Strategic Plan

Industrial Technologies Program

Office of Energy Efficiency and Renewable Energy

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Who We Are

The Industrial Technologies Program (ITP) leads the Federal government's efforts to improve industrial energy efficiency and environmental performance. The Program is part of the Office of Energy Efficiency and Renewable Energy (EERE) and contributes to its efforts to provide reliable, affordable, and environmentally sound energy for America's future.

ITP's primary role is to invest in high-risk, high-value research and development that will reduce the energy requirements of industry while stimulating economic productivity and growth. Because energy is an important input for many of our key manufacturing industries, reducing energy requirements will lower energy costs, reduce greenhouse gases and other emissions, and improve productivity per unit of output. As a Federal program, ITP invests in leap-frog technologies that will produce dramatic energy and environmental benefits for the Nation. It focuses investments on technologies and practices that will provide clear public benefit but for which market barriers prevent adequate private sector investment.

An integral part of EERE's mission is to use public-private partnerships to accomplish its goals. Through a process known as *Industries of the Future*, ITP has become a model of how the Federal government can partner with industry to effectively plan and implement a robust, comprehensive R&D agenda. These public-private partnerships also help to disseminate and share best energy management practices in factories throughout the United States. They also facilitate voluntary efforts, such as the President's Climate VISION initiative to encourage industry to reduce greenhouse gas emissions. By leveraging technical and financial resources of industry and government, the partnerships have generated significant energy and environmental improvements that benefit the Nation and America's businesses.

The Challenge

Reliable, affordable, and environmentally sound energy for America's future is the cornerstone of the National Energy Policy, yet an expanding economy, growing population, and rising standard of living create growing demands for energy. Modernizing energy conservation is a key national goal included in the Policy. It specifies that *"the best way of meeting this goal is to increase energy efficiency by applying new technology – raising productivity, reducing wastes, and trimming costs."* This strategy is the heart of the Industrial Technologies Program.

The U.S. industrial sector has become much more efficient over the past 30 years and it continues to offer excellent opportunities to achieve efficiency gains. New technologies that use energy efficiently often lower emissions and improve productivity. However, energy-intensive industries face enormous competitive pressures that make it difficult to make the necessary R&D investments in technology development to ensure future efficiency gains. Without a sustained commitment by the private and public sectors to invest in technology R&D and adopt new technologies, the ability to close the gap between U.S. energy supply and demand will be severely compromised.

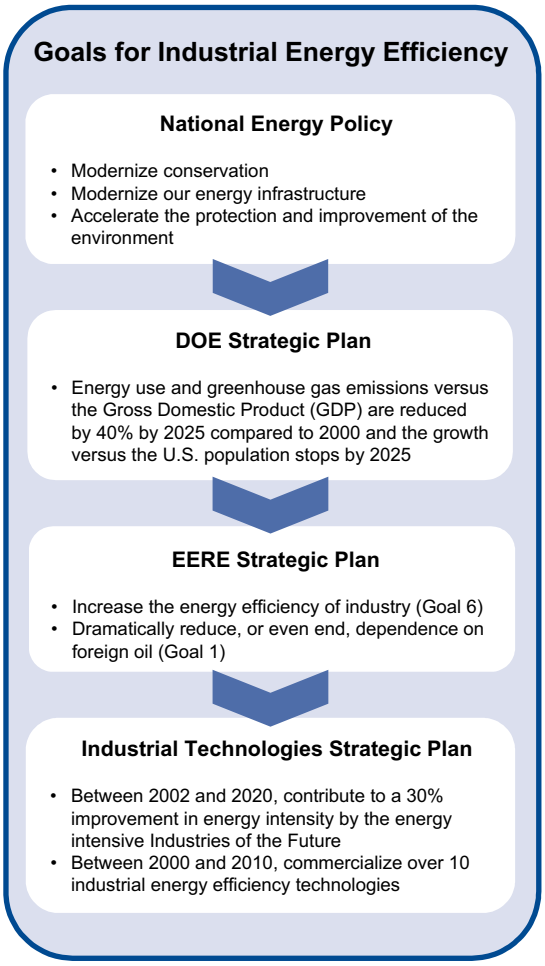
Mission

The Industrial Technologies Program seeks to improve the energy intensity of the U.S. industrial sector through a coordinated program of research and development, validation, and dissemination of energy efficiency technologies and operating practices.

ITP partners with industry, its equipment manufacturers, and its many stakeholders to reduce our Nation's reliance on foreign energy sources, reduce environmental impacts, increase the use of renewable energy sources, improve competitiveness, and improve the quality of life for American workers, families, and communities.

Vision

ITP strives for a world in which U.S. goods are recognized for their extraordinary quality, are produced with minimal energy and environmental impact, are designed for durability and recyclability, and are manufactured with modern technology and practices to ensure our Nation's continued economic vitality and energy security.



Goals

To achieve its mission and vision, ITP develops and promotes technologies and practices that help industry use less energy per unit of output. Reducing energy intensity is the key to increasing energy efficiency in industry without impeding economic growth.

- Between 2002 and 2020, contribute to a 30 percent decrease in energy intensity (Btu per unit of industrial output as compared to 2002) by the energy-intensive Industries of the Future (a potential savings of 3.8 - 4.5 quads).
- Between 2000 and 2010, commercialize over 10 industrial energy efficiency technologies through research, development, and demonstration (RD&D) partnerships.

Strategic Overview of the Industrial Technologies Program

Mission

Improve the energy intensity of the U.S. industrial sector through a coordinated program of research and development, validation, and dissemination of energy efficiency technologies and operating practices.

Goals

Between 2002 and 2020, contribute to a 30% improvement in energy intensity by the energy-intensive Industries of the Future.

Between 2000 and 2010, commercialize over 10 industrial energy efficiency technologies through RD&D partnerships.

Current Situation

- Large efficiency opportunities exist in the energy-intensive industries
- Technical challenges are complex and varied
- High technical and financial risk inhibit investment in efficient process technology
- Severe private underinvestment in efficiency R&D
- U.S. manufacturers face fierce global competition
- Large capital investments required for new technology commercialization
- Capital stock turnover is slow

Strategies

- Focus on energy-intensive Industries of the Future
- Use public-private partnerships
- Identify Grand Challenges
- Implement balanced portfolio of R&D, validation, dissemination
- Perform process-specific R&D in the IOFs (long-term impact)
  - Aluminum
  - Chemicals
  - Forest Products
  - Glass
  - Metal Casting
  - Mining
  - Petroleum Refining
  - Steel
- Perform enabling, crosscutting R&D (long-term impact)
  - Materials
  - Combustion
  - Sensors & Automation
- Perform technology delivery activities (near/mid-term impact)
  - Tools Development & Training
  - Plant Assessments
  - Emerging Technologies
  - Allied Partnerships
  - Technical Outreach

Expected Results of Current Portfolio*

	Process-specific R&D in the IOFs	Enabling, crosscutting R&D	Technology delivery activities	
2010	0.2 quads	0.04 quads	0.7 quads	Energy Savings
	$0.9 billion	$0.1 billion	$4.0 billion	Cost Savings
	4.5 MMTCE	0.6 MMTCE	12.3 MMTCE	Climate Change Gases Avoided
	6 technologies	4 technologies		Commercialized Technologies
2020	2.0 quads	0.8 quads	1.0 quads	Energy Savings
	$7.9 billion	$3.4 billion	$6.5 billion	Cost Savings
	36.7 MMTCE	13.2 MMTCE	18.0 MMTCE	Climate Change Gases Avoided

*Based on fiscal year 2003 technology portfolio. Assumes continued public and private RD&D investments comparable to current levels. Total results may be lower due to competing technologies that target the same market opportunity.

Reducing industrial energy intensity will also contribute to the following ITP objectives:

- **Environmental Quality** - Develop and promote technologies and practices that minimize environmental impact and promote sustainability during the production life cycle.

- **Yield Improvement/Resource Conservation** - Develop and promote technologies and practices that improve product yield and promote resource conservation during the production life cycle. Pursue a "systems" perspective that employs techniques such as materials substitution and waste elimination, reduction, reuse, and recycling.

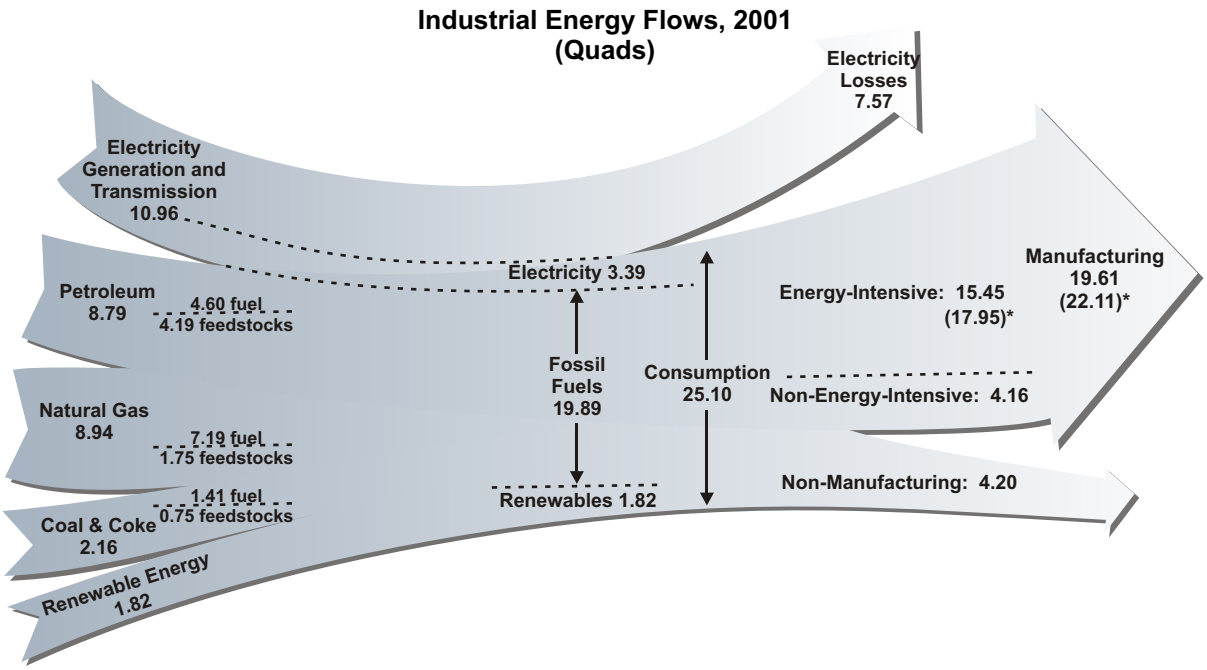
- **Economic Viability** - Support the development of energy-saving technologies that enhance the competitiveness of U.S. industry by improving product yield, quality, durability, recyclability, and life cycle cost.

- **Energy Security** - Support the development, validation, and implementation of energy-saving technologies that promote independence from foreign energy sources, provide resistance to foreign price competition, and encourage sustainable production capability in the United States for our energy-intensive industries.

Core Values

In ITP, we believe that the mark of a truly great organization is its people. We embrace and promote the EERE core values of Pride and Passion, Excellence, Optimism, Precision, Leadership, and Education. We bring these core values to our partnerships, our interactions with our stakeholders, and our teamwork with our fellow EERE programs. We strive to:

- foster an environment where individual initiative and accomplishments are valued in a team setting.
- be a world-class leader in all aspects of our operations, including development of our leadership skills.
- continuously improve and grow as an organization and as individuals in all that we do.
- deliver customer satisfaction as dependable and reliable partners.
- provide a workplace that creates spirit, energy, and respect as employees participate in reaching our mutual goals.
- uphold our role as stewards of the public trust.



Sources: EIA AEO 2003, EIA MECS 2001.

* EIA AEO 2003 does not include 2.5 quads of non-fuel energy in the petroleum refining sector (used to make asphalt, lubricants, solvents, waxes, etc.) that is reported in EIA MECS 2001.

Current Situation

Energy Profile of the Industrial Sector

Industry is the largest and most diverse energy-consuming sector in the United States. In 2001, industry consumed 32.3 quads, or over one-third of the 96 quads consumed in the United States. Roughly 8 quads are lost during power generation and transmission before electricity arrives at industrial plants. Natural gas, petroleum products, and electricity comprise the major energy sources used to heat and power U.S. factories, farms, mining, and construction operations. In addition to heat and power, industry used about 7 quads of fossil fuels as feedstock to produce industrial materials and products such as chemicals and plastics. Industry's energy expenditures for heat and power totaled $80 billion in 2001.

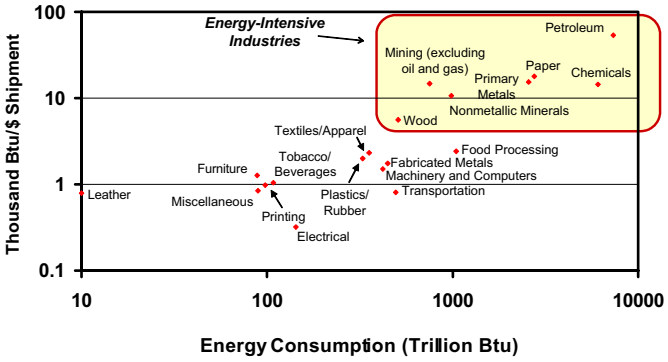
Unlike other sectors, energy use in industry is often determined by the specific industrial process in use. For example, the aluminum industry uses large amounts of electricity for smelting while the glass industry uses large amounts of natural gas to melt silica in furnaces. These inherent variations inhibit a "one-size-fits-all" approach to energy efficiency. However, some important energy applications are common across industry, such as motor drives, steam systems, and compressed air. As a result, industrial energy efficiency opportunities exist in both process-specific and crosscutting energy systems.

Within manufacturing, 6 of the 21 major U.S. industries account for 85% of all energy use. These industries (as well as mining) use large amounts of energy to transform raw materials into higher-value industrial materials and end products. These industries also tend to be energy-intensive, using large amounts of energy per dollar of product output. **Energy intensity**[1] is the single most important indicator of energy efficiency in industry, and is dependent on market prices, economic risks, and other factors.

Key Trends

As the role of energy in industry changes, ITP must reshape its strategy. Changing market conditions, energy prices, and business concerns affect the ability and willingness of industry to pursue energy efficiency opportunities. The following trends have shaped the ITP strategy:

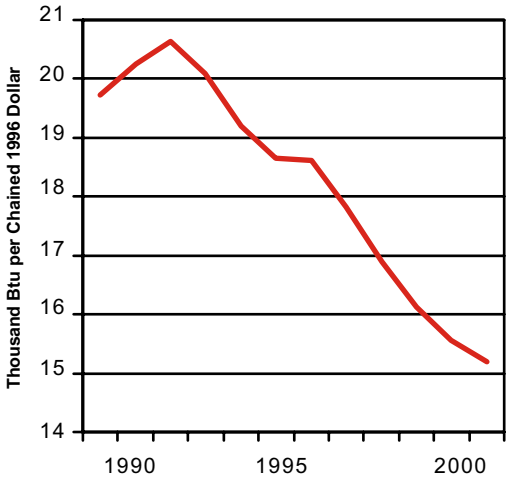
Industrial Energy Intensity vs. Energy Consumption



Sources: EIA MECS 2001, Bureau of EconomicAnalysis.

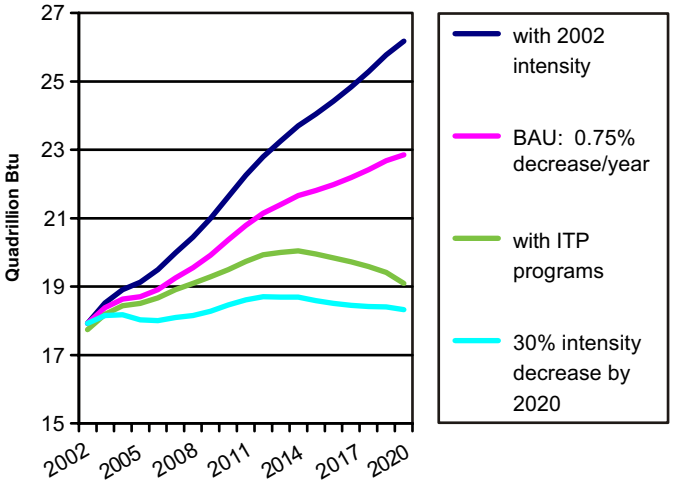
- **The industrial sector will continue to provide one of the biggest opportunities to increase energy efficiency in the United States.** Industrial energy intensity is projected to decline as companies become more energy efficient and the structure of the industrial sector changes. In 2001, industry posted its *lowest energy intensity since the formation of the Department of Energy* (15,200 Btu/dollar of industrial GDP [constant chained 1996]). This was significantly lower than what it was in 1970 and reflects the change in the economic mix of industries and the diligence of

Industrial Energy Use per Dollar of Industrial GDP



Source: EIA MER 2003, Bureau of Economic Anaylsis.

Projected Energy Use in Energy-Intensive Industries

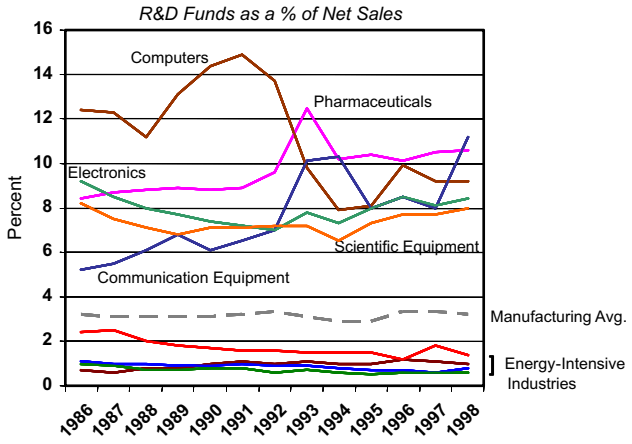


Sources: EIA AEO 2003, EIA MECS 2001, ITP.

[1] Energy intensity is defined as energy use per unit of product output (for example, Btu per dollar value of shipments).

private industry in assimilating energy efficiency technologies. The DOE Policy Office determined that more efficient manufacturing delivered the largest component of total U.S. energy savings from 1970 to 1988. (The change in the mix of industries and commercial building improvements were tied for the second largest component.) Although manufacturing output surged in the late 1990s, energy use grew at a slower rate despite relatively low energy prices. Energy use projections indicate that increased industrial efficiency will continue to be a major source of future U.S. gains in energy efficiency. This ability to increase output without a corresponding increase in energy use is a major strength of U.S. industry.

R&D-to-Sales Ratio in Manufacturing 1986-1998

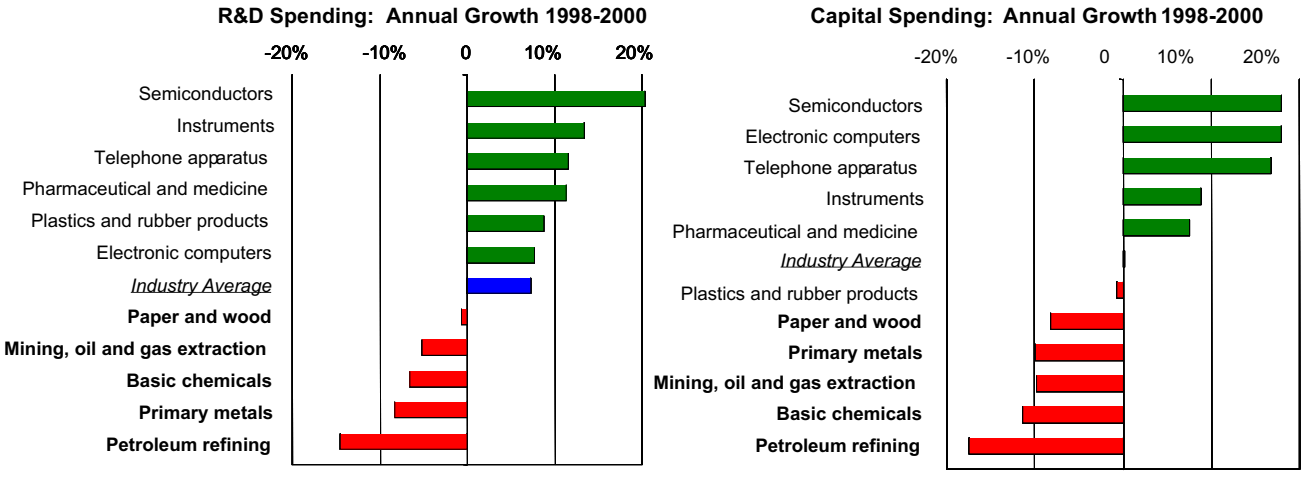


Source: NSF 2002.

- **Energy-intensive industries exhibit relatively low levels of R&D spending.** The energy-intensive industries have the *lowest R&D investment rate in the entire industrial sector*, with a 0.8% R&D/sales ratio. (This compares with an average of 4.3% for all of industry.) Between 1998 and 2000, R&D investments in the energy-intensive industries actually *declined* by 3.0% per annum in sharp contrast to the 7.3% per annum *increase* for all of industry. Over this period, the energy-intensive industries posted the poorest overall economic performance of all industry groups considering net sales, foreign sales, capital spending, employment, and R&D investment.

- **Industry is unable to accept the risks associated with undertaking complex, capital-intensive technology development and implementation.** Highly efficient, next-

Recent Trends in Corporate Spending for R&D and Capital Spending



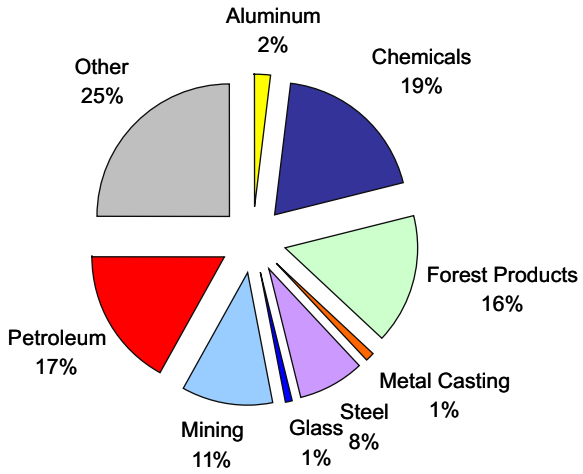
Source: USDOC 2002.
Bold = energy-intensive industries

generation process technologies in well-established, large-volume processes are usually technically complex and require enormous capital investment. They are promising but unproven, exhibit small near-term returns, and carry the risk of lost production. These technologies must compete for scarce capital in the energy-intensive industries, which scaled back their capital investments by 9.8% per year from 1998 to 2000. As a result, few companies are willing to be the first to deploy advanced production technology because the cost of failure could destroy the company or its competitive position. However, studies have concluded that societal benefits of investing in R&D far outweigh corporate benefits, implying that without federal assistance, companies will underinvest.

- **The U.S. materials and process industries face intense competitive pressures.** Strong cost competition from foreign producers and alternative materials as well as shareholder expectations of near-term profits are squeezing all corporate expenditures. Capital productivity has stagnated, resulting in low capital stock turnover and investment returns. Environmental and climate change factors are playing an increasingly important role in corporate decision-making. While energy continues to represent an important component of manufacturing costs, energy efficiency improvements may compete with other operational objectives. In response, companies have pursued strategies to cut costs and mitigate risk through mergers and acquisitions, leveraging R&D funds with private and public partners, globalizing and integrating R&D, and outsourcing technical components.

- **Energy markets and suppliers have restructured.** The businesses that supply energy to the industrial sector have changed dramatically as natural gas and electricity markets restructured. This transition from regulated to competitive energy markets has created greater price volatility, particularly for natural gas and electricity deliveries from the spot market. Conflicting legislative incentives and regulatory uncertainties regarding electricity and the environment have prompted many industrial firms to outsource their energy services and add back-up power generation capability.

Estimated Manufacturing and Mining Fuel Use, 2002*



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

Sources: EERE, EIA AEO 2003, EIA MER 2003.

Strategy

1. Focus on energy-intensive industries

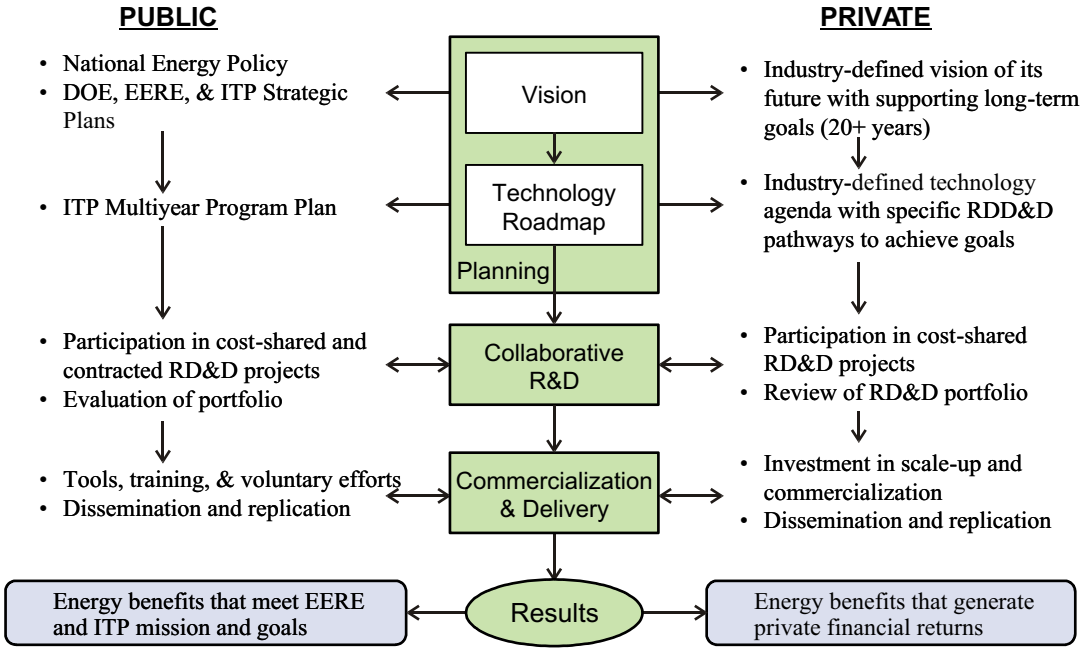
ITP focuses its resources on a small number of energy-intensive materials and process industries that account for

over 75 percent of industrial energy consumption[2]. The chemicals, forest products, steel, aluminum, glass, metal casting, mining, and petroleum refining industries, which comprise the *Industries of the Future*, represent the largest opportunity to increase energy efficiency in industry. ITP will increase the energy efficiency of these industries by targeting manufacturing processes that use the most energy and have the biggest gaps between current energy use and practical minimum energy requirements.

2. Use public-private partnerships to plan and implement the program

The Industrial Technologies Program is modeled as a public-private partnership that brings together the strengths of business and government to solve increasingly complex and difficult problems. In accordance with the *Industries of the Future* process, ITP includes its industry partners in each phase of the technology development process, including planning,

***Industries of the Future* Public-Private Partnership Model**



collaborative research and development, and implementation. The process takes advantage of the inherent relationship between efficiency and production costs, using market drivers to help focus scarce resources where they can effect the greatest improvements in U.S. industrial efficiency. The scope and scale of today's technological challenges require the technical skills of a wide variety of science bases. The financial challenges are equally daunting, requiring large amounts of capital for research, development, scale-up, demonstration, commercialization, and dissemination. Partnerships help to meet these technical and financial challenges by reducing the cost and risk of projects to stimulate private investment.

[2] The classification of these industries is different than the 21 major manufacturing industries described earlier. For example, steel, metal casting, and aluminum are all contained within one of the 21 major manufacturing industries (primary metals).

- **Visions and Roadmaps** have been used by ITP since 1994 as a means to engage industry and other stakeholders in defining their long-term goals, technology challenges, and research priorities. These documents provide critical planning inputs to ITP and were identified as a best practice in the EERE Strategic Program Review. ITP helps facilitate the vision and roadmap process and analyzes the resulting technology needs to identify synergies with ITP's own energy efficiency priorities.

- **Cost sharing** of program activities is a central part of ITP's strategy. Sharing costs leverages public investment with private resources, increases commitment by industry to achieve R&D success, shortens the technology development and commercialization cycle, and improves technology delivery. ITP prefers projects that engage multiple partners to attract broad technical capabilities, reduce financial burdens, and increase commitment within industry. ITP seeks 50-50 cost share for most R&D projects but recognizes that the level of cost share must reflect the risk involved and the ability of partners to match public investments. ITP continues to follow the provisions in the Energy Policy Act of 1992 and will be guided by the President's Management Agenda.

- **State partnerships** allow EERE to expand the reach of its national programs and further leverage Federal resources. ITP assists states in developing their own *Industries of the Future* partnerships to mobilize local industries and other stakeholders and improve energy efficiency through best practices, energy audits, and collaborative R&D. State partnerships enable a two-way dialogue to ensure that ITP understands state priorities and that the states become partners in the dissemination of EERE technologies.

- **Allied Partnerships** provide an opportunity for EERE to reach a broad audience of potential customers by allying with corporations, trade associations, equipment manufacturers, utilities, and other stakeholders to deliver EERE products and services and meet the technology needs of industry.

3. Identify "Grand Challenges" to dramatically improve industrial energy efficiency

Next-generation manufacturing concepts often involve one or more core technical challenges that, if solved, can produce dramatic improvements in energy efficiency, environmental performance, and product yield. These "*Grand Challenges*" typically require high-risk, high-return R&D such as an entirely new processing route to achieve much lower energy use than current processes. To identify these high-value opportunities, ITP analyzes the energy-saving potential of processes and energy systems throughout industry. ITP then pursues public-private partnerships to develop *Grand Challenge* projects in cooperation with industrial partners. ITP's emphasis on *Grand Challenges* in its R&D portfolio is expected to result in a small number of high-value projects that will yield substantial energy, environmental, and economic benefits as well as increases in capital productivity.

- **Analytic studies** are conducted to identify energy efficiency opportunities in support of *Grand Challenges*. For example, ITP conducts *bandwidth studies* to calculate the minimum energy requirements of specific manufacturing processes and compare them to current process efficiencies; the *energy footprint studies* identify all sources of energy losses throughout plant of various types. ITP explores RD&D activities that can capitalize on the difference between actual and practical minimum energy requirements.

4. Implement a balanced portfolio

The ITP program develops, manages, and implements a robust portfolio that addresses industry requirements throughout the technology development cycle.

- **Research and development,** particularly high-risk, high-return R&D, forms the foundation of the ITP program. Program efforts are balanced with respect to risk and timeframe.

- **Validation** and verification of technology benefits through intermediate-term pilot and demonstration phases help emerging technologies gain commercialization and near-term adoption.

- **Dissemination** of energy efficiency technologies and practices is accomplished through a variety of information and technology delivery vehicles. These activities help industry reap the benefits of proven technologies, information and customer decision tools, training, and strategic partnerships.

5. Perform process-specific and crosscutting R&D to improve long-term energy efficiency

ITP's primary long-term strategy is to invest in high-risk, high-value research and development that will reduce the energy requirements of manufacturing while stimulating economic productivity and growth. ITP focuses investments on technologies and practices that provide clear public benefit, but for which market barriers prevent adequate private sector investment. Key efficiency opportunities exist in process-specific and crosscutting energy systems.

- **Process-specific R&D** targets inefficiencies within the specific manufacturing processes used in each of the *Industries of the Future*. ITP conducts R&D projects that focus on the largest energy efficiency opportunities based on the gap between actual energy use and practical minimum energy requirements.

- **Crosscutting R&D** targets efficiency opportunities in the use of enabling technologies that are common to many industrial processes. ITP conducts R&D projects that will improve the efficiency of combustion, materials, sensor and process control systems, and supporting industries, as well as opportunities for improving industrial energy systems, such as combined heat and power. Because of the widespread application of these crosscutting systems, even small improvements in their efficiency can yield large energy savings.

- **Competitive solicitations** are the principal mechanism used by ITP to contract for R&D. Solicitations reflect the priorities of the ITP program as determined by analyses of efficiency opportunities, national priorities, and appropriate Federal role. Selection of projects follows merit-based criteria that emphasize projected energy, environmental, and economic benefits based on sound analysis.

6. Perform technology delivery activities to improve near- and mid-term energy efficiency

Industry can save enormous amounts of energy today — this year's savings exceed 200 trillion Btu/year — by implementing off-the-shelf technologies and energy management practices. ITP funds technical assistance activities to stimulate near-term adoption of the best energy-saving technologies and practices within industry. These activities include plant assessments, tool development and training, information and technology dissemination, and showcase demonstrations. To reach as many plants as possible, ITP also pursues a *replication* strategy.

- **Software tools and training** enable companies to self-assess their plant's steam, compressed air, motor, pumps, insulation, and process heating systems. Training plant managers to optimize energy use for specific utility systems or across an entire plant helps companies operate plants more efficiently with little or no capital investment. ITP's extensive library of publications on proven energy management practices also helps companies achieve immediate energy savings.

- **Plant assessments and audits** uncover inefficiencies in overall operations and in motor, steam, compressed air, pumping, and process heating systems. ITP cost-shares plant-wide assessments that save most companies at least $1 million in annual energy savings after just one assessment. Energy productivity and waste assessments performed for small- and medium-sized plants over the past decade have led to cumulative annual energy savings of about 74 trillion Btu.

- **Showcase Demonstrations** highlight the benefits of energy efficiency and renewable energy technologies by applying them in an operating manufacturing plant. ITP participates in EERE-wide public events to demonstrate how a comprehensive approach to improving plant operations can increase productivity, cost and energy savings, and environmental benefits.

- **Replication** of energy efficiency technologies and practices is critical to ITP's strategy. EERE **Allied Partnerships** are true public-private partnerships that use this replication strategy. EERE provides practical tools and training materials and the Allied Partners train plant engineers and disseminate energy efficiency information. EERE also provides technical assistance to Allied Partner energy assessment teams, whose results are replicated at other facilities owned by the Allied Partner. The ultimate objective of the partnerships is to spread the best practices in energy management throughout industry.

Internal Partnerships

ITP is an integral part of the new EERE organization and has lead responsibility for accomplishing EERE's Strategic Goal 6, *Increase the Energy Efficiency of Industry* and supporting responsibility on Goal 1, *Dramatically Reduce, or Even End, Dependence on Foreign Oil*. The realigned EERE management structure allows ITP to focus on its core competency: developing and managing energy technology portfolios to meet mission goals.

Integration with the entire EERE organization is an important operating strategy. ITP builds synergies with other technical programs to deliver a diverse portfolio of energy efficiency and renewable energy technologies to industrial partners and to bring advanced manufacturing

expertise to the renewable energy community. ITP coordinates with all EERE business functions to create a more efficient and accountable management process. The Golden Field Office has lead responsibility for managing ITP projects and industry procurements, allowing ITP to focus on developing and managing its technology portfolio. The DOE Regional Offices provide a network of capabilities throughout the country to implement ITP's technology delivery strategy.

People represent EERE's most valuable asset. By investing in human capital, ITP provides the expertise to effectively and efficiently accomplish its mission and implement its program. ITP will work with EERE to ensure that its human resources are adequate for the type and magnitude of program activities it conducts and are consistent with the needs and expectations of responsible program management.

ITP coordinates its activities with a variety of government programs that have mutual interests and goals. For example, ITP works with DOE's Basic Energy Sciences and Fossil Energy programs to coordinate research in areas such as nanotechnology and mining, respectively. In addition, ITP coordinates with other Federal agencies including the National Aeronautics and Space Administration (NASA), the National Science Foundation (NSF), the National Institute of Standards and Technology (NIST), the Environmental Protection Agency (EPA) and the Departments of Defense (DoD), Commerce (DOC), Agriculture (USDA), and Interior (DOI). On manufacturing technology issues, ITP collaborates through the GATE-M partnership with many of the participating agencies.

Operating Principles

- Provide strategic leadership (Program Management) from EERE headquarters and rely on field Project Managers to oversee individual projects.
- Seek opportunities to work with all other EERE programs to collectively contribute to the success of the entire EERE team.
- Capitalize on the capabilities of the EERE Regional Offices to perform technology and information dissemination.
- Serve as good stewards of the public resources appropriated to carry out the mission.

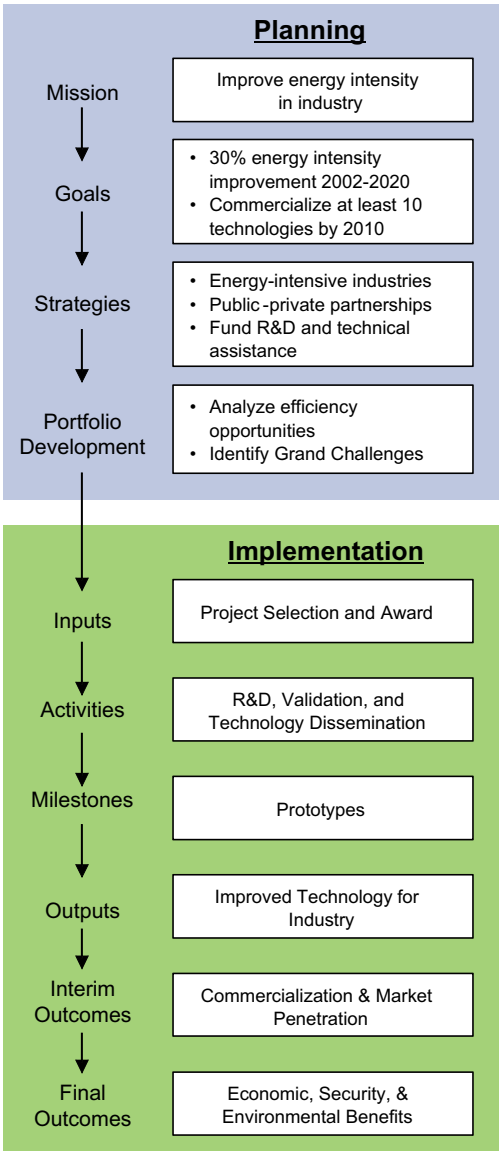
ITP Program Benefits to Date

- In 2002, industrial energy savings of over 265 trillion Btu worth $1.3 billion
- Cumulative 1990-2002 energy savings estimated at over 2,650 trillion Btu
- 160 commercialized technologies
- Over 6,000 U.S. plants use EERE technologies and services

Program Planning and Evaluation

Program planning and evaluation encompasses a variety of management functions to develop, review, track, evaluate, and adjust the ITP portfolio. Due to the complex nature of the industrial technology portfolio, sophisticated planning and evaluation techniques have been an important part of ITP and its predecessor organizations for many years. As a result, ITP has developed an outstanding track record of estimating program benefits, conducting external reviews, tracking technology impacts, and pioneering innovative technology

ITP Planning and Implementation



planning techniques. Over the years, these functions were favorably reviewed by the Secretary of Energy Advisory Board, the National Research Council, and the EERE Strategic Program Review and subsequent improvements were made. Key features of ITP's planning and evaluation approaches are highlighted below.

Program Planning

EERE's Program Management Initiative was introduced in 2001 to create a framework for program planning, budget formulation, budget execution, and analysis and evaluation for all EERE programs. These functions are integrated into EERE's Strategic Management System, which provides the foundation for a logical, structured planning and budgeting process. The Deputy Assistant Secretary for Business Administration provides annual guidance to ITP and the other EERE programs and outlines the specific requirements for program planning and budget development throughout the annual planning cycle.

- **Planning Documents.** Three documents describe the long-, mid-, and near-term plans for the Industrial Technologies Program:
  - Strategic Plan - Outlines the long-term goals and objectives of ITP and the core strategies that will be pursued to achieve them.
  - Multiyear Program Plan - Identifies the key program elements required to achieve ITP strategic goals, including milestones, key decision points, and required resources.
  - Annual Operating Plan - Describes the projects, performers, milestones, and spending plan for the current year based on the multiyear program plan.

- **Portfolio Management.** As ITP adjusts its portfolio to accomplish the goals and strategies outlined in this Strategic Plan, effective portfolio management becomes increasingly important. ITP's new thrust in identifying and initiating *Grand Challenges* will require careful balancing of current projects with new efforts. ITP is adopting innovative portfolio analysis and management tools from industry and government to ensure funded activities will effectively achieve EERE goals.

- **Performance-Based Management.** ITP, working in conjunction with EERE's Office of Planning, Budget Formulation, and Analysis has developed a pilot process to directly link program inputs (e.g., funding), activities conducted by the program (e.g., R&D), the resulting outputs (e.g., improved technologies), and outcomes of those activities (e.g., security benefits such as energy savings) (see diagram on this page). ITP has applied this structure to several program elements and plans to expand it to all program elements.

Program Evaluation and Peer Review

ITP regularly engages external peers to conduct both prospective and retrospective reviews of program activities, in order to ensure that the program is focusing its scarce resources on the most important technical opportunities, selecting high-quality research proposals, and prudently investing public funds to maximize program benefits. ITP strives to improve and strengthen its policies by adopting best practices for peer review and implementing recommended actions. In ITP, peer review consists of three primary components:

- **Merit reviews.** In this prospective peer review activity, ITP follows DOE merit review procedures in selecting projects from competitive solicitations. Well-qualified individuals evaluate and rank proposals, using specific evaluation criteria such as energy benefits and technical merit, and recommend the funding of specific projects by DOE.

- **Project reviews.** In this activity, ongoing research projects are reviewed annually by industry experts to assess past performance and accomplishments and planned project activities. These evaluations are just one of several factors that may result in an adjustment of research direction or financial support for a particular project.

- **Program reviews.** From its inception, ITP has been periodically subjected to retrospective reviews to evaluate whether program benefits have and continue to justify the expenditure of public funds. These outside evaluations have focused on the overall program as well as specific program elements, and typically involve the extensive use of scientific and technical experts and industry stakeholders — most notably, review committees of the National Academy of Sciences. In addition, these and other advisory committees often provide input on the content and direction of the program, which is used for strategic planning purposes.

Performance Indicators

ITP has always emphasized the importance of estimating the expected benefits of existing and proposed projects. The 1993 Government Performance and Results Act (GPRA) required Federal agencies to develop a performance plan and to establish, track, and report on performance measures. As a result, EERE has implemented a consistent process to track key metrics for energy, energy-related cost savings, carbon emissions, and other benefits.

ITP Performance Indicators

Outputs
- # of technologies commercialized
- # of Allied Partners
- # of energy-intensive plants affected including replication
- # of internet information page views on the ITP web site

Outcomes
- Energy saved through ITP activities (trillion Btu)
- Greenhouse gas emissions avoided (million metric tons of carbon equivalent)
- Energy expenditure savings ($ billion)

ITP recognizes that performance indicators can measure outputs and outcomes. *Outputs* are tangible results that reflect successful completion of program activities. *Outcomes* are the desired end results that enable EERE and ITP to achieve their mission. While *outputs* are mostly within the management and control of ITP, *outcomes* require actions and decisions to take place within industry

and the marketplace that may be influenced by many factors outside of ITP's control (e.g., energy prices).

- **Benefits analysis** is conducted to support program management and decision making. The analysis calculates the potential energy, economic, and climate change benefits of its portfolio of projects, pursuant to the Government Performance and Results Act (GPRA). ITP estimates future technology impacts using documented technical and economic data and an EERE-developed market penetration model. Results are reviewed and validated by EERE's Office of Planning, Budget Formulation and Analysis.

- **Tracking energy savings** of commercialized technologies previously funded in ITP's R&D program helps to verify the energy, environmental, and economic impacts of our Federally-funded R&D. Since 1980, 160 ITP-funded technologies have been commercialized and have saved 2.65 quads.

- **OMB R&D Scorecard and Program Assessment Rating Tools (PART)** are diagnostic tools that use objective data to formally assess and evaluate Federal programs on a wide variety of performance issues. The resulting scores are to be displayed in the budget. ITP, working in conjunction with EERE's Office of Planning, Budget Formulation, and Analysis, prepares data inputs to these tools to enable effective evaluation.

- **Annual performance plans** are required from each Federal agency as part of the GPRA. The DOE Annual Performance Plan FY 2004 includes 17 specific goals; ITP contributes most directly to Goal 2, Energy use and green-house gas emissions versus the Gross Domestic Product (GDP) are reduced by 40 percent by 2025 compared to 2000 and the growth versus the U.S. population stops by 2025.

Glossary

AEO - Annual Energy Outlook

BAU - business as usual (associated with improvements in energy efficiency as manufacturers install new equipment that replaces older, less efficient equipment)

Chained 1996 dollars - a measure used to express prices that have been adjusted to remove the effect of changes in purchasing power of the dollar due to inflation or deflation, with 1996 being the reference year

DOE - Department of Energy

EIA - Energy Information Administration

EERE - Office of Energy Efficiency and Renewable Energy

Energy intensity - energy use per unit of product output (for example, Btu per dollar value of shipments)

FY - fiscal year

GDP - gross domestic product

GPRA - Government Performance and Results Act

ITP - Industrial Technologies Program

MECS - Manufacturing Energy Consumption Survey

MER - Monthly Energy Review

MMTCE - million metric tons of carbon equivalent

OMB - Office of Management and Budget

Quad - quadrillion Btu

R&D - research and development

RD&D - research, development, and demonstration

RDD&D - research, development, demonstration, and deployment

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U.S. Department of Energy
Energy Efficiency and Renewable Energy

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

A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. By investing in technology breakthroughs today, our nation can look forward to a more resilient economy and secure future.

Far-reaching technology changes will be essential to America's energy future. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a portfolio of energy technologies that will:

- Conserve energy in the residential, commercial, industrial, government, and transportation sectors
- Increase and diversify energy supply, with a focus on renewable domestic sources
- Upgrade our national energy infrastructure
- Facilitate the emergence of technologies to promote hydrogen as a vital new "energy carrier"

The Opportunities

- *Biomass Program:* Using domestic, plant-derived resources to meet our fuel, power, and chemical needs
- *Building Technologies Program:* Homes, schools, and businesses that use less energy, cost less to operate, and ultimately, generate as much power as they use
- *Distributed Energy & Electric Reliability Program:* A more reliable energy infrastructure and reduced need for new power plants
- *Federal Energy Management Program:* Leading by example, saving energy and taxpayer dollars in federal facilities
- *FreedomCAR & Vehicle Technologies Program:* Less dependence on foreign oil, and eventual transition to an emissions-free, petroleum-free vehicle
- *Geothermal Technologies Program:* Tapping the Earth's energy to meet our heat and power needs
- *Hydrogen, Fuel Cells & Infrastructure Technologies Program:* Paving the way toward a hydrogen economy and net-zero carbon energy future
- *Industrial Technologies Program:* Boosting the productivity and competitiveness of U.S. industry through improvements in energy and environmental performance
- *Solar Energy Technology Program:* Utilizing the sun's natural energy to generate electricity and provide water and space heating
- *Weatherization & Intergovernmental Program:* Accelerating the use of today's best energy-efficient and renewable technologies in homes, communities, and businesses
- *Wind & Hydropower Technologies Program:* Harnessing America's abundant natural resources for clean power generation

To learn more, visit www.eere.energy.gov

Strategic Overview of the Industrial Technologies Program

Mission

Improve the energy intensity of the U.S. industrial sector through a coordinated program of research and development, validation, and dissemination of energy efficiency technologies and operating practices.

Goals

Between 2002 and 2020, contribute to a 30% improvement in energy intensity by the energy-intensive Industries of the Future.

Between 2000 and 2010, commercialize over 10 industrial energy efficiency technologies through RD&D partnerships.

Current Situation

- Large efficiency opportunities exist in the energy-intensive industries
- Technical challenges are complex and varied
- High technical and financial risk inhibit investment in efficient process technology
- Severe private underinvestment in efficiency R&D
- U.S. manufacturers face fierce global competition
- Large capital investments required for new technology commercialization
- Capital stock turnover is slow

Strategies

- Focus on energy-intensive Industries of the Future
- Use public-private partnerships
- Identify Grand Challenges
- Implement balanced portfolio of R&D, validation, dissemination
- Perform process-specific R&D in the IOFs (long-term impact)
  - Aluminum
  - Chemicals
  - Forest Products
  - Glass
  - Metal Casting
  - Mining
  - Petroleum Refining
  - Steel
- Perform enabling, crosscutting R&D (long-term impact)
  - Materials
  - Combustion
  - Sensors & Automation
- Perform technology delivery activities (near/mid-term impact)
  - Tools Development & Training
  - Plant Assessments
  - Emerging Technologies
  - Allied Partnerships
  - Technical Outreach

Expected Results of Current Portfolio*

	Process-specific R&D	Enabling, crosscutting R&D	Technology delivery activities
2010	0.2 quads $0.9 billion 4.5 MMTCE 6 technologies	0.04 quads $0.1 billion 0.6 MMTCE 4 technologies	0.7 quads $4.0 billion 12.3 MMTCE
2020	2.0 quads $7.9 billion 36.7 MMTCE	0.8 quads $3.4 billion 13.2 MMTCE	1.0 quads $6.5 billion 18.0 MMTCE

Energy Savings
Cost Savings
Climate Change Gases Avoided
Commercialized Technologies

*Based on fiscal year 2003 technology portfolio. Assumes continued public and private RD&D investments comparable to current levels. Total results may be lower due to competing technologies that target the same market opportunity.

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