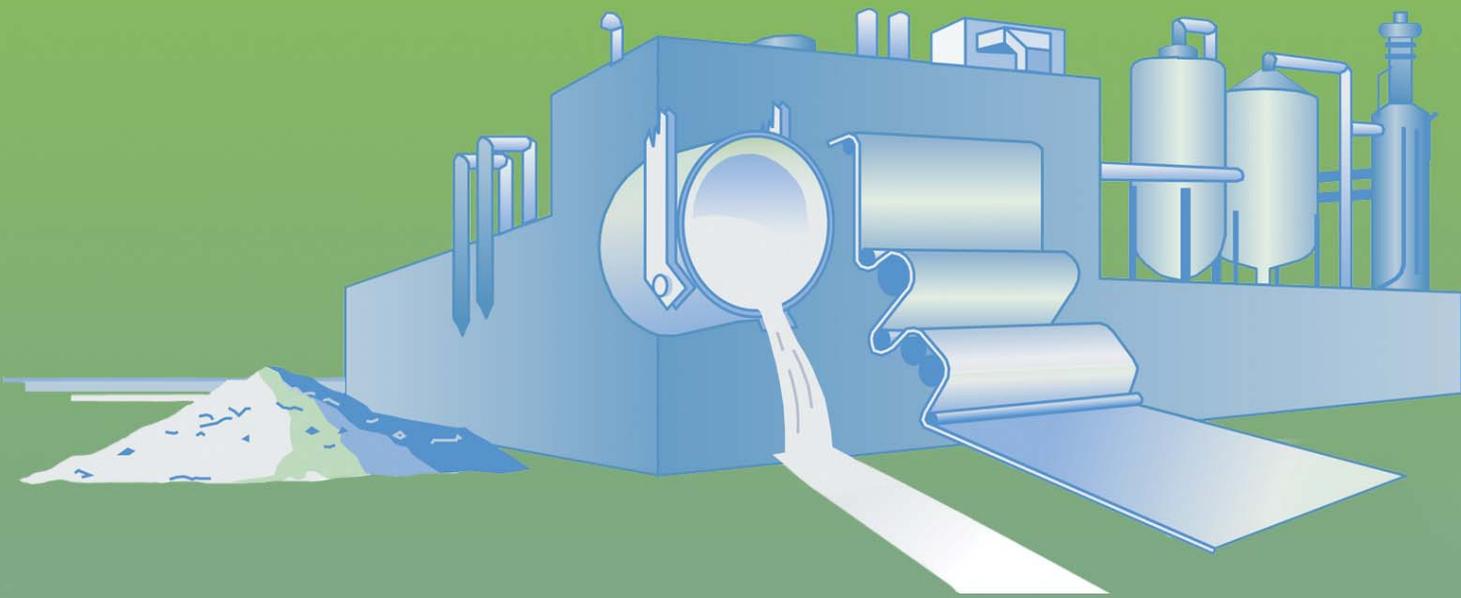


Industrial Technologies Program



Industrial Technologies Program Annual Reports Summary Fiscal Year 2003

Industrial Technologies Program

Boosting the productivity and competitiveness of U.S. industry
through improvements in energy and environmental performance



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

Growing Industrial Energy Savings

Who is ITP? ITP leads the federal effort to improve industrial energy efficiency and environmental performance.



The Challenge:

Develop a portfolio of technologies that will contribute to U.S. industry's energy intensity improvement of 30 percent from 2002 to 2020.

ITP's Mission:

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

2020 Goal: U.S. industry's energy intensity improves 30 percent as compared to 2002.

Energy-Intensive Industries

- Aluminum
- Chemicals
- Forest Products
- Glass
- Metal Casting
- Mining
- Petroleum Refining
- Steel

ITP Results So Far:

Savings in 2001 –

- 296 trillion Btu
- \$1.96 billion

ITP History –

- 3,273 trillion Btu
- \$16 billion (2001 dollars)

Grand Challenge: ITP reduces industry's energy intensity by conducting high-risk, high-return R&D. These projects are identified in technology roadmaps by industry, DOE, and other federal agencies, and verified through energy footprint and bandwidth analysis studies. At present, there are five Grand Challenge projects and additional projects will be awarded in FY 2004.

Intermediate R&D: Intermediate research addresses industry's mid-term R&D needs for technologies that will commercialize in five to 10 years. By the end of FY 2003, ITP had commercialized 92 technologies in this category, with another 139 that could potentially commercialize in the next two to three years.

Technology Delivery: ITP works with plants and industry associations to replicate energy savings; solicits proposals to install and field-test emerging technologies; develops BestPractices software tools and information to improve the energy performance of plant systems; provides no-cost assessments conducted by university-based teams to eligible small and mid-size plants; and provides plant-wide assessments to large facilities through an open solicitation process.

Education Initiatives: ITP exposes hundreds of students each year to careers in manufacturing by funding exploratory research and Industrial Assessment Centers (IAC). Both activities utilize our nation's universities. ITP also supports state-based initiatives that involve partnering with educational institutions. These initiatives help develop the 21st century workforce.

Studies and Analysis: ITP conducts detailed energy footprint and bandwidth analysis studies of facility energy use and achievable energy savings to help target R&D efforts.

Partnerships: ITP has many partners that are involved with different aspects of the program. ITP partners with industry on cost-shared research to address both industry needs and DOE goals. Allied Partners are manufacturers, trade associations, industrial service and equipment providers, utilities, and other organizations that agree to help promote increased energy efficiency and productivity for those industries that participate in ITP's Industries of the Future strategy. State energy offices (and other state-based organizations) also promote industrial energy efficiency and ITP-related products and tools. ITP also works with partners on Climate VISION (Voluntary Innovative Sector Initiatives: Opportunities Now), a voluntary, public-private partnership to pursue cost-effective initiatives that will reduce the projected growth in America's greenhouse gas emissions.

2001

2005

2010

2015

2020

Industries of the Future Partnership

Technology Delivery



Discovery Research: A portion of the ITP budget targets exploratory research with universities and national laboratories. In FY 2003, ITP partnered with universities on 97 projects and National Laboratories on 59 projects.

Grand Challenge: Grand Challenges are focused on high-risk, high-impact technologies. These technologies are expected to commercialize in 10 to 15 years. Currently, ITP has five pilot Grand Challenge projects, including the Mesabi Nugget project in the ITP Steel Industry of the Future portfolio. Additional Grand Challenge solicitations will be released in FY 2004.

Education Initiatives: At the end of FY 2003, 326 students participated in Metal Casting IOF research, and 152 of these students now work in the metal casting industry. Industrial Assessment Centers (IAC) had 236 engineering students participating in FY 2003.

Intermediate R&D: Intermediate R&D technologies are expected to commercialize in five to 10 years. In FY 2003, two projects in this category received *R&D 100 Awards*.

Emerging and Commercialized Technologies: These 139 technologies could potentially be commercialized in two to three years.

Showcase Demonstration: The Texas Technology Showcase in Houston, TX and Mining Energy Solutions Event in Elko, NV demonstrated firsthand benefits of applying energy efficiency and renewable energy technology.

Plant Assessments: Eight plant-wide assessments and 612 Industrial Assessment Center (IAC) audits were conducted in FY 2003. These plant assessments impacted 602 companies.

BestPractices Tools and Training: ITP trained 1,525 end users on ITP software tools that will help reduce their company's energy consumption.

Commercialized Technologies: At the end of FY 2003, 92 technologies were commercialized. Ten commercialized technologies were newly classified "commercial" in FY 2003.

Allied Partners: ITP established 17 new Allied Partners, bringing the total number to 70 at the end of FY 2003.

Climate VISION Partners: ITP helped the DOE Policy Office to establish partnerships with the Aluminum, Automotive, Cement, Chemical, Forest Products, Mining, Petroleum Refining, and Steel industrial sectors in support of President Bush's Climate VISION initiative.

Energy Efficiency Workshops: ITP completed more than 69 energy efficiency workshops held throughout the United States.

EERE Web Site: The EERE Industrial Technologies Program Web site received approximately 1,440,000 hits in FY 2003.

EERE Clearinghouse: The Clearinghouse handled over 2,450 cases in FY 2003.

Industry Challenges

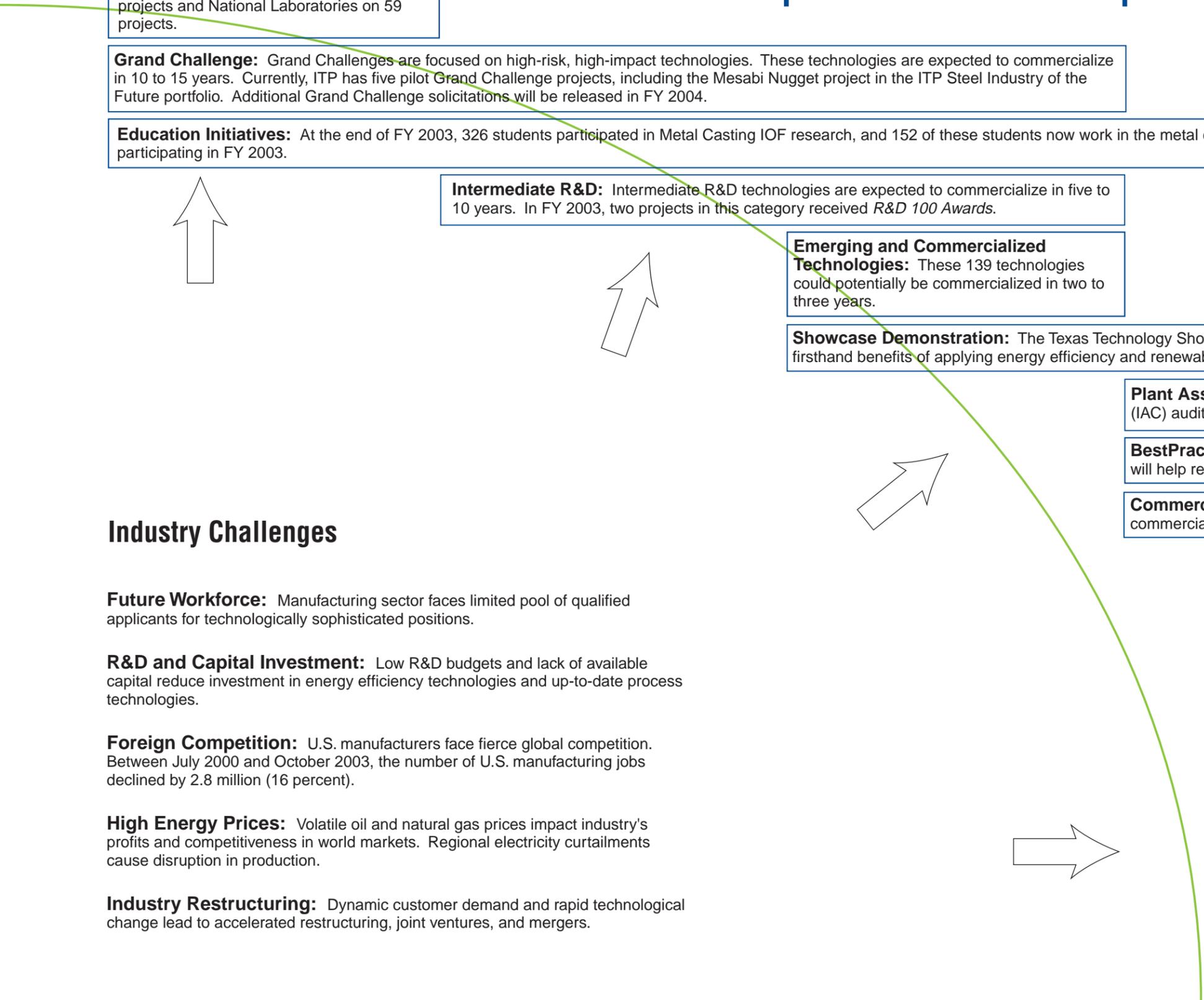
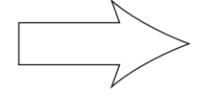
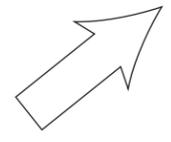
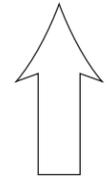
Future Workforce: Manufacturing sector faces limited pool of qualified applicants for technologically sophisticated positions.

R&D and Capital Investment: Low R&D budgets and lack of available capital reduce investment in energy efficiency technologies and up-to-date process technologies.

Foreign Competition: U.S. manufacturers face fierce global competition. Between July 2000 and October 2003, the number of U.S. manufacturing jobs declined by 2.8 million (16 percent).

High Energy Prices: Volatile oil and natural gas prices impact industry's profits and competitiveness in world markets. Regional electricity curtailments cause disruption in production.

Industry Restructuring: Dynamic customer demand and rapid technological change lead to accelerated restructuring, joint ventures, and mergers.





Aluminum: The Advanced Carbothermic Reactor will increase primary aluminum production energy efficiency by 30 percent, reduce capital costs by 60 percent, and reduce CO₂ emissions by 6 percent.



Combustion: The Super Boiler is an ultra-high efficiency steam-generation technology that raises overall boiler efficiency to 94 percent. Its volume and weight is 50 percent less than that of a conventional firetube boiler. Potential natural gas savings are estimated at 0.5 quadrillion Btu per year by 2020, valued at more than \$2 billion.



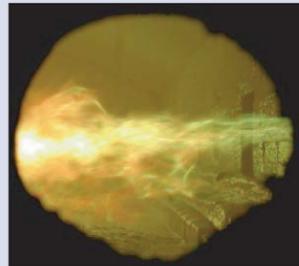
Sensors: The Laser Ultrasonic Tube Wall Measurement System replaces cumbersome manual or radioisotope-based gauges. This technology contributes to improved product quality, reduced scrap, and significant energy savings.



Forest Products: IPST and H.B. Fuller developed a Screenable Pressure Sensitive Adhesive. The adhesive can be easily removed in most recycling facilities and does not require a large capital investment. It is estimated that the new technology will save 3.01 trillion Btu and \$14.55 million in energy cost savings by 2020.



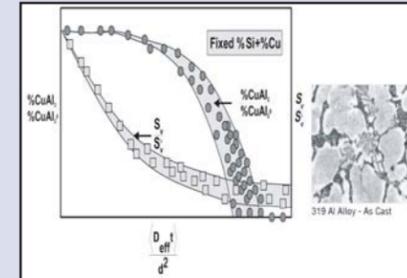
Chemicals: The Monolith Loop Reactor is an integrated monolith catalyst reactor system that can be retrofitted onto existing slurry-catalyst-stirred tank reactors. It provides reaction rates that are over 10 times greater than typical reaction rates in the slurry tank reactor.



Glass: The High-Luminosity, Low-NO_x Oxygen/Natural Gas Burner increases luminosity and radiant heat transfer by modifying the fuel prior to combustion and then forming and burning soot in the flame. Increasing heat transfer rates while decreasing flame temperatures results in increased furnace production rates and thermal efficiency.



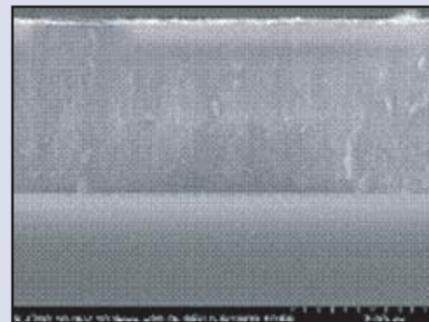
Mining: The Fibrous Monolith Wear-Resistant Component for the Mining Industry will reduce the wear rate and eliminate the catastrophic failure of mining drilling components, resulting in an improved cost/performance ratio compared to the steel, iron, and carbide components currently used by the mining industry. This technology was selected for an *R&D 100 Award*. This new technology is assumed to be 7 percent more efficient due to lifecycle and durability improvements.



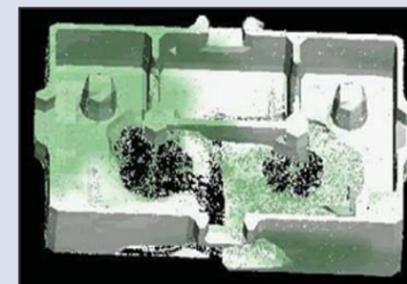
Supporting Industries: An Energy Savings Model for the Heat Treatment of Castings - This project will develop an integrated system of software, databases, and design rules to enable quantitative prediction and optimization of the heat treatment of castings to reduce energy consumption, increase quality, increase productivity, and reduce heat treatment cycle times. Estimated annual energy savings is 6.93 trillion Btu.



Steel: The Mesabi Nugget project is a revolutionary new steelmaking operation that uses one-step furnace operation to produce high-quality iron. The process requires 29 percent less energy than conventional processes.

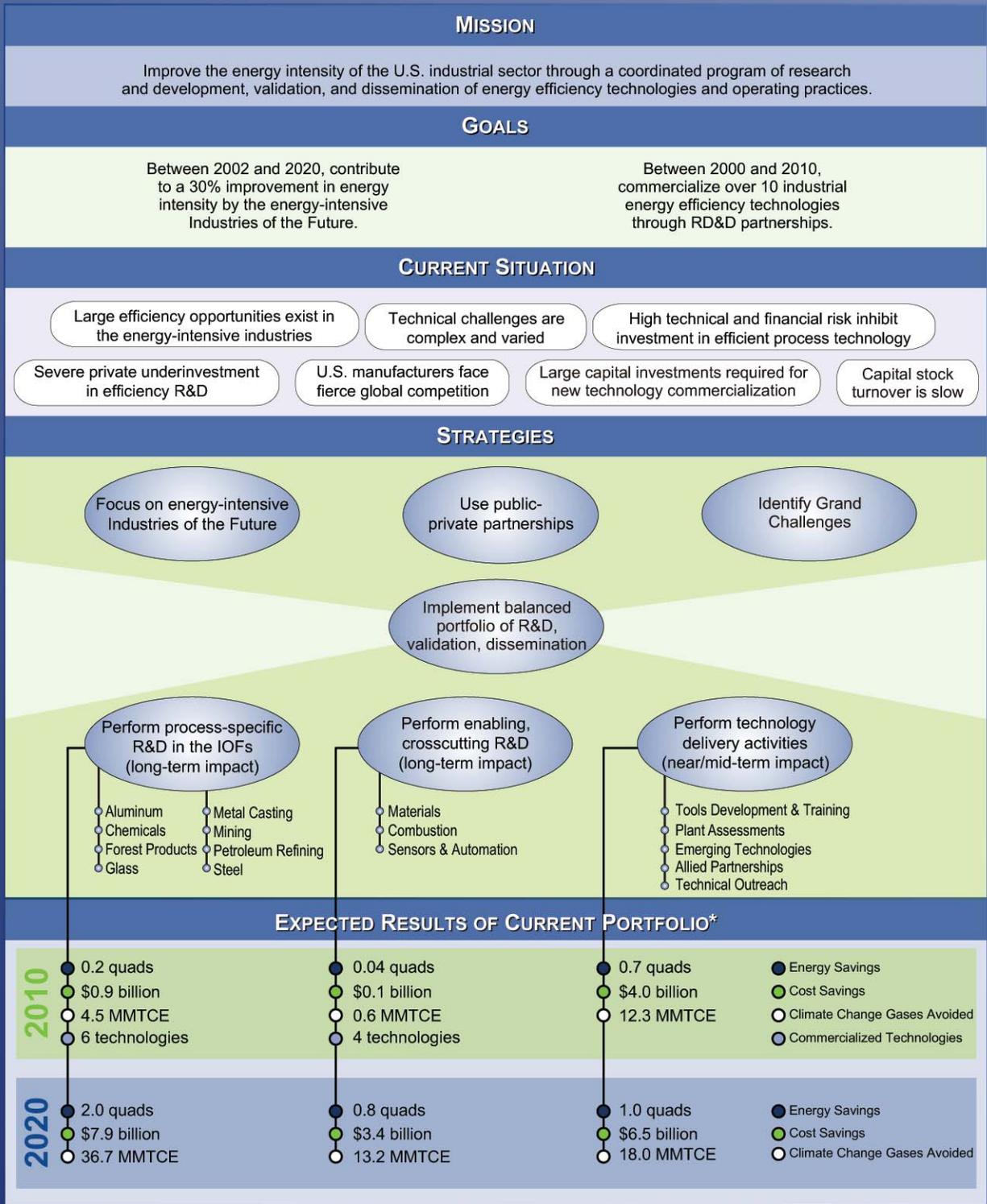


Materials: The Ultranano-crystalline Diamond Coatings project developed a method for controlling the crystal microstructure in diamond films. The unique coating microstructure provides superior wear resistance (hardness), low friction, and inertness to chemicals for rotating and sliding components. The project has successfully demonstrated this coating in automotive and mechanical pump seal applications. It is estimated that reduced friction in pump seals could potentially save approximately 20.86 trillion Btu annually by 2020. This technology received an *R&D 100 Award* in 2003.



Metal Casting: The Computational Fluid Dynamics Tool for Modeling the Blowing and Steaming of Expandable Polystyrene (EPS) Patterns for Lost Foam Casting is a mathematical tool that will allow, for the first time, an analytical approach to systematically designing EPS pattern molds that will produce higher-quality lost foam patterns. This research is expected to achieve significant defect reductions, resulting in yield improvements of about 10 percent and an equal reduction in melting requirements. ITP estimates this project will save 1.57 trillion Btu, with an energy cost savings of \$45.70 million a year in 2020.

Strategic Overview of the Industrial Technologies Program



*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.

A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and great 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 hydrogen technologies as a vital new "energy carrier"



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

