DEPARTMENT OF ENERGY
FY 2002 CONGRESSIONAL BUDGET REQUEST
ENERGY EFFICIENCY AND RENEWABLE ENERGY
ENERGY CONSERVATION
(Tabular Dollars in Thousands, Narrative in Whole Dollars)

INDUSTRY SECTOR

PROGRAM MISSION

Mission

The Office of Industrial Technologies (OIT) partners with key, energy-intensive industries to develop and apply advanced technologies and practices that reduce energy consumption, maintain and create jobs, boost productivity, and significantly improve the competitiveness of the United States.

Strategic Context

Industry is our Nation=s largest energy consuming sector, accounting for 38 percent of all U.S. energy use. Moreover, just nine industries **B** agriculture, aluminum, chemicals, forest products, glass, metal casting, mining, petroleum, and steel **B** account for 27 percent of all U.S. energy use. Collectively, these nine industries represent the backbone of the U.S. economy, supplying over 90 percent of the materials needed for our buildings, transportation, communications, and manufacturing sectors. They ship $1 trillion in products annually, employ over 3 million people, and generate four additional jobs in the economy for each manufacturing job.

These nine industries contain tremendous opportunities to reduce energy use while increasing productivity and cutting waste. However, they are limited in their ability to invest in the necessary R&D by several factors:

- Narrow profit margins and dependence on capital-intensive equipment
- Increasing competition from foreign firms that receive significant support and market advantages from their governments
- Volatile energy prices (industrial energy prices rose 21 percent or more in 1999-2000) and sporadic energy supply interruptions
- Growing pressure to restrict emissions and effluents

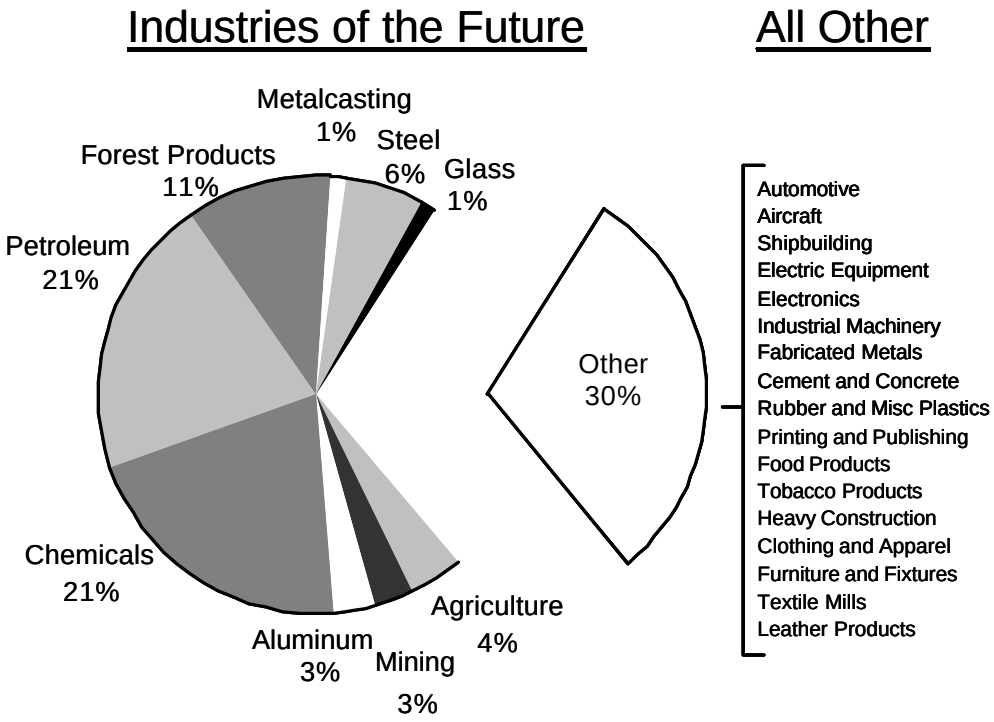
As a result, energy-intensive industries typically invest in R&D at one-third the rate of the manufacturing sector as a whole.

Strategic Approach

By developing and adopting more energy-efficient technologies, industry can boost productivity and competitiveness, strengthen national energy security, and improve the environment. A collaborative partnership between industry and government provides the best strategy to align national energy objectives with the commercial interests of industry for mutual benefit. Through an innovative strategy known as "Industries of the Future", OIT helps industry develop and apply advanced, energy-efficient technologies and processes. OIT invests in pre-competitive and high-risk R&D that individual companies are unable to undertake without government support. By working with entire industries rather than individual companies, OIT maximizes the energy benefits of technology investments and fosters the formation of public-private partnerships. Although the Industries of the Future strategy focuses on nine key energy-intensive industries, it engages the participation and expertise of many related industries.

Energy Use by Industry

Total 1999 End Use: 36.7 Quads[1]



[1]Includes 2.8 quads of renewable energy used principally in the forest products industry.

The Industries of the Future strategy is founded on the conviction that industry is best qualified to identify its technology priorities. The strategy features three core components:

1) Industry leaders collaboratively define a vision, develop industry-wide long-term goals, and create technology roadmaps that articulate specific technology and research strategies to achieve the vision.
2) OIT issues competitive R&D solicitations in support of the roadmaps, requiring a 50 percent cost share from industry over the life of each project. OIT selects projects that address top industry needs, require government support, and help meet national energy goals.
3) OIT supports related programs that focus on crosscutting technologies, financial assistance, and technical system assessments that serve multiple energy-intensive industries.

OIT is continuing its national efforts through its State Industries of the Future initiative. Since each State has a distinctive industrial base, environmental profile, and natural resource mix, the initiative encourages States to tailor its partnership to meet regional industrial energy priorities. The importance of energy-intensive industries to State economies is widely recognized and has given rise to a network of partnerships among State agencies, industry associations, and regional organizations. The Industries of the Future strategy capitalizes on these natural partnerships at the State and regional level to leverage national technology investments; increase energy, economic, and environmental benefits; coordinate State and national activities; and reach smaller companies.

The Industries of the Future strategy facilitates industry access to the wealth of technologies and specialized expertise available through the DOE laboratories and universities. The visions and roadmaps help DOE labs better understand, communicate, and provide efficient access to the special capabilities they possess.

Goals and Benefits

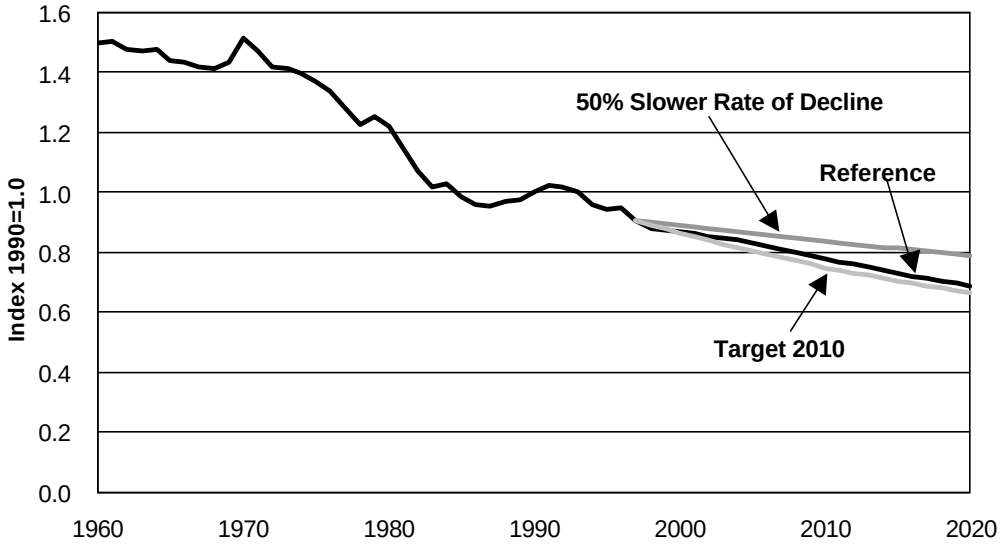
Goals and Performance Measures:

- **$** By 2010, contribute to a 25 percent improvement in energy efficiency and 30 percent reduction in emissions for the nine partner industries (from 1990 levels), and a 35 percent improvement in efficiency and 50 percent reduction in emissions by 2020. See figure1.
- **$** By 2010, commercialize over 180 technologies through R&D partnerships.

Benefits:

By 1999, OIT programs were instrumental in achieving energy cost savings to industry of 189.4 trillion Btus and $820 million. By 2000, OIT had helped develop more than 140 commercialized industrial technologies. This success rate is on the industry pull designed into the Industries of the Future strategy. OIT currently supports roughly 500 R&D projects involving over 2,000 partners. Partners include small, medium, and large companies; national laboratories; universities; States; and non-governmental organizations. R&D projects will be continued. The completion of these projects and their commercialization will provide significant contributions to energy efficiency improvements and reductions in emissions for energy intensive industries.

Figure 1: Industrial Energy Intensity in Alternative Scenarios, 1960-2020



DEPARTMENT OF ENERGY
FY 2002 CONGRESSIONAL BUDGET REQUEST
ENERGY CONSERVATION
(Dollars in Thousands)

INDUSTRY SECTOR

PROGRAM FUNDING PROFILE

Program Activity	FY 2000 Comparable	FY 2001 Comparable	FY 2002 Request	Program Change Request vs. FY 2001 Dollar	Program Change Request vs. FY 2001 Percent
Industries of the Future (Specific) Operating Expenses	$ 65,644	$ 72,390	$ 46,424	$ -25,966	-35.9%
Industries of the Future (Crosscutting) Operating Expenses	$ 57,609	$ 61,719	$ 31,900	$ -29,819	-48.3%
Cooperative Programs with States Operating Expenses	$ 1,964	$ 1,996	$ 0	$ -1,996	-100.0%
Energy Efficiency Science Initiative Operating Expenses	$ 3,830	$ 3,891	$ 0	$ -3,891	-100.0%
Management and Planning Operating Expenses	$ 8,369	$ 8,626	$ 9,400	$ 774	9.0%
TOTAL	$ 137,416	$ 148,622	$ 87,724	$ -60,898	-41.0%
Summary					
Operating Expenses	$ 137,416	$ 148,622	$ 87,724	$ -60,898	-41.0%
Total Program	$137,416[a]	$148,622[b]	$ 87,724	$ -60,898	-41.0%

Staffing (FTE's)			
HQ FTEs	52	59	54
Field FTEs	8	7	6
Total FTEs	60	66	60

Authorizations:
P.L. 102-486, "Energy Policy Act of 1992"
P.L. 94-163, "Energy Policy and Conservation Act" (EPCA) (1975)
P.L. 94-385, "Energy Conservation and Production Act" (ECPA) (1976)
P.L. 95-91, "Department of Energy Organization Act" (1977)
P.L. 95-618, "Energy Tax Act of 1978"
P.L. 95-619, "National Energy Conservation Policy Act" (NECPA) (1978)
P.L. 95-620, "Powerplants and Industrial Fuel Use Act of 1978"
P.L. 96-294, "Energy Security Act" (1980)
P.L. 100-12, "National Appliance Energy Conservation Act of 1987"
P.L. 100-615, "Federal Energy Management Improvement Act of 1988"
P.L. 101-218, "Renewable Energy and Energy Efficiency Technology Competitiveness Act of 1989"
P.L. 101-549, "Clean Air Act Amendments of 1990"
P.L. 101-575, "Solar, Wind, Waste, and Geothermal Power Production Incentives Act of 1990"
P.L. 93-577, "Federal Non-nuclear Energy Research and Development Act of 1974"
P.L. 106-224, "Biomass Research and Development Act of 2000"

[a/] Reflects adjustment for approved reprogramming 00-R-3 of $-2,575,000 for the Small Business Innovative Research (SBIR) program and $-155,000 for the Small Business Technology Transfer Pilot Program (STTR). Reflects comparability adjustment of $-34,700,000 for the new Power Technologies Program

[b/] Reflects adjustment of $-328,000 for Omnibus Rescission, P.L. 106-554. Reflects comparability adjustment of $-25,700,000 for the new Power Technologies Program.

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SUMMARY OF CHANGES

	FY 2002 Request
FY 2001 Comparable	$ 148,622
Non-Discretionary	
– Increase for Federal Pay Raise and Locality Pay.	388
– Increase for Federal Personnel Transit Subsidy.	16
FY 2002 Base	$ 149,026
Industries of the Future (Specific):	
– Steel Vision - FY 2002 funding will focus on improving production efficiency.	-4,049
– Petroleum Vision - No funding requested.	-2,768
– Aluminum Vision - FY 2002 funding will focus on develpment of improved potliners and a control strategy for an advanced cell technology..	-6,325
– Mining Vision - FY 2002 funding will focus on advanced mining and processing technologies..	-1,398
– Metalcasting Vision - New Casting Applications will be shifted to industry, Government support will focus on new material and manufacturing technologies.	-2,202
– Glass Vision - FY 2002 funding will focus on improving energy efficiency in glass furnace combustion.	-1,822
– Chemicals Vision - FY 2002 funding will focus on new chemical science and engineering.	-4,781
– Supporting Industries -No funding requested.	-1,571

– Technical/Program Management Support - The reduction reflects required support for associated reduced program funding levels.	-1,050
Industries of the Future (Crosscutting):	
– Enabling Technologies - Materials - Delay implementation of Industrial Materials of the Future Program. Combustion - Continue support of only 1 of 3 gasification technology demonstrations for forest products industry. Sensors and Controls - No funding requested for two new control system projects. Delay five sensor projects with broad industry applicability	-15,666
– Financial Assistance - No funding requested for initiation of new projects to reflect priority shift from commercialization to research and development.	-5,132
– Technical Assistance - Conduct 320 industrial assessments. Best Practices program will focus on development of allied partnerships, cost-shared plant assessements, and recognition programs.	-7,019
– Technical/Program Management Support - The reduction reflects required support for associated reduced program funding levels.	-2,002
Cooperative Programs With States:	
– No funding requested.	-1,996
Energy Efficiency Science Initiative:	
– No funding requested.	-3,891
Management and Planning:	
– An increase for evaluation and planning offset from a reduction of 6 FTEs as adjusted for discretionary payroll increases.	370
FY 2002 Congressional Budget Request	$ 87,724

INDUSTRIAL TECHNOLOGIES
INDUSTRY SECTOR
(Dollars in Thousands)

INDUSTRIES OF THE FUTURE (SPECIFIC)

I. Mission Supporting Goals and Objectives

Mission

The Industries of the Future (IOF) Specific Program develops and delivers advanced technologies to improve the energy efficiency and environmental performance of America's most energy- and waste-intensive industries. To provide the best value and optimum use of public investments, the IOF Specific Program focuses on nine major U.S. industries (aluminum, agriculture, chemicals, forest products, glass, metal casting, mining, steel, and petroleum) that account for roughly 75 percent of industrial energy use and over 75 percent of manufacturing wastes.

Program Goals and Benefits

The IOF strategy aligns Federal R&D resources with the industry's highest energy and environmental priorities as specified in industry-developed visions and technology roadmaps. The IOF strategy is based on the premise that industry is most able to identify its own unique technology needs. OIT then partners with industry (on a 50/50 cost-share basis) to develop technologies that offer significant opportunities for energy savings and waste reduction and also meet strict requirements for Federal investment. Those requirements include funding projects that are pre-competitive, are high priority and high payoff, will result in significant energy and waste reduction, and can be applied throughout an entire industry not just individual firms.

The manufacturing sector was the largest contributor to economic growth between 1992 and 1997. However, the energy-intensive industries are under enormous competitive pressure which severely limits the ability to invest in long-term, broad benefit R&D. Economic conditions have shifted corporate investments from process R&D to product R&D and from energy savings to labor and capital savings. Thus, many fundamental improvements in energy efficiency and environmental performance are simply too expensive and too risky for individual firms to pursue alone.

To achieve the desired energy savings, OIT engages industry at the onset of the process so that new technologies will be more readily adopted on a widespread basis. OIT taps into the financial and technology resources within manufacturers, customers, suppliers, DOE, other Federal agencies, State government agencies, National Laboratories, and universities to tackle critical technology challenges for mutual benefit.

Although OIT's R&D investments are small compared to those of industry, the IOF strategy provides a powerful lever for stimulating and guiding major technology investments by industry and other government agencies. By aligning resources through industry-developed visions and roadmaps, significant advancements in energy efficiency and environmental performance, across the industry, can and are being achieved.

Goals and Performance Measures:

- **Agriculture** - By 2020, through integrated partnerships with growers, manufacturers, academia, non-profits and national labs, develop leap-frog technologies that allow the nascent biobased products industry to achieve a five-fold increase in the market share for chemicals and consumer goods from crops, trees, and wastes.
- **Aluminum** - Continue development of aluminum advanced cell, including inert, non-carbon anodes and cathodes, for primary production of aluminum to reduce energy consumption by 27 percent.
- **Chemical** - Continue efforts to reduce energy consumption, materials use, water consumption, pollutant and toxic dispersion by 30 percent.
- **Forest Products** - By 2010, increase recovered paper utilization rate to 50 percent by 2010 from 38 percent in 1998.
- **Forest Products -** By 2015, reduce unit water effluent levels by 35 percent compared to 1991 levels.
- **Glass** - Continue projects to develop advanced glass melting technology that will reduce the gap between actual energy use and theoretical efficiency by 50 percent.
- **Metal Casting** - Continue development of energy efficiency technologies to increase yield, reduce scrap, and improve melting efficiency to achieve $300 million in energy savings.
- **Mining** - Continue research on advanced mining and process technologies to reduce energy use and increase productivity.
- **Steel** - Continue technology development efforts to reduce energy used to produce steel.

Benefits:

According to industry feedback from bi-annual Customer Appreciation Days, one of the most important benefits of the IOF partnership is the opportunity for the industry to come together and work on common problems for mutual benefit. This includes the opportunity to collaborate on research and address critical industry issues such as air quality. Companies engaged in the IOF process have indicated that it has improved research focus within the industry and their respective firms, created new technical efforts and partnerships, strengthened relations with the government, and the research community, and improved education and awareness. In sum, the IOF strategy provides a platform for participation that encourages knowledge-sharing and stimulates innovation to ensure globally-competitive and sustainable industries of the future. This budget request will continue activities for eight energy intensive industries. The completion of these projects and their commercialization will provide significant contributions to energy efficiency improvements and reductions in emissions for these energy intensive industries.

Industries of the Future (Specific) Accomplishments

FY 2000 Accomplishments:

- Initiated 12 solicitations with industry in support of the roadmaps developed in the Industries of the Future program.

FY 2001 Ongoing Accomplishments:

- Issue one new solicitation targeted to the Renewables Vision 2020 for Agriculture in support of the goals of the Biobased Products and Bioenergy Initiative.

FY 2002 Planned Accomplishments:

- Commercialize six new energy efficient technologies in partnership with the most energy intensive industries.

II. A. Funding Table: INDUSTRIES OF THE FUTURE (SPECIFIC)

Program Activity	FY 2000 Comparable	FY 2001 Comparable	FY 2002 Request	$ Change	% Change
Forest and Paper Products Vision	$ 11,684	$ 11,827	$ 11,827	$ 0	0.0%
Steel Vision	$ 10,193	$ 10,378	$ 6,329	$ -4,049	-39.0%
Aluminum Vision	$ 10,878	$ 10,928	$ 4,603	$ -6,325	-57.9%
Metalcasting Vision	$ 5,490	$ 5,559	$ 3,357	$ -2,202	-39.6%
Glass Vision	$ 4,492	$ 4,594	$ 2,772	$ -1,822	-39.7%
Chemicals Vision	$ 12,165	$ 12,239	$ 7,458	$ -4,781	-39.1%
Petroleum Vision	$ 1,671	$ 2,768	$ 0	$ -2,768	-100.0%
Mining Vision	$ 2,698	$ 3,517	$ 2,119	$ -1,398	-39.8%
Agriculture Vision	$ 3,700	$ 6,759	$ 6,759	$ 0	0.0%
Supporting Industries.	$ 0	$ 1,571	$ 0	$ -1,571	-100.0%
Technical / Program Management Support.	$ 2,673	$ 2,250	$ 1,200	$ -1,050	-46.7%
Total, Industries of the Future (Specific)	$ 65,644	$ 72,390	$ 46,424	$ -25,966	-35.9%

Note: Industries of the Future (Specific) includes $800 for the State Energy Program Special Projects State Grants in FY 2002, $1,340 in FY 2001, and $1200 in FY 2000. Decrease State IOF awards from 14 to 7.

II. B. Laboratory and Facility Funding Table: INDUSTRIES OF THE FUTURE (SPECIFIC)

	FY 2000 Comparable	FY 2001 Comparable	FY 2002 Request	$ Change	% Change
Ames	$ 72	$ 0	$ 0	$ 0	0.0%
Argonne National Lab (East)	$ 2,904	$ 2,219	$ 1,423	$ -796	-35.9%
Lawrence Livermore National Lab	$ 347	$ 400	$ 257	$ -143	-35.9%
Idaho National Engineering Lab	$ 1,020	$ 796	$ 510	$ -286	-35.9%
Lawrence Berkeley Lab	$ 815	$ 707	$ 453	$ -254	-35.9%
Los Alamos National Laboratory	$ 1,398	$ 1,000	$ 641	$ -359	-35.9%
National Renewable Energy Lab	$ 642	$ 733	$ 470	$ -263	-35.9%
Oak Ridge National Lab	$ 6,661	$ 4,458	$ 2,859	$ -1,599	-35.9%
Pacific Northwest Lab	$ 2,006	$ 1,042	$ 668	$ -374	-35.9%
Sandia National Laboratories	$ 3,685	$ 2,378	$ 1,525	$ -853	-35.9%
All Other	$ 46,094	$ 58,657	$ 37,618	$ -21,039	-35.9%
Total, Industries of the Future (Specific)	$ 65,644	$ 72,390	$ 46,424	$ -25,966	-35.9%

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC)

Program Activity	FY 2000	FY 2001	FY 2002
Forest and Paper Products Vision	**Energy Performance** Research in this area was targeted to increase the industry's fuel flexibility, improve process energy efficiency, and ultimately allow the industry to become essentially independent of fossil fuels. Projects focused on fuel flexibility, fuel conversion and electricity production, heat recovery, manufacturing process efficiency, wider use of renewable resources, and environmental impacts of energy production. A reburner technology to improve energy efficiency and decrease NOx emissions in stoker boilers was demonstrated. ($1,369)	**Energy Performance** Research is targeted to improve energy efficiency and utilization, develop new techniques to extract maximum energy from waste streams, and increase the industry's fuel flexibility. One of the 12 energy reduction projects is developing a wood chip microwave pretreatment technology to increase the yield, efficiency, and quality of Kraft pulping while decreasing chemical consumption and cooking temperatures. ($1,431)	**Energy Performance** Approximately 15 projects will focus on industrial energy efficiency, low level heat recovery. Two technical feasibility studies that will be completed are: the development of an innovative energy efficient paper drying technology; and an assessment of deposit formation in recovery boiler convection passes. In addition, corrosion resistant materials will be developed for use in black liquor gasifiers ($1,445).
	Environmental Performance Projects focused on improving margins of environmental safety and developing process alternatives consistent with pollution prevention. New, high-efficiency chlorine dioxide delignification procedures were employed in mills. An energy-efficient, low volatile organic compound wood drying technology	**Environmental Performance** Research in this area is targeted to develop advanced pollution prevention technologies, decrease pollution abatement costs, and ensure manufacturing facilities are acceptable to industry workers and local communities. Ten projects are funded. An example of this research included a Volatile	**Environmental Performance** Approximately 15 projects will focus on developing advanced pollution prevention technologies, reducing pollution abatement costs, and ensuring manufacturing facilities are acceptable to industry workers and local communities. Several technical feasibility studies will be completed including the use

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Forest and Paper Products Vision (Cont'd)	was demonstrated in a lumber yard. ($2,486)	Organic Compound (VOC) reduction model that was used for emissions control in kraft mills. In addition, a technology to extract and collect VOC's from lumber drying processes will be commercially demonstrated eliminating the need for expensive, energy-intensive emissions control technologies. ($2,508)	of paper mill by-products as an economical source of fiber reinforcement for ready-mixed concrete production, the optimization of oxygen bubble size for oxygen bleaching; and the development of a control strategy to reduce the emissions from wood dust burners and wood dryers. ($2,975)
	Improved Capital Effectiveness Research in this area was targeted to reducing the capital requirements per unit of production and sales. Seven projects were funded and focused on system and process efficiency, materials of construction, and fabrication. A study to assess and eliminate corrosion in Kraft digesters was initiated. ($1,303)	**Improved Capital Effectiveness** Research in this area is targeted to reducing the capital requirements per unit of production and sales. Twelve projects are funded and focused on system and process efficiency, materials of construction, and fabrication. An example of these projects is a tool to predict the corrosion rates in a kraft chemical recovery boiler. This tool will decrease maintenance downtime and increase the safety of the chemical recovery boiler operation. ($1,315)	**Improved Capital Effectiveness** Approximately 12 projects will focus on systems and process efficiency, and materials of construction and fabrication. Feasibility studies will be completed to: understand the formation of soluble scale fouling in concentrators and evaporators; evaluate energy efficient corregating technologies; and explore the use of natural gas rather than steam in paper drying. ($1,395)

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Forest and Paper Products Vision (Cont'd)	**Recycling** Research in this area was targeted to improving separation technologies, reducing energy usage and fiber deterioration, determining optimal combinations of recycled and virgin fibers, and expanding the use of recycled products. Projects focused on sludge use and disposal, surface chemistry, fiber bonding, sorting and collection methods, improved separation technologies, and environmentally benign pressure-sensitive adhesives. A revolutionary screening device was explored. ($1,050)	**Recycling** Research in this area was targeted to improving separation technologies, reducing energy usage and fiber deterioration, determining optimal combinations of recycled and virgin fibers, and expanding the use of recycled products. One of the 8 projects funded is to develop a new screening technology that reduced energy requirements by as much as 80 percent while improving the screen performance and reliability. Screening technologies are used to remove contaminants from recycled fiber. ($1,059)	**Recycling** Approximately 10 projects will be funded to reduce energy use and fiber deterioration in recycling, improve separation technologies and expand the use of recycled fibers. Progress will continue on the development of: pressure sensitive adhesives strong enough to remain intact through the pulping process and removable prior to paper making; and an automated, efficient, fast, autonomous waste paper sorting system. A technology to induce frothing from the top of a flotation deinking cell reducing the energy requirements for deinking will be demonstrated. ($1,475)
	Sensors and Controls Research in this area was targeted to optimize mill operations, evaluate the characteristics of raw materials and final products, and detect emissions. Projects focused on the development of actuators and control devices, process and product models, process measurement, data interpretation, and control system	**Sensors and Controls** Research in this area is targeted to optimizing mill operations, evaluating the characteristics of raw materials and final products, and detecting emissions. An example of the projects in this area was the development of an intelligent, vision-based apparatus for measuring properties on the wet	**Sensors and Controls** Approximately 12 projects will be funded focusing on the development of actuators and control devices, process and product measurement and modeling, and data interpretation. Specifically, an acoustic wave monitor for on-line measurement of the amount of corrosion and erosion

Program Activity	FY 2000	FY 2001	FY 2002
Forest and Paper Products Vision (Cont'd)	effectiveness. A tool and methodology was to be commercialized for characterization of the raw material used in the paper making process. ($3,867)	end of the paper machine. Knowledge of wet-end process parameters improved the efficiency of water removal and reduced energy requirements in drying, the most energy-intensive paper making process. Eight projects were funded. ($3,877)	in recovery boiler tubing will be developed as well as a model to diagnose and optimize control of continuous kraft pulp digesters. ($2,900)
	Sustainable Forestry Collaborative research in this area was targeted to increase forest growth rates and enhance the fiber quality from trees. Projects focused on biotechnology, tree physiology, and sustainable soil productivity. Marker-aided selection methods for selection of genotypes for cloning were developed. ($1,609)	**Sustainable Forestry** Research in this area was targeted to optimize raw material supply by improving wood quality and increasing the yield of wood and fiber per harvested acre. Results reduced costs and increased efficiencies in manufacturing processes for pulp, paper, and wood products. Environmental benefits included increased rates of carbon sequestration in forests and forest products; reduced consumption of pulping and bleaching chemicals; and an increased supply of wood and manufacturing residues to support renewable biomass energy. An example of this research included the development of a process to increase the stem growth rates of loblolly pine and study the	**Sustainable Forestry** Approximately 6 projects will be funded focusing on biotechnology, tree physiology and sustainable soil productivity. Feasibility studies will be completed that evaluate techniques to improve the uniformity of fibers from loblolly pine with increased stem growth; and the use of molecular breeding to achieve desirable traits in juvenile loblolly pine. ($1,637)

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Forest and Paper Products Vision (Cont'd)		molecular mechanisms of cell division to improve the efficiency of wood pulping. Five projects were funded. ($1,637)	
	Participants included: 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.	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.	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.
Total, Forest and Paper Products Vision	**$11,684**	**$11,827**	**$11,827**
Steel Vision	**Production Efficiency**	**Production Efficiency**	**Production Efficiency**
	Collaborative R&D with the industry to develop improved energy-efficient, low-carbon dioxide emission, alternative iron and steel making processes was supported. R&D was initiated on subjects such as advanced shaping technologies and improved process control including sensors for the blast furnace, basic oxygen furnace, and electric arc furnace (EAF). R&D on improved steel quality and	Research to reduce energy while lowering emissions and increasing productivity in steel processing focuses on a wide range of topics as identified in the Steel Industry Technology Roadmap. Currently, key advances are being made through improved sensing and control, increased use of by-products and recycling, and process improvement. These activities will support the industry's reduction of	Design and construct pilot plant demonstrating controlled thermo-mechanical processing for tubes and pipe. Demonstrate an automated steel cleanliness tool using scanning electron microscopy in a plant environment. Assess role of strip casting, based on the structure and properties of strip cast material. ($4,000)

Program Activity	FY 2000	FY 2001	FY 2002
Steel Vision (Cont'd)	consistency using lower cost raw materials was continued. ($3,657)	energy use by 19 percent while increasing its use of recycled steel and by-products to 66 percent of production. Collaborative R&D with the industry to develop improved, energy-efficient, low carbon dioxide emission, alternative iron and steel making processes will be supported. R&D will be conducted to improve the efficiency and productivity of the blast furnace, basic oxygen furnace, and electric arc furnace by developing modifications to hardware and operational practices. These modifications will result from analyses and laboratory studies based on initial efforts in computational fluid dynamics and other design technologies leveraged from the Chemicals Vision. ($3,725)	
	Recycling R&D R&D on methods of increasing steel production based on recovery of iron units from all waste streams was conducted. R&D improved methods of recovering iron units and other metals (e.g., zinc, lead) from	**Recycling R&D** R&D on methods of increasing steel production based on recovery of iron units from all waste streams will be conducted. R&D will identify methods of increasing the efficiency of recycling steel from	**Recycling R&D** Determine operating practices enhancing recycling of waste oxides in the steelmaking vessel. ($1,879)

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Steel Vision (Cont'd)	EAF dust and waste oxides. Improved methods for recycling spent refractories were developed. ($2,860)	in-plant wastes. Processes will be analyzed to identify ways to use other in-plant wastes as feedstock to reduce energy use. ($2,925)	
	Environmental Engineering R&D focused on lowering carbon dioxide and NOx emissions from heating and reheating processes associated with steel production. Research concentrated on advanced burners and burner controls, and on methods to reduce coke use in the blast furnace through hot oxygen injection. ($3,676)	**Environmental Engineering** R&D will develop methods for reducing the amount of consumables used in the steel making process. Consumables such as refractories can become an environmental disposal problem at the end of their lifetime. Efforts will continue to reduce NOx and CO_2 levels from the various unit operations in the steel mill. ($3,248)	**Environmental Engineering** No activity. ($0)
	Feasibility Studies on Innovative Steel Production No activity.	**Feasibility Studies on Innovative Steel Production** Significant cross-over of technologies between Electric Arc Furnace (EAF) and Basic Oxygen Furnace (BOF) steel making indicate that there are significant opportunities to improve the steel making process by, at a minimum, combining and optimizing the best	**Feasibility Studies on Innovative Steel Production** Steel Cup Challenge: Continue activities to develop a new steel conversion process based on prior year studies. ($450)

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Steel Vision (Cont'd)		features of both. The development of a recuperated, continuous (as opposed to batch) steelmaking process could result in saving half the energy currently used in the steel conversion/melting operation. These activities would initiate the feasibility and design studies to develop a new steel conversion process. ($480)	
	R&D participants in the Steel Vision included: American Iron and Steel Institute, member and associate member companies, Steel Manufacturers Association, member and associate member companies, national laboratories, and universities.	R&D participants in the Steel Vision include: American Iron and Steel Institute, member and associate member companies, Steel Manufacturers Association, member and associate member companies, national laboratories, and universities.	R&D participants in the Steel Vision include: American Iron and Steel Institute, member and associate member companies, Steel Manufacturers Association, member and associate member companies, national laboratories, and universities.
Total, Steel Vision	**$10,193**	**$10,378**	**$6,329**
Aluminum Vision	**Primary Production Technologies**	**Primary Production Technologies**	**Primary Production Technologies**
	An accelerated research program was initiated for the development and implementation of an advanced cell, which would be the most significant advancement in aluminum production technology	The accelerated research program will continue for the development and implementation of an advanced cell with the potential to reduce energy consumption by 27 percent and greenhouse gas emissions by	Continue preparations to demonstrate, in full-scale cell tests, commercial viability of potliners containing additives for improved performance and life. Develop control strategy using sensors for

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Aluminum Vision (Cont'd)	since the development of the Hall-Heroult process in 1886. Activities included pilot cell tests of two novel designs and inert anode/cathode materials combinations, as well as 12 kiloAmpere pilot-cell tests of wettable cathode materials with a drained cathode design. In addition, an investigation was initiated into the feasibility of a novel smelting process based on fuel cell technology. Saltcake recycling was demonstrated at pilot-plant scale, and R&D was conducted to develop sensors and controls to sort aluminum scrap at high speeds. ($7,227)	5.5 MMTCE over a "business as ususal" scenario. Implementation of an advanced cell of this kind would be the most significant advancement in aluminum production technology since the development of the Hall - Heroult process in 1886. Scale up of advanced cell development and testing may be delayed indefinitely due to the energy crisis and resulting shut-down of much of the primary aluminum production capacity in the U.S. Feasibility of using fuel cell technology for development of a non-consumable anode will be evaluated, and a control strategy using sensors will be developed for aluminum smelting cells. A pilot scale demonstration of saltcake recycling technology will be completed. Laser and optical techniques for scrap sorting will be evaluated. ($7,237)	aluminum smelting cells and continue to prepare for scale up of advanced cell technology. ($4,603)
	Semi-Fabrication Technologies	**Semi-Fabrication Technologies**	**Semi-Fabrication Technologies**
	A vertical flotation melter and a commercial-scale, high-efficiency, low-NOx combustion system for	Year-long tests of potlinings containing additives for improved performance and life will be	No funding requested. ($0)

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Aluminum Vision (Cont'd)	aluminum scrap remelting was demonstrated. ($3,651) Participants included: Advanced Refractory Technologies, Alcan, Aluminum Company of America, Argonne National Laboratory, Brooks Rand Laboratories, Century Aluminum, EMEC Consultants, Energy Research Company, Goldendale Aluminum, Kaiser Aluminum Company, Northwest Aluminum, NSA Aluminum, Oak Ridge National Laboratory, Michigan Technological University, Reynolds Metals Company, Worcester Polytechnic Institute.	initiated in full-scale industrial cells. ($3,691) Participants include: Alcan, Alcoa Inc., Applied Industrial Solutions, Inc., Argonne National Laboratory, Century Aluminum, Cornell University, EMEC Consultants, Energy Research Company, Gas Research Institute, Kaiser Aluminum Company, Michigan Technological, NSA Aluminum, Oak Ridge National Laboratory, Siemens Westinghouse Co., The Ohio State University Research Foundation, West Virginia University.	Participants include: Alcan, Alcoa Inc., Applied Industrial Solutions, Inc., Argonne National Laboratory, Century Aluminum, Cornell University, EMEC Consultants, Energy Research Company, Gas Research Institute, Northwest Aluminum, Oak Ridge National Laboratory, Ohio State University Research Foundation, West Virginia University
Total, Aluminum Vision	**$10,878**	**$10,928**	**$4,603**
Metalcasting Vision	The objective of the metalcasting vision is to support metalcasting as the preferred supplier of net or near-net-shape metal components. Specific challenges to be achieved by the year 2020 include: increasing productivity by 15 percent though the development of advanced manufacturing technologies, reducing energy consumption per unit value of shipments by 20	Continue a balanced portfolio of high-priority research responsive to the goals and challenges identified in the metalcasting vision and metalcasting technology roadmap. Each of the projects is cost shared 50 percent with industry partners. There are over 220 industry partners in at least 30 states working on program-funded research projects.	Continue a balanced portfolio of high-priority research responsive to the goals and challenges identified in the metalcasting vision and metalcasting technology roadmap.

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Metalcasting Vision (Cont'd)	percent, reducing average lead time by 50 percent, achieving 100 percent pre- and post-consumer recycling and 75 percent beneficial reuse of foundry by-products, and increasing industry reinvestment in research, education and marketing programs by 10 percent.	Participants include: University of Alabama-Birmingham, University of Alabama-Tuscaloosa, Case Western Reserve University, Colorado School of Mines, University of Iowa, Iowa State University, Mississippi State University, University of Missouri-Rolla, Ohio State University, Penn State University, Oak Ridge National Laboratory, Tri-State University (Indiana), University of Tennessee, Worcester Polytechnic Institute, and Pacific Northwest National Laboratory.	
	Manufacturing Technologies Research focused on new models, tools and guidelines in order to advance casting technologies to produce high-quality, high-integrity castings. A new guideline for unconventional yield improvement techniques were made available for the steel casting industries. A 10 percent increase in yield alone has the potential benefit of saving 1.8 trillion Btu per year for melting. ($2,322)	**Manufacturing Technologies** Research continued in development of advanced casting technologies for producing high-quality castings. Research includes Advanced Lost Foam Casting technology and binders (chemicals that hold sand molds together) for iron and steel casting. Technical challenges include the removal of gaseous residuals during metal pouring, better and cheaper foam materials, and rapid prototyping of the patterns. Successful development	**Manufacturing Technologies** Develop new models and alloy properties for semisolid metal processing, and Lost Foam research and Best Practices guide-lines, minimizing die distortion, reducing scrap rate and improving productivity. ($1,557)

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Metalcasting Vision (Cont'd)		and application of Advanced Lost Foam Technology to iron and steel castings alone will have a potential energy efficiency improvement of up to 30 percent, reduce cost by 25 percent, and eliminate binder emissions associated with traditional sand casting methods for steel casting. In addition, research continues in Semi-Solid Metals Processing (SSM) to develop models and characterize material properties in order to produce higher integrity, high volume, light-weight castings, while enabling new castings with thinner walls and reduced machining requirements. ($2,312)	
	Materials Technologies Activities focused on advancing the use of new and improved materials to produce defect-free, high-quality castings while achieving longer life for mold, refractory lining, and casting dies. Innovative research in new coatings was developed to extend the useful life of casting dies ten fold in comparison with current conventional methods. ($1,820)	**Materials Technologies** Activities are focused on advancing the use of new and improved materials to produce defect-free, high-quality casting while achieving longer life for mold, refractory lining, and casting dies. Continue to focus on innovative research to develop advanced coatings capable of extending the useful life of casting dies ten fold in	**Materials Technologies** Complete materials research on the castability on aluminum die casting alloys, and develop New Heat Treating guidelines to enable U.S. die casters to extend the life of die materials by 20-30 percent. ($1,450)

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Metalcasting Vision (Cont'd)		comparison with current conventional methods. In addition, R&D efforts will continue on technologies needed to consistently produce machinable, high-strength, thin-walled gray and ductile iron castings. ($1,822)	
	Environmental Technologies Balanced portfolio included critical research needed to develop design guidelines for advanced modeling design for thin wall iron casting will be available to the metalcasting industry. In addition, a state-of-the-art Neural Network Model for processing and control of cupola furnace was made available. Potential benefits included energy savings of 400 million Btu per year per unit, environmentally enhanced cupola operation in the U.S., decreased coke requirements, reduced carbon, sulfur and manganese losses and elimination of associated emissions. ($424)	**Environmental Technologies** Balanced portfolio will include critical research needed to develop design guidelines for thin wall iron casting. Thin-wall iron castings, on the order of 3-5 mm thickness, will enable automotive engineers to design car components with significant reductions in metals required, resulting in tremendous reductions in energy use and environmental burden in both casting production and transportation fuel. ($475)	**Environmental Technologies** Make available non-incineration technique as an alternative for ferrous foundries to reduce Volatile Organic Compounds emissions. ($350)

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Metalcasting Vision (Cont'd)	**New Casting Applications** New design tools and improvements in casting techniques and models will be developed to enable new applications of advanced casting technologies, which will reduce energy usage, reduce cost, and minimize waste generated. New techniques developed for metal handling enabled U.S. metalcasters to reduce casting defects, improve quality of castings by removing/minimizing oxide defects that require weld repair, and improve the competitiveness of the U.S. metalcasting industry. ($924)	**New Casting Applications** New design tools and improvements in casting techniques and models will be developed to enable new applications of advanced casting technologies, which will reduce energy usage, reduce cost and minimize waste generated. New techniques developed for metal handling will enable U.S. metalcasters to reduce casting defects, improve quality of castings by removing/minimizing oxide defects that require weld repair, and improve the competitiveness of the U.S. metalcasting industry. ($950)	**New Casting Applications** No funding requested. ($0)
Total, Metalcasting Vision	**$5,490**	**$5,559**	**$3,357**
Glass Vision	**Production Efficiency** Modeled refractories (the main structural materials in glass melting furnaces); improved combustion and melting technology; initiated new fundamental knowledge of glass physics; better means of removing heat faster; better understanding of	**Production Efficiency** Continue modeling of refractories (the main structural materials in glass melting furnaces) and improvement of combustion and melting technology. Transfer fundamental knowledge of glass properties; better means of	**Production Efficiency** Transfer advanced sensor technologies and handglass cutting techniques to specialty glass. Continue development of feedstock measurement and control technology. Continue to implement national laboratory-based GPLUS

Program Activity	FY 2000	FY 2001	FY 2002
Glass Vision (Cont'd)	integrated product and process controls. ($1,825)	removing heat faster. Demonstrate advanced sensor technologies, handglass cutting, and process control technique for auto glass. Initiate feedstock measurement and control technology. Implement national laboratory-based GPLUS program. ($1,844)	program. ($670)
	Energy Efficiency/Conservation Combustion of space/glass furnace and control for optimal melter performance was coupled. Developed better refractories; initiated design of research facility to validate new and existing models. ($1,131)	**Energy Efficiency/Conservation** Continue to perform activities to validate new and existing models. Initiate new technologies that support innovative glassmaking and improved heat recovery. Finalize design of glass furnace combustion and melting research facility. Support activities to promote energy management practices. ($1,155)	**Energy Efficiency/Conservation** Commission the glass furnace combustion and melting research facility and begin industry tests. Continue to develop new technologies that support innovative glassmaking and improved heat recovery. Support activities to promote energy management practices. ($970)
	Environmental Protections and Recycling Pilot-scale testing of high-luminosity, low-NOx burner for glass furnaces. Developed process mechanisms that influence particulates; developed predictive	**Environmental Protections and Recycling** Demonstrate high-luminosity, low-NOx burner for glass furnaces. Initiate technology to recover and recycle in-process fiberglass waste. Initiate technology to identify and	**Environmental Protections and Recycling** Refine and transfer high-luminosity, low-NOx burner for glass furnaces. Continue to develop technology to recovery and recycle in-process fiberglass waste; identify and

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Glass Vision (Cont'd)	emissions modeling tools. Supported cullet re-use systems. ($734)	control emission management mechanisms from glass melting furnaces. Support cullet re-use systems. ($755)	control emission management mechanisms from glass melting furnaces. Support cullet re-use systems. ($720)
	Innovative Uses	**Innovative Uses**	**Innovative Uses**
	Improved glass properties using integrated ion exchange. Continued innovative glass compositions and processes to enhance performance and new material-design models to improve properties. ($664)	Initiated new technology for improved coating of flat glass. Continue innovative glass compositions and processes to enhance performance and new material-design models to improve properties. ($685)	Continue to develop new technology for improved coating of flat glass. Continue innovative glass compositions and processes to enhance performance and new material-design models to improve properties. ($313)
	Deployment Logistics	**Deployment Logistics**	**Deployment Logistics**
	Conducted technical workshops on coatings and combustion. Reviewed technology roadmap assessment. ($138)	Conduct two technical workshops. Update technology roadmap assessment. Design technology showcase. ($155)	Update technology roadmap. ($99)
	Participants included: Praxair, Institute for Glass Technology, Brigham Young University, Accu-Tru Intl., Alfred University-Center for Glass Research, PPG, Air Products, Los Alamos National Laboratory, Oak Ridge National Laboratory, Sandia National	Participants include: Visteon, PPG, Techneglas, Owens Corning, Gallo Glass, Fenton Art Glass, BOC Gases, Praxair, Accu-Tru International, Gas Technology Institute, Alfred University-Center for Glass Research, Mississippi State University, Los Alamos	Participants include: Visteon, PPG, Techneglas, Owens Corning, Gallo Glass, Fenton Art Glass, BOC Gases, Praxair, Accu-Tru International, Gas Technology Institute, Alfred University-Center for Glass Research, Mississippi State University, Los Alamos

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Glass Vision (Cont'd)	Laboratory, Pacific Northwest National Laboratory, Argonne National Laboratory, Ames, and the Federal Energy Technology Center.Visteon, PPG, Techneglas, Owens Corning, Praxair, Air Products, Accu-Tru International, Gas Technology Institute, Brigham Young University, Alfred University-Center for Glass Research, Mississippi State University, Los Alamos National Laboratory, Oak Ridge National Laboratory, Sandia National Laboratories, Pacific Northwest National Laboratories, Argonne National Laboratories, Ames Laboratory, National Energy Technology Laboratory, and the State of West Virginia.	National Laboratory, Oak Ridge National Laboratory, Sandia National Laboratories, Pacific Northwest National Laboratories, Argonne National Laboratories, Ames Laboratory, National Energy Technology Laboratory, and the States of West Virginia, Ohio, and Pennsylvania.	National Laboratory, Oak Ridge National Laboratory, Sandia National Laboratories, Pacific Northwest National Laboratories, Argonne National Laboratories, Ames Laboratory, National Energy Technology Laboratory, and the States of West Virginia, Ohio, Pennsylvania, Florida, and North Carolina.
Total, Glass Vision	**$4,492**	**$4,594**	**$2,772**
Chemicals Vision	**New Chemical Sciences and Engineering** Conducted second *Technology Vision 2020* solicitation to support industry-developed roadmaps in: separations catalysis, computational chemistry, materials, and alternative	**New Chemical Sciences and Engineering** Continue R&D to support *Technology Vision 2020* in separations, catalysis, computational chemistry, and alternative synthetic pathways.	**New Chemical Science and Engineering** Develop new process chemistry, and catalysis technologies. Continue advanced separation technology R&D to decrease the over 2 quadrillion Btu per year of

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Chemicals Vision (Cont'd)	synthetic pathways. Advances in separations technologies such as adsorption, crystallization, distillation, extraction and membranes offer prospects of multi-trillion Btu per year energy savings. Cost shared research on more energy efficient separation processes was conducted on olefin recovery from waste streams, sorbent separation, and advanced electrode ionization. ($10,070)	Demonstrate advanced electrodeionization separation technology in pilot-scale - potential energy savings of 4 trillion Btu per year by 2020. Conduct full-scale demonstration of novel membrane-based process to recover propylene from propane - energy savings from displaced feedstock are estimated to be 23 trillion Btu per year by 2020. ($9,989)	energy required to separate, process, and refine chemicals. ($6,358)
	Manufacturing and Operations Supported projects that addressed technology roadmap for materials of construction including: new materials for high-temperature, corrosive environments, improved models for predicted material behavior, new/improved materials, and better joining and fabricating methods. Facilitated development of technology roadmap for manufacturing and operations. ($898)	**Manufacturing and Operations** Conduct solicitation to support development and implementation of energy saving technologies identified in technology roadmap for manufacturing and operations. Continue R&D to develop: new materials for high-temperature, corrosive environments, improved models for predicted material behavior, new/improved materials, and better joining and fabricating methods. ($975)	**Manufacturing and Operations** Assist, with American Institute of Chemical Engineers, about 5 chemical plants in incorporating new best practices and emerging technologies. ($400)

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Chemicals Vision (Cont'd)	**Computational Technologies** Continued CFD consortium projects to establish an industrial user center, commercialize a sensor for multiphase measurements, begin testing beta-version of multiphase computer model and released visualization package. Computational technologies can optimize process energy requirements and shorten the lead time from research to plant design by several years. Cost shared research was conducted on simulating industrial scale turbulent gas solid flows and adapting multi-phase computational fluid dynamics to fluid-particle processes. Completed design of experimental test loop. ($1,197)	**Computational Technologies** Continue advancement of multi-phase CFD consortium projects. Computational technologies can optimize process energy requirements and shorten the lead time from research to plant design by several years. Conduct R&D on simulating industrial scale turbulent gas solid flows and adapting multi-phase computational fluid dynamics to fluid-particle processes. Complete installation of experimental test loop. Complete improvements to MIFX software code. Annual energy savings are estimated to be 100 trillion Btu per year by 2020. ($1,275)	**Computational Technologies** Continue advancement of multiphase CFD consortium projects to develop effective modeling tools for materials handling to reduce energy consumption and downtime. ($700)
	Consortium participants included: Dow, DuPont, Dow Corning, Exxon Chemicals, Chevron, Fluent, AEA Technology, Silicon Graphics, Westinghouse, FETC, Sandia National Laboratory, Lawrence Berkeley National Laboratory, Los Alamos National Laboratory, Oak Ridge National Laboratory, and	Participants include: Praxair, Air Products, Honeywell Reaction Engineering, Sandia National Laboratory, DuPont, Dow Corning, Exxon Chemicals, Chevron, Fluent, Aspen Technology Fluent, OLI Systems, AIChE, University of Texas, Rchm and Haas, NTEC, Membrane Technology Research,	Participants include: Praxair, Air Products, Honeywell Reaction Engineering, Sandia National Laboratory, DuPont, Dow Corning, Exxon Chemicals, Chevron, Fluent, Aspen Technology Fluent, OLI Systems, AIChE, University of Texas, Rchm and Haas, NTEC, Membrane Technology Research,

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Chemicals Vision (Cont'd)	Pacific Northwest National Laboratory, et al.	Argonne National Laboratory, Oak Ridge National Laboratory	Argonne National Laboratory, Oak Ridge National Laboratory
Total, Chemicals Vision	**$12,165**	**$12,239**	**$7,458**
Petroleum Vision	The Petroleum industry developed a vision and technology roadmap, signed a compact, and worked with DOE to implement the roadmap. Conducted a competitive solicitation to initiate projects in accordance with the Petroleum industry vision and roadmap.	The Petroleum industry vision and roadmap focus on environment, process improvement and energy efficiency. A competitive solicitation began in FY 2000 initiates activities to address key needs in these areas. FY 2001 funding will continue to address downstream petroleum needs.	No activity. ($0)
	Projects included remote sensing of equipment leaks, which is expected to reduce fugitive emissions, saving 12 trillion Btu annually; biocatalytic desulfurization of gasoline, expected to lower desulfurization energy use by over 20 trillion Btu/year; and an advanced fluid catalytic cracking model which can guide industry to savings in excess of 6 trillion Btu/year. ($1,671)	Continue cost shared projects including energy saving separations technologies to develop membranes to replace distillation, global on-stream inspection and a gas chromatograph controller to improve process efficiency, a rotary burner to significantly reduce NOx in heaters and boilers while lowering energy use, and broadening enzyme selectivity and improving activity for biological desulfurization. Complete project on developing and demonstrating a	

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
		portable hydrocarbon leak detector. ($2,768)	
Total, Petroleum Vision	**$1,671**	**$2,768**	**$0**
Mining Vision	**Characterization and Processing** Leveraged research funds with industrial cost sharing as well as state and other federal funding to support the industry's vision and roadmap. Developed technologies for exploration, mining, and processing which demonstrate accountable benefits for specific sectors of the Mining industry. Technologies that could be funded included real-time mineral content sensors, mining technologies for difficult conditions (deeper mines, thinner seams, lower-grade ores), and new materials for transportation and handling. (Major mining and mineral processing companies, equipment manufacturers, universities, and national laboratories.) ($2,698)	**Characterization and Processing** Continue to leverage research funds with industrial cost sharing as well as state and other federal funding to support the industry's vision. Facilitate interagency roadmaps for technologies such as exploration and excavation. Will develop technologies for resource characterization, mining, and processing which demonstrate accountable benefits for the US mining industry. Technologies funded include advanced minerals characterization, integrated mining systems, and low-energy metals processing, expected to save over five trillion Btu annually. (Major mining and mineral processing companies, equipment manufacturers, universities, and national laboratories.) ($3,517)	**Characterization and Processing** Will leverage research funds with industrial cost sharing as well as state & other federal funding to support the industry's vision. Will facilitate interagency roadmaps for technologies such as exploration and remediation. Will develop technologies for mineral processing, mine development and operation, and exploration which demonstrate accountable benefits for the U.S. mining industry. Will continue research on advanced mining and processing technologies to support industry needs. (Major mining and mineral processing companies, equipment manufacturers, universities, and national laboratories.) ($2,119)
Total, Mining Vision	**$2,698**	**$3,517**	**$2,119**

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Agriculture Vision	Conducted R&D building on results from the initial solicitation in FY 1999 and began filling the many technology gaps identified by the technology roadmaps which were not addressed by the first solicitation. Used a more flexible and creative solicitation process that increased the number of proposals and outside funding; built new multi-disciplinary and cross-industry partnerships; and encouraged highly innovative ideas. Launched a new educational initiative to promote multi-disciplinary research at Universities and Colleges and provided stipends to select graduate students. In response to the Biomass Research and Development Act of 2000, the program Looked to begin integrating technology, markets and policies for using local crops, trees, and agricultural wastes to make transportation fuels, electrical power and biobased industrial chemicals and consumer goods in "biorefineries" across the country. ($3,700)	Progress in achieving industry's ambitious target of a five-fold increase in market share for renewable bioproducts will begin to build momentum by adding to farmers' incomes, creating new jobs in rural communities and markets overseas, and reducing industry's costs of production. Support project R&D from first two solicitations and issue new request for proposals that builds on the "lessons learned" from earlier solicitations. Emphasis will be on projects that show clear linkages across the highest priorities in the roadmap. Projects should emphasize an integrated and coordinated approach to make better use of public and private funding, and accelerate progress toward industry's ambitious goal of 10 percent of the market for chemical feedstocks from plant material by 2020. Solicitation process broadens our base of partners in the agricultural, chemical, and forestry communities. Continues to provide support to those higher education institutions with winning proposals	Using portfolio analysis, and industry's broader vision and roadmap for bioenergy and biobased products, seek new R&D projects to address specific technology gaps. These would begin to focus on more in-depth integrated approaches and systems to biobased products and bioenergy. ($6,759) Participants include: National Corn Growers Association, American Soybean Association/United Soybean Board, National Association of Wheat Growers, American Forest and Paper Association, Corn Refiners Association, Agricultural Research Institute, National Association of State Universities and Land-grant Colleges, Dow Chemical Co., Dupont, Rohm and Haas Co., Genencor International, Cargill Dow Polymers

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Agriculture Vision (Cont'd)		for new multidisciplinary approaches from FY 2000 and runs second solicitation to broaden participation in the Renewables 2020 education initiative. Seeks deeper collaboration on R&D decisionmaking and public outreach with other parts of the Department of Energy, the Department of Agriculture, and other pertinent agencies in the Federal government as well as State government. ($6,759)	
Total, Agriculture Vision	**$3,700**	**$6,759**	**$6,759**
Supporting Industries	No activity ($0)	Issue competitive solicitations to the IOF supporting industries to support technology R&D not covered by other IOF-specific programs that can help provide significant cost and energy savings. For instance, Forging and Heat Treating industries directly support the Steel and Aluminum industries and have developed visions and roadmaps that can be correlated to the priority needs of the Industries of the Future. ($1,571)	No activity. ($0)

III. Performance Summary: INDUSTRIES OF THE FUTURE (SPECIFIC) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Total, Supporting Industries	**$0**	**$1,571**	**$0**
Technical/Prog. Management Support	Provide critical technical and program management support services. ($2,673)	Provide critical technical and program management support services. ($2,250)	Provide critical technical and program management support services. ($1,200)
Total, Technical/Prog. Management Support	**$2,673**	**$2,250**	**$1,200**
TOTAL, INDUSTRIES OF THE FUTURE (SPECIFIC)	**$65,644**	**$72,390**	**$46,424**

INDUSTRIAL TECHNOLOGIES
INDUSTRY SECTOR
(Dollars in Thousands)

INDUSTRIES OF THE FUTURE (CROSSCUTTING)

I. Mission Supporting Goals and Objectives

Mission

The Industries of the Future (Crosscutting) Initiative works with IOF industry partners and suppliers to conduct cost-shared R&D on technologies that have potential applications across the nine vision industries as well as provide the immediate tools and technical assistance industry needs to expedite the implementation of energy-efficient, clean manufacturing technologies.

Program Goals and Benefits

Industries of the Futures (Crosscutting) is comprised of three program areas: the Enabling Technologies Program, the Financial Assistance Program, and the Industrial Technology Assistance Program.

Enabling Technologies Program

The Enabling Technologies Program within the Industries of the Future initiative conducts cost-shared R&D on technologies with potential application across several OIT vision industries. The R&D areas are chosen through a strategic review process which identifies the technologies, practices, and needs that exist throughout industry that can be most cost-effectively leveraged. The program focuses on three areas that offer major improvements in energy efficiency and emissions reduction across all industries: (1) high-efficiency, clean combustion technology that can produce uniform, high-quality end products at high production rates; (2) sensors/control systems that can operate in high temperatures and harsh environments while increasing process efficiency and productivity; and (3) advanced industrial materials that can reduce energy use, lower emissions, increase component life, improve product quality, optimize process operating conditions, and reduce downtime. In addition, a new area of focus is Gasification. Gasification in industrial processes is a critical link to improve efficiency in Forest Products, Chemicals, and Petroleum. Currently the Forest Products industry spends $4 billion annually to purchase over 90 billion kWh of electricity. Successful adoption of black liquor and biomass gasification technology by the industry will not only totally eliminate these costs, but will result in the industry providing over 20 GW of additional generating capacity to the grid (equivalent of 20 large coal generation power plants).

Goals and Performance Measures:

- **Gasification** - Demonstrate a single black liquor or biomass gasification technology for the Forest Products industry.
- **Integrated Materials** (formerly Advanced Industrial Materials) - Continue development and testing of new membrane technologies, infrared and plasma heat-treating processes, and additional inter-metallic alloys.
- **Combustion -** Continue development of technologies to increase boiler efficiencies and reduce emissions.
- **Sensor/Control Systems -** Continue development of on-line measurement systems and commercialize two integrated sensor and control systems to significantly improve process efficiency.
- **Sensor/Control Systems** - Continue development of wireless sensors for industrial applications and a new family of sensors for applications in high-temperature, reactive, corrosive, and sometimes toxic environments.

Benefits:

Advances in enabling technologies will improve materials performance, increase industrial process control, and improve gasification and combustion efficiency.

Financial Assistance Program

The OIT Financial Assistance Program helps independent inventors, small businesses, and industry who lack the funds and/or know-how to move promising energy-saving and energy production technologies from the research bench to the marketplace. Technologies face a tremendous barrier to acceptance unless this important and unique assistance is provided at the make-or-break intersection on the road to technology commercialization. The Financial Assistance Program provides critical financial assistance in the form of competitive grants to develop and deliver clean, energy-saving technologies; and leverage financial and non-financial resources in cooperation with industry. Most important, these innovations can impact bottom-line performance and provide a sustainable competitive advantage for U.S. industry. The program works with IOF industry partners and suppliers to conduct cost shared research and demonstration projects that have a broad range of applications and benefits that will significantly reduce energy use, minimize waste and increase productivity in specific or multiple vision industries. Program components include the Inventions and Innovation (I&I) Program and the National Industrial Competitiveness through Energy, Environment, and Economics ($NICE^3$) Program that make a real difference by providing modest levels of support, at the right time, to speed the development of new energy-saving, environmentally friendly technologies and demonstrating their potential savings and commercial value.

Goals and Performance Measures:

- **I&I -** Continue to support the development of promising energy inventions with a focus on their entry into the marketplace.
- **$NICE^3$ -** Continue to support the demonstration of the commercial viability of promising energy technologies with a focus on their use in the industrial marketplace.

Benefits:

Results of I&I and NICE^3 research and demonstration projects are being applied throughout the vision industries. Continued deployment of these technologies are expected to result in energy savings, waste reduction and productivity savings.

Industrial Technology Assistance Program

The Industrial Technical Assistance program, which includes Best Practices and the Industrial Assessment Centers (IACs), provides the integrated delivery of energy-saving products, services, and technologies to assist the nine IOF in identifying and realizing their best energy efficient, pollution-preventing options from a systems and life-cycle cost perspective. The program facilitates the adoption of emerging technologies and provides technical assistance to boost the productivity of industrial operations. Advanced technology solutions that have been developed with OIT support are emerging from research and development and are ready for demonstration and use. Best Practices facilitates the delivery of these technology solutions to industry through showcase demonstrations and technology implementation assistance. Showcases demonstrate emerging technologies and their performance benefits under real-use conditions and provide an independent third party validation of performance and costs in comparison to baseline practices. Technology implementation assistance involves cost-shared support of emerging technologies to facilitate their adoption. Best Practices and the IACs also provide technical assistance to target immediate cost-saving opportunities and productivity improvements for IOF customers. Technical assistance includes a continuum of services-from energy assessments and evaluations, through information on industrial equipment and systems, to tools and resources for measuring the effectiveness of new technologies.

Goals and Performance Measures:

- **Best Practices –** Continue to achieve significant energy savings and productivity savings through plant-wide energy assessments, documented energy saving case studies, and the accelerated adoption by industry of the best-available and emerging technologies and best practices.
- **IAC –** Continue to train students and conduct assessments of industrial plants which will result in significant energy and productivity savings.

Benefits:

The Industrial Assessment Centers and Best Practices provide hands-on assistance to industry and disseminate information on operating practices and advanced technologies that can help plant managers save energy. Program statistics for Best Practices show that for every dollar of federal investment, $4 in energy is saved. Also, the IAC database shows that each assessment results in about $58,000 in energy and productivity savings.

Industries of the Future (Crosscutting) Accomplishments

FY 2000 Accomplishments:

- Continued support for Industrial Assessment Centers operating at 30 participating universities that conducted approximately 750 combined energy, waste, and productivity assessments.

- Established partnerships with 50 Industries of the Future plants to provide integrated delivery of tools and technical assistance to target motors, steam, compressed air, and combined heat and power system opportunities.
- Demonstrated an advanced dilute oxygen combustion system that provided increased efficiency.
- One award made to begin work in black liquor gasification for the Forest Products industry.
- Developed higher efficiency radiant burner using advanced continuous fiber ceramic composites (CFCC) material.
- New materials and process recommendations for improved performance, safer, and more efficient materials in Kraft recovery boilers were demonstrated.
- The NICE^3 program provided assistance to 8 State/industry partnerships for the initial demonstration of energy efficiency technologies, which will facilitate their use in other industrial facilities.
- The I&I program provided assistance to 28 inventors and small businesses to develop their meritorious energy efficiency technologies.

FY 2001 Ongoing Accomplishments:

- Continue support for Industrial Assessment Centers operating at 26 participating universities that will conduct approximately 650 combined energy, waste, and productivity assessment days of service to manufacturing clients.
- Complete 15 assessments on 5 case studies of major industrial plants that will document for a variety of system-focused implemented actions. These will influence replication of similar energy savings for other plants.
- Two awards made for biomass gasification engineering design studies for the Forest Products industry.
- Demonstrate less than 10 ppm Nox burner for refinery heaters.
- Complete commercialization of process for the production of uniform metal droplets for metal filters.
- Through the NICE^3 program provide assistance to approximately 13 State/industry partnerships for the initial demonstration of energy efficiency technologies, which will facilitate their use in other industrial facilities.
- Through the I&I program, provide assistance to approximately 41 inventors and small businesses to develop their meritorious energy efficiency technologies.

FY 2002 Planned Accomplishments:

- Continue support for Industrial Assessment Centers operating at 26 participating universities that will conduct approximately 320 combined energy, waste, and productivity assessment days of service to manufacturing clients.
- Complete two showcase demonstrations, at industry sites of advanced energy efficient technologies.
- Complete six plant site assessments to assist plant operators in use of industrial process applications tools. These will influence replication of similar energy savings for other plants.
- Complete testing and evaluation of prototype boiler and commercial process heater designs capable of improved efficiency and less than 5 ppm NO_x emissions.
- Complete design studies and site selection for a biomass gasifier demonstration.
- Complete commercialization of infrared and plasma heating process for metal heat treating and hard coating placement

I. A. Funding Table: INDUSTRIES OF THE FUTURE (CROSSCUTTING)

Program Activity	FY 2000 Comparable	FY 2001 Comparable	FY 2002 Request	$ Change	% Change
Enabling Technologies	$ 26,067	$ 30,529	$ 14,863	$ -15,666	-51.3%
Distributed Generation	$ 0	$ 0	$ 0	$ 0	0.0%
Financial Assistance	$ 10,310	$ 10,240	$ 5,108	$ -5,132	-50.1%
Technical Assistance	$ 16,375	$ 15,948	$ 8,929	$ -7,019	-44.0%
Technical / Program Management Support	$ 4,857	$ 5,002	$ 3,000	$ -2,002	-40.0%
Total, Industries of the Future (Crosscutting)	$ 57,609	$ 61,719	$ 31,900	$ -29,819	-48.3%

Note: Industries of the Future (Crosscutting) includes $800 for the State Energy Program Special Projects State Grants, in FY 2002, $1,460 in FY 2001, and $1,600 in FY 2000. Decrease State IOF awards from 14 to 7.

II. B. Laboratory and Facility Funding Table: INDUSTRIES OF THE FUTURE (CROSSCUTTING)

	FY 2000 Comparable	FY 2001 Comparable	FY 2002 Request	$ Change	% Change
Argonne National Laboratory (East)	$ 195	$ 150	$ 78	$ -72	-48.0%
Idaho National Engineering Laboratory	$ 551	$ 320	$ 165	$ -155	-48.4%
Lawrence Berkeley National Laboratory	$ 989	$ 1,420	$ 734	$ -686	-48.3%
Lawrence Livermore National Laboratory	$ 198	$ 0	$ 0	$ 0	0.0%
Los Alamos National Laboratory	$ 950	$ 1,050	$ 543	$ -507	-48.3%
National Renewable Energy Laboratory	$ 2,156	$ 1,665	$ 861	$ -804	-48.3%
Oak Ridge National Laboratory	$ 13,898	$ 14,235	$ 7,358	$ -6,877	-48.3%
Pacific Northwest National Laboratory	$ 105	$ 500	$ 258	$ -242	-48.4%
Sandia National Laboratories	$ 904	$ 800	$ 413	$ -387	-48.4%
All Other	$ 37,663	$ 41,579	$ 21,490	$ -20,089	-48.3%
Total, Industries of the Future (Crosscutting)	$ 57,609	$ 61,719	$ 31,900	$ -29,819	-48.3%

III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING)

Program Activity	FY 2000	FY 2001	FY 2002
Enabling Technologies	All Engineered Ceramics/CFCC, and Advanced Industrial Materials activities relating to the OPT/DER program, with their related funding, have been transferred to OPT.	All Engineered Ceramics/CFCC and Advanced Industrial Materials activities relating to the OPT/DER program, with their related funding, have been transferred to OPT.	All Engineered Ceramics/CFCC and Advanced Industrial Materials activities relating to the OPT/DER program, with their related funding, have been transferred to OPT. **Industrial Materials for the Future** Initiate Industrial Materials for the Future. Complete 5 CFCC projects. Complete 7 AIM projects. Issue two competitive solicitations, one to industry and universities, and one to National Laboratories. Solicitations will be based on IOF Vision team roadmap materials priorities. ($6,698)
	Engineered Ceramics/CFCCs Collaborative partnerships with industry, national laboratories, and universities developed CFCCs with superior high-temperature strength and fatigue resistance, corrosion resistance, and wear resistance for various applications in the Vision Industries. Developed and demonstrated processing methods	**Engineered Ceramics/CFCCs** Development, testing, and demonstrating CFCCs with superior high temperature strength and fatigue resistance, corrosion resistance, and wear resistance for various applications in the Vision Industries continued. Industries that adopt CFCCs will realize substantial energy, economic and	**Engineered Ceramics/CFCCs** In FY 2002 Engineered Ceramics/ CFCCs and Advanced Industrial Materials will become part of a new materials program, “Industrial Materials for the Future.” This direction is based on recommendations in a National Research Council/National Materials Advisory Board study

III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Enabling Technologies (Cont'd)	for reliable and cost-effective ceramic composites scaled-up to sizes and shapes consistent with industry needs for key near-term and intermediate-term applications. Applications included immersion tubes for molten metals, hot gas filters, radiant burners, heat exchangers, and refinery pipe hangers. Long-term testing and exposure of representative CFCC components such as hot gas filters, and radiant burners was performed under application conditions for hundreds to thousands of hours. Developed and tested advanced ceramics and coatings for industrial manufacturing processes. The supporting technology infrastructure was an integrated effort which addressed the design methodologies for advanced ceramics (including CFCCs), the role of material characteristics on mechanical performance, testing techniques for accurately evaluating their performance, and the development of a data base which included life and long-term reliability in appropriate	environmental benefits, including higher efficiency, lower maintenance and decreased operating costs. The team will demonstrate processing methods and feasibility of process scale-up for reliable and cost-effective ceramic composites in actual sizes and shapes consistent with industry needs for key near-term and intermediate term applications. Applications include immersion tubes for molten metals, hot gas filters for particle separation, radiant burners for glass bending, and drying applications. Long term testing and exposure of representative CFCC components will be performed under application conditions for hundreds to thousands of hours. These long term exposures will allow for the collection of data to support the benefits of using CFCCs and support industrial adoption and commercialization. The supporting technology effort for advanced ceramics (including CFCCs) is continuing to support the needs of industry. These efforts will build on results obtained from	completed in December 1999. Study participants also included many of our industrial customers. In FY 2000 we began a study based on the NMAB recommendations to determine the best way to proceed with the design of a single materials program, open to industry, national laboratories and universities through a competitive process, for implementation in FY 2002. Complete program with final funding for five projects under new Industrial Materials for the Future program.

III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Enabling Technologies (Cont'd)	environments. These efforts helped build the scientific foundation for the successful design, fabrication, characterization, and utilization of advanced ceramics for industrial applications. ($4,710) Participants included: Allied Signal Ceramics, Engineered Composites, Inc., Dupont Lanxide, General Electric, McDermott Technologies, Textron Systems, Oak Ridge National Laboratory, Argonne National Laboratory	field testing and the supporting technology team will evaluate components that have been tested in operating conditions for a better understanding of material properties and failure methods. Databases that include life and long-term reliability in appropriate environments is being expanded. These efforts help build the scientific foundation for the successful design, fabrication, characterization, and utilization of advanced ceramics for industrial applications. ($6,203) Participants include: Allied Signal Ceramics, Engineered Composites, Inc., General Electric, McDermott Technologies, Textron Systems, Oak Ridge National Laboratory, Argonne National Laboratory.	
	Advanced Industrial Materials The Advanced Industrial Materials (AIM) Program developed and deployed advanced intermetallic alloys, other high temperature alloys, polymers, membrane materials, and metal matrix	**Advanced Industrial Materials** The focus of intermetallic alloy research and development was shifted from nickel aluminide, which is a mature material being demonstrated by industry, to more rapid development of iron	**Advanced Industrial Materials** Complete program with final funding for 7 projects under new Industrial Materials of the Future Program.

III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Enabling Technologies (Cont'd)	composites for the IOF. These materials were designed to meet specific needs to improve productivity, product quality and energy efficiency in the Vision Industries. Development of standardized test methods and physical process data bases were begun to enable qualification of these materials in industrial applications. The process for production of uniform spherical metal powders over a wide range of steels and intermetallic alloys was scaled up, in cooperation with industry partners. Work on development of inorganic membranes and electrochemical reactors for harsh chemical environments was turned over to the IOF Chemical Industry Team for industrial demonstration. Work on metal matrix composites, with superior strength and wear resistance was completed. Activities of the Metals Processing Laboratory (MPlus) at Oak Ridge National Laboratory was enhanced for the benefit of the industries and universities engaged in development of new and improved	aluminides, molybdenum and other silicides, and titanium aluminides. ($6,176)	

III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Enabling Technologies (Cont'd)	high temperature alloys for use in corrosive environments in the vision industries. ($5,110) Participants included: Oak Ridge National Laboratory, Sandia National Laboratory, Argonne National Laboratory, Weyerhaeuser, PPG Industries, Dow Chemical, Amoco, and other industry partners in CRADAs and other cooperative agreements. **Combustion Systems** The combustion program initiated projects to meet combustion vision and roadmap targets. A project was awarded for engineering design, development and demonstration of a Super Boiler. A second project was awarded for engineering design, development, and demonstration of an advanced refinery process heater. These two projects address the following targets: environmental quality (two parts per million NOx is a long term goal for boilers), fuel flexibility (maximize the use of multiple fuels, including waste and renewable	Participants include: Oak Ridge National Laboratory, Sandia National Laboratory, Argonne National Laboratory, Weyerhaeuser, PPG Industries, Dow Chemical, Amoco, and other industry partners in CRADAs and other cooperative agreements. **Combustion Systems** The combustion program is continuing to fund the two program areas awarded in FY 2000, boilers and process heating. Both are multi-year projects with completion anticipated in FY 2004. ($1,690)	**Combustion Systems** Continue super boiler program to meet combustion vision and roadmap targets. This project will build on advances made in very low emission burner projects through improved systems design and better heat transfer. ($791)

III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Enabling Technologies (Cont'd)	fuels), energy efficiency (or 20 to 50 percent specific fuel consumption reduction is a long term goal for furnaces), cost effectiveness (lower life cycle costs), and improved system reliability (double the time between scheduled boiler outages). In the process heater area, an improved heater design could lower specific fuel consumption by 20 percent. ($1,950) **Industrial Gasification** Presented here for required comparability, the following efforts are funded in FY 2000 through the Fossil Energy R&D Program. Initiated preliminary design studies, including R&D, engineering design, and cost projections. A competitive solicitation identified technology development and demonstrations of advanced biomass and black liquor gasification systems. Technology development included improved refractory performance, systems integration with combined cycle systems and gas clean-up. Projects funded have a clear path to	**Industrial Gasification** Gasification in industrial processes is a critical link to improve efficiency of processes in Forest Products, Chemicals and Petroleum. Utilization of the low and medium Btu fuels, such as black liquor in the pulp and paper process, produced by Gasification opens new process opportunities for these industries. Design study awarded in FY 2000 continues. Two additional awards are being made for engineering design, cost projections, and identification of critical R&D needs for systems in industrial plants.	**Industrial Gasification** Based on results of 3 engineering design studies, select one project to proceed to construction and demonstration. ($6,600)

III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Enabling Technologies (Cont'd)	demonstration and commercialization of systems in the forest products industry. ($12,659)	Funding and oversight will be in OIT with project management implemented through National Energy Technology Laboratory (NETL). Solicitation is being issued for a technology support program guided by industry and utilizing the expertise of NETL, ORNL and NREL. Supporting technical areas include sulfur management, gas clean-up, materials, systems integration and other combustion related studies. ($12,697)	
	Participants included: Industrial boiler manufacturers, burner manufacturers, process heater and furnace manufacturers.	Participants include: Georgia Pacific, Gaylord Container, Boise Cascade, GTI, Thermo-Chem, Fluor-Daniel, Oak Ridge National Laboratory, National Energy Technology Laboratory, and National Renewable Energy Laboratory.	Participants include: Georgia Pacific, Gaylord Container, Boise Cascade, GTI, Thermo-Chem, Fluor-Daniel, Oak Ridge National Laboratory, National Energy Technology Laboratory, and National Renewable Energy Laboratory.
	Sensors and Control Technologies The Sensors and Controls Program continued to develop and deploy integrated measurement systems for operator-independent control of manufacturing processes with broad applicability across multiple	**Sensors and Control Technologies** The Sensors and Controls Program is continuing to implement its Program Plan to achieve leap-frog advancement of sensor and control technologies that have high impact	**Sensors and Control Technologies** The Sensors and Control program will continue to identify, develop and deploy crosscutting technologies that ultimately can meet performance requirements specified in the IOF

III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Enabling Technologies (Cont'd)	industry sectors. In collaboration with major industrial associations and instrumentation manufacturer societies, the Sensors and Controls Program will implement a comprehensive technology development strategy to meet the needs identified in the individual industry technology roadmaps. Particularly needed is improved technology both in sensors including compatibility with high temperature and harsh environment applications and in information processing from different sensory modalities to detect and remedy malfunctions. ($1,638)	on two or more IOF industries. Focus will be on bringing projects into the field demonstration phase and continuing the bench-scale research and development of projects awarded in FY 2000. Notable demonstrations include 1) an online, laser-based ultrasonic system to measure wall thickness and eccentricity of steel seamless mechanical tubing during piercing, elongation, and rotary sizing operations, 2) an intelligent extruder which incorporates low-cost, readily available sensors into inferential control to produce quality resin products in polymer compounding, and 3) a non-proprietary, dynamically reconfigurable, wireless-network architecture that provides standardized communication protocols and data structures for robust performance in industrial environments. Bench-scale research and development is focusing on achieving major improvements of sensor attributes such as self-diagnostics and self-calibration, high-speed measurements with accuracy and reliability, as well as those for	Roadmaps and thus help the IOFs to attain Vision goals. Continue to achieve advances in non-proprietary, dynamically, reconfigurable wireless architecture and conduct field trials in industrial plants, complete laboratory development and evaluation of a realtime sensor to measure constituents in industrial melts in the aluminum, glass and steel industries, apply thermal imaging system to operating steel and glass furnaces to improve operating energy efficiency. ($774)

Program Activity	FY 2000	FY 2001	FY 2002
Enabling Technologies (Cont'd)		harsh-environment (high temperature or corrosive) sensing. ($3,763)	
	Participants include: Institute of Gas Technology/U. Of Illinois/Combustion Tec/Owens Brockway Glass Containers/Acme; GE Research & Development Center/Krupp Werner-Pfleiderer; Visteon Automotive Systems/Sandia National Laboratory/U. of Utah; Energy Research Company/Mississippi State University/Oak Ridge National Laboratory; Tennessee Technological University/Utah State U./Idaho National Engineering Laboratory/Albany Research Center/American Foundrymen's Society/General Motors.	Participants include: Timken Company, Gas Technology Institute, GE Research & Development Center, PPG, Energy Research Company, Tennessee Technological University, Oak Ridge National Laboratory, T/J Technologies Inc., Detection Limit Inc., and Concurrent Technologies Corporation, National Research Council Canada, University of Illinois, Combustion Tec, Owens Brockway Glass Containers, Krupp Werner-Pfleiderer, Sandia National Laboratories, and University of Utah, Mississippi State University, and Utah State University, Idaho National Engineering Laboratory, Albany Research Center, American Foundrymen's Society, and General Motors.	Participants include: Timken Company, Gas Technology Institute, GE Research & Development Center, PPG, Energy Research Company, Tennessee Technological University, Oak Ridge National Laboratory, T/J Technologies Inc., Detection Limit Inc., and Concurrent Technologies Corporation. Also participating in the collaboration are National Research Council Canada; University of Illinois, Combustion Tec, Owens Brockway Glass Containers; Krupp Werner-Pfleiderer; Sandia National Laboratories, and University of Utah; Mississippi State University; and Utah State University, Idaho National Engineering Laboratory, Albany Research Center, American Foundrymen's Society, and General Motors.
Total, Enabling Technologies	**$26,067**	**$30,529**	**$14,863**
Distributed Generation	**Industrial Power Generation** Transferred the program to Power	**Industrial Power Generation** Transferred the program to Power	

III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
	Technologies. ($0)	Technologies. ($0)	
	Industrial Distributed Generation	**Industrial Distributed Generation**	
	Transferred the program to Power Technologies. ($0)	Transferred the program to Power Technologies. ($0)	
Total, Distributed Generation	**$0**	**$0**	**$0**
Financial Assistance	**Financial Assistance**	**Financial Assistance**	**Financial Assistance**
	OIT introduced an integrated delivery system of financial assistance services in the form of grants. The Program addressed industry requests for a simpler, more flexible package of services that is easier for industry to access. By reducing overhead activities, additional worthy projects are supported. The programs work with regional centers to more effectively leverage local resources and to better tailor assistance to	OIT is continuing the integrated delivery system of financial assistance service. The Program continues to provide industry with a simpler, more flexible package of services that is easier for industry to access. By continuing to reduce overhead activities, additional worthy projects will be supported. The programs continue to work with regional centers to more effectively leverage local resources and to better tailor assistance to	There are numerous energy-saving technologies that have been developed to the point of readiness for a first-time demonstration. However, they do not have the resources to accomplish this testing. The NICE[3] component of Financial Assistance provides significant "leverage" by identifying and supporting the first-time demonstrations of these technologies.
Financial Assistance (Cont'd)	specific needs and situations. The NICE[3] and Inventions Programs issued approximately 36 new grants.	specific local needs and situations. The NICE[3] and Inventions Programs will be issuing approximately 54 new grants.	There are numerous energy-savings technologies conceived by individual inventors and small businesses that are in need of additional support to complete their research and testing. The inventors and small businesses often do not

Program Activity	FY 2000	FY 2001	FY 2002
			have the resources and know-how to further the development of their ideas. The Inventions and Innovation component of Financial Assistance provides significant "leverage" by identifying and supporting the further development of these technologies.
Financial Assistance (Cont'd)	**NICE^3** NICE^3 continued to provide a voluntary, non-regulatory approach to improve competitiveness, foster energy efficiency, and reduce waste. The program worked closely with the Inventions and Innovation (I&I) program to support an integrated delivery of OIT's financial assistance services. Competitive solicitations for both programs were issued on concurrent schedules. Administrative streamlining, and the use of regional centers allowed for more effective leveraging of local resources and enhanced the ability of both programs to better meet specific regional industry needs. See the Financial Assistance description above. (OIT focus industries, the dominant energy	**NICE^3** NICE^3 continues to provide a voluntary, non-regulatory approach to improve competitiveness, foster energy efficiency, and reduce waste. The program continues to work closely with the I&I program to support an integrated delivery of OIT's financial assistance services. Competitive solicitations for both programs continues to be issued on concurrent schedules. Administrative streamlining, and the use of regional centers will continue to allow for more effective leveraging of local resources and enhance the ability of both programs to better meet specific regional industry needs. See the Financial Assistance description above. (OIT	**NICE^3** The NICE^3 program will provide financial assistance to demonstrate energy saving technologies in IOF industries. (The OIT focus industries, the dominant energy users and waste generators in the U.S. manufacturing and industrial sectors, will be primary recipients of the approximately 4 grants to be awarded in FY 2002.) ($2,736)

III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
	users and waste generators in the U.S. manufacturing and industrial sectors, were the primary recipients of the 8 grants awarded.). ($5,923)	focus industries, the dominant energy users and waste generators in the U.S. manufacturing and industrial sectors, are the primary recipients of the approximately 13 grants to be awarded this year). ($5,442)	
Financial Assistance (Cont'd)	**Inventions and Innovation** The I&I Program continued to provide financial assistance to support the development of new energy efficient technologies. The program worked closely with the NICE^3 Program to support an integrated delivery of OIT's financial assistance services to IOF partners. Twenty-eight I&I grants were awarded. The I&I Program reaches typically under served population of independent inventors and small start-up businesses. The program received more than 35,000 applications for financial assistance since its inception in 1974. Nearly 25 percent of the technologies funded have reached commercial success. The successful technologies supported by this program have saved enough energy to light six million homes for one	**Inventions and Innovation** The I&I Program will continue to provide financial assistance to energy efficient technologies. The program will continue to work closely with the NICE^3 Program to support an integrated delivery of OIT's financial assistance services to IOF partners. (This year the I&I program is expected to award approximately 41 grants to independent inventors and small technology-based businesses through competitive processes. On average, the program receives nearly three times as many worthy proposals as it can fund. This means 25 - 30 good proposals go unfunded each year. These recipients change from year to year). ($4,798)	**Inventions and Innovation** The I&I Program will provide financial assistance to energy saving technologies initiated by this program in FY 2001. ($2,372)

III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
	year. ($4,387)		
Total, Financial Assistance	**$10,310**	**$10,240**	**$5,108**
Technical Assistance	**Technical Assistance Activities** In order to respond to its industry partners, OIT introduced an integrated system for delivery of technologies, tools, and technical assistance to thousands of plants. At the core of the integrated delivery strategy is the development of one-on-one ongoing partnerships between OIT and its IOF industry partners at the plant level. OIT=s efforts model the success achieved since 1998 at Bethlehem Steel=s Burns Harbor plant and other showcase plant sites. In 2000, each of the IOF industries had at least one major showcase initiative in partnership with OIT. ($278) Participants were selected from the 9 IOF target industries.	**Technical Assistance Activities** No activity. ($0)	**Technical Assistance Activities** No activity. ($0)
Technical Assistance (Cont'd)	**Industrial Assessment Centers**		

III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Technical Assistance (Cont'd)	IACs conducted approximately 750 combined energy, waste, and productivity assessments were conducted. Top performing schools were given new incentives to look at and evaluate innovative program approaches. Collaborative work with State agencies continued. Work that strengthens university and local industry cooperation continued. Collaboration with the NIST Manufacturing Extension Program centers continued. The students continued to transfer best practices learned through the program to U.S. manufacturers all across the nation. 2,300 students were trained by the IAC program. Work continued at the national level to share results of successful IACs/NIST Manufacturing Extension Program Centers collaboration. Started to implement recommendations from the Strategic Program Review. Conducted solicitation for new Centers. The following schools were selected: Arizona State	**Industrial Assessment Centers** OIT continues to support IACs efforts to provide hands-on training at 26 participating universities in energy and waste management to an additional 150 engineering students and to conduct approximately 650 new combined energy, waste, and productivity assessments. The program works closely with the other OIT Technical Assistance programs to fully support an integrated delivery of services and provides industrial assessment expertise to identify and capitalize on technology applications at participating showcase plants. The IAC database, with data on over 9,000 industrial assessments, helps these plants target specific opportunities for efficiency. Engineering students who have worked with the 26 IACs nationwide continue to graduate with the experience and skills necessary to implement energy efficiency, waste reduction, and productivity improvements. Recommendations from the Strategic Program Review are	**Industrial Assessment Centers** Provide energy, waste, and productivity training to 150 engineering students at 26 participating universities. Conduct approximately 320 assessment days of service to manufacturing clients. The program will work closely with other OIT programs to deliver industrial services in an integrated fashion. Provide industrial assessment technical expertise to Industries of the Future Showcase Plants. ($3,859)

Program Activity	FY 2000	FY 2001	FY 2002
	University, Bradley University (Illinois), Colorado State University, Georgia Institute of Technology, Iowa State University, Leigh University, Loyola Marymount University, Mississippi State University, North Carolina State University, Oklahoma State University, Oregon State University, San Diego State University, San Francisco State University, Syracuse University, Texas A&M University, University of Dayton, University of Florida, University of Illinois at Chicago, University of Louisiana-Lafayette, University of Massachusetts, University of Miami, University of Michigan, University of Texas - Arlington, University of Utah, University of Wisconsin - Milwaukee, West Virginia University. ($7,754)	being implemented. Conducted a solicitation for Special Projects to provide IACs the opportunity to perform work that compliments OIT=s R&D activities, student projects on industrial efficiency, and regional and local initiatives that support DOE objectives. Projects support the research objectives of the professor and the institution or department. Project results will be presented to IAC Directors, incorporated into the integrated delivery process, presented at conferences, published in technical journals, and made available via the internet. Special Projects are in addition to industrial assessments. ($7,694).	
Technical Assistance (Cont'd)	**Best Practices** Previously funded under Technology Transfer, Combined Heat and Power (CHP), Motor, Compressed Air, and Steam. ($0)	**Best Practices**	**Best Practices**

Program Activity	FY 2000	FY 2001	FY 2002
Technical Assistance (Cont'd)		In FY 2001, in order to provide better customer service and to reduce costs, OIT has initiated the Best Practices Program which will integrate the activities of the following programs: (Combined Heat and Power, Motors and Compressed Air, Process Heating and Steam). The program helps U.S. manufacturers by providing credible technical information and assistance to help them lower their energy bills, often with little or no capital investment. ($0)	Technical assistance to 6 plant sites regarding use of industrial process application tools relevant to motor, pump, process heating, steam and compressed air systems will be provided. Eight plant-wide assessments will be selected for cost-shared financial assistance and develop a comprehensive energy-saving strategy for the selected plants. The Allied Partnership will be broadened to include industry and trade associations representing all IOF industries to support wide dissemination and use of OIT information and products. System-level improvements of motor and steam operations accomplished through implementation of energy management best practices will achieve 10 percent of the potential energy savings available. A Best Practices Resource Software Suite will be developed for decision-making across plant operations; the Suite will integrate energy assessment software with information products and will provide links to IOF technologies/products.

III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
			Two plant-wide showcases will be completed, in support of IOF partnerships, to demonstrate emerging technologies and their performance benefits under real-use conditions. Eight emerging technologies will have their energy/environment/ economic performance validated by an independent, third-party entity to help promote industry acceptance of using new technologies. Support will be provided to three states in their implementation of energy-saving technologies as part of state-IOF efforts. ($5,070)
Technical Assistance (Cont'd)	Combined Heat and Power (CHP) CHP technical assistance activities were focused on addressing the barriers and providing the technical tools and expertise necessary to demonstrate to industry how successful CHP technologies are, and to increase awareness of and confidence in these technologies. The program continued to work with the other OIT Technical Assistance programs to fully support an integrated delivery of services making CHP an important technology option for IOF industries. Participants included: State Energy	Combined Heat and Power (CHP) Recent technological advances have made CHP systems more efficient and less expensive. The energy efficiency of CHP systems can exceed 80 percent. Additionally, CHP has been identified as one of the most near term cost-effective sections to reduce global carbon emissions. The effort supports the joint DOE-Industry goal to double the amount of CHP capacity in the	Combined Heat and Power (CHP) Moved to the Power Technologies as part of the Distributed Energy Resources (DER) program. ($0)

III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
Technical Assistance (Cont'd)	Offices, Onsite Energy, Washington State University, Oak Ridge National Laboratory, Allison Engines. ($0) Motors and Compressed Air Motors and compressed air are both motor driven systems. Technical	U.S. by 2010, equal to 46 gigawatts of electricity and reduce air pollution by 40 million metric tons of carbon. The program continues to work with the other OIT Best Practices programs to fully support an integrated delivery of services making CHP an important technology option for IOF industries. CHP technical assistance activities will continue to focus on addressing the barriers conducting CHP technology assessments and providing the technical tools and expertise necessary to demonstrate to industry how successful CHP technologies are, and to increase awareness of and confidence in these technologies. Industry is completing technology and barrier elimination roadmaps. (Funding requested under Best Practices Program above) Participants include: State Energy Offices, Onsite Energy, Washington State University, Oak Ridge National Laboratory, Allison Engines. ($0)	

III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
	assistance support and expertise in these areas was provided as critical components of OIT=s integrated delivery of technical assistance services. The programs continued to work with manufacturers to identify and target new energy efficiency and productivity opportunities and to help them develop and refine the credible, unbiased tools that assist industry in making the most informed energy decisions. ($7,093) Participants included: Oak Ridge National Laboratory, National Renewable Energy Laboratory, Lawrence Berkeley National Laboratory, Macro International, Washington State University Extension Office.	Motors and Compressed Air Motors and compressed air technical assistance support and expertise is provided as critical components of OIT=s integrated delivery of technical assistance services under the Best Practices Program. The programs continue to work with manufacturers to identify and target new energy efficiency and productivity opportunities and to help them develop and refine the credible, unbiased tools that assist industry in making the most informed energy decisions. (Funding requested under Best Practices Program above) ($7,020) Participants include: Oak Ridge National Laboratory, National Renewable Energy Laboratory, Lawrence Berkeley National Laboratory, Macro International, Washington State University Extension Office.	Motors and Compressed Air Transferred and consolidated under the Best Practices Program. ($0)
Technical Assistance (Cont'd)	Steam The Steam Challenge, which was run under the Motor Challenge budget in FY99, was a full fledged initiative jointly partnered by DOE and the Alliance to Save Energy.	Steam The Steam Program continues to be a full-fledged initiative jointly	Steam

Program Activity	FY 2000	FY 2001	FY 2002
Technical Assistance (Cont'd)	Technical assistance, information and tools were provided to plants interested in improving the energy efficiency of their steam systems and industrial heating equipment. The Steam program worked with suppliers, equipment manufacturers and end-users to garner the greatest impact. At the same time integrated delivery of technical assistance provided the right level of assistance to each plant. ($1,250) Participants included: Oak Ridge National Laboratory, National Renewable Energy Laboratory, Lawrence Berkeley National Laboratory, Macro International, Washington State University Extension Office, Alliance to Save Energy.	partnered by DOE and the Alliance to Save Energy under OIT=s integrated delivery effort under the Best Practice Program. Technical assistance, information and tools are being provided to plants interested in improving the energy efficiency of their steam systems and industrial heating equipment. This program provides valuable unbiased information on system design, equipment, purchase, and operation from experts with practical experience addressing steam system challenges. As with motors and compressed air, this program aims to increase U.S. industrial energy efficiency by helping industry adopt the systems approach with boilers, steam distribution systems, steam applications, furnaces and other equipment. The Steam program is working with suppliers, equipment manufacturers and end-users to garner the greatest impact. At the same time integrated delivery of technical assistance provides the right level of assistance to each plant as part of the Best Practices Program. (Funding requested under	Transferred and consolidated the program under the Best Practices Program. ($0)

III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
		Best Practices Program above). ($1,234) Participants include: Oak Ridge National Laboratory, National Renewable Energy Laboratory, Lawrence Berkeley National Laboratory, Macro International.	
Total, Technical Assistance	**$16,375**	**$15,948**	**$8,929**
Technical/Prog. Management Support	Provide critical technical and program management support services. ($4,857)	Provide critical technical and program management support services. ($5,002)	Provide critical technical and program management support services. ($3,000)
Total, Technical / Prog. Management Support	**$4,857**	**$5,002**	**$3,000**

III. Performance Summary: INDUSTRIES OF THE FUTURE (CROSSCUTTING) (Cont'd)

Program Activity	FY 2000	FY 2001	FY 2002
TOTAL, INDUSTRIES OF THE FUTURE (CROSS-CUTTING)	**$57,609**	**$61,719**	**$31,900**

INDUSTRIAL TECHNOLOGIES
INDUSTRY SECTOR
(Dollars in Thousands)

COOPERATIVE PROGRAMS WITH STATES

I. Mission Supporting Goals and Objectives

The Cooperative Programs with States pursues collaborative applied research, development, and demonstration (RD&D) that accelerates the use of clean energy technologies. Collaborating with states provides opportunities to leverage funding for important RD&D that might not otherwise receive adequate support at either the Federal or the State level. These joint efforts, both in applied research and technology field tests, maximize the benefits of clean and efficient building technologies.

In FY 2001, this program will complete its second year. Projects funded to date are being performed in collaboration with States and State energy offices. As a result of a slow start for this new program in FY 2000, the project performers funded in FY 2000 and FY 2001 will continue work into FY 2001 and FY 2002, respectively. As a part of EERE's ongoing program evaluation activities, this program will be rebaselined in FY 2002 based on the results of projects completed during FY 2001and FY 2002. For this reason, no additional funds are requested in FY 2002. Upon completion of the new baseline, funds will be requested in FY 2003.

II. A. Funding Table: COOPERATIVE PROGRAMS WITH STATES

Program Activity	FY 2000 Comparable	FY 2001 Comparable	FY 2002 Request	$ Change	% Change
Cooperative Program with States	$ 1,964	$ 1,996	$ 0	$ -1,996	-100.0%
Total, Cooperative Program with States	$ 1,964	$ 1,996	$ 0	$ -1,996	-100.0%

II. B. Laboratory and Facility Funding Table: COOPERATIVE PROGRAMS WITH STATES

	FY 2000 Comparable	FY 2001 Comparable	FY 2002 Request	$ Change	% Change
Argonne National Lab	$ 0	$ 0	$ 0	$ 0	0.0%
National Renewable Energy Lab	$ 0	$ 0	$ 0	$ 0	0.0%
Oak Ridge National Lab	$ 0	$ 0	$ 0	$ 0	0.0%
All Other	$ 1,964	$ 1,996	$ 0	$ -1,996	-100.0%
Total, Cooperative Program with States	$ 1,964	$ 1,996	$ 0	$ -1,996	-100.0%

III. Performance Summary: COOPERATIVE PROGRAMS WITH STATES

Program Activity	FY 2000	FY 2001	FY 2002
Cooperative Programs with States	**Cooperative Programs with States** Combined solicitation provided cooperative agreements to approximately 6 to 10 States for collaborative applied research, development, and field testing. Partnerships were encouraged with industry, national laboratories, and other entities. Areas of effort are expected to include bioenergy, fuel cells and microturbines, and clean alternative power and increased energy efficiency in vehicles. ($1,964)	**Cooperative Programs with States** OIT section of solicitation provides cooperative agreements to approximately 3-6 states for collaborative applied research, development, and field testing. Partnerships are encouraged with state land grant universities and extension services. Areas of effort focus on specific state needs for one or more of the nine Industries of the Future. ($1,996)	**Cooperative Programs with States** As a part of EERE's ongoing program evaluation activities, this program will be rebaselined in FY 2002 based on the results of projects completed during FY 2001 and FY 2002. For this reason, no additional funds are requested in FY 2002. Upon completion of the new baseline, funds will be requested in FY 2003. ($0)
TOTAL, COOPERATIVE PROGRAMS WITH STATES	**$1,964**	**$1,996**	**$0**

INDUSTRIAL TECHNOLOGIES
INDUSTRY SECTOR
(Dollars in Thousands)

ENERGY EFFICIENCY SCIENCE INITIATIVE

I. Mission Supporting Goals and Objective

The Energy Efficiency Science Initiative seeks to identify and fund "bridging" research and development (R&D) that falls between fundamental exploratory science and pre-commercial applied R&D. By stimulating R&D that maximizes synergies among different research fields, technologies, investigator communities, and end-use applications, this initiative expands EERE's R&D activities among energy efficiency technologies. It also cuts across traditional energy end-use sectors by emphasizing distributed power generation applications for industrial and buildings systems, transportation, and stationary power.

This initiative expands on existing cooperative efforts with the Office of Fossil Energy in areas such as natural gas-fueled turbine and fuel cell technologies, combined heat, power and cooling applications, hydrogen production, and carbon emission sequestration. This effort also involves extensive coordination with the Office of Science in pursuing follow-on research in areas critical to energy efficiency and clean energy development, such as basic biosciences, plant genetics, photo emission, heat transfer, new materials, catalysts, and computational science.

In FY 2001, this program will complete its second year. Projects funded to date are being performed in collaboration with academia in partnership with the National Laboratories. As a result of a slow start for this new program in FY 2000, the project performers funded in FY 2000 and FY 2001 will continue work into FY 2001 and FY 2002, respectively. As a part of EERE's ongoing program evaluation activities, this program will be rebaselined in FY 2002 based on the results of projects completed during FY 2001and FY 2002. For this reason, no additional funds are requested in FY 2002. Upon completion of the new baseline, funds will be requested in FY 2003.

II. A. Funding Table: ENERGY EFFICIENCY SCIENCE INITIATIVE

Program Activity	FY 2000 Comparable	FY 2001 Comparable	FY 2002 Request	$ Change	% Change
Energy Efficiency Science Initiative	$ 3,830	$ 3,891	$ 0	$ -3,891	-100%
Total, Energy Efficiency Science Initiative	$ 3,830	$ 3,891	$ 0	$ -3,891	-100%

II. B. Laboratory and Facility Funding Table: ENERGY EFFICIENCY SCIENCE INITIATIVE

	FY 2000 Comparable	FY 2001 Comparable	FY 2002 Request	$ Change	% Change
All Other	$ 3,830	$ 3,891	$ 0	$ -3,891	-100%
Total, Energy Efficiency Science Initiative	$ 3,830	$ 3,891	$ 0	$ -3,891	-100%

III. Performance Summary: ENERGY EFFICIENCY SCIENCE INITIATIVE

Program Activity	FY 2000	FY 2001	FY 2002
Energy Efficiency Science Initiative	**Energy Efficiency Science Initiative** Funded approximately 10 to 20 cooperative agreements with research and development teams, which were led by universities and included industrial, national laboratory and other partners. The cooperative agreements focused on fundamental strategic R&D, such as advanced materials, bio-based fuels, combustion-related research, sensors and controls, computational sciences, and microsystems science and engineering. This new initiative supported R&D to bridge the gap between fundamental exploratory science and pre-commercial applied R&D. Conducted a first-of-a-kind strategic visioning workshop (e-vision 2000) involving forefront building designers, industrial and transportation experts as well as academics whose energy efficiency ideas expand the possibilities of technology options for our Nation's future. This workshop influenced the development of the FY 2002 Budget Request and defined specific R&D projects for FY 2001	**Energy Efficiency Science Initiative** As part of the continuing initiative to support R&D to bridge the gap between fundamental exploratory science and pre-commercial applied R&D, EERE will conduct a follow-on strategic visioning workshop (e-vision 2001). This workshop will build on the tremendous technology possibilities identified during e-vision 2000, and will broaden the understanding of the proposed options for the Nation's energy future. In succeeding years, it is expected that the e-vision workshops will be conducted biennially. Up to 5 research projects will be awarded as a follow-on to recommendations from e-vision 2000. Additionally, fund approximately 10 to 20 cooperative agreements with research and development teams, which are expected to be led by universities and to include industrial, national laboratory and other partners. The cooperative agreements focus on industrial sector fundamental strategic R&D, as contained in the visions and	**Energy Efficiency Science Initiative** As a part of EERE's ongoing program evaluation activities, this program will be rebaselined in FY 2002 on the results of projects completed during FY 2001 and FY 2002. For this reason, no additional funds are requested in FY 2002. Upon completion of the new baseline, funds will be requested in FY 2003. ($0)

Program Activity	FY 2000	FY 2001	FY 2002
	implementation. ($3,830)	roadmaps for the nine Industries of the Future. ($3,891)	
TOTAL, ENERGY EFFICIENCY SCIENCE INITIATIVE	**$3,830**	**$3,891**	**$0**

INDUSTRIAL TECHNOLOGIES
INDUSTRY SECTOR
(Dollars in Thousands)

MANAGEMENT AND PLANNING

I. Mission Supporting Goals and Objectives

The OIT Office of Management and Planning provides the information, analyses, and personnel necessary to skillfully conduct the Office of Industrial Technologies programs.

Management and Planning ensures a well-planned and efficiently-managed program that will lead to the achievement of the OIT Strategic Plan and industrial sector goals in the most cost-effective manner possible. Effective management requires efficient organizational design, adequate human resources, sufficient and high quality information, and excellent communication both within the organization and with outside parties. Moreover, understanding the potential for increasing the penetration of energy-efficient and clean energy technologies in the industrial sector and for achieving the correct balance requires a solid analytical foundation. Management and Planning provides the resources for carrying out the evaluation, planning, analysis, and program direction functions necessary to effectively guide and support all OIT programs.

The request supports 60 full-time equivalent (FTE) positions to maintain adequate program management and support for the Industrial Sector Program (Interior and Related Agencies). This program also includes Technical Evaluation, and Analysis and Planning. In FY 2002, OIT will continue to improve its business and administrative excellence by implementing recommendations from the National Academy of Public Administration program review as well as providing for increased support for the EERE Strategic Management System.

II. A. Funding Table: MANAGEMENT AND PLANNING

Program Activity	FY 2000 Comparable	FY 2001 Comparable	FY 2002 Request	$ Change	% Change
Evaluation and Planning	$ 925	$ 600	$ 730	$ 130	21.6%
Program Direction	$ 7,444	$ 8,026	$ 8,670	$ 644	8.0%
Total, Management and Planning	$ 8,369	$ 8,626	$ 9,400	$ 774	9.0%

II. B. Laboratory and Facility Funding Table: MANAGEMENT AND PLANNING

	FY 2000 Comparable	FY 2001 Comparable	FY 2002 Request	$ Change	% Change
All Other	$ 8,369	$ 8,626	$ 9,400	$ 774	9.0%
Total, Management and Planning	$ 8,369	$ 8,626	$ 9,400	$ 774	9.0%

III. Performance Summary: MANAGEMENT AND PLANNING

Activity	FY 2000	FY 2001	FY 2002
Evaluation and Planning	**Program Evaluation**	**Program Evaluation**	**Program Evaluation**
	Provided increased technical evaluation, analysis, and planning, including development of quality metrics for the energy intensive industries. Continued some technology transfer activities transferred from Industries of the Future (Crosscutting). ($723)	Provides increased technical evaluation, analysis, and planning, including development of quality metrics for the energy-intensive industries. Continues some technology transfer activities transferred from Industries of the Future (Crosscutting). ($392)	Track program objectives and goals as required under the Government Performance and Results Act (GPRA), focusing program elements on maximum measurable benefits. Analyze new starts and technology commercialization to document program quality metrics. ($516)
	Provide critical technical and program management support services. ($202)	Provide critical technical and program management support services. ($208)	Provide critical technical and program management support services. ($214)
Total, Evaluation and Planning	**$925**	**$600**	**$730**
Program Direction	The following is a breakdown of the funding by Object Class:	The following is a breakdown of the funding by Object Class:	The following is a breakdown of the funding by Object Class:
	11.9 Personnel compensation $ 4,898 12.1 Civilian personnel benefits $ 1,382 21.0 Travel and transportation of persons $ 680 25.0 Other contractual services $ 241	11.9 Personnel compensation $ 5,713 12.1 Civilian personnel benefits $ 1,610 21.0 Travel and transportation of persons $ 750 25.0 Other contractual services $ 125	11.9 Personnel compensation $ 5,505 12.1 Civilian personnel benefits $ 1,555 21.0 Travel and transportation of persons $ 715 25.0 Other contractual services $ 895
Program Direction	Funds supported the salaries, benefits, and travel (including normal increases in both salaries and benefits) for 60 FTEs needed to conduct and monitor research and development of the various Industry	Funds support the salaries, benefits, and travel (including normal increases in both salaries and benefits) for 66 FTEs needed to conduct and monitor research, development of the various Industry	Funds are requested to support the salaries, benefits, and travel (including normal increases in both salaries and benefits) for 60 FTEs needed to research and develop various industrial technologies at

Activity	FY 2000	FY 2001	FY 2002
(Cont'd)	technologies at Headquarters (52) and in the field (8). Included in the program direction are staffing adjustments resulting from Workforce 21 plans. Total obligational authority of $7,201,000 for Program Direction included an estimated $366,000 from FY 1999 unobligated carryover in Program Direction to cover FY 2000 requirements. ($6,835)	technologies, at Headquarters (59) and in the field (7). Program direction provides for continued implementation of Workforce 21 plans. Other services support such activities as training and a small contingency. Also, activities include a systematic analysis of critical staffing needs within the context of current and projected R&D program missions and the development of a comprehensive plan that will focus on building and sustaining a talented and diverse workforce of R&D Technical Managers. Total obligational authority of $8,198,000 for Program Direction includes $905,000 of unobligated carryover from FY 2000 to cover FY 2001 requirements. ($7,293)	Headquarters (54) and in the field (6).
	Management Support Services	**Management Support Services**	**Management Support Services**
	TRANSFER FROM: Industries of the Future (Crosscutting) and Management and Planning	TRANSFER FROM: Industries of the Future (Crosscutting) and Management and Planning	
Program Direction	Consistent with other DOE programs under the jurisdiction of the Interior and Related Agencies	Consistent with other DOE programs under the jurisdiction of the Interior and Related Agencies	Consistent with other DOE programs under the jurisdiction of the Interior and Related Agencies

Activity	FY 2000	FY 2001	FY 2002
(Cont'd)	Appropriations Committees, the Energy Conservation programs provide funding for Management Support Services which include activities such as improving the effectiveness, efficiency and economy of management and general administrative services. These activities are critical to the planning, formulation, and execution of the Energy Conservation programs. ($609)	Appropriations Committees, the Energy Conservation programs provide funding for Management Support Services which include activities such as improving the effectiveness, efficiency and economy of management and general administrative services. These activities are critical to the planning, formulation, and execution of the Energy Conservation programs. ($733)	Appropriations Committees, the Energy Conservation programs provide funding for Management Support Services which include activities such as improving the effectiveness, efficiency and economy of management and general administrative services. These activities are critical to the planning, formulation, and execution of the Energy Conservation programs. ($895)
Total, Program Direction	$7,444	$8,026	$8,670
TOTAL, MANAGE-MENT AND PLANNING	**$8,369**	**$8,626**	**$9,400**

DEPARTMENT OF ENERGY
FY 2002 CONGRESSIONAL BUDGET REQUEST
ENERGY EFFICIENCY AND RENEWABLE ENERGY
ENERGY CONSERVATION
(Dollars in Thousands)

FY 2002 Power Technologies Comparability Matrix

	New Structure	Power Technologies				
		Distributed Energy Resources		Management and Planning		
	FY 2000 Structure	Distributed Generation Tech. Development	End-Use Systems Integration and Interface	Evaluation and Planning	Program Direction	Total
FY 2000	Industry Sector					
	Industries of the Future (Crosscutting)					
	Enabling Technologies					
	Engineered Ceramics/CFCC's	5,500				5,500
	Distributed Generation					
	Industrial Power Generation	24,195	3,000		105	27,300
	Industrial Distributed Generation		1,000			1,000
	Technical Assistance					
	Best Practices Program					0
	Management and Planning					
	Evaluation and Planning			83		83
	Program Direction				817	817
	Total	29,695	4,000	83	922	34,700

	New Structure	Power Technologies				
		Distributed Energy Resources		Management and Planning		
	FY 2001 Structure	Distributed Generation Tech. Development	End-Use Systems Integration and Interface	Evaluation and Planning	Program Direction	Total
FY 2001	Industry Sector					
	Industries of the Future (Crosscutting)					
	Enabling Technologies					
	Engineered Ceramics/CFCC's	5,488				5,488
	Distributed Generation					
	Industrial Power Generation	17,261	998			18,259
	Industrial Distributed Generation		998			998
	Technical Assistance					
	Best Practices Program					0
	Management and Planning					
	Evaluation and Planning			98		98
	Program Direction				898	898
	Total	22,749	1,996	98	898	25,741

DEPARTMENT OF ENERGY
FY 2002 CONGRESSIONAL BUDGET REQUEST
ENERGY EFFICIENCY AND RENEWABLE ENERGY
ENERGY CONSERVATION
(Dollars in Thousands)

FY 2002 Management Support Services Comparability Matrix

	New Structure	Management and Planning	
		Program Direction	
FY	FY 2000 Structure	Management Support Services	Total
2000	Industry Sector		
	Industries of the Future (Crosscutting)	369	369
	Management and Planning	240	240
	Total	609	609

	New Structure	Management and Planning	
		Program Direction	
FY	FY 2001 Structure	Management Support Services	Total
2001	Industry Sector		
	Industries of the Future (Crosscutting)	444	444
	Management and Planning	289	289
	Total	733	733