Industrial Technologies

Funding Profile by Subprogram[a]

	FY 2003 Comparable Appropriation	FY 2004 Comparable Appropriation[b]	FY 2005 Base	FY 2005 Request	FY 2005 Request vs Base	
					$ Change	% Change
Industrial Technologies						
Industries of the Future (Specific)	59,293	47,247	47,247	22,409	-24,838	-52.6%
Industries of the Future (Crosscutting)	33,533	39,904	39,904	31,900	-8,004	-20.1%
Technical Program Management Support	3,998	5,917	5,917	3,793	-2,124	-35.9%
Total, Industrial Technologies.....	96,824	93,068	93,068	58,102	-34,966	-37.6%

Public Law Authorizations:

P.L. 94-163, "Energy Policy and Conservation Act" (EPCA) (1975)
P.L. 94-385, "Energy Conservation and Production Act" (ECPA) (1976)
P.L. 95-91, "Department of Energy Organization Act" (1977)
P.L. 95-618, "Energy Tax Act" (1978)
P.L. 95-619, "National Energy Conservation Policy Act" (NECPA) (1978)
P.L. 95-620, "Powerplants and Industrial Fuel Use Act" (1978)
P.L. 96-294, "Energy Security Act" (1980)
P.L. 100-12, "National Appliance Energy Conservation Act" (1987)
P.L. 100-615, "Federal Energy Management Improvement Act" (1988)
P.L. 101-218, "Renewable Energy and Energy Efficiency Technology Competitiveness Act" (1989)
P.L. 101-549, "Clean Air Act Amendments" (1990)
P.L. 102-486, "Energy Policy Act" (1992)

Mission

The mission of the Industrial Technologies Program (ITP) is to improve the energy intensity of the U.S. industrial sector through a coordinated program of research and development, validation, and dissemination of energy-efficiency technologies and operating practices. This effort will be achieved by partnering with industry, its equipment manufacturers, and its many stakeholders to reduce our Nation's

[a] SBIR/STTR funding in the amount of $1,741,367 was transferred to the Science appropriation in FY 2003. Estimates for SBIR/STTR budgeted in FY 2004 and FY 2005 are $2,318,190 and $1,444,646 respectively.

[b] Programs in the Energy Conservation appropriation were reduced by .59 percent as required by the Omnibus Appropriation Bill.

reliance on foreign energy sources, reduce environmental impacts, increase the use of renewable energy resources, and improve energy efficiency and competitiveness.

Benefits

ITP develops, manages, and implements a balanced portfolio that addresses industry requirements throughout the technology development cycle. Research and development, particularly high-risk, high-return R&D, is conducted to target efficiency opportunities in manufacturing processes and crosscutting energy systems. Validation and verification of technology benefits through intermediate-term pilot and demonstration phases help emerging technologies gain commercialization and near-term adoption. Dissemination of energy-efficiency technologies and practices is accomplished through a variety of technology delivery mechanisms. These activities help accelerate industry understanding, acceptance, and implementation of efficiency advances as industry starts reaping the benefits of proven technologies, system management decision tools, training, and strategic partnerships. The Industrial Technologies Program estimates that, in 2001, it directly contributed to industrial energy savings of over 296 trillion Btus[a] savings worth over $1.9 billion[b]. By 2002, the program helped develop more than 160 commercialized industrial technologies. Cumulative tracked energy savings from 1990 to 2002 are estimated to be over 2,650 trillion Btus. These technology successes are the result of the "industry pull" designed into the Industries of the Future strategy.

More detailed, integrated and comprehensive economic, energy and energy security benefits estimates are provided in the Expected Program Outcomes section at the end of the program level budget narrative.

Strategic and Program Goals

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

Energy Strategic Goal

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

The Industrial Technologies program has one program goal which contributes to General Goal 4 in the "goal cascade":

Program Goal 04.60.00.00: Industrial Technologies. The Industrial Technologies Program goal is to partner with our most energy-intensive industries in strategic planning and energy-specific RD&D to develop the technologies needed to use energy efficiently in their industrial processes and cost-effectively generate much of the energy they consume. The result of these activities will save feedstock

[a] See April 2003 Impacts report at http://www.pnl.gov/impacts/pdfs/03impacts_intro.pdf

[b] Constant 2001 dollar values for energy savings shown in this budget are based upon Energy Information Administration data for 2001 as well as preliminary estimates for 2002 and 2003. Average industrial energy prices per million Btu were $ 6.44 in 2001, $5.44 in 2002, and a forecast of $5.70 for 2003. Source: based on AEO 2002, Table A-3, available at www.eia.doe.gov/oiaf/archive/aeo02/supplement/sup_t2t3.pdf.

and process energy, create domestic supply, improve the environmental performance of industry, and help America's economic competitiveness.

Contribution to Program Goal 04.60.00.00 (Industrial Technologies)

Between 2002 and 2020, contribute to a 30 percent decrease in energy intensity (Btu per unit of industrial output as compared to 2002) in the energy-intensive Industries of the Future (a potential savings of 3.7-4.5 quads above projected baseline efficiency improvements); between 2004 and 2010, commercialize over 10 industrial energy-efficiency technologies through RD&D partners.

Annual Performance Results and Targets

FY 2000 Results	FY 2001 Results	FY 2002 Results	FY 2003 Results	FY 2004 Targets	FY 2005 Targets
Program Goal 04.60.00.00 (Industrial Technologies)					
Industries of the Future (Specific)					
		Commercialized 10 new energy efficiency technologies in partnership with the most energy-intensive industries.	In FY 2003, commercialized 4 new technologies in partnership with the most energy-intensive industries. In FY 2003, turned over 25 percent of projects in the RD&D portfolio.	Commercialize 4 new technologies in partnership with the most energy-intensive industries.	Commercialize 3 new technologies in partnership with the most energy-intensive industries.
Industries of the Future (Specific and Crosscutting)					
	Commercialized 10 new technologies from both the nine vision industries as well as the crosscutting programs. Helped industry save 262 trillion Btu of energy worth $1.6 billion.		In FY 2003, helped industry save more than 180 trillion Btu of energy worth approximately $1 billion.		
Industries of the Future (Crosscutting)					
	Supported Industrial Assessment Centers at 26 participating universities that conducted 650 combined energy, waste, and productivity assessments.		FY 2003 Milestone: 6200 energy-intensive U.S. plants applied EERE technologies and services averaging a 5 percent improvement in energy productivity per plant.	An additional 600 (leading to a cumulative 6800) energy intensive U.S. plants will apply EERE technologies and services averaging a 5 percent improvement in energy productivity per plant.	An additional 200 (leading to a cumulative 7000) energy intensive U.S. plants will apply EERE technologies and services averaging a 7 percent improvement in energy productivity per plant.
Management of Funds					
				Contribute proportionately to EERE's corporate goal of reducing corporate and program uncosteds to a range of 20-25 percent by reducing program annual uncosteds by 10 percent in 2004 relative to the program uncosted baseline (in 2003) until the target range is met.	Contribute proportionately to EERE's corporate goal of reducing corporate and program uncosteds to a range of 20-25 percent by reducing program annual uncosteds by 10 percent in 2005 relative to the program uncosted baseline (2004) until the target range is met.

Means and Strategies

The Industrial Technologies Program will use various means and strategies to achieve its program goals as described below. "Means" include operational processes, resources, information, and the development of technologies, and "strategies" include program, policy, management and legislative initiatives and approaches. Various external factors, as listed below, may impact the ability to achieve the program's goals. Collaborations are integral to the planned investments, means and strategies, and to addressing external factors.

DOE partners with the most energy-intensive industries working with individual companies, trade associations, and professional groups to develop and apply advanced technologies and practices that reduce energy consumption. These industries and departmental investments in programs represent the greatest opportunity to save energy and improve environmental performance in a cost-effective manner.

DOE invests in pre-competitive and high-risk RD&D that individual companies are unable to undertake without government support focusing on industrial materials, combustion and sensors and controls and requiring a 50 percent cost-share from industry.

The *Industries of the Future* strategy engages partners in key phases of the program. Technology visions and roadmaps are developed by industry and other stakeholders to define their long-term goals, technology challenges, and research priorities. ITP uses these roadmaps to match industry's technology needs with Federal energy efficiency priorities in planning the Federal research agenda. ITP implements its research and technology development program through cost-shared projects with multiple industrial and academic partners. Sharing project costs (industrial partners typically contribute 50 percent) leverages public investment with private resources, increases access to scientific capabilities, increases industry commitment to achieving R&D success, shortens the technology development and commercialization cycle, and facilitates technology delivery. ITP activities include both industry-specific R&D and activities that cut across industrial boundaries.

The Management Strategy focuses on energy losses reducing the energy requirements of industry while stimulating economic productivity and growth. ITP invests in next-generation manufacturing concepts that will produce dramatic energy and environmental benefits providing large public benefits. These Grand Challenges typically require high-risk, high-return R&D such as an entirely new processing route to achieve much lower energy use than current processes. Beginning in FY 2005, ITP will shift a portion of its R&D portfolio to focus on multi-industry Grand Challenges for next-generation manufacturing and energy systems technologies.

These means and strategies could result in significant cost savings and a significant reduction in the consumption of energy across fuel types—increase the substitution of clean fuels and power—cost effectively reducing American's demand for energy, lowering carbon emissions, and decreasing energy expenditures---thus putting the taxpayers' dollars to more productive use.

The following external factors could affect IT's ability to achieve its strategic goal:

- Rate of market growth
- Industry profit margins
- Capital investment requirements

- Foreign competition
- Energy supply markets and prices
- Safety and environmental regulations

In carrying out the program's mission, the IT program collaborates with several groups on its key activities including high energy intensity public-private industry partnerships: The *National Energy Policy*[a] encourages energy efficiency programs that are modeled as public-private partnerships. The Industrial Technologies Program has used this partnership model for the past eight years to bring together the strengths of business and government to solve increasingly complex and difficult efficiency problems. These partnerships also help to disseminate and share best energy management practices in factories throughout the United States. ITP's established public-private partnerships help to facilitate new efforts as well, particularly the President's Climate VISION (Climate Voluntary Innovation Sector Initiatives: Opportunities Now) initiative to encourage reductions in industrial greenhouse gas emissions.

Validation and Verification

To validate and verify program performance, the Industrial Technologies Program will conduct internal and external reviews and audits. These programmatic activities are subject to continuing review by, for example, the Congress, the General Accounting Office, the Department's Inspector General, the U.S. Environmental Protection Agency, and state environmental agencies. The table below summarizes validation and verification activities.

Data Sources: Energy intensity is calculated from the Energy Information Administration's (EIA's) Manufacturing Energy Consumption Survey (MECS) and Department of Commerce data. The number of technologies and their energy savings is ascertained through interviews with technology developers and suppliers. Energy savings for the technical assistance programs are estimated based upon past reported participant data.

Baselines: The following are the key baselines used in ITP:

- Industrial energy intensity (2002) 14,000 BTU/$1996 value of shipments of energy intensive industry output.
- Commercialized technologies (base line year for count of commercialized technologies is 2004)

Frequency: EIA/MECS collects energy intensity data once every 4 years, and ITP makes annual estimates based upon data from annual Department of Commerce surveys. ITP collects data on energy savings and technologies commercialized annually.

Data Storage: Energy intensity information is contained on EIA's computers. Data on energy savings and technologies commercialized are stored in ITP's Impacts Database and are available on the internet at ITP's website: www.eere.energy.gov/industry.html. Data on R&D portfolio turnover is based upon information contained in ITP's information system database.

[a] See National Energy Policy report of the National Energy Policy Development Group (May 2001), P. 4-12.

Verification: ITP uses prospective and retrospective peer reviews to evaluate project performance and to adjust support. To verify program performance and results, ITP tracks all technologies commercialized (and the extent of their use) by industry. ITP also provides EIA quality control and outside peer review of the Manufacturing Energy Consumption Survey. Industry representatives review data on energy savings and technologies commercialized. ITP has conducted several reviews of the impacts of several technical programs and assistance programs have been reviewed several times. The National Research Council periodically conducts independent reviews of ITP programs.

Funding by General and Program Goals

(dollars in thousands)

	FY 2003 Comparable Appropriation	FY 2004 Comparable Appropriation	FY 2005 Request	$ Change	% Change
General Goal 4, Energy Security					
Program Goal 04.60.00.00, Industrial Technologies					
Industries of the Future (Specific)	59,293	47,247	22,409	-24,838	-52.6%
Industries of the Future (Crosscutting)	33,533	39,904	31,900	-8,004	-20.1%
Technical/Program Management Support	3,998	5,917	3,793	-2,124	-35.9%
Total, Program Goal 04.60.00.00, Industrial Technologies	96,824	93,068	58,102	-34,966	-37.6%
Total, Industrial Technologies	96,824	93,068	58,102	-34,966	-37.6%

Expected Program Outputs

The Industry Program pursues its mission through integrated activities designed to improve the energy efficiency and productivity of our economy. We expect these improvements to reduce susceptibility to energy price fluctuations and potentially lower energy bills; reduce EPA criteria and other pollutants; and provide greater energy security and reliability by improving our energy infrastructure. In addition to these "EERE business-as-usual" benefits, realizing the Industry Program goals would provide the technical potential to reduce conventional energy use even further if warranted by future energy needs.

Estimates of annual non-renewable energy savings, energy expenditure savings, carbon emission reductions, oil savings, natural gas savings, and reduced need for electricity capacity additions that result from the realization of Industry Program goals are shown in the table below through 2025.

The assumptions and methods underlying the modeling efforts have significant impact on the estimated benefits, and results could vary significantly if external factors, such as future energy prices, differ from the baseline case assumed for this analysis. A summary of the methods, assumptions, and models used in developing these benefit estimates that are important for understanding these results are provided at www.eere.energy.gov/office_eere/budget_gpra.html Final documentation estimated to be completed and posted by March 15, 2004.

FY 2005 GPRA Benefits Estimates for the Industrial Technologies Program[a]

Mid-Term Benefits[b]

	2010	2015	2020	2025
Primary Non-Renewable Energy Savings (Quads)	0.5	0.9	1.6	2.0
Energy Expenditure Savings (Billion 2001$)	5	10	17	16
Carbon Emission Reductions (MMTCE)	9	18	30	41
Oil Savings (MBPD)	0.1	0.1	0.1	0.2
Natural Gas Savings (Quads)	0.19	0.39	0.71	0.63
Total Displaced Need for New Electric Capacity (GW)	3	2	8	15

[a] Benefits reported are annual, not cumulative, for the year given. Estimates reflect the benefits associated with program activities from FY 2005 to the benefit year or to program completion (whichever is nearer), and are based on program goals developed in alignment with assumptions in the President's Budget.

[b] Mid-term program benefits were estimated utilizing the GPRA05-NEMS model, based on the Energy Information Administration's (EIA) National Energy Modeling System (NEMS) and utilizing the EIA's Annual Energy Outlook (AEO) 2003 Reference Case.

Performance Indicators	Actual		Planned					
	FY 02	FY 03	FY 04	FY 05	FY 06	FY 07	FY 08	FY 09
Annual number of technologies commercialized	10	4	4	4	TBD	TBD	TBD	TBD
Annual energy savings from Industrial Program activities in partnership with industry	276	180	220	220	TBD	TBD	TBD	TBD
Number of new Allied Partners	20	20	20	20	TBD	TBD	TBD	TBD
Cumulative number of energy-intensive plants impacted by the program	N/A	6,200	6,800	7,000	7,200	7,800	8,400	9,000
Number of internet information page views (million)	5.3	6	6.2	6.4	TBD	TBD	TBD	TBD

Over the past 30 years, industry has shown a remarkable ability to improve energy efficiency, greatly increasing economic output without a corresponding increase in energy use. Yet an expanding economy will increase industrial energy demand. The Energy Information Administration (EIA) projects industrial energy use will grow by over 30% from 2001 to 2025, even with assumed efficiency gains and an economic shift to less energy-intensive industries. Reducing energy intensity–the amount of energy used to produce a given amount of industrial product–is the key to increasing energy efficiency in industry without impeding economic growth. Because there are significant gaps between current energy use and practical minimum energy use for most industrial processes, the industrial sector will continue to offer excellent opportunities to improve energy efficiency in the United States over the next 25 years.

If energy use per unit of output (energy intensity) in the ITP partner industries continued at 2002 levels, these industries would be using almost 22 quads by 2010. However, by 2010, partner industries are expected to reduce their energy use by 1.3 quads through business-as-usual efficiency improvements (EIA projection of 0.75 percent annually), and, concurrently, activities sponsored by the Industrial Technologies Program aim to help these industries lower energy use by up to an additional 0.9 to 1.9 quads. See Figure 1. By 2020, partner industries could be reducing their energy use by 3.3 quads (from a 26.2 quad level using 2002 energy intensities) through business-as-usual efficiency improvements, and by an additional 3.7 to 4.5 quads as a result of ITP activities.

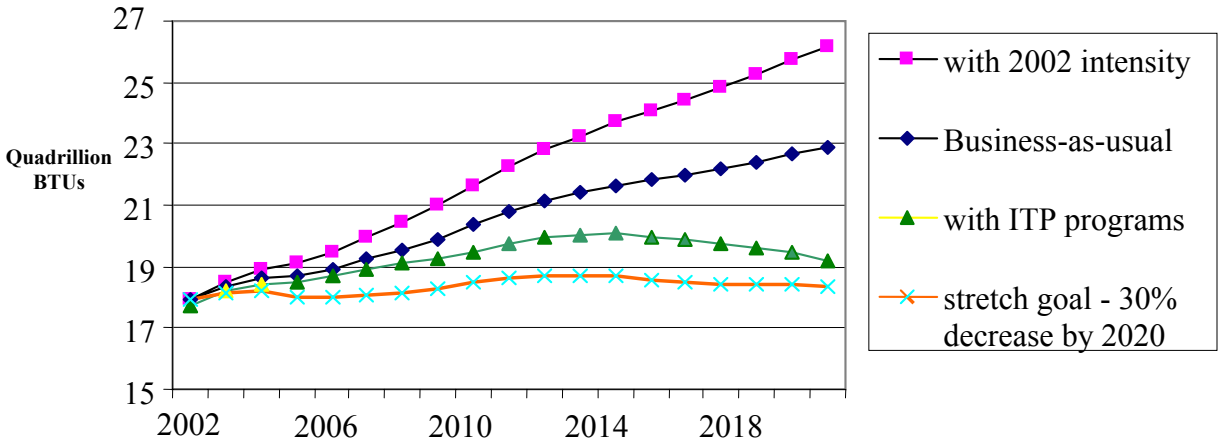

Figure 1: Energy Intensity Target

Industries of the Future (Specific)

Funding Schedule by Activity

(dollars in thousands)

	FY 2003	FY 2004	FY 2005	$ Change	% Change
Industries of the Future (Specific)					
Forest and Paper Products Industry	10,488	8,021	3,000	-5,021	-62.6%
Steel Industry	10,083	6,685	3,767	-2,918	-43.6%
Aluminum Industry	7,908	6,583	2,704	-3,879	-58.9%
Metal Casting Industry	5,228	4,052	2,000	-2,052	-50.6%
Glass Industry	4,462	3,301	1,763	-1,538	-46.6%
Chemicals Industry	14,079	13,184	7,075	-6,109	-46.3%
Mining Industry	5,484	4,694	1,400	-3,294	-70.2%
Supporting Industries	1,561	727	700	-27	-3.7%
Total, Industries of the Future (Specific)	59,293	47,247	22,409	-24,838	-52.6%

Description

The Industries of the Future (Specific) supports cost-shared research, development, and demonstration (RD&D) of advanced technologies to improve the energy intensity and environmental performance of America's energy-intensive and waste-intensive industries. To provide the best value and optimum use of public investments, this activity focuses on a few basic materials processing industries that can achieve the highest returns on Federal investments.

Benefits

Key domestic industries will employ partner co-developed and tested industrial efficiency technologies that reduce their energy consumption and competitive position preserving domestic economic benefits while reducing cost, saving energy and improving environmental performance.

Detailed Program Justification

(dollars in thousands)

	FY 2003	FY 2004	FY 2005
Forest and Paper Products Industry	**10,488**	**8,021**	**3,000**

By 2010, in partnership with industry, the goal of the Forest and Paper Products activity is to implement advanced water removal technologies in papermaking resulting, in an energy efficiency improvement of 10 percent in paper production compared to conventional industry practices.

In FY 2005, conduct energy bandwidth studies to determine which energy intensive areas have the greatest potential to achieve significant energy savings as a method to fund a smaller number of larger projects that have high energy savings potentials.

Continue to support voluntary efforts by the American Forest & Paper Association and other industry organizations to improve their energy efficiency and environmental performance through the industry's Agenda 2020. The collaborative activities will include cost-shared R&D as well as the utilization of new improved energy technologies, industrial energy efficiency tools and energy management best practices. In FY 2003, this activity was reduced by $188,635 and the funds transferred to the Science Appropriation for SBIR/STTR. *Participants include: The American Forest and Paper Association and their member companies, National Laboratories, the Institute of Paper Science and Technology, Pulp and Paper Education and Research Alliance members and partners, and others*.

Steel Industry	**10,083**	**6,685**	**3,767**

By 2010, in partnership with industry, the goal of the Steel activity is to develop a commercially ready technology that will cut the use of energy intensive coke as a feedstock in the steelmaking process.

In FY 2005, continue those activities with the highest long-term national energy saving potential such as the Mesabi Nugget iron making pilot demonstration, a new iron-making technology that uses a rotary hearth furnace to turn iron ore fines and pulverized coal into iron nuggets of similar quality as blast furnace pig iron. This process requires less energy, capital, and operating costs than existing pig iron technology. Participate in Grand Challenge solicitation with focus on cokeless ironmaking. Complete the steel industry highly variable load electric power grid impact study begun in FY 2003.

Continue to support voluntary efforts by the American Iron and Steel Institute and the Steel Manufacturers' Association and other industry organizations to improve their energy efficiency and environmental performance. The collaborative activities will include cost-shared R&D as well as the utilization of new improved energy technologies, industrial energy efficiency tools, and energy management best practices. In FY 2003, this activity was reduced by $181,298 and the funds transferred to the Science Appropriation for SBIR/STTR. *Participants include: American Iron and Steel Institute (member and associate member companies), Steel Manufacturers Association (member and associate member companies), national laboratories, universities and other companies.*

Aluminum Industry	**7,908**	**6,583**	**2,704**

By 2010, the goal of the Aluminum activity is to develop with the aluminum industry advanced technologies, such as carbothermic aluminum reduction, and inert anodes and wettable cathodes that would result in significant net energy savings in primary aluminum production.

Based upon a feasibility study to be completed in FY 2004, participate in Grand Challenge solicitation

with focus on an alternative reduction technology to produce aluminum with over 30% energy savings and a potential of 32-38 percent reduction in greenhouse gas emissions related to energy consumption. Part of the portfolio will consist of projects to improve energy efficiency in secondary aluminum processing (rolling & forming) with an emphasis on reducing scrap and minimizing re-melting of scrap. Complete evaluation for energy efficient isothermal melting technology begun in FY 2001. Continue existing projects that help improve energy efficiency and environmental performance that industry would not undertake without Federal support. In FY 2003, this activity was reduced by $142,227 and the funds transferred to the Science Appropriation for SBIR/STTR. *Participants include: The Aluminum Association, Alcoa, Century Aluminum, Commonwealth Aluminum, and SECAT.*

Metal Casting Industry **5,228** **4,052** **2,000**

In partnership with industry, the goals of the Metal Casting activity are to enable major technical advances in the metal casting industry, to implement new design techniques and practices, to increase yield, and to reduce energy use and generation of scrap.

In FY 2005, develop and verify a model for new radiographic standards in the advanced melting technology area. Develop and validate semi-quantitative pattern signatures for lost foam pattern quality control in the innovative casting process area. These tools will be used to validate lost foam pattern tooling design software. Develop guidelines for die casting die cooling line placement and cooling line geometry for low stress die designs. Participate in Grand Challenge solicitation with focus on advanced melting.

Continue to work with over 320 cost-sharing industry partners in 35 States. Research areas include qualitative visualization tools for die design; extension of the life of permanent molds for aluminum permanent mold castings; analysis of risering techniques and methods for improving yield for steel casters; and identification of lost foam process control procedures. In FY 2003, this activity was reduced by $94,028 and the funds transferred to the Science Appropriation for SBIR/STTR. *Participants include: Cast Metals Coalition, including American Foundry Society, Steel Founder's Society of America, and North American Die Casting Association , Ohio State University, University of Michigan, Case Western Reserve University, Pacific Northwest National Laboratory (PNNL), Oak Ridge National Laboratory (ORNL), Iowa State University, University of Alabama, Worcester Polytechnic Institute (WPI), and University of Iowa*.

Glass Industry **4,462** **3,301** **1,763**

In partnership with industry, the goal of the Glass activity is to develop advanced glass technologies that will reduce the gap between actual melting energy use (more than 11 million Btu to melt a ton of glass as measured in 1996) and the theoretical minimum (2.5 million Btu per ton) by 50 percent by 2020. An analysis of the progress to date toward this goal will be conducted as data from the 2002 Manufacturing Energy Consumption Survey is released.

In FY 2005, begin fabrication of pilot-scale submerged combustion melter. Assess quality of glass produced from plasma melting process. Participate in Grand Challenge solicitation with focus on next generation melter.

Continuing research areas include oxy-fuel fired front-end systems, advanced glass process

(dollars in thousands)

FY 2003	FY 2004	FY 2005

technology, and feedstock measurement and control technology. In FY 2003, this activity was reduced by $80,249 and the funds transferred to the Science Appropriation for SBIR/STTR.

Participants include: Glass Manufacturing Industry Council, PPG Industries, Owens Corning, Johns Manville, Schott Glass Technologies, Gas Technology Institute, Plasmelt, Eclipse/Combustion Tec, Praxair, BOC Gases, Fenton Art Glass, Certain Teed, Osram Sylvania, Energy Research Company, Alfred University-Center for Glass Research, and the States of Ohio and Pennsylvania.

Chemicals Industry **14,079** **13,184** **7,075**

In partnership with industry, the goal of the Chemicals activity is to develop separation and new process chemistry technologies that will increase energy efficiency by up to 30 percent by 2020, compared to conventional 1998 technologies. An analysis of the progress to date toward this goal will be conducted as data from the 2002 Manufacturing Energy Consumption Survey is released.

Beginning in FY 2004, project focus areas include reaction engineering and separations and the development of tools to assess the economic viability and energy efficiency of chemical industry technologies. Cross-cutting technologies such as sensors and materials for the chemical industry will continue to be supported by the cross-cutting program areas in ITP and EERE.

In FY 2005, begin research efforts in the areas of separations, reactions, and enzymatic processes. Participate in Grand Challenge solicitation with focus on distillation technologies. In FY 2003, this activity was reduced by $284,032 and the funds transferred to the Science Appropriation for SBIR/STTR. *Participants include: American Chemical Society, American Institute of Chemical Engineers, Chemical Manufacturers Association, Council for Chemical Research, Praxair, Air Products, Honeywell, Reaction Engineering, Argonne Laboratory, Los Alamos National Laboratory, Oak Ridge National Laboratory, Pacific Northwest National Laboratory, Sandia National Laboratories, Dupont, Dow Chemical, Fluent, Aspen Technology, BP Chemicals, OLI Systems, Washington University, Shell International, University of Texas at Austin, Gas Technology Institute, General Electric, TDA Research, and Aspen Technology.*

Mining Industry **5,484** **4,694** **1,400**

By 2010, in partnership with industry, the goal of the Mining activity is to develop mining technologies that can reduce the energy intensity required to crush a short ton of rock by 20-30 percent from its 1998 baseline. An analysis of the progress to date toward this goal will be conducted as data from the 2002 Manufacturing Energy Consumption Survey is released. In FY 2005, develop wear-resistant component applications for the Fibrous Monolithic composites to reduce downtime and energy use.

Complete the materials coating projects begun in FY2001 to improve wear resistance for high wear crushing and grinding applications. In FY 2003, this activity was reduced by $98,627 and the funds transferred to the Science Appropriation for SBIR/STTR. *Participants included: National Mining Association*, *major mining and mineral processing companies, equipment manufacturers, universities, and national laboratories including Stolar Horizon, Advanced Ceramic Research, University of Utah, University of Alaska, University of Arizona, Montana Tech, Michigan Tech, W. Virginia State University, Virginia Tech, Transtech, Pacific Northwest National Energy Laboratory, Albany Research Laboratory, Los Alamos National Laboratory, Sandia National Laboratories, Idaho National*

(dollars in thousands)

FY 2003	FY 2004	FY 2005

Energy Laboratory, Consolidated Coal, Phelps Dodge Copper Corp., the Florida Institute of Phosphate Research, Caterpillar Corp. and the Fuel Cell Institute.

Supporting Industries..... **1,561** **727** **700**

By 2010, in partnership with industry, the goal of the Supporting Industries activity is to substantially reduce the energy consumption of material forming and finishing processes and powder metal parts and components manufacturing. Potentially, according to estimates in project proposals, 32 trillion Btu/yr. can be saved by 2020.

In FY 2005, projects will define a new program management approach to identify supporting industries with the greatest potential for energy savings.

Continue development and testing of high temperature carburizing process, integrated aluminum casting model, control algorithm for high efficiency sintering of powder metal components, and the pulsed gas metal-arc welding (GMAW) process.

In partnership with industry, continue to assist efforts to reduce energy consumption in carburizing processes, in heat treatment of castings, welding processes and powder metal sintering processes for the pulsed GMAW welding processes. In FY 2003, this activity was reduced by $28,084 and the funds transferred to the Science Appropriation for SBIR/STTR. *Participants include: Forging Ind. Assoc. (FIA), Lincoln Elec. Co., Worcester Polytech. Inst. (WPI), Oak Crest Institute of Science, Center for Heat Treating Excellence (CHTE), Air Products and Chemicals, Boycote Thermal Processing, Caterpillar, Deere & Co., Eclipse, GMC, Houghton Int'l, Ipsen Int'l, AMCAST Ind. Corp., ALCOA, UES Software, Kolene Corp., Pratt & Whitney, Surface Combustion, Timken Co., Boeing Co., and several universities and national labs.*

Total, Industries of the Future (Specific) **59,293** **47,247** **22,409**

Explanation of Funding Changes

	FY 2005 vs. FY 2004 ($000)
Forest and Paper Products	
The funding level will allow continuation of existing projects and initiation of a number of new research projects funded. Energy bandwidth studies are expected to identify energy-intensive areas within the industry with the greatest potential to achieve significant energy savings as a means to fund a smaller number of larger projects in the future. Request level commensurate with current targets.	-5,021
Steel	
The funding level will allow new research projects in the area of cokeless ironmaking. The larger number of projects formerly funded will be replaced by a focused Grand Challenge in this area. Request level commensurate with current targets.	-2,918
Aluminum	
The funding level will allow continuation of existing projects funding for new research in alternative reduction systems. The larger number of projects formerly funded will be replaced by a focused Grand Challenge in this area. Request level commensurate with current targets.	-3,879
Metal Casting	
The funding level will support new radiographic standards in advanced melting at a level commensurate with current targets.	-2,052
Glass	
Research on the next generation of melters is postponed in accordance with current targets and priorities.	-1,538
Chemicals	
Research in the area of distillation is postponed in accordance with current targets and priorities.	-6,109
Mining	
The scope of FY 2005 solicitations and timing of the completion of the current projects will be adjusted in accordance with current targets and priorities.	-3,294
Other: Supporting Industries	-27
Total Funding Change, Industries of the Future (Specific)	**-24,838**

Industries of the Future (Crosscutting)

Funding Schedule by Activity

(dollars in thousands)

	FY 2003	FY 2004	FY 2005	$ Change	% Change
Industries of the Future (Crosscutting)					
Industrial Materials of the Future	13,328	12,542	11,000	-1,542	-12.3%
Combustion	1,952	1,975	1,600	-375	-19.0%
Gasification Programs	0	4,939	0	-4,939	-100.0%
Robotics	0	1,975	0	-1,975	-100.0%
Sensors and Automation	3,683	3,728	3,100	-628	-16.8%
Industrial Technical Assistance	14,570	14,745	16,200	+1,455	+9.9%
Total, Industries of the Future (Crosscutting)	33,533	39,904	31,900	-8,004	-20.1%

Description

The Industries of the Future (Crosscutting) activities work with industrial partners and suppliers to conduct cost-shared RD&D on technologies that have potential applications across many partner industries. ITP also develops and provides the tools and technical assistance needed by industry to expedite the adoption of energy-efficiency, and clean manufacturing technologies, focusing on three primary areas that offer major improvements in energy efficiency and emissions reduction: (1) *advanced industrial materials* that can reduce energy use, lower emissions, increase component life, improve product quality, optimize process operating conditions, and reduce downtime; (2) *high-efficiency, clean combustion* technologies; and (3) *advanced sensors and automation* that can increase process efficiency and productivity even in high temperature and harsh environments.

Benefits

Crosscutting IOF technologies provide the means for development of broad benefit technologies that are not within practical developmental reach of an industry to be developed and deployed across industry and sectors proving economic, energy and environmental benefits nationally.

Detailed Program Justification

(dollars in thousands)

FY 2003	FY 2004	FY 2005

Industrial Materials of the Future **13,328** **12,542** **11,000**

In partnership with industry, the goals of the Industrial Materials of the Future activity are to conduct R&D to develop new materials consistent with the needs identified in the IOF visions and technology roadmaps and reduce energy use by more than 200 trillion Btu (compared to conventional technology) in 2020.

In FY 2005, focus areas will include degradation resistance, where advanced coatings and materials will be developed for protection of industrial components and systems from wear, corrosion and oxidation; thermophysical databases and modeling, where data acquisition of materials mechanical, thermal, and chemical properties for use in modeling and simulations will be performed for materials property optimization to save energy; and materials for engineering components, where advanced materials will be developed and optimized for use in specific industrial processes and equipment. The goal of these efforts is to improve materials properties for in-service performance and to develop appropriate fabrication methods for various applications.

Work will continue on the development of materials for advanced tooling for molds and dies, materials for energy systems, advanced joining methods, and materials for chemical separations. In FY 2003, this activity was reduced by $280,802 for SBIR/STTR and transferred to the Science Appropriation. *Participants include: Alon Surface Technologies, Air Products, Caterpillar, Inc., Carpenter Technologies, General Aluminum Manufacturing Company, Michigan Technological University, Materials Technology Institute, RSP Tooling, LLC, Solar Turbines, Special Metals Corporation, Starfish Systems, Inc., West Virginia University, SECAT, Weyerhauser Company*

Combustion **1,952** **1,975** **1,600**

By 2010, in partnership with industry, the goal of the Combustion activity is that packaged boilers with thermal efficiencies 10-12 percent higher than conventional technology and with single digit ppm NOx emissions be commercially available.

In FY 2005, begin field evaluation of a package boiler capable of greater than 94 percent efficiency and less than five ppm NOx emissions. Participate in Grand Challenge solicitation with focus on superboiler.

Continue research on and initiate field evaluation of a prototype ultra-high efficiency, low emission refinery process heater.
In FY 2003, this activity was reduced by $35,104 and the funds transferred to the Science Appropriation for SBIR/STTR. *Participants include the Gas Technology Institute, Southern California Gas, Cleaver-Brooks, TIAX, Callidus Technologies, and ExxonMobil.*

Gasification Programs..... **0** **4,939** **0**

In FY 2003, Congress provided $13,793,025 for this activity, which is shown within the Biomass and Biorefinery R&D Systems program. In FY 2004, this activity continues to be managed by that program.

Robotics	**0**	**1,975**	**0**

FY 05 research efforts in this area will be combined with the activities in the Sensors and Automation area.

Sensors and Automation	**3,683**	**3,728**	**3,100**

By 2010, in partnership with industry, the goal of the Sensors and Automation activity is to develop the technology necessary to move from batch production to a continuous process using new sensor systems, starting with the recently completed demonstration of the technology in the aluminum industry in 2003.

In FY 2005, initiate research in the areas of advanced sensor technology, affordable wireless technology, next generation control automation, and improved information processing.

R&D projects resulting from a FY 2003 solicitation will be continued. These are expected to include advancing energy-saving industrial wireless sensors beyond the prototype phase, control systems which reduce energy use by incorporating output from on-line and real-time sensors and use multivariate mathematical techniques to generate product property data not obtainable from routine measurement, and a "whole plant" optimization control system, including robotics.

In FY 2003, this activity was reduced by $66,242 and the funds transferred to the Science Appropriation for SBIR/STTR. *Participants include: General Electric Global Research, Honeywell International, The Timken Co., Energy Research Co., Quantum Magnetics, American Air Liquide, Tecnar Automation, Air Products and Chemicals Co., Gas Technology Institute, Oak Ridge National Laboratory, Sandia National Laboratories, Tennessee Technological University, Penn State University*.

Industrial Technical Assistance	**14,570**	**14,745**	**16,200**
▪ **Industrial Assessment Centers**	**6,533**	**6,612**	**7,700**

By 2010, the goals of the Industrial Assessment Centers (IAC) activity (begun in 1976 as the Energy Analysis and Diagnostic Center program) are to have completed over 14,500 Industrial Assessment Audits, trained over 2,900 engineering students, and provided technical assistance to over 10,000 plants to save over 600 trillion Btu of energy by deploying a portfolio of assessments, tools, training, and operational practices. Through 2003, 11,566 audits have been conducted, training 3,188 students, and improving energy use at 11,103 plants, with an estimate of energy savings of over 700 trillion Btus.

In FY 2005, the Industrial Assessment Center (IAC) activity will enter phase II of integrating the overall Best Practices (BP) tools and training into the IAC activity. In the ongoing Phase I, either the Director or Assistant Director at each of the 26 IAC Centers would be certified as a Qualified Specialist in one of the BestPractice energy management software tools. In Phase II, Center Directors certified as qualified specialists in the BP software will become certified as training instructors and will additionally pursue specialist training in additional tools.

Provide energy, waste, and productivity training to over 150 engineering students at 26 participating universities and help them continue to provide a nationwide cadre of experienced and trained engineering alumni. Fully implement the student certification program and provide approximately 150 graduating students with credentials important to them in their further graduate studies and/or in their careers in industry.

Centers will continue to utilize more proactively the BP software tools in their assessment "tool kits" and will continue to develop and replicate innovative implementation strategies to increase energy savings recommendations and to promote the adoption of those recommendations by client companies. Replication strategies will be developed to help client companies better promote energy savings recommendations made by the IAC's to other facilities within their corporate structures. Emphasis will continue to be placed on student training and student activities including student participation in professional and technical conferences and on licensing opportunities.

In FY 2003, this activity was reduced by $117,496 and the funds transferred to the Science Appropriation for SBIR/STTR. *Participants include 26 IAC universities plus one IAC manager (Rutgers University*): *Colorado State University, Loyola Marymount University, Syracuse University, University of Illinois at Chicago, University of Louisiana at Lafayette, Oklahoma State University, Iowa State University , North Carolina State University, University of Massachusetts at Amherst, Mississippi State University, University of Miami, University of Florida, Oregon State University, San Francisco State University, Texas A & M University, San Diego State University, Lehigh University ,Georgia Institute of Technology, University of Utah, University of Wisconsin-Milwaukee, University of Michigan, University of Dayton, West Virginia University, Bradley University, Arizona State University, and University of Texas at Arlington*.

- **Best Practices** **8,037** **8,133** **8,500**

In FY 2005, the development of Best Practices software tools and related training activities such as workshops continue to be a key strategy for increasing energy efficiency in manufacturing plants. Partnering with trade and technical associations and development of specialists qualified in the use of Best Practices software tools have contributed to the use of these tools in the end-user community. Although this strategy has been very successful with significant energy savings, there is a need to improve existing software tools, create new software tools, and to explore other ways to expand the use of software tools. Since it is difficult for plant personnel to attend one or two-day training workshops, distance-learning options will be explored. Several options are available including web-based systems that are either self-paced or instructor-led, CD-ROMS, and live web casts. Based on input from the manufacturing community and other interested parties, a distance learning process will be developed and beta tested.

Continue technical assistance to plant sites, enabling their use of industrial process application tools relevant to motor, pump, process heating, steam and compressed air systems emphasizing system-level improvements. In collaboration with industry, complete development of fan assessment tool and update other tools, as necessary.

Continue efforts to replicate plant-wide assessment results from prior awards in industrial facilities with similar process lines. Complete efforts to increase Allied Partners to 100 companies, support industries and trade associations. Use Allied Partnerships to facilitate replication of the entire Best Practices portfolio.

In FY 2003, this activity was reduced by $144,543 and the funds transferred to the Science Appropriation for SBIR/STTR.

Total, Industries of the Future (Crosscutting)	**33,533**	**39,904**	**31,900**

Explanation of Funding Changes

	FY 2005 vs. FY 2004 ($000)
Industrial Materials of the Future	
Reduce support for materials for engineering components commensurate with current targets and priorities	-1,542
Combustion	
Reduce support for ultra-high efficiency, low emission refinery process heaters commensurate with current targets and priorities.	-375
Gasification Programs	
No funding is requested for this activity	-4,939
Robotics	
FY05 research efforts in this area will be combined with the activities in the Sensors and Automation area	-1,975
Sensors and Automation	
Reduce support for affordable wireless technology commensurate with current targets and priorities	-628
Industrial Technical Assistance	
This increase will permit increased activity in the dissemination of energy-efficiency technologies and practices to help accelerate industry understanding, acceptance, and implementation of efficiency advances	
▪ **Industrial Assessment Centers**	
Restoration of this program to former funding levels is viewed as a priority due to its high level of benefits per dollar spent. A transfer of funding from the Industrial Materials of the Future research	+1088
▪ **Best Practices**	
This program has very high benefits per dollar spent. A transfer of funding from the Industrial Materials of the Future research	+367
Total, Industrial Technical Assistance	**+1,455**
Total Funding Change, Industries of the Future (Crosscutting)	**-8,004**

Technical/Program Management Support

Funding Schedule by Activity

(dollars in thousands)

	FY 2003	FY 2004	FY 2005	$ Change	% Change
Technical/Program Management Support					
Technical/Program Management Support.....	3,998	5,917	3,793	-2,124	-35.9%
Total, Technical/Program Management Support	3,998	5,917	3,793	-2,124	-35.9%

Description

Technical/Program Management activities include preparation of program strategic and operating plans; evaluation of the impact of new legislation on R&D programs; identification and application of performance methodologies (including GPRA); and data collection to assess program and project performance, efficiency and impacts on accomplishing the mission.

Benefits

The technical/program management subprogram provides the analysis framework and technical support to meet the requirements of Department's planning process, Congress, GPRA, and PART (planning, management and purpose). This subprogram also analyzes program gaps and new R&D opportunities. This planning and management analysis is necessary to keep the program's research agenda on target to meet the Program Goal, in the face of dynamic market and technology developments.

Detailed Program Justification

(dollars in thousands

	FY 2003	FY 2004	FY 2005
Technical/Program Management Support.....	**3,998**	**5,917**	**3,793**

In FY 2005, provide critical technical and program management support services including support for multi year planning; strategic planning; analysis of program activities to support efforts to refocus work to achieve greater program impacts; peer reviews of R&D programs and program portfolios and management; and analysis and assessments of past program impacts and performance. *Participants include PNNL, NREL, Energetics, Inc., BCS, Inc., and Rand Corporation.*

Total, Technical/Program Management Support.....	**3,998**	**5,917**	**3,793**

Explanation of Funding Changes

	FY 2005 vs. FY 2004 ($000)
Technical/Program Management Support	
Funding level reflects consolidation of solicitations and projects within ITP.	-2,124
Total Funding Change, Technical/Program Management Support	**-2,124**