Fiscal Year 2008
Budget-in-Brief

U.S. Department of Energy

Energy Efficiency and Renewable Energy

Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

www.eere.energy.gov

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Preface

The mission of the Office of Energy Efficiency and Renewable Energy (EERE) is to strengthen America's energy security, environmental quality, and economic vitality through public-private partnerships that enhance energy efficiency; help bring clean, reliable and affordable energy technologies to the market; and make a difference in the everyday lives of Americans.

In his 2007 State of the Union address, President Bush told the Nation that "it's in our vital interest to diversify America's energy supply – the way forward is through technology." EERE's Fiscal Year (FY) 2008 budget request addresses the urgent energy and environmental challenges facing our country today by accelerating the development of both renewable energy technologies to dramatically increase the amount of clean energy produced in the United States, and advanced energy efficient technologies and practices that use less energy. In addition to its historical role of leading Federal research on these emerging technologies, EERE will also take aggressive steps to catalyze the rapid commercialization and deployment of these critical technologies through innovative partnerships and collaboration with lenders and investment groups, the States, and industry leaders.

Such action supports President Bush's challenge to America in January 2006 when he launched the Advanced Energy Initiative (AEI) to help break our addiction to oil, lessen dependence on foreign resources, and change the way we power our homes, businesses, and automobiles. In his 2007 State of the Union address, the President re-emphasized important components of that initiative and challenged the country to reduce gasoline consumption by 20 percent in the next 10 years. EERE is responding to the President's call to "press on with battery research for plug-in and hybrid vehicles…expand the use of clean diesel vehicles and biodiesel fuel...and [invest] in new methods of producing ethanol, using everything from wood chips to grasses, to agricultural wastes." The FY 2008 budget increases funding for growth in programs key to the President's "20 in 10" goal, including Vehicles research and development (R&D) on more efficient car and truck engines and better batteries for hybrid and plug-in hybrid vehicles, and Biomass R&D to expand our domestic resources and transportation fuels. This request also grows the budgets of Building Technologies to increase the supply of cost-effective energy efficient appliances, homes, and businesses, and Hydrogen and Fuel Cell Technologies to develop new fuels and vehicles that don't use oil. The FY 2008 request maintains funding levels for Solar, Wind, Industrial Technologies, and the Federal Energy Management Program.

Budget priorities reflect a sharper focus on energy security and accelerating clean energy technologies into commercial markets, strengthening the link between the basic sciences and applied energy research. With action plans, performance milestones, and clearly articulated deliverables, EERE's budget request will lead to dynamic partnerships with private industry and academia to promote our Nation's economic well-being, and environmental health. R&D accomplishments, such as the world record 19.5 percent efficient thin-film photovoltaic cell developed by the National Renewable Energy Laboratory and now being commercialized by industry, will bring clean energy sources such as solar one step closer to broader viability.

EERE's overall budget request reflects the necessity to limit spending growth in a time of Federal budget constraints, allocating greater funding to critical national priorities and to areas of promising return, balancing long-, medium-, and near-term opportunities. Consequently, the FY 2008 budget request proposes reduced funding for the Weatherization Program and close-out of the Geothermal Technology Program.

Highlights

The EERE FY 2008 budget request promotes the following components of the President's AEI:

- *The President's Biofuels Initiative.* Funding increase of $30 million. This initiative is critical for achieving the President's "20 in 10" gasoline reduction goal. Making cellulosic ethanol cost-competitive by 2012 is now the focus of the program from FY 2007 until FY 2012. Additionally, the program is pursuing a longer term deployment objective of displacing an amount of petroleum equal to 30 percent of the gasoline consumed in America in 2004 with biofuels by 2030. Biomass is an important renewable resource because it is the only renewable option for producing liquid transportation fuels in the near term, thereby reducing our dependence on imported oil. The Department is making investments to support the goals of the initiative through a concerted effort in both EERE's Biomass Program and the Department's Office of Science, which is supporting two new Bioenergy Centers as part of its research portfolio. In order to capture and coordinate Federal-wide activities supporting the initiative goals, the Biomass Program is developing a National Biofuels Action Plan commissioned through the Biomass Research and Development Initiative.

- *The President's Hydrogen Fuel Initiative*. Funding increase of $17 million. The FY 2008 request continues to advance the President's commitment to provide $1.2 billion over five years for hydrogen-related R&D. The President's FY 2008 budget request increases EERE funding for hydrogen technology research by more than $17.2 million over the FY 2007 request. Increased funding is requested to expand research in several areas including: hydrogen production from renewables, materials for hydrogen storage, fuel cell stack components, and a new R&D effort on cost-effective manufacturing technologies to build a competitive, domestic hydrogen and fuel cell supplier capability.

- *Vehicle Technologies*. Funding increase of $10 million. This year's request increases the emphasis on plug-in hybrid vehicle component technologies by doubling the requested research support for plug-ins from $14.0 million to $27.5 million. Cited by the President as a key part of the strategy for reaching the "20 in 10" goal, these technologies offer the potential to make significant additional improvements in petroleum reduction beyond that achievable with standard hybrid configurations. By utilizing energy drawn from the Nation's electricity grid at off-peak times to charge high energy batteries, these technologies will be able to operate in an electric vehicle mode for expanded distances, potentially meeting most drivers' needs for commuting and short distance driving.

- *The President's Solar America Initiative (SAI).* Launched in the 2006 State of the Union address, this major initiative is designed to achieve cost competitiveness for solar electricity by 2015. The SAI is accelerating cost reduction by working with industry-led teams to aggressively deliver solar systems that are less expensive, more efficient, and highly reliable. By focusing on both manufacturing and systems integration issues, the SAI will support industry deployment of 5 gigawatts (GW) of new grid-connected electricity generating capacity by 2015. This year's activities feature continued work with the industry-led teams selected competitively in FY 2007. Key technologies that have the greatest potential for cost competitiveness in this accelerated timeframe will be pursued. The SAI also features the second year of market transformation activities to reduce market barriers and seize opportunities to promote large-scale solar deployment.

The FY 2008 budget request also supports renewable energy and energy efficiency R&D that will help reduce the overall demand for natural gas and lower energy costs in the electricity sector:

- *Wind Energy*. The FY 2008 budget request includes $40.1 million for wind energy research to reduce costs and overcome barriers to large-scale use of wind power. The program is focused on accelerating U.S. wind energy use through national leadership in R&D and outreach to improve technology performance and reliability, and to overcome barriers to market acceptance and electric power system integration.

- *Solid State Lighting*. Funds requested will continue the accelerated development of solid state lighting technologies that can reduce commercial building lighting electricity consumption by at least 50 percent and promise to revolutionize the energy efficiency, appearance, visual comfort, and quality of lighting. Department of Energy (DOE) R&D is now reaching the market with a LED lamp that sets the bar in high efficiency.

- *Equipment Standards and Analysis*. Funding increase of $1.7 million. The Department is committed to clearing the backlog of rulemakings and meeting all of its new Energy Policy Act (EPACT) of 2005 requirements. This budget request supports the Department's planned schedules and will enable the Department to produce at least one new or amended standard for all products in the backlog no later than mid-2011.

- *"Save Energy Now."* The FY 2008 Industrial Technologies Program (ITP) budget request supports the Secretary of Energy's "Easy Ways to Save Energy" campaign through industrial energy savings assessments. These "Save Energy Now" assessments are part of ITP's Best Practices activity and focus on reducing the energy intensity of U.S. manufacturing, with a special emphasis on reducing natural gas demand and price volatility. The program's Industrial Assessment Centers also train more engineers and scientists in the energy field, providing opportunities for students to conduct energy assessments at no cost to small and medium-sized manufacturing plants.

Benefits continue to be realized from the implementation of EERE's "one-way of doing business model" that integrated EERE's programs and streamlined its business administration functions. The FY 2008 budget provides for the fully developed EERE Project Management Center (PMC). The PMC is a virtual organization consisting of project management staff at the Golden Field Office (GO) and services acquired via the Office of Fossil Energy's National Energy Technology Laboratory (NETL). In FY 2006, the activities of the six former Regional Offices were consolidated into the PMC to establish a more seamless provision of full-service project management services.

The PMC personnel are responsible for providing an integrated, multi-disciplinary function and structured approach that ensures that all program implementation activities are defined, initiated, and carried out successfully in pursuit of EERE program goals and objectives.

In developing this request, EERE continues to be guided by the Research and Development Investment Criteria (RDIC) called for in the President's Management Agenda, as well as the Office of Management and Budget's (OMB) Program Assessment Rating Tool (PART) to evaluate its portfolio and to focus its R&D dollars.

This Budget-in-Brief summarizes the key activities and changes in each of the 14 program areas. A chart summarizing the FY 2008 budget request is on page 47. More detailed information, including the EERE FY 2008 budget request, can be found at www.eere.energy.gov.

Biomass and Biorefinery Systems R&D Program

The mission of the Biomass and Biorefinery Systems R&D Program ("Biomass Program")[1] is to foster research and development on advanced technologies that will transform the Nation's domestic biomass resources into affordable biofuels, biopower, and high-value bioproducts. Biomass is the only clean, renewable energy source that can make an immediate impact in diversifying our liquid transportation fuels, thereby reducing our dependency on imported oil. The program's research focus is in three areas: Feedstock Infrastructure, for reducing the cost of collecting and preparing raw biomass, and for the sustainable production and delivery of future energy crops; Platforms R&D, for reducing the cost of outputs and byproducts from biochemical and thermochemical processes; and Utilization of Platform Outputs, for developing technologies and processes that utilize intermediates such as sugars and syngas to co-produce fuels, value-added chemicals and materials, and heat and power. The program's strategy is to integrate those technologies and processes in biorefinery configurations and partner with industry to validate at commercial scale. The next-generation biorefinery will produce transportation fuels along with value-added chemicals and materials, and/or power from a wide variety of regionally available lower cost feedstocks such as agricultural and forest residues and other biomass.

The additional impetus created by the President's *Biofuels Initiative* will enable program R&D to accelerate the development of cost-competitive, bio-based liquid transportation fuels. The Biomass Program has outlined a strategy for reaching the objectives of the initiative which assumes funding at the requested level, exclusive of congressionally directed activities.

FY 2008 Budget Request
Biomass and Biorefinery Systems R&D

Activity	Funding ($ in thousands) FY 2006 Approp.	FY 2007 Request	FY 2008 Request
Feedstock Infrastructure	492	9,967	10,000
Platforms R&D	19,542	50,530	59,400
Utilization of Platform Outputs R&D....	22,915	89,190	104,863
Cellulosic Ethanol Reverse Auction	0	0	5,000
Congressionally Directed Activities	46,827	0	0
TOTAL	**89,776**	**149,687**	**179,263**

In Fiscal Year 2008, the Department is requesting $179.3 million for the Biomass Program, an increase of $29.6 million from the FY 2007 request. FY 2006 included $47 million (52 percent) for congressionally directed activities.

(Note: The FY 2007 request column shows the budget request because no full year appropriation has been enacted.)

[1] Biomass includes agricultural crops and trees, wood and wood wastes and residues, plants, grasses, residues, fibers, animal wastes, municipal solid wastes, and other waste materials. Biorefineries are processing facilities that extract carbohydrates, oils, lignin, and other materials from biomass, and convert them into multiple products such as transportation fuel, chemicals, and materials.

Feedstock Infrastructure

In FY 2008, feedstock infrastructure systems work will continue for single-pass harvester development for wheat straw and corn stover collection, and storage and transportation options to minimize costs for delivering these agricultural feedstock residues to a biorefinery. Analysis of infrastructure systems and supply curves will continue in order to integrate economic and environmental considerations. All five Regional Feedstock Partnerships will be established and will continue to address regional infrastructure needs in conjunction with the U.S. Department of Agriculture (USDA) and land grant universities. Regional information is needed by potential biorefineries in order to assess and improve resource availability and feedstock economics. Additionally, the program will continue to partner with the genomics research activity within the DOE Office of Science and at USDA to further feedstock efforts. Within funds provided, the program will establish the framework to implement a cellulosic ethanol reverse auction program as authorized by Section 942 of EPACT 2005. ($10.0 million)

Platforms R&D

- Thermochemical Platform conducts research, testing, integration, and feasibility studies to reduce thermochemical conversion costs of biomass and process residues from biorefineries into clean syngas or bio-oils for further clean up and conditioning to make transportation fuels and chemicals. Cleanup and conditioning efforts will focus on the syngas and pyrolysis streams for the removal of particulates and other inorganic materials, on the conversion of tars, and improving syngas yields. In addition, these funds may be used for peer reviews; data collection and dissemination; and technical, market, economic, and other analyses. ($19.6 million)
- Bioconversion Platform R&D is defined by the work to reduce the costs of producing mixed, dilute sugar streams from a wide range of biomass feedstocks. These activities include: feedstock characterization, pretreatment and conditioning, enzyme production and sacharification (sugars production), and technology integration. This effort will help launch into the next generation of cellulosic ethanol and supports future biorefinery validation projects. In addition, these funds may be used for peer reviews; data collection and dissemination; and technical, market, economic, and other analyses. ($38.3 million)

Utilization of Platform Outputs R&D

- Integration of Biorefinery Technologies will continue to support industry's efforts to commercialize biorefineries for the production of transportation fuels and co-products (such as materials and chemicals) as authorized by EPACT 2005, Section 932(d). The cost-shared projects selected for award in FY 2007 will launch the plant commercialization phase of the Biofuels Initiative which is critical to validate the near-term biorefinery pathways for production of cost-competitive cellulosic ethanol. Additionally, the funding increase supports the technical and economic validation of additional biomass conversion technologies and feedstocks in biorefineries at approximately 10 percent of commercial scale. The projects selected would be cost-shared with industry and support the *Biofuels Initiative*. ($92.2 million)
- Products Development focuses on the conversion of sugars from the biochemical platform into cellulosic ethanol. The program supports public/private partnerships focused on developing a commercially viable fermentation organism which is critical to reducing the cost of cellulosic ethanol production. ($10.0 million)

Cellulosic Ethanol Reverse Auction

The Biomass Program will establish the framework for an ethanol reverse auction in accordance with Section 942 of EPACT 2005. The auction will award incentives on a per gallon basis of cellulosic biofuels produced in an amount determined by the Secretary of Energy until initiation of the first reverse auction.

Building Technologies Program

The mission of the Building Technologies Program is to develop technologies, techniques, and tools for making residential and commercial buildings more energy efficient, productive, and affordable. Energy use by residential and commercial buildings accounts for over one-third of the Nation's total energy consumption, including two-thirds of the electricity generated in the United States. This level of energy use costs the Nation about $240 billion annually. Improving the energy efficiency of buildings and equipment reduces energy consumption—especially during critical peak demand periods—which also reduces America's vulnerability to energy supply disruptions, energy price spikes, and constraints on the Nation's electricity infrastructure. The funding supports a portfolio of activities that includes solid-state lighting, improved energy efficiency of other building components and equipment, and their effective integration using whole-building-system-design techniques that will enable the design of net Zero Energy Buildings. The program also includes the development of building codes and appliance standards and successful education and market introduction programs, including ENERGYSTAR® and EnergySmart Schools.

The Fiscal Year 2008 request for the Building Technologies Program is $86.5 million, an increase of $9.1 million from the FY 2007 request.

FY 2008 Budget Request
Building Technologies

Activity	Funding ($ in thousands) FY 2006 Approp.	FY 2007 Request	FY 2008 Request
Residential Buildings Integration	14,858	19,700	19,700
Commercial Buildings Integration	3,069	4,699	7,000
Emerging Technologies	32,289	32,756	32,756
Technology Validation and Market Introduction	0	8,249	13,361
Equipment Standards and Analysis	10,153	11,925	13,639
Oil Heat Research for Residential Buildings	990	0	0
Technical/Program Management Support	1,485	0	0
Congressionally Directed Activities	5,346	0	0
TOTAL	**68,190**	**77,329**	**86,456**

(Note: The FY 2007 request column shows the budget request because no full year appropriation has been enacted.)

Residential Buildings Integration

The long-term goal of Residential Buildings Integration is to develop cost-effective technologies and building practices that will enable the design and construction of net Zero Energy Buildings (ZEB)—homes that produce as much energy as they use on an annual basis—by 2020.

- Research and Development: Building America. This program will focus on reducing total energy use in a new home by 60 to 70 percent. During FY 2008, research for production-ready new residential buildings that are 40 percent more efficient will continue for four climate zones, with completion of the research in one of these zones. Activities will be carried out in partnership with designers, builders, and component manufacturers. ($19.7 million)

Commercial Buildings Integration

The long-term goal of the Commercial Buildings Integration subprogram is to develop cost-effective technologies and building practices that will enable the design and construction of net Zero Energy Buildings—commercial buildings that produce as much energy as they use on an annual basis—by 2025.

- Research and Development will develop four packages of cost-effective technologies for small- to medium-sized (less than 25,000 square feet) commercial buildings to reach 30 percent energy savings over the American Society of Heating, Refrigerating, and Air-conditioning Engineers' (ASHRAE) Standard 90.1-2004. These commercial building energy efficiency improvement packages will describe the technologies, quantify the energy savings and costs, and provide design and construction guidelines for implementation in several climate regions of the United States. ($7.0 million)

Emerging Technologies

The Emerging Technologies subprogram seeks to develop cost-effective technologies (e.g., lighting, windows, and space heating and cooling) for residential and commercial buildings that enable reductions in building energy use 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 building, can result in marketable net Zero Energy designs. ($32.8 million)

- Solid State Lighting will develop technologies that can reduce commercial building lighting electricity consumption by at least 50 percent. Projects will be continued (from the Fiscal Years 2004 - 2007 solicitations) to develop general illumination technologies that achieve energy efficiencies of up to 93 lumens per Watt, through creation of a technical foundation to revolutionize the energy efficiency, appearance, visual comfort, and quality of lighting. These projects will include light-emitting diode (LED) core topics (ultraviolet emissions, power conversion efficiency, and phosphors), LED product development topics (luminaire design and materials, and electronics), organic light-emitting diode (OLED) core topics (materials, light extraction, and novel device structures), and OLED product development (luminaire design and materials). ($19.8 million)

- Space Conditioning and Refrigeration R&D will demonstrate up to three design concepts selected from initial prototypes developed in FY 2006 that have the long-term potential to reduce annual heating, ventilation, and air-conditioning (HVAC) energy consumption by 50 percent in new residential buildings. These energy reductions are relative to 2003 Building America Benchmarks and have an estimated simple payback period of three years or less. The

design concepts must also address other critical Building America needs such as humidity control, uniform comfort, and indoor air quality. The R&D projects will emphasize modest cost premiums, since very high efficiency equipment already exists, but high first cost premiums have resulted in low market penetration. ($2.9 million)

- Building Envelope R&D will develop new envelope materials to enable Zero Energy Buildings. Specifically, this research will include phase change materials and thermochromic surfaces that adjust to optimize building performance. For example, the U.S. construction market uses predominantly light-weight walls that have low thermal storage. Historically, masonry walls have exhibited high heat storage capability that has buffered or reduced heating and cooling loads. DOE's research will allow our light-weight, low-cost construction practices to function similarly to heavy mass walls. In addition, DOE will continue competitive fundamental science research to develop the second generation of materials, chemical engineering applications, and advanced manufacturing 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. DOE will continue its research on highly insulating windows such as vacuum glazings that can achieve R10 performance, approximately three times that of today's ENERGYSTAR® windows. ($7.3 million)

- Analysis Tools and Design Strategies will conduct research on developing, improving, verifying and maintaining software packages for engineers, architects, and builders who design or retrofit buildings to be more energy efficient and comfortable. Activities will focus on research and additions to the EnergyPlus whole-building energy simulation software that enables building designers, operators, owners, and researchers to evaluate technologies for improving the energy efficiency and comfort of buildings while reducing operating costs. ($2.8 million)

Equipment Standards and Analysis

The Equipment Standards and Analysis subprogram develops minimum energy efficiency standards that are technologically feasible and economically justified as required by law. During the FY 2005 through FY 2007 time period, the Department identified and carried out significant enhancements to rulemaking activities. The Department has made a commitment to clear the backlog of delayed actions that accumulated during prior years, while simultaneously implementing all new requirements of the EPACT 2005. Activities were initiated in FY 2006 on 13 products that will continue in FY 2008. The Department will continue to implement productivity enhancements that will allow multiple rulemaking activities to proceed simultaneously, while maintaining the rigorous technical and economic analysis required by statute. ($13.6 million)

Technology Validation and Market Introduction

The Technology Validation and Market Introduction subprogram funds activities that accelerate the adoption of clean, efficient, and domestic energy technologies. The major activities are: ENERGYSTAR®, EnergySmart Schools, Rebuild America and Building Energy Codes. These activities were transferred to Building Technologies in FY 2007 from the Weatherization and Intergovernmental Activities Program. ENERGY STAR® is a joint Department of Energy/Environmental Protection Agency activity designed to identify and promote energy efficient products.

- ENERGYSTAR® will continue to update criteria on selected products in accordance with EPACT 2005. In FY 2008, DOE will focus on raising efficiency targets of the current appliance

portfolio (e.g., clothes washers, dishwashers, room air conditioners and compact fluorescent light bulbs [CFLs]) to insure the ENERGYSTAR® label connotes top-level performance, and introduce new ENERGYSTAR® products (e.g., photovoltaics, solid state lighting, advanced technology water heaters, and packaged terminal air-conditioners). ($6.8 million)

- Rebuild America, including EnergySmart Schools, has been aligned with the Commercial Building Integration research and development activity to accelerate the adoption of advances in commercial building integrated design, software tools, practices and advanced controls, equipment and lighting. The redesigned activity will target the opportunity to reduce energy use by 30 percent in existing schools, and by 40 percent - 50 percent in new school construction through energy improvements, and to reduce lighting energy consumption by 40 percent - 50 percent in commercial buildings. ($2.8 million)

- Building Energy Codes will support the upgrading of model building energy codes such as the ASHRAE Standard 90.1 for commercial buildings, and the International Code Council's International Energy Conservation Code [IECC] for residential buildings. DOE will also provide determinations as required on new ASHRAE or IECC building codes, and update the code compliance software, REScheck and COMcheck, to efficiency levels in the current residential and commercial codes. ($3.8 million)

Federal Energy Management Program

Federal Energy Management Program (FEMP) assists Federal agencies, including DOE, in increasing their use of energy efficiency and renewable energy technologies through alternative financing contract support and technical assistance, and coordinates Federal reporting and evaluation of agency progress each year. FEMP facilitates the award of alternative financing contracts between Federal agencies and the private sector, enabling agencies to install energy efficiency improvements quickly and pay off the costs incurred over a period of time using dollars they saved on energy bills. In addition, Federal energy managers receive technical assistance from FEMP so they can identify, design, and implement energy efficient and renewable energy technologies and practices. FEMP publishes an Annual Report to Congress on Federal energy efficiency and renewable energy use, reports and tracks alternative fuel use in Federal vehicle fleets, and conducts an awards program to recognize individuals and groups within Federal agencies who achieve excellence in energy management. The focus of FEMP in FY 2008 is to significantly expand the number and amount of privately financed Energy Saving Performance Contracts and other projects that will reduce the energy costs and environmental impacts of government operations.

FY 2008 Budget Request
Federal Energy Management Program

Activity	Funding ($ in thousands) FY 2006 Approp.	FY 2007 Request	FY 2008 Request
Project Financing	6,759	5,935	7,935
Technical Guidance and Assistance	7,642	6,519	6,519
Planning, Reporting and Evaluation	2,574	2,473	2,337
Departmental Energy Management	1,999	1,979	0
TOTAL	**18,974**	**16,906**	**16,791**

The Fiscal Year 2008 request is $16.8 million, which is a decrease of $0.1 million from the FY 2007 request.

(Note: The FY 2007 request column shows the budget request because no full year appropriation has been enacted.)

Project Financing

FEMP alternative financing programs help agencies access private sector financing to fund needed energy improvements. FEMP helps Federal agencies use Energy Savings Performance Contracts (ESPCs) and Utility Energy Service Contracts (UESCs) to finance energy saving improvements without the use of current appropriations. 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 such as lighting upgrades, new heating and ventilation systems, and improved control systems. ($7.9 million)

Technical Guidance and Assistance

This effort helps Federal energy managers identify, design, and implement new construction and facility improvement projects that incorporate energy efficiency and renewable energy. FEMP provides unbiased, expert technical assistance through audits for buildings and industrial facilities. The Program also helps Federal facilities manage peak load requirements and deploy new technologies, including combined heat and power, distributed energy, and renewable technologies. Working with FEMP, agencies can acquire the most energy efficient products through procurement training, product efficiency recommendations, communications and outreach, and assistance in amending agency guide specifications to incorporate requirements for energy efficient products. FEMP provides training for Federal agency energy managers and issues publications on energy technologies and best practices. Information and technical assistance will be provided to agencies to implement new Federal Building Performance Standards. ($6.5 million)

Planning Reporting and Evaluation

EPACT 2005 and Executive Order 13123 require DOE to collect, verify, and report to Congress on the progress by Federal agencies, including DOE, toward the Federal energy management goals of reducing energy intensity in buildings, reducing petroleum usage, and conserving water. Data collection, verification and reporting are centralized for the Federal agencies at FEMP, which will publish its Annual Report to Congress. To take advantage of the benefits of consolidating reporting on Federal activities, FEMP is taking on the additional reporting responsibilities for the Federal Fleet activity from the Office of Vehicle Technologies. In addition, FEMP will continue to recognize excellence through the Presidential and Federal awards program, and provide support for the Federal Energy Management Advisory Committee and other interagency committees. Technical analysis will be conducted as required to respond to analytical reporting requirements involved with the Government Performance and Results Act (GPRA), multi-year planning, and other efforts. ($2.3 million)

Departmental Energy Management Program (DEMP)

In FY 2008, the DEMP program is being discontinued. Energy management at DOE is being streamlined. The Federal Energy Management Program will provide policy, guidance and reporting for DOE facilities, but no direct funding for energy retrofit projects. DOE has determined that the management of energy efficiency and renewable investments at its facilities can be more effectively conducted using alternative financing and operation and maintenance funds under the stewardship and oversight of the appropriate Program Secretarial Office. As with all Federal agencies, FEMP will be available to assist DOE sites with alternative financing tools and technical assistance. ($0 million)

Geothermal Technology Program

The Geothermal Technology Program has worked in partnership with industry to establish geothermal energy as an economically competitive contributor to the U.S. energy supply. Geothermal energy production, a $1.3 billion a year industry, generates electricity or provides heat for direct applications, including aquaculture, crop drying, and district heating, or for use in heat pumps to heat and cool buildings. The technologies developed by this program are providing the Nation with new sources of electricity that are highly reliable and cost competitive and do not add to America's air pollution or the emission of greenhouse gases. Geothermal electricity generation is not subject to fuel price volatility and supply disruptions from changes in global energy markets.

While geothermal energy remains an important regional contributor to the Nation's energy needs, current EERE priorities are focused on technology development with broadly applicable and more readily accelerated public benefits. Therefore, the Department plans to close out the Geothermal Technologies Program. This closeout decision was based upon a review of EERE program funding priorities – which include a broad spectrum of considerations.

FY 2008 Budget Request
Geothermal Technology

	Funding ($ in thousands)		
Activity	**FY 2006 Approp.**	**FY 2007 Request**	**FY 2008 Request**
Technology Development	14,860	0	0
Technology Application	4,190	0	0
Congressionally Directed Activities	3,712	0	0
TOTAL	**22,762**	**0**	**0**

(Note: The FY 2007 request column shows the budget request because no full year appropriation has been enacted.)

Hydrogen Technology Program

The Hydrogen Technology Program is a major portion of the President's 5-year, $1.2 billion *Hydrogen Fuel Initiative* which was reinforced by the President's *Advanced Energy Initiative* announced in 2006. Hydrogen Technology research focuses on the critical path barriers to achieving commercial viability of hydrogen and fuel cell systems including: hydrogen production using primarily renewables, storage that enables greater than 300 mile driving range for vehicles, and low-cost and durable polymer fuel cell components. FY 2008 marks the launch of the program's new manufacturing research effort in support of the President's *Manufacturing Initiative*. This effort supports research on cost-effective manufacturing processes to build a domestic, globally competitive hydrogen and fuel cell supplier base. Additional key activities include technology validation in systems under "real world" conditions to determine status towards targets and help guide the R&D program; underlying safety research to support the development of codes and standards; systems analyses of hydrogen pathways and infrastructure scenarios to assess energy, environmental, and economic impacts of hydrogen and fuel cell technologies; and education and training to facilitate near-term demonstrations and market transformation as well as long-term market acceptance.

The Fiscal Year 2008 budget request for Hydrogen Technology is $213.0 million, a $17.2 million increase over the FY 2007 request. Consistent with the program's plan, additional resources are primarily for hydrogen production from renewables, hydrogen storage and fuel cell stack components. FY 2006 included more than $42 million (28 percent) for congressionally directed activities, many of which are outside program goals. Continued funding for congressionally directed activities within the Hydrogen Program is not requested.

FY 2008 Budget Request
Hydrogen Technology

Activity	Funding ($ in thousands) FY 2006 Approp.	FY 2007 Request	FY 2008 Request
Hydrogen Production and Delivery R&D	8,391	36,844	40,000
Hydrogen Storage R&D	26,040	34,620	43,900
Fuel Cell Stack Component R&D	30,710	38,082	44,000
Technology Validation	33,301	39,566	30,000
Transportation Fuel Cell Systems	1,050	7,518	8,000
Distributed Energy Fuel Cell Systems	939	7,419	7,700
Fuel Processor R&D	637	4,056	3,000
Safety and Codes and Standards	4,595	13,848	16,000
Education	481	1,978	3,900
Systems Analysis	4,787	9,892	11,500
Manufacturing R&D	0	1,978	5,000
Congressionally Directed Activities	42,520	0	0
TOTAL	**153,451**	**195,801**	**213,000**

(Note: The FY 2007 request column shows the budget request because no full year appropriation has been enacted.)

Hydrogen Production and Delivery R&D

Hydrogen Production and Delivery research will provide increased emphasis on renewable resources such as solar, biomass, and wind-based production technologies including photoelectrochemical, high-temperature thermochemical, photobiological, gasification and reforming technologies. Hydrogen delivery technologies will also be emphasized to reduce the cost and improve the efficiency of transporting and dispensing hydrogen. The majority of EERE funding for hydrogen production focuses on renewable resources, while work involving other feedstocks is largely funded by, and coordinated with, other DOE offices (i.e., Fossil Energy and Nuclear Energy). Technology areas include reformers that operate on renewable feedstocks (such as ethanol), catalysis, purifiers, electrolyzers, and highly efficient delivery technologies such as compression and liquefaction. ($40.0 million)

Hydrogen Storage R&D

Hydrogen Storage is one of the most technically challenging barriers to the widespread advancement of hydrogen and fuel cell technologies in the transportation sector. The overarching goal is lightweight, low-cost, low-pressure, and efficient on-board vehicular storage systems to achieve a driving range of greater than 300 miles, without impacting vehicular cargo or passenger space to be competitive with today's vehicles. The program will continue to increase investment in applied R&D of novel materials and breakthrough concepts with potential to meet 2010 on-board system performance targets. The program will conduct R&D through the framework of the "National Hydrogen Storage Project," consisting of both Centers of Excellence (which include teams of competitively selected university, industry and Federal Laboratory partners) and competitively selected independent projects. The R&D will be closely coordinated with the DOE Office of Science basic research efforts in hydrogen storage. Along with the materials research, the applied R&D investment in FY 2008 will include engineering science for systems issues, such as thermal management during refueling of vehicular hydrogen storage systems. ($43.9 million)

Fuel Cell Stack Component R&D

This sustained effort focuses on developing components for the fuel cell stack, overcoming critical technical hurdles to improve overall fuel cell performance and durability while lowering cost. Proton-conducting membranes that are low-cost, durable, and operate at low relative humidity will be developed. New diagnostics will be developed to probe properties of the fuel cell and characterize fuel cell operation. Strategies to increase the lifetime of low-cost hydrocarbon-type membranes to more than 5,000 hours will be explored. The program will scale-up development of bipolar plates that perform as well as machined graphite plates, which are expected to cost significantly less and last longer. Gas diffusion layer physical properties and pore structure will be optimized to enhance fuel cell performance and ease external water management. Seals that ensure the integrity of the fuel cell stack will be made more reliable. The Department will continue its participation in the International Partnership for the Hydrogen Economy (IPHE), working on such projects as the evaluation of fuel cell-related test protocols from different countries. ($44.0 million)

Technology Validation

A critical component of the program is validation of hydrogen infrastructure and fuel cell systems under "real world" operating conditions to assess progress toward targets, help guide research activities where needed, and to lay the foundation for wider public awareness and market transformation. This effort provides critical statistical data on progress toward meeting vehicle and

infrastructure technology targets in the areas of fuel cell efficiency and durability, vehicle system range, and fuel cost. Technology Validation also provides essential information required to establish hydrogen application standards as well as feedback on vehicle and infrastructure safety. Through "50-50" cost-shared partnerships with the automotive and energy industries, FY 2008 activities include operating generation 2 fuel cell vehicles (which have more advanced fuel cells and storage systems) and opening additional advanced technology hydrogen fueling stations. These activities are integrated with the research efforts to ensure that important data is captured and fed back into research and development activities in the areas of hydrogen production, delivery, storage, and fuel cells. ($30.0 million)

Transportation Fuel Cell Systems

Focused research, development, and analysis are needed to address key barriers to the commercialization of fuel cell systems for transportation applications, including cost and durability. This activity supports development of individual component technologies for air, water, and thermal management that are critical to systems integration. This effort also includes systems-level modeling activities that guide research, development, and integration activities and explore alternate systems configurations. Fuel cell system cost and trade-off analyses will be conducted to support technology readiness. Scenarios for operating fuel cell systems at low relative humidity and under sub-freezing conditions will be evaluated. Transportation Systems also supports the development of Auxiliary Power Units for heavy vehicle applications and the R&D of fuel cells for portable power applications. Commercialization of fuel cells for portable power will aid in developing the manufacturing base and will introduce the technology to consumers, thus paving the way for fuel cell systems being used in transportation applications. ($8.0 million)

Distributed Energy Fuel Cell Systems

High-efficiency polymer electrolyte membrane (PEM) fuel cell power systems are being developed as an alternative power source to grid-based electricity for buildings and other stationary applications. Distributed Energy Fuel Cell Systems focuses 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 and cost range of $400 - $750 per kW, making fuel cells competitive with conventional technologies. Distributed energy fuel cell systems also benefit from transportation fuel cell R&D, particularly in the areas of developing improved materials for high temperature membranes, improving fuel cell component durability and water and thermal management. This activity includes stationary fuel cell demonstration projects, involving international and intergovernmental partnerships, in support of the IPHE and the Hydrogen Interagency Task Force. ($7.7 million)

Fuel Processor R&D

This activity develops fuel processors for integrated stationary applications and catalysts suitable for a variety of fuel processing applications. The use of fuels such as natural gas, propane, methanol, ethanol, biomass-derived liquids, or diesel in the fuel processor will allow the environmental and efficiency advantages of hydrogen fuel cell technologies to be realized in an integrated stationary fuel cell system. The option of using a variety of fuels to produce hydrogen or hydrogen-rich reformate to power stationary fuel cells will be a significant contributor to energy independence. Synergies exist between distributed hydrogen production and integrated fuel flexible stationary fuel cell systems. ($3.0 million)

Safety and Codes and Standards

This activity facilitates the development of codes and standards for hydrogen applications through R&D that provides a scientific basis for standards requirement and by supporting Standards Development Organizations (SDOs) and Code Development Organizations (CDOs) to conduct their established consensus processes. Successful commercialization of hydrogen technologies requires a comprehensive and defensible database on component reliability and safety, published performance-based domestic standards, and international standards or regulations that will allow the technologies to compete in a global market. In FY 2008, increased emphasis will be placed on codes and standards for near-term hydrogen applications such as forklifts, back-up power and portable devices. R&D will also focus on the development of critical standards such as hydrogen quality and high pressure refueling. In 2008, activities that support the promulgation of safety information include the publishing of an on-line Best Practices Handbook, independent safety evaluations of ongoing hydrogen projects, and updating of the "H_2Incidents" and hydrogen safety bibliographic websites. ($16.0 million)

Education

By increasing understanding of hydrogen and fuel cell technologies, education facilitates the successful implementation of hydrogen and fuel cell demonstration projects and early market transformation. It also lays the foundation for future market adoption and acceptance, which are required to realize the long-term benefits of using hydrogen as an energy carrier. FY 2008 activities will ramp up the development and distribution of educational materials and training for safety and code officials, state and local governments, and potential end-users to support the program's overall market transformation efforts and related provisions in EPACT 2005. In coordination with technology validation projects, funding will support public education and outreach, with an emphasis on understanding the facts about hydrogen safety. Activities will also include the development and expansion of hydrogen and fuel cell programs at colleges and universities, as well as hands-on activities and teacher training at the middle and high school levels. ($3.9 million)

Systems Analysis

Systems Analysis enables an understanding and assessment of technology needs and progress, the potential environmental impacts, and the energy-related economic benefits of the various hydrogen supply and demand pathways. This analysis is done to directly support program decision-making, planning and budgeting, and interactions with other energy domains. Systems Analysis includes independent analysis and evaluation functions consistent with the recommendations of the National Research Council (NRC). One of the findings of the NRC's report on hydrogen states, "The effective management of the DOE Hydrogen Program will be far more challenging than any activity previously undertaken on the civilian energy side of the DOE."[1] Aligned with the NRC's recommendations, Systems Analysis activities identify the impacts of various hydrogen technology pathways, determine key cost drivers and technology gaps, evaluate the significance of research results, and assist in the prioritization of research and development directions. ($11.5 million)

[1] National Research Council and National Academy of Engineering, Committee on Alternatives and Strategies for Future Hydrogen Production and Use, *The Hydrogen Economy: Opportunities, Costs, Barriers, and R&D Needs* (Washington, DC: National Academies Press, 2004).

Manufacturing R&D

In support of the President's Manufacturing Initiative, this new activity focuses on R&D of innovative and cost-effective manufacturing processes and technologies for PEM fuel cells, and hydrogen production, delivery, and storage systems. Government, academic, and industry experts identified research needs and priorities in the "Roadmap on Manufacturing R&D for the Hydrogen Economy." Near-term research and development activities will address manufacturing processes and technologies essential for market transformation, initially in niche applications such as forklifts and back-up stationary power, including: 1) membrane-electrode assemblies and bipolar plates for fuel cells; 2) distributed reforming and electrolysis systems and components for producing hydrogen; and 3) vessels, valves, and regulators for hydrogen storage and dispensing. These research activities will cultivate a robust domestic manufacturing capability in evolving hydrogen infrastructure and fuel cell technologies, vital to establishing U.S. economic leadership in emerging hydrogen and fuel cell industries. ($5.0 million)

Hydropower Program

The Hydropower Program effectively transitioned remaining program activities and information to industry and the public sector and was closed out in FY 2006. No funding is requested in FY 2008.

FY 2008 Budget Request Hydropower			
	Funding ($ in thousands)		
Activity	FY 2006 Approp.	FY 2007 Request	FY 2008 Request
Technology Viability	150	0	0
Technology Application	345	0	0
TOTAL	**495**	**0**	**0**

(Note: The FY 2007 request column shows the budget request because no full year appropriation has been enacted.)

Industrial Technologies Program

The Industrial Technologies Program (ITP) seeks to reduce the energy intensity (energy demand per unit of industrial output) of the U.S. industrial sector through coordinated research and development, validation, and dissemination of energy-efficiency technologies and operating practices. Industry energy consumption accounts for about one-third of all U.S. energy use, and improved industrial energy intensity will contribute significantly to our national effort to reduce oil imports, natural gas demand, and the need for new power plants, while lowering harmful environmental emissions. In addition, more energy-efficient production processes and technologies will accelerate industrial modernization and enable U.S. companies to compete more successfully in global markets. ITP estimates that in 2004, ITP programs and technologies contributed to industrial energy savings of over $3.1 billion. Newly-developed technologies resulting from ITP's R&D activities are now being utilized as energy saving solutions in the 250 industrial energy assessments being performed across the country. These assessments are part of the Secretary of Energy's "Easy Ways to Save Energy" campaign and will build upon the nearly $500 million of potential annual energy savings and nearly 0.8 MMTCE of carbon emissions identified in the energy assessments performed in FY 2006.

The Fiscal Year 2008 budget request of $46.0 million for Industrial, which is a $0.4 million increase over the FY 2007 request. Internal funding shifts reflect a continued strategy to emphasize more effective and efficient ways to increase energy efficiency among energy intensive industries. The shift toward more crosscutting and higher impact R&D activities will allow ITP to focus on fewer R&D projects with higher impacts for a broader set of industries.

FY 2008 Budget Request
Industrial Technologies

Activity	Funding ($ in thousands) FY 2006 Approp.	FY 2007 Request	FY 2008 Request
Industries of the Future (Specific)	20,708	17,001	9,254
Industries of the Future (Crosscutting)	27,928	28,562	36,744
Technical/Program Management Support	3,755	0	0
Congressionally Directed Activities	3,465	0	0
TOTAL	**55,856**	**45,563**	**45,998**

(Note: The FY 2007 request column shows the budget request because no full year appropriation has been enacted.)

Industries of the Future (Specific)

Working with industrial partners, Industries of the Future (Specific) supports cost-shared research, development, and demonstration 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, ITP will begin a three-year process in FY 2008 to transition from industry-specific R&D with narrower applications to more crosscutting research as funding and investigation for existing multi-year projects are completed. Future initiatives will be broader in application potential and enable ITP to shift toward higher impact R&D activities to dramatically improve the energy efficiency and environmental performance of energy-intensive industries. This shift will sharpen ITP's focus on key programmatic objectives that support the Department's strategic goals, along with advancing the economic productivity goals of the American Competitiveness Initiative. ($9.3 million)

- Forest and Paper Products. This activity will focus on completing research to investigate avenues for the reduction of natural gas use. The program will also continue development of energy efficient technology to replace the conventional energy-intensive water removal and paper drying process with 40 percent energy savings potential. Continued collaboration with the American Forest and Paper Association and other industry organizations will lead to commercial introduction of an underwater sparker that improves the efficiency of contaminant removal in the paper recycling process by 10-15 percent. ($1.8 million)

- Steel Industry. This activity will focus on processes that both reduce the use of natural gas and improve energy efficiency in iron and steelmaking. The program will continue to support the American Iron and Steel Institute, Steel Manufacturers Association and other industry organizations to improve domestic steel companies' energy efficiency. ($1.7 million)

- Aluminum Industry. This activity will continue the development of a revolutionary electric-based technology for the aluminum melting process with potential to reduce energy use by one-half, while reducing emissions by more than 80 percent. ($1.8 million)

- Metal Casting Industry. This activity will conclude its research in advanced melting and innovative processes and transfer research and development results to industry. ($0.2 million)

- Chemicals. This activity will focus on bringing existing projects addressing critical areas in oxidation reactions, hybrid distillations and micro reactors to conclusion. In FY 2008, research will include the completion of the development of a microchannel distillation technology that will revolutionize distillation technology in general and improve the overall distillation column efficiency by over 40 percent. ($3.8 million)

Industries of the Future (Crosscutting)

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 industries. Leveraging on its successful partnership with energy-intensive industries as well as its innovative technology transfer practices, in FY 2008 ITP will begin a transition to more multi-industry application and transformational R&D activities in the Energy-Intensive Process R&D key activity. New research relating to industrial materials, combustion, robotics, sensors and automation will be merged into this activity and enable ITP to shift toward broader research areas with higher energy efficiency and environmental performance impacts for energy-intensive industries.

In addition, Fuel and Feedstock Flexibility activities will lead to the development and deployment of alternative fuel and feedstock technologies to replace natural gas and oil. Several new activities will be undertaken in FY 2008. For example, as part of the Interagency Manufacturing R&D activity, ITP will be able to contribute to multi-agency funding of manufacturing R&D, thus participating in a

larger pool of matching funds for research in areas like the processes needed for nanomanufacturing. Deployment activities such as Industrial Assessment Centers and the Best Practices activities will continue to deliver the results of energy-efficiency R&D and energy-saving practices to industrial plants nationwide. ($36.7 million)

- Industrial Materials of the Future. FY 2008 activities will include the demonstration of new refractory materials production and applications techniques for refractory systems with 20 percent better thermal efficiencies and 100 percent better life spans compared to conventional refractories for industrial processes. Collaborations with industry will lead to the commercial introduction of ultrananocrystalline diamond coating (UNCD), a new class of coating for industrial applications to dramatically reduce frictional torque by 75 percent and energy losses leading to longer seal lifetimes and more reliable industrial operations. Research will continue on the development of transformational advanced materials solutions such as membranes for waste energy recovery; refractories for industrial systems; and materials solutions for corrosion and wear. ($4.9 million)
- Combustion. This effort will focus on completing field trial testing to facilitate market adoption of the ultra-high efficiency, ultra-low emissions first-generation SuperBoiler (>94 percent efficiency, <2 ppmv NOx). ($0.7 million)
- Sensors and Automation. This key activity will be scaled down to complete existing projects. FY 2008 activities will include demonstration of a new technology for machine vision detection of surface flaws in metals processing with an 80 percent steel bar surface defect reduction potential. Collaborations with industry will lead to application of wireless temperature monitoring and security system for robust communications to reduce maintenance and improve productivity at an industrial plant. ($1.9 million)
- Industrial Technical Assistance
  - Industrial Assessment Centers. The ITP Industrial Assessment Centers (IAC) activity contributes to the Administration's goal of training more engineers and scientists in the energy field. IAC alumni are very much in demand by top firms as energy managers with real-world knowledge and experience, ready to work on projects immediately and improve the bottom line. The IAC funds a network of universities which send graduate engineering students out to small and medium-sized manufacturers to conduct free energy audits. These assessments identify a range of efficiency improvements, including no-cost and low-cost recommendations, and help U.S. manufacturers struggling to cope with high energy prices. This program seeks by 2020 to have completed more than 20,300 Industrial Assessment Audits. Since its inception in 1976, the IAC program (formerly known as the Energy Analysis and Diagnostic Center Program), has trained more than 3,550 engineering students. In FY 2008, the program will perform 350 days of industrial assessments while providing energy, waste, and productivity training to another 120 engineering students at 14 newly selected universities. These efforts help provide a nationwide cadre of experienced and trained engineering alumni. The student certification program will provide these students with credentials important in their further graduate studies and/or in their careers in saving energy in industry. ($4.0 million)
  - Best Practices. This activity will continue "Save Energy Now" energy savings assessments to reduce U.S. manufacturing plant natural gas consumption in support of the Secretary of Energy's "Easy Ways to Save Energy" campaign. It will also continue to provide technical assistance to industrial plants and energy intensive data centers, enabling their use of

industrial process application tools relevant to energy feedstock selection, motor, pump, process heating, electrical, steam and compressed air systems emphasizing system-level improvements. The Department will expand partnerships for leveraging opportunities with trade and technical associations, Federal agencies, local governments, and others to facilitate replication and recognition of plant-wide assessment results. ($8.8 million)

- Energy-Intensive Process R&D. This new initiative will support multi-industry R&D in the four platform areas of: Advanced Energy Systems (including high efficiency steam generation and combustion technologies and improved energy recovery technologies), Industrial Reaction and Separation (including oxidation processes and advanced water removal), High-Temperature Processing (including high efficiency calcining and next-generation steelmaking), and Fabrication and Infrastructure Technologies (including near net shape casting and forming). Some research relating to industrial materials, combustion, robotics, sensors, and automation will be merged into this activity and enable ITP to shift toward broader research areas with higher energy efficiency and environmental performance impacts for energy-intensive industries. This shift toward larger targets of energy savings opportunities will expedite development of advanced energy-efficient technologies to serve a broader set of industries. ($7.5 million)
- Fuel and Feedstock Flexibility. Seeking to expand fuel and feedstock flexibility, this new activity will give manufacturers options for responding to volatile energy prices and supply pressures. Initial efforts will focus on technical analysis of new advanced fuel and feedstock flexibility technology platforms and industrial process integration issues. Targeted technology deployment efforts for currently available technology will enhance knowledge among industrial decision makers, catalyze stakeholder collaboration, and generate reliable data and analyses in support of fuel and feedstock flexibility implementation in the industrial sector. ($4.0 million)
- Inter-Agency Manufacturing R&D. This new R&D activity will support the development of next-generation adaptable technologies which have the potential to revolutionize the energy and environmental profiles of U.S. manufacturing processes. Next-generation technologies, such as an entirely new processing route and supply chains, can have broad applications across industry sectors, and typically require high-risk, high-return R&D which one industry cannot usually undertake. Initial research focus will include development of technologies such as integrated process predictive tools and wireless real-time sensors systems that are synergetic and adaptable to the confluence of manufacturing processes and products that may reside in dissimilar industries today. The activity will also explore techniques and processes needed for nanomanufacturing, enabling the mass production and application of nano-scale materials, structures, devices, and systems to transform the energy impacts of industrial processes and improve economic productivity. ($5.0 million)

Solar Energy Program

The mission of the Solar Energy Program ("Solar Program") is to conduct aggressive research, development, and deployment of solar energy technologies and systems. As part of the President's Advanced Energy Initiative (AEI), which seeks to change the ways we power our homes, businesses and automobiles, the Solar Program is working to develop cost-competitive solar systems for the Nation. Through the *President's Solar America Initiative* (SAI), announced in the 2006 State of the Union, the Solar Program will accelerate the market competitiveness of solar electricity as industry-led teams compete to deliver solar systems that are less expensive, more efficient and highly reliable. By focusing on manufacturing and systems integration issues, the SAI will support the deployment of 5 gigawatts (GW) of new grid-connected solar electricity generating capacity by 2015.

FY 2008 Budget Request
Solar Energy

Activity	Funding ($ in thousands) FY 2006 Approp.	FY 2007 Request	FY 2008 Request
Photovoltaic Energy Systems	58,802	139,472	137,304
Concentrating Solar Power	7,284	8,900	9,000
Solar Heating and Lighting	1,449	0	2,000
Congressionally Directed Activities	14,256	0	0
TOTAL	**81,791**	**148,372**	**148,304**

The Fiscal Year 2008 budget request for Solar Energy is $148.3 million, which fully supports the AEI. FY 2006 included $14.3 million (17.4 percent) in congressionally directed activities.

(Note: The FY 2007 request column shows the budget request because no full year appropriation has been enacted.)

Targeting improved performance and reliability with reduced cost, the Solar Program focuses its research, development, and deployment activities in three technology areas: photovoltaics, concentrating solar power, and solar water heating.

Photovoltaic Energy Systems

The Photovoltaic Energy Systems (PV) subprogram goal is to develop and deploy highly-reliable PV systems with user lifetime energy costs competitive with electricity from conventional resources. The PV subprogram attempts to achieve this goal by: 1) increasing the sunlight-to-electricity conversion efficiency (performance) of cells, modules and systems; 2) reducing the manufacturing cost of cells, modules, balance of plant components, and overall systems; 3) reducing the installation, interconnection and certification costs for residential, commercial and utility systems, and 4) increasing system operating lifetime and reliability.

To lower costs more rapidly and improve performance, the Solar Program is focusing on PV technology pathways that have the greatest potential to reach cost competitiveness by 2015. Industry-led partnerships, known as "Technology Pathway Partnerships," will be continued in FY 2008 to aggressively address the issues of cost, performance, and reliability associated with each pathway. Under the SAI, substantial work on PV modules, the heart of PV systems, as well as other "balance-of-system" (BOS) components will be conducted. In addition to PV industry members, partners within the Technology Pathway Partnerships include universities and National Laboratories. The PV subprogram will also coordinate with the Building Technologies and the Federal Energy Management programs, and the DOE Office of Science on SAI activities.

The PV subprogram has four major research, development and deployment activities.

- Applied Research. In FY 2008, this activity will conduct cross-cutting research focused on semiconductor material, device and processing issues that benefit multiple companies and/or technologies. Under Applied Research there will be three main research activities performed in FY 2008: the University and Exploratory Research project; the High Performance project; and the Electronic Materials and Devices research activity. The University and Exploratory Research Project works on cross-cutting research to help solve fundamental scientific problems associated with all PV materials and devices, as well as investigating innovative ideas that may lead to next-generation technologies. The High Performance project supports research to substantially increase the efficiency of thin films and multi-junction concentrating cells. The Electronic Materials and Devices Project conducts research in semiconductor materials, device properties, and fabrication processes to improve the efficiency, stability, and cost of photovoltaics. This research supports technology in near, mid- and long-term time frames. ($24.8 million)

- Systems Development. In FY 2008, this activity will work primarily through cost-shared contracts with industry to advance the development of PV systems and components. Systems Development has two primary projects, the Technology Pathway Partnerships (TPPs) and Component Development. Under the TPPs, industry led teams are funded to develop photovoltaic technologies which have the greatest potential for cost-competitiveness by 2015. Examples of promising PV technologies include crystalline silicon and thin film modules and systems. The TTPs will also consider development and testing of balance-of-system component designs that address emerging requirements for modularity, reliability, and decreased installation cost.

  The Component Development activity will use industry, laboratories and universities to help advance the state-of-the-art of individual components as opposed to fully integrated systems. There are four project activities under Component Development: Thin Film Partnerships; Advanced Module Manufacturing; Module Packaging; and Inverter and BOS development. To accommodate SAI, the Thin Film Partnership and Advanced Manufacturing R&D cost-shared contracts with industry will be brought to successful completion in FY 2008. All work considered valuable under these two activities will have been re-competed under the Technology Pathway Partnership solicitations. In the Module Packaging activity, researchers will work to solve reliability issues such as degradation mechanisms and intrinsic instabilities of pre-commercial thin film modules, and to improve packaging for 30-year outdoor lifetime. Inverter BOS development focuses on the critical need to improve the reliability of the inverter and other BOS components. ($81.0 million)

- Technology Acceptance. In FY 2008, this activity will continue work on the multi-year solicitations launched in FY 2007. These aggressive market transformation activities will promote adoption of market-ready solar technologies by providing targeted tools and assistance to important stakeholders such as States, cities, utilities, the building industry, and the Federal sector. Market transformation efforts also facilitate continued growth of the domestic solar market by addressing key market barriers such as substandard interconnection and net metering practices. Several leadership teams will continue solar codes and standards work, while the program develops a voluntary performance standard for PV modules. New finance activities will be developed pending the results and recommendations of the finance scoping study conducted in FY 2007; additional market studies and research will continue. In addition, the Technology Acceptance area will fund continued targeted communications and outreach work that supports the mission of SAI. ($16.6 million)

- Technology Evaluation. This is a new activity area for FY 2008 that contains no new R&D work, but rather contains ongoing activities transferred from the other three PV areas. Technology Evaluation activities focus on evaluation of technical advances throughout the Solar Program using independent testing and analysis, including the evaluation of ongoing system-level progress of the Technology Pathway Partnerships.

  Technology Evaluation will contain three primary activities: Systems Analysis; System Test and Evaluation; and Component Test and Evaluation. System Analysis activities will continue benchmarking, modeling and analysis for the systems driven approach, and market, value and policy analysis necessary to support the SAI. Systems Test and Evaluation activities will focus on the critical need to test and evaluate all the deliverables developed under the TPPs. Under the third activity, Component Test and Evaluation, researchers work in partnership with universities, industry and the National Laboratories to improve the efficiency of cell materials and devices by investigating their fundamental properties and operating mechanisms. ($14.9 million)

Concentrating Solar Power

Concentrating solar power (CSP) systems utilize the heat generated by concentrating and absorbing the sun's energy to drive a heat engine/generator to produce electric power. Concentrating sunlight produces thermal energy at temperatures ranging from 600° F to over 1500° F, which can be used to run heat engines or steam turbines for generating power or producing clean fuels such as hydrogen. There are currently three types of solar thermal systems – parabolic trough, power tower and dish-engine systems – that are capable of producing power using the sun's heat. Trough systems use linear parabolic concentrators to focus sunlight along the focal lines of the receivers. In a power tower system, a field of two-axis tracking mirrors, called heliostats, reflects sunlight onto a receiver that is mounted on top of a centrally located tower. Dish-engine systems are well suited for distributed mini-grid applications ranging in size from 2 to 25 kilowatts (kW), but can also be configured for large power applications as illustrated by power purchase agreements signed in 2005 for dish projects of 300 megawatts (MW) and 500 MW.

In FY 2008, the development of advanced thermal energy storage technologies will be expanded. Test of a single tank thermocline energy storage system will be completed. The development of parabolic trough concentrators and receivers will continue and field validation will be conducted on new collector technology. For distributed applications, research in FY 2008 will focus on improving the reliability of dish systems through the operation and testing of multiple units at Sandia National Laboratory test facilities. Sandia will also assist industry in improving the manufacturabilty of dish

systems in preparation for upcoming projects. Construction will be completed of a dish demonstration project likely to be in California. Technical support will also be provided to the Western Governors' Association and several southwestern utilities to assist their CSP deployment activities. ($9.0 million)

Solar Heating and Lighting (SHL)

This activity represents an increased collaboration between the Solar Technologies and Building Technologies Programs to integrate solar technologies into Zero Energy Buildings (ZEB). Specifically, this work will address the integration of photovoltaic systems, solar water heating, and solar space heating into home design and structure. This activity will establish cost goals and new tasks for the subprogram that are consistent with Building Technologies' ZEB goal. One concept that will undergo evaluation in FY 2008 is a hybrid electrical/thermal solar system capable of providing electrical power and thermal energy used for water and/or space heating. Another activity will address the development of solar water heaters for freezing climates, which complements previous R&D on development of a solar water heater applicable to non-freezing climates. Hybrid solar lighting activities will be determined after an evaluation of the technology scheduled for the end of FY 2007. ($2.0 million)

Vehicle Technologies Program

Activities in the Vehicle Technologies Program contribute to two cooperative government/ industry activities: the *FreedomCAR and Fuel Partnership* (where CAR stands for Cooperative Automotive Research) and the *21st Century Truck Partnership*. The *FreedomCAR and Fuel Partnership* is a collaborative effort among the U.S. Council for Automotive Research (USCAR) – representing the three domestic automobile manufacturers, five energy suppliers, and DOE for cooperative, pre-competitive research on advanced automotive technologies having significant potential to reduce oil consumption. Vehicle Technologies Program activities in the *FreedomCAR and Fuel Partnership* focus on advanced, high-efficiency vehicle technologies such as advanced combustion engines and enabling fuels, hybrid vehicle systems (including plug-in hybrids), high-power and high-energy batteries, advanced lightweight materials, and power electronics. These critical technologies can lead to near-term oil savings when used in advanced combustion hybrid and plug-in hybrid electric vehicles. In FY 2008, an increased emphasis will be given to R&D on technologies such as high energy batteries needed for plug-in hybrid electric vehicles.

The *21st Century Truck Partnership* has similar objectives but is focused on commercial vehicles. The partnership involves key members of the commercial vehicle industry, (truck equipment manufacturers and engine manufacturers) along with three other Federal agencies. The R&D centers on improving advanced combustion engine systems and fuels and on reducing vehicle parasitic losses.

FY 2008 Budget Request
Vehicle Technologies

Activity	Funding ($ in thousands) FY 2006 Approp.	FY 2007 Request	FY 2008 Request
Hybrid Electric Systems	0	0	80,664
Vehicle Systems	12,720	13,315	0
Hybrid and Electric Propulsion	42,843	50,841	0
Advanced Combustion Engine R&D	40,594	46,706	34,550
Materials Technology	34,373	29,786	33,382
Fuels Technology	13,356	13,845	13,845
Technology Integration	0	0	13,697
Innovative Concepts	495	500	0
Technology Introduction	6,250	11,031	0
Technical Program Mgmt Support	2,475	0	0
Congressionally Directed Activities	24,255	0	0
Biennial Peer Reviews	990	0	0
TOTAL	**178,351**	**166,024**	**176,138**

The Fiscal Year 2008 request is $176.1 million for the Vehicle Technologies Program, a $10.1 million increase over the FY 2007 request. The FY 2008 request fully supports the FreedomCAR and Fuel Partnership goals for hybrid and internal combustion powertrain systems. In addition, Vehicle Technologies is devoting $27.5 million to plug-in hybrid electric vehicle (PHEV) R&D where the potential oil reduction benefits are significant. FY 2006 included $24.2 million (13.6 percent) in congressionally directed activities. Continued funding for congressionally directed activities within the Vehicle Technologies Program is not requested.

(Note: The FY 2007 request column shows the budget request because no full year appropriation has been enacted.)

The budget structure was modified in the FY 2008 request by consolidating research areas having similar or congruent objectives under a single subprogram. FY 2007 activities indicated as zero dollars requested in FY 2008 are not actually eliminated, but rather have been merged into other activity headings. The exception is congressionally directed activities for which the request is zero.

Hybrid Electric Systems

This subprogram funds R&D for both passenger and commercial vehicles. Efforts include research in energy storage systems, advanced power electronics and electric motors, hybrid system development and integration, and commercial truck energy loss reduction. A key objective of the Hybrid Electric Systems R&D subprogram is to reduce the volume production cost of a high-power 25kW battery for use in passenger vehicles from $3,000 in 1998 to $500 by 2010.

- The Vehicle and Systems Simulation and Testing (VSST) activity integrates modeling, systems, research, and testing efforts to define technical targets and requirements, guide technology development, and validate performance of DOE-sponsored technologies for passenger and commercial vehicles. The activity develops and validates advanced computer models and simulation programs used to:
  - Develop performance targets for vehicle platforms and their components; and
  - Develop advanced control strategies to optimize the overall performance and efficiency of advanced hybrid electric, plug-in hybrid electric, and fuel cell vehicles.

  The activity also performs R&D on heavy vehicle systems to achieve the heavy commercial vehicle fuel efficiency goals of the 21st Century Truck Partnership by:
  - Developing advanced heavy vehicle systems models, and
  - Reducing non-engine parasitic energy losses from aerodynamic drag, friction and wear, under-hood thermal conditions, and accessory loads.

  In FY 2008, the subprogram will expand simulation and laboratory studies of advanced control strategies and components for plug-in hybrid electric vehicles (PHEV). Data collected during laboratory and field tests will be used to enhance vehicle and systems modeling capabilities and to validate the accuracy of the component models. PHEV activities also will include laboratory and closed track baseline testing and real-world monitored fleet evaluations of advanced plug-in hybrid electric vehicles and in-use testing of vehicles retrofitted with advanced components developed by Vehicle Technologies R&D. Such tests will help identify component and system performance and reliability weaknesses to be addressed through future R&D activities. Also to be evaluated are the effects of the infrastructure/vehicle interface and the potential impact of the use of plug-in hybrids on the electricity grid.

  The activity also will enhance engine emission models to determine the impact of future emission control requirements on the fuel economy of advanced flexible-fuel and hybrid passenger vehicle systems and will validate, in a systems environment, performance targets from the power electronics and energy storage technology research and development activities.

  VSST activities will continue to enhance the capabilities of the heavy vehicle systems model by:
  - incorporating data from on-road test and proprietary industry data, and
  - completing integration of turbulence and other computational fluid dynamics (CFD) models including their validation, as well as, including ancillary and under-hood thermal models.

Activities will include the assessment of aerodynamic drag reduction devices, R&D to reduce drivetrain friction and wear, the evaluation of highly efficient cooling systems, and developing under-hood thermal management approaches to improve vehicle efficiencies while increasing component reliability and life. ($21.1 million)

- The Energy Storage R&D activity encompasses all battery research from the Energy Storage activity previously included in the Hybrid and Electric Propulsion subprogram. This activity supports long-term research, applied research, and technology development of advanced batteries for electric, hybrid-electric and plug-in hybrid vehicle (EV, HEV and PHEV) applications. Federal advanced battery development is coordinated through the Interagency Advanced Power Group (DOE, NASA, Army, Navy, and the Air Force).

  Technology development is conducted with industry through the United States Advanced Battery Consortium (USABC). In FY 2008, the program will continue to develop full-sized lithium-ion modules using low-cost, thermally stable, high-performance anode and cathode materials. Lithium-ion batteries offer twice the performance in a lower-cost, lower-weight, and lower-volume package than the nickel metal hydride batteries used in today's hybrid electric vehicles. The emphasis is on driving down the cost and extending the life of lithium ion batteries. Applied research will focus on the investigation of cell behavior, developing methodologies to more accurately predict battery life, understanding factors that limit the inherent abuse tolerance, investigating factors that limit low-temperature performance, and identifying approaches to overcome barriers to the introduction of lithium-ion batteries.

  In FY 2008, the program will continue to validate requirements and refine standardized testing procedures to evaluate performance and life of PHEV batteries, and will continue to identify areas for additional R&D to address the specific battery needs for these vehicles. The performance requirements of PHEVs challenge today's battery technology. PHEV batteries must perform a dual use function by providing electric drive range and engine power assist. As a result, materials with higher energy capacity, better thermal and electrochemical stability (for increased life and safety), and lower cost are needed. In FY 2008, the program will solicit proposals and award additional subcontracts to battery suppliers for development of batteries for plug-in hybrid application. These subcontracts will be awarded competitively through the USABC.

  Long-term research is focused on developing advanced materials for the next generation of energy storage technologies. In FY 2008, the Energy Storage long-term activity will examine innovative materials and electrochemical couples that offer the potential for significant improvements over existing technologies for use in both hybrid, plug-in hybrid electric and all electric vehicles. Novel anode and cathode materials and electrolytes that have higher energy capability, longer and more stable cycling characteristics, and are lower in cost, will be developed and characterized.

  The activity will also conduct benchmark testing and assessments of non-battery energy storage devices, such as ultracapacitors, that have applicability to hybrid vehicle systems. ($41.8 million)

- Advanced Power Electronics and Electric Motors R&D develops low-cost converters and motor controllers, and motors needed for fuel cell and combustion hybrid electric vehicles. In FY 2008, key efforts will be focused on developing integrated inverters, advanced permanent magnet motors, DC/DC converters, SiC components, low-cost permanent magnet materials, capacitors, advanced thermal systems, and motor control systems to meet passenger vehicle requirements. Existing work in these areas will be expanded to address the different demands created by plug-in hybrid systems. Preliminary deliverables will be tested at National Laboratories for conformance to specifications. ($15.6 million)

Advanced Combustion Engine R&D

This subprogram focuses on removing critical technical barriers to commercialization of higher efficiency, advanced internal combustion engines for passenger and commercial vehicle application. The goals are to improve the engine efficiency for passenger vehicles to 45 percent by 2010 and for commercial vehicles to 55 percent by 2013, while meeting cost, durability, and emissions objectives.

- Combustion and Emission Control R&D activity has been expanded to include the Heavy Truck Engine and the Health Impacts activities. This activity supports the Vehicle Technologies Program goal to enable energy-efficient, clean vehicles powered by advanced internal combustion engines using clean, petroleum- and non-petroleum-based fuels and hydrogen**.** The purpose of this activity is to develop technologies for advanced engines, with the goal of improving thermal efficiency by optimizing combustion, fuel injection, emission control, and waste heat recovery systems, along with reducing friction and pumping losses while ensuring that no new air toxic compounds are generated. There will be a continued emphasis on research in advanced combustion regimes (Homogeneous Charge Compression Ignition and other modes of low temperature combustion) that have the potential to achieve the efficiency goals for cars and trucks while maintaining cost and durability with near-zero emissions of NO_x and particulate matter. 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 in passenger vehicles, and further improve the efficiency and reduce the cost of engines used in commercial vehicles. The health impacts research will continue to evaluate the relative toxicity and consequent human health implications of emissions from new combustion technologies, new fuels derived from unconventional feedstocks, and new blending agents such as biodiesel and hydroisomerized vegetable oils. ($29.7 million)

- Solid State Energy Conversion activity develops technologies to convert waste heat from engines and other sources to electrical energy or work to improve overall thermal efficiency and reduce emissions. This activity will continue cost-shared cooperative agreements awarded in FY 2004 to develop and fabricate high efficiency thermoelectric devices that will recover from 1 to 3kW of electric power from engine waste heat for passenger vehicle and up to 5kW for commercial vehicle application. These improvements could increase vehicle fuel economy by up to 10 percent. For these waste heat applications, the research will demonstrate conversion efficiencies greater than 15 percent using direct energy conversion methods, such as nano-scale high-efficiency thermoelectrics, thermionics, or other innovative concepts. ($3.9 million)

Materials Technology

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 advanced vehicles and other technologies presented elsewhere in the Vehicle Technologies budget. The subprogram consists of three activities: Propulsion Materials Technology, Lightweight Materials Technology, and the High Temperature Materials Laboratory (HTML). The three activities contribute to the VT Program goal by developing higher performing, more cost effective materials that will make lighter vehicle structures and more efficient power systems possible. Lighter vehicles require less energy to operate and thus reduce fuel consumption. Likewise, better propulsion materials can enable more efficient power systems that will contribute to a vehicle's reduced energy consumption. ($33.4 million)

- Propulsion Materials Technology focuses on research that is critical to removing barriers to improved hybrid-electric drives, advanced combustion engines, high efficiency drive-trains, and

emission control technologies. The activity will develop materials necessary for critical engine control sensors, high efficiency motor controllers, high efficiency clean combustion engines, addressing advanced fuel (hydrogen and ethanol) compatibility issues, and developing treatments (coating and surface modifications) for high efficiency gear-trains. Using new analytical and simulation methods, Propulsion Materials will formulate, characterize, and stabilize nano-materials for improved energy storage, energy recovery, and emission control devices for transportation applications. ($9.4 million)

- The Lightweight Materials Technology activity develops metal processing technologies, composite materials, recycling systems, and technical data to reduce vehicle weight while maintaining safety, performance, and reducing cost. It will emphasize technologies for manufacturing lightweight components made from the various materials researched and developed in previous years, especially carbon-fiber-reinforced polymer-matrix composites and magnesium. The purpose will be to lower the costs even further toward cost neutrality. The activity will pursue five areas of research: manufacturability, design data and test methods, joining, recycling/repair, and cost reduction. Reducing vehicle weight through improved design and increased use of lightweight materials is one of the most effective means of improving vehicle fuel economy. Because the single greatest barrier to the use of lightweight materials is their high cost, priority is given to activities aimed at reducing cost through development of new materials, forming technologies, and manufacturing processes. ($18.7 million)
- The High Temperature Materials Laboratory is an advanced materials R&D industrial user center at the Oak Ridge National Laboratory that develops cutting-edge analytical techniques to identify innovative materials for use in surface transportation applications. Projects include investigation of compositional and structural conditions of metals, alloys, ceramics, and novel materials under development for vehicle applications. The Nation's first Aberration Corrected Electron Microscope (ACEM) that has both sub-angstrom level clear imaging and chemical analysis capabilities is being used to study complex material structures such as various formulations of emissions-control catalytic materials identified as promising candidates by the *FreedomCAR and Fuel* and *21st Century Truck Partnerships*. ($4.4 million)

Fuels Technology

The Fuels Technology subprogram supports R&D that will provide vehicle users with cost-competitive fuel options that enable high fuel economy, deliver low emissions, and contribute to petroleum displacement. There are two major aspects of the work: the first is to assess the fuel-related impacts on advanced combustion engines envisioned for the post-2010 timeframe. Such engines will provide high efficiency, comparable to diesel engines, with significantly less engine-out emissions than current diesel engines produce. The second aspect is to address the direct displacement of petroleum-based fuel components by non-petroleum based alternatives in fuels for current vehicles as well as in post-2010 advanced vehicles. Subprogram activities are grouped according to these two primary approaches to petroleum displacement: Advanced Petroleum-Based Fuels (APBF) and Non-Petroleum-Based Fuels and Lubricants (NPBFL). ($13.8 million)

- The Advanced Petroleum-Based Fuels activity in FY 2008 will continue awards made under the two High Efficiency Clean Combustion solicitations (in FY 2005 and FY 2006) and these will account for a significant portion of APBF activities. The on-going work under these awards is intended to identify fuel property requirements of post-2010 passenger vehicle and heavy vehicle advanced internal combustion engines. The activity will continue development of predictive tools that relate molecular structure to ignition behavior and heat release of fuels in advanced internal combustion engines. Through the combined industry/Government effort, kinetic modeling of base

fuel properties that affect advanced combustion regime engine operation will be expanded. ($6.5 million)

- The Non-Petroleum-Based Fuels and Lubricants activity in FY 2008 will continue development of 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, and will continue development of a predictive model based on this data. The activity also will develop and optimize vehicle engines, such as optimized E85 ethanol flexible fuel engines, that take advantage of the fuel properties of high ethanol blends or other non-petroleum-based fuels in order to improve fuel economy or other performance issues associated with their use. ($6.9 million)

Technology Integration

The Technology Integration subprogram accelerates the adoption and use of alternative fuel and advanced technology vehicles to help meet national energy and environmental goals and accelerate dissemination of advanced vehicle technologies through demonstrations and education. Deployment activities linked to R&D also provide early market feedback to emerging R&D. The regulatory elements include legislative, rulemaking, and compliance activities associated with alternative fuel requirements identified within the Energy Policy Acts of 1992 and 2005. Also included are the Advanced Vehicle Competitions and Graduate Automotive Technology Education activities that support the development of students with technical skills in the same areas of technology where the program is engaged in advanced R&D. ($13.7 million)

- The Graduate Automotive Technology Education (GATE) activity in FY 2008 will fund eight GATE Centers of Excellence (competitively selected) to develop new curricula and provide research fellowships for approximately 25 students for research in advanced automotive technologies, including hybrid fuel cell and plug-in hybrid electric vehicles. ($0.5 million)

- The Advanced Vehicle Competitions in FY 2008 will conduct the fourth year of the Challenge X 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. ($1.3 million)

- The Legislative and Rulemaking activity consists of implementation of the State and Alternative Fuel Provider Regulatory Program 10CFR Part 490, alternative fuel designations, the Private and Local Government Fleet Regulatory Program, and implementation of other EPACT requirements including reports and rulemaking, analyses of the impacts from other regulatory and pending legislative activities, and the implementation of legislative changes to the EPACT fleet activities as they occur. The fleet programs require selected covered fleets to procure alternative fuel passenger vehicles annually. ($1.8 million)

- The Vehicle Technologies Deployment activity will continue to promote the adoption and use of petroleum reduction technologies and practices by working with local Clean Cities coalitions and their stakeholders, industry partners, fuel providers, and end-users. Technology focus areas include: alternative fuel vehicles, alternative fuel infrastructure development, idling reduction for commercial trucks and buses, expanded use of non-petroleum and renewable fuel blends such as E85, hybrid vehicles, driving practices for improved efficiency, and engine/vehicle technologies that maximize fuel economy. The program also will continue efforts to provide technical assistance for early adopters of technologies and provide education, training, and workshops to coalitions, public safety officials, and stakeholders related to infrastructure development and targeted niche market opportunities. The program will identify and support opportunities to

showcase the technology focus areas and continue to build national and regional alliances to promote petroleum reduction strategies and will support further expansion of ethanol infrastructure deployment. Demonstration and deployment of other alternative-fuel and advanced combustion and emission control technologies developed by DOE will also be supported. ($9.6 million)

- Biennial Peer Reviews - In FY 2008 there will be a biennial review of the FreedomCAR and Fuel Partnership activities. The review will be conducted by an independent party to evaluate progress and program direction. ($0.5 million)

Weatherization and Intergovernmental Activities Program

The Weatherization and Intergovernmental Activities Program develops, promotes and accelerates 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, Native American Tribal Governments, and international partners.

FY 2008 Budget Request
Weatherization and Intergovernmental Activities

Activity	Funding ($ in thousands) FY 2006 Approp.	FY 2007 Request	FY 2008 Request
Weatherization Assistance Program Grants	242,550	164,198	144,000
State Energy Program Grants	35,640	49,457	45,501
State Energy Activities	495	0	0
Gateway Deployment	25,400	0	0
International Renewable Energy Program	3,871	2,473	0
Tribal Energy Activities	3,960	3,957	2,957
Renewable Energy Production Incentive	4,950	4,946	4,946
Asia Pacific Partnership	0	0	7,500
TOTAL	**316,866**	**225,031**	**204,904**

The Fiscal Year 2008 request for Weatherization and Intergovernmental Activities is $204.9 million, $20.1 million less than the FY 2007 request.

(Note: The FY 2007 request column shows the budget request because no full year appropriation has been enacted.)

The reduction is due to the phase out of the International Renewable Energy Program and decreases in the amounts requested for Weatherization Assistance Program Grants and Tribal Energy Activities. These changes enable greater investments in advanced R&D within the EERE portfolio that can address critical national priorities: reducing dependence on foreign oil, accelerating the development of clean electricity supply options, and developing highly efficient new technologies and products for our homes and buildings. A number of these advances are expected to increase the effectiveness of Weatherization and Intergovernmental Program deployment efforts in the outyears.

The Asia Pacific Partnership (APP) is a new activity in FY 2008. APP is an opportunity to encourage clean energy technology deployment among six countries: Australia, China, India, Japan, South Korea, and the United States. The six partner countries represent about half of the world's economy, population, and energy use.

Weatherization Assistance Grants

Weatherization Assistance provides technical assistance and formula grants to state and local weatherization agencies throughout the United States. A network of over 900 local agencies provides trained crews and contractors 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 or a person with disabilities. Other priorities may be given to families with children, and households that spend a disproportionate amount of their income on energy bills. 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 most appropriate for the home. A combination of those energy-saving measures is then installed. ($144.0 million)

- Weatherization Assistance provides state formula grants to enable the weatherization of 54,599 low-income homes, saving $1.53 in energy costs for every dollar invested over the life of the measures. Most of the funds are allocated to the states as operating funds for this purpose, i.e., for labor, materials, equipment, administrative systems, etc. To maintain a high standard of technology application, effectiveness, and results, a small amount of each grant is allocated for state-managed training and technical assistance. ($139.5 million)

Training and Technical Assistance supports a variety of DOE-led planning, management, evaluation, and technology transfer activities. Of special interest is the third year of the national evaluation of the Weatherization Assistance Program. The evaluation focus is on measuring progress in meeting program objectives and updating estimates of energy savings, energy bill reductions, program costs, and program benefits. Technical assistance is also provided to States and local agencies that use Department of Health and Human Services' Low-Income Home Energy Assistance Program (LIHEAP) funds for DOE Weatherization services. ($4.6 million)

State Energy Program Grants

The State Energy Program (SEP) provides financial and technical assistance to states, enabling state governments to target their high priority energy needs and expand clean energy choices for their citizens and businesses. Current program emphasis is on improving state energy emergency preparedness, strategic planning, and encouraging implementation of EPACT 2005. With the grant funds and leveraged resources, the state and territory energy offices develop and manage a variety of energy efficiency and renewable energy programs. Program benefits include reduced energy use and costs, environmentally conscious economic development, increased renewable energy generation capacity, and lessened reliance on imported oil. SEP also provides technical assistance to States in the planning, management, evaluation, and information technology areas. ($45.5 million)

- State Energy Program Formula Grants provides grants to 50 states, DC, and territories for energy efficiency and renewable energy programs. This ensures all states have energy programs and services for citizens, while maintaining the viability of the national state energy office network. ($35.0 million)
- State Energy Program Competitive Projects awards competitive grants to support states with innovative, financially self-sustaining energy efficiency and renewable energy planning and program activities. SEP Competitive Projects' focus is on accelerating market penetration of renewable and efficiency technologies and increasing available capital for energy projects. Examples of project areas are: revolving loan funds, financing risk reduction, performance contracting, and market-oriented regional consortiums. ($10.5 million)

Other Intergovernmental Activities

These activities promote the market transfer of clean energy innovations for sustainable development, trade, security, environment and climate. ($15.5 million)

- Tribal Energy Activities builds partnerships with Tribal governments to help assess Native American energy needs for residential, commercial, and industrial uses. Additionally, it provides technical and financial assistance in energy efficiency and renewable energy project development. Energy projects are competitively awarded on a cost-shared basis for Native American Tribes to implement comprehensive energy plans. ($3.0 million)
- Renewable Energy Production Initiative (REPI) stimulates clean energy electricity generation. REPI provides financial incentive payments to public and Tribal utilities and not-for-profit electric cooperatives for renewable generation systems that use solar, wind, geothermal, or biomass technologies. ($5.0 million)
- Asia Pacific Partnership is an innovative Administration effort to accelerate the development and deployment of clean energy technologies. Founding partners (Australia, China, India, Japan, Republic of Korea, and the United States) have agreed to work together and with private sector partners to meet goals for energy security, national air pollution reduction, and climate change in ways that promote sustainable economic growth and poverty reduction. The Partnership focus is on expanding investment and trade in clean energy technologies, goods, and services in six key market sectors. EERE will provide support to the residential and commercial buildings, power systems, and industries action areas. ($7.5 million)

Wind Energy Program

The mission of the Wind Energy Program is to support the AEI objective to maximize wind energy resource utilization in the United States by leading the Nation's R&D efforts to improve wind energy generation technology, and to address barriers to the use of wind energy in coordination with stakeholders. Fulfilling this mission will result in greater energy security and enhanced domestic economic benefit through more diverse, clean, reliable, affordable, and secure domestic electricity supplies.

In the AEI, the President recognized wind energy's potential contribution with the following comments:

> "*Areas with good wind resources have the potential to supply up to 20 percent of the electricity consumption of the United States."* [Advanced Energy Initiative, February 2006, p. 13]

In response to the AEI and EPACT 2005, the Wind Energy Program has increased focus on near-term actions to significantly accelerate use of wind energy technologies, thus reducing the Nation's dependence on imported and environmentally damaging energy sources. The Wind Energy Program contributes directly to EERE's and DOE's mission of improving national, energy, and economic security and addresses the call set forth by the President's National Energy Policy, the AEI, and EPACT 2005 for increasing the diversity of our Nation's energy resources.

Since 2000, wind energy has demonstrated significant expansion and promise as an affordable energy supply, increasing from about 2.5 GW to nearly 11 GW by the end of 2006. Dramatic growth has occurred on an annual percentage basis. With further research, the existing untapped wind resource offers immense opportunity for the future. The Wind Program recognizes that wind energy is at a transitional point, particularly for large land-based wind systems, that is shifting the areas of focus for the Federal effort. The program is concentrating on reducing risks that undermine the growth potential of wind energy in the United States by focusing on improving cost, performance, and reliability of large scale land-based technology; facilitating wind energy's rapid market expansion by anticipating and addressing potential barriers (i.e., integration into the electric grid, siting, permitting, environmental issues); and investigating wind energy's application to other areas--from offshore wind technology to distributed and community-owned wind projects.

The program's new focus aims to maximize wind energy resource utilization, thereby increasing and diversifying the domestic energy supply while enhancing system reliability. This expansion will deliver environmental benefits by avoiding pollutant emissions, and strengthen the Nation's economy by reducing effects of fuel price and supply disruptions.

The FY 2008 budget request for Wind Energy is $40.1 million, a decrease of $3.8 million from the FY 2007. FY 2006 included $12.8 million (33.6 percent) in congressionally directed activities. The program will increase Technology Application efforts to expand wind energy market penetration and decrease Technology Viability cost-shared R&D partnerships through project completion and closeout.

FY 2008 Budget Request
Wind Energy

Activity	Funding ($ in thousands) FY 2006 Approp.	FY 2007 Request	FY 2008 Request
Technology Viability	17,829	35,905	27,200
Technology Application	7,634	7,914	12,869
Congressionally Directed Activities	12,870	0	0
TOTAL	**38,333**	**43,819**	**40,069**

(Note: The FY 2007 request column shows the budget request because no full year appropriation has been enacted.)

The Presidential directive to "Change the way we power our homes, businesses, and automobiles" and the implementation focus of EPACT 2005 require the Wind Program to join in tandem leadership with the wind industry to focus priorities on removing barriers to the use of wind energy technology. The program's FY 2008 - 2012 request contains a number of shifts in program focus and activities to reflect this increased leadership and refocused direction.

To remove barriers to the use of wind energy, the Wind Program will reduce emphasis on public-private partnerships for land-based and offshore low wind speed technologies in the 2008-2010 timeframe. The focus instead will be on application related activities–Systems Integration and Technology Acceptance. In addition, increased support for Supporting Research and Testing will be made available to address issues of turbine reliability and performance via efforts of National Laboratories and Cooperative Research and Development Agreements (CRADAs) with industry. The Wind Program is also establishing a new, broader focus on distributed wind technologies and applications to advance the full scope of diverse opportunities for wind energy on the distribution side of the electric power system.

Technology Viability

Technology Viability activities are aimed at advancing wind turbine components and systems, through targeted research and development projects using competitively selected public/private partnerships and CRADAs. All work is closely coordinated with Supporting Research and Testing conducted by National Laboratories. ($27.2 million, of which $5.8 million goes to land-based and offshore systems in Low Wind Speed Technology)

- Low Wind Speed Technology (LWST) The Low Wind Speed Technology project supports the development of large wind system technology pathways (turbines over 100 kW) to achieve the following goals:
  - 3.6 cents/kWh for land-based systems in Class 4 winds by 2012;
  - 7 cents/kWh for shallow water offshore systems in Class 6 winds by 2014.

  Land-based systems are supported through public/private partnerships and CRADAs to increase industry adoption of technology developments and emerging innovation. This work is accomplished in collaboration with national laboratory expertise and selected through a series of three LWST competitive solicitations. Phase I (FY 2002-FY 2009) and Phase II (FY 2004-

2010) concentrate on three technical areas: 1) conceptual design studies; 2) component development and testing; and 3) full turbine prototype development and testing. Due to the time required to bring a technology to market, and the land-based cost of energy (COE) goal completion in 2012, the Phase III solicitation (FY 2008-2012) will address only component improvements to existing low wind speed turbine designs.

For offshore systems, technology assessment and evaluation are supported through collaboration between National Laboratories and private industry. A laboratory-led, industry-supported Sea Based concept study (SeaCon) for offshore systems was initiated in FY 2006 and will continue through FY 2009, when study results will be used to assess whether a robust Federal R&D technology development effort for offshore wind components and full system prototypes is warranted.

Distributed Wind Technology (DWT) is expected to successfully achieve its initial goal of 10-15 cents per kilowatt-hour in Class 3 wind resources in FY 2007 for turbines under 100 kW. In FY 2008, the program is launching a redefined effort for distributed wind systems that targets accelerating the full range of wind technology applications on the distribution side of electric power systems--residential, small commercial, farm, and community wind markets. Focusing on these market sectors will allow expansion of wind energy close to the point of use without requiring new transmission lines. It will also provide many energy users with a strong opportunity to control their energy costs, support local economic development, and contribute to securing the Nation's energy future. Expanding penetration of wind turbines in this market will contribute to realizing the vision for wind energy in the Advanced Energy Initiative. ($3.9 million)

- Supporting Research and Testing (SR&T) advances technologies shown to have the potential to reduce the cost and/or improve the performance and reliability of large utility-scale and distributed wind systems in low wind regimes. SR&T is composed of four program elements. *Design Review and Analysis* ensures that improved products resulting from advances in R&D are developed in a logical and safe manner and in compliance with the applicable international certification standards. *Enabling Research* provides foundational research necessary to develop advanced rotors, drive train and power systems, and systems and controls that provide the technical improvements in components and integrated systems needed to support LWST and DWT projects. It also supports inflow and site characterizations. Characterization of the design environment, improved computer simulation codes, advanced components, and integrated systems and controls are the main product outputs. *Testing Support* includes both facility and field tests of all newly developed LWST and DWT components and systems to ensure design and performance compliance. *Resource Assessment* validates updated high-resolution wind resource maps that are used widely by private industry. ($17.0 million)

Technology Application

This effort addresses opportunities and barriers, other than turbine cost of energy, concerning use of wind energy systems. This work helps to prepare the market for significantly broader application of wind technologies. To be responsive to EPACT 2005 and its directive to increase domestic energy supplies and to meet the objectives of the President's AEI which recognized that areas with good wind resources have the potential to supply up to 20 percent of the electricity consumption of the United States, this area of the program requires expansion. ($12.9 million)

- Systems Integration is comprised of efforts to enhance the compatibility of wind energy technologies with the electric power system, and to develop information to assure treatment of wind energy is objectively based on the costs that it imposes on the power system. It also seeks to mitigate barriers based on inaccurate information about the variability of wind power. These barriers will have to be proactively addressed for wind energy to reach penetration levels described in the AEI. The scope of the activity includes research and analysis to facilitate integration of large wind farms in utility grid systems and transmission corridors; small wind turbines in stand-alone applications such as hybrid diesel systems; and wind turbines in distributed applications, often close to customers. Technical assistance is provided to electric utilities, regulators, and other stakeholders to address issues such as system impacts from wind plant power variations and appropriate treatment for an intermittent source (such as wind power) to allow these plants to participate in the competitive marketplace. Systems Integration also includes coordinated assessment and analysis of integration of wind with hydropower, other renewable energy systems, and emerging energy-related needs such as production of hydrogen, and desalination, purification, and delivery of water. Improved coordination with the Department's Office of Electricity Delivery and Energy Reliability (OE) was established in FY 2006 to assure that the efforts of each office are mutually supportive and coordinated. ($6.0 million)

- Technology Acceptance will focus on resolving institutional issues, providing state and regional energy sector outreach, and investigating and mitigating social, environmental and wildlife issues associated with wind energy development. Wind Powering America ($3.5 million) addresses barriers to wind development at the national, state, and local levels to facilitate deployment of wind technology. These results bring economic benefits to the country; enhance the use of domestic energy resources, including offshore wind resources; and stimulate sustainable tribal and rural-based energy sectors. Technology Acceptance also supports cooperative activities with utility-based and other key stakeholder organizations. These activities include expanding access to wind resource information and providing data on technical and institutional barriers to wind power development and other topical issues. ($6.9 million)

Facilities and Infrastructure

The budget request for Facilities and Infrastructure provides operations and maintenance funds for NREL, a single-purpose National Laboratory dedicated to R&D for energy efficiency, renewable energy, and related technologies. The request for FY 2008 is $6.98 million for operation and maintenance (O&M), an increase of $1.0 million from the FY 2007 request. Sponsored by EERE as a Federally-Funded Research and Development Center, NREL provides EERE, as well as DOE's Office of Science and the Office of Electricity Delivery and Energy Reliability, with world-class R&D, expert advice, and objective programmatic counsel. The NREL complex is home to 1,100 researchers, engineers, analysts, and administrative staff, plus visiting professionals, graduate students, and interns on a 632-acre campus located at three major sites near Golden, Colorado.

Operation and Maintenance

Maintaining EERE's state-of-the-art research facilities at NREL is critical to EERE's R&D mission. Technology-specific capital equipment required by EERE programs is budgeted separately and not included in the maintenance and repair request.

The Plant Projects portion of the O&M request supports the annual investment necessary to maintain and extend the capabilities of EERE's existing real property and related infrastructure at NREL to meet the President's Management Agenda Real Property Initiative. Projects include safety and security improvements, site utilities and infrastructure, and reconfiguration of existing buildings to accommodate changes or growth in R&D research support needs. The Capital Equipment portion of the O&M request maintains EERE's general scientific and administrative equipment through maintenance, repair, or replacement. Included are scientific equipment with multiple program uses across NREL, information technology, site safety and security equipment, and other multiple purpose equipment.

Construction

The Research Support Facility (RSF), as currently configured, will enable limited staff space consolidations and resultant cost savings from current private sector long-term leases which are averaging $5 million per year. Congress provided $10 million of initial funding for the RSF (reduced by 1 percent for general rescission) in FY 2006 to complete the first module of the RSF project. The RSF design approach is to achieve the goal of producing a high-performance Leadership in Environmental and Energy Development (LEED) rated building that will serve as a showcase for the Nation's commercial building sector.

The Science and Technology Facility (STF), initially funded in FY 2004 with final funding in FY 2006, has been completed ahead of schedule, within scope, and at cost. The STF enables EERE's Solar Technologies Program, and other programs relying on materials and thin-film science, to address complex processing and system manufacturing problems that are common to all thin-film and nanostructure energy technologies and beyond the capability of the industry to solve. The STF allows EERE to pursue transformational research approaches to lower manufacturing costs and reduce time-to-market of next-generation thin-film and nano-structure technologies.

Program Direction

The Program Direction budget request provides resources for executive and technical direction and oversight required for the implementation of EERE programs. The budget request covers Federal staff, as well as associated facilities, equipment, supplies, and materials required to support management and oversight of programs. Areas funded by this request include: Federal staff, information systems and technology equipment; office space; travel; and support service contractors.

The FY 2008 budget request for Program Direction totals $105.0 million, a $14.0 million increase over the FY 2007 request. This increase reflects EERE's updated and revalidated staffing needs, which more closely align critical skills to mission requirements and adds staff to support technical program staffing shortfalls and implementation of the AEI and EPACT 2005 priorities.

Program Direction supports staff in both headquarters and the field. Headquarters staff is responsible for program management, while field staff is responsible for project management. The Project Management Center, created by EERE in FY 2004, includes the Golden Field Office, and staff at the National Energy Technology Laboratory (NETL). The Project Management Center is responsible for the field project management of R&D partnerships, laboratory contract administration, and a variety of professional and technical functions including administering the management and operating contract for the National Renewable Energy Laboratory and providing procurement, legal, business management, and information resource management.

Staff at the PMC will continue to work with states and communities to promote EERE programs, identify and engage community and state partners, and help integrate EERE programs with public and private sector activities. The PMC administers nearly $400 million in program funding to states, localities, and regional organizations. It continues to play a key role in administering grants and implementing deployment and outreach programs. Major activities include:

- administering EERE's principal technology deployment grant programs, including the Weatherization Assistance 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, and other stakeholders involved in energy and environmental quality issues; and
- providing EERE's national program managers with customer feedback on how to make EERE programs more efficient and effective.

Program Support

The Program Support budget request provides resources for crosscutting performance evaluation, analysis, and planning for EERE programs and for technical advancement and outreach activities. The timely, independent, and high quality credible information developed by the Program Support components provides decision makers at every level the information they need to make choices related to energy alternatives that will achieve Departmental goals. The FY 2008 budget request for Program Support activities totals $13.3 million, representing a $2.4 million increase from the FY 2007 budget request. The increase reflects the expansion of EERE's market transformation analysis, additional support necessary for new EPACT 2005 reporting requirements, and the Energy Efficiency Public Information Initiative.

The Planning, Analysis, and Evaluation activity funded within Program Support is requesting $8.4 million in FY 2008 to enable collection and analysis of economic, market, and technology data in support of EERE's programs. It also develops cross-cutting analytical tools and models for forecasting future energy and technology markets, estimating the possible impacts of energy policy, supply, and efficiency technologies and the potential energy, economic, environmental, and social benefits of those impacts. These analyses are essential for program planning, prioritization, and management of robust program pathways that can achieve EERE goals in the most cost-effective manner.

The Technology Advancement and Outreach activity within Program Support is requesting $4.9 million in FY 2008 and communicates the EERE mission, program plans, accomplishments, and technology capabilities to a variety of stakeholder audiences including Congress, the general public, educational institutions, industry, and other government and non-government organizations. The funding requested in this budget line is focused on two EERE public information activities: managing the EERE public websites and a central Information Center which provides a toll-free information "hotline." Use of EERE's websites has expanded rapidly, and continues to grow at a pace of 5.4 million additional "page views" per year. The Information Center annually fields around 27,000 inquiries and delivers roughly 300,000 publications to consumers, businesses, and schools.

EERE Funding Summary by Program

(dollars in thousands)

	FY 2006 Current Approp.	FY 2007 Request to Congress	FY 2008 Request to Congress	FY 2008 Request vs. FY 2007 Request
Energy Supply and Conservation				
Biomass and Biorefinery Systems R&D	89,776	149,687	179,263	+29,576
Building Technologies	68,190	77,329	86,456	+9,127
Federal Energy Management Program	18,974	16,906	16,791	-115
Geothermal Technology	22,762	0	0	0
Hydrogen Technology	153,451	195,801	213,000	+17,199
Hydropower	495	0	0	0
Industrial Technologies	55,856	45,563	45,998	+435
Solar Energy	81,791	148,372	148,304	-68
Vehicle Technologies	178,351	166,024	176,138	+10,114
Weatherization and Intergovernmental Activities	316,866	225,031	204,904	-20,127
Wind Energy	38,333	43,819	40,069	-3,750
Facilities and Infrastructure	26,052	5,935	6,982	+1,047
Program Direction	101,868	91,024	105,013	+13,989
Program Support	13,321	10,930	13,281	+2,351
Total, Energy Supply and Conservation	**1,166,086**	**1,176,421**	**1,236,199**	**+59,778**