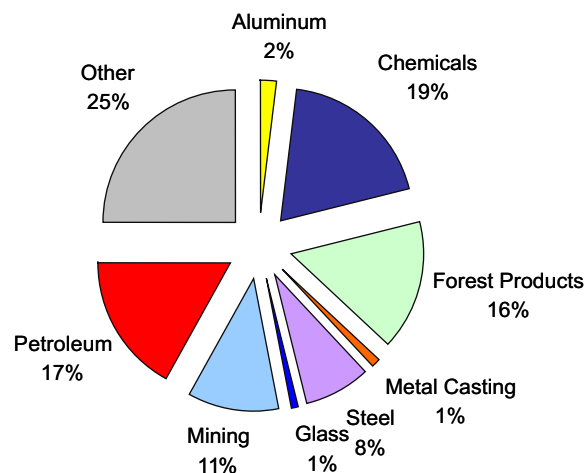


generation process technologies in well-established, large-volume processes are usually technically complex and require enormous capital investment. They are promising but unproven, exhibit small near-term returns, and carry the risk of lost production. These technologies must compete for scarce capital 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, EIAMER 2003.

Strategy

1. Focus on energy-intensive industries

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

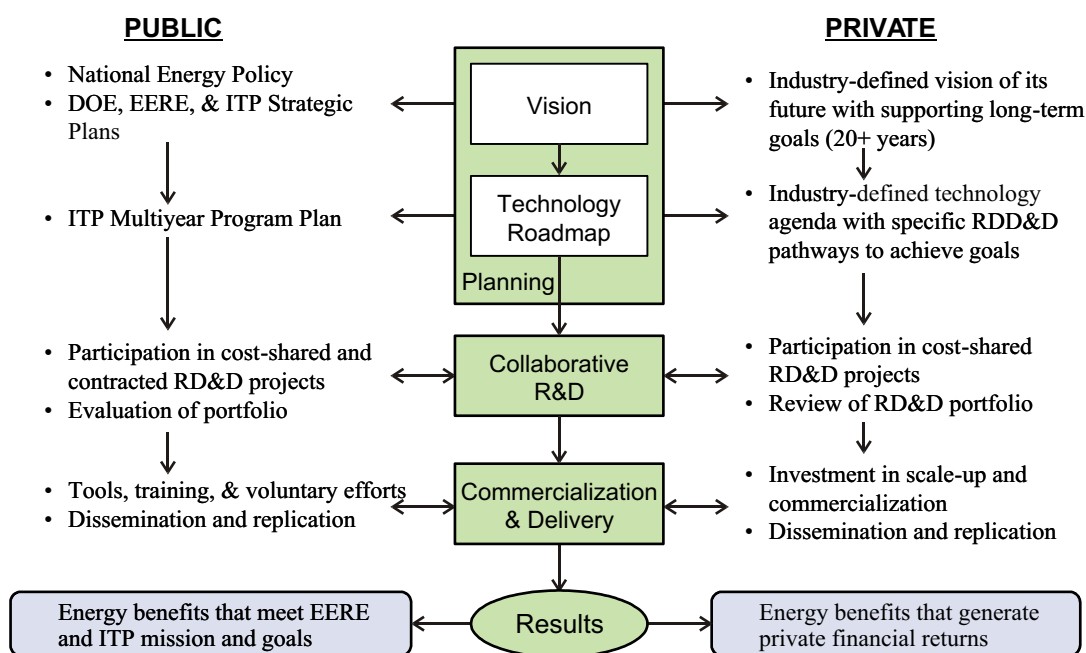


over 75 percent of industrial energy consumption². The chemicals, forest products, steel, aluminum, glass, metal casting, mining, and petroleum refining industries, which comprise the *Industries of the Future*, represent the largest opportunity to increase energy efficiency in industry. ITP will increase 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

