operations Office	71,686	50,077	51,150	1,073	2.1%
Sandia Site Office					
Sandia National Laboratories					
Vehicle Technologies	8,102	9,673	9,110	-563	-5.8%
Fuel Cell Technologies	0	150	0	-150	-100.0%
Industrial Technologies	2,411	650	360	-290	-44.6%
Federal Energy Management Program	326	350	325	-25	-7.1%
Program Management	275	250	250	0	0.0%
Total, Sandia Site Office	11,114	11,073	10,045	-1,028	-9.3%
Southeast Regional Office					
Program Management	3,099	3,200	3,300	+100	+3.1%

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Washington Headquarters					
Office of Scientific and Technical Information					
Vehicle Technologies	50	100	100	0	0.0%
Washington Headquarters					
Vehicle Technologies	88,107	87,137	97,294	+10,157	+11.7%
Fuel Cell Technologies	43,156	54,837	62,812	+7,975	+14.5%
Weatherization and Intergovernmental Activities	295,050	295,962	286,157	-9,805	-3.3%
Distributed Energy Resources	26,193	29,560	22,648	-6,912	-23.4%
Building Technologies	30,286	42802	38553	-4,249	-9.9%
Industrial Technologies	63,112	66,694	42,426	-24,268	-36.4%
Biomass and Biorefinery Systems R&D	5,606	4,848	16,555	+11,707	+241.5%
Federal Energy Management Program	3,684	6,981	6,322	-659	-9.4%
Program Management	49,650	52,114	47,572	-4,542	-8.7%
Total, Washington Headquarters	604,844	640,935	620,339	-20,596	-3.2%
Total, Washington Headquarters	604,894	641,035	620,439	-20,596	-3.2%
Western Regional Office					
Program Management	2,769	2,805	3,053	+248	+8.8%
Total, Energy Conservation	870,790	868,234	846,772	-21,462	-2.5%

Site Description

Central Regional Office

Program Management

Program Management funds the personnel and overhead costs for 21 FTE in the Central Regional Office (CRO) (Denver, CO) in order to provide: (1) promotion of EERE programs at the local and regional levels; (2) administration of grants to, and cooperative agreements with, States and local governments (particularly the Weatherization Assistance Program and State Energy Program grants); and (3) administration and implementation of locally- and regionally-focused deployment activities, such as Clean Cities, Rebuild America, and the Federal Energy Management Program (FEMP). CRO will also occasionally receive small amounts of direct funding from individual R&D or deployment programs to perform specific tasks—such as managing a cooperative or inter-agency agreement, arranging a conference, or other locally-oriented activities. It also provides support to Biomass and Biorefinery Systems R&D.

Chicago Operations Office

Ames Laboratory

Vehicle Technologies

Ames Laboratory is located in Ames, Iowa. Ames provides research for Vehicle Technologies in new materials. Ames conducts basic research on new materials with unique properties. It is a multi-discipline laboratory providing support to Vehicle Technologies (VT). Ames Laboratory work for VT includes the development of low-cost power metallurgy manufacturing methods for particle reinforced aluminum (PRA) composite components. Materials efforts are developing to improve powder for permanent magnets.

Argonne National Laboratory

Introduction

Argonne National Laboratory (ANL) is located in Argonne, Illinois. It is a multi-discipline laboratory providing support to Vehicle Technologies, Fuel Cell Technologies, Weatherization and Intergovernmental Activities, Distributed Energy Resources, Building Technologies, Industrial Technologies, Biomass and Biorefinery Systems R&D, and Program Management.

Vehicle Technologies

Provides simulation, analysis, and develops transient models for hybrid and fuel cell systems. Develops sophisticated software for hardware-in-the loop testing. Provides technical support and analysis for heavy hybrids. Conducts research to reduce parasitic loads on heavy vehicles including reductions in idling losses, rolling resistance, aerodynamic drag, and under hood thermal management. Also, works to improve oil filtration, coolants, and regenerative shocks for trucks. Performs high-performance computing with particular focus on computational fluid dynamics (combustion, underhood cooling, HVAC, etc.). Utilizes the Advanced Photon Source facility to characterize fundamental mechanisms of friction, lubrication, and fuel spray from fuel injectors. Develops nano-fluid technology and new designs for higher efficiency heavy vehicle cooling systems. Monitors R&D in industry for underhood

electrification for heavy vehicle components and new brake material developments. Provides technical and analytical expertise to the Graduate Automotive Technology Education (GATE) activities. Conducts HEV component and subsystem performance and emissions tests in a state-of-the-art test facility. Validates components and subsystems performance targets for hybrid and fuel cell technology using hardware-in-the loop testing to simulate vehicle operating environment. Develops test procedures for advanced vehicle testing and control strategies to improve overall vehicle efficiency and reduce emissions. Conducts research in energy storage for EVs and HEVs and high performance capacitors. Provides battery technical support, and testing of advanced batteries.

Conducts research and development of in-cylinder emission control techniques for CIDI engines and the evaluation of innovative technologies to reduce emissions and improve fuel efficiencies in heavy-duty diesel engines. Develops wide range of materials (both metals and ceramics), with particular expertise in nondestructive evaluation, rapid prototyping, sensors, and catalysts. Develops economic processes for automotive recycling. Develops permanent magnet materials for high performance motors. Characterizes the effect of microdimpling on reduction of surface friction and wear. Develops lower temperature, high strength bonding method for ceramics and dissimilar materials. Conducts technology analysis (energy, environmental, and economic) as well as vehicle system and subsystem modeling.

Fuel Cell Technologies

Argonne National Laboratory is the lead laboratory in all facets of the research and development of fuel processor catalysts and fuel cell system analysis. ANL provides technical assistance in the management of DOE cooperative agreements with industry. ANL develops catalysts, materials, and processes for the autothermal reforming of gasoline and other fuels including diesel with CO clean-up, investigates the effect of fuel additives on fuel processor performance, and characterizes the stability and degradation of fuel processing catalysts. ANL is using sulfonated polyarl ether dendrimers (highly branched macromolecules) and inorganic/organic composites to develop membrance electrolytes with high proton conductivity at low relative humidity and temperatures ranging from room temperature to above 100°C. To minimize the cost of fuel cell cathode catalysts, ANL is exploring transition metal carbides/nitribes based materials, especially the mixed transition metal carbides/nitrides (e.g. M_1M_2N, $M_1N_xC_y$, M = transition metal).

Weatherization and Intergovernmental Activities

ANL worked with engine and platform manufacturers to develop natural gas school buses as part of the Clean Cities platform development effort.

Distributed Energy Resources

ANL performs research and development including non-destructive evaluation (NDE) of advanced ceramics, high temperature recuperators and coatings and laser ignition research for reciprocating engines.

Building Technologies

ANL supported the Building Technology Program by assessing the impacts of potential policy choices on building technology markets through the use of market and benefits models, and external analysis.

Industrial Technologies

ANL performs research and development for the Chemical industry R&D area. Argonne provides unique expertise in advanced separations process technologies and new innovative membrane systems. The laboratory also does research on refractory materials for the steel industry. The laboratory also has unique expertise in anode and cathode development for the aluminum industry using technology to analyze the surface effects conditions on the advanced candidate materials.

Biomass and Biorefinery Systems R&D

ANL will conduct R&D related to converting biomass to bio-based products with the goal of making the technologies more competitive with petroleum-based alternatives.

Program Management

Provide analytical support for major crosscutting issues, such as market and benefit analyses.

Brookhaven National Laboratory

Introduction

Brookhaven National Laboratory (BNL) is located in Upton, New York. It is a multi-discipline laboratory providing support to Vehicle Technologies, Fuel Cell Technologies, Building Technologies, and Program Management.

Vehicle Technologies

Performed analysis studies and conducted research in advanced materials that improved the performance and abuse tolerance of lithium battery systems and provided research support for analysis of internal combustion (IC) engine emissions for FreedomCAR partnership.

Fuel Cell Technologies

BNL conducts research and development of electrocatalyst alloys for fuel cells focusing on synthesis and characterization of the materials.

Building Technologies

BNL conducts research and development activities for the space heating and cooling technologies for Building Technologies.

Program Management

Provides analytical support for crosscutting issues such as market and benefit analyses.

Lawrence Berkeley National Laboratory

Introduction

Lawrence Berkeley National Laboratory (LBNL) is located in Berkeley, California. It is a multi-discipline laboratory providing support to Vehicle Technologies, Fuel Cell Technologies, Weatherization and Intergovernmental Activities, Distributed Energy Resources, Building

Technologies, Industrial Technologies, Federal Energy Management Program, and Program Management.

Vehicle Technologies

Conducts exploratory research in advanced battery technology, including development of new electrode and electrolyte materials and understanding of fundamental electrochemical phenomena. Develops device to measure particulate matter from engines. Develops nondestructive testing techniques for evaluation of aluminum and composite structures in manufacturing environments.

Fuel Cell Technologies

Lawrence Berkeley National Laboratory develops electrocatalysts for membrane electrode assemblies with the goal of increasing understanding of fundamental electrochemical processes.

Weatherization and Intergovernmental Activities

Lawrence Berkeley National Laboratory provides technology transfer technical outreach for Rebuild America and EnergyStar.®

Distributed Energy Resources

Lawrence Berkeley National Laboratory will perform analysis tasks to quantify benefits of distributed generation technologies to the customer, the system and the Nation.

Building Technologies

Lawrence Berkeley National Laboratory conducts research and development activities in lighting, windows, appliance standards, analysis tools and design strategies and space heating and cooling.

Industrial Technologies

The Lawrence Berkeley National Laboratory supports technology delivery activities of the Best Practices Program including assistance in facilitating Allied Partners with supplier industry organizations (e.g. Hydraulic Institute, Compressed Air and Gas Institute). The laboratory supports the tracking of Best Practices implementation results including the impact of training, software tools and other program delivery mechanisms on manufacturing plants.

Federal Energy Management Program

LBNL facilitates projects, develops guidelines and provides expert advice on the monitoring and verification protocols for energy projects savings, laboratory sustainable design principles, public benefit funds, and lighting.

Program Management

Provide analytical support for major crosscutting issues, such as market and benefit analyses.

National Renewable Energy Laboratory

Introduction

National Renewable Energy Laboratory (NREL) is located in Golden, Colorado. It is a multi-discipline laboratory providing support to Vehicle Technologies, Fuel Cell Technologies, Weatherization and Intergovernmental, Distributed Energy Resources, Building Technologies, Industrial Technologies, Biomass and Biorefinery Systems R&D, Federal Energy Management Program and Program Management.

Vehicle Technologies

Provides analysis of performance targets for light and heavy vehicles, including developing a Technical Targets Tool for government use. Develops system models and provides analysis and simulations of advanced hybrid and fuel cell configurations using the ADVISOR software developed at the lab as well as other tools. Performs trade-off analysis and optimization for fuel cell and other advanced vehicles to identify opportunities for decreased fuel consumption using advanced technology and study the impacts of future fuel cell characteristics on vehicle performance. Provides CAD/CAE for optimized vehicle system solutions in support of FreedomCAR partnership goals, and general engineering assessments of HEV and AFV technologies. Conducts research in reducing ancillary and climate control loads for light vehicles and energy losses in general for both heavy and light vehicles such as rolling resistance, aerodynamics, heat losses, friction, pumping, fuel delivery losses, etc. Investigates and develops advanced battery thermal management for hybrid and fuel cell vehicles. Provides analysis, modeling, and technical support for power electronics and electric machines for heavy vehicles. Conducts engine/vehicle integration and platform studies. Develops component models of engine/after treatment systems to allow for quick and inexpensive evaluations of proposed combinations of fuel/engine/emissions control combinations. Leads an effort to identify the effects of sulfur levels of diesel fuels on near term emissions control devices. Leads an effort to determine the lube oil effects on exhaust after treatment devices. Conducts tests of bio-based diesel fuel blending agents to determine their ability to act as reductants in the exhaust stream of diesel engines. Supports EPAct regulatory programs including Federal Fleet, State and Fuel Provider, Private and Local, and Fuel petitions. Tests and evaluates heavy-duty, medium duty and transit alternative and advanced technology vehicles.

Fuel Cell Technologies

National Renewable Energy Laboratory leads the Systems Integration and Analysis function for the program. Models of the technical, economic, and integration aspects of the hydrogen infrastructure and fuel cell vehicle systems provide guidance for the development of hydrogen fuel cell components and materials. In support of ORNL's metallic bipolar plate project, NREL will survey current commercially available alloys to determine the best combination of alloy composition and evaluate nitrided metal samples. NREL will explore pure heteropoly acids (HPAs) and HPA/organic polymer mixtures for high temperature membranes in fuel cells.

Weatherization and Intergovernmental Activities

NREL analyzes the program's communications strategy and develops information outreach products for WIP and specific subprograms. NREL provides technology transfer technical outreach for Rebuild America and Energy Smart Schools. NREL also participates in providing technical assistance in identifying and developing energy policies that will reduce greenhouse gas emissions and contribute to development goals through accelerated deployment of renewable energy and energy efficiency technologies.

Distributed Energy Resources

NREL conducts research and development of novel material, sensor and processing techniques for advanced desiccant systems for humidity control and improved air quality. NREL also performs analysis addressing regulatory and institutional barriers to distributed energy resources.

Building Technologies

NREL conducts research and development for the following activities in Building Technologies: Building America, and High Performance Buildings and Windows.

Industrial Technologies

NREL supports the Best Practices Program in communication activities and products. NREL supports overall Industry Program analysis of the logic of individual program activities including the relationship between program goals, milestones and the budget formulation process for several areas including Industrial Materials of the Future, Aluminum and Metal Casting.

Biomass and Biorefinery Systems R&D

NREL is the lead laboratory for Biomass R&D. NREL also develops analytical methodologies (chemical and life-cycle that are used to facilitate industry commercialization, including economic assessment of technologies). NREL contributes to bio-based products tasks.

Federal Energy Management Program

NREL facilitates projects, develops guidelines and provides expert advice on sustainable and renewable facility designs, green power procurement, distributed energy resources, and alternative financing.

Program Management

Provides analytical support for crosscutting issues, such as market and benefit analyses.

Pacific Northwest National Laboratory

Introduction

Pacific Northwest National Laboratory (PNNL) is located in Richland, Washington. It is a multi-discipline laboratory providing support to Vehicle Technologies, Fuel Cell Technologies, Weatherization and Intergovernmental Activities, Distributed Energy Resources, Building Technologies, Industrial Technologies, Biomass and Biorefinery Systems R&D, Federal Energy Management Program and Program Management.

Vehicle Technologies

Conducts research on predictive cruise control for heavy vehicles to increase energy efficiency. Evaluates advanced energy storage materials. Develops experimental and analytical methods to measure and improve technologies to reduce exhaust emissions and studying materials for lean-burn, high-durability NO_x sensors. Work includes the development of efficient and effective plasma assisted lean NO_x reduction for both light- and heavy-duty diesel engines while minimizing vehicle fuel economy penalty. Works to facilitate the scale-up process for depositing Si/SiGe superlattices, materials used in the development of thermoelectric devices for recovering waste heat in diesel engines

thus improving fuel efficiency. Develops energy efficient production for magnesium, titanium, polymer composite and glass components for advanced automotive and heavy vehicle designs. Studies materials for lean-burn, high-durability spark plugs. Develops environmentally friendly processes for the manufacture of planar thin film ceramic sensors. Creates a Northwest Alliance to develop lightweight materials processing technologies. Develops and tests a lightweight SUV frame prototype with performance equal to conventional steel components. Designs hybrid composite materials for weight critical heavy vehicle structures.

Fuel Cell Technologies

Pacific Northwest National Laboratory develops compact, microchannel fuel reformers. PNNL is developing a model and a controller for solid oxide fuel cells (SOFCs) to be used with APUs. Shock and vibration characteristics applied to SOFC stacks and APU units during operation are being developed in the model. PNNL is identifying candidate filler and cladding alloys for lightweight, low cost, robust metal clad bipolar plates.

Weatherization and Intergovernmental Activities

PNNL provides technology transfer technical assistance for Gateway partners and tools and materials development, analysis tool development, training, and technical assistance related to new state building energy codes.

Distributed Energy Resources

Pacific Northwest National Laboratory is assisting in carrying out regulatory education and outreach. The lab is providing assistance in efforts to remove regulatory barriers to distributed generation.

Building Technologies

The Pacific Northwest National Laboratory conducts research and development activities for the following activities: building codes; appliance standards; and emerging technologies.

Industrial Technologies

In support of the Industries of the Future (Specific) and (Crosscutting) activities, Pacific Northwest National Laboratory provides key support to track past program impacts including the over 150 commercial technologies, and their energy and environmental impacts. Other efforts include the evaluation of emerging technologies. The laboratory produces an impacts report summarizing commercial and emerging technologies and past program results and methodologies. The laboratory also performs support to Mining, Aluminum, Sensors and Controls, Glass, Industrial Materials of the Future and Forest Products.

Biomass and Biorefinery Systems R&D

The Pacific Northwest National Laboratory conducts R&D in support of the development of the syngas platform and related products. Major program components include thermocatalysts for fuels and chemicals and wet biomass for syngas production.

Federal Energy Management Program

PNNL develops guidelines and provides expert advice on energy efficient buildings maintenance and operations, utility load management, utility restructuring, building commissioning, building diagnostic

systems, resource energy management, and analytical support for modeling for the Government Performance Results Act.

Program Management

Provide analytical support for major crosscutting issues, such as market and benefit analyses.

Golden Field Office

Introduction

Golden Field Office is located in Golden, Colorado. It provides project management and procurement support for Vehicle Technologies and Program Management.

Vehicle Technologies

Golden Field Office provided contract award and project monitoring services for the Vehicle Technologies program in FY 2004.

Program Management

Golden Field Office provides direction, guidance, and support to EERE programs. It serves as a major component of EERE's Project Management Center initiative, providing contract award and project management services for the Federal Energy Management Program (except for biomass Energy Savings Performance Contracts), Industrial Technologies (except Mining), Biomass and Biorefinery Systems R&D, and Fuel Cell R&D. It also provides management and oversight for EERE on the Management and Operations (M&O) contracts for the National Renewable Energy Laboratory (NREL), and manages the development of proposals for new facilities at NREL.

Idaho Operations Office

Idaho National Engineering and Environmental Laboratory

Introduction

Idaho National Engineering and Environmental Laboratory (INEEL) is located in Idaho Falls, Idaho. It is a multi-discipline laboratory providing support to Vehicle Technologies, Weatherization and Intergovernmental Activities, Industrial Technologies, and Biomass and Biorefinery Systems R&D.

Vehicle Technologies

Develops and assesses advanced oil by-pass filter concepts for heavy vehicles. Develops and assesses ultracapacitors for hybrid vehicles. Tests of high-power batteries and develops battery test procedures. Tests and simulates hybrid vehicle performance. Develops energy storage models for electric and hybrid vehicles (SIMPLEV). Develops and demonstrates spray forming process for rapid production on net-shape molds, dies, and related tooling for automotive components. Models slurry performing for fiber reinforced composites, NDE for cylinder liners, intelligent welding and spray forming of aluminum. Characterizes metallic structures produced by equal channel angular extrusion process. Field testing and evaluation of electric, hybrid and hydrogen light duty vehicles and infrastructure. Supports Federal Fleet acquisition reporting as required.

Weatherization and Intergovernmental Activities

Funding to INEEL supported technical analysis of Inventions and Innovations grant proposals.

Industrial Technologies

INEEL provides critical support in project management and analysis for the Forest Products and Steel activities. Work is ongoing for an advanced black liquor spray atomization process for the Forest Products industry, and on the development of controlled thermal-mechanical processing of tubes and pipes for enhanced manufacturing performance and in the development and application of laser-assisted arc welding in the Steel industry.

Biomass and Biorefinery Systems R&D

INEEL provides biomass-related R&D services and support for the feedstock infrastructure development effort. This work is being conducted in close collaboration with ORNL and NREL.

Livermore Site Office

Lawrence Livermore National Laboratory

Introduction

Lawrence Livermore National Laboratory (LLNL) is located in Livermore, California. It is a multi-discipline laboratory providing support to Vehicle Technologies, Fuel Cell Technologies, and Industrial Technologies.

Vehicle Technologies

Provides leadership and coordination in the application of advanced methods of conventional fluid dynamics to aerodynamic drag of heavy vehicle for increased energy efficiency. Performs studies of combustion under diesel and homogeneous charge compression ignition (HCCI) conditions using chemical kinetic modeling and other methods to determine means for increasing fuel efficiency, reducing emissions, and increasing peak output power of advanced internal combustion engines (ICEs). Research is directed at materials development and advanced automotive manufacturing concepts, such as metal treatment using Plasma Surface Ion Implantation (PSII) and development of low-cost aluminum sheet. Develops high-voltage, dielectric ultracapacitors based on nanostructure multilayer oxide materials. Develops aerogel-based NO_x catalysts for CIDI engines. Nondestructive evaluation and in-line sensors for the design and product optimization of cast light metals. Applies equal channel angular extrusion to the fabrication of amorphous metallic materials for magnet applications. Chemical kinetic modeling of in-cylinder combustion process of advanced HCCI engine technology as it applies to natural gas engines.

Fuel Cell Technologies

Lawrence Livermore National Laboratory is constructing and testing hydrogen sensors, both for safety and for fuel stream monitoring in a fuel cell vehicles.

Industrial Technologies

LLNL provides technology support to the Forest and Paper Products Vision in the development and testing of a Linescan camera system for imaging and measuring moisture content and in the

development and testing of a guided acoustic wave monitoring to measure boiler corrosion to reduce boiler downtime and improve operating efficiency.

Los Alamos Site Office

Los Alamos National Laboratory

Introduction

Los Alamos National Laboratory (LANL) is located in Los Alamos, New Mexico. It is a multi-discipline laboratory providing support to Vehicle Technologies, Fuel Cell Technologies, Building Technologies, and Industrial Technologies.

Vehicle Technologies

Performs research on ICE combustion using simulation and modeling to increase efficiency and reduce NO_x in lean-burn engines and developing microwave regeneration components and design tools for emission controls. Los Alamos is also performing R&D to discover and develop next-generation emissions-control catalysts for lean burn engines and the development of technology for onboard generation of chemical reductants from diesel fuel.

Fuel Cell Technologies

Los Alamos National Laboratory serves as the lead laboratory in research and development of fuel cell components, reduction of precious metal loading while maintaining performance, and characterization of the poisoning of fuel cell catalysts by impurities in air and fuel feeds. To facilitate heat rejection and simplify the fuel cell system, LANL is designing, synthesizing, and characterizing membranes which operate at low relative humidty and high temperatures, 120°C for transportation applications. Development of direct methanol fuel cells at LANL will accelerate high-volume manufacturing processes for fuel cells. LANL will investigate the impact of sub-freezing temperatures on performance and durability of specific fuel cell components. LANL is characterizing the durability of fuel cell stacks operating on hydrogen (targets are 5,000 hours for transportation applications and 40,000 hours for stationary applications), since the durability of fuel cell stacks has not been demonstrated. LANL is developing low-cost, high surface area support materials to "replace" precious-metals supports and developing high performance MEAS from alternative ionomer (non-Nafion) membrane materials. Finally, LANL is exploring pyrolized macrocycle transition metal catalyst as replacements for the expensive platinum catalysts in fuel cell electrodes.

Building Technologies

Los Alamos National Laboratory conducts research and development for activities in Windows Technologies.

Industrial Technologies

LANL supports program work for the Chemical industry R&D area. The laboratory provides unique capabilities in theoretical scientific analysis modeling fluid flows and understanding chemical reactions and catalysis phenomena. LANL provided the computer analysis of industrial fluid flows, and the computer technology prepared for use by the civilian sector. LANL also supports the Industrial Materials of the Future activities in the development of new materials for membrane separation systems.

Mid-Atlantic Regional Office

Program Management

Program Management funds the personnel and overhead costs for 18 FTE in the Mid-Atlantic Regional Office (Philadelphia, PA) in order to provide: (1) promotion of EERE programs at the local and regional levels; (2) administration of grants to, and cooperative agreements with, States and local governments (particularly the Weatherization Assistance Program and State Energy Program grants); and (3) administration and implementation of locally- and regionally-focused deployment activities, such as Clean Cities, Rebuild America, and the Federal Energy Management Program (FEMP). Mid-Atlantic Regional Office will also occasionally receive small amounts of direct funding from individual R&D or deployment programs to perform specific tasks−such as managing a cooperative or inter-agency agreement, arranging a conference, or other locally-oriented activities.

Midwest Regional Office

Program Management

Program Management funds the personnel and overhead costs for 18 FTE in the Midwest Regional Office (Chicago, Il) in order to provide: (1) promotion of EERE programs at the local and regional levels; (2) administration of grants to, and cooperative agreements with, States and local governments (particularly the Weatherization Assistance Program and State Energy Program grants); and (3) administration and implementation of locally- and regionally-focused deployment activities, such as Clean Cities, Rebuild America, and the Federal Energy Management Program (FEMP). Midwest Regional Office will also occasionally receive small amounts of direct funding from individual R&D or deployment programs to perform specific tasks—such as managing a cooperative or inter-agency agreement, arranging a conference, or other locally-oriented activities. It also supports Fuel Cell Technologies.

National Energy Technology Laboratory

Introduction

National Energy Technology Laboratory (NETL) is located in Morgantown, West Virginia. It provides project management and procurement support to Vehicle Technologies, Weatherization and Intergovernmental Activities, Distributed Energy Resources, Building Technologies, Industrial Technologies, Biomass and Biorefinery Systems R&D, Federal Energy Management Program and Program Management.

Weatherization and Intergovernmental Activities

National Energy Technology Laboratory provides technology transfer technical outreach, grants management system development, and tools development for many WIP activities.

Distributed Energy Resources

NETL manages the university program that supports the advanced reciprocating engine program and performs in-house R&D for that program.

Industrial Technologies

National Energy Technology Laboratory supports work for the mining industry R&D area.

Biomass and Biorefinery Systems R&D

National Energy Technology Laboratory conducts R&D on biomass technologies that can benefit from the laboratory's expertise on coal processing and conversion.

Federal Energy Management Program

Providing technical and financial analyses support for the Biomass Alternate Methane Fuels Technology Specific Super Energy Savings Performance Contract activities.

Program Management

Under an Memorandum of Understanding between the Assistant Secretary for Energy Efficiency & Renewable Energy and the Assistant Secretary for Fossil Energy, NETL acts as a major component of EERE's Project Management Center (PMC) initiative. NETL provides contract award and project management services to seven EERE programs, funded on a reimbursable basis through the Program Management budget. The programs that will be supported by NETL are Vehicle Technologies, Weatherization and Intergovernmental, Distributed Energy Resources, Building Technologies, Industrial Technologies, Biomass and Biorefinery Systems R&D, and the Federal Energy Management Program.

National Nuclear Security Administration's Service Center (NNSA)

Introduction

NNSA Service Center in Albuquerque, New Mexico. It provides procurement support for Vehicle Technologies.

Vehicle Technologies

Solicits, awards, and administers research and development contracts, cooperative agreements, and grants with industry, academia, and other Government organizations. Provides research in full scale aerodynamic stability tests for heavy vehicles.

Northeast Regional Office

Introduction

The Northeast Regional Office provides support to the R&D programs by administering grants and cooperative agreements to regional, State, and local organizations, both public and private and provides direction, guidance, and support deployment and outreach programs on a local and regional level. It is located in Boston, Massachusetts and supports Program Management.

Program Management

Program Management funds the personnel and overhead costs for 18 FTE in the Northeast Regional Office (NRO) in order to provide: (1) promotion of EERE programs at the local and regional levels; (2) administration of grants to, and cooperative agreements with, States and local governments (particularly the Weatherization Assistance Program and State Energy Program grants); and (3) administration and implementation of locally- and regionally-focused deployment activities, such as Clean Cities, Rebuild America, and the Federal Energy Management Program (FEMP). NRO will also occasionally receive small amounts of direct funding from individual R&D or deployment programs to perform specific

tasks—such as managing a cooperative or inter-agency agreement, arranging a conference, or other locally-oriented activities.

Oak Ridge Operations Office

Oak Ridge Institute for Science and Education

Vehicle Technologies

Oak Ridge Institute for Science and Education is located in Oak Ridge, Tennessee. It provides technical support for Vehicle Technologies. Oak Ridge Institute for Science and Education plans technical meetings and conducts peer reviews. In addition, it organizes, plans and conducts scientific workshops to engage industry with the scientific community in the National Labs.

Oak Ridge National Laboratory

Introduction

Oak Ridge National Laboratory (ORNL) is located in Oak Ridge, Tennessee. It is a multi-discipline laboratory providing support to Vehicle Technologies, Fuel Cell Technologies, Weatherization and Intergovernmental Activities, Distributed Energy Resources, Building Technologies, Industrial Technologies, Biomass and Biorefinery Systems R&D, Federal Energy Management, and Program Management.

Vehicle Technologies

Develops models to estimate cost of advanced hybrid and fuel cell vehicles to perform trade-off studies, and also develops models to predict emissions from advanced after-treatment devices. Conducts research to develop high thermal conductivity carbon foams for high performance truck and automobile radiators. Conducts analysis, technical support, testing and research on power electronic devices and electric machines. Conducts research and provides technical/project management support in propulsion and vehicle system materials. Develops material analytical techniques and material related solutions for automotive and heavy vehicle systems. Conducts research in internal combustion engine technologies, in-cylinder diagnostics (such as application of chaos theory and emission studies), and exhaust after treatment (including catalytic converter research, development, and testing). Develops an understanding of NO_x absorber processes affecting regeneration, desulfation, and degradation under real-world conditions. Provides detailed characterization and speciation of combustion and emission products. Using primarily laboratory reactors and some engine experiments, acquired kinetic data for the development of computer models of after treatment devices. Evaluates the toxicity of unregulated emissions that are present in the exhaust streams of engines operating on advanced fuels. Leads an effort to evaluate the fuel effects on selective catalytic reduction systems on diesel engines. Evaluates the critical fuel properties that effect near term emissions control devices for diesel engines. Determines the effects and the mechanism of lube oil suspended phosphorous on the poisoning of exhaust catalysts in diesel engines. Evaluates the benefits of the use of e-diesel fuels in combination with high exhaust gas re-circulation rates in diesel engines. Conducts analysis, technical support, testing and research on power electronic devices (converters and controllers) and electric motors. Gathers heavy truck on-road performance data to improve models. Operates the High Temperature Materials Laboratory, which provides user facilities for materials characterization.

Fuel Cell Technologies

Oak Ridge National Laboratory is the primary National Laboratory for materials R&D aimed at reducing cost and increasing the durability of fuel cell components. ORNL carries out R&D on coated metal bipolar plates and temperature sensors. It characterizes the structure of membranes and membrane electrode assemblies and it develops high-termal-conductivity graphite foam for fuel cell heat exchangers. To reduce sulfur in fuel gas stream, ORNL develops a catalyst to oxidize hydrogen sulfide to elemental sulfur.

Weatherization and Intergovernmental Activities

ORNL provides a wide variety of technical and program analysis activities for WIP. Examples include: residential energy audit and advanced weatherization measure analysis, Rebuild America technology transfer technical outreach, policy analysis for EnergyStar®, and market assessments of new technologies to Gateway partners.

Distributed Energy Resources

ORNL is the primary lab for DER technology development and end-use systems integration. ORNL conducts research and development in advanced materials and sensors for industrial gas turbines and microturbines, advanced reciprocating engines, thermally activated technologies, and combined heat and power (CHP). To conduct this research, ORNL leverages state-of-the-art, unique resources such as the High Temperature Materials Laboratory (HTML) User Center, the Building Technology User Center, and the CHP Integration User Center.

Building Technologies

ORNL is part of a National Laboratory/industry/university consortium conducting research and development for the following activities: Building America; space heating and cooling; envelope and emerging technologies.

Industrial Technologies

In support of the Best Practices effort, ORNL provides support to the Plant-Wide Assessments and technical assistance and also the tracking of program impacts. They also help in the development and delivery of software tools and training. ORNL is the primary laboratory supporting the Industrial Materials of the Future activities to develop advanced materials for industrial use that meet technical requirements identified by industry in the visions and technology roadmaps. ORNL's defense computational capabilities were applied in conjunction of the National Renewable Energy Laboratory in the analysis of high-temperature fluid flows.

Biomass and Biorefinery Systems R&D

ORNL provided assistance on biomass technology assessment and information transfer.

Federal Energy Management Program

ORNL facilitates projects, develops guidelines, and provides expert advice on combine heat and power systems, biomass opportunities, whole building design, and alterative financing.

Program Management

Provide analytical support for major crosscutting issues, such as market and benefit analyses.

Oak Ridge Operations Office

Oak Ridge Institute for Science and Education

Introduction

Oak Ridge Institute for Science and Education is located in Oak Ridge, Tennessee. It provides technical support for Vehicle Technologies. Oak Ridge Institute for Science and Education plans technical meetings and conducts peer reviews. In addition, it organizes, plans and conducts scientific workshops to engage industry with the scientific community in the National Labs.

Vehicle Technologies

Organizing, planning and conducting scientific workshops to engage industry with the scientific community in the National Labs.

Sandia Site Office

Sandia National Laboratories

Introduction

Sandia National Laboratories (SNL) is located in Albuquerque, New Mexico. It is a multi-discipline laboratory providing support to Vehicle Technologies, Fuel Cell Technologies, Industrial Technologies, Federal Energy Management Program, and Program Management.

Vehicle Technologies

Participates in the modeling and simulation for reduction of heavy vehicle aerodynamic drag.

Conducts research on new, rugged high temperature film capacitors for power electronics. Conducts and evaluates electrode materials that would improve abuse tolerance of lithium based battery technologies. Performs abuse tests of various battery technologies. Conducts extensive fundamental research on piston engine combustion processes to reduce emissions formation while maintaining efficiency. Investigates optical and non-optical medium-duty HCCI engines and in an optically accessible light-duty gasoline engine. Develops laser diagnostics are to measure diesel particulate matter concentration, size, morphology, and metallic ash content, measurements vital to the successful development of robust diesel exhaust after treatment systems. Develops materials R&D to improve the performance of tires, engines, and automotive body structures. Performs analyses and laboratory demonstrations of improved manufacturing techniques and instrumentation for forging, heat treatment, coating, welding, and other factory processes. Studies the in-cylinder combustion processes of fuel-borne oxygen in diesel fuels using laser-induced incandescence observations.

Fuel Cell Technologies

SNL is supporting the Fuel Cell Technology program by developing an alternative polymer electrolyte with high temperature and low humidity properties for the replacement of Nafion in fuel cells.

Industrial Technologies

Sandia's unique capabilities have been applied to the Chemical industry R&D activities. These capabilities include research on prototype chemical reactors, research on molecular properties using Sandia's unique computational capabilities, research on industrial separations membranes, and the development of an experimental fluid flow system used to measure properties of chemical reacting flows in greater detail than had previously been achieved. This experimental fluid flow research activity was carried in cooperation with LANL, the PNNL, four U.S. universities, and eight U.S. petroleum and chemical companies.

Federal Energy Management Program

SNL develops guidelines and provides expert advice on renewable technologies for military applications and on distributed generation

Program Management

SNL provides analytical support for crosscutting issues such as market and benefit analyses.

Southeast Regional Office

Introduction

The Southeast Regional Office provides support to the R&D programs by administering grants and cooperative agreements to regional, State, and local organizations, both public and private and Provides direction, guidance, and support deployment and outreach programs on a local and regional level. It is located in Atlanta, Georgia and supports Program Management.

Program Management

Program Management funds the personnel and overhead costs for 25 FTE in the Southeast Regional Office (SRO) in order to provide: (1) promotion of EERE programs at the local and regional levels; (2) administration of grants to, and cooperative agreements with, States and local governments (particularly the Weatherization Assistance Program and State Energy Program grants); and (3) administration and implementation of locally- and regionally-focused deployment activities, such as Clean Cities, Rebuild America, and the Federal Energy Management Program (FEMP). SRO will also occasionally receive small amounts of direct funding from individual R&D or deployment programs to perform specific tasks—such as managing a cooperative or inter-agency agreement, arranging a conference, or other locally-oriented activities.

Washington Headquarters

Office of Scientific and Technical Information (OSTI)

Introduction

Office of Scientific and Technical Information is located in Oak Ridge, Tennessee. It provides technical support for Vehicle Technologies.

Vehicle Technologies

Disseminates heavy vehicle technical reports and literature. Assists in conducting industry/Government workshops in support of Multi-Year Program Planning efforts.

Washington Headquarters

Introduction

Washington, D.C. is the headquarters for the Office of Energy Efficiency and Renewable Energy operations. The Headquarters' operation provides specialized, technical expertise in planning, formulation, execution, and evaluation, in order to support the responsible guidance and management of the budget. It provides support to Vehicle Technologies, Fuel Cell Technologies, Weatherization and Intergovernmental Activities, Distributed Energy Resources, Building Technologies, Industrial Technologies, Biomass and Biorefinery Systems R&D, Federal Energy Management Program, and Program Management.

Western Regional Office

Program Management

Program Management funds the personnel and overhead costs for 19 FTE in the Western Regional Office (WRO) (Seattle, WA) in order to provide: (1) promotion of EERE programs at the local and regional levels; (2) administration of grants to, and cooperative agreements with, States and local governments (particularly the Weatherization Assistance Program and State Energy Program grants); and (3) administration and implementation of locally- and regionally-focused deployment activities, such as Clean Cities, Rebuild America, and the Federal Energy Management Program (FEMP). WRO will also occasionally receive small amounts of direct funding from individual R&D or deployment programs to perform specific tasks—such as managing a cooperative or inter-agency agreement, arranging a conference, or other locally-oriented activities.

Vehicle Technologies

Funding Profile by Subprogram[a]

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation[b]	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Vehicle Technologies						
Vehicle Systems	13,875	13,349	13,349	13,788	+439	+3.3%
Innovative Concepts	494	494	494	500	+6	+1.2%
Hybrid and Electric Propulsion	43,390	45,238	45,238	48,821	+3,583	+7.9%
Advanced Combustion Engine R&D	52,736	49,756	49,756	41,148	-8,608	-17.3%
Materials Technology	38,622	37,001	37,001	38,225	+1,224	+3.3%
Fuels Technology	15,887	12,750	12,750	13,647	+897	+7.0%
Technology Introduction	4,802	4,944	4,944	6,314	+1,370	+27.7%
Technical/Program Management Support	2,095	1,877	1,877	2,500	+623	+33.2%
Biennial Peer Reviews	494	0	0	1,000	+1,000	NA
Total, Vehicle Technologies	172,395	165,409	165,409	165,943	+534	+0.3%

Public Law Authorizations:

P.L. 95-91, "U.S. Department of Energy Organization Act" (1977)
P.L. 102-486, “Energy Policy Act” (1992)

Mission

The mission of the Vehicle Technologies Program is to develop more energy efficient and environmentally friendly highway transportation technologies (for both cars and trucks) that will enable America to use significantly less petroleum. The long-term aim is to develop “leapfrog” technologies that through improvements in vehicle energy efficiency will provide Americans with continuing freedom of mobility and greater energy security, at lower costs and with lower impacts on the

[a] SBIR/STTR funding in the amount of $4,265,000 was transferred to the Science Appropriation in FY 2004. Estimates for SBIR/STTR budgeted in FY 2005 and FY 2006 are $4,083,000 and $4,023,000, respectively.
[b] Reflects the 0.594% and 0.80% rescissions of -$1,005,000 and -$1,346,000 respectively and comparability adjustment for National Energy Technology Laboratory Support of -$1,496,000.

environment than current high efficiency vehicles. The program focuses its research and development investments specifically on potential technology improvements that have uncertain or long-term outcomes, yet have significant public benefit. The high risks associated with these projects make it unlikely that they would be pursued by industry alone.

Benefits

The Vehicle Technologies (VT) Program mission and activities contribute directly to EERE's and DOE's mission of improving National Energy and Economic Security. The Program contributes by addressing the President's National Energy Policy call for reducing dependence on oil imports and modernizing conservation technologies and practices. President Bush observed that ". . . any effort to reduce (oil) consumption must include ways to safely make cars and trucks more fuel efficient. New technology is the best way to do so."[a] In fact, highway vehicles alone account for 54 percent of total U.S. oil use, more consumption than U.S. domestic oil production. Cost competitive and more energy efficient vehicles will enable U.S. citizens and businesses to accomplish their daily tasks while reducing their consumption of gasoline and diesel fuels, thus reducing demand for petroleum, lowering carbon emissions, and decreasing energy expenditures.

Strategic and Program Goals

The Department's Strategic Plan identifies four strategic goals (one each for defense, energy, science, and environmental aspects of the mission) plus seven general goals that tie to the strategic goals. The Vehicle Technologies Program supports the following goal:

Energy Strategic Goal: To protect our national and economic security by reducing imports and promoting a diverse supply of reliable, affordable, and environmentally sound energy.

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 Vehicle Technologies Program has one program goal which contributes to General Goal 4 in the "goal cascade":

Program Goal 04.02.00.00: Vehicle Technologies. The Vehicle Technologies Program goal is to develop technologies that enable cars and trucks to become highly efficient, through improved power technologies and cleaner domestic fuels, and to be cost and performance competitive. Manufacturers and consumers can then use these technologies to help the Nation reduce both energy use and greenhouse gas emissions thus improving energy security by reducing dependence on oil.

[a] Remarks by President George W. Bush on Energy Efficiency, Feb. 25, 2002.

Contribution to Program Goal 04.02.00.00 (Vehicle Technologies)

The key program contribution to General Goal 4, Energy Security, is the direct reduction of petroleum use. The VT Program develops technologies that can enable passenger vehicles (cars, light trucks, and SUV's) and commercial vehicles (heavy trucks, buses, etc.) to become highly energy efficient by means of R&D that provides clean power technologies and improved domestic fuel specifications that work in concert with advanced power systems. In addition, the program R&D will focus on reducing the cost and improving other attributes of advanced vehicle technologies so that they will be both performance and cost competitive. The program's long term measures presented below demonstrate key technology pathways that contribute to achievement of this goal. Some long term measures have been expanded to provide more comprehensive coverage of the program activities as is recommended in the President's Management Agenda.

- Vehicle Systems Subprogram and Materials Technologies Subprogram: Reduce heavy truck parasitic losses (e.g. aerodynamics, ancillary systems) from 39 percent of engine output in 1998 to 24 percent in 2006 and reduce the weight of an unloaded tractor-trailer from 23,000 pounds in 2003 to 18,000 pounds in 2010 (a 22 percent reduction), thereby increasing heavy truck fuel efficiency.
- Hybrid and Electric Propulsion Subprogram: By 2010, Hybrid and Electric Propulsion R&D activities will reduce the production cost of a high power 25 kW battery for use in passenger vehicles from $3,000 in 1998 to $500 (with an intermediate goal of $750 in 2006) enabling cost competitive market entry of hybrid vehicles.
- Advanced Combustion Engine R&D Subprogram and Fuel Technology Subprogram: Improve the efficiency of internal combustion engines from 30 percent (2002 baseline) to 45 percent by 2010 for light-duty passenger and from 40 percent (2002 baseline) to 55 percent by 2013 for commercial heavy-duty vehicle applications while utilizing an advanced fuel formulation that incorporates a non-petroleum based blending agent to reduce petroleum dependence and enhance combustion efficiency.
- By 2010, develop material and manufacturing technologies that if implemented in high volume could cost effectively reduce the weight of passenger vehicle body and chassis systems by 50 percent with safety, performance, and recyclability comparable to 2002 vehicles.
- Contribute proportionately to EERE's corporate goal of reducing corporate and program uncosteds to a range of 20-25 percent.

Annual Performance Results and Targets

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Results	FY 2005 Targets	FY 2006 Targets
Program Goal 04.02.00.00 (Vehicle Technologies)					
Vehicle Systems (Heavy Vehicle Systems R&D Activity) and Materials Technologies (Lightweight Materials Technology Activity)					
Complete testing of the 276-volt battery aimed at demonstrating an integrated system having thermal and electrical controls. [MET GOAL]	Reduce parasitic losses of heavy vehicle systems to 36 percent. [MET GOAL]	Reduce parasitic losses of heavy vehicle systems to 30 percent of total engine output and benchmark additional reductions through commercial heavy-duty truck electrification. [(EXCEEDED GOAL]	Reduce parasitic loses to 27 percent of total engine output in a laboratory test. [MET GOAL]	Reduce parasitic energy loss to 25 percent of total engine output and reduce unloaded tractor-trailer weight to 22,000 pounds.	Reduce parasitic energy loss to 24 percent of total engine output and reduce unloaded tractor-trailer weight to 21,500 pounds.
Hybrid and Electric Propulsion (Energy Storage Activity)					
Complete explorations of lithium-polymer and lithium ion battery technologies; lithium ion was selected as the most promising approach for continued development.	Complete development of second generation Lithium ion electrochemistry for hybrid vehicle power. [MET GOAL]	Reduce high-power 25 kW estimated battery cost to $1,180 per battery system. [EXCEEDED GOAL]	Reduce high-power 25 kW light vehicle estimated lithium ion battery cost to $1,000 per battery system. [MET GOAL]	Reduce high-power, 25 kW, light vehicle, lithium ion battery cost to $900 per battery system.	Reduce-high power, 25 kW, passenger light-duty vehicle, lithium ion battery cost to $750 per battery system.
Advanced Combustion Engine R&D (Combustion and Emission Control and Heavy Truck Engine activities) and Fuels Technology					
		Demonstrate optimized emission control system that achieves 0.07 g/mile NO_x and 0.01 g/mile PM short-term performance in light passenger -vehicles. [MET GOAL]	Complete Light Truck activity with 35 percent fuel efficiency improvement over a gasoline powered light truck and Tier 2 emissions levels (0.07g/mile NO_x).. Demonstrate 45 percent thermal efficiency for heavy-duty commercial vehicle diesel engines while meeting EPA 2007 emission standards (1.2g/hp-hr NO_x). [MET GOAL]	Light vehicle combustion engines will reach 39 percent brake thermal efficiency and commercial heavy-duty vehicle combustion engines will be greater than 45 percent efficient while meeting EPA 2007 emission standards (1.2 g/hp-hr NO_x).	Passenger light-duty vehicle combustion engines will reach 41 percent brake thermal efficiency and commercial heavy-duty vehicle combustion engines will reach 50 percent efficiency while meeting EPA 2010 emission standards (0.2 g/hp-hr NO_x).
Materials Technology (Lightweight Materials Technology activity)					
N/A	Fabricate a sport utility vehicle chassis component using carbon fiber in a low cost molding process that is suitable for high volume production. [NOT MET] Completion of their target was delayed due to an equipment failure requiring significant repairs. The target was rescheduled for completion in FY 2003.	Complete R&D on technologies, which, if implemented in high volume, could reduce the price of automotive-grade carbon fiber to less than $7/pound. [EXCEEDED GOAL]	Complete R&D on technologies which, if implemented in high volume, could reduce the price of automotive-grade carbon fiber to less than $5/pound. [MET GOAL]	Complete R&D on technologies, which, if implemented in high volume, could reduce the price of automotive-grade carbon fiber to less than $4.50/pound.	Complete R&D on technologies, which, if implemented in high volume, could reduce the price of automotive-grade carbon fiber to less than $3.00/pound (modeled).

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Results	FY 2005 Targets	FY 2006 Targets
			Contribute proportionately to EERE's corporate goal of reducing corporate and program uncosteds to a range of 20-25 percent by reducing program annual uncosteds by 10 percent in 2004 relative to the program uncosted baseline (in 2003) (TBD).	*Contribute proportionately to EERE's corporate goal of reducing corporate and program adjusted uncosted obligated balances to a range of 20-25 percent by reducing program annual adjusted uncosteds by 10 percent in 2005 relative to the program FY 2004 end of year adjusted uncosted baseline ($21,257K) until the target range is met.*	*Contribute proportionately to EERE's corporate goal of reducing corporate and program adjusted uncosteds to a range of 20-25 percent by reducing program annual uncosteds by 10 percent in 2006 relative to the program uncosted baseline (2005) until the target range is met.* *Maintain total Program Direction costs in relation to total Program costs in the range of 8% - 12% to demonstrate efficient and effective EERE-wide business and technical support to mission direct programs.*

Means and Strategies

The Vehicle Technologies Program will use various means and strategies to achieve its program goals as described below. "Means" include operational processes, resources, information, and the development of technologies, and "strategies" include program, policy, management and legislative initiatives and approaches. Various external factors, as listed below, may impact the ability to achieve the program's goals. Collaborations are integral to the planned investments, means and strategies, and to addressing external factors.

The Vehicles Technologies program will implement the following means:

- The program focuses its technology research and development investments specifically on areas that would not be pursued by industry alone due to high risks and uncertain or long-term outcomes. Program activities include research, development, demonstration, testing, technology validation, technology transfer, and education. These activities are aimed at developing technologies that could achieve: 1) significant improvements in vehicle fuel efficiency and 2) displacement of oil by other fuels which ultimately can be produced domestically in a clean and cost-competitive manner;

- Fuel efficiency gains will be achieved through the introduction of more efficient technologies and lightweight materials. The use of advanced technologies will be more economically attractive through DOE research and development efforts that reduce their costs;

- Vehicles with advanced technologies include advanced combustion engines, hybrid internal combustion vehicles, and hybrid fuel cell vehicles. The penetration of these vehicles in the marketplace will be enhanced by DOE research and development that, for example, reduces high-power battery costs and extends battery life for hybrid vehicles, improves diesel and other combustion engines by making them more efficient and cleaner, and improves the power electronics and the electric motors needed for fuel cell and combustion hybrid vehicles; and

- The 21st Century Truck Partnership has identified desirable technology goals in five general areas: engine systems, hybrid heavy-duty power-trains, parasitic losses, truck safety, and idling reduction. The partners are jointly developing technical roadmaps that outline the pathways for achieving long-range technology-specific R&D goals (including cost targets) and the milestones required to demonstrate progress. Each partner will consider these goals in implementing its respective R&D programs.

The Vehicles Technologies program will implement the following strategies:

- For passenger light-duty vehicles the long-term strategy is to perfect the technologies that will enable a timely transition to a transportation hydrogen economy. There also are significant gains in oil reduction possible from R&D to improve highway transportation technologies in the interim. Taking advantage of these interim opportunities to significantly reduce oil use (thus benefiting both our economy and our energy security) is a key outcome sought from FreedomCAR activities.

- The truck industry and government partners have developed a common vision -- "that our Nation's trucks and buses will safely and cost-effectively move larger volumes of freight and greater numbers of passengers while emitting little or no pollution and dramatically reducing the dependency on

foreign oil."[a] Ultimately, the partnership seeks safe, secure, and environmentally friendly trucks and buses that use sustainable and self-sufficient energy sources, thereby helping enhance America's global competitiveness.

- These mission strategies are accomplished by targeted Federal investments in technology research and development in strategic partnerships with auto manufacturers, commercial heavy-duty vehicle manufacturers, equipment suppliers, fuel and energy companies, other Federal agencies, state government agencies, universities, National Laboratories, and other stakeholders. These strategic partnerships facilitate the technical coordination of activities and attract cost sharing to provide leveraged benefits for the American taxpayer. Two government-industry partnerships serve as implementing mechanisms for major portions of the program: the FreedomCAR and Fuel Partnership, which implements much of both the President's Hydrogen Fuel Initiative and the Department's FreedomCAR budget, and the 21st Century Truck Partnership.
- In addition, the program invests in technical program and market analysis and performance assessments in order to direct effective strategic planning.

These strategies will result in significant cost savings and a significant reduction in the consumption of gasoline and diesel fuels, thus cost effectively reducing America's demand for petroleum, lowering carbon emissions, and decreasing energy expenditures—thus putting the taxpayers' dollars to more productive use.

The following external factors could affect the ability of the Vehicle Technologies Program to achieve its strategic goal:

- Cleaner and more energy efficient and cleaner highway transportation technologies face several market barriers in gaining consumer acceptance and private investment from manufacturers. The interest that consumers place on new vehicle fuel economy is very dependent on the price of gasoline. In 1980, when gasoline was $2.90 per gallon in 2004 dollars ($1.27 in nominal dollars), 42 percent of the respondents to a national survey said that fuel economy was the most important new vehicle attribute in the next vehicle to be purchased. But in 1987 and 1998, only 4 percent chose fuel economy as the most important attribute because the real price of gasoline had fallen to $1.51 and $1.23 in those years, respectively (nominal $0.91 and $1.06). The high gasoline prices in May 2004 drove the interest in fuel economy to the point that 22 percent chose it as the most important new vehicle attribute. But fuel prices still remain a key barrier to the purchase of fuel efficient vehicles because of the continually changing price of gasoline. Neither manufacturers nor consumers generally expect prices to remain high. As a result, manufacturers have been reluctant to assume the risk required for the production and distribution of advanced vehicle technologies;
- For each vehicle type and class and for each region, a number of technologies will compete against each other for vehicle sales. These include conventional gasoline, advanced combustion diesel, gasoline hybrids, diesel hybrids, gasoline fuel cell, hydrogen fuel cell, electric, natural gas, and alcohol. Factors such as the cumulative sales over time of the various technologies in the market for each type of vehicle, vehicle and fuel prices, and consumer preferences will all affect oil savings; and

[a] Secretary Spencer Abraham, Unveiling of the 21st Century Truck Partnership, Dearborn, Michigan, November 12, 2002

- Estimates for energy savings, oil savings, carbon emission reductions, and energy expenditure savings reflect EIA reference case assumptions about future energy markets. In the event oil prices are higher (or more volatile) than expected or if air quality, national security, or other concerns result in changes in energy policy or encourage consumers to purchase more efficient vehicles, the goals and benefits could be affected.

In carrying out the program's mission, the Vehicle Technologies Program performs the following collaborative activities:

- The program leads, along with the Office of Hydrogen, Fuel Cells, and Infrastructure Technology, the FreedomCAR and Fuel Partnership, a collaboration among the DOE, the U.S. Council for Automotive Research (USCAR) and five energy companies to support the FreedomCAR goals. The USCAR member companies are Ford, General Motors and DaimlerChrysler. The energy partners are BP America, ChevronTexaco Corporation, ConocoPhillips Company, ExxonMobil Corporation, and Shell Hydrogen. The Partnership is focused on collaborative technologies necessary to provide a full range of affordable energy-efficient cars and passenger trucks, and their fueling infrastructure. The aim is to facilitate an industry decision in 2015 to commercialize hydrogen-powered fuel cell vehicles and the hydrogen infrastructure to support them. The partners also support the development of hybrid combustion-engine technologies that could lead to oil savings in the interim period before large numbers of fuel cell vehicles are commercially available.
- The Vehicle Technologies Program, through its FreedomCAR budget and activities, funds research, development, demonstration, and deployment (RDD&D) of the vehicle-related portions of those technologies, including vehicle systems integration, batteries and power-electronics, advanced combustion, lightweight materials, etc. The related fuel-cell work is funded by the Fuel Cell Technologies Program in this appropriation.

FreedomCAR Budget

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Request
Vehicle Technologies Portion	86,653	85,282	100,400
Fuel Cell Portion	63,782	74,944	83,600
Total	150,435	160,226	184,000

- In establishing technical directions and priorities, the program has obtained substantial inputs from energy and transportation experts from outside of DOE through interaction of government-industry-laboratory technical teams, independent project reviews with selected panelists, solicited review of DOE R&D plans, and critiques by organizations such as the National Academy of Sciences (NAS). The perspectives of these outside experts are extremely valuable in helping to assure that the program's research directions and priorities are aligned properly with the needs of light/passenger and heavy/commercial vehicle manufacturers, equipment suppliers, energy companies, other Federal agencies, state agencies, consumers, and other stakeholders; and

- The FreedomCAR partners have identified nine specific technology goals for 2010 (one of which is jointly shared between FCVT and HFCIT) and timetables for government and industry R&D efforts, to measure progress in technologies that could enable reduced oil consumption and increased energy efficiency in passenger light-duty vehicles. This request fully supports FreedomCAR goals for both hybrid and internal combustion power-train systems.

2010 Hydrogen Fuel Initiative and FreedomCAR Coordinated Technology Goals

The Office of FreedomCAR and Vehicle Technologies has sole responsibility for four of the nine goals and joint responsibility, with HFCIT, for one goal:

- Electric Propulsion Systems with a 15-year life capable of delivering at least 55 kW for 18 seconds and 30 kW continuous at a system cost of $12/kW peak;
- Internal Combustion Engine Power train Systems costing $30/kW, having a peak brake engine efficiency of 45 percent, and that meet or exceed emissions standards;
- Electric Drive train Energy Storage with 15-year life at 300 Wh with discharge power of 25 kW for 18 seconds and $20/kW;
- Material and Manufacturing Technologies for high volume production vehicles which enable/support the simultaneous attainment of: 50 percent reduction in the weight of vehicle structure and subsystems, affordability, and increased use of recyclable/renewable materials; and
- Internal Combustion Engine Power train Systems operating on hydrogen with cost target of $45/kW by 2010 and $30/kW in 2015, having a peak brake engine efficiency of 45 percent, and that meet or exceed emissions standards. *(shared responsibility with HFCIT).*

The Office of Hydrogen, Fuel Cells, and Infrastructure Technologies has sole responsibility for these goals:

- 60 percent peak energy-efficient, durable direct hydrogen Fuel Cell Power Systems (including hydrogen storage) that achieves a 325 W/kg power density and 220 W/l operating on hydrogen. Cost targets are $45/kW by 2010 and $30/kW by 2015;
- Fuel Cell Systems (including an on-board fuel processor) having a peak brake engine efficiency of 45 percent, and that meet or exceed emissions standards with a cost target of $45/kW by 2010 and $30/kW by 2015. The goal is no longer being pursued due to a “no-go” decision on the on-board reformer technology pathway;
- Hydrogen Refueling Systems demonstrated with developed commercial codes and standards and diverse renewable and non-renewable energy sources. Targets: 70 percent energy efficiency well-to-pump; cost of energy from hydrogen equivalent to gasoline at market price, assumed to be $1.50 per gallon (2001 dollars); and
- Hydrogen Storage Systems demonstrating an available capacity of 6 weight percent hydrogen, specific energy of 2.0 kWh/kg and energy density of 1.5 kWh/l at a cost of $4/kWh.

- The 21st Century Truck Partnership, Vehicle Technologies’ other major crosscutting effort, has similar aims, but is focused on improving technologies for commercial heavy-duty vehicles. In November 2002, the Secretary of Energy announced the "New Vision for the 21st Century Truck

Partnership" that focuses on improving the energy efficiency and safety of trucks and buses. The truck partnership involves key members of the commercial heavy-duty vehicle industry, truck original equipment manufacturers, hybrid propulsion developers, and engine manufacturers as well as other Federal agencies. Primarily due to hydrogen's low energy density when compared to diesel fuel, hydrogen fuel cells are not seen as a viable option for long-haul heavy highway vehicles. They would not provide adequate driving range and would limit cargo carrying capacity. Therefore, the effort centers on research and development to:

- improve engine systems efficiency;
- improve hybrid heavy-duty commercial vehicles, and truck safety;
- reduce parasitic and idling losses; and
- validate and demonstrate these technologies.

- The 21st Century Truck Partnership will fund a cooperative effort between the commercial heavy-duty vehicle (trucks and buses) industry and major Federal agencies to develop technologies that will make our Nation's commercial vehicles more efficient, cleaner, and safer. The government agency participants are the Departments of Energy, Defense (represented by the U.S. Army), Transportation, and the Environmental Protection Agency. Industry partners are Allison Transmission, BAE Systems Controls, Caterpillar, Cummins, DaimlerChrysler, Detroit Diesel, Eaton Corporation, Freightliner, Honeywell International, International Truck and Engine, Mack Trucks, NovaBUS, Oshkosh Truck, PACCAR, and Volvo Trucks North America.

21st Century Truck Partnership Budget

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Request
21st Century Truck Partnership	76,339	70,055	55,929

Validation and Verification

To validate and verify program performance, the Vehicle Technologies Program will conduct internal and external reviews and audits. These programmatic activities are subject to continuing review by, for example, the Congress, the Department's Inspector General, and the U.S. Environmental Protection Agency. The Vehicle Technologies Program also uses several program performance management methods to validate and verify its performance during the course of the program on an annual and ongoing basis, including: management standards; incorporation of goals; measurement and reporting from program contracts; peer reviewed roadmaps and activities; performance modeling and estimation; prototype testing; site visits; and annual program reviews.

Data Sources: Program Reviews, Peer Reviews, Laboratory Tests, On-Road Tests, and Peer-

Reviewed Model Baselines.

Baseline: Parasitic losses for heavy trucks in 1998 (39 percent), weight of unloaded heavy trucks in 2003 (23,000 pounds), cost of hybrid batteries in 1998 ($3,000 for a high power 25 kW battery), combustion efficiency in 2002 (30 percent for passenger light-duty vehicles and 40 percent for commercial heavy-duty vehicles), and carbon fiber costs in 1998 ($12 per pound).

Frequency: Biennial reviews for the FreedomCAR and 21st Century Truck partnerships.

Data Storage: EE Corporate Planning System

Evaluation: In carrying out the program's mission, the VT Program uses several forms of evaluation to assess progress and to promote program improvement. These are conducted at both the program and the activity levels. The types of evaluations are:

- Technology validation and operational field measurement, as appropriate
- Peer review by independent outside experts of both the program and subprogram portfolios
- Annual internal Technical Program Review of the VT Program
- Specialized program evaluation studies to examine process, impacts, or market baseline and effects, as appropriate
- Quarterly and annual assessment of program and management results based performance through Joule, R&D IC, PMA and PART reviews
- Annual review of methods, and computation of the potential benefits for the Government Performance and Results Act (GPRA)
- Conduct biennial reviews of both the FreedomCAR and 21st Century Truck Partnerships by an independent third party, such as the National Academy of Sciences/National Academy of Engineering, to evaluate progress and program direction. The review will include evaluation of progress toward achieving the Partnership's technical goals and direction. Based on this evaluation, resource availability, and other factors, the FreedomCAR partners and the 21CT partners will consider new opportunities, make adjustments to technology specific targets, and set goals as appropriate.

Verification: Run and document vehicle simulation tests, conduct bench tests, run laboratory tests on the engine and vehicle dynamometers, run wind tunnel tests, and conduct on-road and track tests to evaluate the technology. Conduct fleet tests and undertake target performance review.

Program Assessment Rating Tool (PART)

The Department implemented a tool to evaluate selected programs. PART was developed by 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 VT Program has incorporated feedback from OMB into the FY 2006 Budget Request and has taken or will take the necessary steps to continue to improve performance.

The Vehicle Technologies Program received its first OMB PART review this year. The FY 2006 PART review included Ratings of 80 for program purpose, 90 for planning, 100 for management and 75 for program results and accountability with an overall rating of moderately effective, the second highest score possible (total weighted score of 83). These ratings reflect the commitment of EERE program management at all levels to the basic management and planning principles of the President's Management Agenda including the criteria scored in the PART and the implementation of the EERE reorganization employing those principles. The PART recommended that the program add a peer review to include the 21st Century Truck Partnership, including an assessment of the appropriateness of Federal support in each program area. The PART also recommended that the Department develop a consistent methodology and corresponding assumptions for estimating the potential benefits of its applied R&D programs, including the Vehicle Technologies program to facilitate meaningful analysis to inform budget decisions. The program component of this is up-to-date and these efforts are underway.

Funding by General and Program Goal

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
General Goal 4, Energy Security			
Program Goal 04.02.00.00, Vehicle Technologies			
Vehicle Systems	13,875	13,349	13,788
Innovative Concepts	494	494	500
Hybrid and Electric Propulsion	43,390	45,238	48,821
Advanced Combustion Engines R&D	52,736	49,756	41,148
Materials Technologies	38,622	37,001	38,225
Fuels Technology	15,887	12,750	13,647
Technology Introduction	4,802	4,944	6,314
Technical/Program Management Support	2,095	1,877	2,500
Biennial Peer Reviews	494	0	1,000
Total, Program Goal 04.02.00.00, Vehicle Technologies	172,395	165,409	165,943
Total, General Goal 4 (Vehicle Technologies)	172,395	165,409	165,943

The Vehicle Technologies (VT) Program is organized into subprograms that are described later in the budget. Nearly all of the subprograms are coordinated with the U.S. auto or trucking industries under the FreedomCAR or 21st Century Truck Partnerships, respectively.

Expected Program Outcomes

The Vehicle Technologies Program pursues its mission through integrated activities designed to improve the energy efficiency and productivity of our economy. We expect these improvements to reduce susceptibility to energy price fluctuations and potentially lower energy bills; reduce EPA criteria pollutants; reduce greenhouse gases; enhance energy security by increasing the diversity of domestic fuel use; and provide greater energy security and reliability by reducing reliance on imported oil. In addition to these "EERE business-as-usual" benefits, realizing the Vehicle Technologies Program goals would provide the technical potential to reduce conventional energy use even further if warranted by future energy needs.

Estimates of annual non-renewable energy savings, energy expenditure savings, carbon emission reductions, oil savings, and natural gas savings that result from the realization of Vehicle Technologies Program benefits are shown in the table below through 2050. These benefits are achieved by targeted Federal investments in technology research and development in partnership with auto manufacturers, commercial heavy-duty vehicle manufacturers, equipment suppliers, fuel and energy companies, other Federal agencies, state government agencies, universities, National Laboratories, and other stakeholders. These partnerships facilitate the technical coordination of activities and attract cost sharing to provide leveraged benefits for the American taxpayer.

The assumptions and methods underlying the modeling efforts have significant impact on the estimated benefits, and results could vary significantly if external factors, such as future energy prices, differ from the "baseline case" assumed for this analysis. EERE's baseline case is essentially the same as the EIA "business-as-usual" case presented in its Annual Energy Outlook. In addition, possible changes in public policy and disruptions in the energy system which may affect estimated benefits are not modeled. The external factors such as unexpected changes in competing technology costs, identified in the Means and Strategies section above, could also affect the Program's ability to achieve its goals.

A summary of the methods, assumptions, and models used in developing these benefit estimates that are important for understanding these results are provided at:

http://www.eere.energy.gov/office_eere/budget_gpra.html

Final documentation estimated to be completed and posted by March 31, 2005. Uncertainties are larger for longer term estimates. The results shown in the long term benefits tables are preliminary estimates based on initial modeling of some of the possible program production technologies; nonetheless, they provide a useful picture of growing national benefits over time.

FY 2006 GPRA Benefits Estimates for the Vehicle Technologies Program[a]

Mid-term benefits[b, c]	2010	2015	2020	2025
Primary nonrenewable energy savings (Quads)	0.1	0.7	2.1	4.0
Energy bill savings (Billion 2002$)	ns	7	31	61
Carbon emission reductions (MMTCE)	2	15	42	76
Oil savings (MBPD)	0.0	0.3	0.9	1.8

Long-term benefits[d]	2030	2040	2050
Primary nonrenewable energy savings (Quads)	7.7	14.2	18.9
Energy system cost savings (Billion 2001$)	28	95	177
Carbon emission reductions (MMTCE)	148	272	365
Oil savings (MBPD)	3.6	6.6	8.8

The vehicles in the model increase their market share over time as their incremental cost relative to conventional vehicles declines and as their efficiency relative to conventional vehicles increases. Some of the efficiency gains are attained by using lightweight materials while maintaining the safety of the vehicles. By 2025, about 1.8 million barrels per day (mbpd) of oil (relative to base consumption) is projected to be saved as compared with the reference projection without these technologies. This accounts for more than 8 percent of projected transportation oil use in 2025 (more than percent of total U.S. oil use). By 2050, the projected oil savings grows to 8.8 mbpd, which is about 35 percent of the amount of oil use projected for transportation in that year (more than 25 percent of total U.S. oil use). The primary non-renewable energy savings are expressed in Quads of energy and they are nearly equal to the oil savings since oil is a non-renewable energy source. The energy expenditure savings (in the mid-term benefits) are the savings in fuel costs by vehicle users due to the increased efficiency of their advanced vehicles. The energy system cost savings (in the long-term benefits) includes the fuel cost savings by vehicle users and the incremental expenditures the vehicle users made to purchase their advanced vehicles. Carbon savings are based on the amount of carbon that the petroleum products saved would have released if they had been used.

[a] Benefits reported are annual, not cumulative, for the year given. Estimates reflect the benefits that may be possible if all of the program's technical targets are met and funding continues at levels consistent with assumptions in the FY 2006 Budget.
[b] Mid-term program benefits were estimated utilizing the GPRA06-NEMS model, based on the Energy Information Administration's (EIA) National Energy Modeling System (NEMS) and utilizing the EIA's Annual Energy Outlook (AEO) 2004 Reference Case.
[c] Cumulative benefits in 2025 would be greater than 4.2 billion barrels of oil saved and $125 billion (at $30 a barrel) saved in the purchase of imported oil, assuming a linear accumulation of the NEMS based benefits from 2010 through 2025.
[d] Long-term benefits were estimated utilizing the GPRA06 - MARKAL developed by Brookhaven National Laboratory (BNL). Results can differ among models due to differences in their structure. In particular, the two models estimate economic benefits in different ways, with the MARKAL model reflecting the cost of additional investments required to achieve reductions in energy bills.

Vehicle Systems

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Vehicle Systems					
Heavy Vehicle Systems R&D					
Vehicle Systems Optimization	9,831	8,764	8,888	+124	+1.4%
Truck Safety Systems	385	99	100	+1	+1.0%
Total, Heavy Vehicle Systems R&D	10,216	8,863	8,988	+125	+1.4%
Ancillary Systems	1,155	1,268	1,300	+32	+2.5%
Simulation and Validation	2,504	3,218	3,500	+282	+8.8%
Total, Vehicle Systems	13,875	13,349	13,788	+439	+3.3%

Description

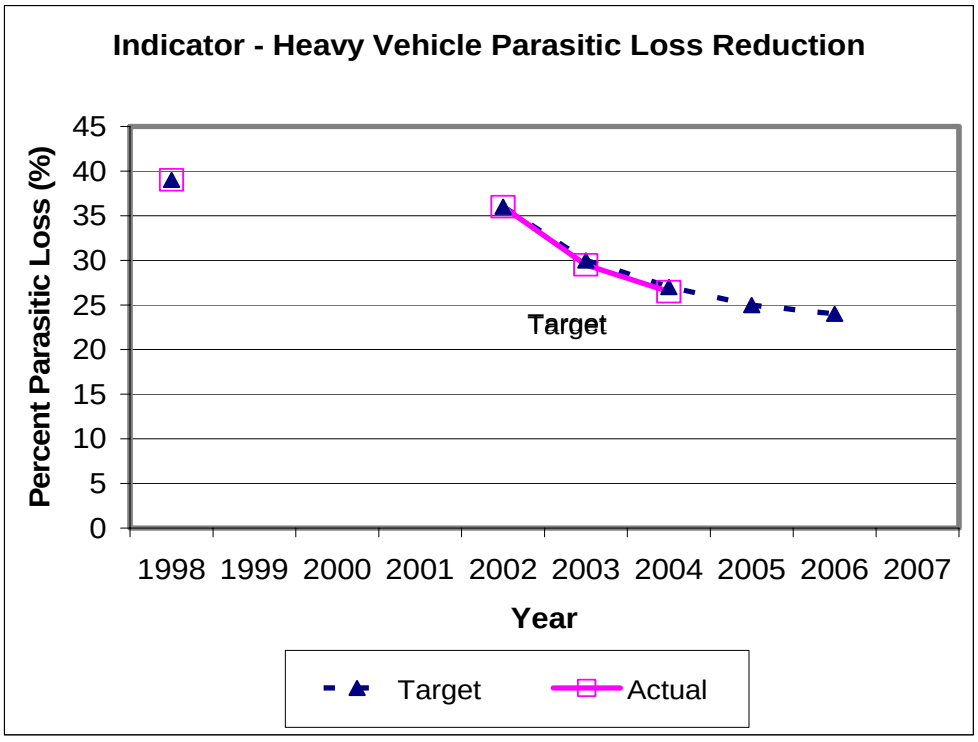
The Vehicle Systems Subprogram funds R&D on advanced vehicle technologies and ancillary equipment that could achieve significant improvements in fuel economy for light-duty passenger and heavy-duty commercial vehicles without sacrificing safety, the environment, performance, and affordability. This subprogram's funding contributes to both the FreedomCAR and 21st Century Truck budgets.

Benefits

The Vehicle Systems Subprogram contributes to the VT Program goal by addressing those system elements that, when resolved and adequately integrated into a vehicle's design, will accomplish improved system efficiency. For example, parasitic losses and vehicle weight in heavy trucks contribute to overall system inefficiencies. When appropriately addressed, improvements in these areas will add to the improvements that are achieved in the other activities.

A key objective for heavy trucks is to demonstrate a reduction in parasitic losses (e.g. aerodynamics, ancillary systems) from 39 percent of engine output in 1998 to 24 percent in 2006.

Progress is indicated by measured parasitic losses (aerodynamics, cooling, and compressed air) and truck weight. Actual and projected parameters for these two factors are shown graphically below:



Note: 1998 value is baseline

Related milestones that will also contribute to meeting the VT Program goal are:

- By 2006, conduct laboratory-based integration of electric turbocompounding system (developed under the Advanced Combustion Engine Subprogram) with heavy-truck power electronics in the "More Electric Truck" activity to attain an additional 6 percent improvement in fuel efficiency for a fully-loaded vehicle.
- By 2006, based on full-scale aerodynamic drag reduction testing, complete assessment of the efficacy of dynamic airflow management technology for stability control of tractor-trailers.
- By 2006, implement initial advanced technology commercial heavy-duty vehicle modeling module in the Powertrain Systems Analysis Toolkit (PSAT).
- By 2006, verify, using the National Renewable Energy Laboratory's Digital Functional Vehicle (DFV) modeling program, that developed passenger light-duty vehicle technologies will achieve vehicle-level performance and component cost objectives.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Heavy Vehicle Systems R&D	**10,216**	**8,863**	**8,988**

The Heavy Vehicle Systems R&D activity develops, in collaboration with heavy-duty commercial vehicle manufacturers and their suppliers, technologies that will reduce non-engine parasitic energy losses from aerodynamic drag, tire rolling resistance, friction and wear, under-hood thermal conditions, and accessory loads. The goals and technology barriers in this activity, were identified and established through workshops involving government, industry and academic expert participants. These activities are undertaken through a variety of mechanisms, including in-house work at the National Laboratories, competitively-awarded contracts or cooperative agreements with industry, and university consortia. Throughout, powertrain and truck system integration issues are considered in order to optimize overall system energy efficiency and to ensure proper accounting of system energy.

- **Vehicle Systems Optimization** **9,831** **8,764** **8,888**

  In FY 2006, assess the viability of various aerodynamic drag reduction devices, including, but not restricted to, flat boat tails, circulation control, wedges, splitters, and cab extenders. Compare wind tunnel results to on-road testing and to theoretical calculations for increased vehicle energy efficiency using various computational fluid dynamics (CFD) techniques, employing appropriate turbulence models. Determine the effect of tire treads on "splash and spray" and compare to CFD models for both safety and increased efficiency. Develop surface texturing and coating techniques to reduce friction in the drive train, axle, and various engine components. Verify the predictions of a new model of scuffing in metals and alloys based on plastic instability, and investigate its applications to ceramics. This approach may extend the durability of sensitive parts by up to 25 percent. Continue new project on the electrification of medium-duty trucks, building on the very successful More Electric Truck (Class 8). Develop storage and control systems that will allow energy efficient hybridization of an ultra-lightweight bus, locomotives, and mining equipment. Emphasis on thermal management will focus on nanofluids, higher temperature coolants, evaporative cooling, heat pipes, re-design of the cooling system and integration of internal heat flow to external aerodynamics with the aim of aerodynamic drag reduction. Work will continue on determining the fractal dimensions of particulate matter at various locations from the engine of spark ignition and diesel engines for optimization of filters and reduction of concurrent fuel penalties. Commence design of a high-thermal-conductivity exhaust gas recirculation (EGR) cooler utilizing nanofluids and carbon foams and resume previously planned aerodynamic drag computational fluid dynamics activities (21CT, $8,888,000). In FY 2004, this activity was reduced by $257,000 for SBIR/STTR, which was transferred to the Science Appropriation. *Participants include: GTRI, WVU, Caterpillar, General Electric, PNNL, INEEL, MIT, ORNL, ANL, Eaton, LLNL, SNL, USC, and NASA.*

(dollars in thousands)

FY 2004	FY 2005	FY 2006

- **Truck Safety Systems**..... **385** **99** **100**

  In FY 2006, initiate feasibility study of using active air circulation control to improve the stability, braking and lift of heavy trucks by manipulating vehicle aerodynamics (e.g., air jets applied to the top of the trailer should assist in stopping the vehicle). Initial efforts will focus on modeling this approach, including CFD modeling and a comparison of cost, technical complexity and energy requirements of this approach to alternative safety systems. As a result of such modeling, if results are promising, development of an experimental work plan will be inaugurated (21CT, $100,000). In FY 2004, this activity was reduced by $9,000 for SBIR/STTR, which was transferred to the Science Appropriation. *Participants include: Georgia Tech Research Institute, LLNL, ANL, PACCAR, and Volvo.*

Ancillary Systems **1,155** **1,268** **1,300**

The Ancillary Systems activity seeks to reduce direct and indirect fuel-consuming loads imposed on internal combustion engines or fuel cell powered vehicles. These loads include those that negatively impact the fuel efficiency of a vehicle but do not propel the vehicle directly; the primary load in this category is the air-conditioning system.

In FY 2006, develop advanced ancillary load reduction technologies which can use waste heat to provide the air conditioning requirements of a vehicle. Modeling suggests that, if implemented on a vehicle, these technologies could increase the fuel economy of a typical vehicle by up to 6.5 percent while reducing tailpipe emissions. Determine the best climate control technologies for fuel cell vehicles, hybrid electric vehicles and conventional vehicles capable of significantly reducing the thermal load on a vehicle while utilizing waste heat to provide vehicle cabin cooling. Conduct collaborative testing with industry to evaluate energy-efficient mobile air-conditioning systems with the validated thermal manikin, physiological model, and local and global thermal comfort psychological model. Utilizing advancements made in mobile air conditioning compressors, expansion devices, heat exchangers, and other energy devices, work with industry and other government agencies to develop the next-generation air conditioning system which, when implemented, can increase fuel economy while reducing emissions. (FreedomCAR, $1,300,000).

In FY 2004, this activity was reduced by $30,000 for SBIR/STTR, which was transferred to the Science Appropriation. *Participants include: NREL, USCAR, other contractors.*

Simulation and Validation **2,504** **3,218** **3,500**

The Simulation and Validation activity develops and validates models and simulation programs to predict the performance, component interaction, fuel economy, and emissions of advanced vehicles. With industry input, these models are used to develop performance targets for the complete range of vehicle platforms and their components to facilitate prioritization of technology R&D activities that could significantly reduce petroleum usage for transportation. The models are also used, in conjunction with "hardware-in-the-loop," to validate the performance of advanced technology

(dollars in thousands)

FY 2004	FY 2005	FY 2006

components and systems developed within VT R&D activities without the need to build and test a complete vehicle.

Expand the validation of advanced technology components' and systems' performance in the laboratory without building a complete vehicle by utilizing "Hardware-In-the-Loop" testing techniques. Data collected during these and other tests will be used to enhance vehicle and systems modeling capabilities and to validate the accuracy of the component models. Apply vehicle systems analysis tools and methods to predict and optimize vehicle and system performance, set technical targets, and bridge the FCVT Program objectives of reduced fuel consumption with the technology-specific goals at the component level. Utilize previously developed flexible, user-friendly tools to analyze and optimize sets of technical targets relative to their potential impact on U.S. transportation sector oil use. Develop technical targets to guide passenger light-duty and commercial heavy-duty vehicle R&D for a range of vehicles to help achieve FCVT's vision of significantly reducing petroleum usage for transportation. Enable and accelerate the development of new fuel-efficient automotive technologies (e.g., hybrid electric vehicles, fuel cells, and lightweight designs) by eliminating technology barriers through advanced modeling techniques and innovative design processes. Validate and populate existing vehicle models with state-of-the-art fuel cell vehicle performance using data obtained from the Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project. Analyze vehicle performance in terms of system and component technical targets and market performance expectations. (FreedomCAR, $3,500,000).

In FY 2004, this activity was reduced by $64,000 for SBIR/STTR, which was transferred to the Science Appropriation. *Participants include: NREL, ANL, and ORNL.*

Total, Vehicle Systems	**13,875**	**13,349**	**13,788**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Heavy Vehicle Systems	
▪ **Vehicle Systems Optimization**	
Computational fluid dynamics will be used to calculate heat transfer within the engine compartment and the air flow around it in order to determine how the application of nanofluids and carbon foams can be utilized to produce smaller radiator systems that will allow more aerodynamic truck designs, thereby decreasing the aerodynamic drag and increasing fuel economy. (Consistent with the Research and Development Investment Criteria (RDIC) section 2a, which relates to how well an activity builds on existing activities and complements related R&D.)	+124
▪ **Truck Safety Systems**	
No significant change	+1
Total, Heavy Vehicle Systems	**+125**
Ancillary Systems	
No significant change	+32
Simulation and Validation	
The increased focus on hybrid electric vehicle technologies by passenger and medium-duty commercial vehicle manufacturers will result in a large number of unique hybrid vehicle technologies being brought to market in the near future. As the various technologies are made available by the manufacturers, the Department's Simulation and Validation activity will build upon industry's work and conduct controlled laboratory benchmarking of these vehicles and technologies in partnership with the vehicle manufacturers. This benchmarking of various light-duty passenger and medium-duty commercial hybrid vehicle technologies will provide data that is needed to validate the accuracy of advanced computer modeling tools, such as the Powertrain Systems Analysis Toolkit (PSAT) at Argonne National Laboratory, that are utilized by the Department to conduct simulations of potential advanced technology vehicles to help guide R&D activities being conducted with industry partners. In addition to validating the models, the data will also be utilized to enhance and expand the capabilities of the various models. (Consistent with RDIC section 2a, Build on and Complement Existing R&D and PART recommendations to develop integrated measures.)	+282
Total Funding Change, Vehicle Systems.....	**+439**

Innovative Concepts

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Innovative Concepts					
Graduate Automotive Technology Education	494	494	500	+6	+1.2%
Total, Innovative Concepts	494	494	500	+6	+1.2%

Description

The Innovative Concepts Subprogram supports activities of both the Vehicle Technologies and the Fuel Cell Technologies Programs and is designed to build critical multi-disciplinary capabilities in automotive engineering at universities. This subprogram is a critical enabler of the new technologies developed to meet the goals of FreedomCAR by providing training for the next generation of automotive engineers.

Benefits

The Graduate Automotive Technology Education (GATE) activity contributes to meeting the VT and HFCIT Program missions by supporting the development of students with technical skills important to the technology pathways chosen to advance the improvement of vehicle efficiency and petroleum fuel displacement. Improving the resource base in this area will help assure the timeliness of R&D success as well as the efficient transfer of new technologies into the market.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Graduate Automotive Technology Education	**494**	**494**	**500**

The Graduate Automotive Technology Education activity aids in the development of interdisciplinary curricula to train the future workforce of automotive engineers. This is accomplished by setting up GATE Centers of Excellence at universities that have been competitively selected, establishing focused curriculum, and providing funds for research fellowships.

In FY 2006, fund GATE Centers of Excellence competitively selected in FY 2005 to develop new curricula and provide research fellowships for approximately 25 students for research in advanced automotive technologies, including hybrid fuel cell vehicles. (FreedomCAR, $500,000). *Current participants include: Michigan Technological University, Ohio State University, Pennsylvania State University, University of California-Davis, University of Maryland, University of Michigan-Dearborn, University of Tennessee, Virginia Tech, and West Virginia University.*

Total, Innovative Concepts	**494**	**494**	**500**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Graduate Automotive Technology Education	
No significant change	+6
Total Funding Change, Innovative Concepts	**+6**

Hybrid and Electric Propulsion

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Hybrid and Electric Propulsion					
Energy Storage					
High Power Energy Storage	16,535	17,430	17,675	+245	+1.4%
Advanced Battery Development	1,445	1,479	1,500	+21	+1.4%
Exploratory Technology Research	4,357	4,164	6,525	+2,361	+56.7%
Total, Energy Storage	22,337	23,073	25,700	+2,627	+11.4%
Advanced Power Electronics	13,182	13,168	13,900	+732	+5.6%
Subsystem Integration and Development					
Light Vehicle Propulsion and Ancillary Subsystems	3,020	3,644	3,735	+91	+2.5%
Heavy Vehicle Propulsion and Ancillary Subsystems	4,851	5,353	5,486	+133	+2.5%
Total, Subsystem Integration and Development	7,871	8,997	9,221	+224	+2.5%
Total, Hybrid and Electric Propulsion	43,390	45,238	48,821	+3,583	+7.9%

Description

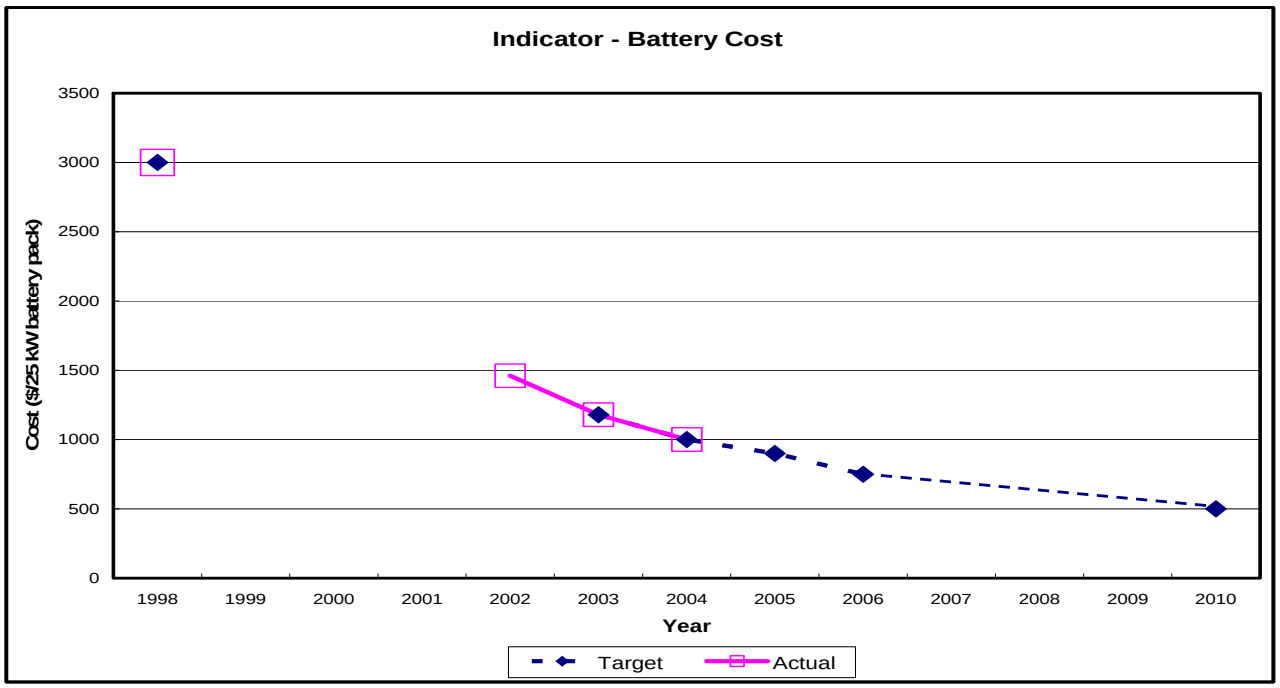
The Hybrid and Electric Propulsion Subprogram funds research and development for both passenger light-duty and commercial heavy-duty vehicles. R&D efforts include research in energy storage systems, advanced power-electronics and electric motors, and commercial hybrid system development and integration. There are three activities: Energy Storage, Advanced Power Electronics, and Subsystem Integration and Development.

Benefits

The Hybrid and Electric Propulsion Subprogram supports achieving the VT Program goal by addressing those technology elements important to the utilization of electric energy storage, electric drives, and energy recovery in new, more efficient vehicle designs.

A key objective of the Hybrid and Electric Propulsion R&D Subprogram is to reduce, by 2010, the production cost of a high-power 25 kW battery for use in passenger light-duty vehicles from $3,000 in 1998 to $500 (with an intermediate goal of $750 in 2006), enabling cost competitive market entry of hybrid vehicles. Also by 2010, develop an integrated electronics system that costs no more than $12/kW peak and can deliver at least 55 kW of power for 18 seconds and 30 kW of continuous power, with a lifetime of 15 years.

Progress is indicated by cost per 25 kW battery system estimated for a production level of 100,000 battery systems per year. Actual and projected progress for this factor is shown graphically below:



Note: 1998 value is baseline.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Energy Storage	**22,337**	**23,073**	**25,700**

The Energy Storage activity supports long-term research, applied research, and technology development for both passenger light-duty and commercial heavy-duty vehicles. Long-term research is focused on developing advanced energy storage technologies for hybrid and electric vehicle applications. Applied research is focused on the development and validation of low-cost and long-life batteries for hybrid vehicle applications. Technology research and development for all passenger light-duty vehicle energy storage is conducted with industry through the United States Advanced Battery Consortium (USABC). All USABC subcontracts to develop advanced passenger vehicle batteries for hybrid and electric vehicles are awarded under a competitive process and are cost-shared by the developers.

The VT Energy Storage Activity coordinates with other DOE programs doing relevant work in advanced battery technologies in order to maximize the return on DOE technology investments in this area. Close cooperation between the VT Energy Storage Activity and the Office of Science has resulted in several SBIR/STTR contracts that have provided valuable support to EV and HEV battery

development efforts. The activity also coordinates with the Energy Storage Program in the Office of Electric Transmission and Distribution on the development of batteries and components that might serve both transportation and stationary applications. Interagency coordination on advanced battery development is conducted through the government-sponsored Interagency Advanced Power Group. The Interagency Advanced Power Group (IAPG) brings together representatives from the Department of Energy, NASA, the Army, the Navy, and the Air Force to exchange information about government agency programs related to energy storage, generation, and conversion. The IAPG is managed by a Steering Committee of senior agency staff. Discussions are carried out through meetings of working groups that bring together technical experts on a regular basis. The Chemical Working Group covers batteries, fuel cells, and capacitors.

- **High-Power Energy Storage** **16,535** **17,430** **17,675**

  In FY 2006, continue to develop full-sized lithium-ion cells using low-cost, stable, high-performance cathode materials based on abundant, low-toxicity manganese oxide. Transfer low-cost separator technology to developers and suppliers for validation and incorporation into full-size prototype cells, modules, and batteries. Continue early-stage development of an advanced battery for use in fuel cell hybrid vehicles. Conduct benchmark testing and assessments of non-battery energy storage devices, such as ultracapacitors and flywheels, that might be applicable in hybrid vehicle systems. (FreedomCAR, $17,675,000). In FY 2004, this activity was reduced by $435,000 for SBIR/STTR, which was transferred to the Science Appropriation. *Participants include: USABC, ANL, BNL, INEEL, LBNL, SNL, NREL, and Industrial contractors.*

- **Advanced Battery Development** **1,445** **1,479** **1,500**

  In FY 2006, complete the efforts to demonstrate the performance of high-energy lithium sulfur battery technologies by the USABC. Continue to benchmark and assess emerging battery technologies. In FY 2004, this activity was reduced by $36,000 for SBIR/STTR, which was transferred to the Science Appropriation. (FreedomCAR, $1,500,000). *Participants include: ANL, USABC, and Industrial contractors.*

- **Exploratory Technology Research** **4,357** **4,164** **6,525**

  In FY 2006, examine innovative energy storage systems that offer the potential for significant improvements over existing technologies for use in hybrid vehicles, including fuel cell hybrid vehicles. Develop and characterize novel anode and cathode materials and electrolytes that have higher energy capability, longer and more stable cycling characteristics, and are lower in cost. In particular, investigate multivalent and alloy based electrodes (such as Sn-based intermetallic alloys of Cu, Sb, and Mg), and electrodes fabricated from higher purity metals, including pure Li. Develop diagnostic techniques to investigate and better understand life- and performance-limiting processes in lithium-based batteries. Develop and apply electrochemical models to understand failure mechanisms and the mechanisms of thermal runaway in lithium batteries.

  Re-evaluate, investigate, and develop solid polymer electrolytes with high room temperature conductivity and good mechanical strength and improved safety. Accelerate the development of low cost, abuse tolerant lithium sulfur battery technology. Explore novel electrochemical energy

storage technologies, specifically non-lithium battery technologies such as Mg-based and Al-based chemistries. (FreedomCAR, $6,525,000). In FY 2004, this activity was reduced by $112,000 for SBIR/STTR, which was transferred to the Science Appropriation. *Participants include: LBNL, BNL, ANL, and universities.*

Advanced Power Electronics	**13,182**	**13,168**	**13,900**

The Advanced Power Electronics activity, which includes R&D on electric motors, develops low cost DC/DC converters and motor controllers, and motors that are needed for fuel cell and hybrid combustion vehicles. Supporting R&D on capacitors, magnets and thermal management complements the motor and power electronics technology research and development.

In FY 2006, efforts are focused on advanced motor R&D, DC/DC converters, low-cost permanent magnet materials, advanced thermal management systems, and motor controller systems to meet light-duty vehicle requirements. Test preliminary deliverables at National Laboratories for conformance to specifications. Maintain close collaboration among researchers, device manufacturers, and users of the technologies for both light-duty vehicles and commercial heavy-duty vehicles. Evaluate crosscutting technologies for passenger and commercial vehicle applications. (FreedomCAR, $13,900,000). In FY 2004, this activity was reduced by $340,000 for SBIR/STTR, which was transferred to the Science Appropriation. *Participants include: Ames, ANL, ORNL, NREL, SNL, FreedomCAR and Fuel Partnership, Ballard Power Systems, AIEC, and Semikron.*

Subsystem Integration and Development.....	**7,871**	**8,997**	**9,221**

Subsystem Integration and Development supports work to validate achievement of technical targets for components and subsystems by emulating a vehicle operating environment for passenger light-duty and commercial heavy-duty vehicles using hardware-in-the-loop testing. This activity also benchmarks and characterizes advanced heavy vehicles and components to determine commercial progress against research performance goals. Data gathered are used to validate simulation models, which are used to predict fuel economy and emissions using advanced controls and configurations for hybrid vehicles. Commercial hybrid efforts support development of advanced, cost-effective components and systems to improve fuel economy by up to 100 percent while meeting 2007 emission standards.

  Light Vehicle Propulsion and Ancillary Subsystems ..... | **3,020** | **3,644** | **3,735** |

  In FY 2006, use hardware-in-the-loop (HIL) techniques to emulate fuel cell propulsion systems to determine systems interactions required for vehicle system integration (e.g., energy storage requirements for different fuel cell subsystem technologies and configurations). Enhance engine emission models to analyze the impact of emissions control on fuel economy. Conduct hardware studies using HIL to determine the impact of expected emission control requirements on fuel economy of advanced hybrid passenger vehicle systems. Validate, in a systems environment, performance targets for deliverables from the power electronics and energy storage technology

research and development activities. Utilize advanced vehicle data from the Testing and Evaluation activity to enhance and validate the PSAT model and determine progress toward meeting FreedomCAR goals. In FY 2004, this activity was reduced by $77,000 for SBIR/STTR, which was transferred to the Science Appropriation. (FreedomCAR, $3,735,000). *Participants include ANL, FreedomCAR and Fuel Partnership, and 21CT partners.*

- **Heavy Vehicle Propulsion and Ancillary Subsystems** **4,851** **5,353** **5,486**

  In FY 2006, in conjunction with industry teams selected in FY 2002 and FY 2003, complete Phase I development of next-generation heavy hybrid components and systems in support of the 21CT Partnership. Initiate R&D activities for industry teams to continue into Phase II directed toward test and validation of hybrid components and systems in prototype vehicle platforms. Start R&D on selected technologies, such as energy storage, power electronics, and electric motors directed toward creation of fully-optimized vehicle systems. These efforts will coordinate with other DOE programs where synergy exists, e.g. fuel cells, batteries, power electronics, engines and parasitic energy losses. (21CT, $5,486,000). In FY 2004, this activity was reduced by $125,000 for SBIR/STTR, which was transferred to the Science Appropriation. *Participants include: NREL, INEEL, Eaton Corporation-Truck Components, Caterpillar, Oshkosh Truck Corporation, GM – Allison Transmission, and other heavy-duty hybrid partners.*

Total, Hybrid and Electric Propulsion..... **43,390** **45,238** **48,821**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Energy Storage	
▪ **High Power Energy Storage**	
Increase benchmarking activities of candidate technologies for high-power applications. (Consistent with RDIC section 2a, building on and complementing existing R&D, and RDIC 2d, which asks how well R&D planning incorporates performance indicators (the benchmarking established performance baselines)…	+245
▪ **Advanced Battery Development** ……	
No significant change ……	+21
▪ **Exploratory Technology Research**	
For Energy Storage, program emphasis is increased in long term, high risk Exploratory Technology Research to advance lithium polymer batteries, lithium sulfur batteries and more fundamental storage concepts. The $2.063 Million increase in Exploratory Technology Research will be used to initiate or expand research in the following areas; novel anode materials, non-flammable electrolytes, low cost cathodes, high energy battery systems technologies. (Consistent with RDIC section 1b, Market Barriers, and RDIC 2a, Build on and Complement Existing R&D.) ……	+2,361
Total, Energy Storage ……	**+2,627**
Advanced Power Electronics	
Include analysis of potential synergisms between component technologies under development for light and heavy hybrid electric vehicles. (Consistent with RDIC 2a, Build on and Complement Existing R&D.) ……	+732
Subsystem Integration and Development	
▪ **Light Vehicle Propulsion and Ancillary Systems**	
Expand current cooperative initiative with automobile manufacturers to develop and validate innovative engine/drivetrain control strategies for advanced hybrid electric vehicles, including those utilizing hydrogen-fueled internal combustion engines. These control strategies will allow for increased drivetrain efficiencies and improved vehicle driveability and subsequent customer acceptance. (Consistent with RDIC 2a, building on and complementing existing R&D, and RDIC 2d, incorporating performance indicators. (Testing and validation measure progress against established performance indicators.)) ……	+91

	FY 2006 vs. FY 2005 ($000)
▪ **Heavy Vehicle Propulsion and Ancillary Subsystems**	
Expand testing and validation on advanced hybrid components	+133
Total, Subsystem Integration and Development	**+224**
Total Funding Change, Hybrid and Electric Propulsion	**+3,583**

Advanced Combustion Engine R&D

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Advanced Combustion Engine R&D					
Combustion and Emission Control	21,845	27,087	24,500	-2,587	-9.6%
Light Truck Engine	12,618	0	0	0	0.0%
Heavy Truck Engine	11,534	13,832	12,148	-1,684	-12.2%
Waste Heat Recovery	2,407	3,435	2,000	-1,435	-41.8%
Off-Highway Engine R&D	3,369	3,451	0	-3,451	-100.0%
Health Impacts	963	1,951	2,500	+549	+28.1%
Total, Advanced Combustion Engine R&D	52,736	49,756	41,148	-8,608	-17.3%

Description

The Advanced Combustion Engine R&D Subprogram focuses on removing critical technical barriers to commercialization of higher efficiency, advanced internal combustion engines in light-duty passenger, medium-duty, and heavy-duty commercial vehicles. The goals are to improve the efficiency of internal combustion engines for passenger vehicle applications from 30 to 45 percent by 2010, and for commercial vehicles from 40 to 55 percent by 2013, while meeting cost, durability, and emissions constraints. Research is conducted in collaboration with industry, National Laboratories, universities, and in conjunction with industry partnerships. The Advanced Combustion Engine R&D Subprogram includes Combustion and Emission Control R&D, Heavy Truck Engine R&D, Waste Heat Recovery R&D, and Health Impacts Research Activities.

Benefits

Advanced combustion engines have the potential to contribute over 40 percent of the total efficiency improvements possible for both passenger and commercial vehicles. These improvements are a major contribution to the GPRA estimated oil savings from the Vehicles Technologies Program. Other than the contributions from hydrogen fuel cell hybrid vehicles whose potential oil savings grow to become comparable, the most promising method to reduce petroleum consumption in the mid-term (10-20 years) is to enable the introduction of high efficiency combustion engines in hybrid vehicles. The Advanced Combustion Engine Subprogram alone offers potential oil savings that are greater than any other EE program.[a] Accelerated research on advanced combustion regimes, including homogeneous charge compression ignition (HCCI) and other modes of low-temperature combustion, is aimed at realizing this potential and making a major contribution to improving the U.S. energy security, environment, and

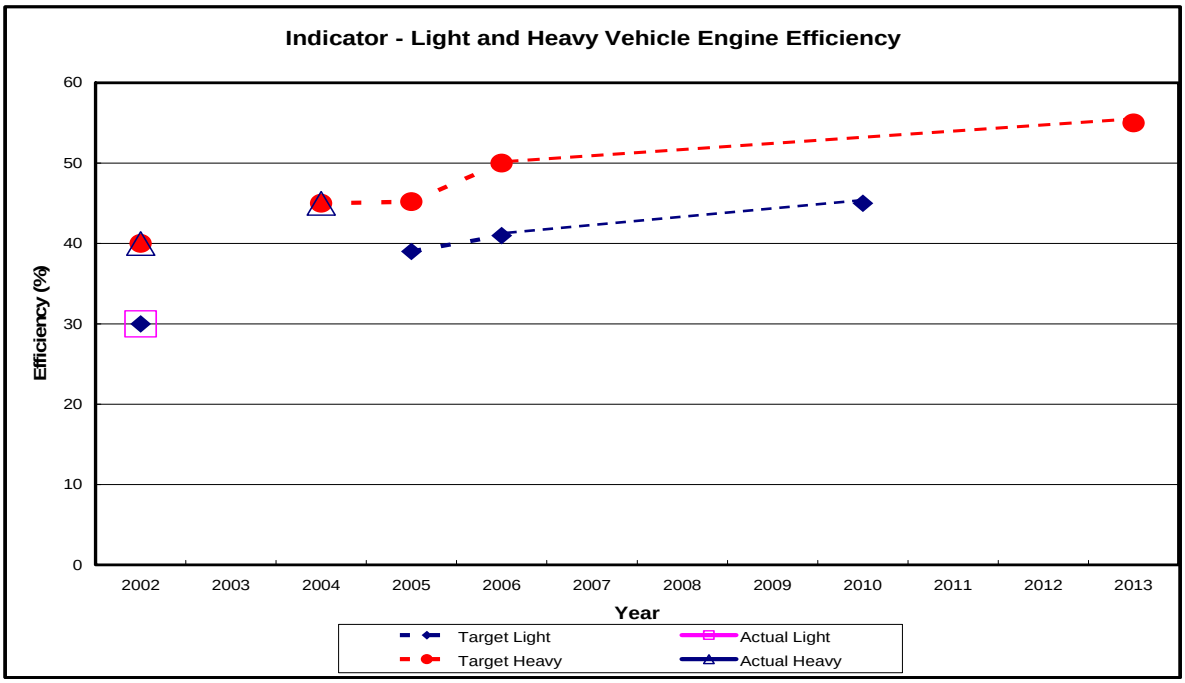
[a] See FY 2005 EERE GPRA Analysis, Figure 3.14 Annual Oil Savings…, p. 3-16

economy. This research will benefit from the synergies of the program's cooperative efforts with the Distributed Energy Program, which focuses on natural-gas-fueled HCCI research.

The Advanced Combustion Engine R&D Subprogram and Fuel Technology Subprogram will contribute to the Vehicle Technologies Program goals by dramatically improving the efficiency of internal combustion engines and will identify fuel properties that improve the system efficiency or can displace petroleum based fuels. Improved efficiency and petroleum displacement both can directly reduce petroleum consumption.

The key objective is to meet the FreedomCAR and 21st Century Truck goals to improve the efficiency of internal combustion engines from 30 percent (2002 baseline) to an estimated 45 percent by 2010 for passenger vehicles and from 40 percent (2002 baseline) to 55 percent by 2013 for commercial vehicles (the target data has been changed from 2012 to 2013). An advanced fuel formulation will be utilized that incorporates a non-petroleum based blending agent to reduce petroleum dependence while enhancing combustion efficiency.

Progress is indicated by efficiency of passenger and commercial vehicle internal combustion engines. For example, the program recently completed development of advanced clean diesel engines for pickup trucks, vans, and sport utility vehicles (SUVs) that demonstrated a 50 percent fuel economy improvement over comparable gasoline-fueled vehicles, while achieving EPA Tier 2 emissions standards in short-term testing.



Note: 2002 value is baseline

Detailed Justification

(dollars in thousands)

FY 2004	FY 2005	FY 2006
Combustion and Emission Control	**21,845**	**27,087**	**24,500**

The Combustion and Emission Control R&D activity supports the Vehicle Technologies Program goal to enable energy-efficient, clean vehicles powered by advanced internal combustion engines using clean, hydrocarbon- and non-petroleum-based, and hydrogen fuels**.** Although advanced diesel engine technology has demonstrated short-term Tier 2 emissions performance, energy consumption, cost and durability of the emission control system will limit the rate of market penetration. The National Academy of Sciences' Committee on the Effectiveness and Impact of Corporate Average Fuel Economy Standards "believes that the Tier 2 NO_x and PM standards will inhibit, or possibly preclude, the introduction of diesels into vehicles under 8500 lb.[a] The research in this activity focuses on developing technologies for passenger and medium-duty, and heavy-duty commercial vehicle engines operating in advanced combustion regimes, including HCCI and other modes of low-temperature combustion, which will increase efficiency beyond current advanced diesel levels and reduce engine-out emissions of NO_x and PM to near-zero levels. This will allow the use of lower-cost emission control systems with little or no energy consumption and greater durability. By overcoming these challenges, more efficient combustion engines can be cost-competitive with current gasoline engines and will gain greater market penetration in passenger vehicles. Also, this activity will be closely coordinated with the Fuels Technology Subprogram since different fuel characteristics and reduced property variability may be needed to meet the goals. Without this activity, high-efficiency advanced combustion engines may not be introduced into the market and oil savings will not be realized.

In FY 2006, increase emphasis on research in advanced combustion regimes that achieve FreedomCAR and 21st Century Truck efficiency goals for passenger and commercial vehicles while maintaining cost and high durability with near-zero regulated emissions.

Conduct optical laser diagnostics of in-cylinder combustion process for Homogeneous Charge Compression Ignition (HCCI), Low-Temperature Combustion (LTC) and mixed-mode regimes. Continue cost-shared cooperative agreements with vertical teams to develop innovative component technologies that enable cost effective implementation of HCCI, LTC and mixed-mode regimes with high efficiency and near-zero emissions. Through simulation and experimentation, conduct R&D on advanced thermodynamic strategies that will enable engines to approach 60 percent thermal efficiency. Utilize laser-based, optical diagnostics to conduct in-cylinder engine research focused on overcoming barriers to the development of high-efficiency, hydrogen-fueled IC engine technology in coordination with the HFCIT Program. Continue performing detailed chemical kinetic modeling of LTC and emissions processes, including fuel composition effects, to aid the development of advanced, high-efficiency IC engines using LTC and mixed-mode combustion regimes. Utilize X-rays from the Advanced Photon Source to study near-fuel injection spray characteristics.

[a] National Research Council, Effectiveness and Impact of Corporate Average Fuel Economy (CAFÉ) Standards, 2002, p. 35

(dollars in thousands)

FY 2004	FY 2005	FY 2006

Work performed under the GM cooperative agreement will focus on engine-scale testing of most promising candidate materials. This could potentially enable the use of lean NO_x catalysts that require no additional energy input. Develop efficient on-board reformers for generation of reductant needed to periodically restore catalyst function. Through partnership with industry, continue development of a shared database of simulation codes for exhaust emissions control systems.

Engine/Emission Controls Integration: Focus of effort is to reduce cost and improve durability of NO_x and particulate matter (PM) sensors through cost-shared cooperative research and development agreements (CRADAs) and cooperative agreements with automotive suppliers and universities. Award cost-shared cooperative agreements to develop sensors to control low-temperature combustion regimes.

Continue funding of cost-shared cooperative R&D agreements in the areas of advanced combustion regime development and advanced control strategies. These awards will improve the chance of achieving the program efficiency goals. (FreedomCAR, $20,765,000; 21CT, $3,735,000). In FY 2004, this activity was reduced by $571,050 for SBIR/STTR, which was transferred to the Science Appropriation. *Participants include: SNL, LANL, ORNL, PNNL, LLNL, ANL, Ford, GM, DaimlerChrysler, Detroit Diesel, Cummins, Engelhard, Exxon Mobil, Caterpillar, Mack, International, John Deere, Delphi, Honeywell, University of Michigan, University of Wisconsin, catalyst manufacturers, other suppliers, other universities, and TBD.*

Light Truck Engine **12,618** **0** **0**

Light Truck Engine R&D activity was successfully completed with FY 2004 funding. No activities are planned during FY 2006. In FY 2004, this activity was reduced by $325,525 for SBIR/STTR, which was transferred to the Science Appropriation.

Heavy Truck Engine **11,534** **13,832** **12,148**

The Heavy Truck Engine activity develops technologies for diesel engines, such as optimized fuel injection, emissions control, waste heat recovery systems, and reduced friction and pumping losses, with the goal of improving the thermal efficiency to 55 percent by 2013, (from the current 40 percent) while meeting Federal emissions standards.

In FY 2006, complete cooperative agreements to improve engine efficiency up to 50 percent through the utilization of advanced combustion regimes (HCCI, LTC and mixed-mode), which are capable of reducing engine-out emissions to near-zero levels of NO_x and PM. This approach will result in a reduced need for emission control equipment, which has a negative impact on fuel economy, cost and durability. Develop and integrate NO_x adsorbers, sulfur traps and PM filters to reduce fuel economy penalty and the potential to meet the durability requirement of 435,000 miles for commercial heavy-duty vehicles while meeting emission standards. Continue to optimize fuel injection and waste heat recovery systems, and reduce friction and pumping losses. Continue to evaluate emission control technologies from the Combustion and Emission Control R&D subprogram for the higher pressures, temperatures, and durability requirements of heavy diesel engines. Release competitive solicitation for

cost-shared cooperative agreements to develop advanced engine technologies to achieve 55 percent thermal efficiency while meeting emission standards. Address the need for advanced components and new approaches to enable better utilization of advanced combustion regimes. Advanced components and new approaches will significantly reduce the risk involved in achieving the program efficiency goals. (21CT, $12,148,000). In FY 2004, this activity was reduced by $297,550 for SBIR/STTR, which was transferred to the Science Appropriation. *Participants include: Caterpillar Inc., Cummins Engine Co., Detroit Diesel Corp., suppliers, National Laboratories, and TBD.*

Waste Heat Recovery **2,407** **3,435** **2,000**

The Waste Heat Recovery activity develops technologies to convert waste heat from engines to electrical energy to improve overall thermal efficiency and reduce emissions.

In FY 2006, continue cost-shared cooperative agreements to develop devices that will recover energy from waste heat. Integrate electric turbo compound unit with engine control system to produce 3 to 5 kilowatts (kW) for light-duty passenger vehicles and up to 20 kW for commercial vehicle applications from engine waste heat. Develop a Quantum Well thermoelectric generator to recover up to 5 kilowatts of energy from engine waste heat. Identify innovative energy recovery technologies that can improve overall efficiency and conduct R&D towards feasibility demonstration. Demonstrate conversion efficiencies greater than 12 percent using direct energy conversion methods, such as thermoelectrics, thermionics, quantum well, or other innovative concepts. Use Peltier heating/cooling systems with a COP> 2.5 to achieve significant energy savings compared to current systems. Develop advanced thermoacoustic cooling, ejector cooling and adsorption and absorption cooling. (21CT, $2,000,000). In FY 2004, this activity was reduced by $62,100 for SBIR/STTR, which was transferred to the Science Appropriation. *Participants include: Honeywell, Caterpillar, Hi-Z, PNNL, and TBD.*

Off-Highway Engine R&D **3,369** **3,451** **0**

No activities are planned during FY 2006 so as to continue focusing on other research opportunities having higher potential for energy savings. In FY 2004, this activity was reduced by $86,925 for SBIR/STTR, which was transferred to the Science Appropriation.

Health Impacts..... **963** **1,951** **2,500**

The Health Impacts activity evaluates the relative toxicity and consequent health implications for people of emissions from new vehicle technologies developed to meet energy efficiency goals. As the prime mover behind the development of clean diesel engine technology, the Department has a large stake in ensuring that unanticipated deleterious health impacts do not arise from the large-scale deployment of this fuel economy improving technology.

In FY 2006, the collection of samples for the subsequent study of health impacts from weekend/weekday ozone formation and its source apportionment (cars vs. trucks) will be completed. The initial sample collection for subsequent toxicity testing of metallic compounds in engine emissions

(dollars in thousands)

FY 2004	FY 2005	FY 2006

originating from fuels and lubricants (man-made additives and/or trace metals ,e.g., mercury, nickel, vanadium, etc., in non-petroleum-based feedstocks) and the comparative toxicity testing of emissions from natural gas fueled vehicles will be completed. The second year of the five year Advanced Collaborative Emissions Study (ACES) of toxic compounds emanating from 2007 compliant heavy-duty diesel engines will move into the sample collection phase. Finally, in FY 2006, the Single-Particle Laser-Assisted Time-of-Flight (SPLAT) instrument needed to measure nanoparticle emissions will be completed. With the additional funds requested, samples for ACES previously scheduled for collection in FY 2007 will be collected beginning in FY 2006. Because of the very low emissions rates from 2007 compliant engines, earlier collection of emissions samples is important to enable earlier and longer exposures for toxicity testing before large numbers of such engines actually enter the marketplace (21CT, $2,500,000). In FY 2004, this activity was reduced by $24,850 for SBIR/STTR, which was transferred to the Science Appropriation. *Participants include: Lovelace Respiratory Research Institute and NIOSH.*

Total, Advanced Combustion Engine R&D	**52,736**	**49,756**	**41,148**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Combustion and Emission Control	
Consolidate the number of cooperative agreements having the highest potential for improving the efficiency of heavy-duty engines operating in advanced low-temperature combustion regimes while maintaining emphasis on light-duty engines. (Consistent with RDIC section 2c, which focuses on the level of industry cost sharing for the program.)	-2,587
Heavy Truck Engine	
Consolidate research effort on improving engine efficiency to 50 percent through the use of advanced combustion regimes, leaving nearer-term improvements to industry. (Consistent with RDIC section 1b, which looks at market barriers to private sector investment, and RDIC 2e, which asks whether the R&D activity includes "off ramps" (such as when technology matures).)	-1,684
Waste Heat Recovery	
Down-select the number of cooperative agreements to pursue only the most effective research projects in the development of turbo compound units that have the potential to improve overall engine efficiency. (Consistent with RDIC section 2e, incorporation of "off ramps".)	-1,435
Off-Highway Engine R&D	
The off-highway activity is terminated so as to focus on other research opportunities having higher potential for energy savings. (Consistent with RDIC section 2d, planning using performance indicators, and RDIC 3a, which focuses on an activity's effectiveness and anticipated benefits.)	-3,451
Health Impacts	
Accelerate initial sample collection for Advanced Collaborative Emissions Study (ACES) from FY 2007 to FY 2006. Because of the very low emissions rates from 2007 compliant engines, collection of emissions samples sufficient for toxicity testing takes longer. It is important to enable earlier and longer exposures for toxicity testing before large numbers of these engines actually enter the marketplace in 2007. (Consistent with RDIC section 1b, market barriers to private sector investment in research, RDIC 1c, which focuses on whether the R&D has a clear public benefit (in this case, public health), and RDIC 2a, complementing related R&D.)	+549
Total Funding Change, Advanced Combustion Engine R&D.....	**-8,608**

Materials Technology

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Materials Technology					
Propulsion Materials Technology					
Automotive Propulsion Materials	2,766	1,972	2,000	+28	+1.4%
Heavy Vehicle Propulsion Materials.....	5,633	4,858	4,926	+68	+1.4%
Total, Propulsion Materials Technology	8,399	6,830	6,926	+96	+1.4%
Lightweight Materials Technology					
Automotive Lightweight Materials.....	16,214	16,465	19,000	+2,535	+15.4%
Heavy Vehicle High Strength Weight Reduction Materials.....	8,617	7,691	7,799	+108	+1.4%
Total, Lightweight Materials Technology	24,831	24,156	26,799	+2,643	+10.9%
High Temperature Materials Laboratory.....	5,392	6,015	4,500	-1,515	-25.2%
Total, Materials Technology.....	38,622	37,001	38,225	+1,224	+3.3%

Description

The Materials Technologies Subprogram supports the development of cost-effective materials and materials manufacturing processes that can contribute to fuel-efficient passenger and commercial vehicles. This subprogram is a critical enabler for concepts developed elsewhere in the FreedomCAR and 21st Century Truck budgets. The subprogram consists of three activities: Propulsion Materials Technology, Lightweight Materials Technology, and the High-Temperature Materials Laboratory (HTML).

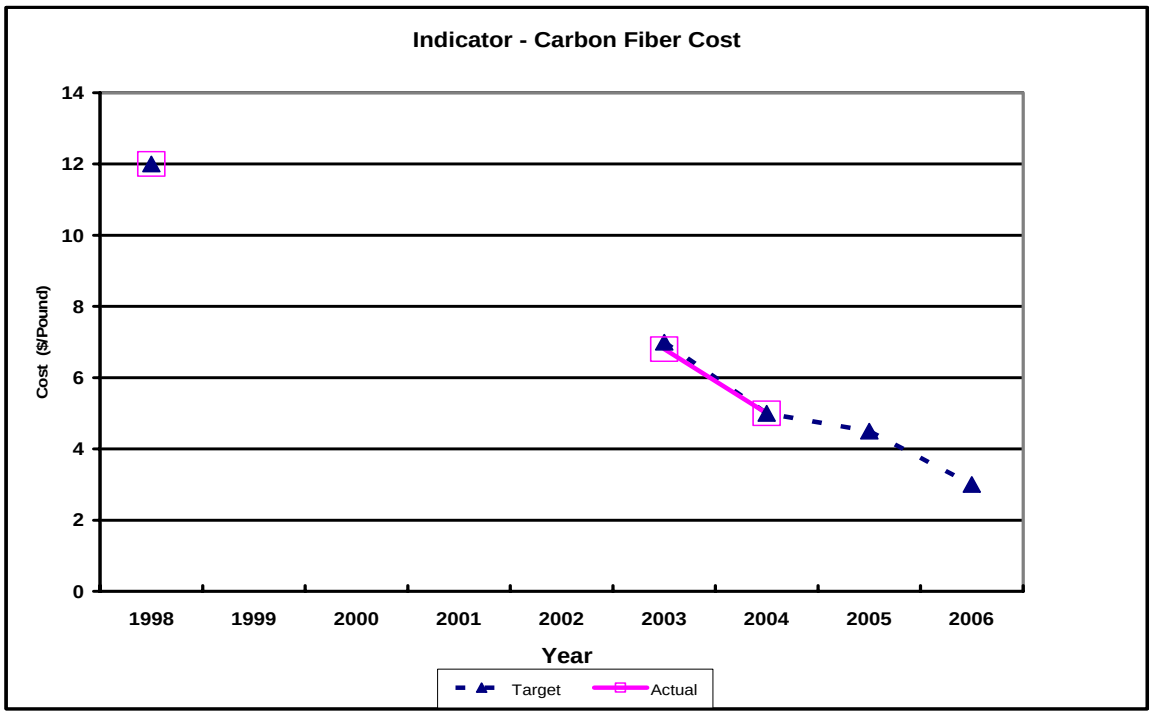
Benefits

The Materials Technology Subprogram will contribute to the VT Program goal by developing better, cost effective materials that will make lighter vehicle structures and more efficient power systems possible. Lighter vehicles (that provide comparable safety) require less energy to operate and thus reduce the consumption of fuel. Likewise, better propulsion materials can make more efficient power systems possible thus also contributing to a vehicle's reduced energy consumption.

A key subprogram goal for the transportation Materials Technologies R&D activity is to develop material and manufacturing technologies by 2010 that, if implemented in high volume, could cost-

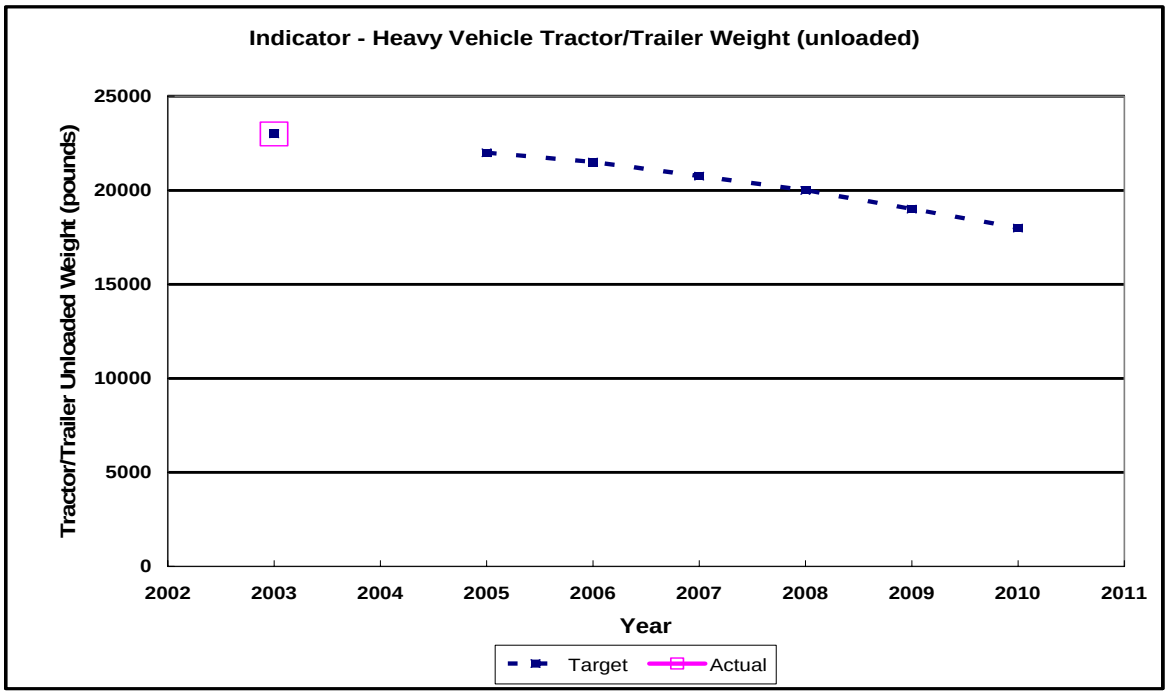
effectively reduce the weight of light-duty vehicle body and chassis systems by 50 percent with safety, performance, and recyclability comparable to 2002 vehicles.

One factor indicating progress is the reduction in the cost (modeled) of bulk carbon fiber. Projected and actual progress for this factor is shown graphically below:



Note: 1998 value is baseline

A second program goal is to demonstrate the technical feasibility of reducing the weight of a tractor-trailer from 23,000 pounds in 2003 to 18,000 pounds in 2010 (a 22 percent reduction), thereby increasing heavy truck fuel efficiency. Projected and actual progress for this factor is shown in the graphic below.



Note: 2003 value is baseline

Related milestones that will contribute to the VT Program goal are:

By 2006, develop and validate Materials Technologies that will:

- Reduce the projected production cost of bulk carbon fiber from $12 per pound in 1998 to $3 per pound.
- Demonstrate the technical feasibility of reducing the weight of a tractor-trailer to an interim target of 21,500 pounds.

Detailed Justification

(dollars in thousands)

FY 2004	FY 2005	FY 2006
Propulsion Materials Technology	**8,399**	**6,830**	**6,926**

The Propulsion Materials Technology activity focuses on technologies that are critical in removing barriers to electric drive, advanced combustion, and efficiency improvement research activities.

(dollars in thousands)

FY 2004	FY 2005	FY 2006

- **Automotive Propulsion Materials**..... **2,766** **1,972** **2,000**

  Emphasis will be on the development of electric drive system and advanced combustion system materials. Complete testing of carbon foam in production representative power electronics applications. Test the performance of diesel fuel injectors with 50 micron orifices in bench tests. Test prototype electrochemical NO_x sensor with industrial partners. (FreedomCAR, $2,000,000). In FY 2004, this activity was reduced by $74,125 for SBIR/STTR, which was transferred to the Science Appropriation. *Participants include: ORNL, LLNL, ANL, and PNNL.*

- **Heavy Vehicle Propulsion Materials**..... **5,633** **4,858** **4,926**

  In FY 2006, continue designing a titanium engine block and perform calculations of the resulting efficiency to be gained by its substitution for cast iron in class 8 tractor engine blocks. Investigate fabrication techniques for titanium. Relate ceramic processing to improved fracture toughness and ductility of novel ceramics to replace metal parts with cost-effective, lightweight, durable ceramics. Continue investigation of new surface modification techniques to reduce friction/wear in engine components to increase fuel efficiency and safety without sacrificing durability. Measure critical performance parameters for lightweight intermetallics, ceramic matrix composites, and cermets for applications in components of advanced high-performance, fuel-efficient diesel engines. Continue multilateral collaborative research within the International Energy Agency Annex on Materials for Transportation on characterization of rolling contact fatigue, integrated surface modification of materials, and new applications for magnesium. (21CT, $ 4,926,000). In FY 2004, this activity was reduced by $145,300 for SBIR/STTR, which was transferred to the Science Appropriation. *Participants include: ORNL, LLNL, SNL, ANL, Industrial Ceramic Solutions, Third Wave Systems, Caterpillar, Cummins, Ricardo Engineering, Sur-Tech, Purdue University, University of Tennessee, and NIST.*

Lightweight Materials Technology **24,831** **24,156** **26,799**

Lightweight Materials Technology activity develops materials and materials processes for manufacturing and recycling vehicle components out of advanced lightweighting materials while maintaining safety, performance, and reducing cost.

- **Automotive Lightweight Materials** **16,214** **16,465** **19,000**

  In FY 2006, emphasis will be on manufacturing of lightweight components made from the various materials researched and developed in previous years. The purpose of the focus will be to lower the costs even further toward the FY 2010 goal of cost neutrality. Research, development and validation of the manufacturing of automotive grade structural carbon fiber and carbon-fiber-reinforced polymer-matrix composite (PMC) structures will dominate funding as in FY 2005. The

(dollars in thousands)

FY 2004	FY 2005	FY 2006

last of two large R&D projects begun in FY 2001 on cast magnesium alloys and components will conclude while projects exploring the casting of very large, integrated (one-piece) subassemblies from magnesium and aluminum will ramp up from beginnings in FY 2005. A new thrust on the affordability of magnesium components will be planned. Projects on stamping and joining of aluminum and advanced- and ultra-high strength steel sheet, on-line/real-time nondestructive evaluations/inspections, and recycling will continue at roughly the pace of FY 2005. Two additional research thrusts will be exploration of titanium, titanium alloys and components made from inexpensive ilmenite ore in structures and development of the ability to predict the performance of automotive PMCs and components. (FreedomCAR, $19,000,000). In FY 2004, this activity was reduced by $418,275 for SBIR/STTR, which was transferred to the Science Appropriation. *Participants include: ANL, LBNL, LLNL, ORNL, PNNL, SNL, numerous companies and universities.*

- **Heavy Vehicle High-Strength Weight Reduction Materials** **8,617** **7,691** **7,799**

In FY 2006, complete testing of ultra-light, ultra-efficient 40 ft. stainless steel transit bus and assess improvement of vehicle performance over conventional vehicles. Apply new magnesium casting process to prototype commercial heavy-duty vehicle components and assess component performance and cost effectiveness for reduced weight, higher efficiency large and medium-sized trucks. Continue development of processes to produce wrought magnesium alloy sheet components to meet commercial heavy-duty vehicle technical requirements, and cost targets. Apply previously identified and characterized innovative, reliable, cost effective joining techniques for high performance lightweight materials and dissimilar material joints, especially high performance metal matrix composites, nanocrystalline, and amorphous materials. Apply newly developed technologies to the joining of carbon composites to other structural materials to achieve substantial weight reduction of commercial vehicle structural components. Select, fabricate, and assess the performance of candidate commercial vehicle structural components made of lower cost, lighter weight titanium alloys. Evaluate the fabricability of amorphous materials and metal matrix composites made by equal channel angular extrusion and assess the applicability of the process for the production of high performance commercial vehicle components. Complete quantification and characterization of the effects of highway ice-clearing chemicals on the corrosion of commercial vehicle materials and the concomitant effects on commercial vehicle safety. (21CT, $7,799,000). In FY 2004, this activity was reduced by $222,300 for SBIR/STTR, which was transferred to the Science Appropriation. *Participants include: American Trucking Associations, PACCAR, Freightliner, ALCOA, Caterpillar, DaimlerChrysler, Delphi, Volvo, Eck Industries, International, Autokinetics, ANL, LANL, INEEL, PNNL, MIT, and ORNL.*

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
High Temperature Materials Laboratory	**5,392**	**6,015**	**4,500**

The High Temperature Materials Laboratory (HTML) activity is an advanced materials R&D industrial user center located at the Oak Ridge National Laboratory. The HTML strives to maintain world-class, state-of-the-art advanced materials characterization capabilities not available elsewhere and makes them available to U.S. industries for use in solving complex materials problems. It develops cutting-edge analytical techniques to identify innovative materials for use in transportation applications. Activities include the investigation and determination of the physical and chemical properties and performance characteristics of metals, alloys, ceramics, composites and even novel nanophase materials under development for vehicle applications.

In FY 2005, the Nation's first Aberration Corrected Electron Microscope (ACEM) that has both sub-angstrom level clear imaging and chemical analysis capabilities was delivered and became fully operational in the Materials Characterization Industrial User Center. In FY 2006 ACEM will be used to study and characterize advanced materials such as lean NO_x catalytic materials in support of FreedomCAR and 21st Century Truck activities, which will enable higher efficiency, clean diesel engines to replace lower efficiency spark ignition engines in most automobiles, light trucks and commercial vehicles. Also in FY 2006, three materials characterization industrial user centers will carry out user agreements. (HTML $4,500,000) In FY 2004, this activity was reduced by $139,000 for SBIR/STTR, which was transferred to the Science Appropriation.

Total, Materials Technologies	**38,622**	**37,001**	**38,225**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Propulsion Materials Technology	
▪ **Automotive Propulsion Materials**	
No significant change	+28
▪ **Heavy Vehicle Propulsion Materials**	
Increased funding will be used to initiate development of prototype heavy diesel engine components using lightweight, cost-effective nanocrystalline materials, such as titanium and magnesium, which are recognized for their high strength. (Consistent with RDIC section 2a, building on and complementing related R&D.)	+68
Total, Propulsion Materials Technology	**+96**
Lightweight Materials Technology	
▪ **Automotive Lightweight Materials**	
Research, development and validation of the manufacturing of automotive grade structural carbon fiber and carbon-fiber-reinforced polymer-matrix composite (PMC) structures will dominate funding. The increase will fund two additional research thrusts: exploration of titanium, titanium alloys and components made form inexpensive ilmenite ore in structures; and development of a robust predictive modeling capability for thermoplastic composites and low-cost carbon fiber production processes to determine/estimate costs and benefits. (Consistent with RDIC section 2a, building on and complementing related R&D, and RDIC 2d, incorporating performance indicators, with costs now being the most important remaining performance target.)	+2,535
▪ **Heavy Vehicle High Strength Weight Reduction Materials**	
Conduct additional evaluations of lightweight structural materials for commercial heavy-duty vehicles. (Consistent with RDIC section 2a, complementing related R&D, and RDIC 2b, industry involvement, addressing industry concerns about the real-world performance of lighter commercial vehicles.)	+108
Total, Lightweight Materials Technology	**+2,643**
High Temperature Materials Laboratory	
HTML operations will be consolidated into three industrial user centers	-1,515
Total Funding Change, Materials Technology	**+1,224**

Fuels Technology

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Fuels Technology					
Advanced Petroleum Based Fuels	9,901	5,876	6,500	+624	+10.6%
Non-Petroleum Based Fuels and Lubricants					
Medium Trucks	1,171	1,282	0	-1,282	-100.0%
Heavy Trucks	1,349	690	0	-690	-100.0%
Fueling Infrastructure	1,155	1,183	0	-1,183	-100.0%
Renewable and Synthetic Fuels Utilization	385	2,733	7,147	+4,414	+161.5%
Total, Non-Petroleum Based Fuels and Lubricants	4,060	5,888	7,147	+1,259	+21.4%
Environmental Impacts	1,926	986	0	-986	-100.0%
Total, Fuels Technology	15,887	12,750	13,647	+897	+7.0%

Description

The Fuels Technology Subprogram supports R&D that will provide vehicle users with fuel options that are cost competitive, enable high fuel economy, deliver low emissions, and contribute to petroleum displacement. The focus is to assess mid- to long-term changes in the make-up of refinery feedstocks and identify the best use of these to produce a refining product that matches the needs of extremely-efficient internal combustion engines that are envisioned for the post-2010 time frame. This subprogram supports the mission of FCVT to develop more energy-efficient and environmentally-friendly highway transportation vehicles that enable America to use less petroleum. It consists of two activities: Advanced Petroleum-Based Fuels (APBF) and Non-Petroleum-Based Fuels and Lubricants (NPBFL).

Benefits

The APBF and NPBFL activities are undertaken: (1) to enable post-2010 advanced combustion regime engines and emission control systems to be as efficient as possible while meeting future emission standards; and, (2) to reduce reliance on petroleum-based fuels. To differentiate these two activities, an advanced petroleum-based fuel is envisioned as consisting of highly-refined petroleum-base fuel derived from what are considered to be future refinery feedstocks, possibly blended with performance-enhancing non-petroleum additives derived from renewable resources such as biomass or from non-petroleum fossil resources such as natural gas or coal. In contrast, a non-petroleum-based fuel consists of a fuel or fuel-blending component derived primarily from non-crude-oil sources such as agricultural products, biomass, natural gas, bitumen, shale, or coal. The benefit of the APBF activity is that it will enable fuel providers to work cooperatively with engine manufacturers to match up future refinery products with

future engine needs. The benefit of NPBFL is that it will provide non-petroleum based blending agents that enable both high fuel economy and direct displacement of petroleum fuels.

Detailed Justification

(dollars in thousands)

FY 2004	FY 2005	FY 2006

Advanced Petroleum Based Fuels (APBF). **9,901** **5,876** **6,500**

The APBF activity develops petroleum-based fuels and lubricants that will enable extremely high efficiency engines for light-duty passenger and heavy-duty commercial vehicle applications. This effort employs the expertise and shared funding of the Government, energy companies, and emission control and engine manufacturers. The goal is to identify fuel properties that can enable engines to operate in the highest efficiency mode while meeting future emissions standards.

In FY 2006, issue a new solicitation to attract vertically-integrated teams, including a passenger vehicle manufacturer and an energy company, to identify fuel-property requirements of post-2010 passenger vehicle advanced internal combustion engines. This activity is crosscutting with the Advanced Combustion Engine Subprogram. Utilizing the in-house National Laboratory expertise through multi-partner cooperative research and development agreements (CRADA), continue development of predictive tools that relate molecular structure to ignition behavior and heat release of fuels in heavy-duty advanced internal combustion engines. Expand CRADAs to include participation from passenger vehicle manufacturers. This effort is conducted through experimentation and modeling, utilizing Government provided specialized equipment and scientists. Through the combined industry/Government effort two base fuel properties that effect advanced combustion regime engine operation will be identified and optimization of a base fuel will be initiated. (FreedomCAR, $3,000,000) (21CT, $3,500,000). In FY 2004, this activity was reduced by $258,000 for SBIR/STTR, which was transferred to the Science Appropriation. *Participants include: NREL, ORNL, SNL, LLNL, and NETL.*

Non-Petroleum-Based Fuels and Lubricants (NPBFL).. **4,060** **5,888** **7,147**

The NPBFL activity formulates and evaluates biomass-based and synthetic fuels for use as blending agents in advanced combustion regime engines. Specific areas being investigated include molecular make-up, effect on bulk fuel properties, and effect on engine performance, storage, handling, toxicity, and volatility.

Medium Trucks. **1,171** **1,282** **0**

In FY 2006, no efforts are planned. Work in this area has supported natural gas engine/vehicle systems development and the technology is considered mature and ready for commercialization. In FY 2004, this activity was reduced by $32,300 for SBIR/STTR, which was transferred to the Science Appropriation.

Heavy Trucks.. . . . . **1,349** **690** **0**

(dollars in thousands)

FY 2004	FY 2005	FY 2006

In FY 2006, no efforts are planned. Prior work in this area that supported natural gas engine/vehicle systems development and the technology is now considered mature and ready for commercial development. In FY 2004, this activity was reduced by $34,000 for SBIR/STTR, which was transferred to the Science Appropriation.

- **Fueling Infrastructure**..... **1,155** **1,183** **0**

In FY 2006, no efforts are planned. Previous work in this area supported natural gas fueling infrastructure R&D and is now considered mature and ready for commercialization. In FY 2004, this activity was reduced by $29,800 for SBIR/STTR, which was transferred to the Science Appropriation.

- **Renewable and Synthetic Fuels Utilization**..... **385** **2,733** **7,147**

In FY 2006, develop baseline data on the relationships between molecular structure and bulk fuel properties, ignition behavior, and heat release for renewable and synthetic fuels in advanced combustion regime engines. Begin development of a predictive model based on these data. Issue a solicitation for development of an index to describe and compare the suitability of renewable and synthetic fuels for use in advanced combustion regime engines. Establish a research-fuel evaluation protocol to identify and quantify technical barriers to the use of non-petroleum fuels blendstocks in petroleum based fuels for advanced combustion regime engines. In FY 2004, this activity was reduced by $10,000 for SBIR/STTR, which was transferred to the Science Appropriation. (FreedomCAR $4,000,000) (21CT, $3,147,000). *Participants include: NREL, ORNL, SNL, LLNL, and NETL.*

Environmental Impacts **1,926** **986** **0**

In FY 2006, no efforts are planned as work in this area is not considered to be within the mission of DOE. In FY 2004, this activity was reduced by $48,900 for SBIR/STTR, which was transferred to the Science Appropriation.

Total, Fuels Technology 15,887 12,750 13,647

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Advanced Petroleum Based Fuels	
Expand combustion MOU at Sandia to include participation of energy companies and expand CRADAs to include both auto industry and energy company partners. (Consistent with RDIC section 2a, complementing related R&D, and RDIC 2b, industry involvement.)	+ 624
Non-Petroleum Based Fuels and Lubricants	
▪ **Medium Trucks**	
Activities in this area are to be shut down. This technology is commercially available. (Consistent with RDIC section 1b, market barriers (they have become minor), and RDIC 2e, incorporation of "off ramps.")	-1,282
▪ **Heavy Trucks**	
Activities in this area are to be shut down. This technology is commercially available. (Consistent with RDIC section 1b, market barriers (they have become minor), and RDIC 2e, incorporation of "off ramps.")	-690
▪ **Fueling Infrastructure**	
Activities in this area are to be shut down. This technology is commercially available. (Consistent with RDIC section 1b, market barriers (they have become minor), and RDIC 2e, incorporation of "off ramps.")	-1,183
▪ **Renewable and Synthetic Fuels Utilization**	
Increased funding will be used to address technical barriers to blending non-petroleum components into refinery-produced, petroleum- based fuels for use in advanced combustion regime engines. These concerns are: 1) Impact on ignition control and combustion stability; 2) Effect on fuel stability; 3) Impact on emission control device operation; 4) Compatibility with existing distribution infrastructure; and 5) Impacts on handling and safety.	
These concerns will be addressed through evaluation of a matrix of non-petroleum components blended in various amounts with petroleum-based fuels. Industry will be consulted to help develop the selection of non-petroleum components and to determine amounts to blend (Consistent with RDIC section 1b, market barriers (high, given no significant current market for these types of fuels), and RDIC 2b, building on and complementing existing R&D.)	+4,414
Total, Non-Petroleum Based Fuels and Lubricants	**+1,259**
Environmental Impacts	
Activities in this area are to be shut down. Work in this area should be done by EPA	-986
Total Funding Change, Fuels Technology	**+897**

Technology Introduction

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Technology Introduction					
Legislative and Rulemaking (formerly Energy Policy Act Replacement Fuels)					
State and Fuel Provider Fleet	746	887	1,000	+113	+12.7%
Private and Local Fleet	199	99	300	+201	+203.0%
Fuel Petitions	105	0	314	+314	NA
Federal Fleets	507	507	700	+193	+38.1%
Regulatory Support	37	0	200	+200	NA
Total, Legislative and Rulemaking (formerly Energy Policy Act Replacement Fuels)	1,594	1,493	2,514	+1,021	+68.4%
Testing and Evaluation					
Vehicle Evaluation	2,221	2,416	2,450	+34	+1.4%
Infrastructure Testing	98	49	50	+1	+2.0%
Total, Testing and Evaluation	2,319	2,465	2,500	+35	+1.4%
Advanced Vehicle Competitions	889	986	1,300	+314	+31.8%
Total, Technology Introduction	4,802	4,944	6,314	+1,370	+27.7%

Description

The Technology Introduction Subprogram accelerates the adoption and use of alternative fuel and advanced technology vehicles to help meet national energy and environmental goals. This subprogram's efforts logically follow and complement successful research by industry and government. The primary functions of Technology Introduction include legislative and rulemaking supporting the Energy Policy Act of 1992 (EPAct) alternative fuel and fleet activities; testing and evaluation of advanced technology vehicles; and advanced vehicle competitions. As identified in the National Energy Policy, consumer education and demonstration activities are critical to accelerating the use of advanced energy technologies.

Benefits

The Technology Introduction Subprogram contributes to the VT Program goal by accelerating the adoption and use of alternative fuels and advanced technology vehicles. These fuels and vehicles will reduce the consumption of petroleum-based fuels thus contributing to achieving the program goal.

Detailed Justification

(dollars in thousands)

FY 2004	FY 2005	FY 2006

Legislative and Rulemaking (formerly Energy Policy Act Replacement Fuels) **1,594** **1,493** **2,514**

The Legislative and Rulemaking activity consists of the State and Alternative Fuel Provider Regulatory Program, Fuel Petitions, Private and Local Government Fleet Regulatory Program, Federal Fleet requirements and the normal implementation of other EPAct requirements including reports and rulemaking, the analysis of the impact of other regulatory and pending legislative activities, and the implementation of legislative changes to EPAct as they occur. The fleet programs require selected covered fleets to procure alternative fuel passenger vehicles annually as well as the Department's compliance with the Federal fleet requirements. The Department also reviews and processes petitions to designate new alternative fuels under EPAct.

- **State and Fuel Provider Fleet**..... **746** **887** **1,000**

  In FY 2006, expand the use of alternative fuel in the state fleets through outreach and partnership building between the state and alternative fuel providers (EPAct Sec 507 (0)). The funding supports working with 4 to 5 States per year to get them to voluntarily use alternative fuel since they are only required to acquire alternative fuel vehicles to meet the mandate. *Participants include: NREL.*

- **Private and Local Fleet**..... **199** **99** **300**

  In FY 2006, complete EPAct Section 509 fourth quarter report and initiate internal review (EPAct Sec 301 (2)). *Participants include: NREL.*

- **Fuel Petitions**..... **105** **0** **314**

  In FY 2006, initiate new fuel petition review and analysis as necessary. Review and analysis of proposed alternative fuel designation legislation. *Participants include: NREL, ANL, and ORNL.*

- **Federal Fleets**..... **507** **507** **700**

  In FY 2006, continue tracking and reporting Federal Fleet compliance (EO 13149). Upgrade the FAST (Federal Automotive Statistical Tool) system to facilitate the review and analysis of their own fleet data by agencies. *Participants include: INEEL, NREL, and GSA.*

- **Regulatory Support**..... **37** **0** **200**

  In FY 2006, continue tracking and analysis of energy legislation and revise EPAct Replacement Fuel goal. *Participants include: NREL, ANL, and ORNL.*

Testing and Evaluation..... **2,319** **2,465** **2,500**

(dollars in thousands)

FY 2004	FY 2005	FY 2006

The primary goal of the Advanced Vehicle Testing Activity (AVTA) is to benchmark and validate the performance of passenger and commercial vehicles that feature one or more advanced technologies, including: Internal combustion engines burning advanced fuels, such as 100 percent hydrogen and hydrogen/compressed natural gas-blended fuels; Hybrid electric, pure electric, and hydraulic drive systems; Advanced batteries and engines; and Advanced climate control, power electronic, and other ancillary systems.

By benchmarking the performance and capabilities of advanced technologies, the AVTA supports the development of industry and DOE technology targets. The testing results are also leveraged as input to component, system, and vehicle models, as well as hardware-in-the-loop testing.

The AVTA develops vehicle test procedures with input from industry and other stakeholders to accurately measure real-world vehicle performance. These test procedures are then used to test production and preproduction advanced technology vehicles on dynamometers and closed test tracks as well as in government, commercial, and industry fleets. The AVTA tests produce unbiased information about vehicles with advanced transportation technologies, which reduces the U.S. dependence on foreign oil, while improving the Nation's air quality.

- **Vehicle Evaluation**..... **2,221** **2,416** **2,450**

  In FY 2006, complete testing of second generation hydrogen-fueled internal combustion engine vehicles and initiate testing of hydrogen-internal combustion engine hybrid electric vehicles. Complete evaluation of first generation hydrogen-fueled internal combustion engine passenger vehicles and electric airport ground support equipment. Expand baseline performance and accelerated reliability testing of new hybrid electric vehicles. Expand data collection on fuel cell transit buses. Initiate evaluation of an additional commercial heavy-duty truck idle-reduction device. Initiate fleet evaluation of light-duty passenger fuel cell vehicles. *Participants include: INEEL, NREL, ANL, FTA, APTA, DOT ORNL, and EPA.*

- **Infrastructure Testing**..... **98** **49** **50**

  In FY 2006, continue evaluation of vehicle refueling safety systems for high-pressure hydrogen refueling. *Participants include: INEEL and Other Federal Agencies.*

Advanced Vehicle Competitions..... **889** **986** **1,300**

Advanced Vehicle Competitions provide educational opportunities for university students to learn and use real-world engineering skills while demonstrating the performance of critical vehicle technologies identified by the Department of Energy and industry. In FY 2006, we will conduct the second year of a three-year ChallengeX competition in partnership with General Motors. Selected teams will be challenged to integrate advanced vehicle technologies and appropriate fuels to develop an approach that minimizes use of petroleum fuel. Many students who graduate from these vehicle competitions go on to take jobs in the auto industry where they bring with them an unprecedented appreciation and

(dollars in thousands)

FY 2004	FY 2005	FY 2006

understanding of advanced automotive technologies. (FreedomCAR, $1,300,000). *Participants include: Michigan Technological University, Mississippi State University, The Ohio State University, Penn State University, Rose-Hulman Institute of Technology, San Diego State University, Texas Tech University, The University of Akron, University of California-Davis, University of Michigan, University of Tennessee, University of Texas at Austin, University of Tulsa, University of Wisconsin-Madison, Virginia Tech, and West Virginia University.*

Total, Technology Introduction	**4,802**	**4,944**	**6,314**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Legislative and Rulemaking (formerly Energy Policy Act Replacement Fuels)	
▪ **State and Fuel Provider Fleet**	
Encourage covered fleets under EPACT Section 507(o) and enforce covered fleets under EPACT Section 501 to increase alternative fuel use in lieu of petroleum through development of online web-based technical tools, training and resources. (Consistent with RDIC section 1b, market barriers (this is a regulatory, rather than market, activity), and RDIC 1e, which focuses on activities where there is a clear public benefit.)	+113
▪ **Private and Local Fleet**	
As directed by legislation, develop options under Section 509 of the Energy Policy Act of 1992 in lieu of the Sec. 507 Private and Local fleet rulemaking. (Consistent with RDIC section 1b, market barriers, and RDIC 1c, public benefit.)	+201
▪ **Fuel Petitions**	
Develop online guidance for filing petitions and further define environmental and energy security benefits as applied to new fuels for which petitions are being submitted. Update Argonne's greenhouse-gas emissions modeling (GREET model) capabilities to anticipate expansion to new fuels, fuel production, and vehicle systems. (Consistent with RDIC section 1b, market barriers, and RDIC 1c, public benefit.)	+314

	FY 2006 vs. FY 2005 ($000)
▪ **Federal Fleets**	
Make systematic improvements to Federal Automotive Statistical Tool (FAST) and work with federal agencies to enhance their ability to reduce petroleum consumption. Put systems in place to enhance ability to track fuel use by agencies. Provide technical tools and strategies to help federal agencies reduce petroleum. (Consistent with RDIC section 1b, market barriers, and RDIC 1c, public benefit.)	+193
▪ **Regulatory Support**	
Undertake analyses for legislation that will affect implementation of fleet programs, particularly areas that appear likely to appear in legislation in 2006 such as opt-out provisions for EPACT sections 501 and 507(o) fleets, which might require a separate tracking system and implementation, possible addition of hybrids for EPAct credit, petitions by utilities to allow plug-in hybrids and additions of new fuels by DOE's authority and/or by Congress. (Consistent with RDIC section 1b, market barriers, and RDIC 1c, public benefit.)	+200
Total, Legislative and Rulemaking (formerly Energy Policy Act Replacement Fuels)	**+1,021**
Testing and Evaluation	
▪ **Vehicle Evaluations**	
No significant change	+34
▪ **Infrastructure Testing**	
No significant change	+1
Total, Testing and Evaluation	**+35**
Advanced Vehicle Competitions	
Additional funding is requested for the items above to enable the capability to measure, model, and validate the performance of the wide range of advanced vehicle technologies used in ChallengeX to determine their performance relative to FreedomCAR goals. In particular, development of mobile emissions testing equipment suitable for ChallengeX's "well to wheels" scoring format incorporating CH_4 and N_2O measurement with criteria pollutants and particulate matter will be pursued in partnership with EPA. (Consistent with RDIC section 1b, market barriers, and RDIC 1c, public benefit.)	+314
Total Funding Change, Technology Introduction	**+1,370**

Technical/Program Management Support

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Technical/Program Management Support	2,095	1,877	2,500	+623	+33.2%
Total, Technical/Program Management Support	2,095	1,877	2,500	+623	+33.2%

Description

Consistent with other DOE programs under the jurisdiction of the Interior and Related Agencies Appropriations Committees, the Energy Conservation programs provide funding for Technical/Program Management Support. This includes activities such as research and development (R&D) feasibility studies; R&D option development and trade-off analyses; and technical, economic, and market evaluations of research. These activities provide important benefits directly to the VT Program described above and are therefore an integral part of the R&D program.

Benefits

Thorough sound analysis is necessary to support effective and efficient decisions, implementation, and management of the VT Program's complex and challenging research program. Effective and efficient management actions will contribute to achieving the program goal by better managing R&D risk and by effective management of the R&D portfolio.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Technical/Program Management Support	**2,095**	**1,877**	**2,500**

In FY 2006, efforts will include preparation of program strategic plan and operating plans; R&D feasibility studies and trade-off analyses; evaluations of the impact of new legislation on R&D programs; analyses of energy issues pertinent to the R&D program; identification of performance methodologies (including GPRA); data collection to assess program and project performance, efficiency, and impacts; and development of performance agreements with management. (FreedomCAR, $1,200,000; 21CT, $1,200,000). *Participants include: Sentech, Antares, and QSS.*

Total, Technical/Program Management Support	**2,095**	**1,877**	**2,500**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Technical/Program Management Support	
Conduct Program Reviews. In support of VT partnership activities, initiate detailed analyses examining the progress towards meeting the technical targets. Expand the portfolio analyses consistent with the Planning, Analysis, and Evaluation Multi-Year Program Plan with focus on balance and prioritization. (Consistent with RDIC section 2b, industry involvement in planning and prioritization, and RDIC 2d, incorporation of performance indicators (in this case, tracking and development of indicators.)	+623
Total Funding Change, Technical/Program Management Support	**+623**

Biennial Peer Reviews

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Biennial Peer Reviews	494	0	1,000	+1,000	N/A
Total, Biennial Peer Reviews	494	0	1,000	+1,000	N/A

Description

A biennial review of both the FreedomCAR and 21st Century Truck activities and resource allocation will be conducted by an independent party such as the National Academy of Sciences/National Academy of Engineering, to evaluate the progress and direction of the programs. For FY 2006, funding is also requested to begin biennial peer review of the 21st Century Truck Partnership. This continuous (biennial) activity supports the PMA, PART, and R&DIC processes. The review will include evaluation of progress toward achieving the technical and program goals supporting each partnership, as well as an assessment of the appropriateness of Federal investment in each of the activities. Based on the evaluation, resource availability, and other factors, the FreedomCAR and 21st Century Truck partners will consider new opportunities, make adjustments to program targets, and set goals as appropriate.

Benefits

Collaboration with outside experts to gain their perspectives is extremely appropriate and productive in helping to assure that the program's research directions and priorities are properly aligned with the needs of auto manufacturers equipment suppliers, energy companies, other Federal agencies, state agencies, consumers, and other stakeholders. Thus the program mission is supported by this subprogram through the greater assurance that the programs R&D investments are well selected and effectively managed.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Biennial Peer Reviews	**494**	**0**	**1,000**

Conduct a biennial review of the FreedomCAR and 21st Century Truck activities by an independent third party, such as the National Academy of Sciences/National Academy of Engineering, to evaluate progress and program direction. For FY 2006, funding is also requested to begin biennial peer review of the 21st Century Truck Partnership. The review will include evaluation of progress toward achieving the technical and program goals supporting each partnership, as well as an assessment of the appropriateness of Federal investment in each of the activities. The FreedomCAR review will address relevant elements of both the Vehicle Technologies Program and Fuel Cell Technologies Program (Energy Conservation) and the Hydrogen Technology Program (Energy Supply). Based on this evaluation, resource availability, and other factors, the partners will consider new opportunities, make adjustments to technology specific targets, and set goals as appropriate.

Conducted peer review in FY 2004; no funds are requested in FY 2005. Funds are requested in FY 2006 for the next review. (FreedomCAR, $500,000; 21st Century Truck, $500,000.)

Total, Biennial Peer Reviews	**494**	**0**	**1,000**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Biennial Peer Reviews	
Requested funds will allow the program to conduct the second biennial peer review of the FreedomCAR activities and the first biennial peer review of the 21st Century Truck Partnership. (Consistent with RDIC section 2f, external review.)	+ 1,000
Total Funding Change, Biennial Peer Reviews	**+ 1,000**

Fuel Cell Technologies

Funding Profile by Subprogram[a]

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation[b]	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Fuel Cell Technologies						
Transportation Systems.....	7,317	7,495	7,495	7,600	+105	+1.4%
Distributed Energy Systems.....	7,249	6,902	6,902	7,500	+598	+8.7%
Stack Component R&D	24,551	32,541	32,541	34,000	+1,459	+4.5%
Fuel Processor R&D	14,442	9,721	9,721	9,900	+179	+1.8%
Technology Validation.....	9,828	17,750	17,750	24,000	+6,250	+35.2%
Technical/Program Management Support	395	535	535	600	+65	+12.1%
Total, Fuel Cell Technologies.....	63,782	74,944	74,944	83,600	+8,656	+11.5%

Public Law Authorizations:

P.L. 93-275, "Federal Energy Administration Act" (1974)
P.L. 93-577, "Federal Non-Nuclear Energy Research and Development Act" (1974)
P.L. 94-163, "Energy Policy and Conservation Act" (EPCA) (1975)
P.L. 94-413, "Electric and Hybrid Vehicle Research, Development and Demonstration Act" (1976)
P.L. 95-91, "Department of Energy Organization Act" (1977)
P.L. 95-238, Title III - "Automotive Propulsion Research and Development Act" (1978)
P.L. 96-512, "Methane Transportation Research, Development and Demonstration Act" (1980)
P.L. 100-494, "Alternative Motor Fuels Act" (1988)
P.L. 102-486, "Energy Policy Act" (1992)

Mission

Fuel Cell Technologies is a key element of the overall integrated Hydrogen, Fuel Cells and Infrastructure Technologies Program (HFCIT) in DOE's Office of Energy Efficiency and Renewable Energy (EERE).[c] The mission of the integrated HFCIT Program is to research, develop, and validate fuel cell and hydrogen production, delivery, and storage technologies. The program aims to have hydrogen from diverse domestic resources used in a clean, safe, reliable, and affordable manner in fuel cell vehicles and stationary power applications.

[a] SBIR/STTR funding in the amount of $1,405,000 was transferred to the Science Appropriation in FY 2004. Estimates for SBIR/STTR budgeted in FY 2005 and FY 2006 are $1,525,000 and $1,615,000 respectively.
[b] Reflects the 0.594% and 0.80% rescissions of -$452,000 and -$604,000 respectively.
[c] The integrated HFCIT Program receives funds from Energy Supply (for Hydrogen Technology) and Energy Conservation (for Fuel Cell Technologies) appropriation bills. This budget description is for the Fuel Cell Technologies portion of the integrated HFCIT Program.

Benefits

Fuel Cell Technologies is a key component of the President's Hydrogen Fuel Initiative and contributes to the goals of DOE's FreedomCAR activities, which support the Nation moving forward to achieve the vision of a diverse, secure, and emissions-free energy future. Together, the Hydrogen Fuel Initiative and FreedomCAR will facilitate a decision by industry to commercialize hydrogen-powered fuel cell vehicles in the year 2015. Widespread commercialization of hydrogen-powered vehicles will support our national security interests by significantly reducing our reliance on foreign oil. To the extent that hydrogen is produced from diverse domestic resources in an environmentally sound manner, Fuel Cell Technologies will provide a significant national environmental benefit by developing fuel cell and related technologies that will use hydrogen to generate power, emitting only water. The transportation applications research undertaken by Fuel Cell Technologies is specifically focused on reducing the cost of transportation fuel cell systems by a factor of 5 while increasing efficiency and durability.

Strategic and Program Goals

The Department's Strategic Plan identifies four strategic goals (one each for defense, energy, science, and environmental aspects of the mission) plus seven general goals that tie to the strategic goals. The Fuel Cell Technologies Program supports the following goal:

Energy Strategic Goal: To protect our national and economic security by reducing imports and promoting a diverse supply of reliable, affordable, and environmentally sound energy.

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 Fuel Cell Technologies Program has one program goal which contributes to General Goal 4 in the "goal cascade":

Program Goal 04.01.00.00: Hydrogen/Fuel Cell Technologies: Develop fuel cell and hydrogen production, storage, and delivery technologies to the point that they are cost and performance competitive and are being used by the Nation's transportation, energy, and power industries. Development of these technologies will also make our clean domestic energy supplies more flexible, dramatically reducing or even ending dependence on foreign oil.

Contribution to Program Goal 04.01.00.00 (Fuel Cell Technologies)

The key Fuel Cell Technologies contribution to General Goal 4, Energy Security, is improving energy efficiency accomplished through developing transportation and distributed energy systems, stack component and fuel processor technologies, and conducting technology validation.

- Transportation Systems/Stack Component R&D will improve fuel cell durability and performance while reducing cost. The manufacturing cost of hydrogen-fueled, 50 kW fuel cell power systems will be reduced from $275/kW in 2002 to $45/kW in 2010 at production levels of 500,000 units per year (projected cost).
- Distributed Energy Systems/Fuel Processor R&D will increase the electrical efficiency of 50-250 kW stationary fuel cell systems operating on natural gas or propane from 29 percent in 2002 to 40 percent in 2010.
- Technology Validation will validate fuel cell performance and 2,000 hour durability under real world conditions in 2009.

Annual Performance Results and Targets

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Results	FY 2005 Targets	FY 2006 Targets
Program Goal 04.01.00.00 (Fuel Cell Technologies)					
Fuel Cell Technologies/Systems and Stack Component R&D					
	$275/kW for a hydrogen-fueled 50kW fuel cell power system.	Achieve $225/kW for a hydrogen-fueled 50kW fuel cell power system. [MET]	Achieve $200/kW for a hydrogen-fueled 50 kW fuel cell power system. [MET]	DOE-sponsored research will reduce technology cost to $125/kW for a hydrogen-fueled 50kW fuel cell power system.	DOE-sponsored laboratory scale research will reduce the modeled technology cost to $110/kW for a hydrogen-fueled 50kW fuel cell power system.
Fuel Cell Technologies/Distributed Energy Systems					
		Achieve 30 percent efficiency at full power for a natural gas or propane fueled 50 kW stationary fuel cell system. [MET]	Achieve 31 percent efficiency at full power for a natural gas or propane fueled 50-250 kW stationary fuel cell system. [MET]	Achieve 32 percent efficiency at full power for a natural gas or propane fueled 5-250 kW stationary fuel cell system.	DOE-sponsored research will improve electrical efficiency to 34 percent at full power for a natural gas or propane fueled 50-250 kW stationary fuel cell power system verified by a prototype (5-50 kW system).
Fuel Cell Technologies/Technology Validation					
		Plan technology validation activity. [MET]	Industry contracts are awarded and initial vehicles delivered that support the 1,000 hour durability target. [MET]	Fuel Cell demonstration vehicles' durability can be projected to 1,000 hours based on voltage measurements.	Fuel Cell demonstration vehicles achieve 1,000 hours durability.
Fuel Cell Technologies					
			Contribute proportionately to EERE's corporate goal of reducing corporate and program uncosteds to a range of 20-25 percent by reducing program annual uncosteds by 10 percent in 2004 relative to the program uncosted baseline (2003) until the target range is met.	*Contribute proportionately to EERE's corporate goal of reducing corporate and program adjusted uncosted obligated balances to a range of 20-25 percent by reducing program annual adjusted uncosteds by 10 percent in 2005 relative to the program FY 2004 end of year adjusted uncosted baseline ($21,257K) until the target range is met.*	*Contribute proportionately to EERE's corporate goal of reducing corporate and program adjusted uncosteds to a range of 20-25 percent by reducing program annual uncosteds by 10 percent in 2006 relative to the program uncosted baseline (2005) until the target range is met.* *Maintain total Program Direction costs in relation to total Program costs in the range of 8% - 12% to demonstrate efficient and effective EERE-wide business and technical support to mission direct programs.*

Means and Strategies

Fuel Cell Technologies will use various means and strategies to achieve its program goals as described below. "Means" include operational processes, resources, information, and the development of technologies, and "strategies" include program, policy, management and legislative initiatives and approaches. Various external factors, as listed below, may impact the ability to achieve the program's goals. Collaborations are integral to the planned investments, means and strategies, and to addressing external factors.

Fuel Cell Technologies will implement the program through the following means:

- Conduct research, development, and technology validation to address the key technical barriers of performance, cost and durability of fuel cell systems for transportation, stationary, auxiliary power units (APUs), and portable power applications;
- For transportation applications, focus R&D on critical requirements to support an industry decision in 2015 to enter into commercialization, primarily focusing on lowering the high-volume system cost of fuel cells to $30/kW. Other significant criteria for transportation fuel cell systems include the need to have fuel cell technologies developed and validated that enable: (1) full performance over 5,000 hours of life; (2) 60 percent efficiency (hydrogen-fueled) at 1/4 rated power; and (3) operation in vehicles with comparable performance, safety, and reliability to the gasoline internal combustion engine;
- For stationary applications, work towards removing technical barriers to facilitate the near-term introduction of fuel cells in a variety of applications that include energy generation for buildings, uninterruptible power systems, and portable power devices such as consumer electronics;
- Support the introduction of fuel cell vehicles and stationary fuel cell systems to controlled user-groups such as utilities or military installations through real world demonstrations. These demonstrations validate technology performance, provide experience to both manufacturers and end-users supporting the successful introduction of commercial products, and help build early public awareness;
- Develop systems models and make trade-off analyses to direct effective technology decisions.
- Conduct cross-cutting analyses and focus on life cycle cost, emissions, and efficiency of transportation and stationary fuel cell systems in the near (2015), mid (2030), and long term (post 2050); and
- Conduct research, development and demonstration activities through competitive, cost-shared cooperative agreements with industry and universities.

Fuel Cell Technologies will implement the program through the following strategies:

- Implement the Department's planning documents including the DOE Hydrogen Posture Plan (which outlines the Department's role in hydrogen energy research and development), the HFCIT Multi-year Research, Development and Demonstration Plan (which establishes technical targets and schedules to address key technology barriers) and the National Hydrogen Energy Roadmap (which lays out research and development pathways to guide hydrogen and fuel cell R&D); and

- Perform formal merit reviews across the Department's portfolio of Hydrogen activities (this process includes the merit review of EERE, Nuclear Energy, Science and Technology (NE), Fossil Energy (FE) and Science (SC) hydrogen and related technologies). The Merit Review evaluation incorporates the principles of the Administration's R&D investment criteria and is conducted in compliance with the Department's Merit Review Guidelines. Additionally, field project managers and technology development managers evaluate progress formally on a quarterly basis;

These means and strategies will result in improving energy security by developing technologies that use reliable, affordable, and environmentally sound hydrogen, adding to the diversity and security of the Nation's energy supply—thus putting the taxpayers' dollars to more productive use.

The following external factors could affect Fuel Cell Technologies' ability to achieve its strategic goal:

- The sustainability of program funding over the long-term which is required for development of these technologies;
- Price, performance and availability of alternative technologies (such as battery electric vehicles) and conventional fuels that will compete with hydrogen-fueled vehicles will affect the market outcomes;
- Decisions on the nature and timing of supporting policy instruments to help stimulate end-use markets; and
- Public acceptance and concerns regarding the safe use of hydrogen.

In carrying out the program's mission, Fuel Cell Technologies performs the following collaborative activities:

- Coordinate across four Departmental elements, EERE, NE, FE and SC, and the Department of Transportation to update the DOE Hydrogen Posture Plan annually to support and coordinate the Department's Hydrogen Fuel Initiative budget request. EERE is the Departmental lead for research planning, budget formulation and budget execution activities under the Hydrogen Fuel Initiative;

(dollars in thousands)

Hydrogen Fuel Initiative	FY 2006 Request
Energy Efficiency and Renewable Energy (EERE)	$182,694
Nuclear Energy (NE)	$20,000
Fossil Energy (FE)	$22,000
Office of Science (SC)	$32,500
Subtotal, Department of Energy	$257,194
Department of Transportation (DOT)	$2,350
Total Hydrogen Fuel Initiative	$259,544

- Participate in the Hydrogen R&D Interagency Task Force. The Task Force involves Federal agencies that have hydrogen and fuel cell related activities to leverage and coordinate Federal resources;
- Participate in the International Partnership for a Hydrogen Economy to leverage R&D capabilities globally;
- Coordinate vehicle technology validation with infrastructure validation funded under the Energy Supply appropriation;
- Collaborate with EERE's Distributed Energy and Building Technologies Programs, and the Office of Fossil Energy's Solid Oxide fuel cell research and development effort; and
- For activities that support transportation applications, cooperate with the EERE Office of FreedomCAR and Vehicle Technologies. Some activities in the President's Hydrogen Fuel Initiative and most activities in the FreedomCAR budget crosscut are implemented through technical teams, which provide a mechanism for developing requirements and, industry consensus (see Technology goals below), evaluating R&D activities, and providing recommendations for Program Direction. These technical teams are composed of government and industry experts that meet regularly. The interdependency is depicted in the table that follows.

2010 Hydrogen Fuel Initiative and FreedomCAR Coordinated Technology Goals

The Office of FreedomCAR and Vehicle Technologies has responsibility for these goals: ▪ Electric Propulsion Systems with a 15-year life capable of delivering at least 55 kW for 18 seconds and 30 kW continuous at a system cost of $12/kW peak; ▪ Internal Combustion Engine Powertrain Systems costing $30/kW, having a peak brake engine efficiency of 45 percent, and that meet or exceed emissions standards; ▪ Electric Drive train Energy Storage with 15-year life at 300 Wh with discharge power of 25 kW for 18 seconds and $20/kW; ▪ Material and Manufacturing Technologies for high volume production vehicles which enable/support the simultaneous attainment of: 50 percent reduction in the weight of vehicle structure and subsystems, affordability, and increased use of recyclable/renewable materials; and ▪ Internal Combustion Engine Powertrain Systems operating on hydrogen with cost target of $45/kW by 2010 and $30/kW in 2015, having a peak brake engine efficiency of 45 percent, and that meet or exceed emissions standards. *(Shared responsibility with HFCIT)*
The Office of Hydrogen, Fuel Cells, and Infrastructure Technology has responsibility for these goals: ▪ 60 percent peak energy-efficient, durable direct hydrogen Fuel Cell Power Systems (including hydrogen storage) with 325 W/kg specific power and 220 W/l power density operating on hydrogen. Cost targets are $45/kW by 2010 and $30/kW by 2015; ▪ Fuel Cell Systems (including an on-board fuel processor) having a peak brake engine efficiency of 45 percent, and that meet or exceed emissions standards with a cost target of $45/kW by 2010 and $30/kW by 2015. The goal is no longer being pursued due to a "no-

go" decision on the on-board reformer technology pathway;

- Hydrogen Refueling Systems demonstrated with developed commercial codes and standards and diverse renewable and non-renewable energy sources. Targets: 70 percent energy efficiency well-to-pump; cost of energy from hydrogen equivalent to gasoline at market price, assumed to be $1.50 per gallon (2001 dollars);
- Hydrogen Storage Systems demonstrating an available capacity of 6 weight percent hydrogen, specific energy of 2.0 kWh/kg and energy density of 1.5 kWh/l at a cost of $4/kWh; and
- Internal Combustion Engine Powertrain Systems operating on hydrogen with cost target of $45/kW by 2010 and $30/kW in 2015, having a peak brake engine efficiency of 45 percent, and that meet or exceed emissions standards. *(Shared responsibility with FCVT)*

Validation and Verification

To validate and verify program performance, the Fuel Cell Technologies Program will conduct internal and external reviews and audits. These programmatic activities are subject to continuing review by, for example, the Congress, the Department's Inspector General, and the U.S. Environmental Protection Agency. Specific milestones, go/no-go decision points, and technical progress are systematically reviewed through the Program's merit review process. The table below summarizes validation and verification activities:

Data Sources:	Merit Review and Peer Evaluation of R&D and Program Peer Reviews are conducted. Engineering models and quarterly reports are used to validate technical targets. Summary program plans are used to evaluate progress towards technical targets.
Baselines:	The following are the key baselines used in Fuel Cell Technologies Program: ▪ systems/stack component R&D (2002): $275/kW fuel cell cost ▪ distributed energy systems/fuel processor R&D (2002): 29 percent electrical efficiency ▪ technology validation (2003, laboratory): 1,000 hours durability of fuel cell vehicle systems ▪ uncosted balances (2004): 38 percent
Frequency:	GPRA Benefits are estimated annually, Merit Review and Peer Evaluation of R&D projects are conducted annually, and Program Peer Review is conducted biennially. Quarterly reports are submitted to DOE Technology Development Managers. Summary program plans are submitted annually.

Evaluation: In carrying out the program's mission, the HFCIT Program uses several forms of evaluation to assess progress and to promote program improvement:

- Technology validation and operational field measurement, as appropriate
- Peer review by independent outside experts of both the program and subprogram portfolios
- Annual internal Technical Program Review of the HFCIT Program
- Specialized program evaluation studies to examine process, impacts, or market baseline and effects, as appropriate
- Quarterly and annual assessment of program and management results based performance through Joule (the DOE quarterly performance progress review of budget targets), R&DIC (annual internal review of performance planning and management of R&D programs against specific criteria), PMA (the Presidents Management Agenda -- annual departmental and PSO based goals whose milestones are planned, reported and reviewed quarterly) and PART (common government wide program/OMB reviews of management and results).
- Annual review of methods, and recomputation of potential benefits for the Government Performance and Results Act (GPRA)

At DOE's request, the National Academies (National Research Council, National Academy of Engineering) performed an extensive review of the Hydrogen and Fuel Cell Program and has published a report: "Hydrogen Economy: Opportunities, Costs, Barriers and R&D Needs." The committee's report indicated the four most fundamental technological and economic challenges are: 1) To develop and introduce cost-effective, durable, safe and environmentally desirable fuel cell systems and hydrogen storage systems; 2) To develop the infrastructure to provide hydrogen for the light-duty vehicle user; 3) To reduce sharply the costs of hydrogen production from renewable energy sources over a time frame of decades; and 4) To capture and store the carbon dioxide byproduct of hydrogen production from coal.

The National Academies will also perform a biennial review of the activities supporting the President's Hydrogen Fuel Initiative and FreedomCAR. The first biennial review is scheduled to occur in FY 2005.

Merit reviews and peer evaluations conducted by energy, hydrogen, and fuel cell experts from outside of the U.S. Department of Energy are held to evaluate the research, development and demonstration activities to ensure that they address the priorities and key technology barriers identified in the HFCIT planning documents.

The HFCIT Program develops and implements planning documents and supports the development of technology roadmaps with industry.[a] These efforts are used to focus the program's investments on activities that are within the Federal Government's role and that address top priority needs.

The National Laboratories can receive direct funds to overcome high-risk hydrogen and fuel cell technology research and development barriers, based on their capabilities and performance. In the future, the program plans to evaluate competition issues related to the national laboratories. Industry and universities already receive funding through a competitive process that leads to cost-shared cooperative agreements. Hydrogen and fuel cell industry experts review each university, laboratory and industry project at the annual Merit Review and Peer Evaluation meeting. Projects are evaluated based on the following Administration's R&D investment criteria: 1) Relevance to overall DOE and Hydrogen Fuel Initiative objectives; 2) Approach to performing the research and development; 3) Technical accomplishments and progress toward project and DOE goals; 4) Technology transfer/collaborations with industry/universities/laboratories; and 5) Approach and relevance of proposed future research. The review panel also evaluates the strengths and weaknesses of each project, and recommends additions to or deletions from the scope of work.

Some activities included in the President's Hydrogen Fuel Initiative and most activities in the FreedomCAR budget are now implemented through the government-industry FreedomCAR and Fuel Partnership, in order to coordinate DOE research activities with automakers and energy industry partners. Transportation fuel cell projects are evaluated by the FreedomCAR fuel cell technical team each year. The program facilitates supplier-customer relationships to ensure that R&D results from National Laboratories and universities are transferred to industry suppliers and that industry supplier developments are made available to automakers, energy industry and stationary power producers.

Reviews are also conducted by the Hydrogen Safety Panel to monitor the safety of procedures and facilities throughout the HFCIT Program.

Data Storage: EERE Corporate Planning System

Verification: Quarterly reports from DOE funded industry, university and National Laboratory partners document the status of quarterly targets and milestones. An annual report is used to evaluate progress towards meeting program goals and technical targets. Data from Technology Validation projects will be used to assess technology status. An independent Systems Integration Function will evaluate research results.

[a] See the following documents: Fuel Cell Report to Congress, Feb. 2003; A National Vision of America's Transition to a Hydrogen Economy, March 2002; National Hydrogen Energy Roadmap, November 2002; FreedomCAR Fuel Cell Technical Roadmap; HFCITP Multi-Year Research, Development and Demonstration Plan; the Hydrogen Posture Plan; and the National Academies' Report, "The Hydrogen Economy: Opportunities, Costs, Barriers, and R&D Needs" 2004.

Funding by General and Program Goal

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
General Goal 4, Energy Security			
Program Goal 04.01.00.00, Fuel Cell Technologies			
Transportation Systems	7,317	7,495	7,600
Distributed Generation	7,249	6,902	7,500
Stack Component R&D	24,551	32,541	34,000
Fuel Processor R&D	14,442	9,721	9,900
Technology Validation	9,828	17,750	24,000
Technical/Program Management	395	535	600
Total, Program Goal 04.01.00.00, Fuel Cell Technologies	63,782	74,944	83,600
Total, General Goal 4 (Fuel Cell Technologies)	63,782	74,944	83,600

Expected Program Outcomes

Fuel Cell Technologies carries out its mission through integrated activities designed to improve the energy efficiency, flexibility, and productivity of our energy economy. We expect these improvements to reduce susceptibility to energy price fluctuations; reduce greenhouse gas emissions; reduce EPA criteria and other pollutants; and enhance energy security by increasing the production and diversity of domestic fuel supplies. Realization of Fuel Cell Technologies goals would provide the technical potential to reduce conventional energy use.

Estimates for energy savings, energy expenditure savings, carbon emission reductions, oil savings, and natural gas savings that result from the realization of the integrated HFCIT Program goals are shown in the tables below through 2050, reflecting the increasing availability of commercial fuel cells and hydrogen sources. When hydrogen-powered fuel cell vehicles are introduced in substantial numbers and fuel cells reach the mass consumer market for electronics and other stationary applications, the oil savings and other benefits to the Nation are expected to be significant. The original estimate of long-term benefits attributable to the entire Hydrogen Fuel Initiative (not just EERE's activities) was 11 million barrels per day (mbpd) in 2040. Achievement of the Hydrogen and Fuel Cell program goals could result in mid-term oil savings of 0.2 mbpd in 2025 (based on the GPRA06-NEMS model) and in the long term ramp up to savings of 2.7 mbpd in 2050 (based on preliminary estimates using the GPRA06–MARKAL model).[a] Additional contributions towards the Hydrogen Fuel Initiative-wide goal of 11 mbpd will come from the Nuclear Energy, Science, and Fossil Energy activities in the Initiative,

[a] In the FY 2006 projections, the HFCIT Program's estimated benefits for 2025 to 2050 are roughly half of those presented in the FY 2005 Budget Request. This is primarily due to a reduction in the model's relative efficiency advantage of a hydrogen fuel cell vehicle over a gasoline hybrid vehicle. This reduction was the result of adopting common assumptions for vehicle weight reductions, aerodynamic improvements, and tire rolling resistance in both vehicle types. Another cause for the reduction in estimated benefits is that the natural gas prices projected for this period are more than 10 percent higher than in last year's analysis.

and also from the Vehicle Technologies program's emerging work on hydrogen-fueled internal combustion engines.

The assumptions and methods underlying the modeling efforts have significant impact on the estimated benefits, and results could vary significantly if external factors, such as future energy prices, differ from the "baseline case" assumed for this analysis. EERE's baseline case is essentially the same as the EIA "business-as-usual" case presented in its Annual Energy Outlook. In addition, possible changes in public policy and disruptions in the energy system which may affect estimated benefits are not modeled. The external factors such as unexpected changes in competing technology costs, identified in the Means and Strategies section above could also affect the Program's ability to achieve its strategic goals. Also note that the modeling long term benefits assumes that funding levels will be consistent with the President's commitment and assumptions in the 2006 Budget, and that funding will be applied to the core program. If the pattern of substantial congressionally directed projects persists over several years, the GPRA benefits estimates will need to be reduced.

The results shown in the long term benefits tables are preliminary estimates based on initial modeling of some of the possible program production technologies; nonetheless, they provide a useful picture of the potential change in national benefits over time if the technology, infrastructure and markets evolve as expected. Estimated benefits which follow assume that individual technology plans are followed and current market assumptions obtain. Final documentation is estimated to be completed and posted by March 31, 2005. Uncertainties are larger for longer term estimates. A summary of the methods, assumptions, and models used in developing these benefit estimates that are important for understanding these results are provided at: http://www.eere.energy.gov/office_eere/budget_gpra.html.

The full long-term potential for renewable-based hydrogen is not reflected in this FY 2006 benefits analysis. Further improvements in the analysis for renewable-based hydrogen technology are underway. In addition, these estimates do not include an assessment of the role of policy measures in facilitating the development of the infrastructure necessary to provide hydrogen at refueling stations nationwide, or in stimulating consumer demand for hydrogen fuel cell vehicles.

FY 2006 GPRA Benefits Estimates for Hydrogen, Fuel Cells and Infrastructure Technologies Program[a]

Mid-term benefits[b]	2010	2015	2020	2025
Primary non-renewable energy savings (Quads)	ns	ns	ns	0.2
Energy bill savings (Billion 2002$)	ns	ns	ns	2
Carbon emission reductions (MMTCE)	ns	ns	ns	5
Oil savings (mbpd)	ns	ns	ns	0.2
Natural gas savings (Quads)[c]	ns	ns	ns	-0.30

Long-term benefits[d]	2030	2040	2050
Primary nonrenewable energy savings (Quads)	1.0	3.0	4.3
Energy system cost savings (Billion 2000$)	1	11	26
Carbon emission reductions (MMTCE)	21	43	60
Oil savings (mbpd)	0.7	2.0	2.7
Natural gas savings (Quads)	-0.27	0.29	0.71

[a] Benefits reported are annual, not cumulative, for the year given. Estimates reflect the benefits that may be possible if all of the program's technical targets are met and funding continues at levels consistent with assumptions in the FY 2006 Budget.
[b] Mid-term program benefits were estimated utilizing the GPRA06-NEMS model, based on the Energy Information Administration's (EIA) National Energy Modeling System (NEMS) and utilizing the EIA's Annual Energy Outlook (AEO) 2004 Reference Case.
[c] Although these results show a small negative impact on natural gas demand in the mid-term, an analysis by the Office of Energy Efficiency and Renewable Energy (EERE) of its entire research and deployment portfolio indicates that by 2020 the industrial, buildings, and other portions of this EERE portfolio will be freeing up significant natural gas demand to more than offset the estimated small impacts on natural gas of the HFCIT Program during the early phases of the transition to a hydrogen economy. In the long term, the program is targeting more renewable-based hydrogen.
[d] Long-term benefits were estimated utilizing the GPRA06 - MARKAL developed by Brookhaven National Laboratory (BNL). Results can differ among models due to differences in their structure. In particular, the two models estimate economic benefits in different ways, with the MARKAL model reflecting the cost of additional investments required to achieve reductions in energy bills.

Transportation Systems

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Transportation Systems.....	7,317	7,495	7,600	+105	+1.4%
Total, Transportation Systems.....	7,317	7,495	7,600	+105	+1.4%

Description

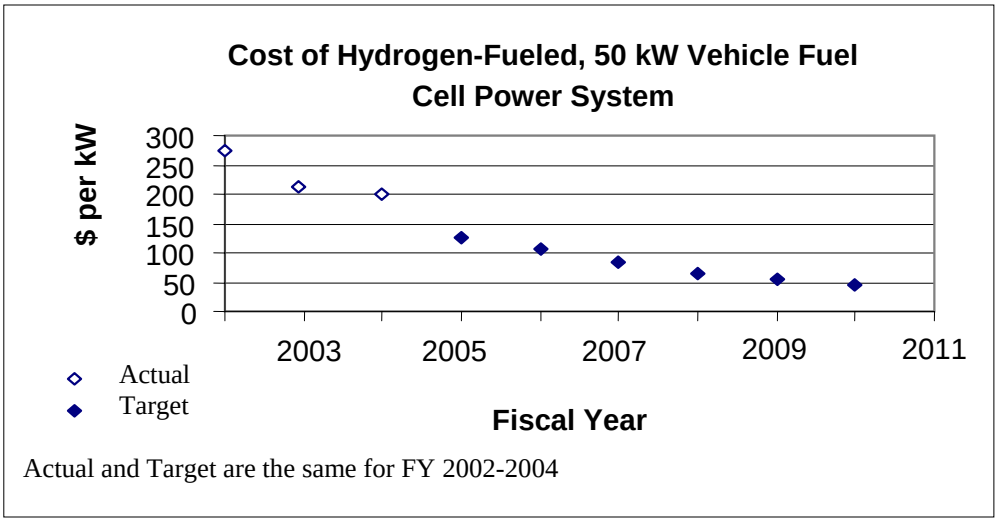
Transportation Systems R&D conducts analyses that address key barriers to fuel cell systems for transportation. Key systems level barriers include lack of compressor/expanders, sensors, and heat exchangers that meet automotive packaging and cost requirements of the fuel cell system. Because of the increased ability of industry to develop complete systems, Transportation Systems R&D does not develop complete, integrated systems for transportation applications. Instead, Transportation Systems R&D supports the development of individual component technology critical to systems integration as well as systems level modeling activities that serve to guide R&D, benchmark systems progress, and explore alternate systems configurations on a cost-effective basis. Other activities include studies that appraise the status of critical metrics (such as cost), assess important materials issues such as catalyst usage and recycle and evaluate water and thermal management strategies. Transportation Systems R&D also supports limited development of vehicle Auxiliary Power Units (APUs) for automotive or heavy vehicle applications. Fuel cell issues such as vibration and dust and/or contaminants which could have a deleterious effect on stack performance and life are also addressed in Transportation Systems R&D. Systems components developed include compressor/expanders, sensors, heat exchangers and water management devices. Transportation Systems R&D will include competitively selected projects that include significant industry cost share.

Benefits

Transportation Systems R&D supports the HFCIT Program's mission by improving performance and durability, while lowering the cost of components and materials, and optimizing operating strategies that enable the widespread use of fuel cells. The improvements will help to accelerate commercialization of fuel cells by making them competitive with conventional technologies so that the potential benefits of energy security and environmental quality can then be realized.

Research activities for transportation applications (including transportation systems and stack component R&D) will reduce the cost of the hydrogen-fueled, 50 kW vehicle fuel cell power systems as indicated below.[a]

[a] Cost of 50 kW vehicle fuel cell power systems estimated for production rate of 500,000 units yearly and includes fuel cell stack, balance of plant, and hydrogen storage.



Actual and Target are the same for FY 2002-2004

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Transportation Systems	**7,317**	**7,495**	**7,600**

Evaluate system cost and perform trade-off analyses including scenarios for ambient pressure and high temperature (120ºC) systems. Complete R&D and assessment of physical and chemical sensors suitable for monitoring and controlling stack and thermal management systems against 2005 technical targets. Physical sensors monitor temperature, differential pressure, relative humidity, and flow while chemical sensors measure hydrogen, carbon monoxide, hydrogen sulfide, oxygen, and ammonia. Conduct research and development of water and thermal management systems. Test and evaluate compact humidifiers and heat exchangers in full scale systems. Complete test and evaluation of turbocompressors which meet established pressure-ratio turndown requirements in a full-scale fuel cell system. Develop fuel cell systems for auxiliary power in trucks to support the 21st Century Truck initiative and in coordination with the Office of Fossil Energy's Solid Oxide Fuel Cell R&D effort. Complete APU fuel cell stack and reformer assembly and begin to build the APU system. Conduct performance, cost, and durability testing of fuel cells to access feasibility for portable power applications. Demonstrate more than 1000 hours of fuel cell membrane and stack operating lifetime (under simulated loads) in a portable power system. Develop air filtration technology and systems to protect the fuel cell from mechanical stresses to allow for long-life and reliable operation in air contaminated with particulates and chemical aerosols typically found in off-road use. *Participants include: UTC Fuel Cells, Honeywell, Delphi Automotive Systems, Cummins Power Generation, PolyFuel, MTI MicroFuel Cells, IdaTech, SAE, NREL, LLNL, PNNL, ANL, and LANL.*

In FY 2004, this activity was reduced by $189,000 for SBIR/STTR and those funds were transferred to the Science Appropriation.

Total, Transportation Systems	**7,317**	**7,495**	**7,600**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Transportation Systems	
Increase supports the HFCIT Program Multi-Year Research, Development and Demonstration Plan targets for stationary fuel processors. This increase will support competitive, merit-reviewed, cost shared R&D with industry (consistent with RDIC 2b, incorporation of industry involvement, and 2f, competitive awards and peer review). This R&D builds on existing technology and complements related R&D activities (RDIC 2a, building on and complementing existing R&D).....	+105
Total Funding Change, Transportation Systems.....	**+105**

Distributed Energy Systems

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Distributed Energy Systems	7,249	6,902	7,500	+598	+8.7%
Total, Distributed Energy Systems.....	7,249	6,902	7,500	+598	+8.7%

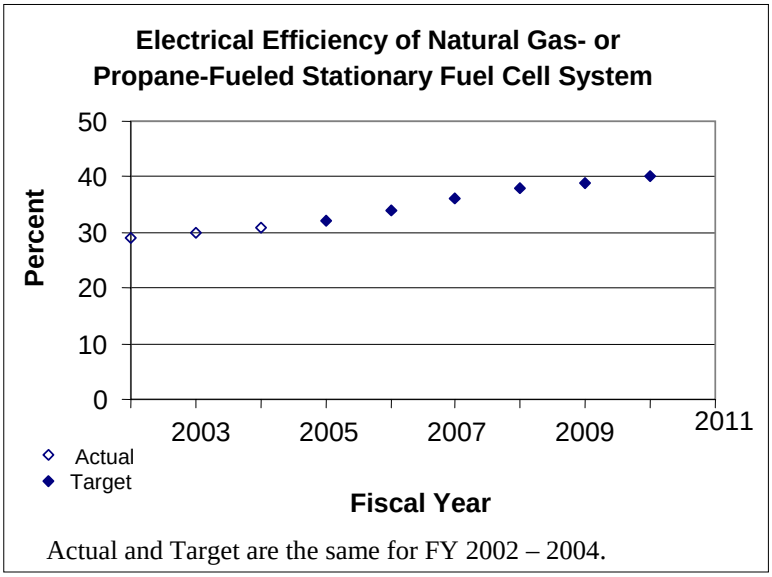
Description

Distributed Energy Systems develops high-efficiency Polymer Electrolyte Membrane (PEM) fuel cell power systems as an alternative power source to grid-based electricity for buildings and other stationary applications. Distributed Energy Systems focuses on overcoming the barriers to stationary fuel cell systems, including cost, durability, heat utilization, start-up time, and managing power transients and load-following requirements. Improved heat usage and recovery are addressed for combined heat and power generation to maximize overall efficiency of (thermal and electrical) systems. This activity will also take advantage of the synergy between transportation systems and distributed energy systems, particularly in the areas of developing improved materials for high temperature membranes, and improving fuel cell component durability. In response to the The National Resource Council recommendation that the DOE discontinue the PEM applied R&D program for stationary systems, DOE has established a go/no-go milestone for the distributed energy systems activity for 2010.

Benefits

Distributed Energy Systems R&D supports the HFCIT Program's mission by focusing on overcoming barriers to stationary fuel cell systems, including improving durability and performance, while lowering cost to enable the widespread use of fuel cells in distributed energy and other small stationary applications. The improvements will help to accelerate commercialization of fuel cells by achieving an ultimate durability requirement of 40,000 hours, making fuel cells competitive with conventional technologies.

Research activities will improve the electrical efficiency of natural gas or liquefied petroleum gas (LPG) fueled stationary fuel cell systems. Specifically, stationary fuel cell R&D activities will increase the electrical efficiency of natural gas or LPG-fueled 50-250kW stationary fuel cell systems as indicated in the performance indicator graph below.



Actual and Target are the same for FY 2002 – 2004.

Detailed Justification

(dollars in thousands)

FY 2004	FY 2005	FY 2006

Distributed Energy Systems..... **7,249** **6,902** **7,500**

In FY 2006, conduct research and development to increase the durability of a 50-250kW stationary fuel cell system. Complete development of market-driven integrated stationary fuel cell system (including fuel cell stack, air and thermal management system, and power grid interface) to make progress toward achieving 2010 efficiency, cost, and durability targets. Complete development of a back-up fuel cell power system for the telecommunications market. Continue economic analysis of stationary fuel cell markets. Perform research and development of materials for high temperature membranes and continue to improve Polymer Electrolyte Membrane (PEM) fuel cell stack durability to ultimately achieve the 40,000 hour durability target by 2010. Develop critical balance of plant components for stationary fuel cells. Continue research and development of water and thermal management systems for stationary fuel cells and combined heat and power applications.

In FY 2004, this activity was reduced by $159,000 for SBIR/STTR and these funds transferred to the Science Appropriation.

Participants include: ANL, NREL, IdaTech, UTC Fuel Cells, Plug Power, and Battelle.

Total, Distributed Energy Systems..... **7,249** **6,902** **7,500**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Distributed Energy Systems	
Increase supports the stationary fuel cell system electrical efficiency target and the 2010 technical targets in the HFCIT Program Multi-Year Research, Development and Demonstration Plan. The majority of the increase will support competitive, merit reviewed, cost-shared R&D with industry. (Consistent with RDIC 2b, which asks how well the R&D planning incorporates industry involvement, and 2f, which focuses on the extent to which an activity is competitively awarded and subject to peer). The increase in R&D complements existing technologies (RDIC 2a, building on and complementing existing R&D) in support of the DOE Hydrogen Posture Plan ..	+598
Total Funding Change, Distributed Energy Systems	**+598**

Stack Component R&D

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Stack Component R&D	24,551	32,541	34,000	+1,459	+4.5%
Total, Stack Component R&D	24,551	32,541	34,000	+1,459	+4.5%

Description

Fuel cell stack component costs dominate the cost structure and lifetime of the fuel cell system. The National Research Council recognizes the importance of stack component R&D in their recommendation to focus the research on breakthroughs in fuel cell costs and materials for durability. Collaborative research and development efforts with industry, National Laboratories and academia focus on the most critical technical barriers for PEM fuel cell stack components for both transportation and stationary applications. Critical technical barriers include cost, durability, efficiency and overall performance of components such as the polymer electrolyte membranes, oxygen reduction electrodes, advanced catalysts, bipolar plates, etc. The success of these research and development efforts will assist the industry in making its decision regarding commercialization of fuel cells. Technical targets established at the component level support the technology goals for fuel cell vehicles.

Benefits

Stack Component R&D supports the HFCIT Program's mission by focusing on overcoming critical technical barriers at the *component level* to improve overall fuel cell performance and durability, while lowering cost. Addressing these barriers at the component level supports technology transfer and the industrial effort to integrate the fuel cell system and develop full-scale fuel cell stacks. R&D that reduces the inherent cost of producing and operating fuel cells while maintaining performance and durability comparable to or better than conventional technology will ultimately help get fuel cells into the marketplace so that national energy and environmental benefits can be realized.

Detailed Justification

(dollars in thousands)

FY 2004	FY 2005	FY 2006
Stack Component R&D **24,551**	**32,541**	**34,000**

Synthesize and characterize polymers and proton-conducting membranes which operate at $\leq$120°C for transportation applications and $\geq$150°C for stationary applications. Coordinate with DOE's Office of Basic Energy Sciences (BES) to obtain increased understanding of proton conduction and degradation mechanisms in high-temperature polymer electrolyte membranes. In FY 2006, scale up

(dollars in thousands)

FY 2004	FY 2005	FY 2006

the most successful single cell membrane electrode assembly design operating at high efficiency and ≤120°C to a short stack (<10 kW). Expand critical single cell durability testing from steady state to drive cycle conditions. Verify first generation 150°C membrane in a single fuel cell for stationary applications. Fabricate membranes with non-aqueous proton-conducting phases for stationary fuel cell operation at >120°C. Increase emphasis in membrane projects to include low relative humidity (<25 percent) operation. Develop membranes capable of operating at low relative humidity to prevent the membrane from drying out under high temperature conditions and to simplify the overall system by reducing or eliminating water management and heat rejection issues. Develop an advanced, low-cost membrane that conducts protons even though it is not fully fluorinated, tolerates a strong oxidizing environment, and operates at conventional temperature and operating conditions.

Evaluate results of single cell testing towards meeting FY 2005 platinum loading and performance targets at ≤120ºC through a go/no-go decision. In the event of a no-go decision, the program will emphasize alternative technologies relating to heat rejection, CO tolerance, and system simplification.

Focus on improving performance and decreasing precious metal loading at the cathode. (Anode performance with platinum loading below the 2010 target has been successfully demonstrated.) Apply in situ characterization techniques developed as part of the BES Program to promising non-platinum catalysts. Increase long-term performance stability of non-precious metal electrocatalysts. Identify suitable candidates for bipolar plate materials and coatings to decrease cost and weight and increase corrosion-resistance and impermeability. Initiate R&D activities to address issues of survivability at freezing temperatures and decrease time from start-up to rated power at below freezing temperatures. Initiate research and development activities to reduce the cost and increase the performance of gas diffusion layers. Continue coordination with BES to increase understanding of the nature of nanoscale catalysts to reduce costs. Develop cell component diagnostics and accelerated aging tests to establish and improve MEA durability. Participate in the European Union Fuel Cell Test Network Program to develop harmonized procedures for testing fuel cells, stacks, and systems.

In FY 2004, this activity was reduced by $635,000 for SBIR/STTR, which was transferred to the Science Appropriation.

Participants include: UTC Fuel Cells, 3M, DeNora, Cabot Superior Micropowders, Englehard, Arkema (previously Atofina) Chemicals, DuPont, Plug Power, Ion Power, Ballard, U. of South Carolina, LANL, NIST, NRL, NASA, ANL, LBNL, ORNL, PNNL, NREL, SNL and BNL.

Total, Stack Component R&D	**24,551**	**32,541**	**34,000**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Stack Component R&D	
Increase supports research addressing cost and durability issues addressing the recommendation of the National Research Council to increase government funding on R&D dedicated to the research on breakthroughs in fuel cell materials for durability. Additionally, the increase supports the transportation fuel cell system cost target and the 2015 technical targets in the HFCIT Program Multi-Year Research, Development and Demonstration Plan. The majority of the increase will support competitive, merit reviewed, cost-shared R&D with industry. (Consistent with RDIC 2b, which incorporates industry involvement, and 2f, competitive awards and peer review) The increase in R&D complements existing technologies (RDIC 2a, building on and complementing existing R&D) in support of the DOE Hydrogen Posture Plan	+1,459
Total Funding Change, Stack Component R&D	**+1,459**

Fuel Processor R&D

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Fuel Processor R&D	14,442	9,721	9,900	+179	+1.8%
Total, Fuel Processor R&D	14,442	9,721	9,900	+179	+1.8%

Description

For the past ten years, the program has funded research and development of on-board fuel processing technology optimized primarily for gasoline, but also functional with methanol, ethanol, and natural gas. The major objectives were to increase efficiency of conversion, lower the cost of catalysts/materials, evaluate systems integration and decrease the size and weight of the fuel processor system. In August 2004, the Department made a decision to discontinue on-board vehicle fuel processing R&D. The decision was based on several key conclusions: current fuel processing technologies did not meet the technical and economic targets; there was no clear path forward to meet the more difficult criteria necessary for full implementation/integration in fuel cell vehicles; there was no interest from the U.S. auto industry; and competing technologies available today (e.g. gasoline, hybrid-electric vehicles) offer similar efficiency and emissions to a fuel cell vehicle operating on gasoline that is reformed on-board the vehicle. FY 2005 funding will be used to complete and redirect on-board fuel processing activities.

The program continues to develop fuel processors for stationary and auxiliary power applications and to develop fundamental catalysts suitable for a variety of fuel processing applications. Fuel processing technology can be fuel-flexible – capable of processing fuels such as methanol, ethanol, natural gas, propane and diesel into hydrogen. Until a new hydrogen production and delivery infrastructure is established, it would be beneficial if the existing fuel infrastructure could be used to supply hydrogen to fuel cell vehicles and power plants.

Benefits

Fuel Processor R&D supports the HFCIT Program's mission by developing the subsystem that aids the widespread use of fuel cell power technology. Because an extensive hydrogen delivery infrastructure does not currently exist, in the near term fuel cells could operate using the existing fuels infrastructure to generate the hydrogen demand. Processing fuels such as natural gas, methanol, ethanol, or diesel, will enable environmental and efficiency advantages of hydrogen fuel cell technologies to be realized until production of hydrogen from renewables, nuclear, and coal with carbon management becomes more readily available. Even in a future hydrogen economy, the option of using a diversity of fuels to produce energy will be a significant contributor to energy independence.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Fuel Processor R&D	**14,442**	**9,721**	**9,900**

FY 2006 activities will focus on off-board fuel processing to increase the efficiency of conversion, lower the cost and improve the performance and durability of catalysts for stationary and auxiliary power systems (heavy duty applications).

Complete development of a 50kWe fuel processor for stationary fuel cell applications using revolutionary materials for absorption-enhanced fuel processing. Evaluate a single step natural gas processing technology producing >98 percent hydrogen and a natural gas reformer technology with novel configuration to enable a fuel cell power system with >40 percent electrical generation efficiency for stationary fuel cell applications.

Increase fundamental understanding of reaction mechanisms to increase catalytic activity and improve sulfur tolerance of catalysts in stationary and auxiliary power systems. Decrease precious metal loading while improving catalyst stability. Develop advanced fuel processing and water-gas shift catalysts suitable for a variety of fuel processing applications. Evaluate novel reactor designs with optimized heat integration. Evaluate carbon oxide(s) absorbent and separation technologies. Evaluate sulfur removal strategies. Develop computer simulation models to evaluate advanced fuel processing concepts to predict and optimize performance. Develop reaction kinetics, predictive models, and test methods for diesel fuel reformers. Develop systems integration and performance optimization and control tools for diesel reforming technologies for auxiliary power systems. This work will be closely coordinated with the 21st Century Truck initiative and the Solid State Energy Conversion Alliance (SECA).

In FY 2004, this activity was reduced by $373,000 for SBIR/STTR and transferred to the Science Appropriation.

Participants include: Nuvera, Texaco Energy Systems, ANL, LANL NETL, PNNL.

Total, Fuel Processor R&D	**14,442**	**9,721**	**9,900**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Fuel Processor R&D	
Increase supports the HFCIT Program Multi-Year Research, Development and Demonstration Plan targets for stationary fuel processors. This increase will support competitive, merit-reviewed, cost shared R&D with industry (consistent with RDIC 2b, incorporation of industry involvement, and 2f, competitive awards and peer review). This R&D builds on existing technology and complements related R&D activities (RDIC 2a, building on and complementing existing R&D)	+179
Total Funding Change, Fuel Processor R&D	**+179**

Technology Validation

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Technology Validation	9,828	17,750	24,000	+6,250	+35.2%
Total, Technology Validation	9,828	17,750	24,000	+6,250	+35.2%

Description

The Technology Validation activity of the Fuel Cell Program will be implemented in close coordination with the Hydrogen Infrastructure Validation activity (funded through the Energy Supply appropriation). These two activities together make up the Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project and comprise less than 20 percent of the total budget for the President's Hydrogen Fuel Initiative. This project is a 50/50 cost shared effort between the government and industry and will include automobile manufacturers, energy companies, suppliers, universities, and State governments. The validation effort will be an important opportunity to validate component R&D in a systems context under real-world operating conditions and gain experience in the safety of hydrogen fueled vehicles. By operating these vehicles in a controlled manner, all participating parties will be able to quantify the performance and durability, document any problem areas, and provide valuable information to researchers to help refine and direct future R&D activities related to fuel cell vehicles.

Benefits

Technology validation will provide the most accurate assessment of the readiness of the technology and the risk of continued government and industry investment. In order for the automotive, utility, and fuel industries to make commercialization decisions by 2015, integrated vehicle and infrastructure systems need to be validated and individual component targets need to be met under real-world operating conditions. This activity supports HFCIT's mission by providing critical statistical data that fuel cell vehicles can meet efficiency and durability targets, storage systems can efficiently meet 300+ mile range requirements and fuel costs are less than for existing gasoline vehicles. Technology Validation also provides information so that research in support of technical standards can be performed and vehicle and infrastructure safety can be demonstrated.

Research activities will improve the durability of fuel cell vehicle systems operated under real-world conditions. Specifically, the program validates the performance and vehicle interfaces of hydrogen fuel cell vehicles to demonstrate an increase in durability from approximately 1,000 hours in 2003 (laboratory) to 2,000 hours by 2009 in a vehicle fleet (2000 hours is equal to approximately 50,000 vehicle miles).

	2004	2005	2006	2007	2008	2009
Durability.....	Initiate	1,000 hours (Projected)[a]	1,000 hours			2,000 hours

Detailed Justification

(dollars in thousands)

FY 2004	FY 2005	FY 2006
Technology Validation **9,828**	**17,750**	**24,000**

A competitive solicitation was issued for 50/50 cost-share partnerships to demonstrate hydrogen fuel cell vehicles and the correspondent refueling infrastructure with automobile manufacturers and energy companies (Controlled Hydrogen Fleet and Infrastructure Technology Demonstration and Validation Project). Five automobile manufacturers and energy company partnerships were selected in April, 2004 as part of this project. The partnerships will design and construct hydrogen fuel cell vehicles to support "learning" demonstrations to validate reaching the 2009 target of 2,000 hours durability. The fuel cell vehicle technology validation effort will quantify the performance, reliability, durability, maintenance requirements and environmental benefits of fuel cell vehicles under real world conditions and provide valuable information to researchers to help refine and direct future R&D activities related to fuel cell vehicles.

In FY 2006, conduct the Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project by completing the first two years of data collection on first generation vehicles including chassis dynamometer tests. This project is collecting data to develop a better understanding of vehicle and infrastructure interface issues of hydrogen fueled vehicles. Fuel cell demonstration vehicles will be operated for 1,000 hours by the end of 2006. Initial composite system efficiency assessment of first generation demo vehicles will be completed using modeling and analysis provided by the independent System Integration Function. Begin to evaluate data that were collected from hydrogen-fueled vehicles, regarding advanced storage systems, advanced hydrogen vehicle development, and advanced fueling interface and safety devices. Second generation demo vehicles will be purchased with industry. The DOE share is to obtain data collection rights for these vehicles. Participate in the California Fuel Cell Partnership. Field evaluations of distributed fuel cell systems under real world conditions to validate system durability and performance will continue in coordination with the hydrogen infrastructure validation activity.

In FY 2004, this activity was reduced by $49,000 for SBIR/STTR, which was transferred to the Science Appropriation.

[a] FY 2005 durability target was changed to 1000 hours "projected" due to the delay in selecting projects from the Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Solicitation. The 1000 hours durability will be validated in FY 2006.

(dollars in thousands)

FY 2004	FY 2005	FY 2006

Participants include: Ford Motor Company, General Motors, DaimlerChrysler, Hyundai, Toyota, Honda, Nissan, BMW, ChevronTexaco, Ballard, UTC Fuel Cells, NREL, ANL, California Fuel Cell Partnership members and others.

Total, Technology Validation	**9,828**	**17,750**	**24,000**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Technology Validation	
During this third year of the "Learning Demonstration" project, the increased funds will be used for data collection of first generation demo vehicles and fabrication of second generation vehicles. The increased funding for technology validation of fuel cell vehicles supports the 2009 technical targets planned in the DOE Hydrogen Posture Plan and the HFCIT Program Multi-Year Research, Development and Demonstration Plan. This increase will support competitive, merit-reviewed, cost shared R&D with industry. (Consistent with RDIC 2b – industry involvement, and 2f – competitive awards and external reviews).	+6,250
Total Funding Change, Technology Validation	**+6,250**

Technical/Program Management

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Technical/Program Management.....	395	535	600	+65	+12.1%
Total, Technical/Program Management	395	535	600	+65	+12.1%

Description

Technical/Program Management includes preparing program, strategic and operating plans; evaluating the impact of new legislation on R&D programs; supporting the FreedomCAR technical teams; evaluating and reviewing the technology development activities; identifying and applying performance methodologies (including GPRA); and collecting data to assess program and project performance, efficiency and impacts on accomplishing the mission.

Benefits

Technical/Program Management supports the HFCIT Program's mission by preparing program plans, tracking program progress, and evaluating impacts of legislation on the program. Program planning, performance monitoring, decision support, program control implementation, and change control, are all important aspects of this activity to support and optimize complex pathway decisions needed for the overall program to achieve its goals.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Technical/Program Management	**395**	**535**	**600**
In FY 2006, representative activities will include preparation of program, strategic, and operating plans; evaluation of the impact of new legislation on R&D programs; identification of performance methodologies (including GPRA); data collection to assess program and project performance, efficiency and impacts; and development of performance agreements with management.			
Total, Technical/Program Management.....	**395**	**535**	**600**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Technical/Program Management	
Increase supports research, development and demonstration planning and technical team support	+65
Total Funding Change, Technical/Program Management	**+65**

Weatherization and Intergovernmental Activities

Funding Profile by Subprogram

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation[a]	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Weatherization and Intergovernmental Activities						
Weatherization Assistance Grants	227,166	228,160	228,160	230,000	+1,840	+0.8%
State Energy Program Grants	43,952	44,176	44,176	41,000	-3,176	-7.2%
State Energy Activities	2,324	2,320	2,320	500	-1,820	-78.4%
Gateway Deployment	34,490	34,349	34,349	26,657	-7,692	-22.4%
Total, Weatherization and Intergovernmental Activities	307,932	309,005	309,005	298,157	-10,848	-3.5%

Public Law Authorizations:

P.L. 94-163, "Energy Policy and Conservation Act" (EPCA) (1975)
P.L. 94-385, "Energy Conservation and Production Act" (ECPA) (1976)
P.L. 95-91, "Department of Energy Organization Act" (1977)
P.L. 95-618, "Energy Tax Act" (1978)
P.L. 95-619, "National Energy Conservation Policy Act" (NECPA) (1978)
P.L. 95-620, "Power plant and Industrial Fuel Use Act" (1978)
P.L. 96-294, "Energy Security Act" (1980)
P.L. 100-12, "National Appliance Energy Conservation Act" (1987)
P.L. 100-615, "Federal Energy Management Improvement Act" (1988)
P.L. 102-486, "Energy Policy Act" (1992)

Mission

The mission of the Weatherization and Intergovernmental Program (WIP) is to develop, promote, and accelerate the adoption of energy efficiency, renewable energy, and oil displacement technologies and practices by a wide range of stakeholders. These include state and local governments, weatherization agencies, communities, companies, fleet managers, building code officials, technology developers, Native American tribal governments, and international agencies. (WIP receives funding from both the Energy Supply and the Energy Conservation appropriations. Energy Supply-funded activities include International Renewable Energy, Tribal Energy activities, and the Renewable Energy Production Incentive. Energy Conservation-funded activities include Weatherization Assistance, State Energy

[a] Reflects the 0.594% and 0.80% rescissions of -$491,000, -$657,000 respectively, comparability adjustment for National Energy Technology Laboratory Support of -$624,000, and $230,000 reduced by 0.80% (-1,184,000) for the Weatherization Assistance Program.

Grants and Gateway Deployment activities.)

Benefits

The Office of Weatherization and Intergovernmental Activities Program contributes directly to DOE's Energy Strategic Goal 4 by addressing the President's National Energy Policy call for reducing demand for fuels and energy and modernizing the deployment and public use of conservation technologies and practices. Weatherization Assistance Grants provide services which can make energy affordable for low-income households. The State Energy Program Grants, along with State Energy Activities, assist States in developing emergency energy plans and in fostering clean, reliable, and diverse energy supplies. Gateway Deployment provides information and technical and financial assistance to improve efficiency in building, transportation, and industrial market sectors, reducing demand for fuels and reducing the strain on our electricity grid by reducing peak demand for electricity.

More detailed, integrated and comprehensive economic, energy and energy security benefits estimates are provided in the Expected Program Outcomes section at the end of the program level budget narrative.

Strategic and Program Goals

The Department's Strategic Plan identifies four strategic goals (one each for defense, energy, science, and environmental aspects of the mission) plus seven general goals that tie to the strategic goals. The Weatherization and Intergovernmental Activities Program supports the following goal:

Energy Strategic Goal: To protect our national and economic security by reducing imports and promoting a diverse supply of reliable, affordable, and environmentally sound energy.

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 Weatherization and Intergovernmental Activities Program has three program goals which contribute to General Goal 4 in the "goal cascade":

Program Goal 04.09.00.00: (Weatherization). The goal of Weatherization Assistance Grants is to increase the energy efficiency of dwellings occupied by low-income Americans, thereby reducing their energy costs. DOE works directly with states and local governments, which contract with local governmental or non-profit agencies to deliver weatherization services.

Program Goal 04.10.00.00: (State Energy Programs). The State Energy Programs goal is to strengthen and support the capabilities of States to promote energy efficiency and to adopt renewable energy technologies, helping the Nation achieve a stronger economy, a cleaner environment and greater energy security.

Program Goal 04.11.00.00: (Intergovernmental Activities). The goal of Intergovernmental Activities is to fund activities that facilitate the movement of energy efficient and renewable energy products into the market place and the integrated deployment of efficiency and renewable resources to communities and customers.

Contribution to Program Goal 04.09.00.00 (Weatherization)

Weatherization Assistance Grants contributes to General Goal 4 by providing cost-effective energy efficiency improvements to low-income households through the weatherization of 92,300 low-income homes through DOE funds in FY 2006. Priority is given to the elderly, persons with disabilities, families with children, and households that spend a disproportionate amount of their income on energy bills (utility bills make up 15 to 20 percent of household expenses for low income families, compared to five percent or less for all other Americans).

Contribution to Program Goal 04.10.00.00 (State Energy Programs)

State Energy Programs contribute to this goal by supporting States' promotion of energy efficiency and renewable energy technologies. The State Energy Program (SEP), among other activities, funds the development and maintenance of energy emergency planning at the state and local levels, a critical security benefit. SEP will also assist States in developing strategic planning and logic modeling to target individual state energy priorities and increase energy security through diversification.

Contribution to Program Goal 04.11.00.00 (Intergovernmental Activities)

Intergovernmental Activities (Gateway Deployment) contribute to this goal by accelerating the adoption of clean, efficient, and domestic energy technologies. This provides the American public and international entities with an integrated deployment approach designed to remove technical, financial, and availability hurdles, and to assure energy reliability and strengthen America's competitive position and national energy security. The suite of Weatherization and Intergovernmental activities key contribution to the Energy Security goal is through accelerating the adoption and broadening the markets of energy efficiency R&D technologies developed by EERE programs, and reducing demand for oil, natural gas, and electricity.

Annual Performance Targets and Results

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Results	FY 2005 Targets	FY 2006 Targets
Program Goal 04.09.00.00: (Weatherization)					
Weatherization Assistance Grants					
Weatherize 77,697 homes, with DOE funds.	Weatherize 105,000 homes, with DOE funds.	Award $223 million in FY 2003 funds through 53 Weatherization Program grants, including all 50 states, to enable the direct Weatherization of 93,000 homes. This will bring the cumulative number of homes weatherized to over 52 million. [MET: 93,750 homes weatherized]	Weatherize 94,450 homes, with DOE funds. [MET]	Weatherize 92,500 homes, with DOE funds, and support the weatherization of approximately 100,000 additional homes with leveraged funds.	Weatherize 92,300 homes, with DOE funds, and support the weatherization of approximately 100,000 additional homes with leveraged funds.
			Cumulative total of 2.8 million homes will be weatherized with DOE funds. [MET] Cumulative total of 5.4 million homes will be weatherized with DOE and leveraged funds. [MET]	*Program will update the energy savings benefit-cost ratio and savings per DOE dollar invested as part of a national evaluation of the program. This will allow the program to track an annual performance efficiency of Btus per Federal dollar invested.*	
Program Goal 04.10.00.00: (State Energy Program Grants)					
State Energy Program Grants					
	.		Achieve an annual energy savings of 52,406,930 source Btu and $317,772,960 in annual energy cost savings by awarding $43,952,000 in grants to States and Territories. [MET]	Achieve an annual energy savings of 10,250,000 source Btus and $64,780.000 in annual energy cost savings with DOE funds. Achieve an annual energy savings 36,695,000 source Btus and $231,912.400 in annual energy cost savings with leveraged funds. *Program will update BTU to dollar calculation derived from 2003 metrics study to establish new baseline.*	Achieve an average annual energy savings of 10-12 trillion source Btus (an estimated $60-65 million in annual energy cost savings) with DOE funds. Achieve an additional average energy savings of 30-35 trillion source Btus (an estimated $220-$230 million in annual energy cost savings) from leveraged funds. *Assessment of strategic planning assistance for 4-6 States through updated BTU to dollar calculation.*
Program Goal 04.10.00.00: (State Energy Program Grants)					
State Energy Activities					

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Results	FY 2005 Targets	FY 2006 Targets
Program Goal 04.11.00.00: (Intergovernmental Activities)					
Gateway Deployment/Rebuild America					
Establish 40 new Rebuild America community partnerships and assisted these communities to retrofit 80 million square feet of floor space in K-12 schools, colleges, public housing, state and local governments.	Establish 40 new Rebuild America community partnerships and assisted these communities to retrofit 80 million square feet of floor space in K-12 school, colleges, public housing, and state and local governments.	Assist 450 *Rebuild America* community partnerships to upgrade 80 million square feet of floor space in K-12 schools, college, public housing, and state/local governments. [MET]	Assist over 500 new and existing *Rebuild America* community partnerships to upgrade 70 million square feet of floor space in K-12 schools, colleges, public housing, and state/local governments, reducing the average energy used in these buildings by 18 percent. [MET]	Help *Rebuild America* community partnerships to upgrade 60 million square feet of floor space in K-12 schools, colleges, public housing, and state/local governments, reducing the average energy used in these buildings by 18 percent.	Reduce the average energy intensity in K-12 schools, colleges, public housing and state/local governments by helping *Rebuild America* community partnerships to upgrade 50 million square feet of floor space.
Gateway Deployment/Energy Efficiency Information and Outreach					
Gateway Deployment/Building Codes Training and Assistance					
			Provide technical assistance to States resulting in 4 States adopting upgraded 2001 and 2003 model commercial or residential building energy codes. [MET] Train 2,000 architects, engineers, builders and code officials to implement the above codes and upgraded 2004 model commercial code. [MET]	Provide technical assistance to States resulting in 4 States adopting upgraded 2001 and 2003 model commercial or residential building energy codes.	Provide technical assistance to States resulting in 4 States adopting upgraded 2003 and 2004 model commercial or residential building energy codes. Train 2,000 architects, engineers, builders and code officials to implement the above codes and upgraded 2004 model commercial code.
Gateway Deployment/Clean Cities					
Support the annual acquisition on 12,000 alternative fuel vehicles in the Federal fleet.	Achieve 135,000 alternative fuel vehicles in operation in Clean Cities.	Achieve a total of 135,000 alternative fuel vehicles (AFV's) in operation in Clean Cities which will displace 180 million gallons of gasoline and diesel a year. [MET].	Clean Cities will conduct 7 major workshops, award $6 million in special project funding, and report a total of 180,000 number of alternative fuel vehicles in operation in clean cities. Achieving these outcomes will result in an estimated displacement of 153 million gallons of petroleum based fuels. [NOT MET]	Clean Cities will conduct 7 major workshops, award $4 million in special project funding for alt fuel, anti-idling, and hybrid technology, and provide technical support to coalitions. Program will report a total number of 198,000 alternative fuel vehicles in operation in clean cities. Achieving these outcomes will result in an estimated displacement of 168 million gallons of petroleum based fuels and 70 new ethanol fueling stations.	Save 200 million gallons of petroleum based fuels through Clean Cities program which will support the installation, with cost-share, of 55-65 alternative fuel stations, including E-85, automotive LPG, and compressed natural gas and train 100 stakeholders on idle reduction technologies and 100 fleet managers on hybrid technologies and purchasing mechanisms.

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Results	FY 2005 Targets	FY 2006 Targets
Gateway Deployment/ENERGY STAR®					
Recruit 400 new ENERGY STAR® partners, bringing the total number of stores marketing ENERGY STAR® appliances up to 6,500.	Recruit 500 additional retail stores, five addition manufacturers bringing the total number of stores marketing ENERGY STAR® appliances to 7,000.	Recruited 375 additional ENERGY STAR® partners including retail stores, utilities and manufacturers. [MET]	Recruit 500 additional retail stores, 5 additional utilities and 10 additional manufacturers. Add domestic hot water heaters to the program. Begin work on a Commercial Window Specification. Expand room air-conditioner program to include heating cycle. Continue outreach to non-English speaking communities and Weatherization activities. [NOT MET]	Recruit 500 additional retail stores, 5 additional utilities and 10 additional manufacturers. Complete draft Commercial Window specification. Begin update of Residential Window specification. Expand coordination with all gateway activities.	Save 0.4 Quads by promoting consumer purchase of ENERGY STAR energy efficient products. Market penetration targets include 29 percent for appliances (baseline 30%, calendar year 2003), 2.25 percent for CFLs (baseline 2%, calendar year 2003), and 45 percent for savings of average qualified vs. average new non-qualified windows (baseline 41%, calendar year 2003). Savings are based on the cumulative savings of average qualified vs. average new non-qualified products from 2000-2005.
Gateway Deployment/NICE[3]					
			Continue program closeout initiated in FY 2003.		
Gateway Deployment/Inventions and Innovations					
Gateway Deployment/International Market Development					
			No activities.		*Maintain total Program Direction costs in relation to total Program costs in the range of 8% - 12% to demonstrate efficient and effective EERE-wide business and technical support to mission direct programs. (Weatherization, State Energy, and Intergovernmental Activities.)*

Means and Strategies

The Weatherization and Intergovernmental Program will use various means and strategies to achieve its program goals as described below. "Means" include operational processes, resources, information, and the development of technologies, and "strategies" include program, policy, management and legislative initiatives and approaches. Various external factors, as listed below, may impact the ability to achieve the program's goals. Collaborations are integral to the planned investments, means and strategies, and to addressing external factors.

The Weatherization and Intergovernmental Program uses several means and program, policy, management and market based strategic approaches to achieve its program goals. Collaboration with States, agencies, and a variety of customers is integral to the investments, means and strategies planned.

WIP will implement the following means:

- Weatherization Assistance Grants Program (WAP) will reduce the energy costs of low-income households by providing cost-effective energy efficiency improvements while ensuring the health and safety of the people served. Priority is given to the elderly, persons with disabilities, families with children, and households that spend a disproportionate amount of their income on energy bills (utility bills make up 15 to 20 percent of household expenses for low income families, compared to five percent or less for all other Americans);

- State Energy Program Grants will provide financial assistance through formula grants to States, enabling state governments to target their own high priority energy needs and expand clean energy choices for their citizens and businesses; and

- Gateway Deployment will achieve energy efficiency gains in building, transportation, and industrial market sectors by providing technical information and financial support to States, local governments, companies, fleet managers, building code officials, technology developers, Native American tribal governments, and international agencies.

WIP will implement the following strategies:

- The Weatherization Assistance Grants Program will utilize a cost-effective combination of energy-saving measures selected for each home based on a comprehensive audit. This activity will provide state formula grants to weatherize approximately 92,300 low-income homes, saving $1.39 in energy costs for every dollar invested over the life of the measures (based on current EIA energy price data). Ninety percent of the total WAP funding will be allocated to the States as operating funds for this purpose, i.e. for labor, materials, equipment, administrative systems, etc.;

- State Energy Program Grants will assist state energy offices with energy planning, which includes allowing States to tailor energy efficiency programs to local needs and to leverage non-Federal resources to supplement Federal assistance. SEP supports state partners in areas such as utility restructuring, implementing newly developed energy efficiency technologies, and urban/regional planning for sustainability; and

- Gateway Deployment will provide technical, financial, and information to customers through efficient intergovernmental deployment of cost-effective energy technologies. The combination of diverse deployment activities provides EERE technology for buildings, transportation, and industrial

markets. Gateway Deployment forms partnerships with municipal governments, fleet managers, and companies and works closely with state energy offices, and regional offices to deploy EERE technologies. Rebuild America accelerates energy efficient improvements in existing buildings through community-level partnerships and focuses on K-12 schools, colleges and universities, state and local governments, public and multi-family housing, and commercial buildings. Clean Cities supports public-private partnerships that deploy alternative fuel vehicles and build supporting infrastructure and guides local businesses and governments through the process of establishing themselves as Clean Cities coalitions. This process includes goal-setting, coalition building, and securing commitments. Inventions and Innovations provides grants to inventors for energy saving technologies. Building Codes Training and Assistance helps States to upgrade and implement their minimum building energy codes by developing core resource materials and providing financial and technical assistance. ENERGY STAR® is a collaborative Department of Energy/Environmental Protection Agency activity. It is a voluntary labeling program designed to identify and promote energy efficient products, with the goal of reducing energy use and carbon dioxide emissions. Through its partnership with more than 7,000 private and public sector organizations, ENERGY STAR® delivers the technical information and tools that organizations and consumers need to choose energy-efficient solutions and best management practices.

These strategies will result in significant cost savings and a significant reduction in the consumption of gasoline, electricity, diesel fuels and natural gas and increase the substitution of clean fuels and power – cost effectively reducing America's demand for energy, lowering carbon emissions, and decreasing energy expenditures.

The following external factors could affect WIP's ability to achieve its strategic goal:

- partner cost share;
- partner participation rates;
- fuel price volatility; and
- local codes/standards.

In carrying out the program's mission, WIP collaborates with several groups on its key activities including:

- The Weatherization Assistance Program (WAP) works with a network of approximately 970 local weatherization agencies. WAP coordinates with the Health and Human Services Low Income Home Energy Assistance Program (LIHEAP) which makes up to 25 percent of its funds available to local WAP agencies for weatherization improvements.
- SEP works closely with all 50 States, DC and territories; and
- Within Gateway Deployment, Rebuild America develops partnerships with local governments. Clean Cities works with fleet managers, local businesses and governments. Building Codes Training and Assistance works with national, regional, and state building code officials and stakeholders to help building owners, builders and the design community understand the building science, benefits, and techniques for going significantly beyond code with added value strategies. ENERGY STAR® is an established partnership between the DOE and the Environmental Protection

Agency since 1996 that works with more than 4000 retailers to label ENERGY STAR® qualified appliances and energy efficient products.

Validation and Verification

To validate and verify program performance, the Weatherization and Intergovernmental Activities Program will conduct internal and external reviews and audits.

Data Sources:	EIA Annual Energy Review (AER); Commercial Building Energy Consumption Survey (CBECS); Residential Energy Consumption Survey (RECS); Annual Energy Outlook (AEO); U.S. Department of Commerce (DOC) Current Industrial Reports (CIR); various trade publications; and information collected directly from WIP performers or partners.
Baselines:	Energy savings for WIP are based on market penetration of technologies after the year 2005. Savings are relative to what energy consumption would have been in the absence of this additional market penetration. State Energy Program baseline assumes annual cost savings of 0.25 million source BTU and annual cost savings of $1.58 for every dollar of funding.[a] Weatherization Assistance Grants maintains a benefit-cost ratio between 1.19 – 2.0. ENERGY STAR® baseline is increased market share for ENERGY STAR® appliances to 29 percent by 2006 and 32 percent by 2010, compared to 15 percent in 2001.
Evaluation:	In carrying out the program's mission, the program uses several forms of evaluation to assess progress and to promote program improvement.

- Operational field measurement as appropriate
- Peer review by independent outside experts of both the program and subprogram portfolios
- Annual internal Program Review of WIP
- Specialized program evaluation studies to examine process, impacts, or market baseline and effects, as appropriate
- Quarterly and annual assessment of program and management results based performance through Joule (the DOE quarterly performance progress review of budget targets), R&DIC (annual internal review of performance planning and management of R&D programs against specific criteria), PMA (the Presidents Management Agenda -- annual departmental and PSO based goals whose milestones are planned, reported and reviewed quarterly) and PART (common government wide program/OMB reviews of management and results).
- Annual review of methods, and recomputation of potential benefits for the Government Performance and Results Act (GPRA)

[a] Estimating Energy and Cost Savings and Emissions Reductions for the State Energy Program Based on Enumeration Indicators Data ORNL/CON-487 January 2003.

In carrying out the program's mission, the Gateway Deployment Program uses several forms of evaluation to assess progress and to promote program improvement.

- Technology validation and operational field measurement, as appropriate
- Peer review by independent outside experts of both the program and subprogram portfolios
- Annual internal Technical Program Review of the Gateway Deployment Program and surveys for deployment of technologies (Clean Cities)
- Specialized program evaluation studies to examine process, impacts, or market baseline and effects, as appropriate
- Quarterly and annual assessment of program and management results based performance through Joule (the DOE quarterly performance progress review of budget targets), R&DIC (annual internal review of performance planning and management of R&D programs against specific scored criteria), PMA (the Presidents Management Agenda -- annual departmental and PSO based goals whose milestones are planned, reported and reviewed quarterly) and PART (common government wide program/OMB reviews of basic management by results).
- Annual review of methods, and recomputation of potential benefits for the GPRA

In carrying out the program's mission, SEP uses several forms of evaluation to assess progress and to promote program improvement.

- Peer review by independent outside experts of both the program and subprogram portfolios
- Specialized program evaluation studies to examine process, impacts, or market baseline and effects, as appropriate
- Quarterly and annual assessment of program and management results based performance through Joule (the DOE quarterly performance progress review of budget targets), R&DIC (annual internal review of performance planning and management of R&D programs against specific scored criteria), PMA (the Presidents Management Agenda -- annual departmental and PSO based goals whose milestones are planned, reported and reviewed quarterly) and PART (common government wide program/OMB reviews of basic management by results).
- Annual review of methods, and recomputation of benefits for the GPRA

Frequency: Complete revalidation of assumptions and results can only take place every 3 to 4 years, due to the reporting cycle of two critical publications; CBECS and RECS; however, updates of most of the baseline forecast and WIP outputs will be undertaken annually.

Data Storage: EIA data sources are available on line. Trade publications are available on a subscription basis. WIP output information is contained in various reports and memoranda. Reviews and analyses conducted by Oak Ridge National Laboratory are available on line at http://www.ornl.gov/info/reports/ORNL_reports.shtml

Verification: Calculations are based on assumptions of future market status, equipment or technology performance, and market penetration rates. These assumptions can be verified against actual performance through technical reports, market surveys and product shipments. Weatherization Assistance Grants validates number of homes through State reporting through WinSAGA system. SEP bases results on an assessment of program outcomes conducted by Oak Ridge National Laboratory whose methodology was independently reviewed in FY 2005 by the Board of Directors of the International Energy Program Evaluation Conference. Gateway Deployment utilizes a variety of data collection and reporting methods including surveys, partner reporting, web based direct data collection, and third party evaluation studies and reviews.

Program Assessment Rating Tool (PART)

The Department implemented a tool to evaluate selected programs. PART was developed by 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. Weatherization Assistance Grants and State Energy Program Grants have incorporated feedback from OMB into the FY 2006 Budget Request, have addressed most of the PART recommendations, and are committed to addressing remaining recommendations and improving performance. The Weatherization Assistance Program has adopted an efficiency performance metric of a program benefit-cost ratio in a range of 1.2 to 2.0 (ratio depends on current and future energy prices). Consistent with PART recommendations, the program will initiate the first year of a three year national evaluation designed to insure that its objectives are being met and that estimates of energy savings, bill reductions, program costs, and program benefits are valid.

The FY 2005 Weatherization PART recognized that the program has a very clear purpose, strong planning and management. The PART also found that the program coordinates effectively with other related government programs in its efforts to meet interrelated Departmental goals and still achieve its goals of a favorable benefit-cost ratio and other performance goals. While the PART recognized the program has met its planned targets for the number of homes weatherized, PART assessment of the program's recent Inspector General audit resulted in lower program accountability scoring, though it acknowledged program management actions are underway to address the findings. The net result was that the Weatherization Program maintained its overall score of 82 and its rating of "moderately effective."

The FY 2006 State Energy Program PART (its initial review) found that the program has a clear purpose, strong management, and has taken steps to improve its operational efficiency. While noting Oak Ridge National Laboratory's assessment that the program generates significant energy and cost savings, the PART review noted that data was not available from all States and that the study was not independently reviewed. In fact, the ORNL study was intended as only the first of a sequence of studies that would be progressively more rigorous and comprehensive. The second study in the series in now in the process of external review, as recommended by OMB. It includes data from 50 States, 4 Territories

and DC, and its methods are being reviewed by the Board of Directors of the International Energy Program Evaluation Conference, an independent body comprised of many peer experts in the energy efficiency program evaluation field.

The State Energy Program PART rated the program "results not demonstrated" as the program's shift from measuring grants processed to measuring energy results was not sufficiently in place to demonstrate results. SEP is working to address strategic planning recommendations noted in the PART review to develop meaningful long-term and annual performance measures, and to better quantify program results, as indicated above.

Funding by General and Program Goal

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
General Goal 4, Energy Security			
Program Goal 04.09.00.00, Weatherization	227,166	228,160	230,000
Program Goal 04.10.00.00, State Energy Programs (State Energy Program Grants)	43,952	44,176	41,000
Program Goal 04.10.00.00, State Energy Programs (State Energy Activities)	2,324	2,320	500
Program Goal 04.11.00.00, Intergovernmental Activities (Gateway Deployment)	34,490	34,349	26,657
Total, General Goal 4 (Weatherization and Intergovernmental Activities)	307,932	309,005	298,157

Expected Program Outcomes

The Weatherization and Intergovernmental Program pursues its mission through integrated activities designed to improve the energy efficiency and productivity of our economy. We expect these improvements to reduce susceptibility to energy price fluctuations and potentially lower energy bills; reduce EPA criteria and other pollutants; enhance energy security by increasing the production and diversity of domestic fuel supplies; and provide greater energy security and reliability by improving our energy infrastructure. In addition to these "EERE business-as-usual" benefits, realizing the programs goals would provide the technical potential to reduce conventional energy use even further if warranted by future energy needs.

Estimates of annual non-renewable energy savings, energy expenditure savings, carbon emission reductions, oil savings, natural gas savings, and displaced need for electricity capacity additions that result from the realization of the Intergovernmental Program goals are shown in the table below through 2025. These results do not include benefits for the tribal and international intergovernmental activities (In Energy and Water Development Account), nor do they reflect the potential for this program to change long term consumer efficiency and renewable buying patterns.

The assumptions and methods underlying the modeling efforts have significant impact on the estimated benefits, and results could vary significantly if external factors, such as future energy prices, differ from the "baseline case" assumed for this analysis. EERE's baseline case is essentially the same as the EIA "business-as-usual" case presented in its Annual Energy Outlook. In addition, possible changes in public policy and disruptions in the energy system which may affect estimated benefits are not modeled. The external factors such as unexpected changes in competing technology costs, identified in the Means and Strategies section above, could also affect the Program's ability to achieve its goals.

The results shown in the long term benefits tables are preliminary estimates based on initial modeling of some of the possible program production technologies; nonetheless, they provide a useful picture of the potential change in national benefits over time if the technology, infrastructure and markets evolve as expected. Estimated benefits which follow assume that individual technology plans and market assumptions obtain. Final documentation is estimated to be completed and posted by March 31, 2005. Uncertainties are larger for longer term estimates. A summary of the methods, assumptions, and models used in developing these benefit estimates that are important for understanding these results are provided at www.eere.energy.gov/office_eere/budget_gpra.html.

FY 2006 GPRA Benefits Estimates for the Weatherization and Intergovernmental Activities Program[a]

Mid-Term Benefits[b]	2010	2015	2020	2025
Primary nonrenewable energy savings (Quads)	0.3	0.6	1.0	1.2
Energy bill savings (Billion 2002$)	5	10	12	10
Carbon emission reductions (MMTCE)	6	12	21	27
Oil savings (MBPD)	0.0	0.1	0.1	0.1
Natural gas savings (Quads)	0.20	0.20	0.26	0.31
Total electric capacity displaced (GW)	7	11	12	14

WIP provides a number of benefits not directly addressed in the table above. Through the Weatherization Assistance Grants, WIP improves energy affordability and safety for low income households who lack the financial resources to make these investments on their own. This program also provides the institutional basis for other sources of Federal, state, local, and utility dollars used to weatherize additional homes, and provides on-the-ground training and experience with advanced building efficiency technologies and technologies for building contractors throughout the country.

WIP also provides state and local governments with improved capability to address local air quality needs at lower cost and with better results than would be achievable on their own. Clean Cities, for instance, provides a network of expertise on the purchase and use of alternative fuel vehicles.

Finally, through the SEP Program, WIP provides basis for state and local energy emergency planning and response capabilities. Initially developed to respond to oil and natural gas shortages in the 1970s,

[a] Benefits reported are annual, not cumulative, for the year given. Estimates reflect the benefits that may be possible if all of the program's technical targets are met and funding continues at levels consistent with assumptions in the FY 2006 Budget.
[b] Mid-term program benefits were estimated utilizing the GPRA06-NEMS model, based on the Energy Information Administration's (EIA) National Energy Modeling System (NEMS) and utilizing the EIA's Annual Energy Outlook (AEO) 2004 Reference Case.

state energy planning has provided local capabilities for addressing recent electricity shortages and homeland security coordination in recent years.

Weatherization Assistance Grants

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Weatherization Assistance Grants					
Weatherization Assistance	223,759	224,738	225,400	+662	+0.3%
Training and Technical Assistance	3,407	3,422	4,600	+1,178	+34.4%
Total, Weatherization Assistance Grants	227,166	228,160	230,000	+1,840	+0.8%

Description

The Department of Energy administers Weatherization Assistance Grants by providing technical assistance and formula grants to state and local weatherization agencies throughout the United States. This support improves the energy savings per home and helps States spend non-Federal funding effectively through uniform technical assistance. A network of approximately 970 local agencies provide trained crews to perform weatherization services for eligible low-income households in single-family homes, multifamily dwellings, and mobile homes. Of the homes weatherized annually, 49 percent are occupied by an elderly person with special needs or a person with disabilities. Other priorities are given to families with children, and households that spend a disproportionate amount of their income on energy bills (utility bills make up 15 to 20 percent of household expenses for low income families, compared to five percent or less for all other Americans). All homes receive a comprehensive energy audit, which is a computerized assessment of a home's energy use and an analysis of which energy conservation measures are best for the home and a combination of those energy-saving measures are installed.

Benefits

Weatherization Assistance Grants contributes to the WIP goal by reducing the energy cost burden to low-income households that pay a disproportionate amount of household income on energy bills. Since 1976, Weatherization Assistance Grants has helped five million American families reduce their energy bills and increase the comfort and safety of their homes resulting in average annual cost savings of $235 per household.[a] Weatherization makes homes more energy efficient, which reduces energy bills, thus improving the financial self-sufficiency for many low-income families. Weatherization also provides many non-energy benefits to recipient households and their communities for example; it helps stabilize the housing stock in low-income neighborhoods and supports approximately 8,000 technical jobs in local home energy businesses. In addition to the DOE funds, the Department of Health and Human Services (HHS) also provides funding for Weatherization through its Low-Income Home Energy Assistance Program.

[a] Meta evaluation of National Weatherization Assistance Program Based on State Studies, 1993-2002 ORNL/CON-488, February, 2003.

Weatherization Assistance Funding for 2004

(in whole dollars)

	Source of Non-Federal Funds	2004 Federal DOE Funds	2004 Non-Federal Funds
Alabama		2,407,556	0
Alaska	Alaska Housing Finance Corp (State)	1,680,350	3,000,000
Arizona	SWG, APS, TEO, and Citizens (utilities)	1,358,959	350,000
Arkansas	Entergy funds - additional measures.	2,070,568	2,350,000
California		6,295,195	0
Colorado	EXCEL Energy - utility	5,479,996	2,689,149
Connecticut	Utility Funds	2,506,917	3,526,504
Delaware	Utility Funds	574,894	542,000
Dist. Columbia	Electric Universal Service Funds	649,216	1,200,000
Florida	State Document and Stamp Tax	1,957,419	2,000,000
Georgia	Utility Funds	2,928,214	800,000
Hawaii	Utility Funds	204,314	0
Idaho	Utility Funds	1,973,522	460,000
Illinois	State Supplemental Energy Assistance	13,849,700	7,200,000
Indiana		6,551,417	0
Iowa	Utility Funds	4,989,424	2,247,970
Kansas		2,530,561	0
Kentucky		4,519,996	0
Louisiana		1,731,371	0
Maine	Maine State Public Utility Commission funds	3,068,227	300,000
Maryland	Utility Funds	2,652,560	850,000
Massachusetts	Utility Funds	6,548,606	16,600,000
Michigan		15,190,413	0
Minnesota	Utility Conservation Program	9,855,435	2,300,000
Mississippi		1,648,503	0
Missouri	2001 State Utilicare, 2002 Utilities funds	6,003,549	1,765,000
Montana	Northwestern Energy and BPA	2,519,458	1,819,941
Nebraska		2,494,014	0
Nevada	Housing Trust Fund	835,429	2,676,763
New Hampshire	Utility Low Income EE Programs	1,508,657	510,000
New Jersey	New Jersey Utility funds, landlord contributions, other private funds	5,102,877	98,000

(in whole dollars)

	Source of Non-Federal Funds	2004 Federal DOE Funds	2004 Non-Federal Funds
New Mexico	State Funds	1,909,730	20,000
New York	Leveraged Non-Federal, Utilities, Owner Invest.	20,170,923	8,200,000
North Carolina		4,158,644	0
North Dakota		2,496,970	0
Ohio	Utility SBC Program	13,741,148	20,000,000
Oklahoma	Leveraged Non-Federal, Utilities, Owner Invest.	2,591,542	15,000
Oregon	BPA Low-Income Wx; IOU Deregulation Wx	2,821,454	3,322,040
Pennsylvania	Utility funds administered by local agencies	14,707,466	0
Rhode Island	Electric and Gas Utilities	1,156,210	600,000
South Carolina	Project Share - South Carolina EGC	1,775,540	0
South Dakota	Utility Funds	1,916,788	0
Tennessee		4,181,594	0
Texas	Investor-Owned Utility Systems Benefit Funds	5,575,530	10,512,259
Utah	Gas Utility, Electric Utility, TANF, State Funds	2,077,161	1,019,535
Vermont	Weatherization Trust Fund	1,277,921	3,786,098
Virginia	Washington Utility funds and state capital funds	4,016,741	158,090
Washington	BPA; Energy Matchmakers	4,540,287	7,333,891
West Virginia	AEP Electric Utility, Natural gas utility	3,211,847	225,000
Wisconsin	Public Benefits Utility Funds	8,568,935	32,229,734
Wyoming		1,174,532	0
Total, Grants		223,758,280	140,706,974
Training and Technical Assistance		3,407,686	0
Total		227,165,966	140,706,974

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Weatherization Assistance	**223,759**	**224,738**	**225,400**

This activity will provide state formula grants to enable the Weatherization of an estimated 92,300 low-income homes, saving $1.39 in energy costs for every dollar invested over the life of the measures (based on current EIA energy price data). Ninety percent of the total WAP funding will be allocated to the States as operating funds for this purpose, i.e., for labor, materials, equipment, administrative systems, etc.

Ten percent of the total program funding will be allocated for training and technical assistance, to maintain a high standard of technology application, effectiveness, and results. Most training and technical assistance will be performed at state and local levels. Under the DOE allocation formula, States will be awarded $18,400,000 (or 8 percent of total funding) for that purpose in FY 2006.

Training and Technical Assistance	**3,407**	**3,422**	**4,600**

DOE will conduct analysis, measure and document program performance, and promote (e.g. through pilot programs, publications, training programs, workshops and peer exchange) the application of advanced techniques and collaborative strategies to continually improve program effectiveness.

Traditionally, DOE uses 1.5 percent of total funding to fund training and technical assistance activities that can be more cost-effectively performed at national/regional levels, to support effective program operations by the network of State and local Weatherization agencies. However, in response to PART recommendations, DOE will modify the DOE/State split on T&TA funding by designating 2 percent of total funding in order to conduct a new national evaluation of the Program with the remaining 8 percent awarded to the States through the DOE allocation formula. In 2005, DOE began funding (approximately $750,000 from DOE T&TA) the first year of this multi-year national evaluation, estimated not to exceed $6 million, to insure that its objectives are being met and that estimates of energy savings, bill reductions, program costs, and program benefits are valid. The Weatherization Assistance Program has not conducted a national evaluation for more than a decade. A new evaluation is needed to verify the overall energy savings and cost-effectiveness of the program, assess the impact of numerous changes made to program policy and procedures, and determine the best methods to improve future program performance. *Participants will include: Oak Ridge National Laboratory and other participants TBD through competitive solicitations.*

Total, Weatherization Assistance Grants	**227,166**	**228,160**	**230,000**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Weatherization Assistance	
Increase due to higher costs associated with lead-safe weatherization	+662
Training and Technical Assistance	
Increase is due to the need to conduct a national evaluation of program effectiveness	+1,178
Total Funding Change, Weatherization Assistance Grants	**+1,840**

State Energy Program Grants

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
State Energy Program Grants	43,952	44,176	41,000	-3,176	-7.2%
Total, State Energy Program Grants	43,952	44,176	41,000	-3,176	-7.2%

Description

The State Energy Program Grants (SEP) mission is to provide financial assistance through formula grants to States, enabling state governments to target their own high priority energy needs and expand clean energy choices for their citizens and businesses. This program was created by Congress in 1996 by consolidating two earlier efforts — the State Energy Conservation Program, and the Institutional Conservation Program, which were established in the 1970's.

SEP is the only Federally-funded, state-based program administered by DOE that provides resources directly to the States. With these funds and the resources leveraged by them, the State and Territory Energy Offices develop and manage a variety of programs geared to increase energy efficiency, reduce energy use and costs, develop alternative energy and renewable energy sources, promote environmentally conscious economic development and reduce reliance on oil produced outside the U.S. State Energy Offices are also instrumental in administering public benefits funds and energy emergency preparedness.

Benefits

SEP contribute to WIP's deployment goals by supporting the capabilities of States to implement activities that promote energy efficiency and adopt renewable energy technologies. The SEP, among many other activities, fund the development and maintenance of energy emergency planning at the state and local levels, a critical security benefit. SEP has recently taken steps to better quantify the energy benefits of the program activities including savings and emissions reductions.[a] The study concluded that the program achieves an annual energy cost savings of 1.17 million source Btu and $7.23 in annual energy cost savings for each $1 of Federal funding by providing grants, technical advice, and oversight to 50 States, District of Columbia, and 5 Territories for energy efficiency programs. The program is currently focused on supporting the implementation of SEP Strategic Plan for the 21st Century, which is addressing key goals of market transformation and collaboration with environmental and economic development interests.

[a] Estimating Energy and Cost Savings and Emissions Reductions for the State Energy Program Based on Enumeration Indicators Data ORNL/CON-487 January 2003.

The program will award Special Project State Grants to States on a competitive, cost-shared basis to help deploy end-use sector technologies in the following EERE programs (shown here for information, only; these amounts are funded in the indicated individual programs):

(dollars in thousands)

Special Project State Grants Funding within EERE Programs	FY 2004	FY 2005 (Estimate)	FY 2006 (Estimate)
Clean Cities (Weatherization and Intergovernmental Program)	$5,225	$4,000	$4,000
Codes and Standards (Weatherization and Intergovernmental Program)	$1,613	$1,650	$1,600
Rebuild America (Weatherization and Intergovernmental Program)	$3,959	$4,000	$4,000
Wind Energy	$380	$375	$375
Solar Energy Technologies	$250	$250	$250
Industrial Technologies	$1,963	$2,000	$2,000
Hydrogen Energy	$0	$50	$50
Geothermal Technologies Program	$500	$0	$0
Federal Energy Management Program	$399	$400	$400
Distributed Energy and Electric Reliability	$1,345	$1,200	$1,200
Building America (Building Technologies)	$499	$500	$500
Biomass Program	$500	$500	$500
EERE Air Quality	$30	$150	$150
Subtotal, EERE Funding for New Awards	$16,663	$15,075	$15,025
Total Funding	$16,663	$15,075	$15,025

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
State Energy Program Grants	**43,952**	**44,176**	**41,000**

Provide grants to 50 States, DC, and territories for energy efficiency/renewable programs. Support implementation of SEP Strategic Plan for the 21st century, addressing key goals of market transformation and collaboration with environmental and economic development interests. Assist States in strategic planning and logic modeling. Provide technical assistance and training to develop state level capabilities to form collaborative partnerships and conduct evaluation of the impact of state energy efficiency and renewable energy programs nationwide. *Participants include: States, Data Tree, National Renewable Energy Laboratory (NREL), and Oak Ridge National Laboratory (ORNL).*

Total, State Energy Program Grants	**43,952**	**44,176**	**41,000**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
State Energy Program Grants	
Funding decrease due to States taking on roles traditionally funded by the Federal government and increased effectiveness in forming collaborative partnerships to attract private sector involvement in funding for energy efficiency and renewable energy projects	-3,176
Total Funding Change, State Energy Program Grants	**-3,176**

State Energy Activities

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2005	$ Change	% Change
State Energy Activities					
Planning and Evaluation Support for State and Local Grant Programs	2,324	2,320	500	-1,820	-78.4%
Total, State Energy Activities	2,324	2,320	500	-1,820	-78.4%

Description

The State Energy Activities Subprogram complements the State Energy Grants Program activities. Cooperative agreements with States provide assistance for energy-related applied research, development, and field testing, which are excluded from the State Energy Program enabling legislation. Planning and evaluation projects will allow for additional technical assistance to States in support of State Energy Assistance and for necessary information management, planning, analysis, and evaluation projects on the formula grant programs.

Benefits

State Energy Activities contribute to WIP deployment goals by supporting State Energy Grants Program activities. This assistance allows States to implement planning and analysis for grants related energy efficient and renewable energy technology research, development, and field-testing, thus improving program effectiveness.

Detailed Justification

(dollars in thousands)

FY 2004	FY 2005	FY 2006
Planning and Evaluation Support for State and Local Grant Programs	**2,324**	**2,320**	**500**

Program will implement the FY 2005 Phase II findings of the Oak Ridge metrics evaluating study. Continue to foster strengthened partnerships between EERE end-use sector offices and the States through activities that support the successful implementation of the Special Projects State Grants. Support program oversight, provide State Energy Advisory Board support, and respond to Congressionally mandated requirements to report on energy codes and standards and EPACT. *Participants include: Southeast Regional Office, Northeast Regional Office, Midwest Regional Office, Central Regional Office, Mid-Atlantic Regional Office, Western Regional Office, ORNL, NREL, and Data Tree.*

Total, State Energy Activities	**2,324**	**2,320**	**500**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Planning and Evaluation Support for State and Local Grant Programs	
Funding decreased due to completion of Phase II of Oak Ridge National Laboratory metrics evaluation study (Estimating Energy and Cost Savings and Emissions Reductions for the State Energy Program Based on Enumeration Indicators Data ORNL/CON-487 January 2003) and reduced need for Windows Systems Approach to Grants Administration (WINSAGA) data reporting systems due to EGov Initiative	-1,820
Total Funding Change, State Energy Activities	**-1,820**

Gateway Deployment

Funding Schedule

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Gateway Deployment					
Rebuild America	9,823	8,641	6,571	-2,070	-24.0%
Energy Efficiency Information and Outreach	1,292	1,064	350	-714	-67.1%
Building Codes Training and Assistance	4,145	5,597	4,550	-1,047	-18.7%
Clean Cities	10,873	10,626	6,510	-4,116	-38.7%
ENERGY STAR®	3,654	4,091	5,776	+1,685	+41.2%
Inventions and Innovations	4,318	3,945	2,400	-1,545	-39.2%
Technical/Program Management Support	385	385	500	+115	+29.9%
Total, Gateway Deployment	34,490	34,349	26,657	-7,692	-22.4%

Description

Gateway Deployment funds activities that facilitate the movement of energy efficient and renewable energy products into the market place and the integrated deployment of efficiency and renewable resources to communities and customers.

Gateway Deployment is an integrated coordination and deployment activity established in 2004 to accomplish effective delivery of the full menu of efficiency and renewable resources aligned with clear community and customer focus. The activity focuses on the end user needs, rather than individual EERE programs. It provides easier access to EERE's vast array of technologies and resources to ensure these are part of the economic solutions for communities across the country. Through an integrated information and outreach approach, Gateway Deployment facilitates "one-stop" access to a variety of specialized technical and financial assistance through activities such as Rebuild America, Energy Efficiency Information and Outreach, Building Codes Training and Assistance, Clean Cities, ENERGY STAR®, and Inventions and Innovations. States and EERE regional offices are the key implementing entities for solutions and customer service.

Technical assistance (TA) services will be strengthened among Gateway activities. The new service will use best practices developed among major EERE TA efforts and provide States and local governments easier access to DOE National Laboratory expertise on EERE technologies and practices.

Education and outreach activities will be integrated around customer market sectors, e.g. schools, government, small business, etc. This integration will bundle information about WIP Programs and EERE technologies for specific audiences and improve program coordination.

Benefits

Gateway Deployment contributes to WIP deployment goals by providing information and technical and financial assistance to improve efficiency in building, transportation, and industrial market sectors. As of the end of 2003, with a cumulative Federal investment of $72 million, Rebuild America partnerships have renovated more than 609 million square feet of floor space, saving building owners more than $141 million each year with a cumulative saving of $1.6 billion through private investment for energy-efficiency improvements in excess of $700 million.[a] Another 590 million square feet of projects have progressed beyond the planning stage. Building Codes Training and Assistance activities have resulted in energy savings of nearly $700 million per year, have improved the energy efficiency of nearly 3 billion square feet of new commercial floor space and nearly 4 million new households, and every $1 spent by the activity has yielded between $50 and $60 dollars in energy cost saving.[b] Clean Cities coalitions have grown to over 80 coalitions that all have made significant commitments to use transportation technologies that displace petroleum. By encouraging the use of alternative fuel vehicles, Clean Cities helps enhance energy security and environmental quality at both the national and local levels. Clean Cities have been increasing their AFVs at a growth rate of approximately 17 percent per year, and projects similar progress in the future. Growth in non-Clean Cities is almost non-existent. DOE ENERGY STAR® is a market transformation activity delivering energy and cost savings to American homeowners, businesses and government facilities. ENERGY STAR® is jointly managed by DOE and EPA. Last year alone, ENERGY STAR® saved Americans over $9 billion. The program estimates that to date, more than $3.3 billion of that savings is directly attributable to the implementation of EERE-developed technology. Gateway Deployment will work to independently validate program accomplishments as well as to develop a common methodology to evaluate program successes in FY 2006.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Rebuild America	**9,823**	**8,641**	**6,571**

In FY 2006 this program will: Help over 700 new and existing partnerships upgrade an additional 50 million square feet of floor space in schools and colleges, commercial buildings and state and local government-owned facilities; continue providing technical assistance for new construction through allied partners for mature market sectors, provide existing partnership base with access to information on energy solutions to broader needs, e.g., wastewater treatment plants, and “smart growth” strategies; overcome information barriers by providing web-based training, decision tools, and case studies that increase the market demand for energy efficient products, and project development and financing services; partner achieve penetration in difficult markets, e.g., hospitality and healthcare facilities, partner with national organizations, manufacturers, utilities, peer relationships, and the energy service industry to leverage resources; continue to provide comprehensive EERE technologies to K-12 priority

[a] As reported by Rebuild Partnerships. Information available on website: http://rebuild.org.
[b] Estimating the Impact of Commercial Building Energy Codes From 1990 to the Present: David Belzer and Mark Halverson Pacific Northwest National Laboratory August 21, 2003.

market sector. Incorporate affordable housing support extension of Building America, and ENERGY STAR® home improvement activities. As directed by Congress, Rebuild America is being managed under the State Technology Advancement Collaborative (STAC) in FY 2005. STAC is a joint venture between DOE, NASEO, and the Association of State Energy Research and Technology Transfer Institutions (ASERTTI). DOE will conduct an independent analysis of STAC in FY 2005 to evaluate STAC's performance. (Includes $4,000 for the State Energy Program Special Project State Grants). *Participants include: ORNL, PNNL, LBNL, National Association of State Energy Officials, and National Association of Energy Service Companies.*

Energy Efficiency Information and Outreach **1,292** **1,064** **350**

Information-outreach is essential to overcome information barriers in the marketplace and to allow consumers and businesses to make informed purchasing decisions. Activities will focus on key market segments, homeowners, and school officials. Outreach will include use of web based tools, media outlets and business communication channels to leverage effectiveness.

Building Codes Training and Assistance..... **4,145** **5,597** **4,550**

The activity will: provide technical and financial assistance to States to update and implement their energy codes to meet the 2001 edition of Standard 90.1 for commercial buildings and the 2003 edition of the International Energy Conservation Code for residential buildings; and train approximately 2,000 code officials, designers, and builders to implement these codes. Update and improve core materials and code compliance software to reflect recent changes in the model energy codes and emerging energy efficiency technologies; and work with 3-5 pilot States, builder organizations, and financial institutions to provide package combining builder training, ENERGY STAR® promotion and financing for new and existing homes. (Includes $1,650 for the State Energy Program Special Project State Grants)

Clean Cities **10,873** **10,626** **6,510**

In support of Energy Policy Section 505, this program will continue to promote alternative fuel efforts and expand activities to promote the use of additional petroleum displacement technologies. The technologies include: anti-idling devices in heavy duty trucks and buses, expanded use of non-petroleum blends, hybrid technologies, a better public understanding of the benefits of fuel economy. Through DOE regional offices, the program will facilitate local coalition market development, training, and grants management; continue limited use of technical assistance teams to help address technical niche market issues raised by local Clean Cities coalitions; and continue platform development of alternative fuel niche markets in anticipation of pending energy legislation and EPA funding opportunities. The program will also continue efforts to provide targeted niche market assistance and training to coalitions about market opportunities in the school bus, transit, and municipal fleet markets. *Participants include: NREL and Others.*

Competitive Grants: In support of EPACT Sections 302 and 409, the program will issue state grants and other public/private partnership grants to competitively fund projects that support infrastructure development, vehicle use in niche markets; and anti-idling devices in large trucks; provide $2.5 million for 20 Special Project State Energy Grants. Of that, about $0.10 million will be for Energy Smart

(dollars in thousands)

FY 2004	FY 2005	FY 2006

School bus projects. *Participants include: States.*

Education and Outreach: In support of the National Energy Policy recommendation to expand consumer education and EPACT Section 405, the program will: sponsor the 11th Annual Clean Cities Conference to showcase commercially available AFVs and advanced technology vehicles; publish case studies of successful alternative fuel niche market applications; and continue building alliances to promote fuel efficient advanced technology vehicles. Continue efforts to support development of the legislatively mandated Fuel Economy Guide and associated www.fueleconomy.gov website.

International Coordination: Conduct trade missions to showcase U.S. alternative fuel products to build markets abroad. *Participants include: NETL, Argonne National Laboratory (ANL), National Renewable Energy Laboratory (NREL), Oak Ridge National Laboratory (ORNL), and the Government Printing Office (GPO) and others.*

ENERGY STAR® **3,654** **4,091** **5,776**

Expand consumer interest in energy efficient appliances, finalize update to residential clothes washer and room air conditioner criteria, and begin revision of residential window criteria, in consensus with industry. In FY 2006 a major program emphasis is the expansion of Home Performance ENERGY STAR, offering contractor-based whole house assessments. The Home Performance ENERGY STAR®Program is training contractors to perform assessments which not only save energy but provide the added benefits of improved air quality, health and safety. This funding is expect to result in the following impacts: promote energy-efficiency upgrade path for the homes of middle-income families; increase market share for ENERGY STAR appliances to 29 percent by 2006 and 32 percent by 2010, compared to 15 percent in 2001; and by 2010 increase market share for ENERGY STAR®windows to 55 percent, compared to 25 percent in 2001. *Participants include: Oak Ridge National Laboratory, D&R, Navigant, Rensselaer Polytechnic Institute, ROs, NETL, Midwest Energy Efficiency Alliance, Consortium for Energy Efficiency, and EPA.*

Inventions and Innovations **4,318** **3,945** **2,400**

Fund up to 13 grants to independent inventors and small technology-based businesses. Continue to provide assistance to small businesses and independent inventors to develop skills in technology commercialization. Review progress of projects initiated in FY 2005, determine and provide the funding requirements for project completion.

	(dollars in thousands)		
	FY 2004	FY 2005	FY 2006
Technical/Program Management Support	**385**	**385**	**500**

In FY 2006, program will support analysis and evaluations for the design of Gateway technical assistance, education and outreach efforts. Representative activities will include preparation of program, strategic plans, and operating plans; feasibility studies and trade-off analysis; evaluation of the impact of new legislation on programs; analysis of energy issues pertinent to the R&D program; development of communication tools; identification of performance measures and methodologies (including GPRA); data collection to assess program and project performance, efficiency and impacts; and development of performance agreements with management.

Total, Gateway Deployment	**34,490**	**34,349**	**26,657**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Rebuild America	
Funding decreased due to increased efficiency of website delivered products and technical assistance	-2,070
Energy Efficiency Information and Outreach	
Funding decreased due to efficiency gains in communication efforts such as websites and communications materials	-714
Building Codes Training and Assistance	
Funding decreased due to improved efficiency of delivering technical assistance to States such as increased use of remote training	-1,047
Clean Cities	
Funding decrease due to reduced need for financial assistance for established alternative fuels infrastructure	-4,116
ENERGY STAR®	
Funding increase to expand and support Home Performance with ENERGY STAR® Program in accordance with the National Energy Policy directive to expand the ENERGY STAR® Program beyond office buildings to include schools, retail buildings, health care facilities, and homes. State and local pilot projects will be supported at the national level by the dissemination of best practices, contractor training, program design assistance and marketing support	+1,685

	FY 2006 vs. FY 2005 ($000)
Inventions and Innovations	
Funding decreased due to focus on technology development strategies that rely less on direct financial assistance to investors	-1,545
Technical/Program Management Support	
Funding increased to support analysis evaluations for redesign of Gateway technical assistance, advocation and outreach efforts	+115
Total Funding Change, Gateway Deployment	**-7,692**

Distributed Energy Resources

Funding Profile by Subprogram[a]

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation[b]	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Distributed Energy Resources						
Distributed Generation Technology Development	39,497	39,322	39,322	35,485	-3,837	-9.8%
End-Use System Integration and Interface	19,676	20,571	20,571	20,500	-71	-0.3%
Technical/Program Management Support	511	523	523	644	+121	+23.1%
Total, Distributed Energy Resources	59,684	60,416	60,416	56,629	-3,787	-6.3%

Public Law Authorizations:

P.L. 94-163, "Energy Policy and Conservation Act" (1975)
P.L. 94-385, "Energy Conservation and Production Act" (1976)
P.L. 95-91, "Department of Energy Organization Act" (1977)

Mission

The mission of the Distributed Energy Resources (DER) Program is to strengthen America's aging energy infrastructure and provide utilities and consumers with a greater array of energy efficient technology choices for the on-site generation of electricity and wasted thermal energy. By 2015, the Distributed Energy Resources Program will develop and deploy a diverse array of high efficiency integrated distributed generation and thermal energy technologies at market competitive prices so that homes, businesses, industry, communities, and electricity companies elect to use them.

Benefits

The Distributed Energy Resources Program supports DOE's mission of advancing the national, economic, and energy security of the United States. The program helps protect our national and economic security by promoting a diverse supply and delivery of reliable, affordable, and environmentally sound energy systems. Distributed energy technologies can expand the use of our Nation's aging electricity power infrastructure, relieve congestion on transmission and distribution

[a] SBIR/STTR funding in the amount of $1,326,000 was transferred to the Science Appropriation in FY 2004. Estimates for SBIR/STTR budgeted in FY 2005 and FY 2006 are $1,347,000 and $1,256,000 respectively.
[b] Reflects the 0.594% and 0.80% rescissions of -$365,000 and -$489,000 respectively and comparability adjustment for National Energy Technology Laboratory Support of -$210,000.

systems, increase supplies during periods of peak demand, support the transition from traditional monopoly regulation to more competitive markets and reduce environmental emissions, including greenhouse gases. Additionally, consumers should have a choice between installing on-site generation and/or electricity provided by central station generators. Consumers (or third party owners such as utilities or energy service providers) install these systems to reduce their energy costs, enhance energy security and/or improve the reliability and quality of energy services they receive from the local utility. Distributed energy devices can sustain "mission-critical" operations when grid-connected power is not available or not sufficient. Local utilities are looking to distributed energy systems to improve the utilization of distribution assets by reducing the peak or altering the shape of energy demand. One of the recent benefits to come from this research is the demonstration of a 42 percent efficient reciprocating engine by Caterpillar Incorporated and the commercial introduction of the Semco desiccant system. Likewise, SEMCO, Incorporated has commercially introduced an Integrated Active Desiccant Rooftop (IADR) unit that allows precise temperature and humidity control in restaurants, schools, movie theatres, and other specialized commercial and institutional markets. Currently, most rooftop air conditioning units cannot adequately dehumidify the increased volume of fresh air required for healthy, modern buildings. Uncontrolled, increased humidity levels result in building occupants lowering thermostat set-points to maintain comfort and increased risk of mold growth and poor indoor air quality. The IADR efficiently dehumidifies air and is regenerated by waste heat. The product is being commercialized as Revolution.™ And lastly, Burns & McDonnell has installed an Integrated Energy Systems (IES) at Austin Energy that incorporates a Solar Turbine (Taurus 60) and a Broad Chiller. This was the first project to put both the turbine and chiller on connecting skids with one set of integrated controls and auxiliary equipment.

Strategic and Program Goals

The Department's Strategic Plan identifies four strategic goals (one each for defense, energy, science, and environmental aspects of the mission) plus seven general goals that tie to the strategic goals. The DER Program supports the following goal:

Energy Strategic Goal: To protect our national and economic security by reducing imports and promoting a diverse supply of reliable, affordable, and environmentally sound energy.

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 DER Program has one program goal which contributes to General Goal 4 in the "goal cascade":

Program Goal 04.59.00.00: Distributed Energy Resources. The Distributed Energy Resources Program goal is to develop a diverse array of cost competitive integrated distributed generation and thermal energy technologies and facilitate market adoption in homes, businesses, industry, communities, and electricity companies, increasing the efficiency of electricity generation, delivery, and use, improving electricity reliability, and reducing environmental impacts.

Contribution to Program Goal 04.59.00.00: (Distributed Energy Resources)

The key contribution of the Distributed Energy Resources Program to the energy security goal is through improving energy efficiency of distributed power systems, directly reducing demand for natural gas and increasing the reliability and flexibility of the electric grid. Distributed Generation Technology research advances the development of more efficient, low emission distributed power generation technologies. End-Use Systems Integration and Interface activities combine efficient power generation technologies with thermally activated heating and cooling applications that further enhance on-site efficiency.

The subprogram activities presented below demonstrate key technology pathways that contribute to achievement of these benefits:

- By 2008, the Distributed Generation Technology Development activities will contribute to the program goal by completing development of a portfolio of distributed generation and thermally activated technologies that show an average 25 percent increase in efficiency (compared to 2000 baseline) and NO_x emissions less than 0.15 lbs/MWh, with an equivalent reduction in cost versus comparable technologies.
- By 2008, the End-Use System Integration and Interface activities will contribute to the program goal by developing the feasibility of integrated systems; these systems will achieve 70 percent efficiency and customer payback in less than 4 years, assuming commercial-scale production, in which one is developed by 2005 and three are developed by 2008.

Annual Performance Results and Targets

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Results	FY 2005 Targets	FY 2006 Targets
Program Goal 04.59.00.00 (Distributed Energy Resources)					
Distributed Energy Resources/Distributed Generation Technology Development					
Complete 5,000 durability, performance, and emissions testing of the Mercury 50 Advanced Turbine System engine.		Complete 4,000 hour field test of ceramic composite shroud components to demonstrate performance and emission benefits to a gas turbine. [MET]	Complete final design and initiate field testing of low emission technology with less than 7 ppm NO_x. [MET]	Demonstrate NO_x emission levels of 0.25 lbs/MWh from a turbine combustion system.	Demonstrate a prototype 35 percent efficient microturbine system.
		Complete the 12 Beta field test units of high efficiency natural gas-fired heat pump (60 percent better than pulse combustion furnace) and install at field test sites hosted by major U.S. Gas Utilities. [MET]	Complete and demonstrate heating coefficient of performance of 1.4 for commercial introduction of a thermally activated system (approximately 40 percent more efficient than a conventional heating system). [MET]		
		Contract with three companies to support research on demonstrating a 5 percent increase in efficiency for an advanced microturbine. [MET]			
			Demonstrate 6 percentage point increase in efficiency for an advanced reciprocating engine. [MET]		
Distributed Energy Resources/End-Use Systems Integration and Interface					
	Demonstrate a microturbine package (highly efficient for reducing peak loads) at a university site.		Complete final design and initiate field testing and evaluation of a complete, fully functional integrated CHP system consisting of a turbine, absorption chiller and control system. [MET]	Complete a case study on a CHP installation that uses heat from a microturbine to provide plate tank heating and sludge drying at an industrial facility, contributing to the PART long-term measure of developing a 70 percent efficient CHP integrated system.	Develop one packaged CHP system which operates at 70+% efficiency.
				Complete and document two DER/CHP demonstration projects within the high tech industry, contributing to the PART long-term measure of developing a 70 percent	

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Results	FY 2005 Targets	FY 2006 Targets
				efficient CHP integrated system.	
			Contribute proportionately to EERE's corporate goal of reducing corporate and program uncosteds to a range of 20-25 percent by reducing program annual uncosteds by 10 percent in 2004 relative to the program uncosted baseline (in 2003) until the target range is met.	*Contribute proportionately to EERE's corporate goal of reducing corporate and program adjusted uncosted obligated balances to a range of 20-25 percent by reducing program annual adjusted uncosteds by 10 percent in 2005 relative to the program FY 2004 end of year adjusted uncosted baseline ($21,257K) until the target range is met.*	*Contribute proportionately to EERE's corporate goal of reducing corporate and program adjusted uncosteds to a range of 20-25 percent by reducing program annual uncosteds by 10 percent in 2006 relative to the program uncosted baseline (2005) until the target range is met.* *Maintain total Program Direction costs in relation to total Program costs in the range of 8% - 12% to demonstrate efficient and effective EERE-wide business and technical support to mission direct programs.*

Means and Strategies

The Distributed Energy Resources Program will use various means and strategies to achieve its program goals as described below. "Means" include operational processes, resources, information, and the development of technologies, and "strategies" include program, policy, management and legislative initiatives and approaches. Various external factors, as listed below, may impact the ability to achieve the program's goals. Collaborations are integral to the planned investments, means and strategies, and to addressing external factors.

The Distributed Energy Resources Program uses several means (processes, technologies, and resources), and program, policy, management and market-based strategic approaches to achieve its program goals. The program goals and intended impacts are particularly sensitive to external factors outside its control. Collaboration with industry and experts are integral to achieving the investments, means and strategies planned and to addressing the external factors.

The Distributed Energy Resources program will implement the program through the following means:

- By advancing performance and reducing technology cost of integrated energy systems including: increasing materials durability, utilizing waste heat, improving the efficiency and emissions of combustion systems, and improving advanced controls; and
- By supporting the integration of distributed energy technologies on the distribution system and at customer's sites to achieve the maximum efficiency, reliability, power quality and load management.

The Distributed Energy Resources program will implement the program through the following strategies:

- Investigate responsive load issues to help customers understand load management;
- Provide the technical basis to develop standards for sitting/permitting/interconnection procedures;
- Work to provide the technical basis to develop rate and cost transparency in the generation and delivery of electricity (including fair and reasonable standby/backup rates);
- Expand utility business strategies to include distributed technologies as a tool to support the distribution system;
- Educate potential customers, utilities, regulators, and the public on the value of heating/cooling in combined heat and power systems;
- Advance the ability of technologies to be dual fueled, and
- Collaborating with the U.S. Environmental Protection Agency (Interagency Agreement) on education and outreach efforts to address environmental sitting and permitting of combined heat and power (CHP) and other distributed energy devices through the EPA CHP Partnership.

These strategies will result in significant cost savings and a significant improvement in the utility's load demand profile from large blocks of central generation and transmission and distribution investments − thus putting the taxpayer's dollars to more productive use.

The following external factors could affect the Distributed Energy Resources Program's ability to achieve its strategic goal:

- The state of the electric sector economy including utilities, transmission and distribution companies, electric suppliers, and manufacturers;
- The fiscal state of the economy to give consumers the ability to finance distributed energy technologies;
- Utility rate structure and regulatory environment that will effect (potentially stifle) customers' ability to choose and install distributed energy systems in a timely and cost-effective manner without changes to existing barriers;
- The pace of development in alternative energy supply technology; and
- The price of energy inputs, primarily natural gas.

In carrying out the program's mission, the Distributed Energy Resources Program performs the following collaborative activities:

- The program operates a comprehensive set of research development and demonstration partnerships including competitively awarded cost-shared projects;
- Federal partnerships include participation with the Federal Energy Management Program (FEMP) to promote and install distributed energy systems at Federal facilities;
- The program supports Hydrogen, Fuel Cells, and Infrastructure Technologies Program by developing technologies that can use hydrogen based fuels for electricity generation or cooling, heating and power applications;
- The program coordinates with the Industrial Technologies Program and Building Technologies Program to identify co-funding projects that involve the use of distributed energy systems in manufacturing plants and commercial/residential buildings;
- The program works with the State Energy Program- Special Projects to increase awareness, promote benefits, and remove barriers to distributed energy;
- Small businesses are supported through the Small Business Innovation Research Program;
- The program also partners (leveraging cost share and technical reviewers) with the California Energy Commission and the New York State Energy Research and Development Authority on distributed generation and CHP research.

Validation and Verification

To validate and verify program performance, the DER Program conducts internal and external reviews and audits. A program peer review was held in December 2003. The purpose of the peer review was to assess the mission, goals, objectives, strategy, program balance, leadership and productivity of the Distributed Energy Program. This peer review evaluated all aspects of the program technology and provided comments to the Department which have been used to develop outyear plans. The peer review Executive Summary is available online at the DER website www.eere.energy.gov/de/.

The next program peer review will be held in the Fall 2005.

Data Sources: The Energy Information Administration's (EIA) Annual Energy Review and Annual Energy Outlook, EIA Form 860 data analyzed by the Resource Dynamics Corporation, Merit Review and Peer Evaluation of R&D, and engineering and economic modeling

Baselines: The following are the key baselines used in the Distributed Energy Resources Program (for the year 2000, unless otherwise noted):

- Industrial Turbines emissions: 0.35 (lb/MWh)
- Microturbines emissions: 0.7 (lb/MWh)
- Reciprocating Engines emissions: 3.1 (lb/MWh)
- Industrial Turbines efficiency: 39 percent (2001)
- Microturbines efficiency: 26 percent
- Reciprocating Engines efficiency: 36 percent
- Technologies with 70% efficiency, with less than 0.15 lbs./MWh and a payback of 4 years or less on production volumes (2003): 0.

Frequency: GPRA benefits are estimated annually; Merit Review and internal review of projects are evaluated annually; and the Program Peer Review is conducted biennially.

Evaluation: In carrying out the program's mission, the DER Program uses several forms of evaluation to assess progress and to promote program improvement.

- Technology validation and operational field measurement, as appropriate
- Peer review by independent outside experts of both the program and subprogram portfolios
- Annual internal Technical Program Review of the DER Program
- Specialized program evaluation studies to examine process, impacts, or market baseline and effects, as appropriate
- Quarterly and annual assessment of program and management results based performance through Joule (the DOE quarterly performance progress review of budget targets), R&DIC (annual internal review of performance planning and management of R&D programs against specific criteria), PMA (the Presidents Management Agenda -- annual departmental and PSO based goals whose milestones are planned, reported and reviewed quarterly) and PART (common government wide program/OMB reviews of management and results).
- Annual review of methods, and recomputation of potential benefits for the Government Performance and Results Act (GPRA)

Data Storage: EE Corporate Planning System

Verification: A trade association working group reviews DER data. The November 2001 Distributed Energy Resources Peer Review verified the distributed generation data. Merit reviews

and peer evaluations by experts from outside of the U.S Department of Energy are used to evaluate individual project and overall program efforts.

Within these peer reviews, DER experts review each project. Principles of the Administration's R&D Investment Criteria for research have been incorporated into this evaluation. The panel also evaluates the strengths and weaknesses of each project and recommends additions or deletions to the scope of work. As an example of this application of the R&D criteria, the Program is closing out the recuperator development project, within the Microturbines activity, as the research has reached the transition point wherein any further development of this technology is now within the capability of industry. As well, the Program has increased funding for the Distributed Energy Systems Applications Integration activity, as the new research will advance building cooling, heating and power integration systems research which builds upon existing technology and complements related R&D activities. The program organization facilitates supplier-customer relationships to ensure that R&D results from federally sponsored efforts are transferred to industry suppliers and that industry supplier developments make their way to the energy market. Annual targets will be verified using published research reports and other auditable information sources.

Program Assessment Rating Tool (PART)

The Department implemented a tool to evaluate selected programs. PART was developed by 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 DER Program has incorporated feedback from OMB into the FY 2006 Budget Request and has taken or will take the necessary steps to continue to improve performance.

The FY 2005 PART review included strong ratings for purpose, planning, and management. These ratings reflect the commitment of EERE program management at all levels to the basic management and planning principles of the President's Management Agenda including the criteria scored in the PART and the implementation of the EERE reorganization employing those principles. The PART recommended that the program develop performance measures to account for outreach activities and that the program focus R&D funding on systems integration while decreasing emphasis on component technology R&D that is within industry's capability. In response to the recommendations from the PART review, the DER Program is in negotiations with OMB to develop a measure to account for outreach activities and has increased its funding for system integration efforts, particularly in the component technology research in the Distributed Energy System Applications Integration activity. The PART also recommended that the Department develop a consistent framework to analyze the costs and benefits of its R&D investments to inform budget decisions. These efforts are underway.

The PART also recommended that the program participate in the development of a consistent framework for the Department to analyze the costs and benefits of its R&D investments, and apply this guidance to development of the FY 2006 budget. The program has provided input the Department needs to improve consistency in the methods and assumptions used to estimate potential benefits. The Department is employing the data in its effort to produce comparable estimates within its energy R&D programs to inform budget decision. EERE is working with OMB, the other applied R & D programs,

and the PMA Budget and Performance Integration principals in the department to establish an increasingly integrated and consistent framework to inform the budget process.

Funding by General and Program Goal

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
General Goal 4, Energy Security			
Program Goal 04.59.00.00, Distributed Energy Resources			
Distributed Generation Technology Development	39,497	39,322	35,485
End-Use System Integration and Interface	19,676	20,571	20,500
Technical/Program Management Support.....	511	523	644
Total, Program Goal 04.59.00.00, Distributed Energy Resources.....	59,684	60,416	56,629
Total, General Goal 4 (Distributed Energy Resources).....	59,684	60,416	56,629

Expected Program Outcomes

The DER Program pursues its mission through integrated activities designed to improve the energy efficiency and productivity of our economy, as well as providing opportunities for local development of domestic renewable resources. We expect these improvements to reduce susceptibility to energy price fluctuations and potentially lower energy bills; reduce EPA criteria and other pollutants; enhance energy security by increasing the production and diversity of domestic fuel supplies; and provide greater energy security and reliability by improving our energy infrastructure. In addition to these "EERE business-as-usual" benefits, realizing the DER Program goals will provide the technical potential to reduce conventional energy use even further through increased efficiency.

Estimates of annual non-renewable energy savings, energy expenditure savings, carbon emission reductions, natural gas savings, and distributed electricity capacity additions that result from the realization of DER Program goals are shown in the table below through 2025. Not all kilowatt-hours (kWh) of electricity have equal value to consumers. Market experience suggests that at least a portion of consumers are willing to pay more for electricity that is more reliable, of higher quality, locally controllable, available during emergency, and/or cleaner. As well, these distributed technologies may be useful in meeting local clean air attainment requirements. As a result, these benefit estimates are likely based on an underestimate of the demand for these products under baseline market assumptions. In addition, these estimates do not account for the synergies between improved DER technologies and end-use applications of those technologies being developed by other EERE programs.

The assumptions and methods underlying the modeling efforts have significant impact on the estimated benefits, and results could vary significantly if external factors, such as future energy prices, differ from the "baseline case" assumed for this analysis. EERE's baseline case is essentially the same as the EIA "business-as-usual" case presented in its Annual Energy Outlook. In addition, possible changes in public policy and disruptions in the energy system which may affect estimated benefits are not modeled. The external factors such as unexpected changes in competing technology costs, identified in the Means and Strategies section above, could also affect the Program's ability to achieve its goals.

The results shown in the long term benefits tables are preliminary estimates based on initial modeling of some of the possible program production technologies; nonetheless, they provide a useful picture of the potential change in national benefits over time if the technology, infrastructure and markets evolve as expected. Estimated benefits which follow assume that individual technology plans and market assumptions obtain. Final documentation is estimated to be completed and posted by March 31, 2005. Uncertainties are larger for longer term estimates. A summary of the methods, assumptions, and models used in developing these benefit estimates that are important for understanding these results are provided at www.eere.energy.gov/office_eere/budget_gpra.html.

FY 2006 GPRA Benefits Estimates for the Distributed Energy Resources Program[a]

Mid-Term Benefits[b]	2010	2015	2020	2025
Primary nonrenewable energy savings (Quads)	0.08	0.13	0.28	0.25
Carbon emission reductions (MMTCE)	2	6	12	11
Natural gas savings (Quads)	-0.01	-0.21	-0.42	-0.42
Program specific electric capacity (GW)	7	34	53	64

[a] Benefits reported are annual, not cumulative, for the year given. Estimates reflect the benefits expected from program goals based on the program activities that would be possible at levels consistent with assumptions in the FY 2006 Budget..
[b] Mid-term program benefits were estimated utilizing the GPRA06-NEMS model, based on the Energy Information Administration's (EIA) National Energy Modeling System (NEMS) and utilizing the EIA's Annual Energy Outlook (AEO) 2004 Reference Case.

Distributed Generation Technology Development

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Distributed Generation Technology Development					
Industrial Gas Turbines	3,950	2,958	2,500	-458	-15.5%
Microturbines	6,704	6,201	5,685	-516	-8.3%
Advanced Reciprocating Engines	13,408	13,608	10,000	-3,608	-26.5%
Technology Based – Advanced Materials and Sensors	7,999	9,150	8,300	-850	-9.3%
Fuel Combustion (formerly Fuel Flexibility)	0	739	1,000	+261	+35.3%
Thermal Energy Technologies (formerly Thermally Activated Technologies)	7,436	6,666	8,000	+1,334	+20.0%
Total, Distributed Generation Technology Development	39,497	39,322	35,485	-3,837	-9.8%

Description

The mission of the Distributed Generation Technology Development Subprogram is to improve the energy and environmental performance of distributed technologies so that the Nation can have more energy choices to achieve a more flexible and smarter energy system. The Technology Development area focuses on a portfolio of electricity generation technologies as well as heat utilization technologies and focuses on efficiency, emissions, RAMD (reliability, availability, maintainability and durability) and cost targets.

Benefits

This subprogram provides the high-risk R&D on technology development such as combustion, materials, system design, thermal recovery and failure analysis to develop the next generation high-efficiency, low emission technologies for industrial gas turbines, microturbines, and reciprocating engines as well as thermally activated technologies. The program is developing a better understanding of fluid dynamics, the combustion and flame stability process, heat/mass transfer, materials processing and system design. Balancing the need for near-zero NO_x emissions, high-efficiency at a low-cost is a challenge that goes beyond incremental improvements. By improving the efficiency of thermally driven energy systems and advancing the efficiency and emissions characteristics of power generation technologies, the Distributed Generation Technology Development Subprogram provides the building blocks necessary to develop advanced integrated systems envisioned in the program goal. Indicators of progress toward achieving this goal include measures of emissions and efficiency, as set out below:

Historic and Planned Results (verified by rig or prototype engine testing)

(Percent/Low Heating Value)

Efficiency	Historic				Planned			
	2001	2002	2003	2004	2005	2006	2007	2008
Microturbines								
Target	28	--	33	33	35	--	--	37
Actual	28	--	33	34	--	--	--	--
Reciprocating Engines								
Target	38	--	39	42	44	44	44	47
Actual	38	39	39	43	--	--	--	--

(lb/MWh)

Emissions	Historic				Planned			
	2001	2002	2003	2004	2005	2006	2007	2008
Industrial Turbines								
Target	0.35	--	--	0.25	--	0.18	--	0.15
Actual	0.35	0.35	0.35	0.30	--	--	--	--
Microturbines								
Target	0.70	--	0.30	--	--	--	--	0.15
Actual	0.70	0.50	0.40	0.30	--	--	--	--
Reciprocating Engines								
Target	3.10	--	--	--	1.50	--	--	0.15
Actual	3.10	3.10	3.10	1.60	--	--	--	--

Detailed Justification

(dollars in thousands)

FY 2004	FY 2005	FY 2006

Industrial Gas Turbines..... **3,950** **2,958** **2,500**

Industrial gas turbines are used in many industrial and commercial applications ranging from 1MW to 20MW. A key effort in the Industrial Gas Turbine research has been to enhance the efficiency and environmental performance of gas turbines for applications up to 20MW. The focus of this effort is to advance materials research, such as composite ceramics and associated environmental barrier coatings, which will continue to improve performance and durability. This builds upon previous research to test and demonstrate innovative high temperature materials such as prime reliant coatings, silicon carbide/silicon carbide fiber composites, oxide composites, and silicon nitride ceramics. The turbine strategy is to selectively test various ceramic turbine components (blades, vanes, nozzles, injector tips, shrouds and combustor liners) and document performance and durability. Efficiency gains can be achieved with materials like ceramics, which allow a significant increase in engine operating temperature and reduce cooling air. This research builds on prior year efforts which focused on developing combustor liners, blades and vanes. Recent data has revealed that water vapor in gas turbine environments corrodes ceramics. Water-vapor attack on the ceramics has moved this research to increasingly focus on environmental barrier coating activities. Endurance testing activities of monolithic ceramic blades and vanes for industrial gas turbine components were discontinued leading the program to focus on more basic ceramic environmental barrier coating development research.

The research activities build on material performance data from the planned FY 2005 field test of ceramic composite shrouds as well as continued long-term testing of coated ceramic composite combustor liners. The composite shroud test data will document the performance gains and benefits of ceramic shroud technology, leading the program to continue long-term viability testing ceramic of ceramic composite components. These activities support a long-term high risk objective to conduct an all ceramic hot section in an industrial gas turbine at 2400 degrees F.

Building on the demonstration of low emissions technology in FY 2005 (0.25lbs/MWhr), long-term viability testing will continue in FY 2006 showing greatly reduced NO_x and CO produced without negatively impacting turbine performance. Turbine performance and emissions reduction benefits will be documented. The long-term goal of the activity is to achieve less than 0.15 lb/MWh in NO_x emissions by 2008. Continuation of the investigation on low emission measuring technologies is necessary due to the inability of conventional flue-gas emissions monitoring systems' to accurately measure low concentrations of pollutants (particularly nitrogen oxides). Building on the alternative NO_x prevention technologies and field test results from FY 2005, FY 2006 will provide a strategic evaluation of several advanced materials and low emissions technology paths to meet the FY 2008 goal.

Continue efforts to lower the manufacturing costs and enhancing the durability of ceramics, environmental barrier coatings and low emission combustion systems, and combustor designs for gas turbines. FY 2006 research will investigate new technology paths for improved turbine performance.

(dollars in thousands)

FY 2004	FY 2005	FY 2006

Research technology attributes will be compared to competing technologies to assess and quantify expected benefits and market acceptance. Additionally, DOE is closing out activities on thermal barrier coatings based on manufacturers' interest to invest in proprietary coatings. *Participants: Alzeta, Argonne National Laboratory (ANL), Catalytica, California Energy Commission, General Electric Power System Composites (GEPSC), General Electric Corporate Research & Development, Goodrich Corporation, Oak Ridge National Laboratory (ORNL), Precision Combustion, Inc., Siemens Westinghouse, Solar Turbines, United Technologies Research Center (UTRC), and Honeywell Engines and Systems.*

Microturbines..... **6,704** **6,201** **5,685**

Microturbines are a new type of combustion turbine for use in distributed energy generation applications. About the size of a refrigerator, microturbines produce 25 to 500 kW of energy and can be located on sites with limited space for power production. Waste heat recovery can be used in combined cooling, heating, and power (CHP) systems. Microturbines offer many advantages over other technologies for small-scale power generation, including the ability to provide reliable backup power, provide power for remote locations, and peak shave. Other advantages include less maintenance and longer lifetimes because of a small number of moving parts, compact size, lighter weight, greater efficiency, lower emissions, and quick starting. Microturbines also offer opportunities to use waste fuels such as landfill gas. The microturbine research will lead a national effort to design, develop, test, and demonstrate a new generation of microturbines for distributed applications that are cleaner, more affordable, reliable, and efficient than products that are currently available. The goal of the microturbine research is to achieve 37 percent efficiency with less than 7 ppm NO_x (approximately 0.15 lb/MWh) at a competitive cost by 2008. Ultimately, the program seeks to demonstrate a microturbine with 40 percent efficiency.

Research in FY 2006 specifically will test key subsystems and components to validate engineering pathways such as bottoming cycles and high temperature microturbine hot section components incorporating ceramics to achieve microturbine system goals of 37 percent efficiency with single digit emission by 2008. Promising subsystems will be integrated into prototype engine test beds to determine operability, durability, and performance benefits. FY 2006 research will continue to investigate technology pathways to meeting low emission environmental targets including addressing issues with part-load performance and combustion sensitivities to fuel variations. Additionally, technology readiness and advancements will be evaluated with respect to current state of the art and end use applications. The contract on recuperator design and development has been closed out because of a lack of a supplier. In FY 2004, this activity was reduced by $210,000 for SBIR/STTR and transferred to the Science Appropriation. *Participants: Argonne National Laboratory (ANL), Capstone Turbine Corporation, California Energy Commission, Honeywell Engines and Systems (ES), Ingersoll-Rand, Oak Ridge National Laboratory (ORNL), Solar Turbines, Southern California Edison (SCE), United Technologies Research Center (UTRC), and General Electric Corporate Research & Development.*

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Advanced Reciprocating Engines	**13,408**	**13,608**	**10,000**

Gas-fired reciprocating engines offer a wide range of power generation at an economical cost over other technologies. With their operating flexibility, reciprocating engines can be used for many purposes, such as local power grid and substation support, peak-shaving, remote power, on-site generation, combined cooling, heating, and power (CHP) applications, high-density electric loads, standby power, and as mechanical drives used for compressors and pumps in industrial, commercial, institutional, and residential applications. The Advanced Reciprocating Engine System (ARES) will lead a national effort to design, develop, test, and demonstrate a new generation of gas-fired reciprocating engines for Distributed Energy applications that are cleaner, more affordable, reliable, and efficient than products that are commercially available today. The goal of the research is to achieve a 47 percent efficient reciprocating engine system with less than 0.15 lb/MWh of NO_x emissions at a competitive cost by 2008. Ultimately, the program seeks to achieve 50 percent efficiency.

Continue research in the ARES project (three prime contractors, National Laboratory activities and university consortium) to meet the program goals and will focus on critical system design needs to meet Phase 2 targets of 47 percent efficiency and 0.15 lb/MWh of NO_x. The program will build on the initial designs, research, and testing from Phase I. With assistance and guidance from industry, universities, and laboratory research, the effort will develop and integrate critical components to the engine platform. Efforts will focus on additional power density, parasitic reduction, advanced air handling systems, improved cylinder designs, and new ignition systems as well as exhaust gas recirculation (EGR). Investigation will continue on the viability of a novel natural gas-fired Homogeneous Charge Compression Ignition (HCCI) (closed-loop controllers) and modified HCCI combustion systems, to meet the 50 percent efficiency target and reduce NO_x considerably. This research will benefit from the synergies of the program's cooperative efforts with the Vehicle Technologies program, which focuses on diesel and gasoline HCCI research. The university projects will continue to focus on ignition processes in large engines using laser and spark ignition, low engine friction technology for ignition improvement for lean gas mixtures, parasitic loss control through surface modification, reduced engine friction and wear, selective NO_x re-circulation for stationary lean-burn natural gas engines, thermal management via active flow control, and two stage catalytic reduction of NO_x. Research environmental issues, distributed energy modeling and technology impacts will continue.

The free piston activities (rapid combustion generator) under the reciprocating engine program was dropped in FY 2005 because of its low ranking in the December 2003 peer review. In FY 2004, this activity was reduced by $420,000 for SBIR/STTR and transferred to the Science Appropriation. *Participants: Argonne National Laboratory (ANL), Caterpillar, Colorado State University, Cummins Engine Co., Inc, Los Alamos National Laboratory (LANL), Massachusetts Institute of Technology, Michigan Technological University, National Energy Technology Laboratory (NETL), Northwestern University, Oak Ridge National Laboratory (ORNL), Ohio State University, Pacific Northwest National Laboratory (PNNL), Purdue University, Sandia National Laboratory (SNL), University of Southern California (USC), University of Tennessee, University of Texas at Austin, Waukesha Engine, Dresser, Inc., and West Virginia University.*

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Technology Based – Advanced Materials and Sensors. . . .	**7,999**	**9,150**	**8,300**

Advanced materials, such as ceramics and environmental barrier coatings and sensors are some of the key enabling technologies for heat exchangers (recuperation), combustion (combustor liners, spark plugs), and operation of stationary industrial gas turbines, microturbines and reciprocating engines to improve the efficiency and reduce emissions. Engineered ceramics, such as ceramic matrix composites offer all of the advantages of ceramics-resistant to heat, corrosion, erosion, and chemical activity-while adding strength and thermal shock resistance that conventional ceramics do not demonstrate. Unfortunately, ceramics are prone to water vapor attack and degradation. Building on work begun in FY 2005 to fundamentally understand recession in ceramics due to this water-vapor attack, characterization of environmental barrier coatings (adherence and quality) will continue through material property testing and microscopic analysis. Activities will continue to focus on developing partnerships with industry to utilize National Laboratory specialized technical skills and facilities to further understand, analyze and develop advanced material and sensor solutions to increase performance, reduce emissions and enhance reliability, availability, maintainability and durability of distributed generation technologies. Activities also focus on gaining further understanding of the fundamental science around high-temperature corrosion and erosion and developing engineering solutions to mitigate the issues.

Continue work with microturbine manufacturers and metal suppliers to develop and characterize advanced recuperator materials to operate at higher temperature with long term durability. Continue testing and evaluation of ceramic components and associate environmental barrier coatings to determine structure-property relationships during exposure in gas turbine environments. Continue evaluation of spark plug corrosion in partnership with the engine manufacturers. Initiate additional activities utilizing National Laboratories capabilities related to turbines, microturbines and engines. In FY 2004, this activity was reduced by $156,200 for SBIR/STTR and transferred to the Science Appropriation. *Participants: Allegheny Ludlum, Argonne National Laboratory (ANL), Capstone Turbine Corporation, Connecticut Reserve Technology, LLC, Cummins Engine Co., Inc, Haynes International, Honeywell Engines and Systems, Ingersoll-Rand, Kennametal Inc., General Electric Power System Composites (GEPSC), and Oak Ridge National Laboratory (ORNL), Poco Graphite, Inc., Saint-Gobain Ceramics and Plastics, University of Dayton Research Institute (UDRI), United Technologies Research Center (UTRC), and Solar Turbines.*

Fuel Combustion (formally Fuel Flexibility).....	**0**	**739**	**1,000**

Based on a completed assessment of fuel issues and opportunities in FY 2005 and an evaluation of capabilities at the National Laboratory activities, the program will conduct a focused combustion solicitation to evaluate the long-term combustion technologies for low-emissions such as rich combustion, lean-burn combustion, and solonox, focusing on the next-generation of dual fuels (gaseous or liquid) such as propane, digester, land-fill methane, town gas, refinery gas, process natural gas, syngas, associated gas, natural gas liquids, raw natural gas and other variations. Laboratory research will evaluate fuel characteristics and affects of fuel variations on the distributed generation equipment for long-term availability and durability. No efforts in this activity will work on fuel development. *Participants: TBD.*

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Thermal Energy Technologies (formally Thermally Activated Technologies)	**7,436**	**6,666**	**8,000**

Thermal Energy Technologies use the recoverable heat from gas-fired systems and rejected/waste heat from industrial processes or electricity generation. These technologies provide important keys for achieving the overall efficiency benefits of distributed energy technologies by converting natural gas, exhaust, or rejected heat into useful energy services like heating, cooling, humidity control, thermal storage, or bottoming cycles. Utilizing thermal energy is an essential building block for CHP. The Thermal Energy effort facilitates research, development, testing, and integration of advanced heating, cooling, dehumidification, and refrigeration equipment.

The program will conduct and implement a new solicitation to develop industry partnerships on advanced thermal technologies (e.g. air-cooled absorption chillers and desiccants). Oak Ridge National Laboratory will continue research efforts on heat and mass transfer/heat exchangers. The National Renewable Energy Laboratory will continue to support the desiccant industry through testing at the thermal energy conversion laboratory and test a prototype air quality sensor. In FY 2004, this activity was reduced by $129,800 for SBIR/STTR and transferred to the Science Appropriation. *Participants: Ambian Climate Technologies, Carrier Corporation, Gas Technology Institute (GTI), Georgia Tech Research Institute (GTRI), Kathabar, Inc., Mississippi State University, Munters, National Renewable Energy Laboratory (NREL), Oak Ridge National Laboratory (ORNL), Trane, Rocky Research, University of Central Florida, York International, and United Technologies Research Center (UTRC).*

Total, Distributed Generation Technology Development	**39,497**	**39,322**	**35,485**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Industrial Gas Turbines	
The program is closing out the thermal barrier coating activities, as the program has reached the transition point wherein any further development of this technology is now within the capability of industry. The program management decision to close out this effort is consistent with management application of RDIC, as set out in Section 2e, and the PART recommendations. Section 2e of the RDIC addresses how well each plan incorporates "offramps" and "endpoints" in the research activity planning.	-458

	FY 2006 vs. FY 2005 ($000)
Microturbines	
The program is closing out the recuperator design and development project, as the program has reached the transition point wherein any further development of this technology is now within the capability of industry. The program management decision to close out this program is consistent with management application of Research Development Investment Criteria (RDIC), as set out in Section 2e, and the PART recommendations. Section 2e of the RDIC addresses how well each plan incorporates "offramps" and "endpoints" in the research activity planning.....	-516
Advanced Reciprocating Engines	
The program is reducing the scope of industrial contracts, as the program has reached the transition point where less cofunded work is necessary to achieve the program's objectives. The program management decision to begin ramping down this effort is consistent with management application of RDIC, as set out in Section 2e, and the PART recommendations. Section 2e of the RDIC addresses how well each plan incorporates "offramps" and "endpoints" in the research activity planning.	-3,608
Technology Based – Advanced Materials and Sensors	
The program is closing out the industrial research efforts in thermal barrier coatings, as the program has reached the transition point where the technology is sufficiently mature and additional composite coatings research will be of sufficiently proprietary in nature that any further development of this technology should be carried out by industry. The program management decision to transfer this research to industry is consistent with management application of RDIC, as set out in Section 2e, and the PART recommendations. Section 2e of the RDIC addresses how well each plan incorporates "offramps" and "endpoints" in the research activity planning.	-850
Fuel Combustion	
Increase to initiate focused solicitation on multi-fuel combustion activities for distributed generation technologies to meet efficiency goals with dual-fuels.....	+261
Thermal Energy Technologies	
Increased funding will support a new solicitation in partnership with industry on desiccants, air-cooled absorption chillers and other thermally-driven equipment	+1,334
Total Funding Change, Distributed Generation Technology Development.....	**-3,837**

End-Use System Integration and Interface

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
End-Use System Integration and Interface					
Distributed Energy Systems Applications Integration					
Distributed Energy Systems Applications Integration	7,026	7,751	8,500	+749	+9.7%
Congressionally Directed Activity, Distributed Energy Systems Applications Integration	988	986	0	-986	-100.0%
Subtotal, Distributed Energy Systems Applications Integration	8,014	8,737	8,500	-237	-2.7%
Cooling, Heating and Power Integration	11,662	11,834	12,000	+166	+1.4%
Total, End-Use System Integration and Interface	19,676	20,571	20,500	-71	-0.3%

Description

Distributed energy devices provide utilities and consumers with more choices and control over how their energy needs are met, and are essential for more openly competitive electricity and natural gas markets to flourish. The focus of the End-Use Integration and Interface activities is to develop highly-efficient integrated energy systems that can be replicated across end-use sectors which will help demonstrate a R&D objective or address a technical barrier.

Benefits

This subprogram develops the knowledge base and technologies necessary to integrate energy systems efficiently in end-use applications. The focus is on heat/mass transfer, air/fluid flows, optimizing performance, adaptive controls for building load management, and sensors/communications technologies for use with building energy systems. The End-Use System Integration and Interface Subprogram integrates the technologies developed in the Distributed Generation Technology Development Subprogram into the efficient packaged systems envisioned in the program goal. An indicator of the progress toward achieving this goal is the number of successful integrated system demonstrations, on the following chart:

Historic and Planned Results

Cumulative # Successful Demonstration	Historic				Planned			
	2001	2002	2003	2004	2005	2006	2007	2008
Target	0	0	0	0	1	--	2	3
Actual	0	0	1	1				

Detailed Justification

(dollars in thousands)

FY 2004	FY 2005	FY 2006

Distributed Energy Systems Applications Integration **8,014** **8,737** **8,500**

- **Distributed Energy Systems Applications Integration** . . **7,026** **7,751** **8,500**

This activity facilitates acceptance of distributed energy resources (DER) in end-use sectors by forming partnerships with industry consortiums in the light industrial, supermarkets, hospitality, education and healthcare sectors. These industries represent a high potential for DER due to the high reliability and power quality requirements and related large cooling loads. Projects include development of decision and design tools and integration of DER technologies at customer sites to meet power and thermal needs and quantify value (such as energy and emissions benefits, installation and retrofit costs and high efficiency, reliability, etc.). Results from these assessments are disseminated as information and education materials among the industries, utilities and States.

Projects will continue from the FY 2004 solicitation (healthcare, supermarkets, hotels and education sectors) and progress in FY 2006. Each project will 1) quantify the energy and emissions benefits and installation and retrofit costs, and other benefits; 2) research integration issues and recommend improvements for developing a 70 percent model efficiency system; and 3) correlate data to analytical models and tools for end use customers. Research will include activities on electronics and supervisory control strategies to better optimize electrical and thermal needs and synchronize with the grid.

R&D issues in using distributed energy as a resource for upgrading and supporting the distribution system to improve capacity will be investigated. Work will be initiated with the distribution system operators to resolve technical issues. Existing building interface issues will be evaluated to understand the electrical boundaries for distributed technologies, working in cooperation with the grid (e.g. actions required by the distributed technologies in response to grid disturbances). The high-tech industry (data centers) activities will be closed-out due to low scoring from the peer review and closure of one contract. Based on recommendations from the December 2003 peer review the end-use integration activities will be prioritized by “market sectors” vs. individual projects.

Activities will continue in the Regional Offices in support of Distributed Energy focusing on regionally specific technology and market issues such as interconnection standards, market design

(dollars in thousands)

FY 2004	FY 2005	FY 2006

(rate structures) that will support replication of distributed technologies. In FY 2004, this activity was reduced by $220,000 for SBIR/STTR and transferred to the Science Appropriation. *Participants: American Gas Association, Capstone Turbine Corporation, Energy Solutions Center, Exergy Partners, Gas Technology Institute (GTI), New York State Energy Research and Development Authority (NYSERDA), National Accounts Energy Alliance, Oak Ridge National Laboratory (ORNL) and the National Renewable Energy Laboratory.*

- **Congressionally Directed Activity, Distributed Energy Systems Application Integration** **988** **986** **0**

  National Accounts Energy Alliance (FY 2004 $987,640).

Cooling, Heating and Power (CHP) Integration **11,662** **11,834** **12,000**

Cooling, Heating and Power Integration (CHP) reduces energy costs and emissions by using energy resources more efficiently. In conventional conversion of fuel to electricity, over two-thirds of the energy input is discarded as heat to the environment and not used for productive purposes. CHP makes greater use of fuel inputs by utilizing the discarded heat with system potential efficiencies ranging from 60 to 80 percent. The industry's CHP Program goal, which DOE is supporting, is to double the capacity of CHP in the United States to 92 GW by 2010 and develop and test CHP packages for integration into overall building system design. Using the viable heat energy rejected from the making of electricity, high efficiencies can be achieved and package technologies can be integrated and optimized for end-use application. By capturing and using this rejected heat energy, these packaged systems could achieve efficiencies greater than 70 percent. The National CHP Roadmap will be used to guide the program's activities in the areas of raising awareness, eliminating environmental barriers and developing market and technology tools (analytical modeling and design of CHP systems. The activity will continue support of the Regional Application Centers and educational programs under the State Energy Programs (special projects). Specifically, these Regional Application Centers will promote and disseminate information on CHP and assist in implementation of CHP projects in the region. The program will develop a Regulatory Requirements Database for Small Electric Generators, develop a CHP emissions calculator, and develop an electric rate primer to assist in eliminating regulatory and institutional barriers. The program will also baseline CHP installations and markets and asses the technical and economic potential of CHP in specific markets and regions. Continue the development of case studies and evaluation of existing distributed generation site demonstration projects including landfills and other gaseous fuels to document technology issues, market issues and policy issues. Continue to analyze emissions data and emissions credits for CHP and propose guidance for future standards. Develop models for integration of CHP equipment to predict and optimize performance and thermal output. Continue to support the Regional Office's efforts on emission standards. The data and information from these activities will be disseminated at the national and regional levels to aid in the installation of CHP facilities as well as available on the web. These projects will increase awareness of and confidence in CHP technologies including their benefits in efficiency and emissions.

(dollars in thousands)

FY 2004	FY 2005	FY 2006

Continue combined heat and power research and development of a skid mounted packaged combined heat and power product referred to as an Integrated Energy System. These technologies will be engineered at the factory, not on-site. Building on previous research, the CHP activity will complete the six phase I projects including demonstrations at Ft. Bragg, North Carolina and Austin, Texas, down-select and continue phase II efforts through FY 2006. These efforts will focus on tighter packaging (less energy loss, lower installed cost, improved operability and reliability), increased thermal optimization, modularity (including the design of a family of products for wider range of sizes) and smaller footprint. Testing and data collection will continue through FY 2006. In parallel, some contracts will progress on to Phase II, which entails fabrication of upgraded systems incorporating changes received from testing and evaluation. Systems range from 60kW to 5.2 megawatt gas fired turbines using recoverable energy delivered to absorption chiller in the 20 to 2500 RT chillers and liquid or solid desiccant systems. One project couples the recoverable heat from a 500W internal combustion engine to an ammonia/water absorption unit for supermarket cold storage or frozen food cases. A computer model is being developed that will assist companies in the design, energy analysis, and cost of CHP systems.

Based on four studies completed on FY 2005, evaluate go/no-go decision based on market/technology performance and economic criteria on microCHP package residential systems to continue to Phase II, system design. Decision to proceed will be based on cost-effectiveness, efficiency, market potential and the ability to mass-manufacturer. In FY 2004, this activity was reduced by $189,860 for SBIR/STTR and transferred to the Science Appropriation. *Participants: American Council for Energy Efficient Economy (ACEEE), American Gas Association (AGA), Broad USA, Burns & McDonnell, Capstone Turbine Corporation, Carrier Corporation, Caterpillar, Cummins, Distributed Utility Associates. Energy and Environmental Analysis, Inc. (EEA), Energetics, Energy Concepts Co., LLC, Exergy Partners, Gas Technology Institute, Honeywell Laboratories, I C Thomasson Associates, Inc., Ingersoll-Rand, International District Energy Association (IDEA), Northeast-Midwest Institute (NEMW), NiSource, Oak Ridge National Laboratory (ORNL), Resource Dynamics, Solar Turbines, TIAX, Trane, United Technologies Research Center (UTRC), University of Maryland, University of Chicago – Illinois, California Energy Commission, University of California-Berkley, University of California- Irvine, San Diego State University, New York State Energy Research and Development Authority (NYSERDA), Pace University, University of Massachusetts-Amherst, Rutgers University, West Virginia University, US Combined Heat and Power Association, Washington State University, and Waukesha Engine, Dresser, Inc.*

Total, End-Use System Integration and Interface	**19,676**	**20,571**	**20,500**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Distributed Energy Systems Applications Integration	
▪ **Distributed Energy Systems Applications Integration**	
The increase in funding will support building cooling, heating and power integration systems research on electronics and electrical testing to better manage electrical and thermal needs. Increased emphasis on systems work was recommended in OMB's evaluation of DER's PART scores, and this decision is consistent with the R&D Investment Criteria, section 2a. Section 2a of the RDIC addresses how well each plan builds on existing technology and complements related R&D activities..	+749
▪ **Congressionally Directed Activity, Distributed Energy Systems Applications Integration**	
Complete Congressionally-directed activity and focus on activities contributing to program goals	-986
Total, Distributed Energy Systems Applications Integration	**-237**
Cooling, Heating and Power Integration	
The increase in funding will support additional work at the regional application centers and augment integrated micro-CHP systems work.	+166
Total Funding Change, End-Use System Integration and Interface	**-71**

Technical/Program Management Support

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Technical/Program Management Support	511	523	644	+121	+23.1%
Total, Technical/Program Management Support	511	523	644	+121	+23.1%

Description

The addition of distributed energy resources as a power choice is a complex issue. This task forms the technical foundation that assists and guides the DER research activities to ensure relevance to the market. Markets, technology advances, and regulations are dynamic, and this task continually monitors available information and adjusts the program direction as necessary to be responsive.

Benefits

The Technical/Program Management Subprogram (TPMS) provides the analysis framework and technical support to meet the requirements of Department's planning process, Congress, GPRA, and PART (planning, management and purpose). This subprogram also analyzes program gaps and new R&D opportunities. This planning and management analysis is necessary to keep the program's research agenda on target to meet the program goal in the face of dynamic market and technology developments.

Detailed Justification

(dollars in thousands)

FY 2004	FY 2005	FY 2006

Technical/Program Management Support 511 523 644

The TPMS will support activities which are an integral part of the distributed generation technology development and end-use systems integration. Activities will include preparation of program strategic plans, multi-year plans, technology roadmaps, and operating plans, peer reviews, development of web-based technical information and technical workshop/conferences specific to Distributed Energy Resources Technology Development and End-Use Systems Integration, technical/program data collection (Corporate Planning System – CPS and related databases) and methodology to support DER performance goals, DER technology assessments and market status. This will also support analysis undertaken to address Government Performance and Results Act and the President's

(dollars in thousands)

FY 2004	FY 2005	FY 2006

Management Agenda requirements, including the Performance Assessment Rating Tool and the Research and Development Investment Criteria. *Participants include: Energetics, LBNL, BCS, and Sentech.*

Total, Technical/Program Management Support.	**511**	**523**	**644**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Technical/Program Management Support	
Increases will support analytical activities (e.g., New York and PJM) to document the costs and benefits of distributed generation/CHP as a resource to the grid system.....	+121
Total Funding Change, Technical/Program Management Support.....	**+121**

Building Technologies

Funding Profile by Subprogram[a]

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation[b]	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Building Technologies						
Residential Buildings Integration	12,937	16,800	16,800	18,311	+1,511	+9.0%
Commercial Buildings Integration	4,440	5,125	5,125	4,541	-584	-11.4%
Emerging Technologies	28,286	31,420	31,420	25,358	-6,062	-19.3%
Equipment Standards and Analysis	10,265	10,147	10,147	8,256	-1,891	-18.6%
Oil Heat Research for Residential Buildings	494	493	493	0	-493	-100%
Technical/Program Management Support	1,377	1,479	1,479	1,500	+21	+1.4%
Total, Building Technologies	57,799	65,464	65,464	57,966	-7,498	-11.5%

Public Law Authorizations:

P.L. 94-163, “Energy Policy and Conservation Act” (EPCA) (1975)
P.L. 94-385, “Energy Conservation and Production Act” (ECPA) (1976)
P.L. 95-91, “Department of Energy Organization Act” (1977)
P.L. 95-618, “Energy Tax Act” (1978)
P.L. 95-619, “National Energy Conservation Policy Act” (NECPA) (1978)
P.L. 95-620, “Power Plant and Industrial Fuel Use Act” (1978)
P.L. 96-294, “Energy Security Act” (1980)
P.L. 100-12, “National Appliance Energy Conservation Act” (1987)
P.L. 100-357, “National Appliance Energy Conservation Amendments” (1988)
P.L. 100-615, “Federal Energy Management Improvement Act” (1988)
P.L. 102-486, “Energy Policy Act” (1992)

[a] SBIR/STTR funding in the amount of $667,000 was transferred to the Science Appropriation in FY 2004. Estimates for SBIR/STTR budgeted in FY 2005 and FY 2006 are $728,000 and $588,000 respectively.
[b] Reflects the 0.594% and 0.80% rescissions of -$404,000 and -$542,000 respectively and comparability adjustment for National Energy Technology Laboratory Support of -$1,674,000.

Mission

The mission of the Building Technologies Program ("BT") is to develop technologies, techniques and tools for making residential and commercial buildings more energy efficient, productive, and affordable. The portfolio of activities includes efforts to improve the energy efficiency of building components and equipment, and their effective integration using whole-building-system-design techniques, the development of building codes and equipment standards, and integration of renewable energy systems into building design and operation.

Benefits

The Building Technologies Program supports DOE's goal to improve energy security by developing reliable, affordable and environmentally sound technologies that significantly reduce the energy consumption and peak electrical demands of residential and commercial buildings, which account for about two thirds of the electric energy consumption in the Nation, thereby enhancing the reliability and efficiency of the Nation's energy supply infrastructure, and therefore reducing potential grid failures at periods of system peak demand.

More detailed, integrated and comprehensive economic, energy and energy security benefits estimates are provided in the Expected Program Outcomes section at the end of the program level budget narrative.

Strategic and Program Goals

The Department's Strategic Plan identifies four strategic goals (one each for defense, energy, science, and environmental aspects of the mission) plus seven general goals that tie to the strategic goals. The Building Technologies Program supports the following DOE strategic and program goals:

Energy Strategic Goal: To protect our national and economic security by reducing imports and promoting a diverse supply of reliable, affordable, and environmentally sound energy.

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 Building Technologies Program has one program goal which contributes to General Goal 4 in the "goal cascade":

Program Goal 04.04.00.00: Building Technologies. The Buildings Technologies Program goal is to develop cost effective tools, techniques and integrated technologies, systems and designs for buildings that generate and use energy so efficiently that buildings are capable of generating as much energy as they consume.

Contribution to Program Goal 04.04.00.00 (Building Technologies)

The principal Building Technologies Program contribution to General Goal 4, Energy Security, is improving energy efficiency. Key technology pathways that contribute to achievement of the goal include:

- Residential Buildings Integration R&D Activities: Provide the energy technologies and solutions that will catalyze 70 percent reduction in energy use of new prototype residential buildings that when combined with onsite energy technologies result in Zero Energy Homes (ZEH)[a] by 2020 and 20 percent reduction in energy use of existing homes. By 2010, five design packages that can achieve an average of 40 to 70 percent reduction in whole house energy use and 20 percent reduction in existing buildings will be developed. Performance indicators include the number of: subsystem technological solutions developed, researched, and evaluated; design packages developed, researched, and evaluated against the Building America benchmark[b] for homes; design packages developed and number of existing homes retrofitted to achieve 20 percent or more improvement in energy efficiency; project and demonstration homes developed in the Building America (BA) Program; building code change proposals developed and submitted to code development bodies; and upgrades of Federal building codes completed.

- Commercial Buildings Integration R&D Activities: By 2010, develop five to seven technology packages that can achieve an average of 50 percent reduction in the purchased energy use in new, small commercial buildings relative to the International Energy Conservation Code (IECC). Performance indicators include the number of: technology packages developed, researched, and evaluated on their demonstrated potential to contribute to a 50 percent reduction of energy use in new buildings; building code change proposals developed and submitted to code development bodies; and upgrades of Federal building standards issued.

- Emerging Technologies (ET) Activities: Accelerate the introduction of highly-efficient technologies and practices for both residential and commercial buildings. The ET activities support the BT goal through research and development of advanced lighting, building envelope, windows, space conditioning, water heating and appliance technologies. Without advanced components and subsystems developed in the Emerging Technologies activities, the goal of zero energy buildings will not be met. The performance indicators include the number of potentially market viable technologies demonstrated and patents awarded.

- Equipment Standards and Analysis: Increase minimum efficiency levels of buildings and equipment through codes, standards, and guidelines that are technologically feasible, economically justified, and saves significant energy. By 2010, issue 13 formal proposals, consistent with enacted law, for enhanced product standards and test procedures. Performance indicators include: product standards and test procedures proposed/issued; and analyses completed for labeling and ENERGY STAR® update and expansion to include new products.

[a] The Zero Energy Building (ZEB) (referred to as Zero Energy Homes (ZEH) in the residential sector) research initiative is bringing a new concept to homebuilders across the United States. A Zero Energy Home combines state-of-the-art, energy efficient construction and appliances with commercially available renewable energy systems such as solar water heating and solar electricity. This combination can result in a net zero energy consumption. A ZEH, like most houses, is connected to the utility grid, but can be designed and constructed to produce as much energy as it consumes on an annual basis. With its reduced energy needs and renewable energy systems, a ZEH can, over the course of a year, give back as much energy to the utility as it takes.

[b] Building America Benchmark, Version 3.1, November 2003, National Renewable Energy Laboratory

Annual Performance Results and Targets

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Results	FY 2005 Targets	FY 2006 Targets
Program Goal 04.04.00.00 (Building Technologies)					
Residential Buildings Integration					
With Building America Partners, complete 3,000 energy-efficient environmentally sound high performance homes. [EXCEEDED GOAL]	Building America complete 1,700 homes in Fiscal Year 2002, bringing the total number of homes built through the program to more than 5,350. More homes were built than the original goal due to increased program success, increased program efficiency, increased builder participation, and reduced lead times to house completion. [MET GOAL]	Pursue six promising technical solutions considering regional and housing type differences targeting 40 percent reductions in residential space conditioning, hot water, and lighting loads. Based on Building America systems research results, develop regional Building System Performance Packages for five climate zones describing "best practice" systems that reduce space conditioning energy use by 30 percent. [MET GOAL]	Initiate 5 design packages that provide promising technological solutions considering regional and housing type differences targeting 40 - 50 percent reductions in residential space conditioning loads, compared to IECC 2003, through Building America Consortia. Strategies to reduce the major loads, including energy used for hot water, lighting and clothes dryers were also investigated. [MET GOAL]	Complete the research for production-ready new residential buildings that are 30% more efficient than the whole-house Building America benchmark in 2 climate zones and document the results in Technology Package Research Reports.	Complete the research for production-ready new residential buildings that are 30% more efficient in 3 climate zones and 40% more efficient in one climate zone than the whole-house Building America benchmark and document the results in Technology Package Research Reports.
	Publish one proposal for upgrade to the Federal Residential Buildings codes. [NOT MET]			Analyze and develop code change proposals that are expected to result in a cost-effective improvement in energy efficiency in residential buildings of approximately 1-2 percent.	Analyze and develop code change proposals that are expected to result in additional cost-effective improvement in energy efficiency in residential buildings of approximately 1-2 percent compared to IECC 2003.

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Results	FY 2005 Targets	FY 2006 Targets
Commercial Buildings Integration					
N/A	The draft framework from the High Performance Building Roadmap was tested multiple times with actual building design projects in FY 2002. Draft guides for achieving low-energy commercial buildings were reviewed, and final guidelines were published in early FY 2003. [MET GOAL]	Facilitate a 10 percent increase in commercial building designs that have meaningful consideration of energy efficiency by developing improved design tools, including code compliance tools, and completing six research assisted design case studies in cooperation with industry. [MET]		Complete assessments of controls technology, optimization methods and market opportunities, with substantial input from designers and building owners, to establish a framework for development of programmatic pathways to achieve 50 percent or better energy performance in significant numbers of buildings enabling development of design and/or technology packages for new commercial buildings.	Complete the development of one design technology package to achieve 30 percent or better energy savings, focusing on a single, high priority building type, such as small commercial retail or office buildings, based on the technical and market assessments completed in 2005.
	All supporting documents for commercial codes including the draft Notice of Proposed Rule are in the General Counsel's office of DOE for concurrence. Preliminary concurrence from various agencies and FEMP has been obtained. Federal code staff work has been completed; significant comment response and redesign and timing of review currently underway by general counsel may result in delay for publication by one quarter. [NOT MET]			Analyze and develop code change proposals that are expected to result in a cost-effective improvement in energy efficiency in commercial buildings of approximately 1-2 percent	Analyze and develop code change proposals that are expected to result in a cost-effective improvement in energy efficiency in commercial buildings of approximately 1-2 percent.

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Results	FY 2005 Targets	FY 2006 Targets
Emerging Technologies					
	Seven research areas were completed. Specific research projects include: energy performance of insulated, unvented attics; development of low cost wood shear panels; energy impacts of ICS (Integral Collector Storage) solar domestic hot water preheat systems; evaluation of mixing performance of residential mechanical ventilation systems; development of high performance affordable housing; evaluation and mitigation of moisture problems in manufactured housing; evaluation of dehumidification systems for residential buildings; and evaluation of low energy buildings with onsite power generation systems. [MET GOAL]		Complete a solicitation and award five or more competitively based research awards for cost-shared research on technology (such as materials and light extraction) to contribute to the goal of 160 lumens/Watt (lm/W) and $11/Klm of white light from solid-state devices with industry, National Laboratories, and universities. [MET GOAL]	Select five new competitively based research awards for cost-shared research on technology (such as optical materials and device structures) to achieve ≥65 lm/W white light from solid-state devices with industry, National Laboratories, and universities.	Conduct selected competitively cost-shared research on technology to achieve ≥ 65 1m/W (in a laboratory device) of white light from solid state devices with industry, National Laboratories, and universities.
WINDOW 5 was released and approved by NFRC; algorithms were adopted as an International Standards Organization (ISO) standard. [MET GOAL]	WINDOW version 5.1 was released to Industry on October 2, 2002 at a NFRC meeting. A Simulation Training Manual and an improved optics database editor (allows for the formulation of advanced glazings including laminated glass) were also released with Windows. An improved heat transfer model, THERM 5.0, was also released. The suite of programs allows for heat transfer modeling of new designs that promote energy efficient product development at significantly lower cost than conventional prototype development. [MET GOAL]			Complete a prototype dynamic window that will have a Solar Heat Gain Coefficient (SHGC) in the range of 0.05 to 0.60 , while meeting American Society for Testing and Materials (ASTM) durability standards for cycling in a high temperature, high ultraviolet light environment.	Fabricate and demonstrate operation of a prototype of an integrated dynamic super insulating window with the following properties: U Factor ≤ 0.20, dynamic SHGC range of 0.05 to 0.60 that is verified in accordance with standard National Fenestration Rating Council (NFRC) tests.

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Results	FY 2005 Targets	FY 2006 Targets
Completed Phase I field demonstrations of heat pump water heaters, with utility partners. [MET GOAL]	Concluded field demonstrations of heat pump water heaters with utility partners. Data was collected from 16 units over a year. Data analysis was performed and a draft report was produced in June. [MET GOAL]	Complete investigation of 5 methods to increase the optimum selection of equipment components for air conditioning and heat pumps. [MET GOAL]		Complete a thermodynamic study of emerging refrigerants. Based on study results, make go/no-go decision on initiation of first stage development of a laboratory prototype, high efficiency residential 1-ton air-conditioning and heat pump unit that uses a novel approach to the vapor compression refrigeration cycle and has the potential for a Seasonal Energy Efficiency Ratio (SEER) of over 20.	Develop initial prototypes of 2-3 design concepts that have the long term potential to reduce annual HVAC energy consumption by 50 percent in new residential buildings.
Equipment Standards and Analysis					
Issued three proposals for upgrades and three upgrades to appliance standards and test procedures. [MET GOAL]	Two proposals for appliance standard upgrades have resulted in Final Rules. The Residential Central Air Conditioner and Heat Pump, and the Final Rule for Dishwasher Test Procedure for Non-Sensor type machines were issued in the Federal Register in May 2002. [MET GOAL]	Conduct 4 rulemakings to amend appliance standards and test procedures. [MET LESS THAN 80 percent OF GOAL]	Prepare for issuance up to four rules to amend appliance standards and test procedures for some of the following products: Residential Furnaces, Boilers, and Mobile Home Furnances; Electrical Distribution Transformers; Commercial Unitary Air-Conditioners and Heat Pumps; and Residential Niche Product Air-Conditioners and Heat Pumps.	Complete analytical and regulatory steps necessary for DOE issuance of 3-4 rules, consistent with enacted law, to amend appliance standards and test procedures that are economically justified and will result in significant energy savings.	Complete analytical and regulatory steps necessary for DOE issuance of 4 rules, consistent with enacted law, to amend appliance standards and test procedures that are economically justified and will result in significant energy savings. Develop for DOE issuance notices of proposed rulemaking (NOPRs) regarding energy conservation standards for electric distribution transformers, commercial unitary air conditioners and heat pumps, and residential furnaces and boilers.
			Contributed proportionately to EERE's corporate goal of reducing corporate and program uncosteds to a range of 20-25 percent by reducing program annual uncosteds by 10 percent in 2004 relative to the program uncosted baseline (in 2003) until the target range is met.	*Contribute proportionately to EERE's corporate goal of reducing corporate and program uncosteds to a range of 20-25 percent by reducing program annual uncosteds by 10 percent in 2005 relative to the program uncosted baseline in 2004 ($33,417k) until the target range is met.*	*Contribute proportionately to EERE's corporate goal of reducing corporate and program adjusted uncosteds to a range of 20-25 percent by reducing program annual uncosteds by 10 percent in 2006 relative to the program uncosted baseline (2005) until the target range is met.* *Maintain total Program Direction costs in relation to total Program costs in the range of 8% - 12% to demonstrate efficient and effective EERE-*

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Results	FY 2005 Targets	FY 2006 Targets
					wide business and technical support to mission direct programs.

Means and Strategies

The Building Technologies Program will use various means and strategies, as described below, to achieve its program goals. "Means" include operational processes, resources, information, and the development of technologies, and "strategies" include program, policy, management and legislative initiatives and approaches. Various external factors, as listed below, may impact the ability to achieve the program's goals. Collaborations are integral to the planned investments, means and strategies, and to addressing external factors.

The Department will implement the following means:

- The Residential Buildings Integration subprogram focuses on improving the efficiency of the approximately 1.5 to 2.0 million new homes built each year and the 100+ million existing homes, including multifamily units. These improvements are accomplished through research, development, demonstrations, and technology transfer strategies. This includes efforts to improve the energy efficiency of residential energy uses such as space heating and cooling, ventilation, water heating, lighting, and home appliances. It includes support for the development of residential building codes and standards to enable application of whole building design techniques. These activities support efforts to develop strategies to integrate solar energy applications and other renewable technologies into buildings and the concept for Zero Energy Buildings. Outputs from the subprogram include design technology packages, which represent research results achieving a level of performance, and derived from these are the Builder Best Practices Manuals, tailored for specific climate regions;
- The Commercial Buildings Integration subprogram addresses energy savings opportunities in new and existing commercial buildings ($254 billion spent annually for new capital construction and $113 billion for renovation). This includes research, development and demonstration of whole building technologies, design methods and operational practices. Technology development efforts focus on cross-cutting, whole building technologies such as sensors and controls and more energy efficient ventilation systems. This also includes efforts to improve commercial building energy codes and standards. These efforts support the net Zero Energy Buildings goal not only by reducing building energy needs, but also by developing design methods and operating strategies which seamlessly incorporate solar and other renewable technologies into commercial buildings;
- The Emerging Technologies subprogram conducts R&D and technology transfer associated with energy-efficient products and technologies, for both residential and commercial buildings. These efforts address high-impact opportunities within the multitude of building components such as lighting, building envelope technologies including advanced windows, and new designs for appliances, and analysis tools and design strategies. Efficiency advances for this equipment will support the BT goal; and
- The Equipment Standards and Analysis subprogram leads to improved efficiency of appliances and equipment by conducting analyses and developing standards that are technologically feasible and economically justified, under the Energy Policy and Conservation Act, as amended (EPCA). Analysis performed under this program will support related program activities such as ENERGY STAR®, to ensure a consistent methodology is used in setting efficiency levels for each related program.

BT's challenge is to bring the appropriate strategies to bear to exploit the opportunities, while designing programs that give appropriate consideration to the marketplace and barriers to energy efficiency. To accomplish this, the Building Technologies Program will implement the following strategies:

- Modernize the R&D portfolios to ensure that the most promising, revolutionary technologies and techniques are being explored, and align the Residential and Commercial Integration subprograms to a vision of zero net energy buildings, and appropriately exit those technologies that are sufficiently mature or proved to the marketplace, and close efforts where investigations prove to be technically or economically infeasible ("off ramps");
- Use a "whole buildings" approach to energy efficiency that takes into account the complex and dynamic interactions between a building and its environment, among a building's energy systems, and between a building and its occupants. This approach has achieved energy savings of 30 percent beyond those obtainable by focusing solely on individual building components, such as energy-efficient windows, lighting, and water heaters;[a]
- Develop technologies and strategies to enable effective integration of energy efficiency and renewable energy technologies and practices;
- Increase minimum efficiency levels of buildings and equipment through codes, standards, and guidelines that are technologically feasible and economically justified. BT develops standards through a public process and submits codes proposals to IECC and ASHRAE;
- The management strategy for developing affordable net Zero Energy Buildings requires a high level of coordination with other programs in the Office of Energy Efficiency and Renewable Energy. These include the Solar Energy Technology Program and the Distributed Energy Resources Program. In addition, the Biomass Program, Wind and Hydropower Technologies Program, Geothermal Technologies Program, and Hydrogen, Fuel Cells and Infrastructure Technologies Program have important technologies to contribute. The Building Technologies Program also invests in technical program and market analysis and performance assessment in order to direct effective strategic planning.

These strategies will result in significant cost savings and a significant reduction in the consumption of energy across building fuel types—increase the substitution of clean fuels—cost effectively reducing America's demand for energy, lowering carbon emissions, and decreasing energy expenditures.

The following external factors could affect Building Technologies' ability to achieve it strategic goal:

- There are several factors that interfere with the private sector making R&D investments in energy efficient building technologies. These include a fragmented industry comprised of thousands of builders and manufacturers, none of which has the capacity to sustain research and development activities over multi-year periods.

[a] Building Science Corporation, Final Report: Lessons Learned from Building America Participation, February 1995 – December 2002, February 2003, NREL/SR-550-33100

- Another factor is the compartmentalization of the building professions, in which architects and designers, developers, construction companies, engineering firms, and energy services providers do not typically apply integrated strategies for siting, construction, operations, and maintenance.[a]

In carrying out the program's mission, Building Technologies performs the following collaborative activities:

- Partnerships and cost share arrangements with industry and other Federal agencies become critical management tools that can build a critical mass to address these barriers.
- The program's management strategy involves four key elements: a customer-focused, team-based organization for greater accountability and improved results; collaboratively developed technology roadmaps to provide for a more integrated, customer driven R&D portfolio; greater competition in project solicitations to increase innovation and broaden research participation; and increased peer review to assure scientifically sound approaches.
- The program has developed six related road maps that are being updated and incorporated into the R&D portfolio: High Performance Commercial Buildings; Windows; Lighting (which includes a specific roadmap on solid state lighting); Building Envelope; Appliances and Controls; and Zero Energy Homes now part of the conservation budget.

Validation and Verification

To validate and verify program performance, the Building Technologies Program will conduct various internal and external reviews and audits. These programmatic activities are subject to continuing review by, for example, the Congress, the General Accounting Office, the Department's Inspector General, the U.S. Environmental Protection Agency, and state environmental agencies. The table below summarizes validation and verification activities.

Data Sources:	EIA Annual Energy Review (AER); Commercial Building Energy Consumption Survey (CBECS); Residential Energy Consumption Survey (RECS); and Annual Energy Outlook (AEO). U.S. Department of Commerce (DOC) Current Industrial Reports (CIR). Various trade publications. Information collected directly from Building Technologies performers or partners.
Baselines:	The following are key baselines used in the Building Technologies Program: ▪ New Residential Buildings (2003): Energy use varies by climate region, based on the Building America Benchmark[b]. Also, the program will focus on creating design technology packages to reduce energy consumption from this baseline. In 2004, 0 design technology packages at 30 percent energy savings relative to BA Benchmark. (For 2006, 0 at 40 percent energy savings relative to BA Benchmark). ▪ New Commercial Buildings Energy Use Intensity: Varies by climate region and building type (ASHRAE 90.1-2004). Baseline for 2003 design technology

[a] Scott Hassell, Anny Wong, Ari Houser, Debra Knopman, Mark Bernstein, RAND Corporation: *Building Better Homes: Government Strategies for Promoting Innovation in Housing,2003.*

[b] Building America, Building America Research Benchmark Definition, Version 3.1, November 11, 2003, National Renewable Energy Laboratory.

packages for 30 percent (zero) and 50 percent (zero), these are relative to (ASHRAE 90.1-2004).

- Solid State Lighting (2003): 30 lumens/Watt efficacy (solid state lighting whitelight).
- Windows (2003): 0.33 to 0.75 U-value (varies by region).
- Residential Heating and Cooling (2003): Average total heating and cooling system energy use, defined by reported consumption in EIA for commercial buildings and all existing buildings, and the Building America benchmark for new residential buildings, by climate region.
- New Residential Building Codes: 2003 International Energy Conservation Code (IECC), International Code Council.
- New Commercial Building Codes: ASHRAE 90.1-2004.

Frequency: Complete revalidation of assumptions and results can only take place every three to four years, due to the reporting cycle of two crucial publications: CBECS and RECS. However, updates of most of the baseline forecast and BT Program outputs will be undertaken annually.

Evaluation: In carrying out the program's mission, the Building Technologies Program uses several forms of evaluation to assess progress and to promote program improvement:

- Technology validation and operational field measurement, as appropriate
- Peer review by independent outside experts of both the program and subprogram portfolios
- Annual internal Technical Program Review of the Building Technologies Program
- Specialized program evaluation studies to examine process, impacts, or market baseline and effects, as appropriate
- Quarterly and annual assessment of program and management results based performance through Joule, R&D Investment Criteria, President's Management Agenda and Program Assessment and Rating Tool (PART) reviews
- Annual review of methods, and recomputation of potential benefits for the Government Performance and Results Act (GPRA)

Data Storage: EIA and DOC data sources are publicly available. Trade publications are available on a subscription basis. BT Program output information is contained in various reports and memoranda.

Verification: Calculations are based on assumptions of future market status, equipment or technology performance, and market penetration rates. These assumptions can be verified against actual performance through technical reports, market survey and product shipments.

Program Assessment Rating Tool (PART)

The Department implemented a tool to evaluate selected programs. PART was developed by 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. BT has incorporated feedback from OMB into its results based management strategy reflected in the FY 2005 Budget Request, and continues to improve performance along the lines suggested by the PART.

The FY 2004 PART review of the Building Technologies Program contained a recommendation to redirect existing funding for lighting R&D towards high-risk, high-payoff technologies that support the Department's proposed Solid State Lighting Initiative. In response to this recommendation, DOE in the FY 2005 budget request redirected $1.5M to solid-state lighting from existing lighting R&D and provided for an increase for Solid State Lighting R&D. Another PART recommendation suggested the development of adequate long-term and annual performance measures, and in FY 2004 the Building Technologies Program developed a multi-year program plan and annual operating plan that included these measures for FY 2005 with refinements and additional measures for FY 2006. The program continues to work with OMB to define meaningful annual performance measures.

The PART also recommended that the program participate in the development of a consistent framework for the Department to analyze the costs and benefits of its R&D investments, and apply this guidance to development of the FY 2006 budget. The program has provided the input the Department needs to improve consistency in the methods and assumptions used to estimate potential benefits. The Department is employing the data in its effort to produce comparable estimates within its energy R&D programs to inform budget decision. EERE is working with OMB, the other applied R&D programs, and the PMA Budget and Performance Integration principals in the department to establish an increasingly integrated and consistent framework to inform the budget process.

Funding by General and Program Goal

(dollars in thousands)

	FY 2004 Request	FY 2005 Request	FY 2006 Request
General Goal 4, Energy Security			
Program Goal 04.04.00.00			
Residential Buildings Integration	12,937	16,800	18,311
Commercial Buildings Integration	4,440	5,125	4,541
Emerging Technologies	28,286	31,420	25,358
Equipment Standards and Analysis	10,265	10,147	8,256
Oil Heat Research for Residential Buildings	494	493	0
Technical/Program Management Support	1,377	1,479	1,500
Total, Program Goal 04.04.00.00	57,799	65,464	57,966
Total, General Goal 4 (Building Technologies)	57,799	65,464	57,966

Expected Program Outcomes

The Building Technologies Program pursues its mission through integrated activities designed to improve the energy efficiency and productivity of our economy. We expect these improvements to reduce susceptibility to energy price fluctuations and potentially lower energy bills; reduce Environmental Protection Agency (EPA) criteria and other pollutants; and provide greater energy security and reliability by improving our energy infrastructure. In addition to these "EERE business-as-usual" benefits, realizing the BT goals would provide the potential to reduce conventional energy use even further, especially if warranted by future energy needs.

Estimates of annual non-renewable energy savings, energy expenditure savings, carbon emission reductions, oil savings, natural gas savings, and the reduced need for electricity capacity additions that result from the realization of Building Program goals are shown in the table below through 2050. In addition to the types of benefits quantified above, building efficiency and renewable technologies often provide non-energy benefits, such as improved lighting quality and building occupant productivity. The benefits estimates reported in this table do not include any expected acceleration in the deployment of these new technologies due to the unique field partnerships that provide the basis for the Residential Building Integration R&D, or synergies with the EPA ENERGY STAR® Home Program.

The assumptions and methods underlying the modeling efforts have significant impact on the estimated benefits, and results could vary significantly if external factors, such as future energy prices, differ from the "baseline case" assumed for this analysis. EERE's baseline case is essentially the same as the EIA "business-as-usual" case presented in its Annual Energy Outlook. In addition, possible changes in public policy and disruptions in the energy system which may affect estimated benefits are not modeled. The external factors such as unexpected changes in competing technology costs, identified in the Means and Strategies section above, could also affect the Program's ability to achieve its goals.

The results shown in the long term benefits tables are preliminary estimates based on initial modeling of some of the possible program production technologies; nonetheless, they provide a useful picture of the potential change in national benefits over time if the technology, infrastructure and markets evolve as expected. Estimated benefits that follow assume that individual technology plans and market assumptions obtain. Final documentation is estimated to be completed and posted by March 31, 2005. Uncertainties are larger for longer term estimates. A summary of the methods, assumptions, and models used in developing these benefit estimates that are important for understanding these results are provided at www.eere.energy.gov/office_eere/budget_gpra.html.

FY 2006 GPRA Benefits Estimates for the Buildings Program[a]

Mid-Term Benefits[b]	2010	2015	2020	2025
Primary nonrenewable energy savings (Quads)	0.1	0.3	0.6	1.2
Energy bill savings (Billion 2002$)	2	5	8	12
Carbon emission reductions (MMTCE)	2	6	14	28
Oil savings (MBPD)	0.01	0.02	0.03	0.02
Natural gas savings (Quads)	0.05	0.10	0.14	0.28
Total electric capacity displaced (GW)	ns	9	19	36

Long-Term Benefits[c]	2030	2040	2050
Primary nonrenewable energy savings (Quads)	2.4	3.5	4.2
Energy system cost savings (Billion 2001$)	29	43	62
Carbon emission reductions (MMTCE)	45	64	92
Oil savings (MBPD)	0.1	0.1	0.1
Natural gas savings (Quads)	1.42	2.26	1.38
Total electric capacity displaced (GW)	62	76	108

[a] Benefits reported are annual, not cumulative, for the year given. Estimates reflect the benefits that may be possible if all of the program's technical targets are met and funding continues at levels consistent with assumptions in the FY 2006 Budget.
[b] Mid-term program benefits were estimated utilizing the GPRA06-NEMS model, based on the Energy Information Administration's (EIA) National Energy Modeling System (NEMS) and utilizing the EIA's Annual Energy Outlook (AEO) 2004 Reference Case.
[c] Long-term benefits were estimated utilizing the GPRA06 - MARKAL developed by Brookhaven National Laboratory (BNL). Results can differ among models due to differences in their structure. In particular, the two models estimate economic benefits in different ways, with the MARKAL model reflecting the cost of additional investments required to achieve reductions in energy bills.

Residential Buildings Integration
Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Residential Buildings Integration					
Research and Development:					
Building America	12,354	15,972	17,721	+1,749	+11.0%
Residential Building Energy Codes	583	828	590	-238	-28.7%
Total, Residential Buildings Integration	12,937	16,800	18,311	+1,511	+9.0%

Description

The long-term goal of the Residential Buildings Integration subprogram is to develop cost effective, production ready systems in five major climate zones that result in houses that produce as much energy as they use on an annual basis.

Benefits

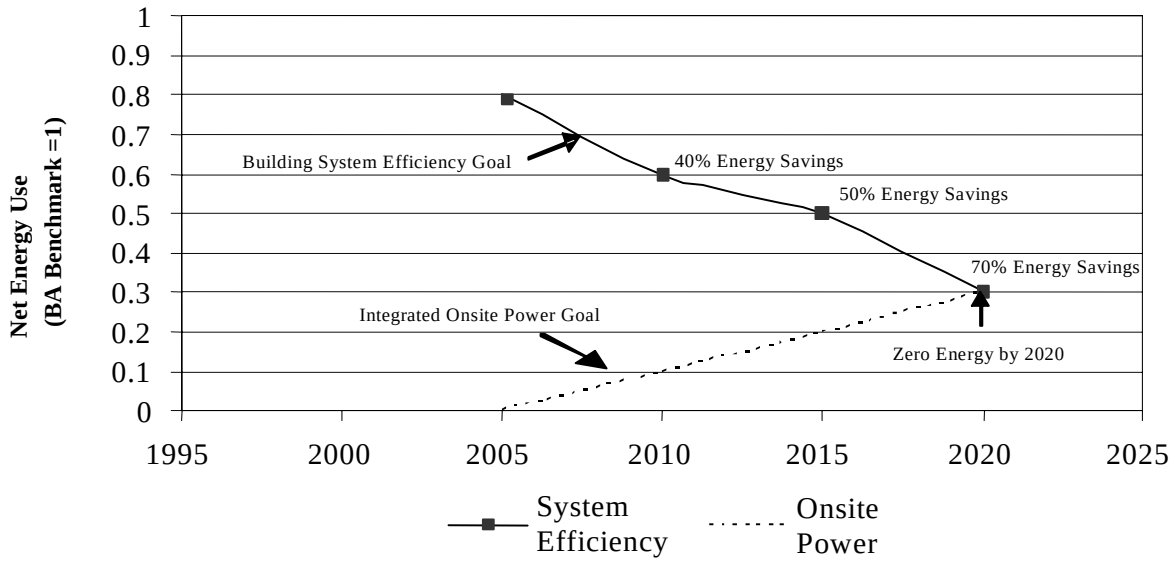
In order to reach Zero Energy Buildings by 2020, integrated cost-effective whole-building strategies will be developed to enable residential buildings to use up to 70 percent less total energy than the Building America Benchmark and provide up to 30 percent in additional energy savings through the use of integrated onsite power systems.[a] Building America (BA) is a private/public partnership that conducts research on energy solutions for new and existing homes on a cost shared basis with major stakeholders in the homebuilding industry. The Building America program combines the knowledge and resources of industry leaders with the U.S. Department of Energy's technical capabilities. Together, they act as a catalyst for energy efficient change in the home-building industry. Industry partners provide all costs for equipment, construction materials and construction labor used in research projects.

The core research activities are focused on identifying and resolving technical barriers to high levels of residential energy conservation by U.S. production homebuilders. BA teams provide systems engineering technical assistance to production builders who agree to test energy efficient materials, equipment and construction practices in prototype homes. These prototype homes confirm that predicted benefits can be successfully delivered to builders and consumers.

[a] Whole house energy savings for all residential end uses are measured relative to the BA Research Benchmark Definition (Building America, Building America Research Benchmark Definition, Version 3.1, November 11, 2003, National Renewable Energy Laboratory). (www.buildingamerica.gov)

The following graph show the future targets, towards reaching the Residential Buildings Integration goal of achieving the technical capability to produce net Zero Energy Buildings by 2020, as well as the required cost targets needed if the research is to be adopted by the industry (which is based on achieving a net zero cash flow based on the cost of financing the incremental improvements coupled with the energy cost savings). The baseline for the Energy Use Intensity measure is the Building America Research Benchmark Definitions. The BA benchmark was developed for tracking and measuring the success of the Residential Building Integration goals, and is based on the 2000 IECC with additional energy consumption estimates for lighting, appliances, and miscellaneous energy uses which are not covered in the building code. The Residential Building Integration goals are designed to achieve increased levels of energy efficiency in residential buildings that will be complemented by integration of high performance onsite power systems from the Solar Program and Distributed Energy Program to produce zero energy residential buildings in 2020.

Residential System Performance Goals



Building America is an analysis-based research program. Long term performance goals will be achieved through a series of incremental steps based on continuing evaluation of research results. This approach provides early identification of performance gaps and allows reallocation of resources to other high priority research areas when a given performance target has been met. The chart below shows the Building America plan and progression over the next five years. Essentially, the research for each "cell" of the table requires a minimum of three years, with the following progression:

- Phase 1 (year one) works with builders from the Building America Consortia to design, construct and test research houses having whole house energy savings based on the target shown in the below chart. The focus of Phase 1 is to use the initial results of cost/performance analysis to evaluate and test prototype systems to determine the most cost effective solution for a given performance level and climate.

- Phase 2 (year two) evaluates the Phase 1 designs, and working with the Building America Consortia, revises the prototype systems based on knowledge gained during the first phase and build a second cycle of test homes. The focus of Phase 2 is to move the prototype systems to the point that they are production-ready, capable of being integrated with production construction techniques practiced by today's builders.
- Phase 3 (year three) evaluates the Phase 2 homes and documents the results in a manner capable of dissemination to the technical staff of lead builders and manufacturers as research reports. In addition to research reports, Phase 3 work includes integration of Building America research results into train the trainer curricula in partnership with ongoing training programs sponsored by professional organizations, universities and other organizations involved in the education and training of those associated with the design and construction of homes.

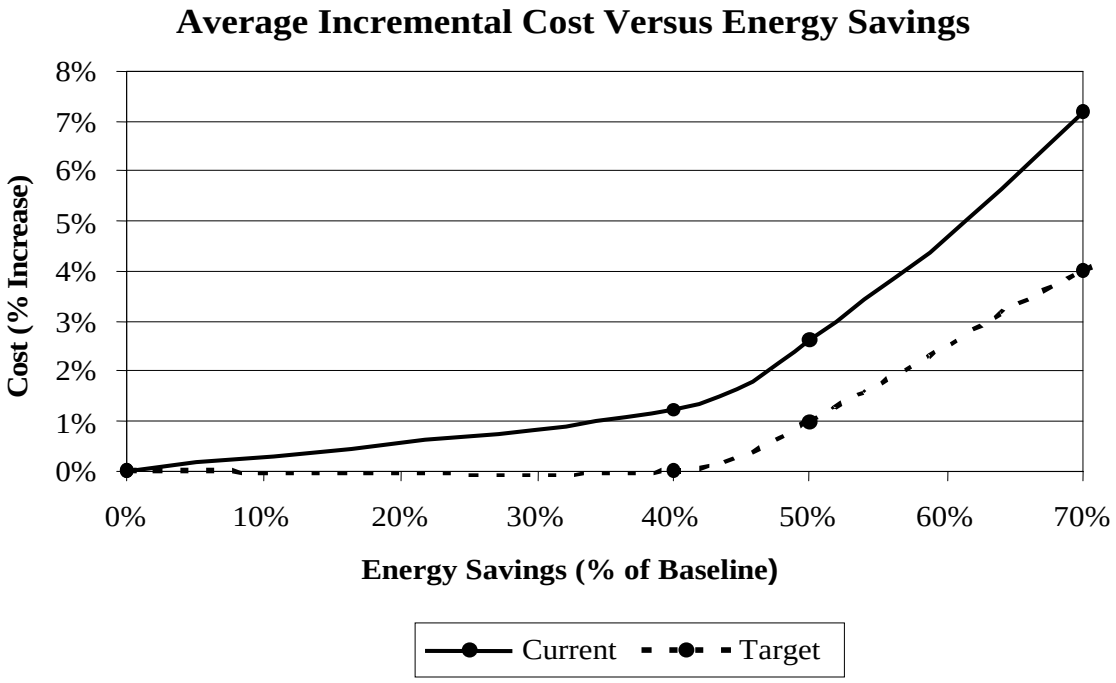
Multi-Year Residential System Research Schedule

(Completion of All Three Phases, New Single Family Homes[a])

	Climate Zone				
Energy Savings	Marine	Hot Humid	Hot Dry	Mixed Humid	Cold
30 percent	2006	2006	2005	2006	2005
40 percent	2007	2007	2006	2008	2007
50 percent	2008	2009	2009	2010	2010

The goals of the Residential Building Integration Program not only involve achieving conservation at the 40 to 70 percent levels, but also specify cost targets that will allow for market adoption. Cost targets are achieved by performing system cost/performance tradeoffs to determine the best options for achieving a given performance level using construction techniques appropriate for each climate. An optimization analysis based on results from research projects is used to determine the portfolio of technologies that can achieve each level of performance for the lowest added cost. For lowest levels of performance, the incremental cost is near the target cost. For high levels of performance the incremental cost exceeds the target. Performance needs identified by system research results from the Building America program are used by equipment manufacturers and other EERE research programs as input to their multi-year planning processes so that these performance needs are integrated into next generation technologies. The average incremental costs for each Residential Integration goal are captured in the graph below along with the target costs.

[a] Residential "joules" are research design/technology reports describing production-ready system solutions leading to the indicated level of energy savings and include analysis results, field test results, and case study specifications. At the request funding level, research will focus on new single family homes in five climate zones.



In addition to the targets shown above, related indicators of progress include:

- By 2008, develop and test 2 promising, cost effective, integrated energy efficiency and onsite power technological solutions required to reduce whole house energy use by 50 percent in the different climate regions of the U.S. and for different housing types.
- FY 2009, design, construct and test research houses having whole house energy savings of at least 40 percent.
- By 2010, validate the performance of houses representing the five climate zones that were constructed to meet the 40 percent performance goal.

Detailed Justification

(dollars in thousands)

FY 2004	FY 2005	FY 2006

Research and Development: Building America **12,354** **15,972** **17,721**

In FY 2006, BT will complete the research for production-ready new residential buildings that are 30 percent more efficient for all five climates and continue research at the 40 percent efficiency level for all five climates. BT will begin the first phase for 40 percent energy efficient homes in the mixed humid climate and 50 percent energy efficiency homes in the marine climate; move to the second phase for production level homes, achieving 40 percent energy efficient homes in marine, hot humid, and cold climates and; complete the third phase evaluation and documentation of 30 percent efficient

(dollars in thousands)

FY 2004	FY 2005	FY 2006

homes in the marine, hot humid and mixed humid climates and the 40 percent efficient homes in the hot dry climates. *Participants include BIRA, Building Science Corporation, CARB, IBACOS, Inc., NREL, ORNL, Florida Solar Energy Center (FSEC), Davis Energy Group, NAHB, and others TBD.*

Residential Building Energy Codes **583** **828** **590**

In FY 2006, develop and complete code change proposals to be considered in the code development hearings for the International Energy Code Council (IECC) 2009 Edition (residential building energy code) that will make it easier for code officials to accept energy efficient/cost effective technologies in support of the 2020 goal of marketable zero energy residential buildings. Develop energy efficient/cost effective revisions to the Supplement to the IECC 2006 Edition (residential building energy code) and the National Fire Protection Association (NFPA) to promote energy efficient site-built and manufactured homes. Coordinate efforts with the Federal residential codes activities to ensure that private sector and Federal codes work together to develop consistent and progressively more stringent energy codes. Provide technical assistance to States and local government as well as Federal agencies to accelerate the adoption of energy efficient building codes. *Participants include: PNNL and others TBD.*

Total, Residential Buildings Integration **12,937** **16,800** **18,311**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Research and Development: Building America	
This increase allows more development, evaluation and refinements of prototype systems at the higher efficiency levels. This addresses key barriers to market adoption that will significantly increase the potential number of prototype systems, which is critical to provide the appropriate solution for each of the climate regions. Major key barriers include market fragmentation and private sector investment which is identified in R&D Investment Criteria, section 1b.	+1,749
Residential Building Energy Codes	
The analysis initiated in FY 2005 to compare the energy use and/or life cycle cost of a number of energy efficiency options in residential buildings that meet energy code requirements contained in model codes, state codes, Home Energy Rating System (HERS) requirements, Energy Star Labeled Homes/Builder's Option Packages (BOPS), Building America, Zero Energy Homes will be completed	-238
Total Funding Change, Residential Buildings Integration	**+1,511**

Commercial Buildings Integration

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Commercial Buildings Integration					
Research and Development.....	3,905	4,345	4,000	-345	-7.9%
Commercial Building Energy Codes.....	535	780	541	-239	-30.6%
Total, Commercial Buildings Integration	4,440	5,125	4,541	-584	-11.4%

Description

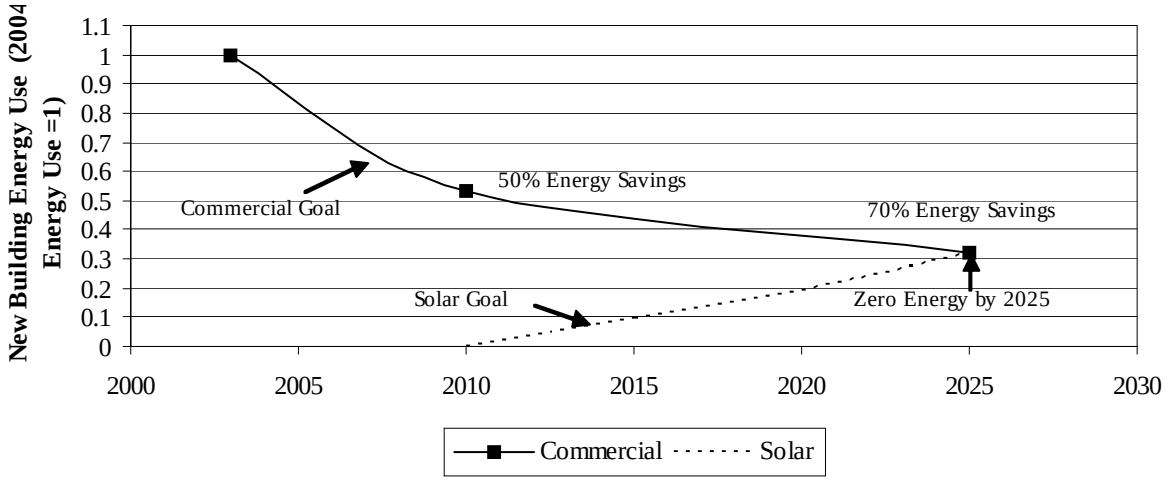
The long-term goal of the Commercial Buildings Integration subprogram is to develop cost effective designs for commercial buildings such that they produce as much energy as they use on an annual basis. Research will focus on integrating energy efficient technologies to reduce the total energy use in commercial buildings by 60 to 70 percent by 2025. These improvements in energy efficiency, when coupled with research to integrate onsite renewable energy supply systems into commercial buildings will result in marketable net zero energy technology packages. During FY 2006, in partnership with designers, builders and component manufacturers, the Commercial Buildings Integration subprogram will focus research on development and evaluation of practical strategies to reduce building energy use in new small commercial buildings by 50 percent.

Benefits

The Commercial Building Integration subprogram will improve energy security by reducing energy consumption and peak electrical demands of commercial building. Advanced controls help achieve and maintain as designed building energy efficiency and improved indoor air quality provides greater productivity and occupant comfort.

The following graph conceptually illustrates the progress, and targets, towards reaching the Commercial Buildings Integration goal of achieving the technical capability to produce net Zero Energy Buildings by 2025.

Energy Use Intensity Versus Commercial Integration Goals



Analytical assessments completed in FY 2005 will define the pathway more definitively, across the wide range of commercial building types and climates.

Related indicators of progress include:

- By 2007, identify integrated packages of technologies from simulation optimization studies of small commercial buildings in multiple climates throughout the U.S.
- By 2007, identify and select potential partners to document and test the packages with 50 percent lower energy use in new commercial buildings.

Detailed Justification

(dollars in thousands)

FY 2004	FY 2005	FY 2006
Research and Development **3,905**	**4,345**	**4,000**

In FY 2006, we will develop and demonstrate the first package of cost-effective technologies for small commercial buildings to reach 30 percent energy savings over ASHRAE 90.1-2004. This commercial building energy efficiency improvement package will describe the technologies, quantify the energy savings and costs and provide design, construction, and commissioning guidelines for implementation in retail buildings in at least several climate regions of the U.S. With the results of the system optimization methods and design strategies begun in FY 2004, we will targets the gaps and determine the technology advancements required for routinely creating zero energy buildings within 20 years. Continue to identify potential partners to test the energy efficiency packages in other commercial building types that will result in 50 percent lower energy use in new construction and 30 percent lower use in existing buildings.

(dollars in thousands)

FY 2004	FY 2005	FY 2006

To reduce commercial ventilation energy use by 50 percent by 2015, conduct research on advanced ventilation equipment and controls. In FY 2006 complete field test of a prototype advanced building air filtration system; develop standard test procedures and ventilation rate measurement and control systems. P*articipants include: LBNL, National Institute of Standards and Technology (NIST), NREL, PNNL, University of California, and others TBD.*

Commercial Building Energy Codes	**535**	**780**	**541**

In FY 2006, continue to develop and influence the movement towards more stringent code change proposals in support of the 2025 goal of marketable zero energy commercial buildings. Continue to actively participate through committee participation in the ICC (International Code Council) and in ASHRAE (American Society of Heating Refrigerating and Air-Conditioning Engineers) to develop revisions and rebuttal testimony to the results of the IECC 2006 Code Development Hearings which will go into effect in 2009 and to the next generation of ASHRAE 90.1, anticipated in 2007. Both the IECC and ASHRAE operate on an 18 month continuous maintenance code cycle with a new edition printed every three years.

Provide continued technical assistance to States and local government as well as Federal agencies to accelerate the adoption of energy efficient building codes such as the IECC 2006 and ASHRAE Standard 90.1-2004 with addenda.

Complete the development of an advanced buildings design guide that makes use of existing technologies that are 50 percent beyond current code (ASHRAE 90.1-1999) for one high priority building type, without regard to cost effectiveness. This guide will ease the difficulties of introducing new technologies into code. *Participants include: PNNL and others TBD.*

Total, Commercial Buildings Integration	**4,440**	**5,125**	**4,541**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Commercial Buildings Integration	
Research and Development	
Based on an evaluation in mid-2005, DOE will terminate the lowest priority projects in the areas of controls, commissioning, and indoor air quality	-345
Commercial Building Energy Codes	
DOE will complete an advanced energy design guide for existing technologies that are 50 percent beyond ASHRAE 90.1-1999 for the highest priority building type	-239
Total Funding Change, Commercial Buildings Integration	**-584**

Emerging Technologies
Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Emerging Technologies					
Lighting R&D	10,798	13,855	13,000	-855	-6.2%
Space Conditioning and Refrigeration R&D	4,875	4,846	2,919	-1,927	-39.8%
Appliances and Emerging Technologies R&D	1,934	1,682	1,708	+26	+1.5%
Building Envelope R&D	7,663	8,274	4,929	-3,345	-40.4%
Analysis Tools and Design Strategies	3,016	2,763	2,802	+39	+1.4%
Total, Emerging Technologies	28,286	31,420	25,358	-6,062	-19.3%

Description

The long-term goal of the Emerging Technologies subprogram is to develop cost effective advanced technologies, e.g., lighting, windows, and space heating and cooling, for residential and commercial buildings. Research will focus on finding technologies to support the residential and commercial building goal to reduce the total energy use in buildings by 60 to 70 percent. The improvement in component and system energy efficiency when coupled with research to integrate onsite renewable energy supply systems into the commercial and residential building will result in marketable net zero energy designs.

Specifically, we will focus on:

- Solid-state lighting, which has long term efficiencies that have the potential to approach 200/lm/W, compared to most conventional technologies maximum efficiencies in the 85 to 115 range.
- Advanced windows, which have the potential to move from a net energy loss to a net energy provider by incorporating advanced insulation materials and technologies that enable dynamic control of thermal and light transmittance performance.
- Heating and cooling systems with the potential to reduce annual HVAC energy consumption by 50 percent, and peak demand by 30 percent.

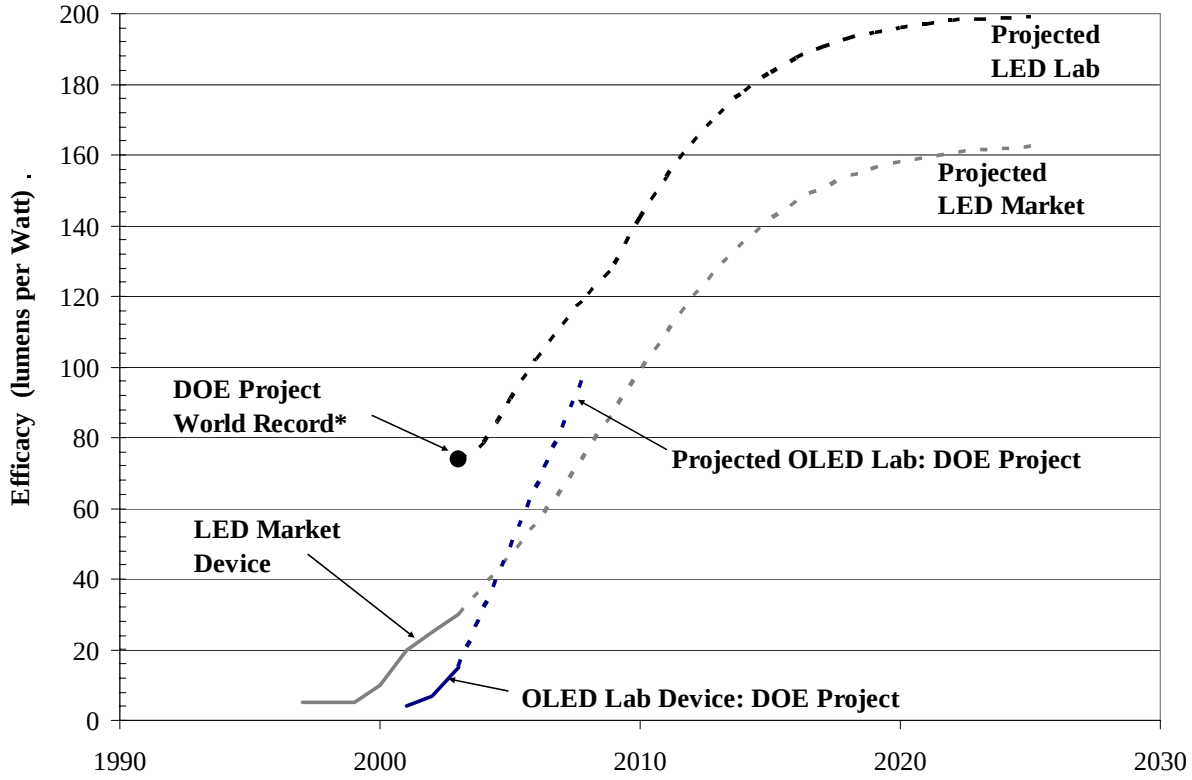
Benefits

The Emerging Technologies subprogram improves energy security through support of the technology development needs of the Residential Integration and Commercial Integration subprograms, and as well as the need for replacement technologies in the existing building stock.

The two graphs and table below are examples of critical technologies required to reduce whole building energy use, both new and existing, and represent areas of major focus in Emerging Technologies. The lighting graph is illustrative of the efficacy improvement possible.

**Additionally, the SSL partners have identified a cost target of $10/klm in 2025, which will lead to market viability.

Lighting Subprogram White Efficacy Targets

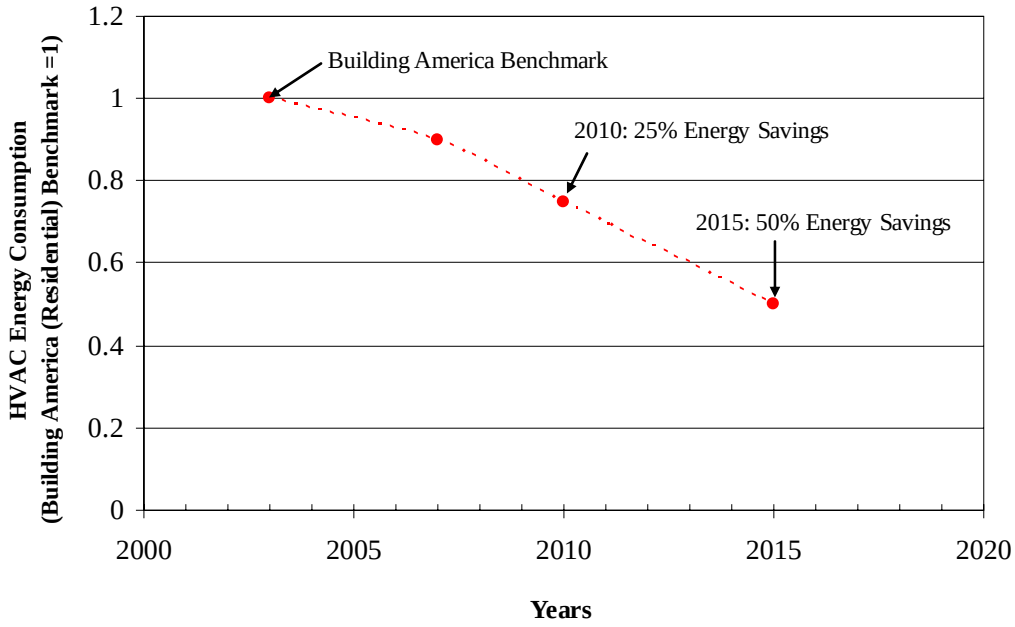


Window Subprogram Technology Performance Targets

Dynamic Window R&D Plan		2005	2006	2007	2010
First Generation of Products (product development)	Price/Sq Ft.	$85-100	$85-60	$50	$20
	Size (Sq. Ft.)	8	16	16	20-25
	Variable Range – VT*	60 to 4%	60 to 4%	60 to 4%	65 to 3%
	Variable Range – SHGC**	0.50 to 0.10	0.50 to 0.10	0.50 to 0.10	0.53 to 0.09
	Durability*** (ASTM Tests)	Med	Med	High	High

* VT: Visible light transmission
** SHGC: Solar Heat Gain Coefficient
*** < 20K cycles – Low; 20K – 50K Cycles – Medium; > 50K Cycles – High

Space Conditioning Subprogram Energy Savings Target (Residential)



Detailed Justification

(dollars in thousands)

FY 2004	FY 2005	FY 2006

Lighting R&D **10,798** **13,855** **13,000**

The lighting R&D is focused on the advancement of improved light sources, primarily solid-state lighting (SSL). The SSL activities are conducted around core technology areas (prepared with input on needs identified in R&D planning workshops attended by the SSL research community). The core technology areas are focused on applied research (technology gaps and enabling research) that will propel product manufacturers into the market with higher efficiency, more durability, and lower cost. Topics include: UV LEDs; Power conversion efficiency –LEDs; Phosphors – LEDs; Materials – OLEDs; Light Extraction – OLEDs; and Novel Device Structures – OLEDs. Additional topics identified in planning (at the SSL workshop) to be addressed in future years include: novel substrates-LED, substrates – OLEDs, reliability and lifetime – LEDs, scientific models-assembly-OLEDs, packaging materials – LEDs, encapsulants – OLEDs, epitaxial process models – LEDs, module packaging – OLEDs, in-situ diagnostic tools – LEDs, fabrication technology – OLEDs, reactor designs – LEDs, chip processing equipment – LEDs.

The product development area is focused on catalyzing product manufacturers into the market with higher efficiency, better durability, and lower cost. Topics include: LED/OLED luminaire design and intelligent electronics.

(dollars in thousands)

FY 2004	FY 2005	FY 2006

In FY 2006, continue the solid-state lighting (SSL) research projects resulting from competitive solicitations in FY 2004 and 2005 to develop and deploy SSL products for general illumination. These projects are addressing technical challenges in: ultra-violet emissions, power conversion efficiency, and white-light phosphors in light emitting diodes (LED); and material science, light extraction, and device structures in organic LEDs. Project success will further necessary advancements in device efficiency, lifetime, manufacturing, and cost reduction for market viability to reach the 160 lumens per Watt goal (exceeding efficiency of any present day white-light products by a least a factor of two). Delay initiation of competitive solicitations for new Solid-State projects until FY 2007 in order to complete projects awarded in FY 2004 and FY 2005. Solid State Lighting funding of $11,000,000 million is requested in FY 2006 (FY 2005 funding is $11,800,000 and FY 2004 funding was $7,200,000).

To improve conventional lighting efficiency by 20 to 50 percent, research will be conducted to improve the performance of conventional lighting systems through the improvement of light sources, lighting controls and fixtures, and application of knowledge of complex response of human vision to light. Complete a research project to develop a phosphor system, containing nano-crystalline structures, for efficiency improvement in fluorescent lamps. Complete project to develop and demonstrate a novel, wireless lighting-control approach that can be cost-effectively embedded into existing fluorescent lamp ballasts. Continue project on enhanced spectrum fluorescent lighting by completing and evaluating additional measured data from cost-shared field demonstrations with major U.S. lamp manufacturers. Expand competitively-selected, cost-shared projects with emphasis on lighting sources and controls. In FY 2004, this activity was reduced by $249,000 for SBIR/STTR and transferred to the Science Appropriation. *Participants include: PNNL, SNL, LANL, Boston University, University of Florida, University of Southern California, After Image + Space, Dust, General Electric Global Research, universities and others that are competitively selected.*

Space Conditioning and Refrigeration R&D..... **4,875** **4,846** **2,919**

In FY 2006, create and evaluate 2-3 design concepts that have the long term potential to reduce annual HVAC energy consumption by 50 percent, and peak demand by 30 percent compared to conventional systems, with an installed cost premium of less than 20 percent. Develop proof-of-concept prototype hardware for subsystems or enabling technologies for these design concepts. The focus will be on system energy consumption, rather than simply EER or SEER, which do not capture the impacts of the entire HVAC system. The R&D projects will emphasize modest cost premiums, since very high efficiency equipment already exists, but has low market penetration due to high first cost. The approaches considered include: intelligent sensor and control systems incorporating adaptive/fuzzy logic that are able to learn and optimize system performance to maintain optimum efficiency; residential "economizing" using cool night air; advanced zoning approaches incorporating occupancy sensing and automated ductwork; providing real-time energy consumption feedback to occupants in order to change usage patterns; energy recovery ventilation; and reducing ventilation loads in commercial buildings through natural, hybrid, or demand control ventilation or air treatment that eliminates or drastically reduces outside air requirements. The potential for multi-function appliances to contribute to achieving the energy consumption reduction goals will also be evaluated.

(dollars in thousands)

FY 2004	FY 2005	FY 2006

Projects competitively awarded in FY2004 and FY 2005 will be completed and evaluated for follow-on research and development opportunities.

Additional efforts in FY 2006 also include an evaluation of low-cost commissioning and remote fault detection and diagnostics (FDD) systems for unitary HVAC systems, including commercial rooftop and residential systems. Prior to beginning hardware development, a study will be completed to review previous work and available products and technologies, create design specifications for a system, prioritize necessary capabilities of the system, set cost targets, identify manufacturing partners, and create several conceptual design approaches. In FY 2004, this activity was reduced by $112,000 for SBIR/STTR and transferred to the Science Appropriation. *Participants include: BNL, LBNL, ORNL, Academia, manufacturers and others that are competitively selected.*

Appliances and Emerging Technologies R&D **1,934** **1,682** **1,708**

In FY 2006, complete project to provide technical assistance to manufacturers of high efficiency recessed downlights to improve their reliability and performance, and to work with builders and utilities to speed market uptake of these improved products. New products from the project are expected to be efficient but, unlike current products, are expected to be highly reliable when installed in insulated ceilings. Complete the second phase of Lighting for Tomorrow, a lighting fixture design competition offered in conjunction with the American Lighting Association and Consortium for Energy Efficiency to expand the offering of efficient (dedicated fluorescent and solid-state lighting) residential lighting fixtures. Complete a project to stimulate introduction of highly efficient new room air conditioner technology by organizing groups of air conditioner buyers. If successful, the project will induce manufacturers to produce and sell room air conditioners that are at least 10 percent more efficient than the current best models. In response to a technology screening and priority project identification study to be completed in FY 2005, the program expects to launch four to six new projects with both the highest potential to contribute to building energy reduction and the greatest potential appeal to large buyers, as indicated by the screening study and buyers group identification tasks completed in the prior year. The new projects will speed commercial introduction of new, highly efficient products through public-private partnerships to improve the cost and performance attributes of selected products by late-stage engineering and development in cooperation with users; to establish the viability and reliability of products by engineering field evaluations and lab testing as input to design improvements; to verify the cost-performance of products as applied in buildings by field demonstration; and to support market development of technology by procurement actions with large volume buyers and manufacturers. Approaches adopted for project implementation will be specific to needs for successful technology introduction. Products and technology selection will be informed by optimization studies completed by BT residential and commercial integration activities, as well as ENERGY STAR® studies, appliance standards, and inputs from public and private partners. In FY 2004, this activity was reduced by $46,000 for SBIR/STTR and transferred to the Science Appropriation.

(dollars in thousands)

FY 2004	FY 2005	FY 2006

Building Envelope R&D	**7,663**	**8,274**	**4,929**
▪ **Thermal Insulation and Building Materials**	**3,152**	**2,762**	**0**

In FY 2006, Thermal Insulation and Building Materials activities are suspended due to the need to assess the advanced state of technologies, which are being demonstrated in the Residential Buildings Integration subprogram. Final FY 2006 in-depth analyses of the Residential Building Integration Program will determine the remaining building envelope R&D opportunities and an assessment will be made whether additional funding in FY 2007 should be requested or whether this area should be concluded. In FY 2004, this activity was reduced by $72,000 for SBIR/STTR and transferred to the Science Appropriation.

▪ **Window Technologies**	**4,511**	**5,512**	**4,929**

BT's approach to achieving energy savings through windows research is to convert windows from today's performance with significant thermal losses, to the point where they are energy neutral, and then move to a higher level of performance, where they contribute to a net energy surplus. In FY 2006, BT will focus its research activities on investigating and improving the dynamic control of fenestration properties through electrochromic (EC) and other advanced coatings, and continue limited research to develop highly insulating windows with a low U-Value.

Dynamic windows allow for active control of the optical properties of glazing layers that will achieve greater energy savings than static coatings because they can adjust to ambient conditions and critical peak conditions on the electric grid. Wide scale demonstrations, product ratings and labeling activities will support the commercialization of the first generation of electrochromic windows. A fully integrated prototype dynamic window with super insulating properties that has the technical feasibility of achieving market viable cost points in the 2015 timeframe will be developed.

DOE will continue competitive fundamental science research to develop the second generation of materials, chemical applications, and processes that can offer "leap frog" reductions in cost for dynamic windows while maintaining a high level of reliability and durability with a broad range of optical properties. The second generation of dynamic windows is targeted enter the market in the 2010 to 2015 timeframe. FY 2006 research will focus on the technical hurdles to increase the size and improve the performance of prototypes developed in FY 2005.

For highly insulating windows, BT will perform limited research demonstrating alternative center glazing layers; these layers will result in products with low U-factors without significant added weight and labor costs. As a component of developing insulating windows, BT will also investigate advanced window durability, such as inert gas diffusion, as shortened life or window failure can reduce the energy savings for highly insulating windows. Highly insulated windows target heating loads in colder climates.

Technology support research will be conducted to assist the windows industry to rate, label and promote highly efficient fenestration products on the market. A new software program COMFEN (Commercial Fenestration) will be completed to assess the impacts of the replacement and installation

of advanced glazings in commercial buildings. Parameters such as energy savings, peak demand reduction, chiller size reduction, elimination of perimeter zone space conditioning, glare reduction, and improved comfort will be characterized. These parameters and associated benefits of advanced glazings are expected to help increase the current market share of energy efficiency glazings. Basic maintenance of existing technical support tools for the residential market will be supported, including support for the National Fenestration Rating Council (NFRC) labeling and rating process (NFRC funded at $262,000 in FY 2004, $100,000 in FY 2005, and $200,000 in FY 2006). In FY 2004, this activity was reduced by $105,000 for SBIR/STTR and transferred to the Science Appropriation. *Participants include: LBNL University of Minnesota, NFRC, Alliance to Save Energy, NREL, and a variety of other performers based on competitive awards.*

Analysis Tools and Design Strategies	**3,016**	**2,763**	**2,802**

In FY 2006, BT will focus its research on developing, improving, verifying, and maintaining software packages for engineers, architects, and builders who design or retrofit buildings to be energy efficient and comfortable. BT will conduct research on and incorporate additions to EnergyPlus to create new-generation whole-building energy simulation software that allows building designers, operators, owners, and researchers to evaluate technologies for improving the energy efficiency and comfort of buildings while reducing operating costs. BT will complete research on current technologies, systems, and controls and incorporate new modules in an EnergyPlus version which aims at development of and compliance with current and near-term building energy standards. Additionally, to support the Building Technologies ZEB goal, accurate assessment tools which include ZEB technologies, systems, and controls are needed. Working with the Commercial and Residential R&D teams, BT will continue to identify, prioritize, and incorporate simulation capabilities to correctly simulate ZEB in a whole-building context. To increase the acceptance of EnergyPlus, BT will also conduct research on the interoperability and data exchange between EnergyPlus and other building software tools such as CAD. In FY 2004, this activity was reduced by $72,000 for SBIR/STTR and transferred to the Science Appropriation. *Participants include: Florida Solar Energy Center, GARD Analytics, LBNL, J. Neymark Associates, NREL, Oklahoma State University, University of Illinois, and others TBD.*

Total, Emerging Technologies	**28,286**	**31,420**	**25,358**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Lighting R&D	
Bring to a conclusion selected R&D projects in the lighting area after a review of the potential performance of all projects, consistent with R&D investment criteria section 3a, which addresses the use of potential performance to indicate R&D activity effectiveness, efficiency, and benefits...	-855
Space Conditioning and Refrigeration R&D	
Based on industry input emphasize high risk longer term project at lower levels of effort to better align space conditioning R&D to residential and commercial integration activities	-1,927
Appliances and Emerging Technologies R&D	
No significant change	+26
Building Envelope R&D	
▪ **Thermal Insulation and Building Materials**	
Suspends thermal insulation research due to advanced state of technologies, which are being demonstrated in the Residential Integration activities. As indicated in the R&D Investment Criteria, section 2e, through coordination with government, industry and consumer groups, it was determined it is now time to suspend thermal insulation research, awaiting the results of the products being demonstrated in the Residential Integration activities. Section 2e of the RDIC addresses how well R&D has reached a defined off-ramp milestone or decision point.	-2,762
▪ **Windows Technologies**	
Windows Technologies: Allow completion of projects competitively awarded in FY 2004 and FY 2005, reducing funds for new competitive solicitations	-583
Total, Building Envelope R&D	**-3,345**
Analysis Tools and Design Strategies	
Increase activities to train EnergyPlus users	+39
Total Funding Change, Emerging Technologies	**-6,062**

Equipment Standards and Analysis
Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Equipment Standards and Analysis	10,265	10,147	8,256	-1,891	-18.6%
Total, Equipment Standards and Analysis	10,265	10,147	8,256	-1,891	-18.6%

Description

The goal of the Equipment Standards and Analysis subprogram is to develop minimum energy efficiency standards that are technologically feasible and economically justified. During FY 2006, the Equipment Standards and Analysis subprogram will focus on developing Notices of Proposed Rulemaking (NOPRs) for energy efficiency standards rulemakings for three priority products: residential furnaces and boilers, electric distribution transformers and commercial unitary air conditioners and heat pumps.

Benefits

The table shows the progress of statutorily mandated Equipment Standards over the years, as well as anticipated future standards.

	(Original standard)		(First update)		(Second update)	
	Statute Date	Effective Date	Final Rule	Effective Date	Final Rule	Effective Date
Equipment						
Residential Products						
Refrigerators and Freezers	1987	1990	1989	1993	1997	2001
Room Air Conditioners	1987	1990	1997	2000		
Central Air Conditioners	1987	1992	2004	2006		
Clothes Dryers	1987	1988	1991	1994		
Clothes Washers	1987	1988	1991	1994	2001	2004
Dishwashers	1987	1988	1991	1994		
Water Heaters	1987	1990	2001	2004		
Furnaces	1987	1992	In Process			
Electric Cooking Products	1987	1990	1998	1998		
Pool Heaters	1987					

	(Original standard)		(First update)		(Second update)	
	Statute Date	Effective Date	Final Rule	Effective Date	Final Rule	Effective Date
Commercial Products						
Fluorescent Lamp Ballasts	1988	1990	2000	2005		
ASHRAE Products	2001	2003/ 2004[a]				
Unitary AC/HP	In Process					
Electric Distribution Transformers	In Process					
High Intensity Discharge Lamps (HID) (Determination)	In Process					
Small Electric Motors (Determination)	In Process					

Related indicators of progress include:

- In FY 2006, publish a final rule related to certain ASHRAE commercial products
- Complete peer review of standards rulemaking required by OMB (Bulletin on Peer Review, December 17, 2004)
- Complete analyses for final rules for residential furnaces/boilers, commercial CAC, and distribution transformers

[a] Central Water Cooled AC, Water Source HP, Evaporatively Cooled AC

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Equipment Standards and Analysis	**10,265**	**10,147**	**8,256**

In FY 2006, develop Notice of Proposed Rulemakings (NOPRs) regarding energy conservation standards for three priority products: residential furnaces and boilers, electric distribution transformers and commercial unitary air conditioners and heat pumps. As identified in the FY 2005 prioritization process analyze and review test procedures for torchieres, ceiling fans and commercial refrigerator products (reach-in refrigerators/freezers, vending machines/beverage merchandiser). Continue to implement a plan based on analyses that propose to add new products to the lighting and appliance standards program as well as other approaches such as tax incentives and ENERGY STAR® labeling to improve and promote the efficiency of appliances and equipment.

Initiate standards rulemakings on products as identified in the prioritization process. Review existing test procedures to ensure that they remain current with advancing technology and measurement of standby power consumption. Ensure compliance to standards through follow-up inquiries, random audits, and investigations of noncompliance allegations. *Participants include: LBNL, NIST, NREL, PNNL and others TBD.*

Total, Equipment Standards and Analysis	**10,265**	**10,147**	**8,256**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Equipment Standards and Analysis	
Several FY 2005 activities will not require new funding in FY 2006. FY 2005 funding will be used for the required peer reviews and will reduce funding requirements for FY 2006	-1,891
Total Funding Change, Equipment Standards and Analysis	**-1,891**

Oil Heat Research for Residential Buildings

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Oil Heat Research for Residential Buildings..	494	493	0	-493	-100%
Total, Oil Heat Research for Residential Buildings	494	493	0	-493	-100%

Description

The goal of the Oil Heat Research for Residential Buildings Integration subprogram is to develop ultra-low emissions combustion technologies for oil-based fuels that could be used in residential building applications.

Benefits

Based on the completion of research to improve the environmental performance of oil combustion systems in FY 2004, no further activities will be performed in the Oil Heat Research for Residential Buildings Integration subprogram.

Detailed Program Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Oil Heat Research for Residential Buildings.....	**494**	**493**	**0**
FY 2005 projects include: development of the technical foundation for condensing oil-fired residential heating systems as a progression towards the goal of Zero Energy Buildings (ZEB) in colder regions of the United States where oil heat is used in a signification portion of residential housing, measurement and documentation of fine particulate (PM 2.5) emission reductions with oil-fired condensing systems as well as documenting efficiency gains in field installations will provide strong regional incentives to market penetration of this technology, and the investigation and development of ultra violet sensors based Fault Detection and Diagnostic (FDD) systems for use with oil fired heating systems will support oil appliance concept developments for ZEB applications. *Participants Include: Brookhaven National Laboratory and National Oil Heat Research Alliance.*			
Total, Oil Heat Research for Residential Buildings.....	**494**	**493**	**0**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Oil Heat Research for Residential Buildings	
No funds are requested in FY 2006 as projects will soon be completed	-493
Total Funding Change, Oil Heat Research for Residential Buildings	**-493**

Technical/Program Management Support

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Technical/Program Management Support ..	1,377	1,479	1,500	+21	+1.4%
Total, Technical/Program Management Support	1,377	1,479	1,500	+21	+1.4%

Description

The Technical/Program Management Support subprogram provides analytic support to aid the program to achieve its net Zero Energy Building goals.

Benefits

This is accomplished by identifying research priorities through R&D feasibility studies and trade-off analyses. During FY 2006, the Technical/Program Management Support subprogram will focus on implementing a research and development evaluation process for successfully integrating component research with building system research.

Detailed Program Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Technical/Program Management Support	**1,377**	**1,479**	**1,500**
In FY 2006, provide critical technical and program management support services including support for multi-year planning; strategic planning; feasibility studies and trade-off analyses; data collection to assess program and project performance; peer reviews of projects and program portfolio and management; evaluation of the impact and conducting analyses for new legislation on R&D programs such as tax credits; and analysis and assessments of past program impacts and performance. *Participants include: PNNL and others TBD.*			
Total, Technical/Program Management Support	**1,377**	**1,479**	**1,500**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Technical/Program Management Support	
No significant change.	+21
Total Funding Change, Technical/Program Management Support	**+21**

Industrial Technologies

Funding Profile by Subprogram[a]

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation[b]	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Industrial Technologies						
Industries of the Future (Specific)	45,659	38,176	38,176	22,087	-16,089	-42.1%
Industries of the Future (Crosscutting)	38,874	32,885	32,885	30,609	-2,276	-6.9%
Technical/Program Management Support	5,917	3,740	3,740	3,793	+53	+1.4%
Total, Industrial Technologies	90,450	74,801	74,801	56,489	-18,312	-24.5%

Public Law Authorizations:

P.L. 94-163, "Energy Policy and Conservation Act" (EPCA) (1975)
P.L. 94-385, "Energy Conservation and Production Act" (ECPA) (1976)
P.L. 95-91, "Department of Energy Organization Act" (1977)
P.L. 95-618, "Energy Tax Act" (1978)
P.L. 95-619, "National Energy Conservation Policy Act" (NECPA) (1978)
P.L. 95-620, "Powerplants and Industrial Fuel Use Act" (1978)
P.L. 96-294, "Energy Security Act" (1980)
P.L. 100-12, "National Appliance Energy Conservation Act" (1987)
P.L. 100-615, "Federal Energy Management Improvement Act" (1988)
P.L. 101-218, "Renewable Energy and Energy Efficiency Technology Competitiveness Act" (1989)
P.L. 101-549, "Clean Air Act Amendments" (1990)
P.L. 102-486, "Energy Policy Act" (1992)

Mission

The mission of the Industrial Technologies Program (ITP) is to reduce the energy intensity of the U.S. industrial sector through a coordinated program of research and development, validation, and dissemination of energy-efficiency technologies and operating practices. This effort will be achieved by partnering with domestic industry, its equipment manufacturers, and its many stakeholders to reduce our Nation's reliance on foreign energy sources, reduce environmental impacts, increase the use of renewable energy resources, and improve energy efficiency and competitiveness.

Benefits

ITP develops, manages, and implements a balanced portfolio that addresses industry requirements throughout the technology development cycle. Research and development, particularly high-risk, high-

[a] SBIR/STTR funding in the amount of $2,184,000 was transferred to the Science Appropriation in FY 2004. Estimates for SBIR/STTR budgeted in FY 2005 and FY 2006 are $1,430,000 and $985,000 respectively.
[b] Reflects the 0.594% and 0.80% rescissions of -$454,000 and -$608,000 respectively and comparability adjustment for National Energy Technology Laboratory Support of -$548,000.

return R&D, is conducted to target efficiency opportunities in manufacturing processes and crosscutting energy systems. Validation and verification of technology benefits through intermediate-term pilot and demonstration phases help emerging technologies gain commercialization and near-term adoption. Dissemination of energy-efficiency technologies and practices is accomplished through a variety of technology delivery mechanisms. These activities help accelerate industry understanding, acceptance, and implementation of efficiency advances as industry starts reaping the benefits of proven technologies, system management decision tools, training, and strategic partnerships. These technology successes are the result of the "industry pull" designed into the Industries of the Future strategy. Reducing industrial energy intensity also contributes to environmental quality by promoting technologies and practices that minimize adverse environmental impact and promote sustainability during the production life cycle, to yield improvement and resource conservation, to economic viability and international competitiveness, and to energy security by promoting technologies that increase independence from foreign energy sources.

More detailed, integrated and comprehensive economic, energy and energy security benefits estimates are provided in the Expected Program Outcomes section at the end of the program level budget narrative.

Strategic and Program Goals

The Department's Strategic Plan identifies four strategic goals (one each for defense, energy, science, and environmental aspects of the mission) plus seven general goals that tie to the strategic goals. The Industrial Technologies Program supports the following goal:

Energy Strategic Goal: To protect our national and economic security by reducing imports and promoting a diverse supply of reliable, affordable, and environmentally sound energy.

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 Industrial Technologies Program has one program goal which contributes to General Goal 4 in the "goal cascade":

Program Goal 04.60.00.00: Industrial Technologies. The Industrial Technologies Program goal is to partner with our most energy-intensive industries in strategic planning and energy-specific RD&D to develop the technologies needed to use energy efficiently in their industrial processes and cost-effectively generate much of the energy they consume. The result of these activities will save feedstock and process energy, improve the environmental performance of industry, and help America's economic competitiveness.

Contribution to Program Goal 04.60.00.00 (Industrial Technologies)

The Industry of the Futures technology program's key contribution to energy security is through improving energy efficiency and directly reducing the demand for oil, natural gas, and electricity. Between 2002 and 2020, industrial technologies will contribute to a 20 percent reduction in energy intensity (Btu per unit of industrial output as compared to 2002) in the energy-intensive Industries of the Future (a potential savings of 1.8 Quads above projected baseline efficiency improvements); between 2004 and 2010, target industries and RD&D partners will commercialize over 10 energy-efficiency technologies developed through the ITP partnerships.

Annual Performance Results and Targets

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Results	FY 2005 Targets	FY 2006 Targets
Program Goal 04.60.00.00 (Industrial Technologies)					
Industries of the Future (Specific)					
	Commercialize 10 new energy efficiency technologies in partnership with the most energy-intensive industries.	Commercialize 4 new technologies in partnership with the most energy-intensive industries. [MET: Exceeded, 5 technologies]	Commercialize 4 new technologies in partnership with the most energy-intensive industries. [MET: Exceeded, 6 technologies]	Commercialize 3 new technologies in partnership with the most energy-intensive industries.	Commercialize 3 new technologies in partnership with the most energy-intensive industries.
		Turn over 25 percent of projects in the RD&D portfolio. [MET]			
Industries of the Future (Specific and Crosscutting)					
Commercialize 10 new technologies from both the nine vision industries as well as the crosscutting programs.	Complete 2 showcase demonstrations at industry sites, of advance energy efficiency technologies.	Help industry save more than 180 trillion Btu of energy worth at least $720 million (assumes average energy prices of $4.00 a million Btu). [MET]			
Help industry save 262 trillion Btu of energy worth $1.6 billion.	Assist industry in saving more than 265 million Btu of energy, worth more than $1.6 million.				
	Complete 20 new Allied Partnerships with energy intensive companies, trade organizations, and other groups.				
Industries of the Future (Crosscutting)					
Support Industrial Assessment Centers at 26 participating universities that conducted 650 combined energy, waste, and productivity assessments.	Continue support for Industrial Assessment Centers operating at 26 participating university that will conduct over 600 combined energy waste, and productivity assessment days of service to manufacturing clients.	6200 energy-intensive U.S. plants that will apply EERE technologies and services averaging up to a 15 percent improvement in energy productivity per plant. [MET: Exceeded, 6400 plants]	An additional 600 (leading to a cumulative 6800) energy intensive U.S. plants will apply EERE technologies and services averaging a 5 percent improvement in energy productivity per plant. [MET: Exceeded, 8200 cumulative plants]	An additional 200 (leading to a cumulative 7000) energy intensive U.S. plants will apply EERE technologies and services.	An additional 200 (leading to a cumulative 8600) energy intensive U.S. plants will apply EERE technologies and services contributing to the goal of a 20% reduction in energy intensity from 2002 levels by 2020.
			Contribute proportionately to EERE's corporate goal of reducing corporate and program uncosteds to a range of 20-25 percent by reducing program annual uncosteds by 10 percent in 2004 relative to	*Contribute proportionately to EERE's corporate goal of reducing corporate and program adjusted uncosted obligated balances to a range of 20-25 percent by reducing program annual adjusted*	*Contribute proportionately to EERE's corporate goal of reducing corporate and program uncosteds to a range of 20-25 percent by reducing program annual uncosteds by 10 percent in 2006 relative to*

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Results	FY 2005 Targets	FY 2006 Targets
			the program uncosted baseline (2003) until the target range is met.	*uncosteds by 10 percent in 2005 relative to the program FY 2004 end of year adjusted uncosted baseline ($40,741K) until the target range is met.*	*the program uncosted baseline (2005) until the target range is met.* *Maintain total Program Direction costs in relation to total Program costs in the range of 8% - 12% to demonstrate efficient and effective EERE-wide business and technical support to mission direct programs.*

Means and Strategies

The Industrial Technologies Program will use various means and strategies to achieve its program goals as described below. "Means" include operational processes, resources, information, and the development of technologies, and "strategies" include program, policy, management and legislative initiatives and approaches. Various external factors, as listed below, may impact the ability to achieve the program's goals. Collaborations are integral to the success of planned investments, means and strategies, and to addressing external factors.

The Industrial Technologies Program will implement the following means:

- DOE partners with the most energy-intensive industries working with individual companies, trade associations, and professional groups to develop and apply advanced technologies and practices that reduce energy consumption. These industry and departmental investments represent the greatest opportunities to save energy and improve environmental performance in a cost-effective manner. DOE invests in pre-competitive and high-risk RD&D that individual companies are unable to undertake without government support.
- The *Industries of the Future* strategy engages partners in key phases of the program. Technology visions and roadmaps are developed by industry and other stakeholders to define their long-term goals, technology challenges, and research priorities. ITP uses these roadmaps to match industry's technology needs with Federal energy efficiency priorities in planning the Federal research agenda.
- ITP implements its research and technology development program through cost-shared projects with multiple industrial and academic partners. Sharing project costs (industrial partners typically contribute 50 percent) leverages public investment with private resources, increases access to scientific capabilities, increases industry commitment to achieving R&D success, shortens the technology development and commercialization cycle, and facilitates technology delivery. ITP activities include both industry-specific R&D and activities that cut across industrial boundaries.

The Industrial Technologies Program will implement the following strategies:

- The Management Strategy focuses on addressing energy losses that when remedied will reduce the energy requirements of industry while stimulating economic productivity and growth.
- ITP invests in next-generation manufacturing concepts that will produce dramatic energy and environmental benefits providing large public benefits. These Grand Challenges typically require high-risk, high-return R&D which one industry cannot typically do, such as an entirely new processing route to achieve much lower energy use than current processes.
- Beginning in FY 2005, ITP shifted a portion of its R&D portfolio to focus on multi-industry Grand Challenges for next-generation manufacturing and energy systems technologies. ITP's emphasis on Grand Challenges in its R&D portfolio is expected to result in fewer, but higher value, projects that will yield substantial energy, environmental, and economic benefits.

These means and strategies could result in significant cost savings and a significant reduction in the consumption of energy across fuel types—increase the substitution of clean fuels and power—cost effectively reducing American's demand for energy, lowering carbon emissions, and decreasing energy expenditures.

The following external factors could affect ITP's ability to achieve its strategic goal:

- Rates of market growth/technology adoption;

- Industry profit margins;
- Capital investment requirements;
- Foreign competition;
- Energy supply markets and prices;
- Safety and environmental regulations;
- Costs and adoption of technologies;
- Labor and material costs; and
- Environmental policies at the national and state level, including Federal efforts to reduce carbon and criteria emissions that might affect the choice of energy sources.

In carrying out the program's mission, Industrial Technologies Program (ITP) performs the following collaborative activities:

- Collaboration with high energy-intensity public-private industry partnerships.
- The *National Energy Policy*[a] encourages energy efficiency programs that are modeled as public-private partnerships. The Industrial Technologies Program has used this partnership model for the past nine years to bring together the strengths of business and government to solve increasingly complex and difficult efficiency problems. These partnerships also help to disseminate and share best energy management practices in factories throughout the United States.
- ITP's established public-private partnerships help to facilitate new efforts as well, particularly the President's Climate VISION (Climate Voluntary Innovation Sector Initiatives: Opportunities Now) initiative to encourage reductions in industrial greenhouse gas emissions.
- ITP works with DOE's Basic Energy Sciences and Fossil Energy Programs to coordinate research in such areas as nanotechnology and mining, respectively.
- ITP coordinates with other Federal agencies, including the National Aeronautics and Space Administration, the National Science Foundation, the National Institute of Standards and Technology, EPA, and the Departments of Defense, Commerce, Agriculture, and Interior to organize research efforts in common areas.
- On manufacturing technology issues, ITP collaborates through the Government Agencies Technology Exchange in Manufacturing (GATE-M) partnership and the National Science and Technology Council inter-agency working group with many of the participating agencies.

Validation and Verification

To validate and verify program performance, the Industrial Technologies Program will report and manage its performance plan directly and conduct internal and external reviews and audits. These programmatic activities are subject to continuing review by, for example, the Congress, the General Accounting Office, the Department's Inspector General, the U.S. Environmental Protection Agency, and state environmental agencies. ITP will also undertake analyses to address Government Performance and Results Act (GPRA) and the President's Management Agenda (PMA) requirements, including the Performance Assessment Rating Tool (PART) and the R&D Investment Criteria (R&DIC).

[a] See National Energy Policy report of the National Energy Policy Development Group (May 2001), P. 4-12.

The table below summarizes validation and verification activities. Progress toward annual performance targets and results are also tracked on a quarterly basis through the DOE management system, Joule.

Data Sources: Energy intensity is calculated from the Energy Information Administration's (EIA's) Annual Energy Outlook, Manufacturing Energy Consumption Survey (MECS) and Department of Commerce data. The number of technologies and their energy savings is ascertained through interviews with technology developers and suppliers. Energy savings for the technical assistance programs are estimated based upon past reported participant data. Project financial data is tracked through the EERE Corporate Planning System.

Evaluation: In carrying out the program's mission, the Industrial Technologies Program uses several forms of evaluation to assess progress and to promote program improvement.

- Technology validation and operational field measurement, as appropriate
- Peer review by independent outside experts of both the program and subprogram portfolios
- Annual internal Technical Program Review of the Industrial Technologies Program
- Specialized program evaluation studies to examine process, impacts, or market baseline and effects, as appropriate
- Quarterly and annual assessment of program and management results based performance through Joule (the DOE quarterly performance progress review of budget targets), R&DIC (annual internal review of performance planning and management of R&D programs against specific criteria), PMA (the President's Management Agenda -- annual departmental and PSO based goals whose milestones are planned, reported and reviewed quarterly) and PART (common government wide program/OMB reviews of management and results).
- Annual review of methods, and recomputation of benefits for the Government Performance and Results Act (GPRA).

Baselines: The following are the key baselines used in ITP:

- Industrial energy intensity (2002) 14,000 Btu/$1996 value of shipments of energy intensive industry output.
- The base line for the cumulative count of new commercialized technologies is zero in 2003 cumulative count.

Frequency: EIA/MECS collects energy intensity data once every 4 years, and ITP makes annual estimates based upon data from annual Department of Commerce surveys. ITP collects data on energy savings and technologies commercialized annually. The EERE Corporate Planning System tracks project awards and expenditures continually.

Data Storage: Energy intensity information is contained in EIA's computer database. Data on energy savings and technologies commercialized are stored in ITP's Impacts Database and are available on the internet at ITP's website: http://eelndom1.ee.doe.gov/OIT/oitpdf.nsf/Files/02impacts_forward.pdf/$file/02impacts_forward.pdf. Data on the counts and impacts of plants contacted is collected by

Lawrence Berkeley National Laboratory and Oak Ridge National Laboratory.

Verification: ITP uses prospective and retrospective peer reviews to evaluate project performance and to adjust support. To verify program performance and results, ITP tracks all technologies commercialized (and the extent of their use) by industry through an analysis of program impacts conducted by Pacific Northwest National Laboratory. ITP also provides EIA quality control and outside peer review of the Manufacturing Energy Consumption Survey. Industry representatives review data on energy savings and technologies commercialized. ITP has conducted reviews of the impacts of several technical programs and assistance programs have also been reviewed several times.

Funding by General and Program Goals

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
General Goal 4, Energy Security			
Program Goal 04.60.00.00, Industrial Technologies			
Industries of the Future (Specific)	45,659	38,176	22,087
Industries of the Future (Crosscutting)	38,874	32,885	30,609
Technical/Program Management Support	5,917	3,740	3,793
Total, Program Goal 04.60.00.00, Industrial Technologies	90,450	74,801	56,489
Total, General Goal4 (Industrial Technologies)	90,450	74,801	56,489

Expected Program Outcomes

The Industry Program pursues its mission through integrated activities designed to improve the energy efficiency and productivity of our economy. We expect these improvements to reduce susceptibility to energy price fluctuations and potentially lower energy bills; reduce EPA criteria and other pollutants; and provide greater energy security and reliability by improving our energy infrastructure. In addition to these "EERE business-as-usual" benefits, realizing the Industry Program goals would provide the technical potential to reduce conventional energy use even further if warranted by future energy needs.

Estimates of annual non-renewable energy savings, energy expenditure savings, carbon emission reductions, oil savings, natural gas savings, and reduced need for electricity capacity additions that result from the realization of Industry Program goals are shown in the table below through 2025.

The assumptions and methods underlying the modeling efforts have significant impact on the estimated benefits, and results could vary significantly if external factors, such as future energy prices, differ from the "baseline case" assumed for this analysis. EERE's baseline case is essentially the same as the EIA "business-as-usual" case presented in its Annual Energy Outlook. In addition, possible changes in public policy and disruptions in the energy system which may affect estimated benefits are not modeled. The external factors such as unexpected changes in competing technology costs, identified in the Means and Strategies section above, could also affect the Program's ability to achieve its goals.

The results shown in the long term benefits tables are preliminary estimates based on initial modeling of some of the possible program production technologies; nonetheless, they provide a useful picture of the potential change in national benefits over time if the technology, infrastructure and markets evolve as expected. Estimated benefits which follow assume that individual technology plans and market assumptions obtain. Final documentation is estimated to be completed and posted by March 31, 2005. Uncertainties are larger for longer term estimates. A summary of the methods, assumptions, and models used in developing these benefit estimates that are important for understanding these results are provided at www.eere.energy.gov/office_eere/budget_gpra.html.

FY 2006 GPRA Benefits Estimates for the Industrial Technologies Program[a]

Mid-Term Benefits[b]	2010	2015	2020	2025
Primary nonrenewable energy savings (Quads)	0.2	0.8	1.8	2.2
Energy bill savings (Billion 2002$)	2	11	17	13
Carbon emission reductions (MMTCE)	5	15	35	44
Oil savings (MBPD)	0.0	0.1	0.2	0.2
Natural gas savings (Quads)	0.12	0.30	0.64	0.72
Total electric capacity displaced (GW)	ns	3	8	11

Long-Term Benefits[c]	2030	2040	2050
Primary nonrenewable energy savings (Quads)	2.3	1.3	0.5
Energy system cost savings (Billion 2001$)	16	10	3
Carbon emission reductions (MMTCE)	42	23	8
Oil savings (MBPD)	0.1	0.1	0.0
Natural gas savings (Quads)	1.26	0.77	0.29
Total electric capacity displaced (GW)	9	2	0

[a] Benefits reported are annual, not cumulative, for the year given. Estimates reflect the benefits that may be possible if all of the program's technical targets are met and funding continues at levels consistent with assumptions in the FY 2006 Budget.
[b] Mid-term program benefits were estimated utilizing the GPRA06 Request-NEMS model, based on the Energy Information Administration's (EIA) National Energy Modeling System (NEMS) and utilizing the EIA's Annual Energy Outlook (AEO) 2004 Reference Case.
[c] Long-term benefits were estimated utilizing the GPRA06 - MARKAL developed by Brookhaven National Laboratory (BNL). Results can differ among models due to differences in their structure. In particular, the two models estimate economic benefits in different ways, with the MARKAL model reflecting the cost of additional investments required to achieve reductions in energy bills.

Performance Indicators	Historic			Planned				
	2002	2003	2004	2005	2006	2007	2008	2009
Annual number of technologies commercialized								
Target	6	4	4	3	3	TBD	TBD	TBD
Actual	10	5	6					
Annual energy savings from Industrial Program activities in partnership with industry (trillion Btu)								
Target		290	220	220	180	TBD	TBD	TBD
Actual	293	352						
Number of new Allied Partners								
Target	20	20	20	20	10	TBD	TBD	TBD
Actual	20	20	21					
Cumulative number of energy-intensive plants impacted by the program								
Target	5,000	6,200	6,800	8,400	8,600	8,800	9,000	9,200
Actual	5,200	6,400	8,200					
Number of internet information page views (million)								
Target	5.0	6.0	6.2	6.4	6.6	TBD	TBD	TBD
Actual	5.3	6.0	6.3					
Percentage change in energy intensity from 2002								
Target		-1.2	-2.4	-3.7	-4.8	TBD	TBD	TBD
Actual		-1.2 est.	-2.4 est.					

Over the past 30 years, industry has shown a remarkable ability to improve energy efficiency, greatly increasing economic output without a corresponding increase in energy use. The Industrial Technologies Program estimates that, in 2002, it directly contributed to industrial energy savings of over 293 trillion Btu[a] in energy savings worth over $1.8 billion.[b] From the ITP activity's inception in 1977 through 2002, ITP helped develop more than 180 commercialized industrial technologies. Cumulative tracked energy savings over that period are estimated to be almost 3,800 trillion Btu.

[a] See March 2004 Impacts report at http://www.pnl.gov/impacts/pdfs/04impacts/front.pdf.

[b] Constant 2002 dollar values for energy savings shown in this budget are based upon Energy Information Administration data for 2002 as well as preliminary estimates for 2003 and 2004. Average industrial energy prices per million Btu were $6.31 in 2002, $7.29 in 2003, and a forecast of $6.70 for 2004. Source: based on AEO 2004, Table A-3, available at www.eia.doe.gov/oiaf/aeo/pdf/aeo_base.pdf.

Yet an expanding economy will increase industrial energy demand. In its Annual Energy Outlook 2004, the Energy Information Administration projects industrial energy use will grow by over 30 percent from 2001 to 2025, even with assumed efficiency gains and an economic shift to less energy-intensive industries. Reducing energy intensity–the amount of energy used to produce a given amount of industrial product–is the key to increasing energy efficiency in industry without impeding economic growth. Because there are significant gaps between current energy use and the practical minimum energy use for most industrial processes, the industrial sector will continue to offer excellent opportunities to improve energy efficiency in the United States over the next 25 years.

If energy use per unit of output in the ITP partner industries continued at 2002 levels, these industries would be using about 20.9 Quads by 2010. However, by 2010, partner industries are expected to reduce their energy use by 1.2 Quad through business-as-usual efficiency improvements (EIA projection of 0.75 percent annually), and, concurrently, activities sponsored by the Industrial Technologies Program are projected to help these industries lower energy use by up to an additional 0.8 Quads. See Figure 1. By 2020, partner industries could be reducing their energy use by 3.2 Quads (from a 25 Quad level using 2002 energy intensities) through business-as-usual efficiency improvements, and by an additional 1.8 Quads as a result of ITP activities.

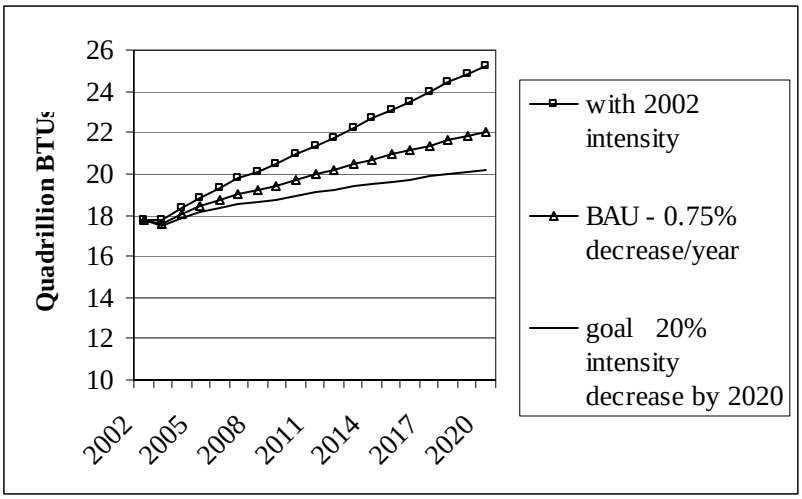


Figure 1: Energy Intensity Target

Industries of the Future (Specific)

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Industries of the Future (Specific)					
Forest and Paper Products Industry	7,419	6,233	3,000	-3,233	-51.9%
Steel Industry	6,529	5,606	3,767	-1,839	-32.8%
Aluminum Industry	6,415	5,505	2,704	-2,801	-50.9%
Metal Casting Industry	3,949	3,944	2,000	-1,944	-49.3%
Glass Industry	3,217	2,564	1,763	-801	-31.2%
Chemicals Industry	12,848	10,239	7,075	-3,164	-30.9%
Mining Industry	4,574	3,394	1,060	-2,334	-68.8%
Supporting Industries	708	691	718	+27	+3.9%
Total, Industries of the Future (Specific)	45,659	38,176	22,087	-16,089	-42.1%

Description

The Industries of the Future (Specific) supports cost-shared research, development, and demonstration (RD&D) of advanced technologies to reduce the energy intensity while improving the environmental performance of America's energy-intensive and waste-intensive industries. To provide the best value and optimum use of public investments, this activity focuses on a few basic materials processing industries that can achieve the highest returns on Federal investments.

Benefits

Key domestic industries will employ partner co-developed and tested industrial efficiency technologies that reduce their energy consumption and competitive position preserving domestic economic benefits while reducing cost, saving energy and improving environmental performance.

Detailed Program Justification

(dollars in thousands)

FY 2004	FY 2005	FY 2006

Forest and Paper Products Industry **7,419** **6,233** **3,000**

By 2020, in partnership with industry, the goal of the Forest and Paper Products activity is to develop alternative pulping and bleaching technologies, advanced water removal technologies for papermaking, and methods for making the strength of recycled fiber equivalent to virgin fiber.

In FY 2006, the key activity plans to perform mechanical and process tests for technologies that will reduce water and energy usage in the pulp and papermaking process.

Continue to support the American Forest & Paper Association and other industry organizations to improve their energy efficiency and environmental performance through the industry's Agenda 2020. The collaborative activities will include cost-shared R&D as well as the utilization of new improved energy technologies, industrial energy efficiency tools and energy management best practices.

In FY 2004, this activity was reduced by $194,132 and the funds transferred to the Science Appropriation for SBIR/STTR. *Participants include: Augusta Newsprint Co., G.R. International, Port Townsend Paper Company, PureVision Technology, Inc., The American Forest and Paper Association, The Institute of Paper Science and Technology, Pulp and Paper Education and Research Alliance, National Laboratories, and others.*

Steel Industry **6,529** **5,606** **3,767**

In partnership with industry, the goal of the Steel activity is to make a substantial contribution to ITP's goal of reducing the energy intensity of energy-intensive industries by 20 percent by 2020, as compared to a 2002 baseline.

By 2010, in partnership with industry, the goal of the Steel activity is to develop a commercially ready technology that will cut the use of energy intensive coke as a feedstock in the steel making process.

In FY 2006, start prototype development for balancing highly variable loads in steelmaking. Continue work initiated in FY 2005 Grand Challenge for cokeless ironmaking.

Continue to support the American Iron and Steel Institute, the Steel Manufacturers' Association, and other industry organizations to improve their energy efficiency and environmental performance. The collaborative activities will include cost-shared R&D as well as the utilization of new improved energy technologies, industrial energy efficiency tools, and energy management best practices. In FY 2004, this activity was reduced by $156,066 and the funds transferred to the Science Appropriation for SBIR/STTR. *Participants include: American Iron and Steel Institute (member and associate member companies), Steel Manufacturers Association (member and associate member companies), National Laboratories, universities and other companies.*

(dollars in thousands)

FY 2004	FY 2005	FY 2006

Aluminum Industry **6,415** **5,505** **2,704**

By 2010, the goal of the Aluminum activity is to develop with the aluminum industry advanced technologies, such as carbothermic aluminum reduction, and inert anodes and wettable cathodes that would result in significant net energy savings in primary aluminum production.

In FY 2006, the "Reduction of Alumina" technology investigated in the FY 2005 Grand Challenge will be evaluated to determine if it should be pursued to the pilot stage, and four current elementary R&D forming projects will be evaluated to determine which seem most promising. Move from bench scale to full scale development of Isothermal Melting Process.

Continue existing projects that help improve energy efficiency and environmental performance that industry would not undertake without Federal support. In FY 2004, this activity was reduced by $167,867 and the funds transferred to the Science Appropriation for SBIR/STTR. *Participants include: The Aluminum Association, ALCOA, Apogee, Century Aluminum, Commonwealth Aluminum, and SECAT.*

Metal Casting Industry **3,949** **3,944** **2,000**

In partnership with industry, the goals of the Metal Casting activity are to enable major technical advances in the metal casting industry, to implement new design techniques and practices, to increase yield, and to reduce energy use and generation of scrap.

In FY 2006, develop computer models for the design of tighter tolerance die castings and the lost foam pattern displacement process. Continue work initiated in FY 2005 Grand Challenge for advanced melting.

Continue to work with over 320 cost-sharing industry partners in 35 States. Research areas include computer models and alloy diversification for lost foam; design tools to improve die casting applications; low-cost semi-solid metal feedstock; and improvement and diversification in permanent molds. In FY 2004, this activity was reduced by $103,326 and the funds transferred to the Science Appropriation for SBIR/STTR. *Participants include: Cast Metals Coalition, including American Foundry Society, Steel Founder's Society of America, North American Die Casting Association , Ohio State University, University of Michigan, Case Western Reserve University, Pacific Northwest National Laboratory (PNNL), Oak Ridge National Laboratory (ORNL), Iowa State University, University of Alabama, Worcester Polytechnic Institute (WPI), and University of Iowa.*

Glass Industry **3,217** **2,564** **1,763**

In partnership with industry, the goal of the Glass activity is to develop advanced glass technologies that will reduce the gap between actual melting energy use (more than 11 million Btu to melt a ton of glass as measured in 1996) and the theoretical minimum (2.5 million Btu per ton) by 50 percent by 2020.

In FY 2006, continue work initiated in FY 2005 Grand Challenge for the next generation melter. Continuing research areas include advanced glass process technology, modeling, and measurement and

control technology. In FY 2004, this activity was reduced by $84,176 and the funds transferred to the Science Appropriation for SBIR/STTR.

Participants include: Glass Manufacturing Industry Council, PPG Industries, Owens Corning, Johns Manville, Gas Technology Institute, Plasmelt, Eclipse/Combustion Tec, Praxair, BOC Gases, Certain Teed, Osram Sylvania, Corning, Inc., Alfred University-Center for Glass Research, and the States of Ohio and Pennsylvania.

Chemicals Industry..... **12,848** **10,239** **7,075**

In partnership with industry, the goals of the Chemicals activity are to develop separation technologies, new chemical process technologies, and new enabling technologies that will increase energy efficiency across the industry by 30 percent by 2020, compared to conventional 1998 technologies.

FY 2006 planned activities include the completion of demonstration testing of the Alloy Selection System at Elevated Temperatures, the Production and Separation of Fermentation Derived Acetic Acid project, the Dimpled Tube Technology for Process Heaters, and Process Optimization Tools for Solution Crystallization.

Continue work initiated in FY 2005 Grand Challenge for distillation technologies. In FY 2004, this activity was reduced by $336,192 and the funds transferred to the Science Appropriation for SBIR/STTR. *Participants include: American Chemical Society, American Institute of Chemical Engineers, Chemical Manufacturers Association, Council for Chemical Research, Praxair, Air Products, Honeywell, Reaction Engineering, Argonne Laboratory, Los Alamos National Laboratory, Oak Ridge National Laboratory, Pacific Northwest National Laboratory, Sandia National Laboratories, Dupont, Dow Chemical, Fluent, Aspen Technology, BP Chemicals, OLI Systems, Washington University, Shell International, University of Texas at Austin, Gas Technology Institute, General Electric, TDA Research, and Aspen Technology.*

Mining Industry..... **4,574** **3,394** **1,060**

By 2010, in partnership with industry, the goal of the Mining activity is to develop mining technologies that can reduce the energy intensity required to crush a short ton of rock by 20-30 percent from its 1998 baseline.

Cancel and close out lower priority projects reflecting an increased focus on future mining process technologies.

In FY 2004, this activity was reduced by $119,697 and the funds transferred to the Science Appropriation for SBIR/STTR. *Participants included: National Mining Association, major mining and mineral processing companies, equipment manufacturers, universities, and National Laboratories including Stolar Horizon, Advanced Ceramic Research, University of Utah, University of Alaska, University of Arizona, Montana Tech, Michigan Tech, W. Virginia State University, Virginia Tech, Transtech, Pacific Northwest National Laboratory, Albany Research Laboratory, Los Alamos National Laboratory, Sandia National Laboratories, Idaho National Energy Laboratory, Consolidated Coal, Phelps Dodge Copper Corp., the Florida Institute of Phosphate Research,*

(dollars in thousands)

FY 2004	FY 2005	FY 2006

Caterpillar Corp. and the Fuel Cell Institute.

Supporting Industries..... **708** **691** **718**

By 2020, in partnership with industry, the goal of the Supporting Industries activity is to substantially reduce the energy consumption of material forming and finishing processes and powder metal parts and components manufacturing.

In FY 2006, continue to identify multiple-industry research projects with large potential energy savings. Continue development and testing of high temperature carburizing process, integrated aluminum casting model, control algorithm for high efficiency sintering of powder metal components, the pulsed gas metal-arc welding (GMAW) process, friction stir and fatigue resistant welding processes, and intensive quenching technology.

In partnership with industry, continue to assist efforts to reduce energy consumption in carburizing processes, in heat treatment of castings, welding processes and powder metal sintering processes for the pulsed GMAW welding processes.

In FY 2004, this activity was reduced by $18,544 and the funds transferred to the Science Appropriation for SBIR/STTR. *Participants include: Forging Ind. Assoc. (FIA), Lincoln Elec. Co., Worcester Polytech. Inst. (WPI), Oak Crest Institute of Science, Center for Heat Treating Excellence (CHTE), Air Products and Chemicals, Boycote Thermal Processing, Caterpillar, Deere & Co., Eclipse, GMC, Houghton Int'l, Ipsen Int'l, AMCAST Ind. Corp., ALCOA, UES Software, Kolene Corp., Pratt & Whitney, Surface Combustion, Timken Co., Boeing Co., and several universities and National Laboratories.*

Total, Industries of the Future (Specific) **45,659** **38,176** **22,087**

Explanation of Funding Changes

FY 2006 vs. FY 2005 ($000)

Forest and Paper Products Industry

This change reduces funding for lower priority projects to allow emphasis on energy-efficient processing technologies. This decision is consistent with Section 2a of the RDIC which addresses how well the R&D activity's planning builds on existing technology, complements related R&D activities, and proposes technically feasible R&D activities ..... -3,233

	FY 2006 vs. FY 2005 ($000)
Steel Industry	
This change reduces funding for projects with lower market barriers. This decision is consistent with Section 1b of the RDIC which addresses the extent to which there are market barriers to private sector investment in research	-1,839
Aluminum Industry	
This decrease for ITP will postpone the funding of a Grand Challenge in the area of carbothermic production consistent with industry priorities. Section 2b of the RDIC addresses how well the R&D activity's planning and prioritization incorporate industry involvement	-2,801
Metal Casting Industry	
This change reduces funding for lower priority projects. This decision is consistent with Section 2a of the RDIC which addresses how well the R&D activity's planning builds on existing technology, complements related R&D activities, and proposes technically feasible R&D activities	-1,944
Glass Industry	
This decrease for ITP will postpone the first test series for a pilot-scale, submerged combustion melter, cost-shared with industry involvement. This decision is consistent with Section 2a of the RDIC which addresses how well the R&D activity's planning builds on existing technology, complements related R&D activities, and proposes technically feasible R&D activities	-801
Chemicals Industry	
This decrease for ITP will postpone the funding of Grand Challenges in the areas of separations and reactions. This decision is consistent with Section 2a of the RDIC which addresses how well the R&D activity's planning builds on existing technology, complements related R&D activities, and proposes technically feasible R&D activities	-3,164
Mining Industry	
This decrease for ITP will cancel and close out lower priority projects reflecting an increased focus on future mining process technologies. This decision is consistent with Section 2e of RDIC which addresses how well the R&D activity plan incorporates "off ramps" and a clear end point	-2,334
Supporting Industries	
No significant change	+27
Total Funding Change, Industries of the Future (Specific)	**-16,089**

Industries of the Future (Crosscutting)

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Industries of the Future (Crosscutting)					
Industrial Materials of the Future	12,222	10,847	11,286	+439	+4.0%
Combustion	1,925	1,577	1,642	+65	+4.1%
Gasification Programs	4,790	0	0	0	0.0%
Robotics	1,975	1,972	0	-1,972	-100.0%
Sensors and Automation	3,593	3,057	3,181	+124	+4.1%
Industrial Technical Assistance	14,369	15,432	14,500	-932	-6.0%
Total, Industries of the Future (Crosscutting)	38,874	32,885	30,609	-2,276	-6.9%

Description

The Industries of the Future (Crosscutting) activities work with industrial partners and suppliers to conduct cost-shared RD&D on technologies that have potential applications across many partner industries. Three primary areas of focus that offer major improvements in energy efficiency and emissions reduction are: (1) *advanced industrial materials* that can reduce energy use, lower emissions, increase component life, improve product quality, optimize process operating conditions, and reduce downtime; (2) *high-efficiency, clean combustion* technologies; and (3) *advanced sensors and automation* that can increase process efficiency and productivity even in high temperature and harsh environments. ITP also develops and provides the tools and technical assistance needed by industry to expedite the adoption of energy-efficiency, and clean manufacturing technologies.

Benefits

Crosscutting IOF technologies provide the means for development of broad benefit technologies that are not within practical developmental reach of an industry. These technologies will be developed and deployed across industries providing economic, energy and environmental benefits nationally.

Detailed Program Justification

(dollars in thousands)

FY 2004	FY 2005	FY 2006

Industrial Materials of the Future **12,222** **10,847** **11,286**

In partnership with industry, the goals of the Industrial Materials of the Future activity are to conduct R&D to develop new materials consistent with the needs identified in the IOF visions and technology roadmaps and reduce energy use by more than 200 trillion Btu (compared to conventional technology) in 2020.

In FY 2006, complete database construction and begin model development for the prediction of localized corrosion. Work will continue on the development of databases and thermophysical models, materials for manufacture of tools and dies, advanced refractories for industrial systems, and materials solutions for corrosion and wear.

In FY 2004, this activity was reduced by $319,821 for SBIR/STTR and transferred to the Science Appropriation. *Participants include: Alon Surface Technologies, Air Products, Caterpillar, Inc., Carpenter Technologies, General Aluminum Manufacturing Company, Michigan Technological University, Materials Technology Institute, RSP Tooling, LLC, Solar Turbines, Special Metals Corporation, Starfish Systems, Inc., West Virginia University, SECAT, Weyerhauser Company.*

Combustion **1,925** **1,577** **1,642**

By 2020, have crosscutting steam generation and process heating technologies in the marketplace that enable the industrial sector to achieve the ITP goal of 20 percent reduction of energy intensity.

By 2010, in partnership with industry, the goal of the Combustion activity is that packaged boilers with thermal efficiencies 10-12 percent higher than conventional technology and with single digit ppm NOx emissions are commercially available.

In FY 2006, complete development of Computational Fluid Dynamics-based design tool. Continue work initiated in FY 2005 Grand Challenge for a superboiler. Continue research on and initiate field evaluation of a prototype ultra-high efficiency, low emission refinery process heater.

In FY 2004, this activity was reduced by $50,363 and the funds transferred to the Science Appropriation for SBIR/STTR. *Participants include the Gas Technology Institute, Southern California Gas, Cleaver-Brooks, TIAX, Callidus Technologies, and ExxonMobil.*

Gasification Programs..... **4,790** **0** **0**

In FY 2004, this activity focused on the black liquor demonstration project at Big Island and related technology development. The work continues to be managed by the Biomass Program in view of the work's applicability to future forest products biorefineries and the fact that biorefineries are the focus of the Biomass and Biorefinery R&D Systems Program. Because funding of technology development and validation appears to be within industry's capability, the FY 2006 budget request does not seek funding for this activity in accordance with the Administration's R&D Investment Criteria (RDIC) (directing funding to long-term, high-risk research that industry is unlikely to undertake without

(dollars in thousands)

FY 2004	FY 2005	FY 2006

Federal support). In FY 2004, this activity was reduced by $122,696 for SBIR/STTR and transferred to the Science Appropriation. Participants will be chosen either late in FY 2005 or early in FY 2006.

Robotics **1,975** **1,972** **0**

FY 2006 research efforts in this area will be combined with the activities in the Sensors and Automation area.

Sensors and Automation **3,593** **3,057** **3,181**

By 2010, in partnership with industry, the goal of the Sensors and Automation activity is to develop systems that ultimately will enable a level of productivity and product quality currently unattainable under human or machine control and produce a gain of at least 5 percent in energy efficiency. The demonstration of new sensor technology in the aluminum industry will enable secondary aluminum production to move from a batch to a continuous process.

In FY 2006, develop modular sampling system prototype and an advanced micro analyzer; identify, test and evaluate industrial wireless sensor systems; develop a steel quality sensor; and continue robotics R&D activities in the areas of gas-fired thermal treatment processes and general improvement in manufacturing line productivity.

In FY 2004, this activity was reduced by $135,214 and the funds transferred to the Science Appropriation for SBIR/STTR. *Participants include: General Electric Global Research, Honeywell International, Eaton Corporation, The Timken Co., Energy Research Co., OG Technologies, TIAX, LLC, Oak Ridge National Laboratory.*

Industrial Technical Assistance..... **14,369** **15,432** **14,500**

- **Industrial Assessment Centers** **6,443** **7,051** **6,500**

  By 2020, the goals of the Industrial Assessment Centers (IAC) activity (begun in 1976 as the Energy Analysis and Diagnostic Center Program) are to have completed over 20,300 Industrial Assessment Audits and trained over 3,550 engineering students. Through the end of 2003, over 13,300 audits have been completed, training over 2,150 students, with an estimated cumulative energy savings of nearly 1 quadrillion Btu.

  In FY 2006, the IAC activity is expected to include 650 assessment days, and to provide energy, waste, and productivity training to another 140 engineering students at 26 participating universities, helping them to continue to provide a nationwide cadre of experienced and trained engineering alumni. The IAC activity will also fully implement the student certification Program to provide graduating students with credentials important to them in their careers in industry. Centers will integrate overall Best Practices (BP) tools and training into the IAC activity by ensuring that Center Directors already certified as qualified specialists in the BP software become certified as training instructors and pursue specialist training in additional tools.

  Centers will continue to utilize more proactively the BP software tools in their assessment "tool

kits" and will continue to develop and replicate innovative implementation strategies to increase energy savings recommendations and to promote the adoption of those recommendations by client companies. Replication strategies will be developed to help client companies better promote energy savings recommendations made by the IACs to other facilities within their corporate structures. Emphasis will continue to be placed on student training and activities including student participation in professional and technical conferences and on licensing opportunities.

In FY 2004, this activity was reduced by $168,606 and the funds transferred to the Science Appropriation for SBIR/STTR. *Participants include 26 IAC universities plus one IAC manager (Rutgers University*): *Colorado State University, Loyola Marymount University, Syracuse University, University of Illinois at Chicago, University of Louisiana at Lafayette, Oklahoma State University, Iowa State University, North Carolina State University, University of Massachusetts at Amherst, Mississippi State University, University of Miami, University of Florida, Oregon State University, San Francisco State University, Texas A & M University, San Diego State University, Lehigh University ,Georgia Institute of Technology, University of Utah, University of Wisconsin-Milwaukee, University of Michigan, University of Dayton, West Virginia University, Bradley University, Arizona State University, and University of Texas at Arlington.*

▪ **Best Practices**	**7,926**	**8,381**	**8,000**

In FY 2006, complete 6 plant-wide assessments and complete 45 training sessions on energy-efficiency software.

Continue technical assistance to plant sites, enabling their use of industrial process application tools relevant to motor, pump, process heating, steam and compressed air systems emphasizing system-level improvements. In collaboration with industry, develop new software tools and update existing tools, as necessary.

Continue efforts to replicate plant-wide assessment results from prior awards in industrial facilities with similar process lines. Complete efforts to increase Allied Partners to 200 companies, support industries and trade associations. Use Allied Partnerships to facilitate delivery and replication of the entire Best Practices portfolio. In FY 2004, this activity was reduced by $207,300 for SBIR/STTR and transferred to the Science Appropriation.

Total, Industries of the Future (Crosscutting)	**38,874**	**32,885**	**30,609**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Industrial Materials of the Future	
This increase for ITP will allow the completion of a database construct to develop a repository of fundamental thermophysical property data to advance materials and process capabilities. Section 2a of the RDIC addresses how well does the plan build on existing technology, complement related R&D activities, and propose technically feasible R&D activities. This decision is consistent with Section 2a of the RDIC which addresses how well the plan builds on existing technology, complements related R&D activities, and proposes technically feasible R&D activities.....	+439
Combustion	
This increase for ITP will permit the completion of the development of the Computational Fluid Dynamics-based design tool developed in partnership with industry. This decision is consistent with Section 2b which addresses how well the R&D activity's planning and prioritization incorporates industry involvement…….	+65
Robotics	
FY 2006 research efforts in this area will be combined with the activities in the Sensors and Automation area	-1,972
Sensors and Automation	
This increase for ITP will permit the development of a steel quality sensor developed in partnership with industry to minimize the level of steel-quality-related rejects currently plaguing the U.S. steel industry and eliminate the resulting energy-intensive re-melting and re-shaping. This decision is consistent with Section 2b of RDIC which addresses how well the R&D activity's planning and prioritization incorporates industry involvement.....	+124
Industrial Technical Assistance	
▪ **Industrial Assessment Centers**	
Pending development of replication strategies to help client companies better promote energy savings recommendations made by IACs to other facilities within their corporate structures, ITP will reduce university-based dissemination of energy-efficiency technologies and practices	-551
▪ **Best Practices**	
Increased outreach by Allied Partners will enable ITP to reduce Federal program support for these outreach activities	-381
Total, Industrial Technical Assistance.....	**-932**
Total Funding Change, Industries of the Future (Crosscutting).....	**-2,276**

Technical/Program Management Support

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Technical/Program Management Support	5,917	3,740	3,793	+53	+1.4%
Total, Technical/Program Management Support	5,917	3,740	3,793	+53	+1.4%

Description

Technical/Program Management activities include preparation of Program strategic and operating plans; evaluation of the impact of new legislation on R&D Programs; identification and application of performance methodologies (including GPRA); and data collection to assess Program and project performance, efficiency and impacts on accomplishing the mission.

Benefits

The technical/program management subprogram provides the analysis framework and technical support to meet the requirements of Department's planning process, Congress, GPRA, and OMB's Program Assessment Rating Tool (PART) process. This subprogram also analyzes program gaps and new R&D opportunities. This planning and management analysis is necessary to keep the Program's research agenda on target to meet the Program Goal, in the face of dynamic market and technology developments.

Detailed Program Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Technical/Program Management Support	**5,917**	**3,740**	**3,793**

In FY 2006, provide critical technical and Program management support services including support for multi year planning; strategic planning; analysis of Program activities to support efforts to refocus work to achieve greater Program impacts; peer reviews of R&D Programs and Program portfolios and management; and analysis and assessments of past Program impacts and performance. *Participants include PNNL, NREL, Energetics, Inc., BCS, Inc., Teratech, and Rand Corporation.*

Total, Technical/Program Management Support	**5,917**	**3,740**	**3,793**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Technical/Program Management Support	
This increase for ITP will increase peer review of analysis activities. This decision is consistent with Section 2f of the RDIC which addresses the external reviews of R&D activity plans	+53
Total Funding Change, Technical/Program Management Support	**+53**

Biomass and Biorefinery Systems R&D

Funding Profile by Subprogram[a]

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation[b]	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Biomass and Biorefinery Systems R&D						
Utilization of Platform Outputs R&D	6,570	6,859	6,859	21,205	+14,346	+209.2%
Technical Program Management Support	396	394	394	600	+206	+52.3%
Total, Biomass and Biorefinery Systems R&D	6,966	7,253	7,253	21,805	+14,552	+200.6%

Public Law Authorizations:

P.L. 93-577, "Federal Non-nuclear Energy Research and Development Act" (1974)
P.L. 94-163, "Energy Policy and Conservation Act" (EPCA) (1975)
P.L. 94-385, "Energy Conservation and Production Act" (ECPA) (1976)
P.L. 95-91, "Department of Energy Organization Act" (1977)
P.L. 95-618, "Energy Tax Act" (1978)
P.L. 95-619, "National Energy Conservation Policy Act" (NECPA) (1978)
P.L. 95-620, "Powerplants and Industrial Fuel Use Act" (1978)
P.L. 96-294, "Energy Security Act" (1980)
P.L. 100-12, "National Appliance Energy Conservation Act" (1987)
P.L. 100-615, "Federal Energy Management Improvement Act" (1988)
P.L. 101-218, "Renewable Energy and Energy Efficiency Technology Competitiveness Act" (1989)
P.L. 101-549, "Clean Air Act Amendments of 1990"
P.L. 101-575, "Solar, Wind, Waste, and Geothermal Power Production Incentives Act" (1990)
P.L. 102-486, "Energy Policy Act" (1992)
P.L. 106-224, "Biomass Research and Development Act" (2000)
P.L. 108-148 "Healthy Forest Restoration Act" (2003)

[a] SBIR/STTR funding in the amount of $170,000 was transferred to the Science Appropriation in FY 2004. Estimates for SBIR/STTR budgeted in FY 2005 and FY 2006 are $177,000 and $547,000 respectively.
[b] Reflects the 0.594% and 0.80% rescissions of -$46,000 and -$61,000 respectively and comparability adjustment for National Energy Technology Laboratory Support of -$320,000.

Mission

The mission of the Biomass and Biorefinery Systems R&D Program ("Biomass Program") is to partner with U.S. industry to foster research and development on advanced technologies that will convert our Nation's biomass resources into affordable industrial products (including energy and higher valued chemicals and materials) through the development of biorefineries.[a] An analogy to this approach is the petroleum refinery that refines crude oil into a broad range of industrial products. The Biomass Program receives funds from both the Energy Supply and the Energy Conservation appropriations. Energy Supply-funded activities focus primarily on developing advanced technologies for producing intermediate feedstocks such as such as sugars, synthesis gas (syngas), and pyrolysis oils for use in biorefineries toward the production of fuels, chemicals and/or power. Energy Conservation-funded activities focus on developing advanced technologies for more energy efficient industrial processes and co-production of high-value industrial products from the intermediate feedstocks.

Benefits

The program's research focus covers three areas: Feedstock Infrastructure for reducing the cost of collecting and preparing raw biomass[b], Platforms Research and Development for reducing the cost of outputs and byproducts from biochemical and thermochemical processes (i.e., reducing the cost of biomass sugars, syngas, and pyrolysis oil); and Utilization of Platform Outputs for developing technologies and processes that co-produce liquid and gaseous fuels, chemicals and materials, and heat and power--and integrating those technologies and processes in biorefinery configurations (i.e., converting sugars, syngas or pyrolysis oil to useable fuels, chemicals, materials, heat for steam generation, etc.). Energy and Water Development appropriations provide the funding for Feedstock Infrastructure and Platforms Research and Development.

Examples of existing biorefineries include wet and dry mill ethanol plants, and paper mills. The program is partnering with these industries to develop the next generation of biorefineries that will produce value-added chemicals and materials together with fuels and/or power from non-conventional, lower cost feedstocks such as agricultural and forest residues. Cargill Dow, LLC is an example of the type of success that will lead to biorefineries able to utilize starch and/or lignocellulosic feedstocks for the production of fuels and chemicals. They have successfully commercialized polylactic acid (PLA) for use in polymer applications, from a renewable feedstock, corn. Substituting corn for petroleum, the company uses 20 to 50 percent less fossil resources than conventional plastics. In addition, since the production of PLA recycles the earth's carbon, the PLA when configured in a biorefinery for sugar and steam production and using the next generation production technology for lactic acid, emits 100 percent less carbon dioxide, i.e., 2 to 8 kilograms of carbon dioxide per kilogram of polymer less than petroleum-derived polymers such as nylon, polycarbonate, polystyrene, etc.[c] The company continues to develop technologies for the integration of fuels production with PLA production. Next generation biorefineries built on this partnership model will be more efficient and use more diverse biomass

[a] Biorefineries are processing facilities that extract carbohydrates, oils, lignin, and other materials from biomass, convert them into multiple products such as transportation fuels, power, and products.

[b] Biomass means any organic matter that is available on a renewable or recurring basis, including agricultural crops and trees, wood and wood wastes and residues, plants, grasses, residues, fibers, and animal wastes, municipal solid wastes, and other waste materials.

[c] Vink, E. et al, Applications of Life Cycle Assessment to NatureWorks Polylactide (PLA) Production, Vol. 80, Polymer Degradation and Stability, Elsevier, 2003)

resources to accelerate economic development of the bio-industry, increase domestic energy supply and production diversity, and enhance energy security.

Strategic and Program Goals

The Department's Strategic Plan identifies four strategic goals (one each for defense, energy, science, and environmental aspects of the mission) plus seven general goals that tie to the strategic goals. The Biomass Program supports the following goal:

Energy Strategic Goal: To protect our national and economic security by reducing imports and promoting a diverse supply of reliable, affordable, and environmentally sound energy.

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 Biomass Program has one program goal which contributes to General Goal 4 in the "goal cascade":

Program Goal 04.08.00.00: Biomass. Develop biorefinery-related technologies to the point that they are cost- and performance-competitive and are used by the Nation's transportation, energy, chemical and power industries to meet their market objectives. This helps the Nation by reducing fossil energy consumption, our dependence on foreign oil, and greenhouse gas emissions, while also expanding domestic energy supplies and improving the Nation's energy infrastructure.

Contribution to Program Goal 04.08.00.00 (Biomass)

The program directly supports General Goal 4, Energy Security, principally by increasing production of biomass-based substitutes for petroleum-derived chemicals and diversifying supply. It also directly addresses the goals and recommendations of the President's National Energy Policy, the Biomass R&D Act of 2000 and the Farm Security and Rural Investment Act of 2002.

The Biomass Program will contribute to General Goal 4 by developing core technologies to optimize the utilization of platform intermediates (e.g., biomass-derived sugars, synthesis gas, etc.) for the production of products: fuels, chemicals and materials, and heat and power, that maximize the value and viability of biorefineries. The Energy and Water Development activities will synergistically complement the Interior activities as a result of their focus on platforms for sugars, synthesis gas and pyrolysis oils.

Indicators of progress toward achieving those benefits include:

- In 2006, identify at least one sugar derived bio-based chemical or material (among those being evaluated) that possesses sufficient potential to enter into the scaled-up developmental phase of R&D from the previous bench-scale phase.
- In 2006, develop a preliminary process flow diagram showing the integration of a sugar-derived bio-based chemical or material in an integrated biorefinery, as well as a preliminary analysis showing the economic viability of an integrated biorefinery.

- In 2007, establish that a least one developmental biobased chemical or material possesses sufficient potential to be demonstrated in an integrated biorefinery that will produce fuels, chemicals and/or materials.
- By 2010, establish the technical and market potential, through pilot-scale testing and industry cost shared commercial demonstration, of four new value-added chemicals and/or materials (the baseline is 0 in 2002).

Annual Performance Results and Targets

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Results	FY 2005 Targets	FY 2006 Targets
Program Goal 04.08.00.00 (Biomass)					
Utilization of Platform Outputs R&D: Products Development					
Demonstrate advanced electro-deionization separation technology for product purification at a pilot scale in trials at a Tate & Lyle's high fructose corn syrup plant.	Cargill Dow LLC started up the first full-scale PLA plastic manufacturing facility (300 million lbs./yr.) based on corn sugar as the feedstock.	In partnership with industry, complete pilot scale demonstration of two new biobased product technologies for economic, technical, and product performance. [MET] A 2-cycle engine oil derived from soy oil is commercialized for the emerging bioproducts industry. [NOT MET: 2-cycle engine oil commercialized in FY 2004]	Completed validation of one new biobased product technology, with long-term potential of greater than 2 billion lbs./yr. sales, at the pilot scale for economic, technical, and product viability in partnership with industry. With industry partners, a new biobased product technology advances to scale-up partners' intention to commercialize in a new industrial biorefinery by FY 2008. The biorefinery will be at pilot scale..	Establish the technical and market potential of a new biobased product. *Contribute proportionately to EERE's corporate goal of reducing corporate and program adjusted uncosted obligated balances to a range of 20-25 percent by reducing program annual adjusted uncosteds by 10 percent in 2005 relative to the Biomass & Biomass Refinery Systems Program FY 2004 end of year adjusted uncosted baseline ($62,235K) until the target range is met.*	Identify at least one sugar-derived bio-based chemical or material (among those being evaluated) that possesses sufficient potential to enter into the scaled-up developmental phase of R&D from the previous bench-scale phase. Develop a preliminary process flow diagram showing the integration of a sugar-derived bio-based chemical or material in an integrated biorefinery, as well as a preliminary analysis showing the economic viability of an integrated biorefinery. *Contribute proportionately to EERE's corporate goal of reducing corporate and program adjusted uncosteds to a range of 20-25 percent by reducing program annual uncosteds by 10 percent in 2006 relative to the program uncosted baseline (2005) until the target range is met.* *Maintain total Program Direction costs in relation to total Program costs in the range of 8% - 12% to demonstrate efficient and effective EERE-wide business and technical support to mission direct programs.*

Means and Strategies

The Biomass Program will use various means and strategies to achieve its program goals as described below. "Means" include operational processes, resources, information, and the development of technologies, and "strategies" include program, policy, management and legislative initiatives and approaches. Various external factors, as listed below, may impact the ability to achieve the program's goals. Collaborations are integral to achieving the planned investments, means and strategies, and to addressing external factors.

The Biomass Program will implement the following means in order to improve the cost-competitiveness of biomass technologies (including feedstock collection and storage):

- R&D through competitive solicitations for industrial partnerships with appropriate cost sharing to attract innovation and ensure investment value for industry and university contracts.
- Management of R&D by a series of objectives and milestones; tracked by the Project Management Center[a] and verified with reviews from industry and university experts.
- Input from peer reviews[b]. Peer reviews of program plans and activities are aimed at obtaining expert, independent opinion on the program's goals and objectives; feasibility of reaching the goals; appropriateness of technical barriers being addressed; appropriateness of the Federal role, and whether the level of Federal funding for projects is commensurate with technical objectives.

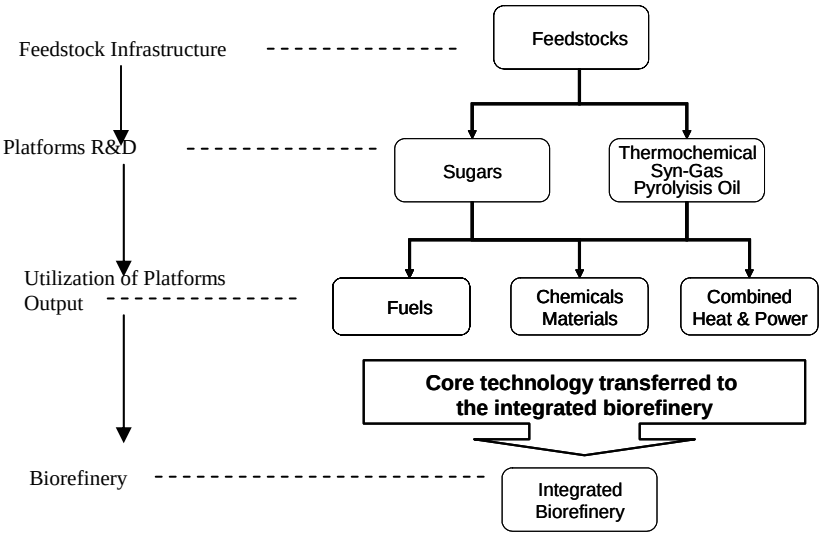
The Biomass Program will implement the following strategies:

- Guidance by the Biomass Technical Advisory Committee and the Biomass R&D Board established under the Biomass R&D Act of 2000. Evaluation and analysis results are also input to the decision process as required by the Government Performance & Results Act (GPRA) and the President's Management Agenda (PMA).
- The Administration's R&D investment criteria and DOE's internal assessment modeled after the Administration's Program Assessment Rating Tool (PART). These are overlaid on the various inputs provided by external and internal entities so that program decisions will result in the highest possible return on Federal investments.
- Using a stepwise progression to gain industry cost-share and commitment to program goals, the program is pursuing the biorefinery approach beginning with existing biorefineries. These are based on starch in the case of the sugars-based biorefinery (corn dry mills, in particular). Biorefineries will logically follow a progression moving from the lowest cost feedstock with the least technology and market risk through a series of steps where research will be needed to bring more feedstocks and more products under the biorefinery umbrella. This progression is expected to develop along two pathways, sugars-based and thermochemical.
- Under-utilized residues from existing recalcitrant biorefinery feedstock streams, i.e., residual starch, cellulose and hemi-cellulose, will be targeted first as feedstock in the near term. The sugars-based

[a] EERE implemented the Project Management Center approach at the Golden Field Office and the National Energy Technology Laboratory to enhance the management of projects.
[b] As of December 2004, the most recent review was the November 2003 Biomass Program Review, Washington, DC.

biorefinery might include the following step-wise progression: 1) starch based residuals in corn kernel; 2) cellulose in kernel; 3) kernel separation into products; 4) sugar-based biorefineries driven by expanding markets for additional products, starch-based residuals in the kernel and cellulose in agricultural residues such as corn stover and wheat straw; and 5) ultimately the sugars-based biorefinery utilizing cellulosic energy crops.

- The thermochemical-based biorefinery will also proceed in a step-wise progression: 1) laboratory scale utilizing a clean, dry, and uniform biomass feedstock to produce clean syngas or pyrolysis oil; 2) pilot test with industrial partners using a relatively clean feedstock to produce a "dirty" syngas or pyrolysis oil; 3) industrial partners produce a clean syngas or pyrolysis oil; 4) industrial partners produce a clean syngas or pyrolysis oil from a non-uniform feedstock (potentially wet or sulfur laden) at pilot scale; 5) at an industrial facility integrate various syngas or pyrolysis systems into a biorefinery configuration that produces fuel, power, or chemicals.
- In time it is likely that a biorefinery may emerge that combines elements of thermochemical-based and sugars-based biorefineries. One example of this dual approach could be a biorefinery that separates biomass's lignin fraction (for thermochemical conversion) from its carbohydrate fraction (for sugars conversion). These and similarly integrated biorefinery progressions should result in increasing benefits built along a continuum beginning with the initial stages of technology integration in about 2011 as the technology and infrastructure develop further. The figure below summarizes the program's approach.



These strategies are expected to result in significant cost savings and reduction in imported oil dependency.

The following external factors could affect the Biomass Program's ability to achieve its strategic goal:

- Cost and availability of conventional fossil energy sources,
- Consumer acceptance, and
- The cost of competing technologies.

The market penetration rate of bio-based technologies is a function of technical breakthrough, price trends of coal, oil and natural gas, and policy factors.

In carrying out its mission, the program performs the following collaborative activities:

- Annual USDA/DOE solicitation for biomass technologies R&D and other coordination under the Biomass Research and Development Act; and
- Partnerships with existing biorefineries to develop technologies resulting in more cost-effective use of current feedstock and/or utilization of additional, new feedstock such as cellulosic residues.

Validation and Verification

To validate and verify program performance, the Biomass and Biorefinery Systems R&D Program will conduct internal and external reviews and audits. For example, during peer reviews of the program, these programmatic activities have been reviewed by experts from universities, state agencies, industry, and the U.S. Department of Agriculture. The table below summarizes validation and verification activities.

Data Sources:	The Renewable Fuels Association's production statistics; the National Renewable Energy Laboratory's Renewable Electric Plant Information System (REPIS); the Energy Information Administration's (EIA) Annual Energy Review, Renewable Energy Annual and Annual Energy Outlook; the Gas Technology Institute Survey of Distributed Resources; EIA Form 860 data analyzed by the Resource Dynamics Corporation. Individual projects develop production cost and quantity estimates for sugar, syngas, ethanol, and other fuels and chemicals (these are reviewed and monitored by managers).
Baselines:	▪ Bio-based product technology commercialized: 2002 baseline=0 ▪ Integrated biorefineries built for producing chemicals, fuels and power utilizing biomass feedstocks: 2002 baseline=0
Evaluation:	In carrying out the program's mission, the Biomass Program uses several forms of evaluation to assess progress and to promote program improvement. ▪ Technology validation and operational field measurement, as appropriate ▪ Peer review by independent outside experts of both the program and subprogram portfolios ▪ Biennial internal Technical Program Review of the Biomass Program ▪ Specialized program evaluation studies to examine process, impacts, or market baseline and effects, as appropriate ▪ Quarterly and annual assessment of program and management results based performance through Joule (the DOE quarterly performance progress review of budget targets), R&DIC (annual internal review of performance planning and management of R&D programs against specific criteria), PMA (the

Presidents Management Agenda -- annual departmental and PSO based goals whose milestones are planned, reported and reviewed quarterly) and PART (common government wide program/OMB reviews of management and results).

- Annual review of methods, and updated analysis of potential benefits for the Government Performance and Results Act (GPRA)

The National Laboratories receive direct funds for technology research and development, based on their capabilities and performance. Advisory panels consisting of non-Federal and industry experts review each laboratory and industry project at scheduled stage-gate reviews and peer evaluation of R&D. Project peer reviews include the following criteria, consistent with the Administration's R&D investment criteria: 1) Relevance to overall DOE objectives; 2) Approach to performing the research and development; 3) Technical accomplishments and progress toward project and DOE goals; 4) Technology transfer/collaborations with industry/universities/laboratories; and 5) Approach and relevance of proposed future research. The panels also evaluate the strengths and weaknesses of each project, and recommend additions to or deletions from the scope of work. The program organization facilitates relationships to ensure that Federal R&D results are transferred to industry.

Frequency: Potential benefits are estimated annually. Independent evaluation of R&D projects are performed according to schedule per the "stage-gate" process for moving each project through an independent review "gate," from a less costly stage (such as preliminary paper studies) to a more costly stage (such as bench scale experiments). Program Peer Reviews are conducted annually.

Data Storage: EERE Benefits website, Corporate Planning System and other computer-based data systems.

Verification: DOE technology managers verify the achievement of targets through project reviews, including reviews of cost and performance modeling results. Project leaders in the field must provide to the technology managers documentation of experimental and/or analytic results as evidence of success. The evidence is listed in material supporting the DOE Joule performance tracking system. Various trade associations review the data and the modeling processes (e.g. REPIS renewable), and the EIA verifies the REPIS database. Peer reviews are independently conducted by personnel from industry, academia and governmental agencies other than the U.S. Department of Energy.

Funding by General and Program Goal

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
General Goal 4, Energy Security			
Program Goal 04.08.00.00, Biomass and Biorefinery Systems R&D			
Utilization of Platform Outputs R&D	6,570	6,859	21,205
Technical Program Management Support	396	394	600
Total, Program Goal 04.08.00.00, Biomass and Biorefinery Systems R&D	6,966	7,253	21,805
Total, General Goal 4 (Biomass and Biorefinery Systems R&D)	6,966	7,253	21,805

Expected Program Outcomes

The Biomass Program pursues its mission through integrated activities designed to increase the use of domestic renewable resources and contribute towards improved energy productivity of our economy. We expect these improvements to reduce national susceptibility to energy price fluctuations and potentially lower energy bills; reduce several EPA-criteria pollutants and other pollutants; enhance energy security by increasing the production and diversity of domestic fuel supplies; and provide greater energy security and reliability by improving our energy infrastructure. In addition to these "EERE business-as-usual" benefits, realizing the Biomass Program goals would provide the technical potential to reduce conventional energy use even further if warranted by future energy needs.

Estimates of annual non-renewable energy savings, energy expenditure savings, carbon emission reductions, oil savings, and natural gas savings that result from the realization of Biomass Program goals are shown in the table below through 2050. The level of cellulosic ethanol production expected as a result of realizing the program goals is also reported.

These estimates do not include other benefits such as local air quality improvements and represent a conservative initial effort at assessing the benefits of the Biomass Program activities and likely significantly underestimate the benefits from integrated biorefinery production options that are yet to be modeled. In addition, these estimates do not yet address some of the more fundamental technologies being developed in the Integrated Biorefinery and Bioproducts processes.

The assumptions and methods underlying the modeling efforts have significant impact on the estimated benefits, and results could vary significantly if external factors, such as future energy prices, differ from the "baseline case" assumed for this analysis. EERE's baseline case is essentially the same as the EIA "business-as-usual" case presented in its Annual Energy Outlook. In addition, possible changes in public policy and disruptions in the energy system which may affect estimated benefits are not modeled. The external factors such as unexpected changes in competing technology costs, identified in the Means and Strategies section above, could also affect the Program's ability to achieve its goals.

The results shown in the long term benefits tables are preliminary estimates based on initial modeling of some of the possible program production technologies; nonetheless, they provide a useful picture of the potential change in national benefits over time if the technology, infrastructure and markets evolve as expected. Estimated benefits which follow assume that individual technology plans and market assumptions obtain. Final documentation is estimated to be completed and posted by March 31, 2005. Uncertainties are larger for longer term estimates. A summary of the methods, assumptions, and models used in developing these benefit estimates that are important for understanding these results are provided at www.eere.energy.gov/office_eere/budget_gpra.html.

FY 2006 GPRA Benefits Estimates for Biomass Program[a]

Mid-Term Benefits[b]	2010	2015	2020	2025
Cellulosic ethanol production (million gallons)[c]	0	120	260	1,570
Primary nonrenewable energy savings (Quads)	0	0.02	0.06	0.12
Energy bill savings (Billion 2002$)	0	ns	ns	ns
Carbon emission reductions (mmtce)	0	ns	2	3
Oil savings (MBPD)	0	ns	0.01	0.01
Natural gas savings (quads)	0	ns	ns	0.02

Long-Term Benefits[d]	2030	2040	2050
Cellulosic ethanol production (million gallons)[e]	1,586	5,598	8,772
Primary nonrenewable energy savings (Quads)	0.2	0.7	1.1
Energy system cost savings (Billion 2002$)	0	0	1
Carbon emission reductions (MMTCE)	4	12	19
Oil savings (MBPD)	0.09	0.29	0.40
Natural gas savings (Quads)	0.02	0.06	0.16

[a] Benefits reported are annual, not cumulative, for the year given. Estimates reflect the benefits that may be possible if all of the program's technical targets are met and funding continues at levels consistent with assumptions in the FY 2006 Budget.
[b] Mid-term program benefits were estimated utilizing the GPRA06-NEMS model, based on the Energy Information Administration's (EIA) National Energy Modeling System (NEMS) and utilizing the EIA's Annual Energy Outlook (AEO) 2004 Reference Case.
[c] Includes ethanol from corn stover, other residues, and future energy crops, and ethanol from corn kernel fiber and associated residual starch. GPRA05 did not include ethanol from the residual starch bound to the fiber.
[d] Long-term benefits were estimated utilizing the GPRA06 - MARKAL developed by Brookhaven National Laboratory (BNL). Results can differ among models due to differences in their structure. In particular, the two models estimate economic benefits in different ways, with the MARKAL model reflecting the cost of additional investments required to achieve reductions in energy bills.
[e] Measured as incremental ethanol production over reference case.

Utilization of Platform Outputs R&D

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Utilization of Platform Outputs R&D.....	6,570	6,859	21,205	+14,346	+209.2%
Total, Utilization of Platform Outputs R&D	6,570	6,859	21,205	+14,346	+209.2%

Description

Utilization of Platform Outputs R&D focuses on the conversion of outputs from both the sugars platform and the syngas platform (these platform research and development areas are funded by Energy and Water Development) into fuels, chemicals and materials, and heat and power. Besides sugars and syngas, the program is considering lignin, biomass-derived oil and proteins as feedstocks for making bio-based products. Utilization of Platform Outputs R&D will develop core technologies for the production of many value-added products. These key, enabling technologies can be applied to a variety of opportunities in the biorefinery with the goal of enabling the production of cost-competitive fuels, chemicals and materials, and heat and power. Industrial cost-shared research will be conducted to develop integrated biorefinery designs that will utilize a variety of near-term feedstocks such as corn fiber and corn stover to determine engineering designs for the future commercialization of these technologies as well as integrate additional products into existing biorefineries, adding effectiveness and efficiency to their design.

Benefits

Bio-based products with high market value will increase the profitability and efficiency of future industrial biorefineries whose other major products may be fuels for the transportation sector and/or other sectors, including hydrogen. Producing a slate of bio-based chemicals would also add a dimension of seasonal flexibility to the biorefineries in view of the seasonal nature of biomass harvesting.

Indicators of progress toward achieving those benefits include:

Cumulative number of bio-based products for which the technical and market potential is established

	Actual	Planned			
	2003	2005	2009	2010	2015
Target	n/a	2	3	4	6
Actual	1	—	—	—	—

- In 2006, identify at least one sugar-derived bio-based chemical or material (among those being evaluated) that possesses sufficient potential to enter into the scaled-up developmental phase of R&D from the previous bench-scale phase.
- In 2006, develop a preliminary process flow diagram showing the integration of a sugar-derived bio-based chemical or material (among those being evaluated) in an integrated biorefinery, as well as a preliminary analysis showing the economic viability of an integrated biorefinery.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Utilization of Platform Outputs R&D	**6,570**	**6,859**	**21,205**

In FY 2006, Utilization of Platform Outputs R&D will continue activities initiated in 2005, which include competitively selected R&D projects aimed at core technology development to enable a broad suite of bio-based products.[a] Projects focused on the development of processes for the production of chemicals and materials that can be integrated into biorefineries will continue. Projects with industrial partners will focus on novel separations technologies and bio-based plastics. Additional work with industry, universities and the National Laboratories will focus on improvements to increase the efficiency of individual process steps, e.g., catalysis, separations, etc. In FY 2006, the subprogram will continue to develop existing industrial partnerships and seek new potential industrial partnerships to integrate additional products into a biorefinery. These projects will continue to bridge the gaps between products development and full integration into a biorefinery. The subprogram will continue collaborative efforts with stakeholders in validating the sustainability of biobased products. FY 2006 activities are intended to advance the state of technology in order to facilitate a FY 2008 competitive solicitation for further development and demonstration of an integrated biorefinery.

[a] Core technology areas were defined through an analytical effort that resulted in the selection of the top twelve building block chemicals that can be produced from sugars via biological or chemical conversions. These twelve building block chemicals can be subsequently converted to a number of high value bio-based chemicals or materials.

(dollars in thousands)

FY 2004	FY 2005	FY 2006

In FY 2004, $170,000 for SBIR/STTR was transferred to the Science Appropriation. Participants include: *National Corn Growers Association, Metabolix, PNNL, INEEL, ANL, NREL, industry partners who will be selected in FY 2005, and a wide array of colleges and universities.*

Total, Utilization of Platform Outputs R&D	**6,570**	**6,859**	**21,205**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Utilization of Platform Outputs R&D	
Based on prioritization of activities and in accordance with the President's Management Agenda and R&D Investment Criteria No. 2a (how well does the plan build on existing technology, complement related R&D activities, and propose technically feasible R&D activities) and 2b (how well does the R&D activity's planning and prioritization incorporate industry involvement) increased funding is requested for the following partnership activities: (a) industry led, cost shared projects selected under a FY 2005 competitive solicitation focusing on technologies that enable bio-based products development; and, (b) projects aimed at increasing the effectiveness and efficiency of biorefineries through optimal integration of enhanced processes for bio-based products.	+14,346
Total Funding Change, Utilization of Platform Outputs R&D	**+14,346**

Technical/Program Management Support

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Technical/Program Management Support	396	394	600	+206	+52.3%
Total, Technical/Program Management Support	396	394	600	+206	+52.3%

Description

Technical/Program Management Support focuses on strategic and operating plans, feasibility studies, and evaluation of program performance. As information related to new R&D data, new governmental policies and industry initiatives are available; this needs to be incorporated into ongoing analytic, planning and evaluation activities. These activities address the requirements of the Government Performance and Results Act (GPRA) and the President's Management Agenda (PMA), including the Performance Assessment Rating Tool (PART) and the R&D Investment Criteria (R&DIC).

Benefits

These efforts support EERE management's overall objectives of increasing program efficiency and targeting future resources to the most productive program efforts.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Technical/Program Management Support	**396**	**394**	**600**
In FY 2006, update strategic and operating plans, feasibility studies, and evaluation of program performance. Perform analysis of environmental emissions and energy use for each step of the production and utilization cycle for bio-based products. Document efficiency and sustainability benefits of products derived from biomass. *Participants include National Renewable Energy Laboratory (NREL), Oak Ridge National Laboratory (ORNL), and various universities.*			
Total, Technical/Program Management Support	**396**	**394**	**600**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Technical/Program Management Support	
Increase environmental and energy analysis to provide decision quality needed to support project selection and development in projects scheduled for 2004/2005 solicitations. (Consistent with R&D Investment Criterion 3a, performance relative to benefits.)	+206
Total Funding Change, Technical/Program Management Support	**+206**

Federal Energy Management Program

Funding Profile by Subprogram

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation[a]	FY 2006 Base	FY 2006 Request	FY 2006 Request vs. Base	
					$ Change	% Change
Federal Energy Management Program						
Project Financing	7,830	7,133	7,133	6,827	-306	-4.3%
Technical Guidance and Assistance	8,140	8,160	8,160	7,720	-440	-5.4%
Planning, Reporting and Evaluation	2,571	2,638	2,638	2,600	-38	-1.4%
Technical/Program Management Support	879	0	0	0	0	0.0%
Total, Federal Energy Management Program	19,420	17,931	17,931	17, 147	-784	-4.4%

Public Law Authorizations:

P.L. 94-163, “Energy Policy and Conservation Act” (EPCA) (1975)
P.L. 94-385, “Energy Conservation and Production Act” (ECPA) (1976)
P.L. 95-91, “DOE Organization Act” (1977)
P.L. 95-619, “National Energy Conservation Policy Act” (NECPA) (1978)
P.L. 100-615, “Federal Energy Management Improvement Act" (1988)
P.L. 102-486, "Energy Policy Act" (1992)

Mission

The mission of the Federal Energy Management Program (FEMP) is to promote energy security, environmental stewardship and cost reduction through energy efficiency and water conservation, the use of distributed and renewable energy, and sound utility management decisions at Federal sites.

Benefits

FEMP supports the mission of the Office of Energy Efficiency and Renewable Energy (EERE) by improving the energy efficiency and productivity of Federal Government buildings and by bringing clean, renewable technologies to Federal facilities. FEMP supports DOE’s goals of protecting our national and economic security by promoting a diverse supply and delivery of reliable, affordable, and environmentally sound energy to Federal facilities. These activities fulfill the statutory requirements of the National Energy Conservation Policy Act (NECPA); provisions under the Energy Policy Act of

[a] Reflects the 0.594% and 0.80% rescissions of -$109,000 and -$146,000 respectively and comparability adjustment for National Energy Technology Laboratory Support of -$214,000.

1992 (EPACT); and Executive Order 13123 (Efficient Energy Management). Accomplishing this mission contributes to several national energy and environmental priorities. The President's National Energy Policy calls for America to modernize conservation efforts, increase energy supplies, "accelerate the protection and improvement of the environment, and increase our Nation's energy security." It directs heads of executive departments and agencies to "take appropriate actions to conserve energy use at their facilities to the maximum extent consistent with the effective discharge of public responsibilities." As of 2003 (the year with the latest available data), FEMP has assisted Federal agencies in reducing energy intensity in Federal buildings by 25 percent using 1985 as a baseline. While the trendline is clear (see graph in the Expected Program Outcomes section entilted "Building Energy Intensity") in reducing energy intensity over time, a great many factors combine to affect Federal agency energy consumption in any one year and the measured trend in changes over time. FEMP programs have a significant effect, but such things as new Federal building construction, military base closures and greater use of the existing building stock can have an important effect, too.

More detailed, integrated and comprehensive economic, energy and energy security benefits estimates of the Federal Energy Management Program are provided in the Expected Program Outcomes section at the end of the program level budget narrative.

Strategic and Program Goals

The Department's Strategic Plan identifies four strategic goals (one each for defense, energy, science, and environmental aspects of the mission) plus seven general goals that tie to the strategic goals. FEMP supports the following goal:

Energy Strategic Goal: To protect our national and economic security by reducing imports and promoting a diverse supply of reliable, affordable, and environmentally sound energy.

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.

FEMP has one program goal that contributes to General Goal 4 in the "goal cascade":

Program Goal 04.13.00.00: Federal Energy Management Program. The Federal Energy Management Program goal is to provide technical and financial assistance to Federal agencies and thereby lead the Nation by example in use of energy efficiency and renewable energy. Through the Federal Government's own actions, FEMP's target is to reduce energy intensity in Federal buildings by 35 percent by 2010 (relative to the 1985 statutory baseline level of 138,610 Btu per gross square foot).

Contribution to Program Goal 04.13.00.00 (FEMP)

The program directly supports General Goal 4, Energy Security by improving energy efficiency and increasing renewable energy use in Federal buildings. It also addresses the goals and recommendations of the President's National Energy Policy.

FEMP employs a variety of approaches to assist agencies in realizing energy, environmental and cost savings potentials, including: interagency coordination committees, direct technical assistance, education and training, information and outreach programs, targeted project financial support, and

assistance in accessing alternative private sector funding. Success occurs when FEMP and its agency and private sector partners enable Federal energy managers to make better energy management choices that result in a more efficient, effective and energy secure government.

Annual Performance Results and Targets

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Results	FY 2005 Targets	FY 2006 Targets
Program Goal 04.13.00.00 (Federal Energy Management Program)					
Project Financing					
Achieve $121 million in private sector investment through Super ESPCs.	Achieve $97 million in private sector investment through Super ESPCs.	Achieve between $80 and $120 million in private sector Energy Savings Performance Contract (ESPC) investment. [MET: $252 million in private sector investment]	Will achieve between $35 and $55 million in private sector investment through Super ESPCs, contributing to national energy security. [NOT MET: Program not authorized]	Will achieve between $80 and $120 million in private sector investment through Super ESPCs which will result in about a 0.2 percent annual reduction in energy intensity. These projects are cost-effective resulting in a positive net present value gain for the tax payer.	Will achieve between $80 and $120 million in private sector investment through Super ESPCs and/or UESCs which we expect to result in about a 0.2 percent annual reduction in energy intensity. These projects are cost-effective resulting in a positive net present value gain for the tax payer.
Technical Guidance and Assistance					
		Provide technical and design assistance for 40 energy efficiency, renewable energy, and water conservation projects; 10 will be large-scale distributed energy resources and combined heat and power projects. Report results achieved through the end of FY 2001. [MET: 53 energy efficiency and renewable projects]	Will provide technical and design assistance for 60 energy efficiency, renewable energy, Operations and Management (O&M), distributed Energy Resource (DER)/Combined Heat and Power (CHP), and water conservation projects. [MET]	Will provide technical and design assistance for 60 Federal projects which include energy efficiency, renewable energy, O&M, Distributed Energy Resources, Combined Heat and Power, SAVEnergy Audits, ALERTS and water conservation projects. These projects are cost-effective, because the technologies applied have been shown to be cost-effective by the supporting EERE programs.	Will provide technical and design assistance for 27 Federal projects which include energy efficiency, renewable energy, O&M, Distributed Energy Resources, Combined Heat and Power, ALERTS and water conservation projects which we expect to result in about 60 billion Btus in energy saved.
Complete 25 Assessment of Load and Energy Reduction Techniques (ALERT) assessments to shave anticipated peak demand and general energy consumption by 10 percent.	Provide over 60 energy assessments including ALERTS, SAVEnergy Audits, industrial facility assessments, and operation and maintenance assessments that identified energy and cost saving opportunities.	Complete at least 35 energy assessments including SAVEnergy Audits, industrial facility assessments and operation and maintenance assessments to identify energy and cost saving opportunities. [MET: 50 energy assessments]			

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Results	FY 2005 Targets	FY 2006 Targets
Trained 5,500 Federal energy personnel in best practices.	Train 6,200 Federal energy personnel in best practices supporting National Energy Policy education goals.	Train 4,000 Federal energy personnel in best practices supporting National Energy Policy education goals. [MET: 6700 personnel trained]	Will train 4,000 Federal energy attendees in energy management best practices supporting National Energy Policy education goals. [MET]	Will train 4,000 Federal energy attendees in energy management best practices supporting National Energy Policy education goals.	Will train 4,000 Federal energy attendees in energy management best practices.
	Publish initial listing of products that use minimal standby power by December 31, 2001, in accordance with E.O. 13221. [MET]	Integrate information on standby power into Defense Logistics Agency and General Services Administration's product schedules in accordance with E.O. 13221. [MET]	*Contribute proportionately to EERE's corporate goal of reducing corporate and program uncosteds to a range of 20-25 percent by reducing annual program uncosteds by 10 percent in 2004 relative to the program uncosted baseline (in 2003) until the target range is met.* *[NOT MET]*	*Contribute proportionately to EERE's corporate goal of reducing corporate and program adjusted uncosted obligated balances to a range of 20-25 percent by reducing program annual adjusted uncosteds by 10 percent in 2005 relative to the FEMP/DEMP Program FY 2004 end of year adjusted uncosted baseline ($11,266K) until the target range is met.*	*Contribute proportionately to EERE's corporate goal of reducing corporate and program adjusted uncosteds to a range of 20-25 percent by reducing program annual uncosteds by 10 percent in 2006 relative to the program uncosted baseline (2005) until the target range is met.* *Maintain total Program Direction costs in relation to total Program costs in the range of 8% - 12% to demonstrate efficient and effective EERE-wide business and technical support to mission direct programs.*

Means and Strategies

FEMP will use various means and strategies to achieve its program goals as described below. "Means" include operational processes, resources, information, and the development of technologies, and "strategies" include program, policy, management and legislative initiatives and approaches. Various external factors, as listed below, may impact the ability to achieve the program's goals. Collaborations are integral to the planned investments, means and strategies, and to addressing external factors.

FEMP helps Federal agencies take advantage of energy management opportunities in building construction, renovation, retrofit, operations and maintenance; energy consuming product and equipment procurement; and utility service acquisition and utility load management.

FEMP will implement the following means:

- interagency coordination committees;
- direct technical assistance;
- education and training;
- information and outreach programs; and
- assistance in accessing alternative private sector funding.

FEMP will implement the following strategies:

- Identify high impact opportunities across Federal agencies for energy efficiency improvements and to increase the use of renewable energy.
- Implement a strategy to increase the utilization of technologies developed by the Office of Energy Efficiency and Renewable Energy.
- Develop strategies for improved security for critical energy needs at Federal facilities.

These strategies will result in significant cost savings and a significant reduction in energy use at Federal facilities.

The following external factors could affect FEMP's ability to achieve its strategic goal:

- Mission changes at Federal sites that would change building usage; and
- Availability of energy management personnel at Federal sites.
- The legal authority for implementing energy savings performance contracts (ESPCs) had expired in September 2003, but was reinstated for two years starting in November 2004. Thus, for the entire FY 2006, there will be legal authority for ESPCs, and FEMP will be actively involved in promoting ESPC awards.

The following collaborations help FEMP achieve its goals:

- FEMP hosts a number of working groups with its Federal agency partners to ensure that agencies are focused on the Congressionally mandated energy efficiency and renewable energy goals; they are developing strategies for obtaining the resources required to achieve these goals; and they share information on best energy management practices.

Validation and Verification

To validate and verify programs, FEMP conducts ongoing internal reviews of its program activities each year. In addition, external peer reviews are conducted on a regular basis. FEMP provides a report to Congress and a report to the President every year on the progress of Federal agencies on reaching their energy efficiency and renewable energy goals.

Data Sources:	Agencies submit annual reports documenting energy use, cost, gross square footage, and exempt facilities. The reports are supplemented by FEMP's tracking and reporting and are submitted each year to Congress.
Baselines:	Federal energy management goals are measured from the 1985 baseline for standard buildings (138,610 Btu/square foot) and the 1990 levels for energy intensive buildings (The 1990 levels vary for each Federal agency). Goals are expressed in Btu per gross square foot and are not normalized for other factors.
Frequency:	Annual.
Evaluation:	In carrying out the program's mission, the Federal Energy Management Program Management Program uses several forms of evaluation to assess progress and to promote program improvement. ▪ Technology validation and operational field measurement, as appropriate ▪ Peer review by independent outside experts of both the program and subprogram portfolios ▪ Annual internal Program Review of the Federal Energy Management Program ▪ Specialized program evaluation studies to examine process, impacts, or market baseline and effects, as appropriate ▪ Quarterly and annual assessment of program and management results based performance through Joule (the DOE quarterly performance progress review of budget targets), R&DIC (annual internal review of performance planning and management of R&D programs against specific criteria), PMA (the Presidents Management Agenda -- annual departmental and PSO based goals whose milestones are planned, reported and reviewed quarterly) and PART (common government wide program/OMB reviews of management and results). ▪ Annual review of methods, and recomputation of potential benefits for the Government Performance and Results Act (GPRA)
Data Storage:	FEMP maintains a database of reported information. Agencies maintain their own, more detailed data.
Verification:	External audits are conducted each year. Reporting anomalies are identified and resolved during the annual reporting cycle.

Funding by General and Program Goal

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
General Goal 4, Energy Security			
Program Goal 04.13.00.00, FEMP			
Project Financing	7,830	7,133	6,827
Technical Guidance and Assistance	8,140	8,160	7,720
Planning Reporting and Evaluation	2,571	2,638	2,600
Technical/Program Management Support	879	0	0
Total, Program Goal 04.13.00.00, FEMP	19,420	17,931	17,147
Total, General Goal 4 (FEMP)	19,420	17,931	17,147

Expected Program Outcomes

FEMP pursues its mission through integrated activities designed to improve the energy efficiency of, and renewable energy usage by, the Federal Government. We expect these improvements to reduce the energy intensity at Federal facilities; reduce the susceptibility of Federal agencies to energy price fluctuations; lower their energy bills; reduce EPA criteria and other pollutants in the cities where agency operations are located; and enhance energy security by increasing the flexibility of local energy demand.

Estimates of annual non-renewable energy savings, energy expenditure savings, and carbon emission reductions that result from the realization of FEMP's goals are shown in the table below through 2025. In addition to these "EERE business-as-usual" benefits, realizing the FEMP goals would provide the technical potential to reduce conventional energy use by the Federal Government even further if warranted by future energy needs.

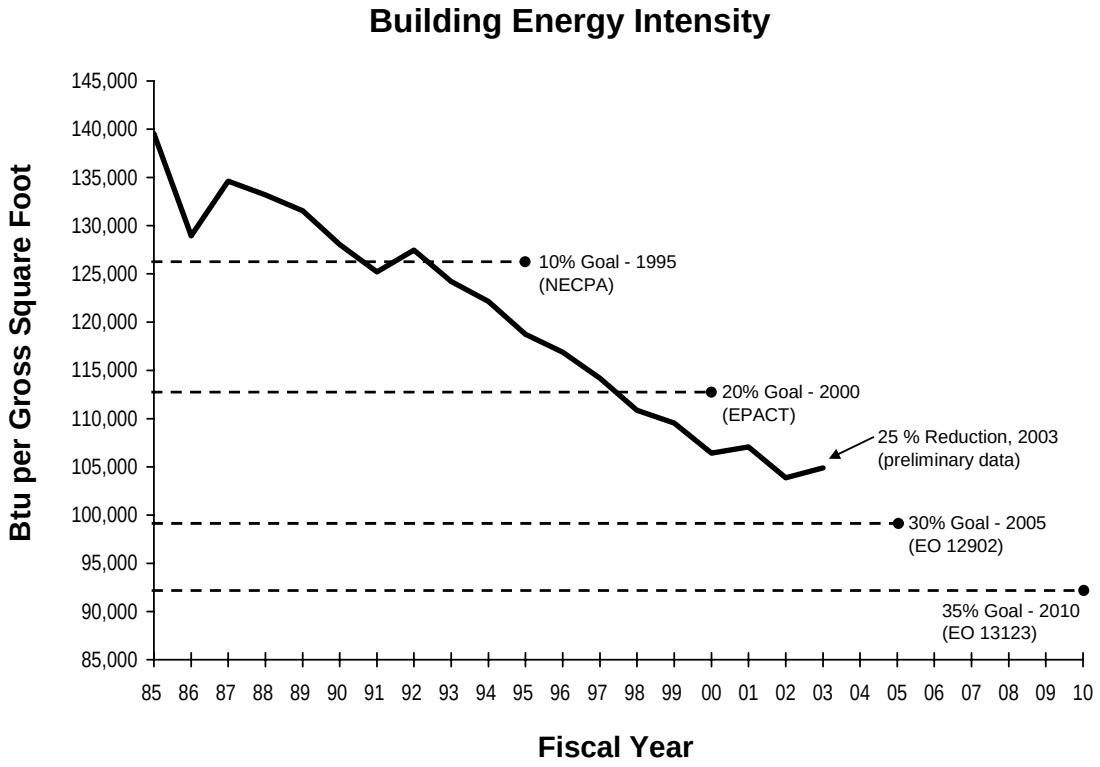
The assumptions and methods underlying the modeling efforts have significant impact on the estimated benefits, and results could vary significantly if external factors, such as future energy prices, differ from the "baseline case" assumed for this analysis. EERE's baseline case is essentially the same as the EIA "business-as-usual" case presented in its Annual Energy Outlook. In addition, possible changes in public policy and disruptions in the energy system which may affect estimated benefits are not modeled. The external factors such as unexpected changes in competing technology costs, identified in the Means and Strategies section above, could also affect the Program's ability to achieve its goals.

The table below provides a useful picture of the potential change in national benefits over time if the technology, infrastructure and markets evolve as expected. Estimated benefits which follow assume that individual technology plans and market assumptions obtain. Final documentation is estimated to be completed and posted by March 31, 2005. Uncertainties are larger for longer term estimates. A summary of the methods, assumptions, and models used in developing these benefit estimates that are important for understanding these results are provided at www.eere.energy.gov/office_eere/budget_gpra.html.

FY 2006 GPRA Benefits Estimates for FEMP[a]

Mid-term benefits[b]	2010	2015	2020	2025
Primary nonrenewable energy savings (Quads)	0.03	0.04	0.05	0.06
Energy bill savings (Billion 2002$)	0.2	0.3	0.4	0.5
Carbon emission reductions (MMTCE)	1	1	1	1

In addition to the benefits quantified here, improved Federal energy management increases the ability of the Federal Government to manage its energy loads during emergencies and facilitates coordination of Federal energy use with local authorities in the event of local energy supply constraints or emergencies. By helping large Federal facilities quickly reduce their peak demand, FEMP benefited California and other western States during past electricity shortages.



[a] Benefits reported are annual, not cumulative, for the year given. Estimates reflect the benefits that may be possible if all of the programs technical targets are met and funding continues at levels consistent with assumptions in the FY 2006 Budget.
[b] Mid-term program benefits were estimated utilizing the GPRA06-NEMS model, based on the Energy Information Administration's (EIA) National Energy Modeling System (NEMS) and utilizing the EIA's Annual Energy Outlook (AEO) 2004 Reference Case.

Project Financing

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Project Financing.....	7,830	7,133	6,827	-306	-4.3%
Total, Project Financing	7,830	7,133	6,827	-306	-4.3%

Description

FEMP developed its alternative financing programs to help agencies access private sector financing to fund needed energy improvements. FEMP helps Federal agencies use Energy Savings Performance Contracts (ESPC) and Utility Energy Service Contracts (UESC) to finance energy saving improvements at no net cost to taxpayers. These funds pay for energy improvements at Federal facilities that are in need of significant energy system retrofits. Projects include all types of energy improvements including lighting upgrades, new heating and ventilation systems, and improved control systems.

Benefits

These alternative financing mechanisms for energy efficiency and renewable energy projects have and will continue to vastly improve the energy efficiency of Federal facilities. These projects save on the energy bills of Federal facilities and are implemented at no net cost to the taxpayer. By providing a means for Federal agencies to utilize renewable energy and energy efficiency technologies, these financing mechanisms help reduce the emissions associated with power usage at Federal facilities and promote the use of clean alternatives to conventional technologies. The investment of millions of dollars through alternative financing vehicles helps develop the energy efficiency and renewable technology industries, and supporting industries are buttressed by this economic activity.

In November 2004, the legal authority for implementing energy savings performance contracts (ESPCs) was reinstated for two years. Thus, for all of FY 2006, FEMP will be actively involved in promoting ESPC awards. FEMP will continue to promote UESC capabilities to develop a balanced portfolio of alternative financing options for Federal agencies.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Project Financing	**7,830**	**7,133**	**6,827**

In order to deliver services for Super ESPC delivery orders, FEMP activities will include communications and outreach, identifying and screening projects, preparing delivery orders and evaluating proposals. Projects will be reviewed and documented and measurement and verification plans and reports will be evaluated. Additionally, workshops will be conducted to help prepare agency technical, contracting, budget, legal, administrative, and management personnel to use the Super ESPC contracting vehicle. In November 2004, the statutory authority for implementing ESPC awards was reinstated for two years, allowing ESPC activity to continue unimpeded for all of FY 2006. The FY 2006 combined target for implementing Super ESPC delivery orders and undertaking UESC projects is an estimated $80 to $120 million in private sector investment.

Support will be provided for UESC projects through workshops for Federal agencies, development and distribution of guidance documents, and direct assistance for projects. FEMP's objective is to enable Federal decision-makers to make well informed decisions regarding energy project implementation and renewable power purchases by providing information, communications, outreach, training, and technical assistance on the impacts of utility restructuring. FEMP will lead the Federal Utility Partnership Working Group (FUPWG) and establish strategic partnerships with targeted utilities which have both a large concentration of Federal customers and a commitment to assist those customers. These partnerships will be used to leverage private sector resources and expertise to assist in the adoption of EERE technologies at Federal sites.

FEMP will assist with technology transfer efforts to provide technical assistance for biomass and alternate methane fuels, geothermal, combined heat and power, and other renewable energy and advanced efficiency technologies for ESPC and utility projects. In order to help determine whether a project is a good deal for the government, financial and business tools will be provided to Federal agencies.

Technical and financial analysis assistance provided for the ESPC and UESC projects is expected to result in Federal agency reimbursements of about $650,000 in FY 2006. Reimbursements were $160,000 in FY 2004 and are projected to be about $650,000 in FY 2005. *Participants include: Lawrence Berkeley National Laboratory (LBNL), National Renewable Energy Laboratory (NREL), Pacific Northwest National Laboratory (PNNL), Oak Ridge National Laboratory (ORNL), National Energy Technology Laboratory (NETL) and small business contractors.*

Total, Project Financing	**7,830**	**7,133**	**6,827**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Project Financing	
Fewer resources will be needed in FY 2006 in anticipation of successful implementation of certain activities such as direct contracting for project facilitation services and a substitution of web-based training for certain classroom-based training ..	-306
Total Funding Change, Project Financing.....	**-306**

Technical Guidance and Assistance

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Technical Guidance and Assistance					
Direct Technical Assistance	6,165	6,286	5,780	-506	-8.0%
Training and Information	1,975	1,874	1,940	+66	+3.5%
Total, Technical Guidance and Assistance	8,140	8,160	7,720	-440	-5.4%

Description

Technical assistance helps agencies to take advantage of innovative technologies and training opportunities. FEMP assists Federal energy managers identify, design, and implement new construction and facility improvement projects. FEMP provides unbiased, expert technical assistance in areas such as audits for buildings and industrial facilities, peak load management; and new technology deployment, including combined heat and power and distributed energy technologies. FEMP also provides analytic software tools to help agencies choose the most effective energy and water project investments. To learn from the experts first-hand, Federal employees and others can enroll in FEMP's training programs in such areas as project financing, life-cycle costing, operations and maintenance (O&M), and sustainable design. In addition, FEMP helps agencies acquire the most energy efficient and water conserving products through procurement training, product efficiency recommendations, communications and outreach, and assisting agencies in amending their guide specifications to incorporate requirements for energy efficient products.

Benefits

Technical Guidance and Assistance supports FEMP’s mission by helping agencies implement projects and practices that reduce energy costs, improve air quality, and promote the use of water conservation, energy efficiency and renewable energy. FEMP’s direct project assistance provides the information and means that agencies need to determine cost-saving and energy-saving practices appropriate to their needs as they design new buildings and renovate existing ones. FEMP’s technical information guides Federal agencies as they make purchasing decisions, utility management decisions, and other choices that affect their energy use. Because FEMP focuses its technical assistance on EERE’s energy efficiency and renewable technologies, the deployment and acceptance of these technologies is accelerated in the Federal sector.

Detailed Justification

(dollars in thousands)

FY 2004	FY 2005	FY 2006

Direct Technical Assistance **6,165** **6,286** **5,780**

In FY 2006, FEMP will provide support for Federal agency projects to identify energy and cost saving opportunities in the design, review, and implementation of energy efficiency, water conservation, operations and maintenance, Distributed Energy Resources/Combined Heat and Power (DER/CHP) and renewable projects, including facility construction and renovation. In order to identify energy and cost savings opportunities, program activities will support Assessments of Energy and Load Reduction Techniques (ALERTS) and industrial facility assessments.

The FY 2006 request will provide for a minimum of 27 Federal projects and assessments. In FY 2006, there will likely be fewer projects and assessments than in FY 2005. First, many of the projects will be of greater substance, and there will be greater communication of project results to encourage wider application of leading-edge energy efficiency and renewable energy technology at Federal facilities. Second, FEMP will be off-ramping SAVEnergy Audits.

To help agencies deploy these technologies on a broader basis, program activities will include communications and outreach, development of technical information and assistance and identification of low-cost/no-cost improvements to their operation and maintenance of energy systems. Training and technology assessment will continue to be provided. *Participants will include: LBNL, NETL, NREL, PNNL, ORNL, SNL and small business contractors.*

Training and Information **1,975** **1,874** **1,940**

To enable agency action on a greater number of projects than FEMP can assist directly, technical information, tools and technical publications will be provided. In addition, program activities will include training over 4,000 energy attendees, publishing revised or new product energy efficiency recommendations and the coordination of energy efficiency criteria with the EPA/DOE ENERGY STAR® Program.

FEMP will help agencies acquire the most energy efficient and water conserving products through procurement training, communications and outreach, and assisting agencies in amending their guide specifications to incorporate requirements for energy efficient products. *Participants will include: LBNL, NETL, NREL, PNNL, ORNL, SNL and small business contractors.*

Total, Technical Guidance and Assistance **8,140** **8,160** **7,720**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Direct Technical Assistance	
FEMP will be off-ramping SAVEnergy audits, because most Federal buildings have already completed an energy audit..	-506
Training and Information	
Will increase the number of technology case studies and emerging technology assessments.	+66
Total Funding Change, Technical Guidance and Assistance	**-440**

Planning, Reporting and Evaluation

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Planning, Reporting and Evaluation	2,571	2,638	2,600	-38	-1.4%
Total, Planning, Reporting and Evaluation	2,571	2,638	2,600	-38	-1.4%

Description

Program activities include the facilitation of meetings with Federal energy officials, support for the Federal Energy Management Advisory Committee, technical analysis, information management, outreach publications, and legislative/executive branch reporting. Other activities include support for awareness campaigns and the administration of a Federal awards program. FEMP will collect and publish data for the Annual Report to Congress and respond to inquiries to help ensure accuracy in reporting and analysis of trends.

Benefits

Through planning, reporting and evaluation, FEMP evaluates the effectiveness of its programs in the past and plans the design of its programs for the future in a way that provides the most benefit for the taxpayer's dollar. In this way the program's investments lead to the greatest possible reductions in energy costs, improvements in air quality, and promotion of water conservation, energy efficiency and renewable energy technologies.

Detailed Justification

(dollars in thousands)

FY 2004	FY 2005	FY 2006
Planning, Reporting and Evaluation **2,571**	**2,638**	**2,600**

Program activities include the facilitation of one or two meetings with senior Federal energy officials, support for the Federal Energy Management Advisory Committee and support for awareness campaigns. FEMP will collect and publish data for the Annual Report to Congress, respond to inquiries, provide support to ensure accuracy in reporting and analysis of trends, administer a Federal awards programs, support its annual conference (Energy 2006) and maintain and update the FEMP

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Central Database. Funding will be provided for technical analysis, information management, outreach publications, legislative/executive branch reporting and analysis undertaken to address the Government Performance and Results Act (GPRA) and President's Management Agenda (PMA) requirements. *Participants will include: LBNL, NETL, NREL, PNNL and small business contractors.*			
Total, Planning, Reporting and Evaluation	**2,571**	**2,638**	**2,600**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Planning, Reporting and Evaluation	
No significant change	-38
Total Funding Change, Planning, Reporting and Evaluation	**-38**

Technical/Program Management Support

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Technical/Program Management Support	879	0	0	0	0.0%
Total, Technical/Program Management Support	879	0	0	0	0.0%

Description

Technical/Program Management has been used in support of activities relating to annual awards, technical analysis, information management, outreach publications, and legislative/executive branch reporting.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Technical/Program Management Support	**879**	**0**	**0**
As FEMP's core activities have matured, the efficiencies in those activities have increased, enabling FEMP to streamline its support activities. The support activities previously under this subprogram have been discontinued and/or have been absorbed by the Planning, Reporting and Evaluation subprogram.			
Total, Technical/Program Management Support	**879**	**0**	**0**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Technical/Program Management Support	
No change	0
Total Funding Change, Technical/Program Management Support	**0**

Capital Operating Expenses and Construction Summary

Capital Operating Expenses

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Capital Equipment					
Vehicle Technologies	2,255	300	3,500	+3,200	+1,066.7%
Fuel Cell Technology	0	670	600	-70	-10.4%
Weatherization and Intergovernmental Activities	0	0	0	0	0.0%
Distributed Energy Resources	1,992	1,000	1,000	0	0.0%
Building Technologies	154	150	150	0	0.0%
Industrial Technologies	255	250	250	0	0.0%
Biomass and Biorefinery Systems R&D	254	250	250	0	0.0%
Federal Energy Management Program	11	0	0	0	0.0%
Program Management	519	500	500	0	0.0%
Total, Capital Equipment	5,440	3,120	6,250	+3,130	+100.3%
Total, Capital Operating Expenses	5,440	3,120	6,250	+3,130	+100.3%

Program Management

Funding Profile by Subprogram

(dollars in thousands/whole FTEs)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Request[a]	FY 2006 Request	$ Change	% Change
Program Management					
Program Direction	77,489	79,151	82,481	+3,330	+4.2%
Planning, Analysis, and Evaluation	4,944	4,935	5,005	+70	+1.4%
Information, Communications, and Outreach	1,531	1,530	1,550	+20	+1.3%
Congressionally Directed Activities	8,398	7,395	0	-7,395	-100.0%
Total, Program Management	92,362	93,011	89,036	-3,975	-4.3%

Public Law Authorizations:

P.L. 94-163, "Energy Policy and Conservation Act" (EPCA) (1975)
P.L. 94-385, "Energy Conservation and Production Act" (ECPA) (1976)
P.L. 95-91, "Department of Energy Organization Act" (1977)
P.L. 95-618, "Energy Tax Act of 1978"
P.L. 95-619, "National Energy Conservation Policy Act" (NECPA) (1978)
P.L. 96-294, "Energy Security Act" (1980)
P.L.102-486, "Energy Policy Act of 1992"

Mission

The Energy Conservation Program Management budget provides executive and technical direction; public information; planning, analysis, evaluation; budget formulation and execution; and all other oversight required for efficient and productive implementation of Energy Conservation programs in the Office of Energy Efficiency and Renewable Energy (EERE). Program Management supports staff at Headquarters, six Regional Offices, and the Golden (Colorado) Field Office in planning and implementing Energy Conservation activities, as well as facilitating delivery of applied R&D and grant programs to Federal, regional, State, and local customers. The Program Management budget also includes funding for project management provided by the National Energy Technology Laboratory (NETL) on a reimbursable basis, and in FYs 2004 and 2005 includes several Congressionally-directed activities.

Through its Program Management activities, EERE performs critical functions that directly support its programmatic mission of the Department. These functions include establishing and maintaining

[a] Reflects the 0.594% and 0.80% rescissions of -$530,000 and -$709,000 respectively and comparability adjustment for National Energy Technology Laboratory Support of +$5,086,000.

strategic and tactical alignment with National policy and the President's Management Agenda, managing information technology, ensuring sound legal and policy advice and fiscal stewardship, developing and implementing uniform program policy and procedures, performing cross-cutting economic and market analyses, estimating GPRA and other benefits of EERE's programs, performance planning and management, maintaining and supporting our workforce, providing security at our Golden Field Office and Regional Offices, and providing Congressional and public liaison and information.

Benefits

Each of the major subprograms of Program Management serves to make possible, enhance, or quantify the benefits of all the other programs in Energy Conservation.

The Program Direction subprogram is essential to the performance of all Energy Conservation programs and the achievement of their missions, because it provides for their staff, management, and program execution (contracting and financial awards). It also provides the cross-cutting functions necessary for a successful program, including preparation of budget requests, communication with Congress and the Office of Management and Budget, and oversight to ensure that program activities are consistent with the Department's mission, the National Energy Policy, and the President's Management Agenda. The Golden Field Office and NETL provide much of EERE's project management capability, and GO also provides oversight of the National Renewable Energy Laboratory. The Regional Offices provide EERE with a support and communication mechanism to understand and address regional variations in energy resources, markets, and demand patterns, and offer regionalized deployment capabilities.

The Planning, Analysis, and Evaluation subprogram establishes and maintains the methods, information base, and standards for planning and policy analysis, budget formulation, and performance management and evaluation. The subprogram provides direct expertise and funds contracts that provide technical, economic, and policy analyses and support for strategic and multi-year planning, performance and budget integration, GPRA benefit estimation for all DOE Energy Conservation programs, and foundational understanding of current and projected energy and technology markets. Each of these activities is central to the goals of the President's Management Agenda, each implements the requirements of the Government Performance and Results Act, and each is also key to effective management of the Energy Conservation programs and to deciding on the optimal allocation of resources among the programs.

The Information, Communications and Outreach subprogram coordinates and manages efforts to make all of the other programs' work – and their results – known to the public. This contributes both to the Energy Conservation account's deployment goals and to Administration E-government initiatives to make government more transparent and accessible to the public.

Program Direction

Funding Profile by Category

(dollars in thousands, whole FTEs)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Headquarters					
Salaries and Benefits	30,871	32,993	34,736	+1,743	+5.3%
Travel	1,200	1,947	1,900	-47	-2.4%
Support Services	9,874	6,520	6,000	-520	-8.0%
Other Related Expenses	5,431	4,953	4,926	-27	-0.5%
Total, Headquarters	47,376	46,413	47,562	+1,149	+2.5%
Full Time Equivalents	238	262	262	0	0.0%
Golden Field Office					
Salaries and Benefits	5,172	6,676	7,109	+433	+6.5%
Travel	174	217	245	+28	+12.9%
Support Services	1,076	1,142	1,158	+16	+1.4%
Other Related Expenses	1,008	1,286	1,304	+18	+1.4%
Total, Golden Field Office	7,430	9,321	9,816	+495	+5.3%
Full Time Equivalents	47	60	60	0	0.0%
Regional Offices					
Salaries and Benefits	12,212	11,714	12,215	+501	+4.3%
Travel	824	818	836	+18	+2.2%
Support Services	1,428	875	1,424	+549	+62.7%
Other Related Expenses	2,795	3,050	3,235	+185	+6.1%
Total, Regional Offices	17,259	16,457	17,710	+1,253	+7.6%
Full Time Equivalents	112	119	113	-6	-5.0%
National Energy Technology Laboratory (Reimbursable Work)					
Salaries and Benefits[a]	2,627	4,624	6,742	+2,118	+45.8%
Travel	242	116	163	+47	+40.5%

[a] Includes indirect overhead charges included in full cost recovery per FTE calculated by NETL.

(dollars in thousands, whole FTEs)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Support Services	2,445	2,105	325	-1,780	-84.6%
Other Related Expenses	110	115	163	+48	+41.7%
Total, National Energy Technology Laboratory	5,424	6,960	7,393	+433	+6.2%
(Reimbursable Full Time Equivalents, non-add)[a]	(27)	(39)	(41)	(2)	+5.1%
Program Direction					
Salaries and Benefits	50,882	56,007	60,802	+4,795	+8.6%
Travel	2,440	3,098	3,144	+46	+1.5%
Support Services	14,823	10,642	8,907	-1,735	-16.3%
Other Related Expenses	9,344	9,404	9,628	+224	+2.4%
Total, Program Direction	77,489	79,151	82,481	+3,330	+4.2%
Total, Full Time Equivalents	397	441	435	-6	-1.4%

Mission

As stated in the Departmental Strategic Plan, DOE's Strategic and General Goals will be accomplished not only through the efforts of the major program offices in the Department but with additional effort from offices which support the programs in carrying out the mission. EERE performs critical functions which directly support the mission of the Department. These functions include activities that are performed in four office groups:

- Headquarters, where policy development and technical and budget planning are centered, and where the first stages of program execution occur;
- Six Regional Offices, which provide regionalized support for EERE's deployment and State Grant programs, along with other local coordination activities requested by the 11 technology programs;
- Golden Field Office, which provides field management of the National Renewable Energy Laboratory and is one of EERE's two centralized Project Management Offices to handle the later stages of program execution; and
- National Energy Technology Laboratory, which serves as EERE's other Project Management Office on a reimbursable-services basis for program execution through a Memorandum of Agreement (MOA) between the Assistant Secretary for Energy Efficiency and Renewable Energy and the Assistant Secretary for Fossil Energy.

[a] Non-EERE Employees

Headquarters

EERE faces four major institutional management challenges:

1. EERE's programs are numerous and diverse, addressing multiple national goals and providing multiple types of public benefits, making management and integration at the corporate level very complex;

2. EERE complies with multiple external requirements, such as the Government Performance Results Act (GPRA), that require a broad spectrum of information to be delivered at different times of the year, and has been at the forefront (often a "pilot" program) of efforts to improve benefits analysis and R&D performance measurement;

3. EERE's customer base is very diverse and therefore information preparation and delivery must address a greater range of intended audiences than many programs face; and

4. EERE's research, development and deployment (RD&D) programs have, in the past, depended heavily on contractors managing subcontractors.

In response to outside recommendations (e.g. the National Academy of Public Administration - NAPA) and its own continuing self assessments, EERE has established an Action Plan for FY 2004-2006 to guide reforms that will address identified shortcomings, including:

- Continuing to implement our streamlined and integrated program and business model, which consolidated our work into eleven technology development and deployment programs and centralized our business administration functions into a single EERE organization. Our work focused on culture change and consolidating the improvements already made;

- Continuing a formal Program Management Initiative begun in FY 2003, focused on training for all program managers. As a result, EERE intends to have a fully certified and trained program management corps;

- Integrating the Strategic Management System (SMS) with the best features of the existing EERE project management systems and with the evolving DOE I-Manage initiative to create the EERE Corporate Planning System (CPS), which will provide a unified corporate approach toward planning and budgeting, program execution, and performance measurement across EERE. Program and financing information was migrated to the CPS in FY 2004, and all activities are expected to use the system starting in FY 2005.

- Developing new standard operating procedures intended to reduce end-of-year uncosted balances;

- Implementing advance procurement planning and improved "work packaging" to reduce procurement and financial assistance "churning" due to administrative change orders and numerous very small funding actions;

- Implementing a workforce restructuring in FY 2004-2006 to achieve the most effective distribution of FTEs across EERE's programs, based on a Workforce Analysis performed in FY 2004, in order to provide effective oversight and manage towards performance goals;

- Developing stronger management oversight on the use of support service contracts, and combining that with the workforce analysis to develop a strategy for optimally deploying support service resources for maximum benefit; and
- Working with the DOE Chief Financial Officer (CFO), the White House Office of Management and Budget (OMB), and the Congress to better convey and account for expenditure of program direction and policy analysis costs.

The Headquarters program direction budget supports staff, facilities, and contracted services in four functional areas that are essential for productive operation of the EERE enterprise:

- Program Management. Supplies the critical expertise needed within the R&D and deployment programs at Headquarters to organize, plan, direct and monitor RD&D activities associated with Energy Conservation's eight programs.
- Program Execution Support. Provides a full spectrum of program execution business activities for EERE managers from a single integrated organization. These services include all actions associated with program execution; acquisition, reporting and analysis steps that make appropriation intentions reality; support to the Planning, Budget, and Analysis (PBA) office for budget execution activities; human resources development, travel, training, operations and logistics, security activities (except cyber security); and providing administrative management policy direction and support to Program Managers, Golden Field Office and Regional Offices.
- Planning, Budget, and Analysis. PBA leads EERE's activities in budget formulation, defense, and execution; strategic and portfolio planning and assessment; performance management; and program evaluation. It coordinates development of EERE's budget requests, including integration of performance measures and updates of the EERE Strategic Plan. PBA tracks, reports, and analyzes the allocation of appropriated funding, and performs the initial steps in budget execution, including coordinating the development and implementation of Approved Funding Plans. PBA manages development of EERE's annual Government Performance and Results Act (GPRA) metrics and EERE's performance planning and accountability report. PBA also coordinates the Planning, Analysis, and Evaluation required for consistent implementation of the President's Management Agenda (PMA) and R&D Investment Criteria, and manages EERE's reporting of PMA progress through OMB's Program Assessment Rating Tool (PART). PBA directs the activities funded under the Planning, Analysis, and Evaluation subprogram line item. PBA also provides analysis for the statutorily-required biennial National Energy Policy report and similar government-wide policy efforts.
- Information and Business Management Systems. Develops and manages corporate level information and business management systems to insure consistent, efficient and effective business policies and practices for EERE's Headquarters and field organizations. These information systems serve all of the business activities associated with planning and budget formulation, program and project management, budget execution, analysis, and evaluation. This function also provides supports to other DOE headquarters business systems (such as the I-MANAGE, ePME, and E-Gov initiatives) and provides support to (but does not directly fund) IT activities at EERE's Golden Field Office and Regional Offices; provides all headquarters information technology and associated cyber security; addresses management reviews; coordinates environmental safety and health and continuity-of-operations issues; coordinates audit activities and National Laboratory evaluations;

and identifies field facility needs, reviews construction plans, and oversees the construction decision and approval process at headquarters.

Golden Field Office

The Golden Field Office (GO) continues to budget for 60 FTE's in FY 2006 – level with FY 2005. GO serves as one of two Project Management Centers (PMCs) under EERE's Project Management Initiative, the other being the National Energy Technology Lab (NETL). As a PMC, Golden provides dedicated Contracting Officers (COs) and Contracting Officers' Representatives (CORs) to perform field project management of R&D partnerships. The staff of COs and CORs is supported by approximately 15 Technical Monitors hired under a support-services contract. GO also supports EERE Energy Conservation efforts through administration of the National Renewable Energy Laboratory M&O contract, and serves as a field coordinator of facility planning and construction. Federal staff expenditures are funded by both of EERE's Energy Supply and Energy Conservation appropriations. GO provides management support for approximately 450 agreements and some 300 active projects in nearly every State and in several other nations to support the following programs:

- Fuel Cell Technologies;
- Federal Energy Management Program;
- Biomass and Biorefinery Systems R&D;
- Industrial Technologies (except Forest and Paper Products); and
- Vehicle Technologies.

Key activities include:

- Administering the management and operating (M&O) contract for the National Renewable Energy Laboratory (NREL);
- Managing the Federal Energy Management Program (FEMP) Super Energy Savings Performance Contracts ("Super-ESPCs") and serving as the focal point for FEMP finance and procurement activities;
- Supporting the Inventions and Innovations Program; and
- Partnering with industry and academia in joint R&D projects to further develop and facilitate delivery of applied R&D.

Regional Offices

EERE's 6 Regional Offices (ROs), located in Southeast, Northeast, Midwest, Central, Mid-Atlantic, and Western, catalyze the implementation of energy efficient and renewable energy strategies at the State and local level by working with States and communities to promote EERE programs; identifying and engaging community and State partners; and integrating EERE programs with public and private sector activities. The ROs, with 113 FTEs budgeted for FY 2006 (and another 6 funded in the Energy and Water Development appropriation), represent over a quarter of EERE's Federal workforce, and administer nearly $0.4 billion in program funding to States, localities, and regional organizations. They play a key role in implementing EERE's mission in administering grants, managing projects, and delivering programs that accelerate market penetration of energy efficiency and renewable energy technologies. Beginning in FY 2006, salary, benefits, and travel funding for a number of FTEs estimated to support renewable energy and hydrogen technologies will also be included in the Energy Supply account in the Energy and Water Development appropriation. Key activities include:

- Administering EERE's principal technology deployment grant programs, including the Weatherization Assistance Program and the State Energy Program;
- Delivering EERE's principal technical assistance programs, including Clean Cities, Rebuild America, and the Federal Energy Management Program;
- Serving as EERE's liaison to State Energy Offices, other State agencies, regional organizations of the National Governors' Association, and other stakeholders involved in energy and environmental quality issues;
- Organizing over 150 meetings, workshops and conferences per year across all EERE technologies, and providing logistical support and briefing materials for high-profile/VIP events and visits for senior EERE and DOE management;
- Implementing Memoranda of Understanding between DOE and other Federal agencies, such as the Environmental Protection Agency, General Services Administration, Federal Emergency Management Agency (FEMA), and the Department of the Interior (DOI), to implement joint projects where the whole portfolio of EERE technologies is relevant;
- Providing EERE's national program managers at Headquarters with customer feedback on how to make their programs more effective and efficient;
- Supporting and helping deliver special initiatives of the President, Secretary, and Assistant Secretary;
- Creating local, State, and regional partnerships and leveraging local, State, and regional resources to maximize the impact of EERE's technologies and programs; and
- Helping EERE's end use sectors deliver their programs to State and local stakeholders.

The following is a crosscut of FY 2006 Regional Office budget estimates by EERE's major Energy Conservation programs: Federal Energy Management Program; Weatherization and Intergovernmental Program; Industrial Technologies Program; Distributed Energy Resources; as well as support activities:

FY 2006 Regional Office Budget Estimates

(dollars in thousands)

	FEMP	WIP	Industry	DER	Crosscutting	Management and Administration	Totals
Southeast	317	792	159	119	1,474	908	3,769
Northeast	158	1,014	159	238	501	592	2,662
Midwest	158	1,069	159	158	524	750	2,818
Central	158	1,308	159	356	564	434	2,979
Mid-Atlantic	119	911	159	158	524	632	2,503
Western	317	952	159	158	801	592	2,979
Totals	1,227	6,046	954	1,187	4,388	3,908	17,710

National Energy Technology Laboratory

The National Energy Technology Laboratory (NETL) serves as one of two Project Management Centers (PMCs) for EERE; the other is the Golden Field Office. NETL is primarily a Fossil Energy facility, and it provides project management and financial services to other elements of DOE on a reimbursable basis. In FY 2004 EERE and FE signed a Memorandum of Agreement that formalized this reimbursable arrangement.

NETL will provide procurement, financial assistance, and project management services to the following programs:

- Vehicle Technologies;
- Weatherization and Intergovernmental Program (both State grants and Gateway Deployment);
- Distributed Energy Resources;
- Building Technologies;
- Industrial Technologies (Mining Vision and in FY 2004, Black Liquor Gasification);
- Biomass and Biorefinery Systems R&D (thermochemical conversion, black liquor); and
- Federal Energy Management Program (Project Financing activity only).

As one of EERE's PMCs, NETL provides dedicated Contracting Officers (COs) and Contracting Officer's Representatives (CORs) to perform field project management of R&D partnerships. The staff of COs and CORs are supported by in-house procurement and legal specialists, along with other services as needed. In FY 2004, funding was reprogrammed from the R&D and deployment programs into Program Direction for this purpose, and in is directly requested here in FY 2006.

While EERE and NETL gain experience with the Project Management Center business model, the exact costs of support will continue to be refined, but the table below shows the funds reprogrammed in FY 2004 and the estimated cost allocations in FY 2005 and FY 2006.

(dollars in thousands)

Programs Served by NETL	FY 2004	FY 2005	FY 2006
Biomass and Biorefinery Systems R&D	370	320	0
Building Technologies	1,400	1,674	2,086
Distributed Energy Resources	902	1,098	1,215
Federal Energy Management Program	296	214	218
Industrial Technologies	434	548	340
Vehicle Technologies	1,342	1,496	1,705
Weatherization and Intergovernmental Activities	680	1,610	1,829
Total NETL PMC funding from Program Direction	5,424	6,960	7,393

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Salaries and Benefits	**50,882**	**56,007**	**60,802**

Funds a total of 435 full time equivalent employees in FY 2006, reflecting the shift of 6 FTE to the Energy and Water Development appropriation. Staff funded in this decision unit provide the executive management, program oversight, analysis, and information required for the effective implementation of the EERE programs funded in the Energy Conservation appropriation.

The DOE Headquarters component, consisting of 262 FTEs, is responsible for the development of policies, strategic plans and related guidance to program offices; the evaluation of program performance; the formulation, defense and execution of energy conservation budgets; program planning and execution; and communications with the public and stakeholders regarding policies, funding, program performance, and related issues.

Program Direction supports a Golden Field Office personnel level of 60 FTEs, mostly dedicated to GO's Project Management Center role.

Program Direction also supports 113 FTEs located in EERE's six Regional Offices, which provide management of EERE's State and local grant programs and also perform numerous technology-deployment activities. The FTE level is reduced from the previous level by 6, because in FY 2006, 6 FTE at the ROs are funded in the Energy and Water Development appropriation.

These salary and benefit amounts also include the estimated portion of the reimbursable work at NETL that will be applied to salaries and benefits.

Staff performance is measured by responsiveness to National Energy Policy goals and objectives; implementation of the President's R&D investment criteria for priority decision making; continued improvement in the utilization of Federal personnel, travel, and support service activities; increases in

competitive and cost-sharing procurement awards; extending the use of more efficient electronic government information systems, improving financial performance; and further integration of program metrics into resource allocation processes.

Travel **2,440** **3,098** **3,144**

The FY 2006 request provides adequate travel funds for 435 FTE, including the enhanced staff of project managers at the Golden Field Office. These funds also include the estimated portion of the reimbursable work at NETL that will be applied to travel.

Support Services..... **14,823** **10,642** **8,907**

The requested funds will allow EERE to continue implementing management improvements guided by the President's Management Agenda, NAPA reviews, EERE's Strategic Plan, and EERE's Workforce Restructuring study. The FY 2006 request will provide for starting peer reviews of EERE program performance, providing feedback to the program and research staff. The requested funds will also provide program management support at Headquarters, Golden, and the Regional Offices for information technology (including integration of EERE's systems with DOE corporate IT initiatives such as Grants.Gov, I-Manage, and ePME), outreach and communications, procurement, and financial and human resources management. It will provide administrative support for technical symposia, technical editing of plans and reports, and necessary data-entry and analytical graphics services. The request also provides staff training and funding for Defense Contract Audit Agency audits.

These funds also include the estimated portion of the reimbursable work at NETL that will be applied to support services for administrative and editorial assistance to the NETL project managers.

Participants will include: TMS, Inc., NETL, and TBD.

Other Related Expenses..... **9,344** **9,404** **9,628**

The FY 2006 request will support:

- $4,897,000 for Headquarters Working Capital Fund (WCF) activities such as administrative services, rent, automated office support, contract close out, telephone services, postage, printing, graphics, and similar services;
- $2,895,000 for rent at the GO and the six Regional Offices; and
- $1,836,000 for Other Related Expenses, including computer equipment and support, utilities, postage, printing, graphics, administrative expenses, and security at Golden and the Regional Offices, plus Worker's Compensation, software licenses, publications, and conferences, plus directly reimbursable Other Related expenses at NETL.

Total, Program Direction **77,489** **79,151** **82,481**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Salaries and Benefits	
Provides for anticipated increases in pay and benefits costs: statutory increases, promotions and within-grade increases, performance awards, and health benefits costs that are rising much faster than inflation, adjusted downward for 6 FTE being shifted to Energy and Water Development appropriation. Also includes estimated salary and benefits (full cost recovery per FTE) for the estimated increase in reimbursable work at NETL	+4,795
Travel	
Adjustment for 6 FTE being shifted to Energy and Water Development funds, offset by an increase in estimated NETL travel	+46
Support Services	
IT and program management efficiencies reduce funding needs for business systems, training, technical editing, program peer reviews, and data-entry and graphics services	-1,735
Other Related Expenses	
Funds anticipated rent increases at Regional Offices and increased estimated directly-reimbursable Other Related Expenses at NETL, partially offset by reductions in Working Capital Fund and Other Related Expenses	+224
Total Funding Change, Program Direction	**+3,330**

Support Services by Category

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Management Support					
Management Support	14,785	10,308	8,582	-1,726	-16.7%
Reimbursable Management Support	38	334	325	-9	-2.7%
Total, Management Support	14,823	10,642	8,907	-1,735	-16.3%
Total, Support Services	14,823	10,642	8,907	-1,735	-16.3%

Other Related Expenses by Category

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Other Related Expenses					
Equipment transport	70	75	50	-25	-33.3%
Rent to GSA	2,233	2,594	2,789	+195	+7.5%
Rent to Others	65	106	106	0	0.0%
Communications, Utilities, Miscellaneous	1,372	1,005	1,074	+69	+6.9%
Printing and Reproduction	145	150	150	0	-0.0%
Other Services	20	20	29	+9	+45.0%
Supplies and Materials	170	175	180	+5	+2.9%
Equipment	175	180	190	+10	+5.6%
Working Capital Fund	4,990	4,994	4,897	-97	-1.9%
Reimbursable Other Related	104	105	163	+58	+55.2%
Total, Other Related Expenses	9,344	9,404	9,628	+224	+2.4%

Estimated "Fully Loaded" Attribution of Program Direction and FTE, by Program[a, b, c]

(dollars in thousands/whole FTEs)

	FY 2004	FY 2005	FY 2006	$ or FTE Change	% Change
Hydrogen, Fuel Cells and Infrastructure Technologies .	7,543	8,520	8,717	+197	+2.3%
Direct Full Time Equivalents	40	50	49	-1	-2.0%
(NETL Reimbursable Full Time Equivalents).....	0	0	0	0	0.0%
Freedom Car and Vehicle Technologies.....	9,715	9,893	10,276	+383	+3.9%
Full Time Equivalents	44	50	49	-1	-2.0%
(NETL Reimbursable Full Time Equivalents).....	7	8	9	+1	+12.5%
Weatherization and Intergovernmental Activities	18,131	17,993	19,427	+1,434	+8.0%
Full time Equivalents.....	64	66	65	-1	-1.5%
(NETL Reimbursable Full Time Equivalents).....	3	10	11	+1	+10.0%
Distributed Energy Resources	7,368	7,930	8,295	+365	+4.6%
Full Time Equivalents	34	40	39	-1	-2.5%
(NETL Reimbursable Full Time Equivalents).....	5	6	7	+1	+16.7%
Building Technologies.....	11,247	11,137	11,767	+630	+5.7%
Full Time Equivalents	52	57	56	-1	-1.8%
(NETL Reimbursable Full Time Equivalents).....	7	9	10	+1	+11.1%
Industrial Technologies	10,545	11,046	11,234	+188	+1.7%
Full Time Equivalents	96	105	105	0	0.0%
(NETL Reimbursable Full Time Equivalents).....	2	3	3	0	0.0%

[a] This estimated attribution of total ("fully loaded") program direction costs and FTE levels to the "line" program offices within EERE was originally requested in the FY 2004 Interior and Related Agencies Conference Report (108-330).

[b] The attributions are conceptual only, and do not represent funds directly at the disposal of the individual programs. They are based on a blend of administrative and overhead costs that have been grouped into several categories: (1) costs that, on average, vary on a per-capita basis, and thus depend on the estimated FTE allocation (such as salary, travel, Working Capital fund, etc.); (2) costs that can fairly be considered to be incurred equally by each program (such as many Business Administration functions); (3) costs that are most fairly shared by a subset of programs served (such as Golden Field Office or NETL project management); and (4) costs that are directly attributed to support for particular programs, such as program-specific Regional Office funding (shown in the cross-cut table in the RO section).

[c] "Fully Loaded" FTE attributions are estimated similarly to the fully loaded program direction costs, but also include currently planned direct program FTE levels, which may change as a result of the Workforce Restructuring study that is currently underway in EERE. Programs whose project management is supported by NETL show fewer FTEs than programs using the Golden Field Office because no FTEs are associated with the NETL funding.

(dollars in thousands/whole FTEs)

	FY 2004	FY 2005	FY 2006	$ or FTE Change	% Change
Biomass and Biorefinery Systems R&D	2,544	2,221	1,941	-280	-12.6%
Full Time Equivalents	12	11	11	0	0.0%
(NETL Reimbursable Full Time Equivalents)	2	2	0	-2	-100.0%
Federal Energy Management Program	10,396	10,411	10,827	+416	+4.0%
Full Time Equivalents	55	62	61	-1	-1.6%
(NETL Reimbursable Full Time Equivalents)	1	1	1	0	0.0%
Total, Program Direction	77,489	79,151	82,481	+3,330	+4.2%
Total, Full Time Equivalents	397	441	435	-6	-1.4%
(Total, NETL Reimbursable Full Time Equivalents)	27	39	41	+2	+5.1%

Geographic and Organizational Location of FTEs

(dollars in thousands/whole FTEs)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Headquarters					
Hydrogen, Fuel Cells and Infrastructure Technologies	13	18	18	0	0.0%
FreedomCAR and Vehicle Technologies	26	28	28	0	0.0%
Weatherization and Intergovernmental Activities	39	36	36	0	0.0%
Distributed Energy Resources	6	9	9	0	0.0%
Building Technologies	35	35	35	0	0.0%
Industrial Technologies	22	24	24	0	0.0%
Biomass and Biorefinery Systems R&D	5	3	3	0	0.0%
Federal Energy Management Program	20	20	20	0	0.0%
Front Office (Asst. Sec., Principal DAS, Board)	10	12	12	0	0.0%
Office of Communications and Outreach	10	13	13	0	0.0%
Business Administration	48	60	60	0	0.0%
DAS-Technology Development	4	4	4	0	0.0%
Subtotal, Headquarters FTE	238	262	262	0	0.0%
Regional Offices FTE	112	119	113	- 6	- 5.0%
Golden Field Office FTE	47	60	60	0	0.0%
Total, FTE	397	441	435	- 6	- 1.4%

Planning, Analysis, and Evaluation

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Planning, Analysis, and Evaluation.....	4,944	4,935	5,005	+70	+1.4%
Total, Planning, Analysis, and Evaluation....	4,944	4,935	5,005	+70	+1.4%

Description

Activities funded under Planning, Analysis, and Evaluation (PAE) collect, analyze, and integrate economic, market, and technology characterization data and develop cross-cutting technological and economic models and forecasts, providing the analytic basis for strategic planning, benefits estimation, and corporate portfolio analysis. In addition, PAE funds development of enhanced planning, analytical, and evaluation methodologies and tools. In support of the Government Performance and Results Act (GPRA) and EERE's own strategic planning, PAE assesses the market and economic impact EERE's energy-efficiency technology portfolio might have, and the potential energy, economic, environmental, and social benefits that would result.

Both renewable and efficiency technologies have broad impacts across energy markets. Because of these market interactions, it is necessary to analyze the impacts of EERE (both EWD and Interior programs) investments in the context of EERE's overall portfolio and both energy supply and demand markets. For example, improvements in building efficiency will reduce the demand for electricity, and, as a result, affect the market for wind energy. Likewise, improvements in wind technologies, will reduce the demand for natural gas in electricity markets, making additional natural gas available for use in industrial cogeneration or hydrogen production. The integrated approach used by EERE to analyze program market impacts provides the context necessary to ensure that these interactions are taken into account; improves consistency in assessing technology choices; provides a more realistic picture of impacts and helps to better understand synergies and competition across EERE's portfolio.

These analyses are essential for program planning, prioritization, management and inform EERE’s allocation decision. A solid analytical foundation is basic to understanding the potential for increasing the penetration of energy efficient and renewable energy technologies, and for achieving the correct balance and direction of programmatic activities. In addition, analysis and evaluation activities are required to ensure continued program alignment with the goals of the National Energy Policy (NEP) and the President's Management Agenda (particularly Budget and Performance Integrating and the PART/RDIC components), and to properly explain the budgets and potential benefits of EERE's programs.

EERE maintains strong capabilities in data analysis and model development to ensure that decisions regarding program direction and resource allocation are guided by the best possible information. Analytical capabilities and supporting databases are continually refined and strengthened to improve the information available for program guidance decisions and to better evaluate the energy, economic, and environmental impacts of programmatic alternatives. An Office of Planning, Budget, and Analysis (PBA) multiyear plan is under development to improve EERE's evaluation, planning, and analytical

capabilities. PBA is building upon the benefits framework developed by the National Research Council (NRC), which relates different types of program benefits to various potential future energy needs, as one of the organizing principles for EERE's analytical agenda.

Improving the ability of programs to estimate potential benefits is an integral component of the Administration's R&D investment criteria initiative. The programs continue to work toward improved transparency in describing assumptions, methods, sensitivities, and uncertainties, and toward improved consistency in assumptions, modeling procedures and scenario analyses.

Benefits

The key benefits are broader and better-quality information to support management decisions at the Program and corporate levels. Specifically, the Planning, Analysis, and Evaluation subprogram establishes and maintains the standards for planning and policy analysis, budget formulation, budget execution, and performance management and evaluation. The subprogram funds contracts that provide technical, economic, and policy analyses and support for strategic and multi-year planning, performance and budget integration, GPRA benefit estimation for all DOE Energy Conservation programs, and foundational understanding of current and projected energy markets. Each of these activities is central to the goals of the President's Management Agenda, each implements the requirements of the Government Performance and Results Act, and each is also key to effective management of the Energy Conservation programs and to deciding on the optimal allocation of resources among the programs.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Planning, Analysis, and Evaluation.....	**4,944**	**4,935**	**5,005**

The FY 2006 request for this crosscutting activity is the same as FY 2005. This budget line supports the development, interpretation, and dissemination of the basic data and economic and benefits models required to implement energy policy and manage and evaluate energy efficiency programs. It also funds analyses related to the biennial national energy plan required by the Department's Organization Act, and reviews technology commercialization successes and failures to quantify retrospective benefits. In addition to the funding shown above, roughly $1.5 million per year is provided from individual Energy Conservation programs to support these PAE activities.

Recent emphasis on GPRA and the President's Management Agenda, including the Office of Management and Budget's "Program Assessment Rating Tool" and "Research and Development Investment Criteria", and a Congressionally-supported National Research Council study, requires a greater effort to project benefits, assess past performance and benefits, anticipate future markets, and provide a more solid integration of analysis tools and products across the EERE program portfolio. As a part of the EERE FY 2005 budget submission, this budget line supported the preliminary work to extend of the analysis timeframe to 2050 in order to address longer-term portions of the EERE portfolio, and has begun work on indicators related to energy security.

With this budget submission, EERE has extended its analysis to address at least two potential future

energy scenarios (developed in conjunction with the Office of Fossil Energy) in order to assess how well EERE's portfolio prepares the Nation for a range of possible future energy needs. Funding and analytical resources have been redirected towards additional priority analytical needs, including development of: common EERE approaches to assessing and managing program performance risk; an enhanced ability to model hydrogen, biomass, and other changes in energy markets resultant from EERE's portfolio; an assessment of retrospective benefits; and a more standardized approach to program planning and evaluation.

During FY 2006, PBA expects to develop final FY 2007 benefit estimates, and preliminary FY 2008 estimates; provide analysis of program options for the FY 2008 budget; update retrospective benefit estimates; and provide analytical support for EERE or DOE level strategic planning. Capacity improvements scheduled for FY 2006 include adoption of formal measures of local air quality and energy reliability improvements; and adoption of standard methods for assessing program risk.

Participants are expected to include: NREL, LBNL, ORNL, PNNL, and TBD technical service contractors.

Planning, Analysis, and Evaluation	**4,944**	**4,935**	**5,005**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Planning, Analysis, and Evaluation	
Increased efforts to implement the President's Management Agenda (PMA) by increasing performance measurement	+70
Total Funding Change, Planning, Analysis, and Evaluation	**+70**

Information, Communications, and Outreach

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Information, Communications, and Outreach	1,531	1,530	1,550	+20	+1.3%
Total, Information, Communications, and Outreach	1,531	1,530	1,550	+20	+1.3%

Description

Information, Communications, and Outreach activities in EERE are carried out by the Office of Communication and Outreach (OCO). OCO communicates the EERE mission, program plans, accomplishments, and technology capabilities to a variety of stakeholder audiences including Congress, the public, educational institutions, industry, and other government and non-government organizations. In addition, OCO prepares speeches and presentations by the Assistant Secretary and others when requested; manages the EERE public website and EERE's centralized public information clearinghouse; manages official correspondence; and coordinates reviews of EERE-related statements by other DOE offices and Federal agencies.

Many of OCO's functions are inherently Federal, and are performed by EERE staff, whose salaries, benefits, and all related funding (like all EERE staff) are covered in the Program Direction subprogram. The funding requested in this subprogram is focused on two EERE public information activities: the EERE public website and a central information clearinghouse, which provides a toll-free information "hotline."

The objectives of the EERE public website and the central information clearinghouse activities are: (1) to provide accurate information on energy efficiency and renewable energy technologies to the public so EERE's customers can make informed decisions in the marketplace, resulting in an increase in the adoption of energy efficiency technologies and practices; and (2) to raise the general awareness of state-of-the-art energy efficiency technologies and practices.

Benefits

The Communications and Outreach subprogram coordinates and manages efforts to make all of the other programs' work – and their results – known to the public. This contributes both to the Energy Conservation account's deployment goals and to Administration E-government initiatives to make government more transparent and accessible to the public.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Information, Communications, and Outreach	**1,531**	**1,530**	**1,550**

From March 2003 through February 2004, the number of web pages viewed by users reached 46 million, up from 34 million in the previous year. The increased demand for information in this medium will require us to devote a larger share of the OCO budget to web-server operations and maintenance and to content creation and updates. All EERE websites will be consolidated to a single web server in 2005. In 2005, EERE will implement a content management system for its websites, and in 2006 will continue to identify and implement improvements to web content and timeliness in response to increased consumer and stakeholder usage. We are continuing to update the website to reflect new technology advancements, new information for consumers and improved access to EERE business and technical resources.

The toll-free information clearinghouse provides a more personalized service than the website, and is available to consumers and businesses that do not have Internet access. The clearinghouse fielded 20,000 inquiries and delivered 215,000 publications to consumers, businesses, and schools in 2004.

In FY 2005, this main clearinghouse is being combined with several program-specific clearinghouses that have been operated in the past by different EERE programs. This direct funding will pay for about half of the clearinghouse costs; the remainder will be covered by program contributions.

Participants will include: NREL, LBNL, ORNL, PNNL, RS Information Systems, and TBD.

Total, Information, Communications, and Outreach	**1,531**	**1,530**	**1,550**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Information, Communications, and Outreach	
No significant change	+20
Total Funding Change, Information, Communications, and Outreach	**+20**

Congressionally Directed Activities

Funding Schedule by Activity

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Congressionally Directed Activities					
Cooperative Program with States	4,938	3,944	0	-3,944	-100.0%
National Academy of Sciences (NAS) Program Review	497	493	0	-493	-100.0%
Energy and Research Consortium of the Western Carolinas	2,963	2,958	0	-2,958	-100.0%
Total, Congressionally Directed Activities	8,398	7,395	0	-7,395	-100.0%

Description

These activities have been added at the direction of Congress. The Cooperative Program with States is a Congressionally-directed activity that funds cooperative agreements with States, which in turn support technology development, field testing, and deployment activities that promote the commercialization of energy-efficiency technologies. The technologies and applications supported can address any sector of the nation's economy. The National Academy of Sciences review of selected R&D activities is a continuation of an activity directed in FY 2003. The activities at the Energy and Research Consortium of the Western Carolinas represent new direction in FY 2004.

Detailed Justification

(dollars in thousands)

FY 2004	FY 2005	FY 2006
Cooperative Program with States..... **4,938**	**3,944**	**0**

FY 2004 and FY 2005 funds will be distributed through cooperative agreements with States to support technology development, field testing, and deployment activities that promote the commercialization of energy-efficiency technologies. *Participants include: STAC, 13 projects in 23 States.*

National Academy of Sciences (NAS) Program Review	**497**	**493**	**0**

The National Academy of Sciences is funded to study the prospective (predicted) benefits of Energy Conservation programs, and the possible methodologies for such predictions. *Participants will include: NAS.*

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Energy and Research Consortium of the Western Carolinas	**2,963**	**2,958**	**0**
This activity will be executed in accordance with Congressional direction. EERE will endeavor to obtain benefits to the Department's goals and EERE's programs in negotiating the work to be performed by the earmark recipient. *Participants will include: Energy and Research Consortium of the Western Carolinas.*			
Total, Congressionally Directed Activities	**8,398**	**7,395**	**0**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Cooperative Program with States	
No funding is requested for FY 2006	-3,944
National Academy of Sciences (NAS) Program Review	
No funding is requested for FY 2006	-493
Energy and Research Consortium of the Western Carolinas	
No funding is requested for FY 2006	-2,958
Total Funding Change, Congressionally Directed Activities	**-7,395**

Economic Regulation

Economic Regulation

Economic Regulation
Office of Hearings and Appeals

Appropriation Summary by Program

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2005 Base	FY 2006 Request	FY 2006 Request vs. Base	
					$ Change	% Change
Economic Regulation						
Program Direction……..	1,047	0	0	0	0	0.0%
Total, Economic Regulation	1,034[ab]	0	0	0	0	0.0%

Preface

The Office of Hearings and Appeals provides legal adjudicatory services for the Department's programs in order to resolve any conflicting interests in a fair, impartial and efficient manner.

Within the Economic Regulation Appropriation, the Office of Hearings and Appeals has three principal legal staffs –the Office of Legal Analysis, the Office of Financial Analysis and the Office of Economic Analysis.

This Overview will describe Strategic Context, Mission and Benefits. These items together put this Appropriation in context.

Strategic Context

Following publication of the Administration's National Energy Policy, the Department developed a Strategic Plan that defines the mission, four strategic goals for accomplishing that mission, and seven general goals to support the strategic goals. As stated in the Departmental Strategic Plan, DOE's Strategic and General Goals will be accomplished not only through the efforts of the major program offices in the Department but with additional effort from offices which support the programs in carrying out DOE's mission. The Office of Hearings and Appeals performs critical functions which directly support the mission of the Department. These functions include careful, effective stewardship of the oil overcharge monies entrusted to the Department and providing efficient restitution to those firms and individuals that had been injured by oil overcharges pursuant to the Emergency Petroleum Allocation Act of 1973 (EPAA).

[a] Distribution of the recession from the Consolidated Omnibus Appropriation Bill in FY 2004.
[b] Also includes a general reduction of $7,000 in the FY 2004 Interior and Related Agencies Appropriation.

Mission

The Office of Hearings and Appeals (OHA) mission is to conduct fair and efficient hearings and to issue decisions of the Department with respect to any adjudicative proceedings delegated by the Secretary. OHA's jurisdiction includes review of determinations issued by officials within the Department.

Benefits

In regard to its Economic Regulation mission, OHA adjudicates cases arising under the Emergency Petroleum Allocation Act of 1973 (EPAA), and continues to conduct refund proceedings returning petroleum overcharge funds collected by the Department. As directed by Congress, OHA finished all Interior-funded Economic Regulation activities at the end of FY 2004.

Program Direction

Funding Profile by Category

(dollars in thousands/whole FTEs)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Headquarters					
Salaries and Benefits…….…..……	793	0	0	0	0.0%
Travel……..……..……..……	15	0	0	0	0.0%
Support Services……	20	0	0	0	0.0%
Other Related Expenses…….	206	0	0	0	0.0%
Total, Program Direction……...	1,034	0	0	0	0.0%
Total, Full Time Equivalents..……...	2	0	0	0	0.0%

Mission

The Office of Hearings and Appeals (OHA) mission is to conduct fair and efficient hearings and to issue decisions of the Department with respect to any adjudicative proceedings which the Secretary may delegate. OHA's jurisdiction includes appeals requesting review of any determination reached by any other official within the Department under OHA's jurisdiction.

As stated in the Departmental Strategic Plan, DOE's Strategic and General Goals will be accomplished not only through the efforts of the major program offices in the Department but with additional effort from offices which support the programs in carrying out DOE's mission. The Office of Hearings and Appeals performs critical functions which directly support the mission of the Department. These functions include effective stewardship of oil overcharge monies entrusted to the Department and through monetary restitution to firms and individuals injured by oil overcharges.

Detailed Justification

	(dollars in thousands)		
	FY 2004	FY 2005	FY 2006
Salaries and Benefits…….	**793**	**0**	**0**

FY 2004 funding for personnel costs included pay raises and promotions. No funding requested in FY 2005 and FY 2006 due to the Congressionally directed phase out of Interior and Related Agencies funded activities.

Travel……	**15**	**0**	**0**

FY 2004 funding for transportation to DOE field sites to conduct hearings on crude oil overcharge cases. No funding requested in FY 2005 and FY 2006 due to the Congressionally directed phase out of Interior and Related Agencies funded activities.

Support Services…….	**20**	**0**	**0**

FY 2004 funding for computer hardware and related contractual support services. No funding requested in FY 2005 and FY 2006 due to the Congressionally directed phase out of Interior and Related Agencies funded activities.

Other Related Expenses…….	**206**	**0**	**0**

FY 2004 funding for the Working Capital Fund expenses, which included rent, telephone, supplies, postage, building operations, equipment maintenance, printing and Automated Office Support System support and maintenance. No funding requested in FY 2005 and FY 2006 due to the Congressionally directed phase out of Interior and Related Agencies funded activities.

Total, Program Direction……..	**1,034**	**0**	**0**

Support Services by Category

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Support Services					
Management Support Services...	20	0	0	0	0.0%
Total, Support Services……..	20	0	0	0	0.0%

Other Related Expenses by Category

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Other Related Expenses					
Working Capital Fund……	206	0	0	0	0.0%
Total, Other Related Expenses…….	206	0	0	0	0.0%

Strategic Petroleum Reserve

Strategic Petroleum Reserve

Strategic Petroleum Reserve

Proposed Appropriation Language

For necessary expenses to carry out Strategic Petroleum Reserve facility development and operations and program management activities pursuant to the Energy Policy and Conservation Act of 1975 as amended (42 U.S.C. 6201 et seq.), [$169,710,000] $166,000,000 to remain available until expended.

Explanation of Change

Decrease from the FY 2005 appropriation reflects the scheduling of fewer major maintenance activities.

Strategic Petroleum Reserve
Office of Fossil Energy

Overview

Appropriation Summary by Program

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Strategic Petroleum Reserve……..	170,948	169,710	170,048	166,000	-4,048	-2.4%
Total, Strategic Petroleum Reserve……	170,948	169,710	170,048	166,000	-4,048	-2.4%

Detailed Funding Table

(dollars in thousands)

Strategic Petroleum Reserve (SPR)	FY 2004	FY 2005	FY 2006
Facilities Development and Operations……	155,044	152,946	149,000
Management……..……	15,904	16,764	17,000
Total, Strategic Petroleum Reserve……	170,948	169,710	166,000

Preface

The Strategic Petroleum Reserve provides the United States with adequate strategic and economic protection against disruptions in oil supplies. The program's goal is to mitigate the Nation's energy and security vulnerabilities and to serve as the global benchmark for petroleum reserves.

Within the Strategic Petroleum Reserve appropriation, there are two programs:

- Facilities Development and Operations
- Management

This Overview will describe Strategic Context, Mission, Benefits, Strategic Goals, and Funding by General Goal. These items together put the appropriation in perspective. The Annual Performance Results and Targets, Means and Strategies, and Validation and Verification sections address how the goals will be achieved and how performance will be measured. Finally, this Overview will address the Program Assessment Rating Tool (PART) and Significant Program Shifts in all programs.

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 years)→General Goal (10-15 years)→Program Goal (GPRA Unit) (10-15 years)

To provide a concrete link between budget, performance, and reporting, the Department developed a "GPRA" 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.

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 Strategic Petroleum Reserve (SPR) is to store petroleum to reduce the adverse economic impact of a major petroleum supply interruption to the US and to carry out obligations under the international energy program. At the end of 2004, our inventory was 670 million barrels, which provided 57 days of net import protection. The Reserve will be filled to 700 million barrels in 2005, providing 59 days of net import protection. During 2003, we reevaluated the cavern storage capacity revealing an additional 27 million barrels of capacity available for crude oil storage. This added capacity results from the dissolution of salt by water injected into the caverns during oil movements and the recertification of an existing 12 million barrel cavern previously considered as too gassy for long term crude oil storage.

Benefits

The U.S. (and trading partner) reliance on oil and U.S. net oil import levels (forecast to increase) combined with location of significant global oil reserves in regions of the world subject to political unrest, have made the U.S. vulnerable to supply disruptions. The presence of the SPR provides protection from supply disruptions.

Strategic Goal

The Department's Strategic Plan identifies four strategic goals: one each for defense, energy, science, and environmental aspects of the mission plus seven general goals that tie to the strategic goals. The Strategic Petroleum Reserve appropriation supports the following goal:

Energy Strategic Goal: To protect our national and economic security by promoting a diverse supply and delivery of reliable, affordable, and environmentally sound energy.

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 within the Strategic Petroleum Reserve appropriation have one Program Goal that contributes to the General Goals in the "goal cascade". This goal is:

Program Goal 04.58.00.00: Maintain operational readiness of the Strategic Petroleum Reserve to drawdown at a sustained rate of 4.4 million barrels per day for 90 days, within 15 days notice by the President. Maintain a 2 million barrel reserve of home heating oil in the U.S. Northeast. Utilize the Naval Petroleum Reserve 3 (NPR-3) as a testing and demonstration field for the Rocky Mountain Oilfield Testing Center's ongoing research. Continue closeout and equity finalization activities related to NPR-1 and finalize settlement to the State of California with respect to its claims to be "school lands".

Contribution to General Goal

The programs within the SPR appropriation contribute to General Goal 4 by assuring the Reserve is maintained in a high state of readiness. Assurance is measured by how quickly the program can respond to a Presidential direction to draw down; how much of the oil inventory in SPR storage is available; and the cost efficiency of operations. Facilities Development and Operations funds all requirements associated with developing and maintaining facilities for the storage of petroleum, operations associated with placing petroleum into storage, and operational readiness initiatives associated with drawing down and distributing the inventory within 13-15 days notice in the event of an emergency. Management funds personnel and administrative expenses related to maintaining the Project Management Office (New Orleans, Louisiana) and the Program Office (Washington, DC), as well as contract services required to support management and the technical analysis of program issues.

Funding by General and Program Goal

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
General Goal 4, Energy Security…….			
Program Goal 04.58.00.00 Petroleum Reserves……..	170,948	169,710	166,000
Total, General Goal 4 (Strategic Petroleum Reserves)……	170,948	169.710	166,000

Major FY 2004 Achievements

- Reached crude oil inventory level of 670 million barrels. Since receiving Presidential direction to fill to 700 million barrels (in November 2001), over 125 million barrels has been added to the Reserve.

Annual Performance Results and Targets

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Results	FY 2005 Targets	FY 2006 Targets
Facilities Development & Operations and Management					
Complete the transfer of Phase I - Federal Royalty Oil to the SPR by November 2000 per the FY 1999 Agreement with the Department of Interior. (MET GOAL)	Complete the transfer of Phase II and III - Federal Royalty Oil to the SPR. (MET GOAL - Added approximately 19.6 million barrels of Royalty Oil that contributed to the total delivery to inventory of 42.5 million barrels from all Exchange and Federal Royalty Oil agreements.)	Increase crude oil inventory to 628 million barrels. (GOAL NOT MET - The inventory of the SPR at the end of September was 624.4MMB. The variance was caused by deferral of nearly 20 MMB in oil receipts during the Venezuela oil crisis. For this deferral, we will receive an additional 2.9MMB crude premium.)	Increase crude oil inventory to 656 million barrels. (EXCEEDED GOAL: End of year inventory was 670 million barrels.	Increase crude oil inventory to 690 million barrels. (Based on the latest contracts for receipt of Royalty Oil, an inventory of 700 million barrels will be reached by mid-2005).	
	Award firm fixed-price turnkey (design/build) contract to provide a portable degas plant for continuous removal of excess gas from the SPR crude oil inventory. (MET GOAL)	Complete the Degas Plant design. (MET GOAL)	Commence full Degas Plant operations at a rate of 100,000 – 150,000 barrels per day by May 2004. (MET GOAL: Processing started April 16). Degas 23 MMB of crude oil inventory. (MET GOAL)		
					Achieve maximum sustained (90 day) drawdown rate of 4.4 MMB. Achieve $\geq$ 95% of monthly maintenance and accessibility goals. Achieve operating cost per barrel of capacity of $0.201.

Means and Strategies

The SPR will use various means and strategies to continue its mission and achieve program goals. Assurance of a readiness posture will be accomplished through internal readiness reviews, assessments, exercises, and tests. Effectiveness of the SPR to mitigate the economic damage of severe oil supply disruptions will be influenced by the SPR's size (inventory and capacity) and ability to deliver into the marketplace. Since FY 1999, the Department has been using agreements with the Department of the Interior to use Federal Royalty Oil to fill the SPR to 700 million barrels. Completion of deliveries is scheduled for 2005. The SPR's Vapor Pressure Mitigation Program includes operation of a portable vapor pressure (degas) plant for continuous removal of excess gas from the crude oil inventory. Full degas plant operations began in April 2004.

Performance can be affected by external factors including petroleum market conditions and developments in the commercial distribution system (i.e., pipelines, and terminals). Royalty-in-kind transfers are contingent on annual delivery targets negotiated with the Department of the Interior.

Validation and Verification

There is a hierarchy of performance information for the SPR. The Department collects and tracks the limited "dashboard" measures. The SPR Program Office monitors the "critical few", specific, short and long-term measures. The SPR Project Management Office manages the detailed, operational measures that are implemented by the contractors. Organizational and action plans are reviewed and analyzed at quarterly Program Reviews. Monthly Project Assessments and Project Reviews are conducted to analyze performance against all milestones and contracts. These reviews provide an opportunity to discuss performance and provide direction to contractors. These same measures are reviewed daily during the site managers' site status meetings. Budget formulation/ execution assessments are regularly conducted throughout the year, including annual budget validations. Other evaluations include: semiannual Management & Operating (M&O) contractor award fee performance assessments against Work Authorization Directives; on-site reviews to verify operational, maintenance and management performance data; and draw down readiness quarterly reviews.

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 outcome- 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 2006 Budget Request, and the Department will take the necessary steps to continue to improve performance.

Assessment under the PART found the SPR to be an effective program, well designed with a clear mission. The total program score was 92%, with individual sections scoring as follows: Program Purpose and Design - 100%, Strategic Planning – 88%, Program Management - 100%, and Program Results – 87%.

Significant Program Shifts

Due to continued geothermal heating and renewed gas intrusion into the crude oil, the SPR initiated a second vapor pressure mitigation program. Continuous removal of excess gas from the SPR crude oil inventory began in 2004. Through degassing, the SPR will be able to maintain its full mission capability while delivering crude oil that meets all safety and environmental standards.

The Strategic Petroleum Reserve continues to intermittently operate at a higher security alert. Additional security protection Officers have been placed on duty at all sites and a series of 40 security measures have been implemented, as directed by the Office of Security Operations at Department of Energy headquarters. In addition, permanent physical security enhancements have been implemented in response to the perceived threat of continued terrorist activity.

Strategic Petroleum Reserve
Office of Fossil Energy

Funding By Site By Program

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$Change	%Change
SPR Project Offices ……..	162,238	159,440	155,638	-3,802	-2.4%
Washington Headquarters …….	4,888	6,393	6,429	+36	+0.6%
Sandia National Laboratories…….....	2,612	2,667	2,723	+56	+2.1%
National Energy Technology Laboratory…….	860	860	860	0	0%
Oak Ridge National Laboratory…….	350	350	350	$ 56	0%
Total, SPR…….	170,948	169,710	166,000	-3,710	-2.2%

Site Description

SPR Project Offices
The sites located in Texas and Louisiana provides all operational readiness activities (operations, maintenance, security, etc) for the Reserve. Also includes technical and program management support in Washington, DC and New Orleans, Louisiana.

Washington Headquarters
The Washington Headquarters includes technical and program management support in Washington, DC.

Sandia National Laboratory
The Sandia National laboratory, located in Albuquerque, NM, provides technical, comprehensive, site-specific engineering research and development support for the planning, design, development, and monitoring of Strategic Petroleum Reserve (SPR) crude oil storage facilities.

National Energy Technology Laboratory
The National Energy Technology Laboratory (NETL) located in Morgantown, WV, Pittsburgh, PA and Tulsa, OK is a multipurpose laboratory, owned and operated by the U.S. Department of Energy. NETL conducts detailed analysis of crude oil streams, caverns and storage cavern composites to ascertain the quality of stored oil on selected oil samples. These measurements include the vapor pressure and gas-oil ratio.

Oak Ridge National Laboratory

The Oak Ridge National Laboratory (ORNL), located in Oak Ridge, TN, provides analytic support to the SPR by documenting SPR analysis models, assisting in the development of SPR oil valuation and bid analysis tools, evaluating potential applications of DIS-Risk model approach related to energy policy issues and evaluating SPR planning alternatives.

Facilities Development and Operations

Funding Profile by Subprogram

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					Change	Change
Facilities Development and Operations ……..	155,044	152,946	152,946	149,000	-3,946	-2.6%
Total, Facilities Development and Operations……	155,044	152,946	152,946	149,000	-3,946	-2.6%

Public Law Authorization:
Public Law 94-163, "Energy Policy and Conservation Act" (FY 2003) As Amended

Mission

The mission of Facilities Development and Operations is to provide for all requirements associated with developing and maintaining facilities for the storage of petroleum, as well as operations associated with placing petroleum into storage. Operational readiness activities associated with drawing down and distributing the inventory on a 13-15 day notice in the event of an emergency are also included.

Benefits

Facilities Development and Operations provides funding for protection from supply disruptions. The U.S. (and trading partner) reliance on oil and U.S. net oil import levels (forecast to increase) combined with location of significant global oil reserves in regions of the world subject to political unrest, have made the U.S. vulnerable to supply disruptions.

Detailed Justification

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Facilities Development and Operations……	**155,044**	**152,946**	**149,000**

Continue activities for renewed vapor pressure mitigation, to include full degas plant operations at a rate of 100,000 – 150,000 barrels per day. Maintain the Drawdown Readiness Program and perform annual exercises. Continue Recovery Program exercises to maintain readiness and reliability. Address risk

(dollars in thousands)

FY 2004	FY 2005	FY 2006

reduction by continuing the ES&H program and corrective action plan activity. Complete the Royalty-in-Kind transfer program with the Department of the Interior to fill the Reserve to 700 million barrels in 2005.

Procure pipeline for Raw Water Intake Line at West Hackberry in 2005. Pipeline installation scheduled for FY 2006. Maintain the Drawdown Readiness Program and perform annual exercises. Continue Recovery Program exercises to maintain readiness and reliability. Continue the ES&H Program and corrective action plan development to address unacceptable risks.

Total, Facilities Development and Operations…	155,044	152,946	149,000

Explanation of Funding Changes

	FY 2006 vs. FY 2005 $ (000)
Facilities Development & Operations	
Decrease due to completion of Bryan Mound site modifications in FY 2005 offset by increase due to transfer of the Vapor Pressure Plant from Big Hill …….	-3,573
Decreased power requirements for Royalty-in-Kind	- 906
Increase due to Security Condition Orange	+ 533
Total Funding Change, Facilities Development & Operations	**-3,946**

Management

Funding Profile by Subprogram

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					Change	Change
Management ……..	15,904	16,764	17,102	17,000	-102	-0.6%
Total, Management …	15,904	16,764	17,102	17,000	-102	-0.6%
FTEs……	128	128	128	128	0	0.0%

Mission

The mission of Management is to provide for all costs of personnel and administration related to maintaining the Project Management Office in New Orleans, Louisiana and the Program Office in Washington, DC. Includes funding for contract services required to support management and the technical analysis of program issues.

Benefits

Management provides funding for federal staff and contract support services to ensure protection from oil supply disruptions. Reliance on oil and U.S. net oil import levels (forecast to increase) combined with location of significant global oil reserves in regions of the world subject to political unrest, have made the U.S. vulnerable to oil supply disruptions.

Management

Funding Profile by Category

(dollars in thousands/whole FTEs)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Washington Headquarters					
Salaries and Benefits	2,538	3,103	3,237	+134	+4.3%
Travel	160	135	140	+5	+3.7%
Support Services	1,259	2,332	2,302	-30	-1.3%
Other Related Expenses	931	823	750	-73	-8.9%
Total, Washington Headquarters	4,888	6,393	6,429	+36	+0.6%
Full Time Equivalents	27	27	27	0	0.0%
Strategic Petroleum Reserve Project Office					
Salaries and Benefits	8,992	9,442	9,646	+204	+2.2%
Travel	428	342	356	+14	+4.1%
Support Services	0	0	0	0	+0%
Other Related Expenses	1,596	587	569	-18	-3.1%
Total, Strategic Petroleum Reserve Project Office	11,016	10,371	10,571	+200	+1.9%
Full Time Equivalents	101	101	101	0	0.0%
Total, Management					
Salaries and Benefits	11,530	12,545	12,883	+338	+2.7%
Travel	588	477	496	+19	+4.0%
Support Services	1,259	2,332	2,302	-30	-1.3%
Other Related Expenses	2,527	1,410	1,319	-91	-6.4%
Total, Management	15,904	16,764	17,000	+236	+1.4%
Total, Full Time Equivalents	128	128	128	0	0.0%

Detailed Justification

	(dollars in thousands)		
	FY 2004	FY 2005	FY 2006
Salaries and Benefits ……	**11,530**	**12,545**	**12,883**

Funds salaries and benefits for 128 full time equivalent employees to assure achievement of Level 1 Performance criteria for drawdown and distribution. Provide for support and oversight of M&O contractor and subcontractor activities and program operations. FY 2004 requirements were offset with available carryover. FY 2005 and FY 2006 reflect full funding requirements.

Travel ……..	**588**	**477**	**496**

Provides travel to assure capability to achieve Level 1 Performance criteria for drawdown and distribution. FY 2004 requirements were offset with available carryover. FY 2005 and FY 2006 reflect full funding requirements.

Support Services……	**1,259**	**2,332**	**2,302**

Provide analytic support for SPR development, fill and distribution policy decisions. Includes distribution modeling maintenance. FY 2004 requirements were offset with carryover that has been exhausted. FY 2005 and FY 2006 reflects full funding requirements.

Other Related Expenses……..	**2,527**	**1,410**	**1,319**

Major elements are communications, building lease and electric power for DOE-occupied space (New Orleans, Louisiana), training, small purchases, and personal computer hardware and software. Also includes contractual services, supplies and materials.

Total, Management……...	**15,904**	**16,764**	**17,000**

Explanation of Funding Changes

Management	**FY 2006 vs. FY 2005 $ (000)**
Mandatory increase for Cost of Living adjustment	+338
Decrease reflects reductions in supplies, materials, and contractor services.....	-102
Total Funding Change, Management	**+236**

SUMMARY OF SUPPORT FOR ENERGY INFORMATION ADMINISTRATION (EIA)

Strategic Petroleum Reserve

(dollars in thousands)

PROGRAM	FY 2004	FY 2005	FY 2006
Energy Modeling Forum	5	5	5
ADP System Utilization	50	50	50
Petroleum Analysis/Subscripts	65	65	65
Total	120	120	120

Per the Memorandum of Understanding between the EIA and SPR dated June 13, 1983, funding is provided for the services as computer usage and hardware support, logistics information, and data collection.

Northeast Home Heating Oil Reserve
Office of Fossil Energy

Overview

Appropriation Summary by Program

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2005 Base	FY 2005 Request	FY 2006 Request vs. Base	
					$ Change	% Change
Northeast Home Heating Oil Reserve……	4,939	4,930	4,930	5,325	+395	+8.0%
Use of Prior –Year Balances……	0	0	0	-5,325	-5,325	>999
Total, Northeast Home Heating Oil Reserve	4,939	4,930	4,930	0	-4,930	>999

Detailed Funding Table

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Northeast Home Heating Oil Reserve……	4,939	4,930	5,325
Use of Prior-Year Balances……..	0	0	-5,325
Total, Northeast Home Heating Oil Reserve…….	4,939	4,930	0

Preface

The Northeast Home Heating Oil Reserve is a permanent part of America's energy readiness effort (separate from the Strategic Petroleum Reserves) assuring home heating oil supply for the Northeast states during times of very low inventories and significant threats to immediate further supply.

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

[a] Government Performance and Results Act of 1993

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

On July 10, 2000, the President directed the Department of Energy to establish a heating oil reserve in the Northeast capable of assuring home heating oil for the Northeast states during times of very low inventories and significant threats to immediate further supply. On March 6, 2001, Energy Secretary Abraham formally notified Congress that the Administration would establish the Reserve as a permanent part of America's energy readiness effort, separate from the Strategic Petroleum Reserve.

Benefits

Two million barrels of heating oil will protect the Northeast against a disruption for 10 days, the time required for ships to carry heating oil from the Gulf of Mexico to New York harbor for distribution. The Reserve was originally established in commercial facilities located in New York Harbor and New Haven, Connecticut. In 2001, the Secretary approved the relocation of 250,000 barrels of heating oil inventory from Connecticut to Rhode Island, giving the reserve additional truck and marine loading options.

Strategic Goal

The Department's Strategic Plan identifies four strategic goals: one each for defense, energy, science, and environmental aspects of the mission plus seven general goals that tie to the strategic goals. The Northeast Home Heating Oil Reserve appropriation supports the following goal:

Energy Strategic Goal: To protect our national and economic security by promoting a diverse supply and delivery of reliable, affordable, and environmentally sound energy.

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 within the Northeast Home Heating Oil Reserve appropriation have one Program Goal that contributes to the General Goals in the "goal cascade". This goal is:

Program Goal 04.58.00.00: Maintain operational readiness of the Strategic Petroleum Reserve to drawdown at a sustained rate of 4.4 million barrels per day for 90 days, within 15 days notice by the President. Maintain a 2 million barrel reserve of home heating oil in the U.S. Northeast. Utilize the NPR#3 as a testing and demonstration field for the Rocky Mountain Oilfield Testing Center's ongoing

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

research. Continue closeout and equity finalization activities related to NPR#1 and finalize settlement to the State of California with respect to its claims to be "school lands".

Contribution to General Goal

The Northeast Home Heating Oil Reserve contributes to General Goal 4 by assuring that it is maintained in a high state of readiness and capable of completing a drawdown of the heating oil inventory in 12 days. Assurance is measured by how quickly the program can respond to a Presidential direction to drawdown; how much of the inventory in storage is available; and the cost efficiency of operations.

Funding by General Goal

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
General Goal 4, Energy Security			
Program Goal 04.48.00.00, Petroleum Reserves	4,939	4,930	5,325
Total, General Goal 4 (Northeast Home Heating Oil Reserve)	4,939	4,930	5,325

Means and Strategies

The Northeast Home Heating Oil Reserve will use various means and strategies to continue its mission and achieve program goals. Assurance of a readiness posture will be accomplished through internal readiness reviews, assessments, exercises, and tests. Effectiveness of the Heating Oil Reserve to mitigate the economic damage of severe heating oil supply disruptions will be influenced by the Reserve's ability to deliver into the marketplace.

Validation and Verification

There is a hierarchy of performance information for the SPR. The Department collects & tracks the "critical few" measures. The SPR Program Office monitors limited, specific, short and long-term measures. The SPR Project Management Office manages the detailed, operational measures that are implemented by the contractors. Organizational and action plans are reviewed and analyzed at quarterly Program Reviews. Monthly Project Assessments and quarterly Project Reviews are conducted to analyze performance against all milestones and contracts. These reviews provide an opportunity to discuss performance and provide direction to contractors. These same measures are reviewed daily during the site managers' site status meetings. Budget formulation/ execution assessments are regularly conducted throughout the year, including annual budget validations. Other evaluations include: semiannual M&O contractor award fee performance assessments against Work Authorization Directives; on-site reviews to verify operational, maintenance and management performance data; and draw down readiness quarterly reviews.

Northeast Home Heating Oil Reserve

Funding by Site by Program

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$Change	%Change
Northeast Home Heating Oil Reserve					
Amerada Hess ……	2,280	2,280	2,400	+120	+5.3%
Motiva (New Haven, CT) …….	600	600	600	0	0%
Morgan Stanley …….	1,200	1,200	1,200	0	0%
Motiva (Providence, RI) ……	600	600	600	0	0%
Strategic Petroleum Reserve Project Office…….	20	20	20	0	0%
Washington Headquarters……..	239	230	505	+275	120.0%
Total, NEHHOR…….	4,939	4,930	5,325	+395	+8.0%

Site Description

Amerada Hess (Woodbridge, NJ)
The Amerada Hess Terminal is located in the New York Harbor (Woodbridge, NJ) currently holds 1 million barrels of home heating oil.

Motiva (New Haven, CT)
The Motiva Terminal is located in New Haven, CT and currently holds 250,000 barrels of home heating oil.

Morgan Stanley (New Haven, CT)
The Magellan Terminal is located in New Haven, CT and currently holds 500,000 barrels of home heating oil.

Motiva (Providence, RI)
The Motiva Terminal is located in Providence, RI, and currently holds 250,000 barrels of home heating oil.

Strategic Petroleum Reserve Project Office
The project office is located in New Orleans, LA and administers the quality and management surveillance support from Defense Energy Support Center (DESC).

Washington Headquarters
The headquarters office located in Washington, DC handles development and maintenance of the Northeast Home Heating Oil Reserve bid platform and other technical and management support to maintain readiness.

Northeast Home Heating Oil Reserve

Funding Profile by Subprogram

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2005 Base	FY 2005 Request	FY 2006 Request vs. Base	
					$ Change	% Change
Northeast Home Heating Oil Reserve……	4,939	4,930	4,930	5,325	+395	+8.0%
Use of Prior –Year Balances……	0	0	0	-5,325	-5,325	>999
Total, Northeast Home Heating Oil Reserve	4,939	4,930	4,930	0	-4,930	>999

Public Law Authorization:
P.L. 94-163, "Energy Policy and Conservation Act" (FY 2003)

Mission

The Northeast Home Heating Oil Reserve assures a home heating oil supply for the Northeast states during times of very low inventories and significant threats to immediate further supply. The Reserve is a permanent part of America's energy readiness effort, separate from the Strategic Petroleum Reserve. The current structure of the Northeast Home Heating Oil Reserve is:

Location	Amount of Distillate	Distribution Capability (minimum contractual capabilities)
Amerada Hess (NY harbor)	1,000,000 BBL	100,000 BPD
Motiva (New Haven, CT)	250,000 BBL	25,000 BPD
Morgan Stanley (New Haven, CT)	500,000 BBL	50,000 BPD
Motiva (Providence, RI)	250,000 BBL	25,000 BPD

Benefits

Two million barrels of heating oil will protect the Northeast against a disruption for 10 days, the time required for ships to carry heating oil from the Gulf of Mexico to New York harbor for distribution. The Reserve was originally established in commercial facilities located in New York Harbor and New Haven, Connecticut. In 2001, the Secretary approved the relocation of 250,000 barrels of heating oil inventory from Connecticut to Rhode Island, giving the reserve additional truck and marine loading options.

Detailed Justification

	(dollars in thousands)		
	FY 2004	FY 2005	FY 2006
Northeast Home Heating Oil Reserve.....	**4,939**	**4,930**	**5,325**

Continues operation of the Reserve, including lease of commercial storage space, and administrative support from the Defense Energy Support Center. Activities are funded with prior- year balances.

FY 2004 and FY 2005 activities include storage leases, program administration, and mock sales exercises with industry participation to test and evaluate the sales processes, procedures and on-line system.

Total, Northeast Home Heating Oil Reserve.....	**4,939**	**4,930**	**5,325**

Explanation of Funding Changes

Northeast Home Heating Oil Reserve	
▪ Increase in storage costs and administrative costs……..	+395
Total Funding Change, Northeast Home Heating Oil Reserve…….	**+395**

Energy Information Administration

Energy Information Administration

Energy Information Administration

Proposed Appropriation Language

For necessary expenses in carrying out the activities of the Energy Information Administration, [$83,819,000] *$ 85,926,000*, to remain available until expended.

Explanation of Change

EIA's FY 2006 request is an increase of $2,107,000 over the FY 2005 comparable appropriation. The FY 2006 funding supports on-going operations, with a focus on improving petroleum and natural gas data security, reliability, and quality; conducting the quadrennial commercial, manufacturing, and residential energy consumption surveys; implementing the enhanced Voluntary Greenhouse Gases Emissions Reporting System to support the President's Climate Change Initiative; and developing a program performance prototype to assess EIA's data collection and operations costs at a more disaggregated level. Pursuant to recent appropriations report language, EIA will apply more than half of the requested increase in FY 2006 to fund the Energy Consumption Surveys on a sustainable basis. EIA will drop two petroleum surveys (specifically the EIA-856 Monthly Foreign Crude Oil Acquisition Report and the EIA-182 Domestic Crude Oil First Purchase Report), and reduce maintenance of the National Energy Modeling System for mid-term energy markets analysis and forecasting.

Energy Information Administration

Overview

Appropriation Summary by Program

(dollars in thousands)

	FY 2004 Comparable Appropriation[a,b]	FY 2005 Comparable Appropriation[c]	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Energy Information Administration	81,100	83,819	86,705	85,926	-779	-0.9%
Total, Energy Information Administration	81,100	83,819	86,705	85,926	-779	-0.9%

Detailed Funding Table

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Energy Information Administration			
Oil & Gas	22,179	23,570	23,757
Coal, Nuclear, Electric, & Alternate Fuels	12,453	12,633	12,769
Energy Markets & End Use	11,695	11,788	13,142
Integrated Analysis & Forecasting	8,658	10,138	10,357
Information Technology	8,713	7,338	7,186
National Energy Information Center	2,484	2,531	2,580
Statistics & Methods	3,049	2,716	2,830
Resource Management	11,869	13,105	13,305
Total, Energy Information Administration	81,100	83,819	85,926

[a] In FY 2004, EIA used $4,005,288 of carryover and prior year deobligations to maintain the same level of data, analyses, and services as compared to FY 2003.

[b] Reflects a FY 2004 rescission of $530,000 cited in the Department of the Interior and Related Agencies Appropriations Act, 2004. (P.L. 108-108), and a second rescission of $481,328 cited in the *Consolidated Appropriation Act, 2004* (P.L. 108-199), for a total reduction of $1,021,328.

[c] Reflects a FY 2005 0.594% rescission of $504,900 cited in the *Consolidated Appropriation Act, 2005* (P.L. 108-447) Division E (Department of the Interior and Related Agencies), and a 0.8% across-the-board reduction of $675,960 cited in Division J (Other Matters), for a total reduction of $1,180,860.

Preface

The Energy Information Administration (EIA) is being increasingly called upon to provide timely energy information and analysis on ongoing and topical energy issues to assist the Administration and Congress in their deliberations regarding national and international energy policy, markets and investments. As energy is the foundation of the U.S. economy, it is to EIA that the Nation's leaders, media, and citizens turn for information and analyses when an energy disruption occurs; when debates on competing national energy development and utilization strategies are discussed; when business and personal energy investment decisions are made; or when government and industry policy-makers need access to the most comprehensive source of energy data. EIA strives to be this Nation's premier source of unbiased energy information, analysis, and forecasting.

As the energy industry restructures, expands, and becomes increasingly more complex and interdependent, EIA must revise and update its energy data collection, analysis activities and capabilities to reflect the current industry composition and operation, and allow EIA to continue to provide the most comprehensive picture of the energy markets and industry. This budget request presents EIA's planned program funding and resource requirements, and includes a description of how EIA's planned activities support the Department of Energy's (DOE) strategic goals.

Within the Interior appropriation, EIA has one program: Energy Information Administration with no subprograms.

This Overview will describe Strategic Context, Mission, Benefits, Strategic Goals, and Funding by General Goal. These items together put the appropriation in perspective. The Annual Performance Results and Targets, Means and Strategies, and Validation and Verification sections address how the goals will be achieved and how performance will be measured. Finally, this Overview will address 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 (10-15yrs) → 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 align resources with specific goals. Each GPRA unit has completed or will complete a Program Assessment Rating Tool. A unique program goal was developed for each GPRA unit. A numbering scheme has been established for tracking performance and reporting.

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

[a] Government Performance and Results Act of 1993

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 President's Management Agenda (PMA).

Mission
The Energy Information Administration is a leader in providing high-quality, policy-neutral energy information to meet the requirements of Congress, the Federal Government, industry, and the public in a manner that promotes sound policymaking, efficient markets, and public understanding.

Benefits
Every Congress and Administration since EIA's inception have come to rely on EIA's data and analysis to provide the basis for energy policy development, debates, and decisions. They rely on EIA to investigate, analyze and report on the potential impact of energy policy plans, and to provide a clear, accurate and concise assessment of topical energy issues and events. EIA has established itself as a non-policy making, unbiased and independent information and analysis resource to which the Congress and the Administration can turn to provide the continuous flow of reliable energy information and analysis needed to make informed energy policy decisions. Energy consumers, producers, and investors, State and local governments, and international agencies also depend on EIA's policy-neutral energy data and analysis.

Strategic, General, and Program Goals
The Department's Strategic Plan identifies four strategic goals (one each for defense, energy, science, and environmental aspects of the mission) plus seven general goals that tie to the strategic goals. The Interior appropriation supports the following goal:

Energy Strategic Goal: To protect our national and economic security by promoting a diverse supply and delivery of reliable, affordable, and environmentally sound energy.

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 program, funded within the Interior appropriation, Energy Information Administration (EIA) has one Program Goal that contributes to the General Goals in the "goal cascade". This goal is:

Program Goal 04.61.00.00, Energy Information Administration: EIA's information program is relevant, reliable and consistent with changing industry structures, and EIA's products are accurate and timely.

Contribution to General Goal
EIA contributes to the Energy Security goal by providing national and international energy data, analysis, information, and forecasts to meet the needs of energy decision-makers and the public. EIA's energy data collection, analysis, and dissemination promote sound policymaking, efficient markets, and public understanding.

EIA's priority is to maintain high quality, core energy data programs and forecasting methodologies essential to providing timely energy information, analysis and forecasts. EIA will continue to collect,

analyze and disseminate energy information, and provide analyses and forecasts to Administration and Congressional energy policymakers, and the public. EIA will accomplish its mission through the use of surveys, expert analyses, and various information collection and dissemination techniques, most notably the Internet. EIA also will continue investment in resources to assure the long-term accuracy of energy data and analyses, which reflect changes in various energy sectors resulting from actions such as: the restructuring of energy industries, demographic changes, new fuel standards, and other legislative decisions.

The FY 2006 $85.9 million request supports on-going operations, with a focus on improving petroleum and natural gas data security, reliability, and quality; conducting the quadrennial commercial, manufacturing, and residential energy consumption surveys; implementing the enhanced Voluntary Greenhouse Gases Emissions Reporting Systems to support the President's Climate Change Initiative; and developing a program performance prototype to assess EIA's data collection and operations costs at a more disaggregated level. At the FY 2006 level of funding, EIA will discontinue two petroleum surveys (specifically the EIA-856 Monthly Foreign Crude Oil Acquisition Report, and the EIA-182 Domestic Crude Oil First Purchase Report), and reduce maintenance of the National Energy Modeling System for mid-term energy markets analysis and forecasting.

Funding by General and Program Goal

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
General Goal 4, Energy Security			
Program Goal 04.61.00.00, Energy Information Administration	81,100	83,819	85,926
Total, General Goal 4 (Energy Information Administration)	81,100	83,819	85,926

Major FY 2004 Achievements

As the global economy continues to grow, energy prices have surged and there has been a strong demand for energy information. It has fallen to EIA to provide the objective, policy-neutral energy answers, analyses, and forecasts to the Administration, Congress, and policymakers, as well as State Governments and International Agencies. The number and sophistication of these analytical requests have steadily grown, often requiring EIA to postpone planned work, and requiring adjustments on delivery dates, reductions in the scope of the study, and abbreviating the final report.

EIA obtained clearance to proceed with the implementation of the Monthly Natural Gas Production Survey. EIA provided 78 special briefings to Congress, the General Accounting Office, the Executive Branch, and high-ranking Federal officials (see Accomplishments section). Quick responses, recurring meetings, and presentations to State agencies, trade groups, foreign governments, or international groups, are not included among these 78 briefings. EIA estimates an annual, non-reimbursed, expenditure of $2,000,000, not counting overhead costs, for these briefings, special reports, and associated analyses.

Annual Performance Results and Targets

FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Results	FY 2005 Targets	FY 2006 Targets
In FY 2001, EIA had an increase of over 6.9 million unique users of EIA's Web site. (Met Goal)	In FY 2002, EIA had an increase of over 2.3 million unique users of EIA's Web site. (Met Goal)	In FY 2003 EIA had an increase of over 2 million unique users of EIA's Web site. (Met Goal)	Target: Increase the number of unique monthly users of EIA's Web site by at least 20 percent per year through 2005 from a FY 1997 baseline of 37,000 monthly users. Results: In FY 2004 EIA had an increase of over 2 million users of EIA's Web site. (Met Goal)	**Timeliness of EIA Information Products:** 85 percent of EIA recurring products meeting their release date targets.	**Timeliness of EIA Information Products:** 90 percent of EIA recurring products meeting their release date targets.
In FY 2001, EIA provided 76 informational briefings for high-level policymakers in the Administration and Congress. (Met Goal)	In FY 2002, EIA provided 85 informational briefings for high-level policymakers in the Administration and Congress. (Met Goal)	In FY 2003, EIA provided 96 informational briefings for high-level policymakers in the Administration and Congress. (Met Goal)	Target: Conduct informational briefings for high-level energy policy-makers in the Administration and Congress to provide timely information and analyses on topical energy issues and situations. Results: In FY 2004, EIA provided 78 information briefings for high-level policymakers. (Met Goal)	**Quality of EIA Information Products:** 90 percent or more of customers rate themselves in customer surveys as satisfied or very satisfied with the quality of EIA information.	**Quality of EIA Information Products:** 90 percent or more of customers rate themselves in customer surveys as satisfied or very satisfied with the quality of EIA information.
In FY 2001, EIA's work received 194 citations in major media outlets. This represents an 18 percent increase from the prior year. (Met Goal)	In FY 2002, EIA's work received 96 citations in major media outlets. (Met Goal)	In FY 2003, EIA's work received 236 citations in major media outlets. (Met Goal)	Target: Increase the number of citations of EIA in major media outlets by at lease an average of 10 percent per year through 2003 from a FY 1999 baseline of 79, and then maintain a constant level of media citations +/- 10%. Results: In FY 2004, EIA's work received 259 citations in major media outlets. (Met Goal)	**Relevancy and Reliability of EIA Information Program:** 70 percent of key EIA survey frames[a] will have sufficient industry coverage to produce accurate supply, demand and price statistics.	**Relevancy and Reliability of EIA Information Program:** 70 percent of key EIA survey frames will have sufficient industry coverage to produce accurate supply, demand and price statistics. **Efficiency Measure:** *Release data from a selected subset of surveys at a cost savings and on schedule, without any decrease in accuracy*

[a] Survey frames are a list, map, or other specification of the units that constitute the available information relating to the population of interest for a particular collection effort.

Means and Strategies

In FY 2006 EIA's program will consist of data collection necessary to fulfill its statutory requirement for the maintenance of an energy database, the publication of reports and analyses that are used by a wide variety of customers in the public and private sectors, reduced maintenance of the National Energy Modeling System for mid-term energy markets analysis and forecasting, the maintenance of the Short-Term Integrated Forecasting System for near-term energy market analysis and forecasting, and customer forums and surveys to maintain an up-to-date product and service mix.

Over the next several years, many external factors will increase the criticality and visibility of EIA's data and analyses including:

- Dramatic price volatility in U.S. markets for petroleum and natural gas, which increases demand for up-to-date information and projections.
- Congressional and other customer requests for analyses and forecasts regarding the effects of energy price volatility, and policies related to alternative energy and environmental issues.
- Continual restructuring of the electric and natural gas industries, which has made energy use and price data, especially at the end-use level, much more difficult to obtain from new and emerging merchant providers.
- Trading of New York Mercantile Exchange (NYMEX)-cleared derivatives based directly on EIA inventory numbers, which began in June 2004.

EIA's data and analysis is especially critical to Federal policymakers and State governments, who increasingly rely on these data and analyses to understand and effectively manage the current and emerging effects of energy industry developments on consumers nationally and in their particular State. However, EIA will face an unprecedented challenge in maintaining the quality of its data due to:

- The increasing amount of work needed to keep survey response rates high in the current cultural climate with respondents increasingly more difficult to reach and more resistant to completing surveys.
- The need for expanded and more complex energy consumption and expenditures data collection procedures due to the more complex energy supply structure, especially those related to the natural gas and electric markets.

Validation and Verification

To validate and verify program performance, EIA conducts an annual customer satisfaction survey. EIA's senior management reviews the results of the customer survey, and uses the information to adjust available resources to improve EIA outcomes, such as to enhance the quality of EIA's Web site, improve customer services, and reengineer electronic products, and adjust the information product mix. EIA also examines additional measures such as the number of information products prepared at the request of Congress, the Administration, and State policymakers per year (including briefings, testimony, and reports). EIA tracks product usage levels in many ways, including the impact of EIA data on energy markets, number of requests from Congress and the Administration for reports and analysis, number of customers and the products they use, number of telephone inquiries, number of news media citations, and number of Web site file downloads, etc.

EIA's statistical survey development, of which survey frames[a] are a crucial portion, is driven by EIA's information quality guidelines. EIA has performance standards to ensure the quality (i.e., objectivity, validity, accuracy, reliability, utility, and integrity) of information it disseminates to the public. Quality is ensured and maximized at levels appropriate to the nature and frequency of the disseminated information. EIA also strives for transparency about information and methods in order to improve understanding and to facilitate reproducibility of the information. Additional information about EIA's quality program is available at our information quality guidelines Web site: http://www.eia.doe.gov/neic/aboutEIA/guidelines.html.

EIA's results on performance measures are presented to senior management on a quarterly basis. Included is the number of unique monthly users of EIA's Web site, and EIA's progress in meeting the established goal of continuously increasing the numbers of customers accessing and using EIA's energy data, information and services. Management also is briefed on the number of media citations and discussions with high-level policy makers in the Administration and Congress.

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 outcome- 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 2006 Budget Request, and the Department will take the necessary steps to continue to improve performance.

EIA was PARTed for the first time in conjunction with the FY 2006 budget process. EIA received a rating of "Results Not Demonstrated"'. This is primarily the result of the assessments ratings on performance measures and annual performance targets. In mid-FY 2004 EIA released a new long-range plan and associated performance measures. At the time of the PART assessment, EIA had not fully established these measures, baselines and targets. EIA intends to establish these measures, baselines and targets, as well as enhance independent expert review of EIA programs, in FY 2005.

Significant Program Shifts
In FY 2006, EIA will reduce its energy data collection activities by eliminating two petroleum surveys: the EIA-856 Monthly Foreign Crude Oil Acquisition Report and the EIA-182 Domestic Crude Oil First Purchase Report, and will reduce maintenance of the National Energy Modeling System for mid-term energy markets analysis and forecasting. These products were delivered in FY 2004 through the recovery and use of prior year funds.

Started in FY 2004, and fully operational in FY 2005, EIA's natural gas production survey, the centerpiece of the Administration's Natural Gas Data Initiative, will be providing timely and accurate information about monthly trends in natural gas production during FY 2006. The monthly *Short Term Energy Outlook* will include additional regional detail, providing the market and policymakers at the

[a] Survey frames are a list, map, or other specification of the units that constitute the available information relating to the population of interest for a particular collection effort.

State and Federal levels with more information on projected fuel costs, which will help consumer planning, as well as budgeting for Government programs such as the Low-Income Home Energy Assistance Program (LIHEAP). Updated electricity surveys will provide improved estimates of fuel-switching capabilities and other critical parameters, allowing more accurate assessment of responses to price volatility, while petroleum product surveys and systems will continue to accommodate changes in fuel specifications.

EIA Supports the President's Management Agenda

In the area of Human Capital Management EIA received a score of "Green" for all of FY 2004. To achieve this score, EIA has:

- A Human Capital Management Strategy – linked to DOE mission and goals.
- A Business Vision – in place and current.
- Addressed Skills Gaps – identified and reduced gaps in mission-critical occupations and implemented an expedited recruiting process.
- A Succession Plan – participated in DOE Leadership Programs, and the Presidential Management Fellows Program, and completed an EIA rotation policy for existing staff to expand the breadth of knowledge for EIA's best and brightest.
- A Knowledge Management Plan – policy in place.
- An Integrated Diversity Plan – included mission-critical occupations and leadership, and specialized recruitment efforts to increase opportunities for a more diversified workforce.
- Performance Measures on Structural Improvements – continued replacement of industry specialist positions as they are vacated with one of four core series specialists: economist, operations research analyst, mathematical statistician, or survey statistician.
- Performance Appraisals for SES, Managers and Staff – linked to the DOE mission and cascaded through 100 percent of workforce.
- A Human Capital Management Plan with Links to the Program Plan and the FY 2006 Budget – 1) provided for extensive technical monitor training which directly supports the EIA support services budget, and 2) provided for project management training for key managers/senior staff and replacement of industry specialists with core series specialists in direct support of the EIA mission.

In the area of Competitive Sourcing

Through the use of contractual support to perform the IT work previously performed by EIA's Federal staff, EIA has reduced Federal IT staff, and increased the use of small businesses. In addition, EIA's remaining Federal IT staff is undergoing a competitive sourcing review.

In the area of Small Business Support

EIA plans to remain a Departmental leader in the use of small businesses. For FY 2004, EIA exceeded our goal of 47 percent of its contract funding to small businesses. For FY 2005 and FY 2006, EIA projects that more than 47 percent all contract funds will continue to be let to small business, provided EIA's IT projections remain constant.

In the area of Financial Management

EIA will make use of the Department's newly developed financial management system.

In the area of E-Government

EIA will continue to increase use of the Internet to collect and disseminate energy data, information, analysis, forecasts and reports. Currently some respondents are able to provide their data on-line with

the data being checked in real-time. Currently, EIA collects data on 60 surveys via the Internet employing a secure transfer procedure to assure security of information provided.

In the area of Energy Data Dissemination
EIA's energy information, analyses, and forecasts are available via EIA's Web site. Based on the growth in usage for the past three fiscal years, in FY 2006 EIA Web site usage is projected to exceed 25 million unique user sessions. In FY 2006, EIA will print only four multi-fuel periodic reports: the *Annual Energy Outlook*, the *Annual Energy Review*, the *Monthly Energy Review*, and the *International Energy Outlook*[a]. EIA, with its focus on customer satisfaction, will continue to offer its customers a Print-on-demand service.

EIA Omnibus Procurement (EOP)
In January 2004, EIA awarded its second multiple award contract for personnel, facilities, equipment, material, supplies, and performance-based service contracting. The EOP II covers five functional areas: 1) Information Management and Product Production Support Services, 2) Energy Analysis and Forecasting Support Services, 3) Communication Services, Records Management & Administrative Support, 4) Information Technology Support Service, and 5) Energy End User Surveys. The EOP II provides a two-year base with a three-year option to extend the performance-based services under cost plus fixed fee, cost plus award fee, and firm fixed price instruments.

EIA continues to build on the best practices for increasing small business participation. EIA encourages small business to partner with both large and small businesses to meet the Department's small business goal. EIA is forging ahead with cost effective contracting under this procurement vehicle, extensive training for the Technical Monitors, and future business re-engineering prospects.

[a] *International Energy Outlook* presents an assessment of the outlook for international energy markets through 2025, including outlooks for major energy fuels and issues related to electricity and the environment. Projections are prepared using the National Energy Modeling System (NEMS), which consists of multiple independent modules and databases and the modeling systems needed to integrate the individual modules that are used to simulate the end-use demand sectors, energy supply, and electricity generation. NEMS must be revised annually to maintain its reliability as public policy changes and new trends emerge in the historical data.

Accomplishments

The following time line provides a perspective of significant events in the energy markets and examples of EIA's response to provide energy data and analyses to aid in critical energy policy decisions.

1st Q FY 2004

Energy Event	EIA Response
In late September, OPEC members cut the output ceiling for the ten member countries, excluding Iraq, by 900,000 barrel per day to 24.5 million barrels per day, effective November 1, 2003.	In October, EIA briefed OMB staff on the short-term fuel price outlook based on the September 2003 *Short-Term Energy Outlook*, and prepared an oil market and heating fuel briefing package for the Deputy Secretary.
In October, the State of New Hampshire sues 22 major oil companies for their use of the gasoline additive methyl tertiary butyl ethylene (MTBE), which has been linked to water pollution.	EIA issued *Preparations for Meeting New York and Connecticut MTBE Bans* in response to a request from Congressmen Ose and Shays. This report characterized the progress that the two States have made in transitioning from MTBE to ethanol scheduled to take effect in January 2004, and the likely impact of the changeover on these States' gasoline supplies and gasoline prices.
Rapid growth in storage during the 2003 gas injection season, tracked in the EIA *Weekly Natural Gas Storage Report*, reduces concerns regarding possible gas shortages during the 2003-2004 winter heating season. Bolivian President Sanchez de Lozada announces in October that he will not pursue a plan to export more than one billion cubic feet per day of LNG to the United States.	EIA's *Annual Energy Outlook 2004*, issued in December 2003, and many private projections forecast growing U.S. reliance on liquefied natural gas (LNG). EIA issued *The Global Liquefied Natural Gas Market: Status & Outlook* for the Secretary of Energy's December 2003 LNG Summit. This well-received report provided data and information on world-wide natural gas reserves, LNG import/export trade and facility capacity, new LNG facilities proposed and under development, LNG facility costs, and LNG contracting and price.
Questions regarding the behavior of gasoline prices during the 2003 peak driving season continue to attract the interest of policymakers.	In November 2003, EIA issued its *Report on August Gasoline Price Spike*, fulfilling a commitment made by the Secretary in testimony before the House Energy and Commerce Committee. The report examined the factors behind the large price increase for retail gasoline in August 2003, including the combination of unexpected demand increases and downward supply shocks occurring at a time when gasoline inventories were already low.

2nd Q FY 2004

Energy Event	EIA Response
The 108th Congress resumes discussion on energy legislation following the failure of a motion in the Senate to end debate on the energy bill conference report at the end of the first session.	In February 2004, EIA issued *Summary Impacts of Modeled Provisions of the 2003 Conference Energy Bill* at the request of Senator John Sununu. The analysis showed that the maximum impact of the *Conference Energy Bill* on primary energy consumption was expected to be 0.4 quadrillion British thermal units (Btu) or 0.3 percent. EIA presented testimony to the Subcommittee on Energy and Air Quality, Committee on Energy and Commerce, U.S. House of Representatives concerning EIA's analysis of provisions related to ultra-deepwater and unconventional technologies, as incorporated in Sections 941-949 of the *2003 Conference Energy Bill*.
Policymakers in Congress express interest in questions surrounding access to Alaska natural gas and oil resources and the implications for natural gas markets of a failure to build new regassification terminals for LNG.	In February, EIA released *Analysis of Restricted Natural Gas Supply Cases*. This report, requested by Representative Barbara Cubin, Chairman of the House Subcommittee on Energy and Mineral Resources, evaluated alternate natural gas supply scenarios to that of the *Annual Energy Outlook 2004* reference case, examining restrictions on supplies of unconventional natural gas and LNG, and assuming no Alaska natural gas pipeline. In March, EIA released *Analysis of Oil and Gas Production in the Arctic National Wildlife Refuge* (ANWR), a 20-page report prepared for Representative Richard Pombo, Chairman, Committee on Resources that forecasts the impact that development plans for ANWR could have on domestic oil production, U.S. dependence on foreign oil, and oil prices.
In January, the prompt month crude oil futures price on the New York Mercantile Exchange (NYMEX) settles at $36.20 per barrel, surpassing $36 per barrel for the first time in 10 months.	In February, EIA assessed the impact of continued additions to the Strategic Petroleum Reserve (SPR) on world oil prices for the Secretary of Energy. The analysis was widely shared throughout the Administration and Congress and was discussed by the Administrator in several testimonies.
As oil prices rise, some exporting countries argue that increases in prices are justified by the weakening of the dollar.	Responding to inquiries from the Administration and Representative John Dingell, EIA issued the Impact of a Weaker Dollar on Crude Oil Markets in March 2004. This paper demonstrated that increases in oil prices far exceeded the level needed to maintain the purchasing power of oil exporters.

3rd Q FY 2004

Energy Event	EIA Response
The possibility arises that SA.2028, the amended version of S.139, the McCain-Lieberman *Climate Stewardship Act of 2003* that had a floor vote in October 2003, could return to the floor for further consideration.	EIA issued its *Analysis of Senate Amendment 2028, The Climate Stewardship Act of 2003*, to Senator Mary Landrieu. This report provided information on the energy and economic impacts of proposed legislation to limit emissions of greenhouse gases, relying on the modeling methodology, data sources, and assumptions extensively documented in EIA's June 2003 report on the original version of S.139.
Legislative proposals to reduce emissions from power plants continue to receive attention as the Environmental Protection Agency contemplates regulatory action under existing laws to reduce emissions of sulfur oxides, nitrogen oxides, and mercury under existing statutes.	EIA issued its *Analysis of S. 1844, the Clear Skies Act of 2003*; *S. 843, the Clean Air Planning Act of 2003*; and *S. 366, the Clean Power Act of 2003* to Senator James Inhofe, Chairman, Committee on Environment and Public Works. The report analyzes the impacts of limits on nitrogen oxide, sulfur dioxide, mercury and carbon dioxide emissions (for S. 843 and S. 366) from electricity generators. It reports the projected impacts on electricity generation by fuel, emissions, capacity expansion, prices, and industry costs
Coal prices in the spot market continue to rise sharply. Anecdotal press accounts raise concern in the government and financial communities regarding the adequacy of coal stockpiles at electric generating plants during the summer peak period.	EIA pulls "early responder" monthly survey data from major electricity plants and compares results to year-earlier data from the same plants. The analysis shows that stocks are generally adequate, despite limited instances of rail delivery delays. Additional review of historical data shows that the early responder information is a reliable predictor for the full sample of plants.
Policymakers express continued interest in improved environmental and production indicators in the natural gas sector.	In June, EIA prepared a report for the General Accounting Office (GAO) on the methodology and sources used in preparing EIA estimates of the venting and flaring of natural gas during natural gas production processes. The GAO is assessing the extent of venting and flaring of natural gas and related measurement issues for Senator Jeff Bingaman. EIA prepares natural gas production survey for public review and OMB clearance. The new survey, to be fielded in 2005, will provide more timely and accurate data on natural gas production.

4th Q FY 2004

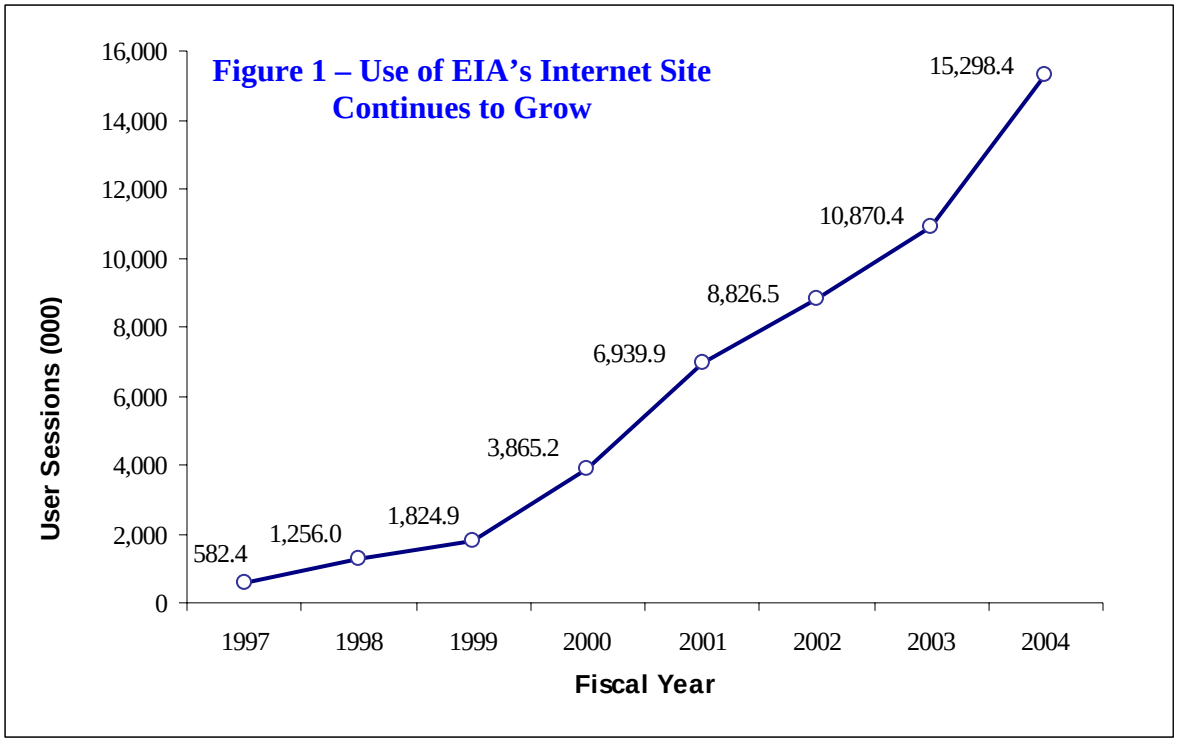
Energy Event	EIA Response
Crude oil prices remain high and volatile through late summer. In mid-September Hurricane Ivan had a major adverse impact on oil and natural gas production in the Gulf of Mexico and also affects delivery of oil imports. Refinery operations are also significantly impacted.	EIA's daily situation reports, complied in cooperation with the Minerals Management Service, track production impacts and assess prospects for restoration. EIA's W*eekly Petroleum Status Report* tracks impacts on imports, refinery operations, and crude oil and product stocks. As distillate stocks fell below normal seasonal levels in the aftermath of Ivan, EIA prepares its *Winter Fuels Outlook* to be released at the start of October. Congressional and Administration staff concerned with low-income energy assistance issues seek information from EIA staff.

Accomplishments in Energy Data Programs
Dissemination of key energy data has been accelerated through improvements in data collection and processing. For example, the *Annual Energy Review* was released in September 2004, two months earlier than last year's edition. Release of the *Monthly Energy Review* and the *Electric Power Monthly* will also occur prior to their predecessor release.

The weekly and monthly petroleum surveys were successfully updated to reflect major changes in fuel specifications, consistent with regulatory changes at the State and Federal levels.

Data collection via the Internet, which allows for more timely and accurate reporting, increased substantially. Internet data collection (IDC) was implemented for 3 of 4 coal surveys in 2004. Fifty-one percent of the annual coal survey forms were received through the new IDC system, and by 2nd quarter 80 percent of the quarterly coal surveys were coming in by IDC. IDC for the electricity surveys substantially increased market penetration. For example, 80 percent of monthly respondents used IDC to report May 2004 data, compared to 54 percent use of IDC a year earlier.

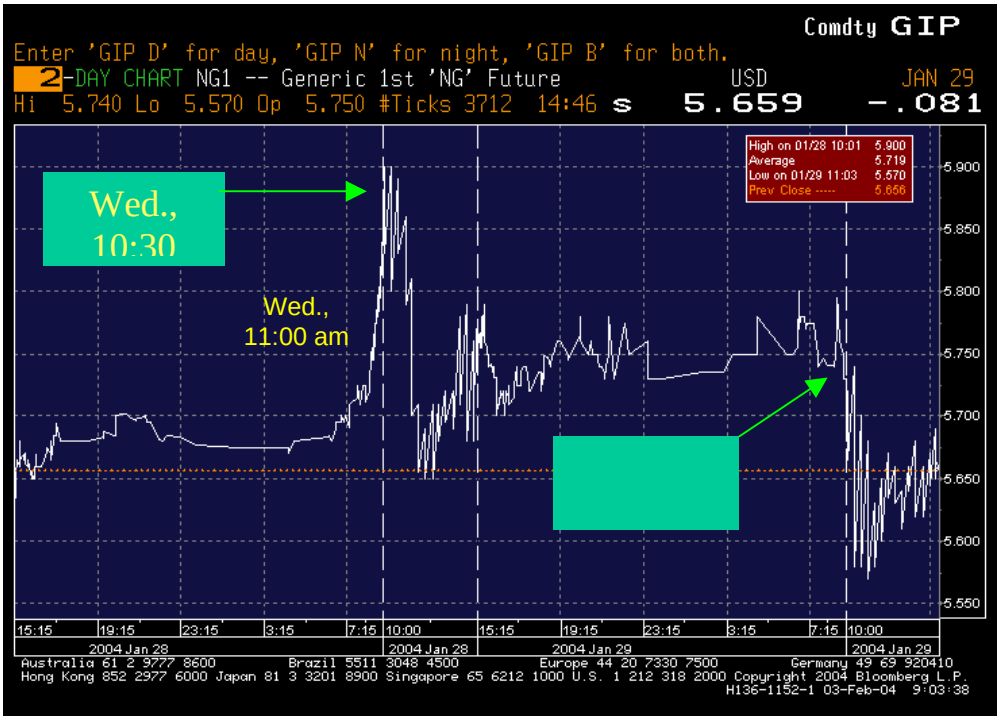
Additional Accomplishments
EIA aggressively works to expand the availability of electronic information and upgrade energy data dissemination, particularly on the EIA Web site. This increased use of electronic technology for energy data dissemination has led to an explosive growth in the number of our data customers and the breadth of their interests, as well as an increase in the breadth of information distributed. For example, the growth in monthly users of EIA's Internet services is remarkable (see Figure 1). In each of the years since FY 1997, EIA has met or exceeded its goal of increasing the number of monthly users of EIA's Web site by 20 percent annually. In FY 2004, EIA Web site users increased by 41 percent.



EIA's high quality data plays a critical role in efficient energy markets. The market depends on our natural gas and petroleum data, as no alternative private sources for this data are known. For example,

Figure 2: Natural Gas Markets Rely Heavily on EIA Weekly Data

Note the impact on natural gas markets immediately following the release of EIA's Oil and Gas Storage Data.



Source: NYMEX Henry Hub Natural Gas Near-Month Futures Contract January 28 (Wed.) and 29 (Thur.), 2004
Bloomberg's data

our weekly petroleum inventory and natural gas storage numbers, released each Wednesday and Thursday morning respectively, have had significant impact on futures' markets. Figures 2 and 3 illustrate these impacts with the impact on the Natural Gas and the Crude Oil market on January 28th and 30th. Of interest concerning EIA's weekly reports, the citation in *Natural Gas Intelligence* for November 24, 2004 stated:

> "A paper circulated earlier this month by Gerald D. Gay [et. al] . . after taking a closer look at the accuracy of the weekly storage predictions of the 34 firms and those in the Bloomberg weekly survey of analysts' predictions . . .analysts providing storage forecasts assisted "significantly in the price discovery" on the natural gas futures market by providing important information . . ."
>
> "We find that analyst forecasts are less accurate and more widely dispersed during the critical withdrawal season than during the injection season; that energy company analysts have generally outperformed their counterparts employed in financial companies; and that analyst forecasts became overall more accurate and less dispersed following the takeover by the [EIA] of responsibility for publishing a key weekly storage report . . ."

Figure 3: Oil Markets Rely Heavily on EIA Weekly Data

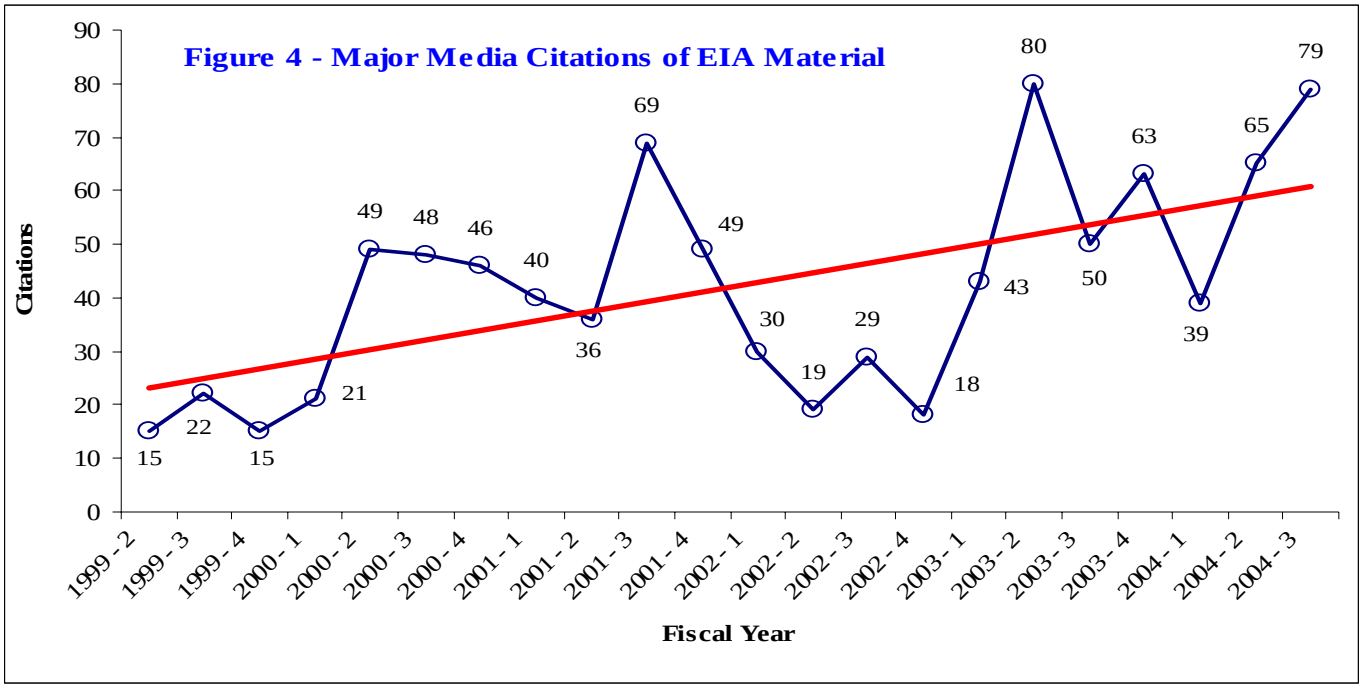
Note the impact on oil markets immediately following the release of EIA's Oil and Gas Storage Data.

Source: NYMEX Light, Sweet Crude Oil (WTI) Near-Month Futures Contract, January 28 (Wed.) and 29 (Thur.), 2004
Bloomberg's data

In June 2004, the New York Mercantile Exchange (NYMEX) began trading financial derivatives[a] tied directly to EIA's weekly inventory reports, and is currently expanding their trading. This trading has brought increased media, financial community, industry, and Congressional scrutiny of EIA procedures and systems.

EIA also has increased dramatically the distribution of its information by becoming the dependable source of objective energy information for the major news media: *New York Times*, *Washington Post*, *Wall Street Journal*, *USA Today*, and *Los Angeles Times* (see Figure 4). This achievement has enabled our energy data to be seen widely and used by the general public with minimal cost to the agency.

[a] Derivatives are financial instruments (contracts) that do not represent ownership rights in any asset but, rather, derive their value from the value of some other underlying commodity or other asset. When used prudently, derivatives are efficient and effective tools for isolating financial risk and "hedging" to reduce exposure to risk. Although derivatives have been used in American agriculture since the mid-1800s and are a mainstay of international currency and interest rate markets, their use in domestic energy industries has come about only in the past 20 years with energy price deregulation.



Summary

The FY 2006 request will allow EIA to continue the majority of its on-going program activities to support the needs of the Administration, Congress, States, industry, and the public for reliable and accurate energy information and analyses. EIA will continue to seek and implement efficiencies that provide better energy data and analyses products at less cost.

Funding by Site by Program

(dollars in thousands)

	FY 2004[a,b]	FY 2005[c]	FY 2006	$ Change	% Change
Washington Headquarters Energy Information Administration.....	81,100	83,819	85,926	+2,107	+2.5%

Site Description

The Energy Information Administration (EIA), an independent statistical agency, is the Nation's premier source of unbiased energy information, analysis and forecasting. EIA provides timely energy information and analysis to its customers, which includes the Nation's leaders, energy policymakers, media, and citizens.

[a] In FY 2004, EIA used $4,005,288 of carryover and prior year deobligations to maintain the same level of data, analyses, and services as compared to FY 2003.

[b] Reflects a FY 2004 rescission of $530,000 cited in the Department of the Interior and Related Agencies Appropriations Act, 2004. (P.L. 108-108), and a second rescission of $481,328 cited in the *Consolidated Appropriation Act, 2004* (P.L. 108-199), for a total reduction of $1,021,328.

[c] Reflects a FY 2005 rescission of $504,900 cited in the *Consolidated Appropriation Act, 2005* (P.L. 108-447) Division E (Department of the Interior and Related Agencies), and an across-the-board reduction of $675,960 cited in Division J (Other Matters), for a total reduction of $1,180,860.

/

Program Direction

Funding Profile by Category

(dollars in thousands/whole FTEs)

	FY 2004[a,b]	FY 2005[c]	FY 2006	$ Change	% Change
Washington Headquarters					
Salaries and Benefits	40,346	42,386	43,282	+896	2.1%
Travel.....	311	407	407	0	0%
Support Services.....	23,156	22,834	23,706	+872	+3.8%
Other Related Expenses.....	17,287	18,192	18,531	+339	+ 1.9%
Total, Program Direction.....	81,100	83,819	85,926	+2,107	+2.5%
Total, Full Time Equivalents (FTEs)[d]	358	369	369	0	0%

Public Law Authorizations:

P.L. 75-688, Natural Gas Act (1938)
P.L. 83-703, Atomic Energy Act (1954)
P.L. 93-275, 15 U.S.C. 761, Federal Energy Administration (FEA) Act (1974)
P.L. 93-319, Energy Supply and Environmental Coordination Act (1974)
P.L. 94-163, Energy Policy and Conservation Act (1975)
P.L. 94-385, 15 U.S.C. 790, Energy Conservation and Production Act (1976)
P.L. 95-91, 42 U.S.C. 7135, Department of Energy (DOE) Organization Act (1977)
P.L. 95-621, Natural Gas Policy Act (1978)
P.L. 95-620, 42 U.S.C. 8301, Powerplant and Industrial Fuel Use Act (1978)
P.L. 96-294, Energy Security Act (1980)
P.L. 97-229, 42 U.S.C. 6245, Energy Emergency Preparedness Act (1982)
P.L. 99-58, National Coal Imports Reporting Act (1985)
P.L. 99-58, 42 U.S.C. 6201, Energy Policy and Conservation Act Amendments of 1985
P.L. 100-42, 42 U.S.C. 8312, Powerplant and Industrial Fuel Use Act Amendments of 1987
P.L. 102-486, 42 U.S.C. 13385, Energy Policy Act (1992)
P.L. 104-13, 44 U.S.C. 3501, Paperwork Reduction Act (1995)
P.L. 105-277, 44 U.S.C. 3504, Government Paperwork Elimination Act (1998)

[a] In FY 2004, EIA used $4,005,288 of carryover and prior year deobligations to maintain the same level of data, analyses, and services as compared to FY 2003.

[b] Reflects a FY 2004 rescission of $530,000 cited in the Department of the Interior and Related Agencies Appropriations Act, 2004. (P.L. 108-108), and a second rescission of $481,328 cited in the *Consolidated Appropriation Act, 2004* (P.L. 108-199), for a total reduction of $1,021,328.

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[d] Excludes one (1) FTE funded by the Nuclear Waste Disposal Fund.

Other Laws, U. S. Code and Regulations with Significant Provisions Affecting EIA:

5 U.S.C. 552, Freedom of Information Act (1966)
5 U.S.C. 552a, The Privacy Act of 1974
31 U.S.C. 1341, Anti-Deficiency Act (1980)
P.L. 97- 255, Federal Managers' Financial Integrity Act (1982)
P.L. 97-415, 42 U.S.C. 2210, Nuclear Regulatory Commission Authorization Act (1983)
P.L. 99-509, 42 U.S.C. 7135, Omnibus Budget Reconciliation Act (1986)
P.L.101-576, Chief Financial Officers Act (1990)
Government Performance and Results Act (GPRA) (1993)
Government Management Reform Act (GMRA) (1994)
P.L. 107-347, Title V of the E-Government Act (2002)

18 U.S.C. 1001 makes it a crime for any person knowingly and willingly to make to any Agency or Department of the United Sates any false, fictitious or fraudulent statements as to any matter within its jurisdiction.

18 U.S.C. 1805 makes it a crime to disclose confidential information.
C.F.R. Title 5, Administrative Personnel

Department of Energy Privacy Act Issuances, Systems DOE-4 (EIA Form 457, Residential Energy Consumption Survey), System DOE-6 (EIA Customer Database), and DOE-59 (Mailing Lists for Requesters of Energy Related Information).

Mission

Program Direction provides the Federal staffing resources and associated costs required to provide overall direction and execution of EIA's mandate to provide high-quality, policy-neutral energy data, analyses, information, and forecasts to meet the requirements of Congress, the Federal Government, industry, and the public in a manner that promotes sound policymaking, efficient markets, and public understanding.

As stated in the Departmental Strategic Plan, DOE's Strategic and General Goals will be accomplished not only through the efforts of the major program offices in the Department but with additional effort from offices which support the programs in carrying out the mission. EIA performs critical functions which directly support the mission of the Department. These functions include the development and maintenance of a comprehensive energy database, the dissemination of energy data and analyses for a wide variety of customers in the public and private sectors, and the preparation of specific reports. Statutes require EIA, among other tasks, to maintain the National Energy Modeling System for mid-term energy markets analysis and forecasting, maintain the Short-Term Integrated Forecasting System for near-term energy market analysis and forecasting, conduct surveys of energy use in residences, commercial buildings, and conduct customer forums and surveys to maintain an up-to-date product and service mix.

EIA's other function is to respond to inquiries from a broad variety of customers for energy information. The primary customers of EIA services are public policymakers in the Administration and Congress. Other customers include agencies of the Federal Government, State and local governments, energy markets, industry, educational institutions, the news media, and the public. The EIA strategy is to make its products and services available to customers through an expansion of electronic dissemination through the EIA Web site. In FY 2004 and FY 2005, EIA printed only four multi-fuel publications: the *Annual Energy Outlook*, the *Annual Energy Review*, the *International Energy Outlook*, and the *Monthly*

Energy Review. With its focus on customer satisfaction, EIA will continue to print these four publications in FY 2006 and will continue to offer its customers a Print-on-demand service.

Detailed Justification

	(dollars in thousands)		
	FY 2004	FY 2005	FY 2006
Salaries and Benefits	**40,346**	**42,386**	**43,282**

In FY 2004 funded 358 Full Time Equivalents (FTEs), in FY 2005 and FY 2006 fund 369 FTEs (excluding 1 FTE funded each year by the Nuclear Waste Disposal Fund), including salaries, health benefits, overtime, promotions, incentive awards, lump sum leave, and personnel performance awards.

In FY 2006, Federal staff will conduct a total of 64 weekly, monthly, and annual energy data surveys and operate associated data collection and validation systems; disseminate energy data via publications and the Internet; conduct quadrennial surveys of energy use in residences, commercial buildings, and the manufacturing sector, and analyze results on a regional basis; prepare the *Annual Energy Outlook* and the monthly *Short-Term Energy Outlook*; and maintain, update, and operate required energy models.

Federal staff also prepare special modeling analyses requested by the Secretary of Energy, the Administration, or the Congress (e.g. Clear Skies, McCain/Lieberman *Climate Stewardship Act*, Alaska pipeline, Energy Derivatives, Natural Gas Infrastructure, etc.); provide public and internal analysis and reports (e.g. Energy Situation Analysis Reports) during periods of energy market stress (Venezuela, Iraq, California, Northeast Electrical service blackout, etc.); collect and analyze financial data from major energy companies and data on foreign direct investment; prepare and update Country Analysis Briefs; operate National Energy Information Center.

EIA continues to implement its Human Capital Management Plan. It has reduced skill gaps in mission-critical occupations by replacing vacated industry specialist positions with core series professional specialists; implemented a streamlined hiring process for entry-level positions and developed a similar process for journeyman-level positions for implementation in late FY 2004, initiated an energy industry study program for new recruits; developed a Succession Plan that facilitates continuity of leadership, knowledge transfer, specific leadership work experiences, and rotation opportunities for existing staff to expand their energy experience to more than one fuel area or functional specialty; upgraded the technical expertise of EIA's contracting function; and expanded EIA's formal training/certification of its project managers, IT specialists and technical monitors. For example, over 60 percent of the technical monitors received training in FY 2004. Additional in-depth training in performance-based contracting procedures is scheduled for early FY 2005.

Travel	**311**	**407**	**407**

Fund travel for EIA personnel to attend training, professional development programs, industry and State conferences, meet with national and international government and energy industry officials, and provide expertise in support of EIA mission.

	(dollars in thousands)		
	FY 2004	FY 2005	FY 2006
Support Services	**23,156**	**22,834**	**23,706**

Fund contractual support for EIA's activities of energy data collection, analysis, forecasting, and energy information dissemination. Funded work includes survey development and processing, and the automated tools and equipment to collect, store, maintain, protect, and disseminate energy information.

- **Oil and Gas** **8,645** **9,378** **9,450**

  The Oil and Gas activity designs, develops, operates and maintains oil and gas statistical data collection and dissemination systems and short-term analytical and estimation systems. Activities include the data collection, quality control, processing, and analysis and report preparation activities associated with EIA's oil and gas information products. In addition to their direct use by thousands of customers, these oil and gas data provide essential inputs for EIA's Short-Term Integrated Forecasting System and National Energy Modeling System. Energy information topics cover: petroleum - focusing on crude oil and refined petroleum product production, supply and price; natural gas - focusing on natural gas production, storage, consumption and markets; and reserves - focusing on oil and gas reserves. The company level data gathered in the oil and gas surveys are edited and aggregated into approximately 60,000 distinct on-line data series, such as weekly natural gas storage levels and retail gasoline prices. The data comprise about a billion characters of information, updated weekly, monthly and annually.

  In FY 2006, the Oil and Gas activity will operate 34 petroleum and natural gas surveys, 2 fewer than FY 2005 and FY 2004.

  - Conduct Petroleum Surveys and Analyses

    During FY 2006, activities include operating surveys on weekly, monthly and annual cycles, processing the survey data, disseminating it (Web site and Print-on-demand); addressing deteriorating survey frames, identifying new companies required to report on petroleum surveys, providing modifications and support to the supply and marketing information database system, and continuing data quality projects such as reducing large unaccounted for crude oil statistics, missing motor gasoline production, and missing crude and petroleum product imports.

    In FY 2004 and FY 2005, for the weekly supply data, EIA will emphasize validating the quality of the new motor gasoline blenders, assessing the impact of the new blenders on the adjustments made for motor gasoline, and updating the sample for blenders. EIA will strive to maintain the weekly motor gasoline production data, whose customers are policy makers in the Congress, the White House, Office of the Secretary of Energy, State Energy Officials, corporate planners, gasoline producers, marketers and gasoline purchasers. For the monthly supply data, quality assurance to track ultra-low sulfur diesel fuel volumes, locate importers of diesel fuel and analyze major reporting issues for diesel fuel, including downgrading that may occur at various stages in the supply chain. Quality control targets would include maintenance of the total U.S. frame of ethanol producers, ethanol motor gasoline blenders, and importers of special blending components.

- Conduct Natural Gas Surveys and Analyses
  During FY 2006, activities include operating natural gas surveys on weekly, monthly and annual cycles, processing the survey data, disseminating it (Web site and Print-on-demand); addressing deteriorating survey frames, identifying new companies required to report on natural gas surveys, providing modifications and support to the information processing system, and continuing data quality projects so that surveys reflect changing natural gas markets. This program includes the Weekly Natural Gas Underground Storage Survey, which is the only weekly gas supply data in the United States and is critical to decisions of supply planners in industry and utilities, as well as to analysts in assessing the current natural gas supply and demand situation.

  Due to the growing importance of natural gas, providing more timely and accurate gas production data are a high priority. This was evidenced by the recent high profile attention to the issue by Chairman Greenspan of the Federal Reserve Board, the mainstream media, and financial analysts. The goal is to publish production data for U.S. and leading States or regions about 60 days after the producing month, significantly improving the current 120-day lead time. The current voluntary survey of States to obtain annual data for all States on production and wellhead prices by State would continue.
- Conduct Reserves Surveys and Analyses
  During FY 2006, activities include operating the Annual Survey of Domestic Oil and Gas Reserves and operating the Annual Report of the Origin of Natural Gas Liquids Production, as well as making improvements to their frames and operations within funding limitations to reduce errors and increase weighted response rates. Analytical activities include the operations and maintenance of systems to estimate and forecast natural gas production and productive capacity; and systems to estimate and forecast crude oil production for use in the Short-Term Energy Outlook (STEO). In FY 2006, discontinue data collection grants to States through the State Heating Oil and Propane Program (SHOPP).
- Data Quality and Security Enhancements Needed Due to NYMEX trading of EIA-Based Derivatives
  During FY 2006, EIA will engage in upgrading data security, significantly strengthen data handling and control, and improve several energy data elements. In June 2004, NYMEX began trading derivatives tied directly to EIA's Weekly Natural Gas Survey inventory numbers. Also, trading of an instrument based on EIA's crude oil information started in November 2004. Additional markets and products are expected to begin trading in 2005. This trading has brought increased media, financial community, industry, and Congressional scrutiny of EIA procedures and systems.

  The additional funding will deliver enhanced operations (security and quality) for weekly surveys with new NYMEX-traded derivatives, and enhanced survey systems security and reliability. This initiative supports the DOE Strategic Plan by enabling the Department to do a better job in securing and delivering key data needed for efficient energy markets, addressing the legitimate concerns of the financial media (Reuters, Dow Jones, Bloomberg, etc.), traders, and industry.

The impact of not completing these needed enhancements could result in less efficient markets, and could open EIA and the Department to criticism.

- **Coal, Nuclear, Electric & Alternate Fuels..... 3,725 3,395 3,421**

The Coal, Nuclear, Electric, and Alternate Fuels activity includes the design, development, and maintenance of fuel-specific statistical and short-term analytical and forecasting information systems. Fund contracts for statistical services in support of collection, processing, and dissemination of selected high priority weekly, monthly, quarterly, and annual data on reserves, supply, disposition, and prices for coal, nuclear, and electric power; support for short-term forecasting systems.

- Conduct Electric Power Surveys
  In FY 2006, operate electric power data collection surveys used to report major electric outages. This involves continuing to collect and process the large volume of additional data, particularly from non-utility facilities included since the restructuring and deregulation activities in the electric power industry. Summaries of the data collected on these surveys are made available in monthly and annual data reports.
- Conduct Coal Surveys
  Operate coal data collection surveys, and through an interagency agreement validate data collected by the Mine Safety and Health Administration on their quarterly production form. The quarterly surveys cover manufacturing plants and coke plants on their coal receipts, consumption, stocks, and prices. The annual surveys of coal producers/ preparation plants and coal distributors collect data on coal reserves, coal bed statistics, production capacity, sales and revenue, and coal distribution by State of origin to State of destination including transportation mode. These data are used to estimate weekly coal production by State and develop short-term and long-term forecasts of coal supply and demand providing a timely, reliable source of information on market trends for the industry for strategic planning and market analysis and to support rational spot markets and futures markets.
- Conduct Renewable and Alternate Fuel Surveys
  Process annual surveys of manufacturers of solar thermal collectors, photovoltaic cells, and geothermal heat pump equipment. Together, with data from the electric power industry, this information is used by policy makers in evaluating legislative proposals for incentives for renewable energy and for planning by the renewable industry. The annual alternative fuel survey gathers data from: (1) Federal, State and fuel provider fleets on their alternative transportation fuel vehicles and the amount of fuel consumed, and (2) auto manufacturers on the number of alternative transportation fueled vehicles that have been made available each year.
- Conduct Uranium Surveys
  Process an annual survey of the uranium producers, marketers, and nuclear plant operators and a quarterly survey of uranium producers in compliance with Subtitle B, 42 U.S.C. 2296b-4, Sec. 1015 of the Energy Policy Act of 1992. The data are used together with information on nuclear capacity and generation collected from the electric power industry to develop short-term forecasts of nuclear generation. These forecasts are the basis for fee adequacy studies for the nuclear waste fund and are used to develop long-term forecasts of nuclear fuel cycle requirements and spent fuel discharges.

	(dollars in thousands)		
	FY 2004	FY 2005	FY 2006

- **Energy Markets and End Use**..... **3,805** **3,380** **4,299**

The Energy Markets and End Use activity includes the design, development, and maintenance of energy statistical and short-term forecasting information systems concerning energy consumption, the financial condition of major energy companies, and the integration of areas which cut across energy sources.

- EIA Periodic Analysis Products
  Continue to conduct energy contingency analysis and produce the *Country Analysis Briefs* (CABs) and the *Energy Situation Analysis Report* (ESAR), as needed to cover energy emergency activities. Produce monthly updates of the *Short-Term Energy Outlook*, produce the *Summer Motor Gasoline Outlook* and the *Winter Heating Fuels Outlook* annually, conduct the *Financial Reporting System Survey*, validate and analyze the data and produce *Performance Profiles of Major Energy Producers* report, and the annual report on *Foreign Direct Investment in U.S. Energy*. Produce the *Annual Energy Review* and the *Monthly Energy Review*.

  In FY 2006, short-term outlook products will utilize a forecasting model with increased regional detail, replacing an earlier model which was purely national in scope, and as such misses regional events that can have a significant impact on the projections. For example, it is very possible to have normal weather on a national basis but also have enough regional variation and supply shortages at the same time.
- Conduct Consumption Surveys
  The FY 2006 budget funds the Energy Consumption Surveys on a quadrennial basis, avoiding the need to drop one or more of the surveys, or further stretch the survey cycle.

  The redesigned *Commercial Buildings Energy Consumption Survey* (CBECS) is EIA's benchmark survey of energy use related to characteristics of the commercial building stock. This survey, now conducted every 4 years, includes field data collection costs and survey processing of the Buildings Survey data and initiates data collection and processing of the Energy Supplier Survey portion.

  The *Manufacturing Energy Consumption Survey* (MECS) is the Nation's definitive national survey of manufacturing energy use. This survey, now conducted every 4 years, provides authoritative information, available nowhere else, on energy throughput along with economic and operational characteristics of manufacturers. Linked with production and employment data from Census Bureau economic surveys, the MECS provides consumption information for policy development, market assessment, and public understanding. MECS provides the ability to assess fuel switching capability and the effects of energy price changes on industry, and provides critical inputs to short and longer term forecasting activities.

  The *Residential Energy Consumption Survey* (RECS) is the Nation's definitive national survey of household energy use. This survey, now conducted every 4 years, provides authoritative information, available nowhere else, on structural, equipment, and operational characteristics of housing units, along with energy consumption and expenditures. Fielding

RECS gives EIA parity with other Federal statistical agencies in providing baseline information crucial to understanding societal demand for and use of goods and services. RECS provides critical contributions to EIA's integrated energy statistics and forecasting programs, and is used by other agencies such as EPA and the HHS Low-Income Home Energy Assistance Program.

- **Integrated Analysis and Forecasting**..... **1,492** **2,348** **2,437**

The Integrated Analysis and Forecasting activity includes the development of forward-looking analyses and forecasts for alternative energy futures for the U.S. and other nations. This activity involves the development and maintenance of the National Energy Modeling System, and other modeling systems needed to analyze the interactions of demand, conversion, and supply for all energy sources and their economic and environmental impacts. Fund contracts for statistical services in support of maintenance of selected, highest priority mid-term macroeconomic, international, demand, supply, conversion, and integrating components of the National Energy Modeling System (NEMS), and produce the *Annual Energy Outlook* and the Greenhouse Gas reporting system. In order to fund the consumption surveys in FY 2006, EIA will scale back the *International Energy Outlook*.

- Modeling, Forecasting, and Analysis of U.S. Energy Markets
  Maintain and operate the NEMS, which consists of 13 inter-related energy modules that address future energy demand for the residential, commercial, industrial, and transportation sectors, and future supply of petroleum, natural gas, coal, and renewables at a slightly-reduced level. NEMS is the U.S. Government's integrated mid-term energy model, used in preparing the *Annual Energy Outlook*, feature articles on significant topics in mid-term energy markets, and special reports requested by Congress, the Administration, the Department of Energy, and/or other Government agencies.
- Modeling, Forecasting, and Analysis of International Energy Markets
  In FY 2006, continue the *International Energy Outlook* (IEO) at a reduced level of operation. The IEO the U.S. Government's publication on mid-term forecasts of world energy markets, which is used to answer questions concerning significant issues affecting world energy markets in the mid-term. This activity has been responsible for the development of the System for the Analysis of Global Energy (SAGE), an energy technology model, representing global energy supply and demand in 15 regional models.
- Greenhouse Gas Program
  This activity encompasses the publication of the annual estimate of greenhouse gases contained in the *Emissions of Greenhouse Gases in the United States,* the Voluntary Reporting of Greenhouse Gases Program, and the enhancements to the Voluntary Reporting of Greenhouse Gases Program requested by the President in his Climate Change Initiative. The FY 2006 program would cover operating costs to analyze data provided by respondents on baselines, emissions, and emission reductions of greenhouse gases and improve the quality of the data.

	(dollars in thousands)		
	FY 2004	FY 2005	FY 2006

- **Information Technology** **4,134** **2,944** **2,814**

  The Office of Information Technology (OIT) provides EIA-wide desktop, hardware, software, database, network, and other IT support consistent with EIA's mission requirements as a statistical agency that is statutorily charged with data confidentiality requirements and a significant degree of independence from DOE. Starting in late FY 2004, the Department mandated the use of its IT umbrella contract for EIA's IT infrastructure support. EIA continues to use its EOP II multi-award contract for software applications development and other IT programmatic services.

  In FY 2006, operate and maintain the EIA network consisting of an enterprise server; four Web servers; over fifty production servers; all network communication equipment including hubs, routers, switches, and cables; and peripheral equipment including a storage device for the enterprise server, high speed printers, and robotic tape backup machines. Maintain communication equipment to connect the network with remote sites in Silver Spring, Maryland and Dallas, Texas, and with individual users.

  The FY 2006 Information Technology request continues to support Internet data collection. This project eliminates the paper-based data collection instruments and replaces them with an interactive Internet-based energy data collection system to increase the accuracy and improve timeliness of all energy data collected by EIA.

- **National Energy Information Center**..... **584** **480** **496**

  The National Energy Information Center is the worldwide point of contact for energy information for the Administration, Congress, State and local government agencies, the academic community, industrial and commercial organizations, foreign governments and international organizations, the news media, the financial community, research and consulting organizations, and the general public.

  Fund contracts for information services to respond to public inquiries, and disseminate EIA products and energy information including periodicals, one-time reports, brochures, flyers, and info cards. For FY 2006, NEIC will respond to approximately 30,000 requests: (a) for EIA data, analyses, and forecasts, most significantly from Executive agencies, Members of Congress and associated staffs, and print and broadcast journalists from major media outlets across the Nation and around the world; (b) for extensive EIA Web site support; and (c) for referrals to energy information elsewhere in the national and international statistical system. EIA will distribute periodicals, one-time reports, brochures, flyers, and info cards, and will continue to offer its customers Print-on-demand service. NEIC will design and manage 10 Web site channels, including the increasingly popular Energy Kid's Page, and conduct two customer surveys and two Web site usability tests. It also will conduct the Energy Industry Study Program and orientation sessions for all new employees.

	(dollars in thousands)		
	FY 2004	FY 2005	FY 2006

- **Statistics and Methods** **406** **353** **412**

  The Statistics and Methods activity provides services in the areas of data quality evaluation; performance measurement; survey and statistical design; development and coordination of definitions and standards governing collection, processing, documentation, and dissemination of energy information; and management of a respondent burden control and public-use forms clearance program.

  In FY 2006, provides for workshops for improving knowledge and skills of EIA staff, statistical services in support of quality assurance, improvement of statistical procedures used within EIA survey systems, and development-oversight of performance measures of EIA's operations and products.

- **Resource Management** **365** **556** **337**

  The Resource Management activity includes the overall management and administrative support to EIA, including program and strategic planning, financial management, contracts management, human resource management, resource and work force analyses, administrative support, logistic support services, and performance statistics support.

  For FY 2006, EIA will: (1) Continue to implement generic processes to improve the efficiency, and especially the timeliness, of EIA's human resource, contracting and financial analysis; (2) Implement interfaces with Departmental information systems to reduce or eliminate error-prone data entry and processing steps; and (3) Continue EIA's support for the President's Management Agenda.

Other Related Expenses..... **17,287** **18,192** **18,531**

Other related expenses include goods and services provided through the DOE Working Capital Fund for operations such as building occupancy, utilities, supplies and materials, phone service, copying, mail supplies, procurement management, and payroll processing. It also covers employee training tuition; non-Working Capital Fund overhead expenses such as the Dallas Field Office, communications equipment, personal computers, and supplies, materials, and services purchased directly by EIA; the Department's required set-aside to cover prior year obligations; and funding for Historical Black Colleges and Universities, Hispanic Serving Institutions, Tribal Colleges and Universities, and commemorative programs.

Total, Program Direction 81,100 83,819 85,926

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Salaries & Benefits	
▪ Provides for general pay increases, promotions, and within-grade increases.	+896
Support Services	
▪ The net increase fully funds the Energy Consumption Surveys, fully funds an entire year of the Monthly Natural Gas Production Survey, and maintains ongoing programs.	+872
Other Related Expenses	
▪ Increase in Working Capital Fund assessments including Standard Accounting and Reporting System (STARS) implementation costs and IT project management training; and higher non-Working Capital Fund overhead costs including new E-Government assessments and increased cost of computer workstations and network infrastructure technology upgrades needed to improve operational efficiencies.	+339
Total Funding Change, Program Direction	**+2,107**

Support Services by Category

(dollars in thousands)

	FY 2004[a]	FY 2005	FY 2006	$ Change	% Change
Technical Support					
Oil and Gas	8,645	9,378	9,450	+72	+0.8%
Coal, Nuclear, Electric and Alternate Fuels	3,725	3,395	3,421	+26	+0.8%
Energy Markets and End Use.....	3,805	3,380	4,299	+919	+27.2%
Integrated Analysis & Forecasting.....	1,492	2,348	2,437	+89	+3.8%
Information Technology	4,134	2,944	2,814	-130	-4.4%
National Energy Information Center.....	584	480	496	+16	+3.3%
Statistics and Methods	406	353	412	+59	+16.7%
Resource Management	365	556	377	-179	-32.2%
Total, Technical Support Services.....	23,156	22,834	23,706	+872	+3.8%

[a] In FY 2004, EIA used $4,005,288 of carryover and prior year deobligations to maintain the same level of data, analyses, and services as compared to FY 2003.

Other Related Expenses by Category

(dollars in thousands)

	FY 2004	FY 2005	FY 2006	$ Change	% Change
Other Related Expenses					
Purchases of Goods and Services from Government Accounts (Includes Working Capital Fund & Interagency Agreements)	7,822	7,981	8,244	+263	+3.3%
Training	197	292	293	+1	+0.3%
Operation of GOCOs (National Labs)	276	280	280	0	0%
Supplies and Materials (Includes Dallas Field Office, equipment, supplies & services)	8,158	8,783	8,858	+75	+0.9%
Grants, Subsidies, and Contributions (Includes SHOPP Grants to States, HBCU, HSI, Tribal Universities)	834	856	856	0	0%
Total, Other Related Expenses	17,287	18,192	18,531	+339	+1.9%

Clean Coal Technology

Clean Coal Technology

Clean Coal Technology
[(Deferral)]

Proposed Appropriation Language

Of the funds made available under this heading for obligation in prior years, $257,000,000 [shall not be available until October 1, 2005: *Provided*, That funds made available in previous appropriations Acts shall be available for any ongoing project regardless of the separate request for proposal under which the project was selected] *are cancelled*.

Explanation of Change

These balances are no longer needed to complete active projects in this program. The Budget proposes to redirect these funds to the Fossil Energy program for work on the FutureGen project to develop a coal-fired, nearly emissions-free electricity and hydrogen generation plant.

Clean Coal Technology

Overview

Appropriation Summary by Program

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Clean Coal Technology	-98,000	-160,000	0	0	+160,000	+100%
Total, Clean Coal Technology	-98,000	-160,000	0	0	+160,000	+100%

Detailed Funding Table

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Clean Coal Technology			
Advance appropriation	87,000	97,000	257,000
Rescission	-88,000	0	-257,000
Deferral of Unobligated Balances	-97,000	-257,000	0
Total, Clean Coal Technology	-98,000	-160,000	0

Mission

The Clean Coal Technology program is a government and industry co-funded effort to provide technical and operational data of innovative coal technologies demonstrated at commercial scale. Beginning in 1985, the Department administered five competitive solicitations selecting projects with the potential to satisfy the requirements of the energy markets while improving the environmental performance of coal-based technologies. To date, more than thirty projects have been successfully completed, providing the marketplace with valuable performance experience and data for a variety of applications.

For FY 2004, an appropriation of $87 million was made available, $88 million was rescinded, and the availability of $97 million was deferred to FY 2005. For FY 2005, an appropriation of $97 million was made available and the availability of $257 million was deferred to FY 2006. For FY 2006, the Department proposes to cancel the $257 million deferral from FY 2005 and redirect these funds to the Fossil Energy R&D program for work on the FutureGen project. Prior year funding exists to meet all outstanding commitments to ongoing projects. Funds for the administration of the program are specifically requested under the Program Direction account.

Benefits

The importance of demonstrating technologies that improve the performance and extend the service of the Nation's reliable coal-based generating capacity is vital for supporting today's economy. The CCT Program is establishing the engineering and scientific foundation for the next generation of clean coal technologies that will be capable of near zero emissions and generation efficiencies twice that of the existing coal fleet.

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 goal:

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 Clean Coal Technology program has one program goal which contributes to the General Goal 4 in the "goal cascade":

Program Goal 04.55.00.00: Zero Emission Coal-Based Electricity and Hydrogen Production: Create public/private partnerships to provide technology to ensure continued electricity generation 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 energy efficiencies over 60 percent with coal and 75 percent with natural gas.

Contribution to General Goal

Clean Coal Technology contributes to General Goal 4 through demonstrating technologies that improve the performance and extend the service of the Nation's reliable coal-based generating capacity.

Funding by General and Program Goal

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Goal 4, Energy Security			
Clean Coal Technology	-98,000	-160,000	0
Total, General Goal 4 (Clean Coal Technology)	-98,000	-160,000	0

Clean Coal Technology

Funding Profile by Subprogram

(dollars in thousands)

	FY 2004 Comparable Appropriation	FY 2005 Comparable Appropriation	FY 2006 Base	FY 2006 Request	FY 2006 Request vs Base	
					$ Change	% Change
Clean Coal Technology						
Cooperative Agreements	-98,000	-160,000	0	0	+160,000	+100%
Program Direction	0	0	0	0	0	0%
Total, Clean Coal Technology	-98,000	-160,000	0	0	+160,000	+100%

Mission

The Clean Coal Technology (CCT) program is a government and industry co-funded effort to provide technical and operational data of innovative coal technologies demonstrated at commercial scale. Beginning in 1985, the Department administered five competitive solicitations selecting projects with the potential to satisfy the requirements of the energy markets while improving the environmental performance of coal-based technologies. To date, more than thirty projects have been successfully completed, providing the marketplace with valuable performance experience and data for a variety of applications.

For FY 2004, an appropriation of $87 million was made available, $88 million was rescinded, and the availability of $97 million was deferred to FY 2005. For FY 2005, an appropriation of $97 million was made available and the availability of $257 million was deferred to FY 2006.

For FY 2006, the Department proposes to cancel the $257 million deferral from FY 2005 and redirect these funds to the Fossil Energy R&D program for work on the FutureGen project. Prior year funding exists to meet all outstanding commitments to ongoing projects. Funds for the administration of the program are specifically requested under the Program Direction account.

Benefits

Demonstrating technologies that improve the performance and extend the service of the Nation's reliable coal-based generating capacity is vital for supporting today's economy. The CCT Program is establishing the engineering and scientific foundation for the next generation of clean coal technologies that will be capable of near zero emissions and generation efficiencies twice that of the existing coal fleet.

Detailed Justification

(dollars in thousands)

FY 2004	FY 2005	FY 2006

(dollars in thousands)

	FY 2004	FY 2005	FY 2006
Clean Coal Technology	**-98,000**	**-160,000**	**0**
▪ **Cooperative Agreements**	**-98,000**	**-160,000**	**0**

For FY 2006, the Department proposes to cancel the $257 million deferral from FY 2005. Inititate construction for the Kentucky Pioneer gasification project and prepare final reports for the fuel cell portion of the project at the Wabash River site. *Participants include: Kentucky Pioneer Energy, Ltd. with FuelCell Energy and Global Energy.*

For FY 2005, an appropriation of $97 million was made available and the availability of $257 million was deferred to FY 2006. Complete permitting and financing activities for the Kentucky Pioneer Gasification project and complete operation of the fuel cell portion of the project at the Wabash River site. Complete testing and reporting for the Clean Coal Diesel project and reporting for the JEA Circulating Fluid Bed Combustor project. *Participants include: JEA, Kentucky Pioneer Energy, Ltd. With Fuel Cell Energy and Global Energy, and TIAX.*

For FY 2004, an appropriation of $87 million was made available, $88 million was rescinded, and the availability of $97 million was deferred to FY 2005. Continued permitting and financing activities for the Kentucky Pioneer gasification project and continued construction of the fuel cell portion of the project at the Wabash River site. Completed demonstration phase for the JEA Circulating Fluid Bed Combustor project. Initiated 2-cylinder engine testing using coal slurry for the Clean Coal Diesel project. Completed final reports for the Advanced Coal Conversion project. *Participants include: JEA, Kentucky Pioneer Energy, Ltd. With Fuel Cell Energy and Global Energy, Western Syncoal LLC, and TIAX.*

▪ **Program Support**	**0**	**0**	**0**

Program management and support and program direction activities funded under the Fossil Energy R&D Program Direction account.

Total, Clean Coal Technology	**-98,000**	**-160,000**	**0**

Explanation of Funding Changes

	FY 2006 vs. FY 2005 ($000)
Clean Coal Technology	
▪ Request for FY 2006 cancels unneeded balances	0
▪ Funding for FY 2005 deferred unneeded balances	+160,000
Total Funding Changes, Clean Coal Technology	+160,000