DEPARTMENT OF ENERGY
FY 2003 CONGRESSIONAL BUDGET REQUEST
ENERGY EFFICIENCY AND RENEWABLE ENERGY
ENERGY CONSERVATION
(Tabular Dollars in Thousands, Narrative in Whole Dollars)

INDUSTRY SECTOR

PROGRAM MISSION

Mission: The Industrial Technologies program partners with key, energy-intensive industries to develop and apply advanced technologies and practices that reduce energy consumption, improve environmental performance, 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 39 percent of all U.S. energy use. Moreover, just nine industries (agriculture, aluminum, chemicals, forest products, glass, metal casting, mining, petroleum, and steel) account for 27 percent of national energy use. Collectively, these basic materials processing industries represent the backbone of the U.S. economy, supplying more than 90 percent of the materials needed for our buildings, transportation, communications, and manufacturing sectors. They ship $1 trillion in products annually, employ three million people, and generate four additional jobs in the economy for each job generated in their industries.

These nine industries hold tremendous opportunities to reduce energy use while increasing productivity and cutting waste. However, they are limited in their ability to invest in the necessary research, development, and deployment (RD&D) by several factors:

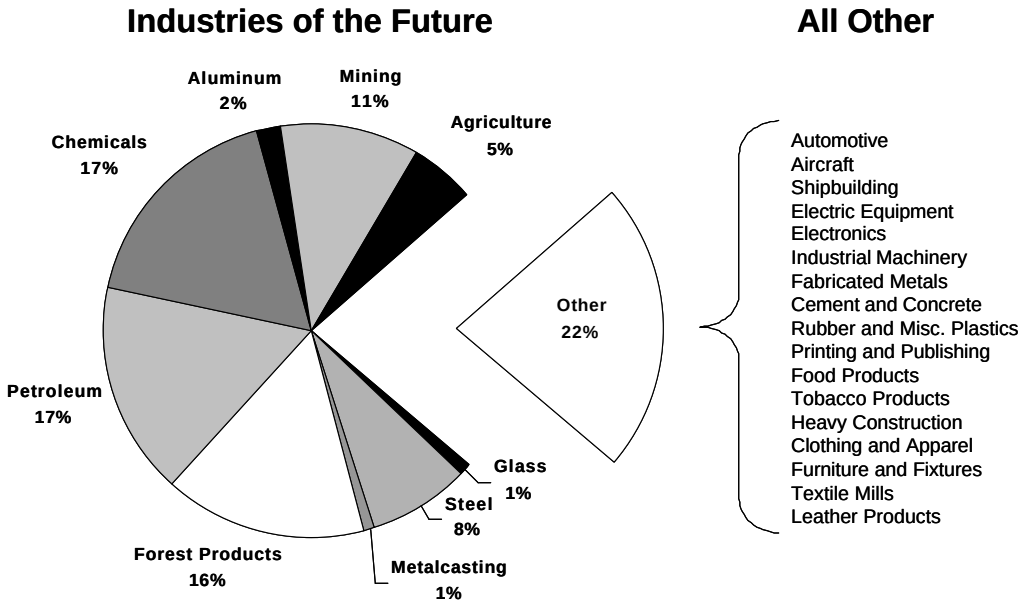
- Narrow profit margins and dependence on capital-intensive equipment
- Increasing competition from foreign firms that receive significant support and market advantages from their governments
- Volatile energy prices (industrial energy prices rose 35 percent or more in 1999-2001) and sporadic energy supply interruptions
- Growing pressure to restrict emissions and effluents

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

The National Energy Policy (NEP)[a] recognizes that improved energy efficiency in energy-intensive industries can yield large improvements in overall productivity, product quality, safety, and pollution prevention. The NEP specifically recommends "appropriate funding of those research and development programs that are performance-based and are modeled as public-private partnerships."

Figure 1

Energy Use by Industry
Total 2000 End Use: 35.8 Quads*



*Includes 2 quads of renewable energy used principally in the forest products industry.

***Strategic Approach*:** By developing and adopting more energy-efficient technologies, U.S. industry can boost productivity and competitiveness, strengthen national security, and improve the environment. A collaborative partnership between industry and government provides the best strategy to align national energy objectives with the business interests of industry for mutual benefit. Through an innovative strategy known as "Industries of the Future," Industrial technologies works with the nine most energy-intensive industries to develop and apply advanced, energy-efficient technologies, processes, and practices. Collectively, these Industries of the Future represent the greatest opportunity to save energy and improve environmental performance in a cost-effective manner. Industrial technologies invests in pre-competitive and high-risk RD&D that individual companies are unable to undertake without government support. Typically, a 50-percent cost-share from industry over the life of the RD&D project is required. By working with entire industries rather than just individual companies, Industrial technologies maximizes the energy benefits of technology investments and fosters the formation of public-private partnerships. Although the Industries of the Future strategy focuses on the nine most energy-intensive industries, it engages the participation and expertise of many related industries.

[a]See National Energy Policy report of the National Energy Policy Development Group (May 2001), p.4-12. "The priority would be to improve the energy intensity of the U.S. economy as measured by the amount of energy required for each dollar of economic productivity. This increased efficiency should be pursued through the combined efforts of industry, consumers, and Federal, state, and local governments."

The Industries of the Future strategy is based on the view that industry is best qualified to establish its own goals for the future and identify its technology needs and 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. Industrial technologies issues competitive RD&D solicitations in support of the roadmaps, requiring a 50-percent cost-share from industry over the life of each project. Industrial technologies selects projects that address top industry needs, meet strict criteria for government support, and help meet national energy goals.

3. Industrial technologies supports related programs that serve multiple energy-intensive industries by focusing on crosscutting technologies (e.g. sensors and controls), technology demonstrations, energy systems assessments, and technical assistance.

Industrial technologies is expanding its national efforts through its State Industries of the Future initiative. The importance of energy-intensive basic 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 extend its reach to smaller companies. Since each state has a distinctive industrial base, environmental profile, and natural resource mix, the initiative encourages each state to tailor its partnership to meet regional industrial priorities.

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

Long Term Program Goals and Benefits

The Government Performance and Results Act (GPRA) has been implemented by Industrial technologies through the development of quality metrics projecting the results of individual projects within program planning elements for the Industrial technologies portfolio of projects in a single year. Results are shown in Table 1 for 2005, 2010 and 2020.[a]

[a]Industrial technologies produces a report on an annual basis documenting the GPRA process and showing all the assumptions and projects that were included. See, for example, GPRA 2002 Quality Metrics- Methodology and Results: Office of Industrial Technologies, February 28, 2001, 36pp + Appendices. In aggregating the potential savings from successful development of these technologies, engineering judgement is used to avoid double-counting the same savings for different projects. A market penetration model is used for the analysis, and specific program results are critically examined each year.

The performance indicators, listed in Table 2, show[a] six measures that are tracked to demonstrate progress towards achieving the potential energy savings listed in the GPRA Table 1 shown above. Trends beginning FY 1996 are shown in the Table 2.

Table 1. GPRA 2003 Projected Program Benefits

	Primary Energy Savings (Btu)		
Planning Unit	**2005**	**2010**	**2020**
Aluminum	17	76	194
Chemicals	96	233	786
Forest Products[b]	32	80	258
Glass	15	31	79
Metal Casting	21	35	75
Steel	30	71	151
Mining	41	76	167
Agriculture[c]	61	189	545
Petroleum Refining	17	36	122
Industrial Materials for the Future	31	74	207
Sensors & Controls	1	9	37
Combustion Systems	16	141	819
Industrial Assessment Centers	14	40	58
Inventions & Innovations	61	112	283
NICE3	21	45	121
Best practices	35	169	438
TOTAL	508	1417	4340

Note: Program benefit projections are developed through an impact analysis process undertaken annually by EERE, based on assumptions for future energy markets derived from EIA's annual energy outlook. EERE's sectors analyze the impacts their programs will have on energy savings, energy cost savings, and carbon reductions if all program goals are met, and future energy markets develop as expected. A sample of program benefit estimates are externally reviewed by Arthur D. Little. An integrated analysis model run by an external contractor controls for interaction effects across programs and sectors.

[a]Performance indicators: Metrics on the number of commercialized technologies and annual energy savings have been tracked by the program for over 20 years. Others such as the number of Allied Partners and Internet Information Page Views track information that can be easily and repeatedly updated. Two new metrics will also be tracked: 1) the number of plants impacted seeks to provide a broad indicator of reach of the overall program in reaching energy intensive plants; and 2) RD&D portfolio turnover is intended to be an indicator of program and portfolio change.

[b]Forest Products industry energy svings related to black liquor gasificaiton technology are included under Combustion.

[c]Benefits of the Agriculture IOF program include large substitutions of biomass feedstock for fossil fuel.

At the sector level, we report a range of estimates that correspond to two modeling cases: with and without program interactions. For example, reductions in new electricity generation requirements due to energy efficiency improvements would reduce the potential market for a range of electricity supply options. When integrated and non-integrated estimates are virtually the same, no estimate range is shown.

Table 2. Performance Indicator Trends[ab]

	FY96	FY97	FY98	FY99	FY00	FY01	FY02[c]	FY03
Number of Commercialized	8	12	9	4	9	10e	10	10
Annual Energy Savings[d]	175	198	218	236	249e	262e	276	290
RD&D Portfolio Turnover of	NA	NA	26	34	25	25e	25	25
Number of New Allied Partners[e]	NA	NA	NA	NA	NA	18	20[f]	20
Number of Plants Impacted[g]	NA	NA	NA	NA	NA	NA	TBD[h]	2000[h]
Internet Information Page Views (million)	NA	NA	NA	1.5	3.0	4.6	5.3	6.0

Goals and Performance Measures:

- Between 1990 and 2010, contribute to a 25-percent decrease in energy intensity (as compared to 1991)[h] by the nine energy-intensive Industries of the Future (a potential savings of almost 6 quads). By 2020, contribute to a 35-percent decrease in energy intensity (a potential savings of almost 10 quads). See Figure 2.

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[a] Performance Indicators: the following metrics (number of technologies commercialized, energy savings from Industrial technologies activities in partnership with industry, R&D portfolio turnover of projects, number of new allied partners, number of energy intensive plants impacted by the program, number of internet information page views) quantify the overall success of the Program and are tracked annually as shown in Table 2.

[b] *e=estimate*

[c] All FY02 numbers are preliminary estimates

[d] In trillions of Btu. 1 trillion Btu are worth over $5 million given recent industrial energy prices.

[e] Allied Partner program began in FY01. Industrial technologies partners with companies, industrial and professional associations, non-governmental organizations and universities/colleges, utilities, and equipment manufacturers. The new program includes 12 month agreements that are renewable. Accomplishments under the new program are reviewed annually. An end-of-year report is required each year reviewing what was accomplished under the agreement.

[f] A page view is a request made to the Internet server for any content on the site. This does not include graphics.

[g] A database is being established to track plants adopting technologies and practices developed with support from Industrial technologies.

[h] 15 trillion Btu per billion dollars ($1992)

- Between 1990 and 2010, commercialize over 100 energy-efficient industrial technologies through RD&D partnerships.

Figure 2. OIT Seeks to Lower Industrial Energy Intensity 1999 to 2020

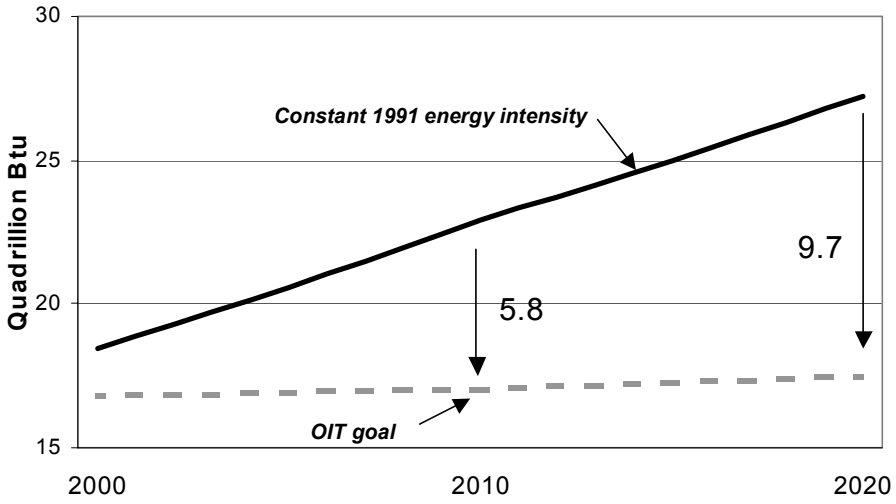


Figure 3. Cumulative OIT Energy Savings

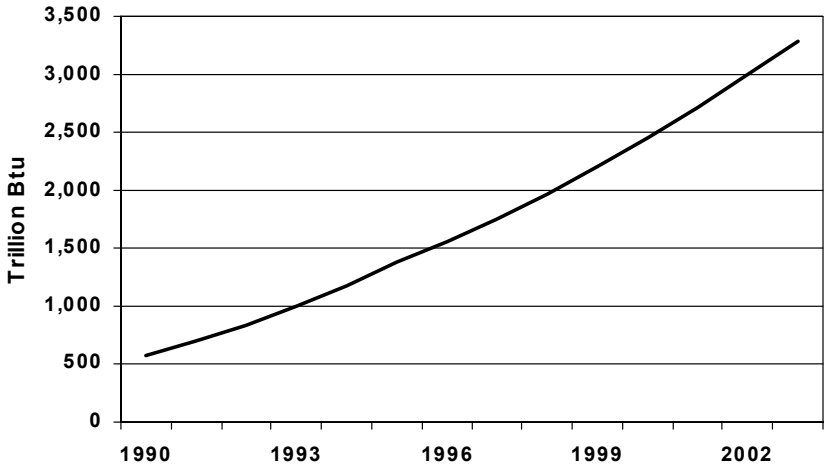
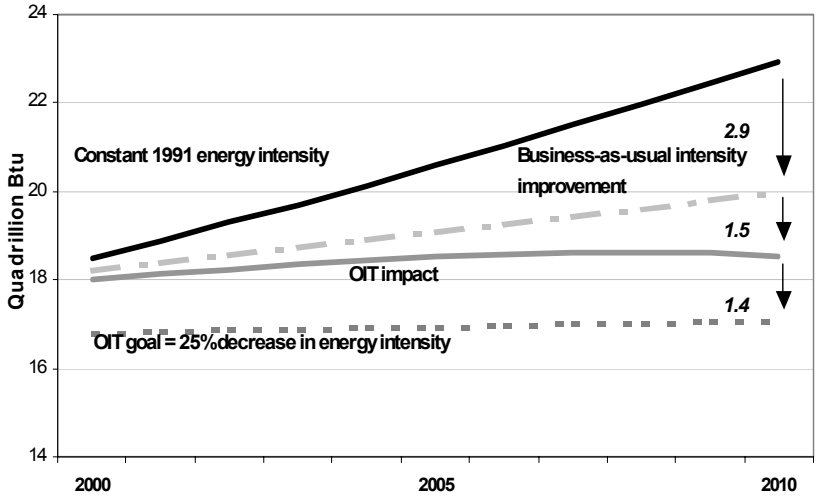


Figure 4. Energy Target Will Require Additional Activity



Benefits: In 2001, Industrial technologies programs directly contributed to industrial energy savings of over 260 trillion Btu — savings worth well over $1.6 billion.[a,b] Between 1990 and 2000, Industrial technologies helped develop more than 90 commercialized industrial technologies. Cumulative tracked energy savings from 1990 to 2003 are estimated to be over 3.2 trillion Btu as shown in Figure 3. This success rate is a result of the "industry pull" designed into the Industries of the Future strategy. Industrial technologies currently supports roughly 500 RD&D projects involving over 2,000 partners. Partners include small, medium, and large companies, national laboratories, universities, states, and non-governmental organizations. By concentrating on vital, high-risk RD&D in pre-competitive areas, these diverse partners are collaborating effectively to surmount long-standing technology hurdles and accelerate the pace of technology development.

RD&D projects will continue to produce commercialized technologies that will contribute significantly to increased energy efficiency in energy-intensive industries. As shown in Figure 4, by 2010 our nine partner industries are expected to reduce their energy use by nearly 3 quads through business-as-usual efficiency improvements (EIA projection of .75 percent annually). Concurrently, Industrial technologies-sponsored activities are projected to help these industries lower energy use by an additional 1.5 quads. The remaining gap of 1.4 quads between projected savings and the 2010 goal represents a "stretch" opportunity to further increase energy efficiency and productivity in this core group of industries. Actions that could contribute to this opportunity include more aggressive application of advanced technologies, accelerated commercialization paths of advanced technologies, and public policy incentives for RD&D investment and capital acquisition leading to substantially improved energy efficiency outcomes.

Program Strategic Performance Goals (PSPG)

ER1-7: Specific Vision Industries
Specific Vision Industries R&D activities will develop a portfolio of energy saving technologies and methods that will catalyze reduced energy use in the nine energy-intensive "Industries of the Future" of 329 trillion Btu of annual savings in 2005 827 trillion Btu in 2010, and 2,377 trillion Btu in 2020, compared with the EIA conventional technology baseline..

ER1-8: Crosscutting Industrial Technologies
Crosscutting Industrial Technologies R&D activities will develop a portfolio of crosscutting energy saving technologies, methods, and assistance that will catalyze reduced energy use in energy-intensive "Industries of the Future" of 178 trillion Btu of annual savings in 2005, 590 trillion Btu in 2010, and 1963 trillion Btu in 2020, compared with the EIA conventional technology baseline.

The PSPGs are additive and proportional to their contribution to their activities' individual contributions to the overall goal of the industry

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[a] Constant 2000 dollar values for energy savings shown in this budget are based upon Energy Information Administration data for 1999 as well as preliminary estimates for 2000 and 2001 and a forecast for 2002. Average industrial energy prices per million Btu in 1999 were $4.55; $6.88 in 2000; $6.30 in 2001 and a forecast of $5.33 in 2002.

[b] Energy savings numbers are based on Industrial technologies FY2003 GPRA analysis.

program.

Annual Performance Results and Targets for ER1-7,8[a]

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
! In FY 2001, 10 new technologies were commercialized from both the nine vision industries as well as the crosscutting programs. [b] ! In FY 2001, Industrial technologies helped industry save an estimated 262 trillion Btu of energy worth more than $1.6 billion.[c] ! Continued support for Industrial Assessment Centers operating at 26 participating universities that will conduct approximately 650 combined energy, waste and productivity assessments.	! Commercialize 10 new energy efficient technologies in partnership with the most energy intensive industries. ! Complete 2 showcase demonstrations, at industry sights, of advanced energy efficient technologies. ! In FY2002, Industrial technologies will complete 20 new Allied Partnerships with energy intensive companies, trade organizations and other groups. ! 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. ! In FY2002, help industry save more than 265 trillion Btu of energy worth more than $1.6 billion. ! Industrial technologies internet web sites will record over 5 million page views.	! In FY 2003, commercialize 10 new technologies. ! In FY 2003, help industry save more than 280 trillion Btu of energy worth at least $1.5 billion. ! In FY 2003, project turnover will represent 25% of the FY2002 RD&D project portfolio. ! FY 2003 Milestone: 2000 energy intensive U.S. plants will apply EERE technologies and services achieving up to a 15% improvement in energy productivity per plant. ! Industrial technologies internet web sites will record some 6 million page views. ! In FY 2003, Industrial technologies will complete 20 new Allied Partnerships with energy intensive companies, trade organizations and other groups

[a]The annual performance results and targets shown are part of a coordinated and complementary effort which jointly contribute to the program strategic performance goals

[b] To support the development of commercialized technologies solicitations are issued by Industrial technologies. For example, in FY2001 one new solicitation was issued in FY 2001 targeted to the Renewables Vision 2020 for Agriculture in support of the goals of the President's Bio-based Products and Bio-energy initiative. (ER3-3)

[c] An important element in industrial energy savings were the energy audits conducted through the continued support for Industrial Assessment Centers as well as the 15 additional assessments and 5 case studies of major industrial plants that will document a variety of system-focused implemented actions were conducted. These assessments influence important replication of similar energy savings for other plants. (ER1-7,8)

DEPARTMENT OF ENERGY
FY 2003 CONGRESSIONAL BUDGET REQUEST
ENERGY CONSERVATION
(Dollars in Thousands)

INDUSTRY SECTOR

PROGRAM FUNDING PROFILE

Program Activity	FY 2001 Comparable	FY 2002 Comparable	FY 2003 Request	$ Change	% Change
Industries of the Future (Specific) Operating Expenses . . .	$71,831	$72,624	$71,615	($1,009)	-1.4%
Industries of the Future (Crosscutting) Operating Expenses	$59,737[a]	$60,900	$57,109	($3,791)	-6.2%
Cooperative Programs with States Operating Expenses	$1,964	$2,000	$2,000	$0	0.0%
Energy Efficiency Science Initiative Operating Expenses . .	$3,828	$4,000[b]	$0	($4,000)	-100.0%
Management and Planning Operating Expenses	$8,626	$9,400	$7,635	($1,765)	-18.8%
TOTAL	$145,986[c]	$148,924	$138,359	($10,565)	-5.8%
Summary					
Operating Expenses	$145,986	$148,924	$138,359	($10,565)	-5.8%
Total Program	$145,986	$148,924	$138,359	($10,565)	-5.8%

[a]Comparability adjustment has been made for transfer of multiple projects from Industry sector for Power Technologies.

[b]Does not yet reflect FY 2002, P.L.-107-63 direction that half ($2,000,000) be made available to the DOE Fossil Energy Research and Development account..

[c]Reflects adjustment for a reprogramming 01-R-02 reprogramming to Science for SBIR/STTR for $-2,636,000. Reflects adjustment of $ -328,000 for Omnibus Rescission. P.L. 106-554.

Staffing (FTEs)	FY 2001 Actual	FY 2002 Budgeted	FY 2003 Budgeted
HQ FTEs	50	54	47
Field FTEs	5	6	7
Total FTEs	55	60	54

Actual Full-Time Equivalent (FTE) usage is cited for FY 2001 while budgeted staffing numbers are displayed in the FY 2002 and FY 2003 columns. For comparability purposes, budgeted FY 2001 FTE were HQ 59, Field 7 and total 66.

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"

DEPARTMENT OF ENERGY
FY 2003 CONGRESSIONAL BUDGET REQUEST
ENERGY CONSERVATION
(Dollars in Thousands)

INDUSTRY SECTOR

SUMMARY OF CHANGES

	FY 2003 Request
FY 2002 Enacted	$ 148,924
Non-Discretionary	
- Increase for Federal Pay Raise and Locality Pay	$ 138
FY 2003 Base	$ 149,062
Industries of the Future (Specific):	
– Petroleum Refing Vision - No funding requested	$-2,800
– Agriculture Vision - The increase reflects the needs for education priorities identified in the industry draft bio-based products and bio-energy roadmap.	$ 1,000
– Technical/Program Management Support - The increase reflects a partial restoration of supporting activities that were reduced in FY 2002.	$ 791
Industries of the Future (Crosscutting):	
– Industrial Materials for the Future - The decrease reduces the number of new industry R&D projects from 12 to 9.	$ -1,000
– Combustion - The decrease is for the biomass gasification projects.	$ -2,791
– Inventions and Innovation - The decrease reduces the number of grants from 20 to 10	$ -2,000

	FY 2003 Request
– Technical Assistance - Funding will focus on increased on-site plant assessments by the Industrial Assessment Centers and on the replication of energy savings from sites that have previously received technical assistance. .	$ 1,000
– Technical/Program Management Support - The increase reflects a partial restoration of supporting activities that were reduced in FY 2002..	$ 1,000
Energy Efficiency Science Initiative	
– No funding requested.	$ -4,000
Management and Planning:	
– Program Direction - Decrease reflects adjustment in FTE levels	$ -1,903
FY 2003 Congressional Budget Request	$ 138,359

INDUSTRIAL TECHNOLOGIES
INDUSTRY SECTOR
(Dollars in Thousands)

INDUSTRIES OF THE FUTURE (SPECIFIC)

Mission Supporting Goals and Objectives

Mission: The Industries of the Future (Specific) program supports cost-shared research, development, and demonstration (RD&D) in 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 eight major U.S. industries (aluminum, agriculture, chemicals, forest products, glass, metal casting, mining, petroleum, and steel) that collectively account for roughly 70 percent of industrial energy use and over 75 percent of manufacturing wastes.

Summary: The Industries of the Future (Specific) program consists of an integrated portfolio of RD&D projects on advanced technologies that will improve the energy efficiency and environmental performance of eight major energy-intensive industries. The RD&D projects focus solely on technologies that will bring broad energy benefits within the eight partner industries and that would not be developed by individual companies acting alone. By managing an integrated portfolio, we are able to identify and transfer some of the advanced technologies developed for one energy-intensive industry to applications in other energy-intensive industries and their supporting industries. The effort is further leveraged through our state-level Industries of the Future initiative, which capitalizes on partnerships among state agencies, industry associations, and regional agencies to broaden the reach of national technology investments and enhance state economic development.

The Industries of the Future (Specific) Program uses open, competitive solicitations as the primary mechanism to provide financial assistance to effective public-private partnerships, leverage Federal funds, and obtain substantial reductions in energy intensity for the eight partner industries. To facilitate the use of this mechanism, the solicitation process was streamlined and is now uniform across all Industrial technologies programs and sub-programs. Project management efforts are centralized to provide greater uniformity and more effective delivery of services. Competitive solicitations require the national laboratories to work in partnership with the private sector to submit proposals. To facilitate these partnerships, the Laboratory Coordinating Council works to inform the private sector about the unique and relevant capabilities of the national laboratories. This approach allows the national laboratories to contribute to partnership projects in which their unique capabilities provide value, as determined by their partners. The project selection process entails merit reviews by peer experts and careful evaluation of projected energy and economic savings. Prospective and retrospective peer review exercises are used to evaluate project performance and progress and to adjust support. To verify program performance and results, all commercialized technologies and the extent of their use by industry are tracked.

Long Term Goals and Objectives

Program Strategic Performance Goal
ER1-7: Specific Vision Industries
Specific Vision Industries R&D activities will develop a portfolio of energy saving technologies and methods that will catalyze reduced energy use in the eight energy-intensive "Industries of the Future" of 329 trillion Btu of annual savings in 2005 827 trillion Btu in 2010, and 2,377 trillion Btu in 2020, compared with the EIA conventional technology baseline.

Performance Indicators:
Number of technologies commercialized
Energy savings from Industrial technologies activities in partnership with industry
RD&D portfolio turnover of projects
Number of new Allied Partners
Number of energy-intensive plants impacted by the program
Number of internet information page views

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
! In FY 2001, 10 new technologies were commercialized from both the nine vision industries as well as the crosscutting programs. [1] ! In FY 2001, Industrial technologies helped industry save an estimated 262 trillion Btu of energy worth more than $1.6 billion.[2] ! Continued support for Industrial Assessment Centers operating at 26 participating universities that	! Commercialize 10 new energy efficient technologies in partnership with the most energy intensive industries. ! Complete 2 showcase demonstrations, at industry sights, of advanced energy efficient technologies. ! In FY2002, Industrial technologies will complete 20 new Allied Partnerships with energy intensive companies, trade organizations and other groups. ! Continue support for Industrial Assessment Centers operating at 26 participating	! In FY 2003, commercialize 10 new technologies. ! In FY 2003, help industry save more than 280 trillion Btu of energy worth at least $1.5 billion. ! In FY 2003, project turnover will represent 25% of the FY2002 RD&D project portfolio. ! FY 2003 Milestone: 2000 energy intensive U.S. plants will apply EERE technologies and services achieving up to a 15% improvement in energy productivity

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
will conduct approximately 650 combined energy, waste and productivity assessments.	universities that will conduct approximately 320 combined energy, waste, and productivity assessment days of service to manufacturing clients. ! In FY2002, help industry save more than 265 trillion Btu of energy worth more than $1.6 billion. ! Industrial technologies internet web sites will record over 5 million page views.	per plant. ! Industrial technologies internet web sites will record some 6 million page views. ! In FY 2003, Industrial technologies will complete 20 new Allied Partnerships with energy intensive companies, trade organizations and other groups

The following eight industry-specific programs contribute to accomplishing the overall Industrial technologies goals as measured by the performance indicators.

Forest and Paper Products Vision Goals and Objectives

- Reduce energy use in the forest products industry by 32 trillion Btu in 2005 (compared to conventional technology), 80 trillion Btu in 2010, and 258 trillion Btu in 2020.[a]
- By 2010, the forest products industry will implement advanced water removal technologies in papermaking resulting in an energy efficiency improvement of 10 percent in paper production.[b]

Steel Vision Goals and Objectives

- Reduce energy use in the steel industry by 30 trillion Btu in 2005 (compared to conventional technology), 71 trillion Btu in 2010, and 151 trillion Btu in 2020.
- Continue development of energy-efficient steel making technologies and prove the feasibility of a revolutionary steel conversion process that will significantly reduce energy intensity in the steel industry.[5]

[a] Forest Products industry energy savings related to black liquor gasification technology are included under Combustion/Gasification.

[b] This is a significant objective among others in the program. It will significantly contribute to achieving the energy savings identified in the preceding statement.

Aluminum Vision Goals and Objectives

- Reduce energy use in the aluminum industry by 17 trillion Btu in 2005 (compared to conventional technology), 76 trillion Btu in 2010, and 194 trillion Btu in 2020.
- By 2010, the aluminum industry will develop and implement advanced cell technologies, including inert anodes and wettable cathodes (27 percent reduction in energy consumption) and carbothermic reduction (32-38 percent reduction in energy consumption), for elimination of greenhouse gases and for net energy savings in primary aluminum production of 27 trillion Btu in 2010 and 68 trillion Btu in 2020.[5]

Metalcasting Vision Goals and Objectives

- Reduce energy use in the metal casting industry by 21 trillion Btu in 2005 (compared to conventional technology), 35 trillion Btu in 2010, and 75 trillion Btu in 2020.
- Enable major technical advances in the metal casting industry to implement new design techniques and practices to increase yield and reduce scrap and energy use. [5]

Glass Vision Goals and Objectives

- Reduce energy use in the glass industry by 15 trillion Btu in 2005 (compared to conventional technology), 31 trillion Btu in 2010, and 79 trillion Btu in 2020.
- Continue projects to develop advanced glass technology that will reduce the gap between actual melting energy use and the theoretical minimum by 50 percent.[5]

Chemicals Vision Goals and Objectives

- Reduce energy use in the chemical industry by 96 trillion Btu in 2005 (compared to conventional technology), 233 trillion Btu in 2010, and 786 trillion Btu in 2020.
- Continue separation and new process chemistry technology R&D to significantly increase energy efficiency.[5]

Mining Vision Goals and Objectives

- Reduce energy use in the mining industry by 41 trillion Btu in 2005 (compared to conventional technology), 76 trillion Btu in 2010, and 167 trillion Btu in 2020.
- By 2010, significantly reduce the energy intensity required to crush a short ton of rock.[5]

Agriculture Vision Goals and Objectives

- Through the increased use of bioproducts, reduce industrial energy use by 61 trillion Btu in 2005 (compared to conventional technology), 189 trillion Btu in 2010, and 545 trillion Btu in 2020.[a]
- As part of the Office of Energy Efficiency and Renewable Energy's (EERE) integrated Biomass Research and Development portfolio, develop leapfrog technologies that allow the emerging biobased products industry to achieve a fivefold increase in the market share by 2020 for chemicals and materials produced from biomass (crops, crop residues, trees, forest residues and other biomass waste).[5]

Supporting Industries Vision Goals and Objectives

- By 2010, significantly reduce the energy intensity of material forming and finishing processes.
- Reduce energy consumption in carburizing processes by 20 trillion Btu/year; in heat treatment of castings by 7 trillion Btu/year; and in welding processes by 20 billion Btu/year in aluminum alloy forging processes.[5]

No funding is requested for Petroleum Refining Vision in FY 2003; existing projects will be documented and closed down using FY 2002 funds.

[a]Benefits of the Agriculture IOF program include large substitutions of biomass feedstock for fossil fuel feedstock currently used in the production of chemicals. This displacement accounts for some 55-60% of the total primary energy saved by the program.

Annual Performance Results and Targets: *Forest and Paper Products Vision*

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Commercialized feedstock-to-products characterization tool and mechanical alternatives for chemical replacement in recycle mills.	• Commercialize the methane de-NO_x reburning process for wastewood, sludge, and biomass fired stoker boilers saving 1 trillion Btu per year by 2010 and 3 trillion Btu per year by 2020. • Demonstrate the use of low temperature plasma technology to control volatile organic compound emissions from an oriented strandboard plant that will save 0.5 trillion Btu per year by 2010 and 1 trillion Btu per year by 2020.	• Install prototype multiport cylinder dryers into existing full-scale dryers that will save 5 trillion Btu/year by 2010 and 18 trillion Btu/year by 2020. • Evaluate the use of high speed microwave treatment for rapid wood kiln drying in a commercial scale kiln that will save 1 trillion Btu/year by 2010 and 8 trillion Btu/year by 2020. • Demonstrate a suite of sensors in a wood drying kiln with wireless data transmission that will save 9 trillion Btu/year by 2010 and 35 trillion Btu/year by 2020. • Design and test full-scale, advanced black liquor nozzles in industrial applications that will save 23 trillion Btu/year in 2010 and 70 trillion Btu/year in 2020.

Annual Performance Results and Targets: *Steel Vision*

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Commercialized optical sensors and controls for improved basic oxygen furnace operations. • Commercialized recycling of waste oxides in steel making furnaces. • Made significant advancements in cost-effective, energy-efficient hot oxygen injection technology for the blast furnace, exposed automotive sheet steel surface quality technology, laser-assisted arc welding technology, magnetic gate system technology for molten metal flow control, nickel aluminide radiant heater technology, optical sensor for post-combustion control in electric arc furnace steel making, and non-chromium passivation techniques for electrolytic tin plate for the steel industry.	• Commercialize hot strip model to improve the steel product quality predictability, production yield, and energy efficiency. • Commercialize laser contouring sensor to enable optimized operation of steel making furnaces and reduce remelt and energy consumption. • Demonstrate an automated steel cleanliness tool using scanning electron. • Commercialize oscillating combustion technology in steel manufacturing processes.	• Expand the laser contouring sensor technology for ladle metallurgy and electric arc furnace market applications. • Complete R&D for sustainable steel making using biomass and waste oxides. • Complete evaluation of microwave de-oiling of steel mill waste sludges. • Complete conceptual definition of a revolutionary steel making process for the 21st century plant.

Annual Performance Results and Targets: *Aluminum Vision*

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Demonstrated conversion of spent potliner to products for the aluminum industry. • Conducted Showcase event at Alcoa's Spanish Fork facility, Utah, to highlight energy efficiency best practices as well as DOE-funded developments in sensors, furnace burner, and melter designs.	• Design and construct a 5K amp test cell for aluminum production, with an inert anode and wettable cathode and a novel cell design.	• Demonstrate an intelligent pot-room control system at a commercial smelter. • Demonstrate commercial viability of improved potliners with extended lifetimes to improve cell performance. • Determine the feasibility of carbothermic reduction technology to produce aluminum with 32-38 percent reduction in energy emissions. • Demonstrate a vertical flotation melter, with thermal efficiency 2.5 times that of a conventional furnace, at commercial scale on a plant floor.

Annual Performance Results and Targets: *Metalcasting Vision*

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Developed design guidelines for new feeding distance rules for carbon/low alloy steel castings. The guidelines were published and widely disseminated to the US steel casting industry. The potential benefit is an improved yield of up to 10%. • In-plant demonstration of new foundry melting practices developed for steel casting.	• Revise the Metal Casting Industry Vision to reflect new trends and challenges that the industry will need to address to achieve their 2020 vision goals. • Initiate development of new design rules for high alloy steel to increase yields and reduce scrap by 30%.	• New rapid solidification process (RSP) tooling technique developed for die casting industry will enable metal casters to reduce lead time, improve quality of casting, and save energy. • A new multi-layer system guideline will be available to the die casting industry. Die life is expected to be extended by at least 50%. • New development in radiographic standards for steel casting will enable a 30% reduction in scrap. • A new Computational Fluid Dynamics (CFD) Designer Software tool developed for advanced lost foam pattern production will be commercially available.

Annual Performance Results and Targets: *Glass Vision*

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Initiated commercial-scale demonstration of high-luminosity, low-NO_x burner technology and laser cutting of handglass for the glass industry. • Continued to incorporate furnace operating and design parameters in advanced glass furnace model.	• Begin installation of electrostatic cullet and batch preheating technology at a glass production facility. • Complete demonstration of high-luminosity, low NO_x burner technology. • Complete demonstration of laser-based cutting and finishing of handglass.	• Complete demonstration of electrostatic cullet and batch preheating technology at a glass production facility that will save 5 trillion Btu in 2010 and 8 trillion Btu in 2020. • Complete process development for recycling in-house fiberglass waste that will save 1 trillion Btu in 2010; potentially many times that amount if expanded to post-consumer fiberglass waste by 2020. • Validate advanced glass furnace model and hold a technology transfer workshop. • Complete development of laser-induced breakdown spectroscopy (LIBS) on-line sensor for improving production efficiency.

Annual Performance Results and Targets: *Chemicals Vision*

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Completed pilot test of advanced electrodeionization separation technology to reduce energy use by 4 trillion Btu per year by 2020.	• Begin implementation of the pressure swing absorption for product recovery technology in chemical plants to reduce energy use by 28 trillion Btu per year by 2020. • Complete pilot test of membrane for olefin recovery technology to reduce energy use by 24 trillion Btu per year by 2020.	• Complete multiphase computational fluid dynamics consortium projects to provide new design tools that will save 10 trillion Btu per year by 2020. • Complete R&D and pilot test of advanced alloys for ethylene production to reduce energy use by 107 trillion Btu per year by 2020.

Annual Performance Results and Targets: *Petroleum Refining Vision*

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Completed development of a portable hydrocarbon leak detector for the petroleum industry.	• Demonstrate portable hydrocarbon leak detector to identify fugitive emissions, which can lower costs, save energy, and reduce environmental impacts. • Demonstrate rotary burner for refinery process heating to save energy and reduce NO_x emissions to less than 10 ppm. • Close out program and transfer to industry portable hydrocarbon leak detector and rotary burner technology.	• No activities.

Annual Performance Results and Targets: *Mining Vision*

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Completed development of Three-Dimensional Simulation of Charge Motion in Semiautogenous Grinding (SAG) and Ball Mills for Energy Efficiency.	• Transfer the following successful projects to the private sector for commercialization: 1. Three-Dimensional Simulation of Charge Motion in Semiautogeneous grinding (SAG) and Ball Mills to reduce energy intensity 2. Dense-medium cyclone optimization 3. Novel rewatering aids for mineral and coal fines • Apply selective flocculation of fine mineral particles to many mining operations.	• Complete high-temperature superconductors to underground communication project to provide wireless underground communication, improve productivity and safety. • Continue development of advanced power and control for fuel cell mining vehicles to improve underground air quality and reduce energy use. • Complete horizon sensing technology to guide mining equipment and detect change in material to prevent the extraction of waste materials. • Commercialize fibrous monolithic composite as wear-resistant components to reduce downtime and energy use.

Annual Performance Results and Targets: *Agriculture Vision*

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Developed technologies to convert sugars from biomass to a valuable chemical (propylene glycol) used for anti-freeze, coatings, and other applications. Attracted commercial interest and a partnership for scale-up. (20 trillion Btu fossil fuel savings by 2020). • Advanced the development of soy-based 2-cycle engine oils for the emerging bio-products industry. • Demonstrated advanced electrodeionization separation technology for product purification at a pilot scale in trials at a Tate & Lyle HFCS plant.	• Cargill Dow LLC starts up the first full-scale PLA plastic manufacturing facility (300 million lbs./yr.) based on corn sugar as the feedstock. (200 trillion Btu fossil fuel savings by 2020.) • A 2-cycle, engine oil based on soy oil is commercialized for the emerging bioproducts industry. • Two new biobased polymer technologies advance to scale-up with industry partners committed to commercialization within two to three years.	• Commercialize two new biomass-based product technologies.

Annual Performance Results and Targets: *Supporting Industries Vision*

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Completed technology roadmaps for the advanced ceramics and process heating industries • The FY 2001 SI solicitation resulted in five technology projects for the heat treating, forging, and welding industries consistent with their respective technology roadmaps.	• The Metal Powder Industries Federation agrees to become an Allied Partner of the Industrial technologies Supporting Industries Program.	• Complete matrices of coincident research needs: 1. between supporting industries (SI-SI) 2. between SI and IOFs (SI-IOF) 3. (3) the SI-SI-IOF coincident research needs matrix. • Complete an energy and environmental metrics study of supporting industries including assessment of the strategic implementation of its results.

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

Program Activity	FY 2001 Comparable	FY 2002 Comparable	FY 2003 Request	$ Change	% Change
Forest and Paper Products Vision	$11,799	$11,827	$11,827	$0	0.0%
Steel Vision	$10,365	$10,329	$10,329	$0	0.0%
Aluminum Vision	$10,876	$8,103	$8,103	$0	0.0%
Metalcasting Vision	$5,559	$5,357	$5,357	$0	0.0%
Glass Vision	$4,582	$4,572	$4,572	$0	0.0%
Chemicals Vision	$12,113	$14,458	$14,458	$0	0.0%
Petroleum Vision	$2,609	$2,800	$0	$-2,800	-100.0%
Mining Vision	$3,517	$5,119	$5,119	$0	0.0%
Agriculture Vision	$6,590	$7,259	$8,259	$1,000	13.7%
Supporting Industries.	$1,571	$1,600	$1,600	$0	0.0%
Technical / Program Management Support.	$2,250	$1,200	$1,991	$791	65.9%
Total, Industries of the Future (Specific)	$71,831	$72,624	$71,615	$-1,009	-1.3%

Note: Industries of the Future (Specific) includes $1,340 in FY 2001, $1,440 in FY2002, and $1,440 in FY2003 for the State Energy Program Special Projects State Grants. FY 2001Comparable column has been reduced by $559,000 for SBIR/STTR transfer .

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

	FY 2001	FY 2002 [a]	FY 2003 [a]	$ Change	% Change
Argonne National Laboratory (East)	$2,219	$2,243	$2,268	$25	1.1%
Lawrence Livermore National Laboratory	$400	$404	$409	$5	1.2%
Idaho National Engineering and Energy Laboratory	$796	$805	$814	$9	1.1%
Lawrence Berkeley National Laboratory	$707	$715	$723	$8	1.1%
Los Alamos National Laboratory	$1,000	$1,011	$1,022	$11	1.1%
National Renewable Energy Laboratory	$733	$741	$749	$8	1.1%
Oak Ridge National Laboratory	$4,458	$4,507	$4,556	$49	1.1%
Pacific Northwest National Laboratory	$1,042	$1,053	$1,065	$12	1.1%
Sandia National Laboratories	$2,378	$2,404	$2,430	$26	1.8%
All Other	$58,098	$58,741	$57,579	$-1,162	-1.9%
Total, Industries of the Future (Specific)	$71,831	$72,624	$71,615	$-1,009	-1.4%

[a] These dollars reflect an estimated distribution of Industrial technologies funds. They are not requested funds for individual laboratories.

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

Program Activity	FY 2001	FY 2002	FY 2003
Forest and Paper Products Vision	**Energy Performance** Research was 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 developed a wood chip microwave pretreatment technology to increase the yield, efficiency, and quality of Kraft pulping while decreasing chemical consumption and cooking temperatures. ($1,403)	**Energy Performance** Approximately 15 projects are being funded focusing on industrial energy efficiency and low-level heat recovery. Technical feasibility studies underway include: the development of an innovative energy efficient paper drying technology and an assessment of deposit formation in recovery boiler convection passes. Corrosion resistant materials are being developed for use in black liquor gasifiers. ($1,445)	**Energy Performance** Approximately 12 projects will focus on industrial energy efficiency and low-level heat recovery. Two technical feasibility studies will be completed: the development of an innovative energy-efficient paper drying technology and an assessment of deposit formation in recovery boiler convection passes. Continue development of corrosion-resistant materials for use in black liquor gasifiers. ($3,300)
	Environmental Performance Research was 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 were funded including the development of a Volatile Organic Compound (VOC) reduction model	**Environmental Performance** Approximately 15 projects are being funded focusing 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 are being completed including the use	**Environmental Performance** Approximately 7 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. The use of low temperature plasma technologies for elimination of volatile organic compound

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

Program Activity	FY 2001	FY 2002	FY 2003
Forest and Paper Products Vision (cont'd)	that was used for emissions control in kraft mills. In addition, a technology to extract and collect VOCs from lumber drying processes was 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)	emissions in the forest products industry will be demonstrated at a mill. ($1,727)
	Improved Capital Effectiveness Research was targeted to reduce the capital requirements per unit of production and sales. Twelve projects were funded and focused on system and process efficiency, materials of construction, and fabrication. An example was a tool to predict the corrosion rates in a kraft chemical recovery boiler. This tool decreased maintenance downtime and increased the safety of the chemical recovery boiler operation. ($1,315)	**Improved Capital Effectiveness** Approximately 12 projects are being funded focusing on systems and process efficiency, and materials of construction and fabrication. Feasibility studies are underway 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)	**Improved Capital Effectiveness** Approximately 10 projects will focus on systems and process efficiency, and materials of construction and fabrication. Feasibility studies will be completed to: evaluate the use of borate autocausticizing in the recovery furnace eliminating the energy-intensive lime kiln causticizing; and to evaluate the use of wood drying hydrocarbon emissions as an auxiliary fuel for wood drying. ($2,200)

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

Program Activity	FY 2001	FY 2002	FY 2003
Forest and Paper Products Vision (cont'd)	**Recycling** Research was targeted to improve separation technologies, reduce energy usage and fiber deterioration, determine optimal combinations of recycled and virgin fibers, and expand the use of recycled products. Developed a new screening technology that reduced energy requirements by as much as 80% while improving the screen performance and reliability. Screening technologies are used to remove contaminants from recycled fiber. ($1,059)	**Recycling** Approximately 10 projects are being funded to reduce energy use and fiber deterioration in recycling, improve separation technologies, and expand the use of recycled fibers. Progress is continuing 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 is being demonstrated. ($1,475)	**Recycling** Approximately 7 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 optimizing paper making drying processes to eliminate the irreversible loss in the ability of fibers to bond together for a second time when the fibers are recycled. ($1,200)
	Sensors and Controls Research was targeted to optimize mill operations, evaluate the characteristics of raw materials and final products, and detect emissions. One example of the projects in this area was the	**Sensors and Controls** Approximately 12 projects are being funded focusing on the development of actuators and control devices, process and product measurement and modeling, and data interpretation.	**Sensors and Controls** Approximately 5 projects will be funded focusing on the development of actuators and control devices, process and product measurement and modeling, and data interpretation.

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

Program Activity	FY 2001	FY 2002	FY 2003
Forest and Paper Products Vision (cont'd)	development of an intelligent, vision-based apparatus for measuring properties on the wet 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)	Specifically, an acoustic wave monitor for on-line measurement of the amount of corrosion and erosion in recovery boiler tubing is being developed as well as a model to diagnose and optimize control of continuous kraft pulp digesters. ($2,900)	A wireless microwave-based moisture sensor will be prototyped in a lumber drying kiln to optimize wood drying. ($2,200)
	Sustainable Forestry Research was targeted to optimize raw material supply by improving wood quality and increasing the yield of wood and fiber per harvested acre. Projects achieved 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	**Sustainable Forestry** Approximately 6 projects are being 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)	**Sustainable Forestry** Approximately 8 projects will be funded focusing on biotechnology, tree physiology, and sustainable soil productivity. Continue studies to develop process models to predict the effect of forest management on growth and productivity of managed forest and understand the effects of intensive forest management. ($1,200)

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

Program Activity	FY 2001	FY 2002	FY 2003
Forest and Paper Products Vision (cont'd)	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 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	**$11,799**	**$11,827**	**$11,827**
Steel Vision	**Production Efficiency** Research to reduce energy while lowering emissions and increasing	**Production Efficiency** Design and construct pilot plant demonstrating controlled thermo-	**Production Efficiency** Continue development of controlled thermo-mechanical

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

Program Activity	FY 2001	FY 2002	FY 2003
Steel Vision (cont'd)	productivity in steel processing focused on a wide range of topics as identified in the Steel Industry Technology Roadmap. Key advances were made through improved sensing and control, increased use of by-products and recycling, and process improvement. These activities supported the industry's reduction of energy use by 19% while increasing its use of recycled steel and by-products to 66% of production. Collaborative R&D with the industry to develop improved, energy-efficient, low carbon dioxide emission, alternative iron and steel making processes were supported. R&D was 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 resulted from analyses and laboratory studies based on initial efforts in	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)	processing technology for tubes and pipe. ($3,500)

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

Program Activity	FY 2001	FY 2002	FY 2003
Steel Vision (cont'd)	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 identified methods of increasing the efficiency of recycling steel from in-plant wastes. Processes were analyzed to identify ways to use other in-plant wastes as feedstock to reduce energy use. ($2,920)	**Recycling R&D** Identify technologies and practices to eliminate the risk of radioactive scrap entering the steel production cycle. Determine operating practices enhancing recycling of waste oxides in the steel making vessel. ($2,000)	**Recycling R&D** Complete R&D for recycling and re-use of basic oxygen furnace steel making slags through bench-scale testing. ($1,000)
	Environmental Engineering Developed 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 to reduce NO_x and CO_2 levels from the various unit operations in the steel mill	**Environmental Engineering** Complete long-term testing of an optical sensor for real-time measurement of gases in the EAF. Demonstrate low-NO_x, forced internal recirculating burner using by-product gases. ($1,500)	**Environmental Engineering** Complete R&D for sustainable steel making using biomass and waste oxides. Complete evaluation of microwave de-oiling of steel mill waste sludges. ($1,500)

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

Program Activity	FY 2001	FY 2002	FY 2003
	continued. ($3,240)		
Steel Vision (cont'd)			
	Feasibility Studies on Innovative Steel Production	**Feasibility Studies on Innovative Steel Production**	**Feasibility Studies on Innovative Steel Production**
	Significant crossovers of technologies between Electric Arc Furnace (EAF) and Basic Oxygen Furnace (BOF) steel making indicated that there are significant opportunities to improve the steel making process by, at a minimum, combining and optimizing the best features of both. The development of a recuperated, continuous (as opposed to batch) steel making process could result in saving half the energy currently used in the steel conversion/melting operation. These activities initiated feasibility and design studies to develop a new steel conversion process. ($480)	Steel Cup Challenge: continue activities to develop a new steel conversion process based on prior year studies. The expected outcome is to prove the fasibility of the new steel conversion process for future prototype development consideration. ($2,829)	Select and initiate R&D on a revolutionary steel conversion process based on the results of the feasibility studies. ($4,329)
	R&D participants in the Steel Vision included: American Iron and Steel Institute (member and associate member companies),	R&D participants include: American Iron and Steel Institute (member and associate member companies), Steel Manufacturers	R&D participants include: American Iron and Steel Institute (member and associate member companies), Steel Manufacturers

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

Program Activity	FY 2001	FY 2002	FY 2003
Steel Vision (cont'd)	Steel Manufacturers Association (member and associate member companies), national laboratories, and universities.	(member and associate member companies), national laboratories, and universities.	(member and associate member companies), national laboratories, and universities.
Total, Steel Vision	**$10,365**	**$10,329**	**$10,329**
Aluminum Vision	**Primary Production Technologies** The accelerated research program was continued for the development and implementation of an advanced cell with the potential to reduce energy consumption by 27% and greenhouse gas emissions by 5.5 million metric tons of carbon equivalent over a "business as usual" 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 was delayed due to the	**Primary Production Technologies** 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 aluminum smelting cells and continue to prepare for scale up of advanced cell technologies. ($4,603)	**Primary Production Technologies** An intelligent pot-room control system will be demonstrated at a commercial smelter. An innovative design production cell, with an inert anode and wettable cathode, will be pilot tested at 5000 amps at a production facility. The technical and economic viability of carbothermic reduction technology to produce aluminum with 32-38% reduction in energy will be determined by laboratory-scale reactor tests. ($4,603)

Program Activity	FY 2001	FY 2002	FY 2003
Aluminum Vision (cont'd)	energy crisis and resulting shutdown 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 was evaluated, and a control strategy using sensors was developed for aluminum smelting cells. A pilot scale demonstration of saltcake recycling technology was completed. Laser and optical techniques for scrap sorting were evaluated. ($7,185)		
	Semi-Fabrication Technologies Year-long tests of potlinings containing additives for improved performance and life were initiated in full-scale industrial cells. ($3,691) Participants: R&D participants include Alcan, Alcoa Inc., Applied Industrial Solutions, Inc., Argonne National Laboratory, Century Aluminum, Cornell University,	**Semi-Fabrication Technologies** Develop new process techniques to reduce oxidative losses in aluminum by 50% and stress cracking by 60%. Demonstrate dross reductions of 60% on an industrial reverberatory furnace by an advanced combustion system. Assess spray rolling of aluminum strip at lab scale and 2X scale-up. Over 80 different industrial,	**Semi-Fabrication Technologies** A high watt density immersion heater will be demonstrated for energy efficient aluminum melting. A low dross combustion system will be demonstrated at pilot and commercial scale. Quenchant cooling will be modeled and improved for the plant floor. A vertical flotation melter will be demonstrated commercially.

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

Program Activity	FY 2001	FY 2002	FY 2003
Aluminum Vision (cont'd)	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.	university, and laboratory partners will participate in the partnership in 2002. ($3,500)	Over 80 different industrial, university, and laboratory partners will participate in the partnership in 2003. ($3,500)
Total, Aluminum Vision	**$10,876**	**$8,103**	**$8,103**
Metalcasting Vision	Continued 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% with industry partners. Over		Approximately 21 research projects will be funded. All projects will be 50% cost-shared with industry partners.

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

Program Activity	FY 2001	FY 2002	FY 2003
Metalcasting Vision (cont'd)	220 industry partners in at least 30 states work on program-funded research projects. Continued research projects from previous year's competitive solicitations include the following educational institutions and national laboratory: 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 (ORNL), Tri-State University (Indiana), University of Tennessee, Worcester Polytechnic Institute, and Pacific Northwest National Laboratory (PNNL).		
	Manufacturing Technologies Research continued to develop advanced casting technologies for producing high-quality castings.	**Manufacturing Technologies** Develop new models and alloy properties for semisolid metal processing (SSM), new models,	**Manufacturing Technologies** The Program is supporting research in advanced manufacturing technologies and processes to

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

Program Activity	FY 2001	FY 2002	FY 2003
Metalcasting Vision (cont'd)	Research focused on advanced lost foam casting technology and binders (chemicals that hold sand molds together) for iron and steel casting. Technical challenges included the removal of gaseous residuals during metal pouring, better and cheaper foam materials, and rapid prototyping of the patterns. In addition, research continued in semi-solid metals processing (SSM) to develop models and characterize material properties in order to produce higher integrity, high volume, lightweight castings, while enabling new castings with thinner walls and reduced machining requirements. ($2,312)	and pattern materials in lost foam research and Best Practices guidelines, minimizing die distortion, reducing scrap rate, and improving productivity. ($2,359)	improve the energy efficiency of metal casting process. These research efforts include the development of new design rules and foundry practices for high alloy steel casting models to increase the yield and reduce scrap by 30% in steel casting. The research effort will also explore unconventional techniques to increase yields by an additional 10%. ($2,359)
	Materials Technologies Activities focused on advancing the use of new and improved materials to produce defect-free, high-quality	**Materials Technologies** Complete materials research on the castability on aluminum die casting alloys, enabling new applications	**Materials Technologies** The Program is supporting research in this area to give a better fundamental understanding of the

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

Program Activity	FY 2001	FY 2002	FY 2003
Metalcasting Vision (cont'd)	casting while achieving longer life for mold, refractory lining, and casting dies. Continued to focus on innovative research to develop advanced coatings capable of extending the useful life of casting dies tenfold in comparison with current conventional methods. In addition, R&D efforts continued on technologies needed to consistently produce machinable, high-strength, then-walled gray and ductile iron castings. ($1,822)	of advanced 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%. ($2,000)	performance and material properties of casting materials. An example of these projects is the Semi-Solids Metals Processing (SSMP) at Worcester Polytechnic Institute (WPI). The goal of this project is to develop low-cost, energy-efficient, high quality SSM feedstock. Demonstration of a multi-layer coating system to extend the die life of die casting dies will be completed. ($2,000)
	Environmental Technologies A balanced portfolio included critical research needed to develop design guidelines for 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	**Environmental Technologies** Make available non-incineration technique as an alternative for ferrous foundries to reduce VOC emissions. ($300)	**Environmental Technologies** Complete the development of technical performance data and guidelines needed to advance the beneficial reuse of spent foundry sand. Information developed from the project will be disseminated widely for industry adoption through industry workshops, professional committees, and other media.

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

Program Activity	FY 2001	FY 2002	FY 2003
	transportation fuel. ($475)		There are over 320 industry partners in 35 states providing cost shares to the research projects. ($300)
Metalcasting Vision (cont'd)	**New Casting Applications** New design tools and improvements in casting techniques and models were developed to enable new applications of advanced casting technologies, which will reduce energy use, 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** New design tools, improvements in casting techniques and models will be developed to enable new applications of advanced casting technologies and reduce casting defects and improve quality of castings. ($698)	**New Casting Applications** The Program is supporting research to develop new design tools and improve casting techniques to enable new applications of advanced energy efficient casting technology. Material characterization effort to determine the detrimental effort of welding on the corrosion performance of duplex stainless steels will be completed. New Rapid Solidification Process (RSP) tooling technique developed for die casting industry. ($698)
Total, Metalcasting Vision	**$5,559**	**$5,357**	**$5,357**

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

Program Activity	FY 2001	FY 2002	FY 2003
Glass Vision	**Production Efficiency** Continued modeling of refractories (the main structural materials in glass melting furnaces) and improvement of combustion and melting technology. Transferred fundamental knowledge of glass properties to industry. Demonstrated advanced sensor technologies, handglass cutting, and process control technique for auto glass. Initiated feedstock measurement and control technology. Implemented national laboratory-based GPLUS program. ($1,832)	**Production Efficiency** Continue modeling of refractory corrosion. Transfer handglass cutting technique to specialty glass industry. Continue development of feedstock measurement and control technology. Continue sensor and process control efforts. Continue implementation of national laboratory-based GPLUS program. ($1,450)	**Production Efficiency** Complete refractory corrosion modeling efforts. Begin demonstration of feedstock measurement and control technology. Continue to implement national laboratory-based GPLUS program. ($950)
	Energy Efficiency/Conservation Continued activities to validate new and existing furnace models. Initiated new technologies that support innovative glassmaking and improved heat recovery. Finalized design of glass furnace	**Energy Efficiency/Conservation** Continue activities to validate a three-dimensional glass furnace simulation model. Continue to develop new technologies that support innovative glassmaking and improved heat recovery.	**Energy Efficiency/Conservation** Complete efforts to validate a three-dimensional glass furnace simulation model that more accurately represents the melting process. Continue to develop new technologies that support

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

Program Activity	FY 2001	FY 2002	FY 2003
Glass Vision (cont'd)	combustion and melting research facility. Supported activities to promote energy management practices. ($1,155)	Conceptual design of oxy-fuel glass research facility provided to the industry. Support activities to promote energy management practices. ($1,650)	innovative glassmaking and improved heat recovery. Award projects from industry solicitation for improved energy and production efficiency and environmental performance in glassmaking and advanced processing of engineered glasses. Support activities to promote energy management practices. ($2,200)
	Environmental Protections and Recycling	**Environmental Protections and Recycling**	**Environmental Protections and Recycling**
	Demonstrated high-luminosity, low-NO_x burner for glass furnaces. Initiated technology to recover and recycle in-process fiberglass waste. Initiated technology to identify and control emission management mechanisms from glass melting furnaces. Supported cullet re-use systems. ($755)	Refine and transfer high-luminosity, low-NO_x burner technology for glass furnaces to industry. Continue to develop technology to recover and recycle in-process fiberglass waste; identify and control emission management mechanisms from glass melting furnaces. Support development of cullet re-use systems. ($840)	Produce recycled materials from in-process fiberglass waste for further testing; design and test a prototype instrument to minimize volatilization mechanisms in glass melting furnaces. Begin testing of cullet re-use systems. ($900)

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

Program Activity	FY 2001	FY 2002	FY 2003
Glass Vision (cont'd)	**Innovative Uses**	**Innovative Uses**	**Innovative Uses**
	Initiated new technology for improved coating of flat glass. Continued 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. ($525)	Conduct pilot-scale testing of improved technology for coating flat glass. ($400)
	Deployment Logistics	**Deployment Logistics**	**Deployment Logistics**
	Conducted technical workshops on coatings and combustion. Reviewed technology roadmap assessment. ($155)	Update technology roadmap. ($107)	Conduct technical workshops on cullet recycling and energy management. Reassess technology roadmap to refine priorities. ($122)
	Participants included: Visteon, PPG, Techneglas, Owens Corning, Gallo Glass, Fenton Art Glass, BOC Gases, Accu-Tru International, Gas Technology Institute, Alfred University-Center for Glass Research, Mississippi State University, Los Alamos National Laboratory, Oak Ridge National Laboratory, Sandia National Laboratories, Pacific	Participants include: Visteon, PPG, Techneglas, Owens Corning, Gallo Glass, CertainTeed, Fenton Art Glass, BOC Gases, Energy Research Company, Gas Technology Institute, Alfred University-Center for Glass Research, Mississippi State University, Los Alamos National Laboratory, Oak Ridge National Laboratory, Sandia National	Participants include: Visteon, PPG, Techneglas, Owens Corning, Gallo Glass, Fenton Art Glass, CertainTeed, BOC Gases, Energy Research Company, Gas Technology Institute, Alfred University-Center for Glass Research, Mississippi State University, Los Alamos National Laboratory, Oak Ridge National Laboratory, Sandia National

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

Program Activity	FY 2001	FY 2002	FY 2003
Glass Vision (cont'd)	Northwest National Laboratory, Argonne National Laboratory, Ames Laboratory, National Energy Technology Laboratory, and the States of West Virginia, Ohio, and Pennsylvania.	Laboratories, Pacific Northwest National Laboratory, Argonne National Laboratory, Ames Laboratory, National Energy Technology Laboratory, and the States of West Virginia, Ohio, Pennsylvania, Florida, and North Carolina.	Laboratories, Pacific Northwest National Laboratory, Argonne National Laboratory, Ames Laboratory, and the States of West Virginia, Ohio, Pennsylvania, Florida, Indiana, and North Carolina.
Total, Glass Vision	**$4,582**	**$4,572**	**$4,572**
Chemicals Vision	**New Chemical Sciences and Engineering** Continued R&D to support *Technology Vision 2020* in separations, catalysis, computational chemistry, and chemical synthesis pathways. Demonstrated advanced electrodeionization separation technology in pilot-scale–potential energy savings of 4 trillion Btu per year by 2020. Conducted full-scale demonstration of novel membrane-based process to recover propylene	**New Chemical Sciences and Engineering** Continue advanced separation technology R&D to decrease the over 2 quadrillion Btu per year of energy required to separate, process, and refine chemicals. ($6,358)	**New Chemical Science and Engineering** Continue separation technology R&D to more efficiently separate, process, and refine chemicals. Develop new process chemistry technologies that will significantly improve chemical reactions and product yields to increase energy efficiency in key chemical product chains by more than 30%. ($6,358)

Program Activity	FY 2001	FY 2002	FY 2003
Chemicals Vision (cont'd)	from propane–energy savings from displaced feedstock are estimated to be 23 trillion Btu/year by 2020. ($9,863)		
	Manufacturing and Operations Conducted solicitation to support development and implementation of energy saving technologies identified in technology roadmap for manufacturing and operations. Continued 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** Partner with American Institute of Chemical Engineers (AIChE) to develop energy metrics for 5 chemical plants to incorporate new best practices and emerging technologies. ($400)	**Manufacturing and Operations** Expand development of energy metrics for major chemical processes with AIChE. Complete pilot test for new alloy for ethylene production that will save 107 trillion Btu/year by 2010. Initiate Chemical Industry Vision 2020 led project to develop innovative energy supply systems for chemical process technologies to save 200 trillion Btu/year by 2020. ($400)
	Computational Technologies Continued advancement of multi-phase CFD consortium projects. Computational technologies can optimize process energy requirements and shorten the lead time from research to plant design	**Computational Technologies** Continue advancement of multiphase computational fluid dynamics consortium projects to reduce energy consumption and downtime. ($1,000)	**Computational Technologies** Complete multiphase computational fluid dynamics consortium projects that will save 10 trillion Btu per year by 2020. ($1,000)

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

Program Activity	FY 2001	FY 2002	FY 2003
Chemicals Vision (cont'd)	by several years. Conducted R&D on simulating industrial scale turbulent gas solid flows and adapting multi-phase computational fluid dynamics to fluid-particle processes. Completed installation of experimental test loop. Completed improvements of MIFX software code. Annual energy savings are estimated to be 100 trillion Btu/year by 2020. ($1,275)		
	Chemical Synthesis Technologies	**Chemical Synthesis Technologies**	**Chemical Synthesis Technologies**
	No funds requested. ($0)	Develop new process chemistry and catalysis technologies that will significantly improve chemical reactions and product yields to increase energy efficiency in key chemical product chains by more than 30%. ($6,700)	Develop new process chemistry and catalysis technologies that will significantly improve chemical reactions and product yields to increase energy efficiency in key chemical product chains by more than 30%. ($6,700) Participants include: Praxair, Air Products, Honeywell Reaction Engineering, Sandia National Laboratory, Dupont, Dow Corning, Exxon Chemicals, Chevron, Fluent, Aspen Technology, OLI Systems,
Chemicals Vision			

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

Program Activity	FY 2001	FY 2002	FY 2003
(cont'd)			AIChE, University of Texas, Rohm and Haas, NTEC, Membrane Technology Research, Argonne National Laboratory, and Oak Ridge National Laboratory.
Total, Chemicals Vision	**$12,113**	**$14,458**	**$14,458**
Petroleum Vision	The Petroleum Industry Vision and Roadmap focuses on the environment, process improvement, and energy efficiency. Initiated projects selected in FY 2000 solicitation to address downstream petroleum needs. Continued cost-shared projects including energy saving separations technologies to develop membranes to replace distillation, global on-stream inspection, gas chromatograph controller to improve process efficiency, a rotary burner to significantly reduce NO_x in heaters and boilers while lowering energy use, broadening enzyme selectivity, and improving	Complete second year of 3 year, cost-shared projects on separations membranes, gas chromatograph controller, global on-stream inspection, rotary burner and biodesulfurization initiated in FY 2001. Initiate several new cost-shared projects to help small refineries improve process energy efficiency. ($2,800)	Close out projects previously funded. No funds requested. ($0)
Petroleum Vision			

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

Program Activity	FY 2001	FY 2002	FY 2003
(Cont'd)	activity for biological desulfurization. ($2,609)		
Total, Petroleum Vision	**$2,609**	**$2,800**	**$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. Facilitated interagency roadmaps for technologies such as exploration and excavation. Developed technologies for resource characterization, mining, and processing that demonstrate accountable benefits for the U.S. mining industry. Technologies funded include advanced minerals characterization, integrated mining systems, and low-energy metals processing. These technologies are expected to save over 5 trillion Btu annually. ($3,517) Partners included major mining and	**Characterization and Processing** Leverage research funds with industrial cost sharing as well as state and other Federal funding to support the industry's vision. Facilitating update of industry vision and roadmaps. Initiate funding in response to the laboratory-led processing roadmap. The Mining IOF will continue research on crosscutting technologies in mining such as sensors, materials, and other process and technical advances to improve energy efficiency and productivity in mining. The mining IOF will facilitate an education roadmap targeting university engineering enrollment and university-based research including graduate program research.	**Characterization and Processing** The Mining Industry of the Future program will leverage funds with industry cost-share to fund new industry-led projects related to the mining and exploration roadmap. Continue planned work on multi-year R&D projects that were awarded in previous years. Initiate work on the development of advanced mineral processing technologies and resource characterization, which is an additional high priority area identified in the industry vision and the associated roadmaps. Commercialize "Oil Pro" and other projects which have ended or are ending this year. These projects reflect the goal of our vision to develop low cost and efficient

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

Program Activity	FY 2001	FY 2002	FY 2003
Mining Vision (cont'd)	mineral processing companies, equipment manufacturers, universities, and national laboratories.	Continue research on advanced mining and processing technologies to support industry needs. ($5,119) Partners include major mining and mineral processing companies, equipment manufacturers, universities, and national laboratories.	production and to develop advanced products. ($5,119) Partners include many mining and mineral processing companies, equipment manufactures, universities, and national laboratories.
Total, Mining Vision	**$3,517**	**$5,119**	**$5,119**
Agriculture Vision	**Biobased Industrial Feedstocks Initiative** Participated fully in implementing the new Executive Order on Biobased Products and Bioenergy. Progress in achieving industry's ambitious target of a fivefold increase in market share for renewable bioproducts began to build momentum. Supported project R&D from first 2 solicitations and issued new request for proposals that build on the "lessons learned" from earlier	**Biobased Industrial Feedstock Bioenergy/Bioproducts Initiative** Implement Agriculture IOF as an integrated part of the EERE Biomass R&D portfolio. Continue to support the 18 active Agriculture IOF R&D projects, and the 8 multi-disciplinary biobased product technology university graduate education programs, helping to ensure well-focused efforts and achievement of key milestones.	**Biobased Industrial Feedstock Bioenergy/Bioproducts Initiative** Implement Agriculture IOF as an integrated part of the EERE Biomass R&D portfolio. The 12 active R&D projects will continue to focus on innovative technology for the use of biomass as feedstock for chemicals and materials and result in less processing energy used to produce these products compared to their petroleum feedstock alternatives.

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

Program Activity	FY 2001	FY 2002	FY 2003
Agriculture Vision (cont'd)	solicitations. Emphasized projects that showed clear linkages across the highest priorities in the roadmap. Projects emphasized an integrated and coordinated approach to make better use of public and private funding and accelerated progress toward percent of the market for chemical feedstocks from plant material by 2020. Solicitation process broadened our base of partners in the agricultural, chemical, and forestry communities. An overwhelming response of 28 excellent proposals from talented multi-partnered research collaborations was received. Six outstanding projects were funded. Continued to provide support to those higher education institutions with winning proposals for new, multidisciplinary approaches from FY 2000 and issued a second solicitation to broaden participation in the Renewables 2020 education initiative.	Expect the successful start-up of Cargill Dow's first large-scale (300 Mlbs./yr.) polyactic acid (PLA) plastics plant in Blaire, Nebraska, based on corn sugar as the feedstock. This facility will be expanded to include the fermentation of the lactic acid required as well. Ongoing projects funded by the Agriculture IOF and the DOE Biobased Products and Bioenergy Initiative should further reduce the cost and increase the energy efficiency of this technology and enable as much as 8 billion lbs. PLA market by 2020. Expect the commercial introduction of a soy-oil based, 2-cycle engine oil and 2 other projects should result in a firm commercial commitment with a target date within 2 years for biobased polymers and/or solvents. The Agriculture IOF program will leverage, participate, and integrate with the planned EERE-wide	These efforts include: novel separations technology, the production of plastics, foams, adhesives, and coatings based on sugars and vegetable oils, lower cost and energy use in harvesting, pre-processing and biomass storage, and the modification of crops to reduce the cost, processing requirements and energy use in the use and conversion of the crops to biobased products. It is expected that 2 of these current and/or past projects will include scale-up of the technology to pilot scale demonstrations with industry partners and 1 or 2 commercializations in the areas of new biobased polymers or solvents. Initial technology breakthroughs are expected in plant sciences relative to improved crop composition for biobased products, as well as novel, lower cost, less energy-intensive harvesting and storage technology.

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

Program Activity	FY 2001	FY 2002	FY 2003
Agriculture Vision (cont'd)	Sought 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 governments. Novel electrodeionization (EDI) technology for lower cost, lower capital, less energy-intensive purification of HFCS was successfully demonstrated in a pilot trial at a Tate&Lyle plant. This technology can have wide application in the biobased product and chemical industry. A soy-based, 2-cycle engine oil moved to full engine testing. Firm commercial interest in new technology to produce propylene glycol (for anti-freeze and polymer coating applications) from glucose from corn. ($6,590)	biobased products and bioenergy solicitations funded through OPT and Industrial technologies. These solicitations will focus on biorefinery technology resulting in the production chemicals as well as fuels and/or power. It will also leverage related Industrial technologies IOF and other programs such as the Forest Products IOF, the Chemical IOF, and Financial Assistance to add to the portfolio of R&D related to biobased products. This has already proven to be valuable and synergistic. The FY 2002 budget will be used to fund existing projects. ($7,259) 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, National Association of State Universities and Land-	The Agriculture IOF program will leverage, participate and integrate with the EERE-wide biobased products and bioenergy solicitations for efforts that benefit bioproducts as well as bioenergy focusing on biorefinery pertinent research. It will also leverage related Industrial technologies IOF and other programs such as the Forest Products IOF, the Chemical IOF, and Financial Assistance to add to the portfolio of R&D related to biobased products. No new Agriculture IOF R&D solicitations will be issued. Appropriate adjustments will be made to existing R&D project funding based on their performance using milestone targets. The existing university grants funding may be increased and/or a new solicitation in this area will be offered to continue to expand and improve the multi-disciplinary graduate programs in biobased

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

Program Activity	FY 2001	FY 2002	FY 2003
Agriculture Vision (cont'd)		grant Colleges, Cargill, ADM, Dow Chemical Co., Dupont, Eastman Chemical, BF Goodrich, Rohm and Haas Co., Amalgamated Research Inc., Biomass Agriculture Products (B/MAP), Genencor International, Cargill Dow Polymers, PNNL, INEEL, ANL, ORNL, NREL, and many universities.	product/bioenergy technology at 8 universities. ($8,259) Participants include: National Corn Growers Association, American Soybean Association/United Soybean Board, National Association of Wheat Growers, American Forest and Paper Association, National Association of State Universities and Land-grant Colleges, Cargill, ADM, Dow Chemical Co., Dupont, Eastman Chemical, BF Goodrich, Rohm and Haas Co., Genencor International, and Cargill LLC, Metabolix, B/MAP, Vertec Biosolvents, BCI, Altus Biologics, Amalgamated Research Inc., PNNL, INEEL, ANL, ORNL, NREL, and a wide array of universities.
Total, Agriculture Vision	**$6,590**	**$7,259**	**$8,259**

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

Program Activity	FY 2001	FY 2002	FY 2003
Supporting Industries	Issued competitive solicitation 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)	Continue work funded for FY 2001 for developing systems for saving energy in heat treatment of castings; novel materials and process designs for thermally-stable tool and die steel; strategies for the die material and surface coatings; energy conserving forging technology applicable to aluminum alloys; and a novel methodology for optimizing the welding process. ($1,600) Participants include: Forging Ind. Assoc.(FIA), Lincoln Elec. Co., Worcester Polytech. Inst. (WPI), Center for Heat Treating Excellence (CHTE), Air Products and Chemicals, Boycote Thermal Processing, Caterpillar, Deere & Co., Eclipse, GMC, Houghton Int'l, Ipsen Int'l, AMCAST Ind.Corp., ALCOA, UES Software, Kolene Corp.,Pratt & Whitney, Surface Combustion, Timken Co., several universities and national labs.	Continue work funded for: heat treatment control algorithm; effects of operating parameters on welds; effects of infrared heating on forging stock's mechanical properties; experiments to determine energy and environmental envelopes of innovative die materials and lubricants; and computational models and process studies to design alloys with improved carburization response ($1,600)

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

Program Activity	FY 2001	FY 2002	FY 2003
Total, Supporting Industries	**$1,571**	**$1,600**	**$1,600**
Technical/Prog. Management Support	Provided critical technical and program management support services. ($2,250)	Provide critical technical and program management support services. ($1,200)	Provide critical technical and program management support services. ($1,991)
Total, Technical/Prog. Management Support	**$2,250**	**$1,200**	**$1,991**
TOTAL, INDUSTRIES OF THE FUTURE (SPECIFIC)	**$71,831**	**$72,624**	**$71,615**

INDUSTRIAL TECHNOLOGIES
INDUSTRY SECTOR
(Dollars in Thousands)

INDUSTRIES OF THE FUTURE (CROSSCUTTING)

Mission Supporting Goals and Objectives

Mission: Industries of the Future (Crosscutting) works with IOF industry partners and suppliers to conduct cost-shared RD&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.

Summary: Industries of the Future (Crosscutting) comprises six program areas:

(1) Industrial Materials for the Future (IMF)
(2) Combustion
(3) Sensors & Controls
(4) National Industrial Competitiveness through Energy, Environment, and Economics (NICE^3)
(5) Inventions and Innovation (I&I)
(6) Industrial Technical Assistance (Best Practices and Industrial Assessment Centers)

For simplicity of presentation, several headings under which these activities previously appeared have been dropped. The activities themselves remain the same, although industrial gasification and combustion systems have been grouped together under the title "Combustion." Items 1 through 3 above were formerly grouped under the heading "Enabling Technologies." Items 4 and 5 above were formerly grouped under the heading "Financial Assistance."

The IMF, Combustion, and Sensor & Controls programs conduct cost-shared RD&D on technologies with potential application across multiple Industrial technologies vision industries. Theses programs focus on three areas that offer major improvements in energy efficiency and emissions reduction: (1) advanced industrial materials that can reduce energy use, lower emissions, increase component life, improve product quality, optimize process operating conditions, and reduce downtime; (2) high-efficiency, clean combustion and gasification technologies; and (3) advanced sensors/control systems that can increase process efficiency and productivity even in high temperatures and harsh environments. Current efforts in gasification focus on black liquor and biomass gasification technologies in the Forest Products industry. Currently the Forest Products industry spends $4 billion annually to purchase over 90 billion of 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).

The National Industrial Competitiveness through Energy, Environment, and Economics (NICE^3) and Inventions and Innovation (I&I) Programs make a significant difference by providing modest levels of support, at the right time, to speed the development of new energy-saving, environmentally friendly technologies and to demonstrate their potential savings and commercial value. NICE^3 provides funding to state and industry partnerships (both large and small business) to demonstrate full-scale energy efficient technologies in an industrial setting. I&I provides funding and business skill development to independent inventors, small businesses, and industry who lack the financial resources and/or know-how to move their promising energy saving concepts from the research to the prototype stage.

The Industrial Technical Assistance program, which includes BestPractices and the Industrial Assessment Centers (IACs), provides the integrated delivery of energy-saving products, services, and technologies to assist the energy-intensive industries in identifying and realizing their best energy-efficient, pollution-preventing options from a systems and life-cycle cost perspective.

Crosscutting RD&D enables energy improvements in multiple industries. The Industries of the Future strategy embraces efficiency enhancements to technologies that are widely used in a broad cross-section of U.S. industry. Given the breadth of use of these technologies, even a small improvement in their efficiency can mean substantial energy and cost savings. Industrial technologies's Industrial Materials for the Future program works with the national laboratories and collaborative industry partnerships to develop new and improved materials to provide superior strength and corrosion resistance even in high-temperature industrial environments. The Combustion program seeks to improve energy efficiency, reduce emissions, enhance fuel flexibility, and otherwise meet industry's future combustion needs by working with the combustion community to develop cost-effective technologies. Combustion program also supports the development of black liquor and biomass gasification technologies in the Forest Products industry. The Sensors and Controls program is working to provide integrated measurement systems for operator-independent control of plant processes. Research is extending sensor reach and accuracy in harsh environments and improving the integration and processing of sensor data to enable on-line, automated assessment and adjustment of system parameters.

The NICE^3 and I&I programs provide help at both ends of the technology development spectrum. Individual or small business inventors can receive assistance through Industrial technologies's Inventions and Innovation program to develop promising energy-efficient concepts and supporting business plans. To move new technologies into demonstration mode, Industrial technologies's NICE^3 program assists entities wishing to demonstrate emerging technologies in partnerships with state offices. These demonstrations help prove to potential technology customers that the technologies can work well in the real world, measurably reducing industrial energy use.

The Industrial Technical Assistance Program complements the IOF RD&D efforts. Technical assistance includes a continuum of services from energy assessments and evaluations, and information on industrial equipment and systems, to tools and resources for measuring the

effectiveness of new technologies. Allied partnerships with over 200 associations and companies is an important mechanism to help leverage program RD&D development and deployment. These partnerships work within the existing industrial market infrastructure**,** leveraging off of and building on existing business relationships between supply chain companies, end users, consultants, technology developers, and utilities to raise awareness and increase adoption of new energy efficient technologies and energy management practices in IOF industries. The Industrial Technical Assistance Program helps to identify and conduct cooperative efforts with Allied Partners to develop and disseminate broad new information materials, software decision making tools, training curricula or events, and other activities that help facilitate the use of industrial energy efficiency technologies and measures. In addition, the Industrial Assessment Center (IAC) Program provides a nationwide cadre of experienced and trained engineering alumni, many of whom enter the industrial community able to apply practical energy management skills learned first-hand at manufacturing client plant sites.

Long Term Goals and Objectives

Program Strategic Performance Goal

Specific Vision Industries R&D activities will develop a portfolio of energy saving technologies and methods that will catalyze reduced energy use in the nine energy-intensive Industries of the Future to reach annual savings of 329 trillion Btu in 2005 (compared with conventional technology), 827 trillion Btu in 2010, and 2,377 trillion Btu in 2020.

ER1-8: Crosscutting Industrial Technologies

Crosscutting Industrial Technologies R&D activities will develop a portfolio of crosscutting energy saving technologies, methods, and assistance that will catalyze reduced energy use in energy-intensive "Industries of the Future" of 178 trillion Btu of annual savings in 2005, 590 trillion Btu in 2010, and 1963 trillion Btu in 2020, compared with the EIA conventional technology baseline.

Performance Indicators:

Number of technologies commercialized
Energy savings from Industrial technologies activities in partnership with industry
RD&D portfolio turnover of projects
Number of new Allied Partners
Number of energy-intensive plants impacted by the program
Number of internet information page views.

Annual Performance Results and Targets [a]

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
! In FY 2001, 10 new technologies were commercialized from both the nine vision industries as well as the crosscutting programs. [b] ! In FY 2001, Industrial technologies helped industry save an estimated 262 trillion Btu of energy worth more than $1.6 billion. [c] ! Continue support for Industrial Assessment Centers operating at 26 participating universities that will conduct approximately 650 combined energy, waste and productivity assessments.	! Commercialize 10 new energy efficient technologies in partnership with the most energy intensive industries. ! Complete 2 showcase demonstrations, at industry sights, of advanced energy efficient technologies. ! In FY2002, Industrial technologies will complete 20 new Allied Partnerships with energy intensive companies, trade organizations and other groups. ! 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. ! In FY2002, help industry save more than 265 trillion Btu of energy worth more than $1.6 billion. ! Industrial technologies internet web sites will record over 5 million page views.	! In FY 2003, commercialize 10 new technologies. ! In FY 2003, help industry save more than 280 trillion Btu of energy worth at least $1.5 billion. ! In FY 2003, project turnover will represent 25% of the FY2002 RD&D project portfolio. ! FY 2003 Milestone: 2000 energy intensive U.S. plants will apply EERE technologies and services achieving up to a 15% improvement in energy productivity per plant. ! Industrial technologies internet web sites will record some 6 million page views. ! In FY 2003, Industrial technologies will complete 20 new Allied Partnerships with energy intensive companies, trade organizations and other groups

[a] The annual performance results and targets shown are part of a coordinated and complementary effort which jointly contribute to the program strategic performance goals.

[b] To support the development of commercialized technologies solicitations are issued by Industrial technologies. For example, in FY2001 one new solicitation was issued in FY 2001 targeted to the Renewables Vision 2020 for Agriculture in support of the goals of the President's Bio-based Products and Bio-energy initiative. (ER1-8)

[c] An important element in industrial energy savings were the energy audits conducted through the continued support for Industrial Assessment Centers as well as the 15 additional assessments and 5 case studies of major industrial plants that will document a variety of system-focused implemented actions were conducted. These assessments influence important replication of similar energy savings for other plants. (ER1-8)

Industrial Materials of the Future (IMF) Goals and Objectives

- Reduce energy use in the Industries of the Future by 31 trillion Btu in 2005 (compared to conventional technology), 74 trillion Btu in 2010, and 207 trillion Btu in 2020.
- Conduct R&D to develop new materials consistent with the needs identified in the IOF visions and technology roadmaps and significantly reduce energy use in the energy-intensive IOF industries.[a]

Combustion Goals and Objectives

- Reduce energy use in the Industries of the Future by 16 trillion Btu in 2005 (compared to conventional technology), 141 trillion Btu in 2010 and 819 trillion Btu in 2020.[b]
- By 2006, demonstrate a >95% efficient packaged boiler with NO_x emissions below 5 ppm.
- By 2010, demonstrate an integrated high efficiency black liquor and solid biomass gasification/combined cycle systems with equal or greater availability than existing boilers.

Sensors and Controls Goals and Objectives

- Reduce energy use in the Industries of the Future by 1 trillion Btu in 2005 (compared to conventional technology), 9 trillion Btu in 2010, and 37 trillion Btu in 2020.
- By 2010, contribute toward transformation of current batch aluminum production into a continuous process using new sensor systems.

NICE^3 Goals and Objectives

- Reduce energy use in the Industries of the Future by 21 trillion Btu in 2005 (compared to conventional technology), 45 trillion Btu in 2010, and 121 trillion Btu in 2020.
- Demonstrate a high efficiency adjustable speed drive coupling system to reduce energy costs by 40-74% for motor driven systems in industry.
- Test and evaluate a single stage turbine with a 40% efficiency.

Inventions and Innovations Goals and Objectives

- Reduce energy use in the Industries of the Future by 61 trillion Btu in 2005 (compared to conventional technology), 112 trillion Btu in 2010, and 283 trillion Btu in 2020.
- Demonstrate an efficient and environmentally benign technology for papermaking to reduce electrical energy for papermaking by 30% and also improve paper quality.

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[a] This is a significant objective among others in the program. It will significantly contribute to achieving the energy savings identified in the preceding statement.

[b] Of the savings estimates 107 trillion Btu in 2010 and 713 trillion Btu in 2020 are associated with the forest products industry.

- By 2003, demonstrate a distillation column flooding predictor to improve petroleum refinery distillation tower throughput by 2 to 5 percent.

Industrial Technical Assistance Goals and Objectives

- Reduce energy use in the Industries of the Future as a result of the BestPractices program by 35 trillion Btu in 2005 (compared to conventional technology), 169 trillion Btu in 2010, and 438 trillion Btu in 2020.
- Reduce energy use in the Industries of the Future as a result of the IAC energy audits by 14 trillion Btu in 2005 (compared to conventional technology), 40 trillion Btu in 2010 and 58 trillion Btu in 2020.[c]
- By 2010, the IAC Program will achieve an annual energy savings of $195 million and non-energy savings of $603 million, and will have completed approximately 17,000 Industrial Assessment Audits with 3,100 engineering students trained in conducting these audits.
- By 2003, develop a total of 100 Allied Partnerships.

Annual Performance Results and Targets: *Industrial Materials for the Future (IMF)*

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Completed analysis of the industrial materials needs common to all IOF industries. • Issued competitive solicitations to address materials needs common to all IOF industries. • Successfully commercialized use of nickel aluminide trays in heat treating furnaces to substantially reduce energy intensity. • Completed commercialization process for production of uniform metal droplets and filters.	• Launch Industrial Materials for the Future program through the award of new R&D projects cost-shared with the industry. • Complete Continuous Fiber Ceramic Composite projects. • Commercialize infrared plasma processing technology for surface heat treating and placement of hard coatings.	• Develop a new class of iron-chromium-silicon alloys for superior corrosion resistance. • Complete development of iron-aluminide-stainless steel composite tubes for carbonization and coking resistance.

[c] Non-energy benefits assessed by this program including productivity and environmental benefits are as much as 2-4 times greater than the energy savings.

Annual Performance Results and Targets: *Combustion*

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Award made for black liquor biomass gasification engineering design studies for the Forest Products industry (DeRidder, LA). • Selected site (DeRidder, LA) and began design study for solid wood waste gasifier demonstration. • Completed one engineering design study for black liquor gasification in the forest products industry (Big Island, VA). • Demonstrated less than 10 ppm NO_x burner for refinery heaters.	• Begin construction of a black liquor gasifier for demonstration (Big Island, VA). • Initiate research projects to support biomass and black liquor gasification demonstrations. • Complete testing and evaluation of prototype boiler design capable of greater than 94% efficiency and less than five ppm NO_x emissions. • Complete engineering design of ultra-high efficiency, low emission refinery process heater.	• Initiate design and construction of a pre-production boiler capable of greater than 94 percent efficiency and less than five ppm NO_x emission refinery process. • Initiate design and construction of a prototype ultra-high efficiency, low emission refinery process heater. • Start-up and shake-down of black liquor gasifier (Big Island, VA). • Conclude design study for solid wood waste gasifier demonstration (DeRidder, LA). • Begin engineering design and cost projection for Kraft black liquor gasification demonstration. • Continue research projects to support biomass and black liquor gasification demonstrations.

Annual Performance Results and Targets): *Sensors and Controls*

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Conducted demonstration of wireless system in operating industrial plant.	• Evaluate thermal imaging system in an industrial furnace. • Test extrusion control system in plastics plant.	• Conduct pilot evaluation of machine vision, artificial intelligence-based combustion control system. • Evaluate a magnetic resonance wood moisture monitor in a lumber mill. • Monitor multiple gaseous species in steel, chemical, and glass plants using tunable diode laser system.

Annual Performance Results and Targets: *NICE*^{3}

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Provided assistance to 10 State/industry partnerships for the initial demonstration of energy efficiency technologies, which will facilitate their use in other industrial facilities. • Tested a high temperature, corrosive-resistant recuperator that will realize a 20-30% energy savings over conventional technology • Tested a high efficiency adjustable speed drive coupling system to reduce energy costs by 40-74% for motor driven systems in industry. • Demonstrated a combinatorial chemical analysis technology that samples 20-100 times faster than current prep-scale liquid chromatography technology.	• Provide incremental funding to 8 State/industry partnerships for the initial demonstration of energy efficiency technologies, which will facilitate their use in other industrial facilities. • Initiate the demonstration of a high efficiency adjustable speed drive coupling system to reduce energy costs by 40-74% for motor driven systems in industry. • Initiate the demonstrate a high temperature, corrosive-resistant recuperator that will realize a 20-30 percent energy savings over conventional technology.	• Provide incremental funding to 8 State/industry partnerships for the initial demonstration of energy efficiency technologies, which will facilitate their use in other industrial facilities. • Demonstrate a particle shearing device in the forest products industry that will save 1.71 million KWh annually by 2010. • Initiate the testing of a lost foam casting process that will save 256.7 Btu by 2010. • Complete the testing of a 40% efficient single stage turbine.

Annual Performance Results and Targets: *Inventions and Innovation*

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Provided assistance to 41 inventors and small businesses to develop their meritorious energy efficiency technologies.	• Provide incremental funding to 20 inventors and small businesses to develop their meritorious energy efficiency technologies.	• Provide incremental funding to 20 inventors and small businesses to develop their meritorious energy efficiency technologies.
• Tested a distillation column flooding predictor that will improve petroleum refinery distillation tower throughput by 2 to 5%.	• Test an efficient and environmentally benign technology for papermaking to reduce electrical energy for papermaking by 30% and also improve paper quality.	• Demonstrate an efficient and environmentally benign technology for papermaking to reduce electrical energy for papermaking by 30% and also improve paper quality.
	• Test an industrial fuel cell micro-generator that will save 2.1 trillion Btu by 2010.	• Demonstrate industrial fuel cell micro-generator that will save 2.1 trillion Btu by 2010.

Annual Performance Results and Targets: *Industrial Technical Assistance*

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Continued support for Industrial Assessment Centers operating at 26 participating universities that conducted approximately 650 combined energy, waste, and productivity assessment days of service to manufacturing clients. .	• 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.	• Continue support for Industrial Assessment Centers operating at 26 participating universities that conducted approximately 750 combined energy, waste, and productivity assessment days of service to manufacturing clients.
• In Best Practices, completed 15 assessments and 5 case studies of major industrial plants that document a variety of system-focused implemented actions. These will influence replication of similar energy savings for other plants.	• Conduct two state level energy fairs to promote replication of the Best Practices Portfolio.	• Conduct 5 regional/state level energy fairs to promote replication of the Best Practices Portfolio.
• Completed three showcases for the Aluminum, Petroleum Refining, and Mining Industries of the Future, at 6 plants involving more than two dozen energy assessments.	• Complete 3 showcases of advanced energy efficient technologies at industry sites in the Forest Products and Aluminum Industries of the Future. • Select 8 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 2 showcases of advanced energy efficient technologies at industry sites in the Mining and Chemical Industries of the Future. • Select 8 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.

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

Program Activity	FY 2001 Comparable	FY 2002 Comparable	FY 2003 Request	$ Change	% Change
Engineered Ceramics/CFCC's	$ 5,853	$ 0	$ 0	$0	0.0%
Advanced Industrial Materials	$ 5,826	$ 0	$ 0	$0	0.0%
Industrial Materials for the Future	$ 0	$ 13,698	$ 12,698	$-1,000	-7.3%
Combustion	$ 14,387	$ 18,391	$ 15,600	$-2,791	-15.2%
Sensors and Controls	$ 3,763	$ 3,774	$ 3,774	$0	0.0%
NICE[3]	$ 5,092	$ 2,736	$ 2,736	$0	0.0%
Inventions and Innovation	$ 4,798	$ 4,372	$ 2,372	$-2,000	-45.7%
Industrial Technical Assistance	$ 15,016	$ 14,929	$ 15,929	$1,000	6.7%
Technical / Program Management Support	$ 5,002	$ 3,000	$ 4,000	$1,000	33.3%
Total, Industries of the Future (Crosscutting) *	$ 59,737	$ 60,900	$ 57,109	$-3,791	-6.2%

* Note: Industry of the Future (Crosscutting) includes $1,460 in FY2001, $1,560 in FY2002, and $1,560 in FY2003 for the State Energy Program Special Projects State Grants. FY 2001 has been reduced by $1,982,000 for SBIR/STTR transfer.

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

	FY 2001	FY 2002 *	FY 2003 *	$ Change	% Change
Argonne National Laboratory (East)	$ 150	$ 153	$ 143	$-10	-6.5%
Idaho National Engineering Laboratory	$ 320	$ 326	$ 306	$-20	-6.1%
Lawrence Berkeley National Laboratory	$ 1,420	$ 1,448	$ 1,358	$-90	-6.2%
Los Alamos National Laboratory	$ 1,050	$ 1,070	$ 1,004	$-66	-6.1%
National Renewable Energy Laboratory	$ 1,665	$ 1,697	$ 1,592	$-105	-6.1%
Oak Ridge National Laboratory	$ 14,235	$ 14,512	$ 13,609	$-903	-6.2%
Pacific Northwest National Laboratory	$ 500	$ 510	$ 478	$-32	-6.2%
Sandia National Laboratories	$ 800	$ 816	$ 765	$-51	-6.3%
All Other	$ 39,597	$ 40,368	$ 37,854	$-2,514	-6.2%
Total, Industries of the Future (Crosscutting)	$ 59,737	$ 60,900	$ 57,109	$-3,791	-6.2%

* These dollars reflect an estimated distribution of Industrial technologies funds. They are not requested funds for individual laboratories.

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

Program Activity	FY 2001	FY 2002	FY 2003
Industrial Materials for the Future	No activities. ($0)	Based on a study and recommendations from the National Research Council/National Materials Advisory Board, initiate Industrial Materials for the Future Program. Issue competitive solicitations for industry, national laboratories, and universities/not-for-profit research institutes, based on IOF roadmap priorities. Complete Continuous Fiber Ceramic Composites Program and establish standards and codes; commercialize burner tubes, fan blades, burner faces, and tube hangers. Complete intermetallic alloy, membrane materials, and composites and coatings development. Support Metals Processing Laboratory at ORNL to work with IOF industries on materials problems. Select and fund 29 new research	Conduct materials research and development projects selected by competitive solicitation in FY 2002. Develop new classes of improved alloys for longer service lives and process optimization, including stainless steels and intermetallic alloys. Develop new methods of metals processing and joining, including extrusion of bimetallic tubes, ultrasonic processing during crystallization, and welded joint design. Conduct surface modification research and development, using infrared and laser heating, to reduce energy for heat treating and coatings of industrial components. Develop new super hard coatings and monolithic components using diamond deposition and borides. Develop improved refractories and insulating materials for high temperature processes to reduce down-time and improve energy efficiencies in the IOF industries.

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

Program Activity	FY 2001	FY 2002	FY 2003
Industrial Materials for the Future (cont'd)		and development projects from competitive solicitation. ($13,698)	Develop combinatorial techniques, acquire thermophysical property data, and use the information for modeling materials synthesis and behavior in high temperature industrial environments. ($12,698)
Total, Industrial Materials for the Future	**$0**	**$13,698**	**$12,698**
Engineered Ceramics/CFCCs	Transferred all Engineered Ceramics/CFCC and Advanced Industrial Materials activities relating to the OPT/DER program, with their related funding, to OPT. Continued development, testing, and demonstration of CFCCs with superior high temperature strength and fatigue resistance, corrosion resistance, and wear resistance for various applications in the Vision Industries. CFCC materials helped industry realize substantial energy, economic, and environmental benefits, including higher efficiency, lower maintenance, and decreased operating costs. Demonstrated processing methods	Complete program with five projects that are now part of the Industrial Materials for the Future program. ($0)	No activities. ($0)

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

Program Activity	FY 2001	FY 2002	FY 2003
Engineered Ceramics/CFCCs (cont'd)	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 were performed under application conditions for hundreds to thousands of hours. These long term exposures allow for the collection of data to support the benefits of using CFCCs and support industrial adoption and commercialization. Continued development of supporting technology effort for advanced ceramics (including CFCCs). These efforts built on results obtained from field testing and the supporting technology team evaluated components that had been tested in operating conditions for a better understanding of		

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

Program Activity	FY 2001	FY 2002	FY 2003
Engineered Ceramics/CFCCs (cont'd)	material properties and failure methods. Databases that include life and long-term reliability in appropriate environments were expanded. These efforts helped build the scientific foundation for the successful design, fabrication, characterization, and utilization of advanced ceramics for industrial applications. ($5,853) Participants included: Allied Signal Ceramics, Engineered Composites, Inc., General Electric, McDermott Technologies, Textron Systems, Oak Ridge National Laboratory, and Argonne National Laboratory.		
Total, Engineered Ceramics/CFCCs	**$5,853**	**$0**	**$0**
Advanced Industrial Materials	Shifted focus of intermetallic alloy research and development from nickel aluminize, a mature material being demonstrated by industry, to more rapid development of iron aluminides, molybdenum, and other silicides, and titanium aluminides. ($5,826)	Complete program with seven projects that are now part of the Industrial Materials for the Future program. ($0)	No activity. ($0)

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

Program Activity	FY 2001	FY 2002	FY 2003
Advanced Industrial Materials (cont'd)	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.		
Total, Advanced Industrial Materials	**$5,826**	**$0**	**$0**
Combustion	**High-Efficiency Combustion Systems** (formerly Combustion Systems) Two program areas were awarded finding in FY 2000, super boilers and process heating. Both are multi-year projects with completion anticipated in FY 2004. ($1,690) Participants included the Gas Technology Institute, Southern California Gas, Donlee Technologies, Arthur D. Little, Callidus Technologies, and ExxonMobil.	**High-Efficiency Combustion Systems** (formerly Combustion Systems) Continue super boiler and process heater programs to meet combustion vision and roadmap targets. These projects build on advances made in very low emission burner projects in combination with improved systems design and better heat transfer. ($2,000) Participants included the Gas Technology Institute, Southern California Gas, Cleaver-Brooks, Arthur D. Little, Callidus	**High-Efficiency Combustion Systems** (formerly Combustion Systems) Continue super boiler and process heater program to meet combustion vision and roadmap targets. This project will be reaching full-scale prototype design and construction. The prototypes will achieve maximum efficiency and single-digit NO_x emissions. ($2,000) Participants include the Gas Technology Institute, Southern California Gas, Cleaver-Brooks, Arthur D. Little, Callidus Technologies, and ExxonMobil.

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

Program Activity	FY 2001	FY 2002	FY 2003
		Technologies, and ExxonMobil.	
Combustion (cont'd)	**Industrial Gasification** Design study awarded in FY 2000 was completed. Two additional awards were made for engineering design, cost projections, and identification of critical R&D needs for systems in industrial plants. Funding and oversight is from Industrial technologies with project management implemented through National Energy Technology Laboratory (NETL). Developed solicitation 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: Georgia Pacific, Boise Cascade, GTI, Thermo-Chem, Fluor-Daniel, Oak Ridge National Laboratory,	**Industrial Gasification** Complete black liquor gasifier engineering study and procurement and initiate construction for the Big Island, VA, demonstration. Continue engineering design and cost projections for biomass gasification demonstration (DeRidder, LA). Make awards for the technology support program guided by industry and expertise of NETL, ORNL, and NREL. Supporting technical areas include sulfur management, gas clean-up, materials, systems integration, and other combustion-related studies. ($16,391) Participants include: Georgia Pacific, Boise Cascade, GTI, Thermo-Chem, Fluor-Daniel, Oak Ridge National Laboratory, National Energy Technology Laboratory, and National Renewable Energy Laboratory.	**Industrial Gasification** Procurement and construction will be completed and start-up and shake-down begun for the Big Island, VA, mill demonstration of black liquor gasification. Engineering will be completed for the DeRidder biomass gasification demonstration. Engineering design and cost projections will begin for Kraft black liquor gasification demonstration. Continue the technology support program guided by industry and expertise of NETL, ORNL, and NREL. ($13,600) 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.

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

Program Activity	FY 2001	FY 2002	FY 2003
	National Energy Technology Laboratory, and National Renewable Energy Laboratory.		
Total, Combustion	**$14,387**	**$18,391**	**$15,600**
Sensors and Control Technologies	Continued to implement program plan to achieve leapfrog advancement of sensor and control technologies that have high impact on two or more IOF industries. The focus was on bringing projects into the field demonstration phase and continuing the bench-scale research and development of projects awarded in FY 2000. Notable demonstrations included: 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 incorporated 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 provided	Continue to identify, develop, and deploy crosscutting technologies to meet performance requirements specified in the IOF Roadmaps and thus help the IOFs attain Vision goals. Continue to achieve advances in non-proprietary, dynamically reconfigurable wireless architecture and conduct field trials in two paper mills, complete laboratory development and evaluation of a realtime sensor to measure constituents in industrial melts in the aluminum, glass, and steel industries, and apply thermal imaging system to furnaces to improve operating energy efficiency. ($3,774) Participants include: Timken Company, Gas Technology Institute, GE Research & Development Center, PPG, Energy Research Company, Tennessee Technological University, Oak	Continue to identify, develop and deploy crosscutting technologies to meet performance requirements specified in the IOF Roadmaps and thus help the IOFs attain Vision goals. Use advanced mathematical processing for extracting product property and process and control information from conventional sensor readings. Accelerate industrial non-proprietary, dynamically reconfigurable wireless telemetry development and leverage government funds with industry funds. Evaluate IOF-sponsored sensor and control projects for applicability in industries other than originally intended. Complete laboratory development and evaluation of a realtime sensor to measure constituents in industrial melts in the aluminum, glass, and steel industries and apply thermal imaging system to industrial furnaces to improve operating

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

Program Activity	FY 2001	FY 2002	FY 2003
Sensors and Control Technologies (cont'd)	standardized communication protocols and data structures for measurements with accuracy and reliability, as well as those for harsh-environment (high temperature or corrosive) sensing. ($3,763) Participants included: 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.	Ridge National Laboratory Also, participating in the collaboration are National Research Council Canada; University of Illinois, Combustion Tec, Owens Brockway Glass Containers; Kupp 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.	energy efficiency. ($3,774) Participants include: Timken Company, Gas Technology Institute, GE Research & Development Center, PPG, Energy Research Company, Tennessee Technological University, Oak Ridge National Laboratory
Total, Sensors	**$3,763**	**$3,774**	**$3,774**

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

Program Activity	FY 2001	FY 2002	FY 2003
and Control Technologies			
NICE³	NICE³ provides a voluntary, non-regulatory approach to improve competitiveness, foster energy efficiency, and reduce waste. Working with the States, awarded 10 new grants to demonstrate innovative energy saving process technologies in the Industries of the Future. Completed the development of a briquetting process for industrial furnaces that will save 6 trillion Btu by 2010. ($5,092)	Incrementally fund 8 new projects to demonstrate energy saving technologies in the Industries of the Future. Complete the development of a combinatorial chemical analysis technology that samples 20-100 times faster than current prep-scale Liquid Chromatography technology. ($2,736)	Provide financial assistance to demonstrate energy saving technologies in the IOF industries. There will be approximately 8 incrementally funded grants awarded in FY 2003. Complete the development of a high efficiency adjustable speed drive coupling system to reduce energy costs by 40-74% for motor driven systems in industry. ($2,736)
Total, NICE³	**$5,092**	**$2,736**	**$2,736**
Inventions and Innovation	I&I supports the early-stage development of energy-efficient technologies. The program continued to work closely with the NICE³ Program to support an integrated delivery of Industrial technologies's services to IOF partners. The I&I program awarded	Continue funding energy saving projects initiated in FY 2001. Incrementally fund 20 grants to independent inventors and small technology-based businesses through a competitive processes.	Continue to provide financial assistance to inventors and innovators developing energy saving technologies. Two technology implementation workshops for small businesses and independent inventors are planned. The program will continue to work closely with
Inventions and Innovation	41 grants to independent inventors and small technology-based	Continue to provide assistance to small businesses and independent	the NICE³ Program to support an integrated delivery of Industrial

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

Program Activity	FY 2001	FY 2002	FY 2003
(cont'd)	businesses through competitive processes. Conducted one technology implementation workshop for small businesses and independent inventors. Completed the development of a metal casting stress relief process that will reduce energy consumption by up to 98% compared with natural-gas fired heat treatment. ($4,798)	inventors to develop skills in technology commercialization. Conduct two technology implementation workshops. Complete the development of a Distillation Column Flooding Predictor that identifies instability in a petroleum refinery distillation tower prior to flooding. The technology will improve petroleum refinery distillation tower throughput by 2 to 5 percent. ($4,372)	technologies's services to IOF partners. Incrementally fund up to 20 grants to independent inventors and small technology-based businesses. ($2,372)
Total, Inventions and Innovations	**$4,798**	**$4,372**	**$2,372**
Industrial Technical Assistance	**Industrial Assessment Centers** Continued to support IAC's efforts to provide hands-on training at 26 participating universities in energy and waste management to an additional 120 engineering students and to conduct approximately 650 new combined energy, waste, and productivity assessments. The program worked closely with the	**Industrial Assessment Centers** Provide energy, waste, and productivity training to 120 engineering students at 26 participating universities. Conduct approximately 650 assessment days of service to manufacturing clients. Work closely with other Industrial technologies programs to deliver industrial services in an integrated	**Industrial Assessment Centers** Provide energy, waste, and productivity training to 140 engineering students at 26 participating universities. Conduct approximately 750 assessment days of service to manufacturing clients. The program will work closely with other Industrial technologies programs to deliver industrial

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

Program Activity	FY 2001	FY 2002	FY 2003
Industrial Technical Assistance (cont'd)	other Industrial technologies Technical Assistance programs to fully support an integrated delivery of services and provided 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, helped these plants target specific opportunities for efficiency. Engineering students who have worked with the 26 IAC's nationwide continue to graduate with the experience and skills necessary to implement energy efficiency, waste reduction, and productivity improvements. Continued to implement recommendations from the Strategic Program Review. Conducted a solicitation for Special Projects to provide IACs the opportunity to perform work that compliments Industrial technologies's R&D activities, student projects on industrial efficiency, and regional and local	fashion. Providing industrial assessment technical expertise to Industries of the Future Showcase Plants. Conduct a solicitation to select new Field Manager(s). ($5,859) .	services in an integrated fashion. Provide industrial assessment technical expertise to Industries of the Future Showcase Plants. The program continues to provide a nationwide cadre of experienced and trained engineering alumni, many of whom enter the industrial community able to apply practical energy management skills learned first-hand at manufacturing client plant sites. Transition to new Field Manager(s). ($7,694)

Program Activity	FY 2001	FY 2002	FY 2003
Industrial Technical Assistance (cont'd)	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 conducted in addition to industrial assessments. ($6,762)		
	Best Practices To provide better customer service and reduce costs, Industrial technologies initiated the Best Practices Program that integrated the activities of: Motors and Compressed Air, Process Heating, and Steam. Provided credible technical information and assistance to help U.S. manufacturers lower their energy bills, often with little or no capital investment. ($0)	**Best Practices** Provide technical assistance to 6 plant sites on use of industrial process application tools relevant to motor, pump, process heating, steam, and compressed air systems. Select 8 plant-wide assessments for cost-shared financial assistance and development of a comprehensive energy-saving strategy for the selected plants. Broaden the Allied Partnership to 50 companies from industry and trade associations representing all IOF industries to support wide dissemination and use	**Best Practices** Continue technical assistance to plant sites enabling their use of industrial process application tools relevant to motor, pump, process heating, steam, and compressed air systems; emphasize system-level improvements through implementation of energy management best practices. Select 8 plant-wide assessments for cost-shared financial assistance; develop a comprehensive energy-saving strategy for each plant and replication plan. Efforts will

Program Activity	FY 2001	FY 2002	FY 2003
Industrial Technical Assistance (cont'd)		of Industrial technologies information and products. Develop a Best Practices Resource Software Suite for decision-making across plant operations. Conduct 2 state level Energy Fairs. Conduct 2 plant-wide showcases in support of IOF partnerships to demonstrate emerging technologies and their performance benefits under real-use conditions. Initiate validation of energy/environment/economic performance of 8 emerging technologies through an independent, third-party entity to help promote industry acceptance of new technologies. ($9,070)	continue to increase Allied Partners to 100 companies from the IOF industries, support industries, and trade associations. Use Allied Partnerships to facilitate replication of the whole Best Practices portfolio including the conduct of 5 regional/state-level Energy Fairs. Support 2 plant-wide showcases in support of IOF partnerships to demonstrate emerging technologies, energy management best practices, and their performance benefits under real-use conditions. Continue validation of energy/environment/economic performance of 8 emerging technologies through an independent, third-party entity to help promote industry acceptance and replication. ($8,235)
	Motors and Compressed Air/Steam Motors and compressed air technical assistance support and expertise were provided as critical components of Industrial	**Motors and Compressed Air/Steam** Transferred and consolidated under the Best Practices Program. ($0)	**Motors and Compressed Air/Steam** Transferred and consolidated under the Best Practices Program. ($0)

Program Activity	FY 2001	FY 2002	FY 2003
Industrial Technical Assistance (cont'd)	technologies's integrated delivery of technical assistance services under the Best Practices program. 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. ($7,020) Participants included: Oak Ridge National Laboratory, National Renewable Energy Laboratory, Lawrence Berkeley National Laboratory, Macro International, and Washington State University Extension Office.		
	Steam The Steam Program continued to be a full-fledged initiative jointly partnered by DOE and the Alliance to Save Energy under Industrial technologies's integrated delivery effort under the Best Practice program. Technical assistance,	**Steam** Transferred and consolidated the program under the Best Practices program. ($0)	**Steam** Transferred and consolidated the program under the Best Practices program. ($0)

Program Activity	FY 2001	FY 2002	FY 2003
Industrial Technical Assistance (cont'd)	information, and tools were provided to plants interested in improving the energy efficiency of their steam systems and industrial heating equipment. This program provided 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 worked 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. ($1,234) Participants included: Oak Ridge		

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

Program Activity	FY 2001	FY 2002	FY 2003
Industrial Technical Assistance (cont'd)	National Laboratory, National Renewable Energy Laboratory, Lawrence Berkeley National Laboratory, and Macro International.		
Total, Industrial Technical Assistance	**$15,016**	**$14,929**	**$15,929**
Technical/Prog. Management Support	Provided critical technical and program management support services. ($5,002)	Provide critical technical and program management support services. ($3,000)	Provide critical technical and program management support services. ($4,000)
TOTAL, INDUSTRIES OF THE FUTURE (CROSS-CUTTING)	**$59,737**	**$60,900**	**$57,109**

INDUSTRIAL TECHNOLOGIES
INDUSTRY SECTOR
(Dollars in Thousands)

COOPERATIVE PROGRAMS WITH STATES

Mission Supporting Goals and Objectives

Mission: The Cooperative Program with States pursues collaborative applied research, development and demonstration (RD&D) that utilizes important federal-state partnerships to accelerate the use of energy efficiency technologies in energy-intensive industries.

Executive Summary: The Industries of the Future (IOF) strategy relies on effective partnerships to leverage Federal funds and achieve significant reductions in the energy intensity of its nine partner energy-intensive industries. Effective partnerships with states and their respective industries are a key component of this strategy. Cooperative Programs with the States is a component of our "State IOF" initiative.

Context: The National Energy Policy (NEP) establishes a national priority for improving energy efficiency. It states that this increased efficiency should be pursued through the combined efforts of industry, consumers, and the federal, state, and local governments. The National Energy Policy also directs that funding for energy efficiency research and development programs should be proposed for those programs that are performance-based and are modeled as public-private partnerships. For the industrial sector, the Industries of the Future (IOF) strategy is being used to develop and maintain effective partnerships, which leverage Federal funds to help achieve substantive reductions in energy intensity in nine energy-intensive industries. The State IOF activities are central to our effective partnership with the states and their respective industries and the ability to broaden the reach of the national IOF partnership.

Management Strategy: The importance of energy-intensive industries to State economies is widely recognized and has given rise to a network of partnerships among State agencies, universities, industry associations, and regional organizations. The Industries of the Future (IOF) 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 increase reach to smaller companies. In addition, Cooperative Programs with the States utilizes the state land grant universities and extension services to facilitate the increased adoption of energy efficiency measures by industries in their states. Competitive financial assistance will be used as the appropriate procurement mechanism to implement this program.

Long Term Goals and Objectives

- Leverage Federal funds to achieve reductions in the energy intensity of energy-intensive industries by supporting collaborative RD&D with the states and using these important partnerships to involve the state land grant universities and extension services in facilitating the adoption of energy efficiency measures by industries in their states.
- Competitively select 3 to 6 states per year for awards. Similar to State IOF, where competitive awards are made through the State Energy program special projects solicitation, additional states partnerships will be formed and existing partnerships will be strengthened each year.

Annual Performance Results and Targets:

FY 2001 Results	FY 2002 Target	FY 2003 Proposed Target
• Provide cooperative agreements to 3-6 states for collaborative research, development, and field testing.	• Continue the activities funded in FY 2001.	• Provide cooperative agreements to 3-6 states for collaborative research, development, and field testing.

II. A. Funding Table: COOPERATIVE PROGRAMS WITH STATES

Program Activity	FY 2001 Comparable	FY 2002 Comparable	FY 2003 Request	$ Change	% Change
Cooperative Program with States	$ 1,964	$ 2,000	$ 2,000	$ 0	0.0%
Total, Cooperative Program with States	$ 1,964	$ 2,000	$ 2,000	$ 0	0.0%

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

	FY 2001	FY 2002	FY 2003	$ Change	% Change
All Other	$ 1,964	$ 2,000	$ 2,000	$ 0	0.0%
Total, Cooperative Program with States	$ 1,964	$ 2,000	$ 2,000	$ 0	0.0%

III. Performance Summary: COOPERATIVE PROGRAMS WITH STATES

Program Activity	FY 2001	FY 2002	FY 2003
Cooperative Programs with States	Industrial technologies section of solicitation provided cooperative agreements to approximately 3-6 states for collaborative applied research, development, and field testing. Partnerships were encouraged with state land grant universities and extension services. Areas of effort focused on specific state needs for one or more of the nine Industries of the Future. ($1,964)	Industrial technologies section of solicitation provides cooperative agreements to approximately 3-6 states for collaborative applied research, development, and field testing. Partnerships were encouraged with state land grant universities and extension services. Areas of effort focused on specific state needs for one or more of the nine Industries of the Future. ($2,000)	Provide cooperative agreements to approximately 3-6 states for collaborative applied research, development, and field testing. Partnerships will be encouraged with state land grant universities and extension services. Areas of effort are expected to focus on specific state needs for one or more of the nine Industries of the Future generated through active state IOF partnerships. ($2,000)
TOTAL, COOPERATIVE PROGRAMS WITH STATES	**$1,964**	**$2,000**	**$2,000**

INDUSTRIAL TECHNOLOGIES
INDUSTRY SECTOR
(Dollars in Thousands)

ENERGY EFFICIENCY SCIENCE INITIATIVE

Mission: The Energy Efficiency Science Initiative (EESI) seeks to identify and fund "bridging" research, development and Demonstration (RD&D) that falls between fundamental exploratory science and pre-commercial applied RD&D.

Executive Summary: By stimulating RD&D that maximizes synergies among different research fields, technologies, investigator communities, and end-use applications, this initiative expands EERE's RD&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.

Context

Corporate Context

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 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.

Market Context

The awards are generally small, and universities, small businesses, national labs (not as the lead), and industry (as appropriate) are all eligible to participate in this initiative.

Management Strategy: In FY 2001, this program completed its second year. Projects funded to date have been 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 have continued work into FY 2001 and FY 2002, respectively. Due to the need to accommodate higher priority activities, no additional funds will be requested in FY2003.

II. A. Funding Table: ENERGY EFFICIENCY SCIENCE INITIATIVE

Program Activity	FY 2001 Comparable	FY 2002 Comparable	FY 2003 Request	$ Change	% Change
Energy Efficiency Science Initiative	$ 3,828	$4,000[a]	$ 0	$ (4,000)	-100.0%
Total, Energy Efficiency Science Initiative .	$ 3,828	$ 4,000	$ 0	$ (4,000)	-100.0%

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

	FY 2001	FY 2002	FY 2003	$ Change	% Change
All Other	$ 3,828	$ 4,000	$ 0	$ (4,000)	-100.0%
Total, Energy Efficiency Science Initiative . .	$ 3,828	$ 4,000	$ 0	$ (4,000)	-100.0%

a/ Does not yet reflect FY 2002 Interior and Related Agencies Appropriation (P.L. 107-63) language directing that 50 percent of Energy Efficiency Science Initiative funds for FY 2002 ($2,000,000), and beyond, be made available to the DOE Fossil Energy Research and Development account.

III. Performance Summary: ENERGY EFFICIENCY SCIENCE INITIATIVE

Program Activity	FY 2001	FY 2002	FY 2003
Energy Efficiency Science Initiative	**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 conducted a follow-on strategic visioning workshop (e-vision 2001). This workshop built 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 were awarded as a follow-on to recommendations from e-vision 2000. Additionally, funded approximately 10 to 20 cooperative agreements with research and development teams, which are being led by universities and include industrial, national laboratory and other partners. The cooperative agreements focus on industrial sector fundamental strategic R&D, as contained in the visions and roadmaps for the nine Industries of	**Energy Efficiency Science Initiative** In collaboration with the DOE Office of Fossil Energy, a single award solicitation will be issued to address technology gaps between exploratory science and pre-commercial applied R&D. ($4,000)	**Energy Efficiency Science Initiative** No activities. ($0)

Program Activity	FY 2001	FY 2002	FY 2003
	the Future. ($3,891)		
TOTAL, ENERGY EFFICIENCY SCIENCE INITIATIVE	**$3,828**	**$4,000**	**$0**

INDUSTRIAL TECHNOLOGIES
INDUSTRY SECTOR
(Dollars in Thousands)

MANAGEMENT AND PLANNING

I. Mission Supporting Goals and Objectives

Mission: Management and Planning provides the information, analyses, and personnel necessary to proficiently manage the Office of Industrial Technologies programs.

Summary: Management and Planning ensures well-planned and efficiently-managed programs by Industrial technologies that support the energy efficiency goals and objectives of the National Energy Policy (NEP) for the industrial sector. Effective management includes efficient organizational design, human resource development and staffing, quality information management systems, 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 Industrial technologies programs.

***Context*:** Management and Planning supports 54 full-time equivalent (FTE) positions to maintain adequate program management and support for Industrial technologies. These positions support the implementation of both Headquarters program management functions and project management functions at the Idaho Operations Office. This program also includes Technical Evaluation, and Analysis and Planning activities, which are required to ensure continued program alignment with the goals and objectives of the National Energy Policy (NEP).

***Management Strategy*:** In FY 2003, Industrial technologies 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. This will build on past management improvements which have increased both the effectiveness and efficiency of Industrial technologies's programs. Management and Planning funding has allowed Industrial technologies to recruit, develop and retain professional staff. This staff have enabled Industrial technologies to implement improvements, such as strengthening our partnerships with the private sector and the states, increasing the leveraging of Federal funds, achieving a greater reduction in energy intensity in industrial sector operations; streamlining solicitations and providing uniformity among our solicitations; centralizing

project management at the Idaho Operations Office for most of our projects in order to provide a uniform and more efficient and effective level of management; and using competitive financial assistance as the acquisition mechanism that best supports effective partnerships and the achievement of results for the industrial sector.

Long Term Goals and Objectives

- Through Headquarters and field staff, provide effective and efficient program and project management of Industrial technologies's programs, resulting in effective partnerships with the private sector and states, a high leveraging of Federal funds, and substantive reductions in the energy intensity of Industries of the Future (IOF) industries.
- Recruit, develop, and retain proficient staff.
- Work with partners on process improvements to increase the effectiveness of Industrial technologies's programs in delivering results.

II. A. Funding Table: MANAGEMENT AND PLANNING

Program Activity	FY 2001 Comparable	FY 2002 Comparable	FY 2003 Comparable	$ Change	% Change
Evaluation and Planning	$600	$730	$730	$0	0.0%
Program Direction	$8,026	$8,670	$6,905	$-1,765	20.0%
Total, Management and Planning	$8,626	$9,400	$7,635	$-1,765	18.7%

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

Program Activity	FY 2001	FY 2002	FY 2003	$ Change	% Change
All Other	$8,626	$9,400	$7,635	$1,765	18.7%
Total, Management and Planning	$8,626	$9,400	$7,635	$ 1,765	18.7%

III. Performance Summary: MANAGEMENT AND PLANNING

Activity	FY 2001	FY 2002	FY 2003
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). ($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)	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)
	Provided critical technical and program management support services. ($208)	Provide critical technical and program management support services. ($214)	Provide critical technical and program management support services. ($214)
Total, Evaluation and Planning	**$600**	**$730**	**$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 $ 5,713	11.9 Personnel compensation $ 5,505	11.9 Personnel compensation $ 4,495
	12.1 Civilian personnel benefits $ 1,610	12.1 Civilian personnel benefits $ 1,555	12.1 Civilian personnel benefits $ 1,270
	21.0 Travel and transportation of persons $ 750	21.0 Travel and transportation of persons $ 715	21.0 Travel and transportation of persons $ 450
	25.0 Other contractual services $ 125	25.0 Other contractual services $ 895	25.0 Other contractual services $ 690

Activity	FY 2001	FY 2002	FY 2003
Program Direction (cont'd)	Funds supported the salaries, benefits, and travel (including normal increases in both salaries and benefits) for usage of 55 FTEs needed to conduct and monitor research, development of the various Industry technologies, at Headquarters (50) and in the field (5). Program direction provided for continued implementation of Workforce 21 plans (Budgeted Headquarters 59 and Field 7 for 66 total). Other services supported such activities as training and a small contingency. Also, activities included 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	Funds 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 Headquarters (54) and in the field (6). ($7,775)	Funds are requested to support the salaries, benefits, and travel (including normal increases in both salaries and benefits) for 54 FTEs needed to research and develop various industrial technologies at Headquarters (47) and in the field (7). ($6,215)

Activity	FY 2001	FY 2002	FY 2003
Program Direction (cont'd)	FY 2001 requirements. ($7,293)		
	Management Support Services	**Management Support Service**	**Management Support Services**
	TRANSFER FROM: Industries of the Future (Crosscutting) and Management and Planning		
	Consistent with other DOE programs under the jurisdiction of the Interior and Related Agencies Appropriations Committees, the Energy Conservation programs provided 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)	Consistent with other DOE programs under the jurisdiction of the Interior and Related Agencies 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)	Consistent with other DOE programs under the jurisdiction of the Interior and Related Agencies 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. ($690)
Total, Program Direction	$8,026	$8,670	$6,905
TOTAL, MANAGEMENT AND PLANNING	**$8,626**	**$9,400**	**$7,635**