

Industrial Technologies Program



Partnering *for* Success



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

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

Partnering *for* **Success**

Partnering for Success features companies that have not only recently worked in partnership with the U.S. Department of Energy's (DOE) Office of Energy Efficiency (EERE), but have also gone the extra mile to raise awareness of the benefits of industrial energy efficiency. EERE's Industrial Technologies Program (ITP) partners with hundreds of companies and organizations, and they all make substantial contributions to our energy efficiency goals. We acknowledge their efforts, and regret that we cannot feature all of them here. We are continually developing partnerships with new companies and organizations and invite your participation. In *Partnering for Success*, we present a sampling of partners who work to decrease industrial energy use and waste, increase productivity, and enhance environmental benefits.

The Industrial Technologies Program offers partners other opportunities for recognition, such as case studies and articles in the *Energy Matters* newsletter, Showcases and other energy events that demonstrate new technologies and improvements, and our Web site that contains news and information on the Industrial Technologies Program and partner activities.

Check ITP's Web site to see new partnership highlights.
www.eere.energy.gov/industry

Notice

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The companies and organizations featured here all have one aspect in common. They are working in partnership with the U.S. Department of Energy's (DOE) Office of Energy Efficiency and Renewable Energy (EERE) toward a more competitive future. Collectively, they contribute to significant advances in the development of energy efficiency technologies, increased productivity, and enhanced environmental performance for U.S. industry. Their actions have contributed substantially to improving the energy intensity of the U.S. economy.



The participation and activities of these companies and others are wide-ranging. Through the Industries of the Future (IOF) strategy, they are involved in charting future visions for their industries and creating roadmaps to ensure these visions are realized. They lead research and development projects that often find competitors collaborating. They perform comprehensive energy assessments at their facilities that result in substantial energy savings.

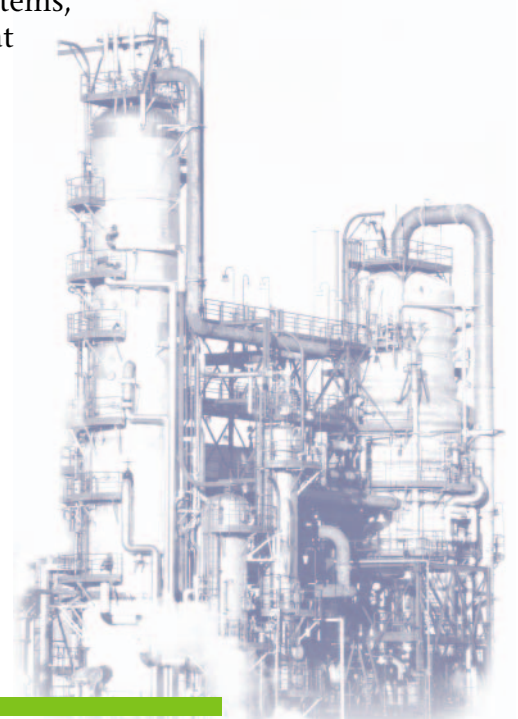
These companies promote awareness of the benefits of industrial energy efficiency through industry energy events, training sessions, Web sites, and publications. Companies not only carry this message to their customers, but they practice it every day. Many of these companies have created a corporate culture that rewards energy-efficiency awareness and innovation. Some have worked to develop industry standards for efficient performance of energy-intensive systems, such as motors and pumps. Others have replicated initial findings at multiple facilities with impressive results.

Please join me in recognizing our partners' dedication and commitment to increasing industrial energy efficiency, improving productivity, and reducing waste, while helping to strengthen our economy and national energy security. We are proud of our mutual accomplishments and invite your company's participation in future activities. Please visit our Web site at www.eere.energy.gov/industry to see how you can help us partner for success!

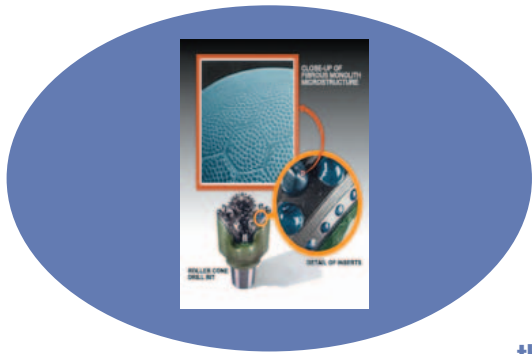
Sincerely,

A handwritten signature in black ink, appearing to read "Buddy Garland".

Buddy Garland
Program Manager
Industrial Technologies Program



Advanced Ceramics Research



Advanced Ceramics Research is developing fibrous monolith wear-resistant components that will bring estimated energy savings of 2.7 trillion Btu per year in 2010 and 7.8 trillion Btu per year in 2020.

Advanced Ceramics Research, Inc., (ACR) develops state-of-the-art, high-temperature, high-performance ceramic materials and processes. ACR has been an outstanding collaborator in all aspects of Mining Industries of the Future (IOF) implementation. ACR's participation with the Mining IOF is led by its President and CEO. Advanced Ceramics Research has:

- Provided industry expertise in Mining Roadmap workshops.
- Hosted a 2001 brainstorming forum of mining executives, university professors, and others to discuss opportunities for application of advanced materials to save energy in the U.S. mining industry.
- Championed the Mining IOF strategy in Arizona and throughout the industry. For example, ACR is working with a local community college, owned by the Tohono O'odham Tribe in Tucson, to train individuals on methods to manufacture advanced ceramics.
- Assisted in technology transfer. For example, during the 2001 National Mining Association's MineExpo, the largest exposition in the mining industry, ACR participated with the Mining IOF to demonstrate advanced materials that hold energy-saving potential in mining.

In current Mining IOF research and development, ACR received a 2002 R&D 100 Award for its fibrous monolith wear-resistant components to increase the wear life of mining drill bit inserts, point-attack tools, dozer teeth, and hydro-cyclone apex tools. This will significantly improve energy efficiency by increasing the duty-life of these components. Estimated energy savings for the industry are 2.7 trillion Btu per year in 2010 and 7.8 trillion Btu per year in 2020. The technology will also reduce operating costs in U.S. mines, thereby improving competitiveness.



AICHE

Founded in 1908 and today boasting over 50,000 members, the American Institute of Chemical Engineers (AIChE) is the original association focused on advancing the chemical engineering profession. AIChE dedicates itself to fostering and disseminating chemical engineering knowledge to industries including energy, chemical, biotechnology, food, electronic, and pharmaceutical, while applying the expertise of its members to societal issues such as sustainable development, the environment, human health, and water management and reuse.

As the global leader of the chemical engineering profession, AIChE stresses the development and exchange of relevant knowledge throughout the world. The institute works to stimulate collabora-

Collaborative efforts that leverage resources are crucial for the identification of R&D needs and the development of technology that can be applied to societal issues in all parts of the world.
—Joseph Rogers
AIChE

tive efforts among industry, universities, government, and professional societies, while encouraging other engineering and scientific professionals and entities to participate in its own R&D ventures.

Working as an Office of Energy Efficiency and Renewable Energy (EERE) Allied Partner, AIChE offers the time and expertise of its members to review the EERE research project portfolio and the development and application of promising technologies. The institute conducts BestPractices training events in its regional chapters throughout the United States and assists the Chemical Industries of the Future (IOF) with BestPractices outreach to chemical plants.

AIChE assisted in the development of the Vision2020 Separations and Reaction Engineering Roadmaps and arranged a topical conference held in March 2002 to showcase technologies being developed under the Chemical IOF portfolio. AIChE cosponsored the EERE Texas Technology Showcase held in Houston, Texas, in March 2003. Currently, the institute is collaborating in the development and standardization of new energy-efficiency metrics and benchmarks, as well as a CD-ROM for the chemical industry that includes energy-efficiency tools and resources for training programs and new technology developments.



Air Products and Chemicals, Inc.

Alcoa

As the world's only supplier of both gas and chemical products, Air Products and Chemicals, Inc., is a leader in global electronics and chemical processing industries and a long-time innovator in the steel, metal, glass, and food processing manufacturing sectors.

Air Products conducts fundamental research across various technology platforms in the fields of materials, chemistry, processing, and chemical engineering. The company actively seeks out long-term research partnerships with individual researchers, universities, other companies, industrial consortia, and U.S. and foreign government agencies and laboratories, including the U.S. Department of Energy. Among these research partnerships are two in collaboration with EERE:

Catalytic Hydrogenation Retrofit Reactor—Working with Johnson Matthey to develop a new reactor system to serve as a catalyst in industrial hydrogenation processes. The new system will be easily retrofitted onto existing commercial batch stirred-tank reactors to replace slurry catalysts used during hydrogenation processes in the fine and specialty chemical industries. Projected benefits include:

- Elimination of problems in areas of environmental contamination, waste production, industrial hygiene, and process safety
- 12 percent reduction in energy use
- Improved yield
- Reduced operational costs.

Pressure Swing Adsorption for Product Recovery—Working to identify existing adsorbents and develop new adsorbents and processes for the recovery of products such as hydrogen from processing waste streams. Projected benefits include:

- Potential recovery of 80,000 metric tons of hydrocarbons per year, saving 336,000 standard cubic feet per day of natural gas from U.S. polyolefin plants
- Decreased NOx, CO2, and VOC emissions.

We can increase and strengthen our technological options for the future through early-stage participation in partnerships with EERE.
—Phil Winkler
Air Products and Chemicals, Inc.

Along with these partnerships, Air Products is working on two Chemical Plus projects—direct capture of products, and computation methods for chemical and physical properties—and, as a founding member of the Chemical Industry Vision2020 Partnership, holds a chair on the Vision2020 steering committee.

Alcoa, Inc., is the world's largest producer of primary aluminum, finished aluminum products, and alumina. In addition, Alcoa's aluminum products and components are used worldwide in aircraft, automobiles, beverage cans, buildings, chemicals, and a wide variety of industrial and consumer applications.

Alcoa is a long-time partner with DOE's Office of Energy Efficiency and Renewable Energy (EERE) and an important participant in the development of industry roadmaps and vision documents. Alcoa is currently the principal partner in three EERE research projects and a partner/contributor to ten R&D projects. Alcoa is a world class R&D organization that contributes to research efforts with EERE on high-risk, industry-changing technologies (i.e. carbothermic reduction and inert anodes).

Alcoa recognizes the benefits of partnering with EERE on BestPractices, Industrial Energy Assessments, and the 2001 Utah Industrial Showcase. During the Showcase, Alcoa demonstrated new energy-saving and environmentally friendly technologies implemented with EERE support at its Spanish Fork, Utah, facility. Alcoa's recent activities with EERE include:

- **DOE BestPractices Training**—Alcoa and EERE held a three-day training session on pumping systems and motors, adjustable-speed drives, and compressed air systems for more than 30 Alcoa employees.
- **Energy Assessments**—Alcoa has conducted energy assessments that identified significant saving opportunities. EERE's plant-wide assessments (PWA) in Lafayette, Indiana; Bauxite, Arkansas; and Plant City, Florida, facilities identified potential annual savings of \$1.9 million, \$1.1 million, and \$800,000 respectively. Alcoa has included PWAs as part of the company's energy-management efforts and has conducted PWAs at other Alcoa plants. To date, implementation of projects identified from various Alcoa PWAs has yielded a total of \$8.9 million in annual savings. Alcoa plans to conduct PWAs at 10 additional domestic plants by the end of 2003.
- **Emerging Technologies**—Alcoa has evaluated the use of air/oxy-fuel furnace burner technology and the vertical flotation furnace for melting recycled aluminum. These technologies were developed by other EERE partners.
- **Broadcasting Energy Benefits**—Alcoa wrote a white paper on "Energy Conservation in Extrusion Operations" for its plants, and it produces a quarterly energy conservation newsletter for its operations worldwide. In addition, Alcoa developed an energy efficiency self-assessment on its intranet, which allows Alcoa locations to measure themselves against industry best practices.



Carbothermic reduction of alumina is a new aluminum production process

Alcoa is a long-time partner with EERE and an important participant in the development of industry roadmaps and vision documents.



Allied Partner



Alliance to Save Energy

The Alliance to Save Energy and DOE's Office of Energy Efficiency and Renewable Energy (EERE) have collaborated for more than a decade in advancing energy efficiency in manufacturing. Both organizations recognize the key roles played by industrial technology and energy management in our economy, environment, and national security.

As a non-profit organization, the Alliance mobilizes a progressive coalition of Associate Members that participate in the market for energy efficiency. By conducting trade shows, seminars, and media presentations, the Alliance leverages the resources of these associates, and effectively extends EERE's outreach efforts. It has advanced the energy-efficiency dialog both within and beyond U.S. borders.

Industrial sector collaboration between EERE and the Alliance has primarily focused on steam systems. This partnership created the Steam Challenge, now known as "BestPractices Steam," and generates technical steam references and media for the benefit of industry.

As a precursor to the steam effort, the Alliance conducted a series of roundtables with industry in several locations across the country. The resulting report, *Understanding the Energy Efficiency Investment Decisions of Smaller Manufacturers*, was released in April 1995. This study identified the barriers to implementing energy efficiency in manufacturing. Its findings influenced EERE's ensuing outreach to industrial plant managers.

Read more about the Alliance's industrial activities at www.ase.org/programs/industrial.



A Steam BestPractice, color-coded piping supports Connectiv's Steam Operations

The Alliance to Save Energy and EERE have collaborated for nearly a decade in advancing energy efficiency in manufacturing.

Allied Partner



Aluminum Association

The Aluminum Association, Inc., is the U.S. trade association for producers of primary aluminum, recyclers, and producers of semi-fabricated aluminum products. The Association provides leadership to the industry through its programs and services, which aim to enhance aluminum's position in a world of proliferating materials, increase its use as the "material of choice," remove impediments to its fullest use, and assist in achieving the industry's environmental, societal, and economic objectives. Member companies operate approximately 200 plants in the United States and many conduct business worldwide.

The Aluminum Association is an instrumental partner in the DOE Office of Energy Efficiency and Renewable Energy (EERE) Industries of the Future strategy. In 1996, the Aluminum Association signed a compact with the Secretary of the U.S. Department of Energy, agreeing to work together to promote energy efficiency. The Aluminum Association leads in the development of the Aluminum Industry Vision and Technology Roadmaps. Recent efforts include:

- *Aluminum Industry Vision*—November 2001
- *Alumina Technology Roadmap*—November 2001
- *Aluminum Industry Technology Roadmap*—February 2003
- *Applications for Advanced Ceramics in Aluminum Production*—February 2001.



The project results will be integrated into the aluminum design manual and should enable improved structural efficiency, which will result in significant energy savings.

The Aluminum Association is partnering with Cornell University on the R&D project "Integrated Numerical Methods and Design Provisions for Aluminum Structures." The focus of this project is on developing numerical methods for structural analysis and design of complex aluminum structures. The project results will be integrated into the aluminum design manual and should enable improved structural efficiency, which will result in significant energy savings. The Association is also a partner on the aluminum scrap sorting and prevention of molten aluminum water explosions R&D projects. These projects will lead to more economical scrap sorting and improved worker safety.

The Aluminum Association promotes EERE's goals through extensive dissemination of EERE products and information to its members and the public. Its Web site disseminates EERE program and project information. In addition, the Aluminum Association works with EERE to develop booklets and other materials relating to efficient energy use.

Allied Partner



AMCAST

Founded in 1866, AMCAST is a major supplier of performance-critical aluminum permanent-mold cast suspension components for the automotive industry. It also serves the construction industry and other industrial sectors.

In 2000, a plant-wide energy assessment (PWA) was performed at AMCAST Industrial Corporation's Wapakoneta, Ohio, manufacturing facility by DOE's Office of Energy Efficiency and Renewable Energy Best-Practices team. The assessment identified how saving energy can improve the bottom line. It resulted in 12 separate recommendations that would improve the efficiency of the plant's production process and decrease energy consumption. These

The twelve recommendations that followed the Wapakoneta facility's



AMCAST staff install aluminum-titanate riser tube

plant-wide assessment required an investment of \$1 million and will save up to \$3.6 million per year, resulting in a simple payback of just three months.

12 recommendations required an investment of \$1 million and will save up to \$3.6 million per year, resulting in a simple payback of just three months. The assessment found that a majority of the improvements to be made were in the manufacturing process. As a result of material modifications to process equipment, AMCAST will realize reductions in maintenance, scrap, downtime, and improve product quality.

AMCAST aggressively implemented the projects identified in the PWA and in the process found additional opportunities for improvement. The total implemented savings was \$6 million. AMCAST then began transferring the success from the Wapakoneta plant to the other five plants in the corporation with similar processing lines. Within several years it is anticipated that the total corporate savings from implementation at the other plants will raise the total savings corporate-wide to \$36 million.

AMCAST
AUTOMOTIVE

American Chemistry Council

ACC members have made a commitment to reduce their greenhouse gas intensity toward an overall target of 18 percent by 2012

The American Chemistry Council (ACC) represents the leading companies engaged in the business of chemistry. ACC members apply the science of chemistry to make innovative products and services that make people's lives better, healthier and safer. ACC is committed to improved environmental, health and safety performance through Responsible Care™, common sense advocacy designed to address major public policy issues, and health and environmental research and product testing. Approximately 170 companies are members of ACC.

The U.S. Department of Energy, through its Office of Energy Efficiency and Renewable Energy, and ACC are working together to implement ACC's commitments to the President's Climate VISION (Voluntary, Innovative Sector Initiatives: Opportunities Now) program. Climate VISION is a voluntary, public-private partnership to pursue cost-effective initiatives that will reduce the projected growth of America's greenhouse gas emissions. ACC members have made a commitment to reduce their greenhouse gas intensity toward an overall target of 18 percent by 2012, using a baseline of 1990. The commitment consists of a 12-element action plan that has energy efficiency as a key strategy.

As part of its joint efforts with EERE, ACC plans to develop a member education and mutual assistance program including open workshops. The workshops will be coordinated with EERE's BestPractices for industry, set up to develop and deliver industrial energy-efficiency tools and energy management best practice training.

ACC and the Chemical Industry Vision2020 Technology Partnership will also coordinate to identify longer-term advanced technology energy-efficiency opportunities by utilizing the Vision2020 technology roadmaps and collaborative technology development projects.

**American
Chemistry
Council**
Good Chemistry
Makes It Possible

American Iron & Steel Institute

Playing
a pivotal role in the steel
industry's ongoing renewal and
realizing its vision of the future, the
AISI engages in a wide variety of
collective and collaborative activities,
such as those carried out with EERE.
—Larry Kavanaugh
AISI

For over a century, North American steel producers have left their day-to-day rivalries behind to work with the American Iron and Steel Institute (AISI), in furthering its mission to promote steel as the material of choice and to enhance the competitiveness of the North American steel industry. AISI's overall mission centers around common goals and a clear vision for the future:

- To produce steel in a safe and environmentally friendly manner
- To increase the market for North American steel in both traditional and innovative applications
- To lead the world in innovation and technology in the production of steel.

AISI engages in a wide range of collaborative research projects through a partnership with the Office of Energy Efficiency and Renewable Energy (EERE). As an EERE partner, AISI lends its industry expertise to EERE-sponsored studies focusing on improving energy efficiency, reducing emissions, and enhancing product properties. In 2001, AISI led the revision of the *Steel Industry Technology Roadmap*, a guide for identifying the technological advances needed to achieve steel's vision of the plant of the future. Results of this partnership help establish baseline data that will provide the foundation for future energy savings and productivity improvements to achieve these goals.

The AISI is working with EERE to implement its Climate Vision action plan. AISI members have committed to the following actions:

- Develop a standard steel industry greenhouse gas emissions protocol
- Compile and report greenhouse gas emissions trends in terms of energy efficiency and intensity on an annual basis
- Establish an organizational mechanism to communicate climate change technologies and developments
- Establish a sector-wide target for reducing energy consumption per ton of steel and/or greenhouse gas emission intensity for 2012 tied to a 2002 database.

AISI intends to use Technology Roadmap objectives in collaborative R&D with EERE to support their commitment.



American Petroleum Institute

The American Petroleum Institute (API) is a national trade association representing more than 400 corporations involved in all aspects of the oil and gas industry. Among its many activities, API serves as a focal point for addressing oil and natural gas industry issues, including the R&D needs of its refineries through their semiannual Refining Meetings. API supports its public policy positions with scientific, technical, and economic research programs.

API's Technology Committee is charged with identifying the technical areas of greatest concern to the downstream industry and with developing technology strategies to address those concerns. The API Technology Committee, in cooperation with EERE, developed the *Technology Vision 2020—A Report on Technology and the Future of the U.S. Petroleum Industry*, and the *Technology Roadmap for the Petroleum Industry*. These documents focus on the research

Both
in Utah and nation-
wide...collaborative efforts
such as Industries of the Future are
important to developing some of the
technologies that will enhance our
quality of life in the 21st century.
—Red Cavaney, American
Petroleum Institute

needed to strengthen the industry over the next two decades. The documents recognize that government-industry collaboration and effective use of the scientific capabilities of the national laboratory system can leverage scarce funds for research to ensure that technology advances are identified and adopted.

API is a partner with EERE on a number of R&D projects including: "Gas Imaging for Advanced Leak Detection," and "Rotary Phase Burner Technology." The gas imaging project provides accelerated and simplified leak detection by optical imaging of hydrocarbon plumes, while the rotary burner project reduces emissions of carbon dioxide and nitrogen oxides. Members of the API Technology Committee review EERE proposals and projects. API co-sponsored the EERE Texas Technology Showcase, held in Houston, Texas, in March 2003.

API is committed to improving the energy efficiency and economic competitiveness of the U.S. petroleum industry. API's President Red Cavaney testified in the Congressional Forum at the EERE 2001 Utah Showcase and stated "Collaborative efforts such as Industries of the Future are important to developing some of the technologies that will enhance our quality of life in the 21st century."



Applied Proactive Technologies

Applied Proactive Technologies, Inc., (APT) provides energy efficiency programs to utilities and clients throughout the United States. They provide complete planning, managerial, implementation and evaluation services for conservation and load management, demand side management, energy efficiency, and market transformation programs.

The Motors division, headed by the Program Director, designed and ran the Southern California Edison Next Step Motor Program and currently runs the MotorUp Premium Efficiency Motor Initiative in New England, New Jersey, and Long Island, NY and the NYSERDA Energy Smart Premium Efficient Motors program in New York State.

MotorUp promotes NEMA Premium™ efficient motors in the commercial and industrial sectors with rebates, DOE *MotorMaster+* software and training, technical documents, newsletters, and other energy efficiency tools. MotorUp also gives Effective Motor Management seminars focused on the benefits, energy savings, and life cycle costing of premium motors and quality repair. MotorUp has recently launched a new Instant Rebate program allowing motor distributors to apply the MotorUp rebate directly to a customer's invoice when purchasing a NEMA Premium class motor.

MotorUp has helped implement NEMA Premium™ purchasing specifications for numerous companies including Raytheon, Anheuser-Busch, Crane Paper, Verizon, Suffolk County Water Authority, and many others. MotorUp has successfully encouraged motor manufacturers to develop NEMA Premium Efficient lines.

The Motor Decisions Matter (MDM) committee spearheaded the development of a Premium Efficient motor standard (NEMA Premium™) adopted nationally. MDM promotes motor management policy development nationally to upper level management at commercial and industrial companies.

As an Allied Partner, APT relies heavily on the resources and expertise of DOE's BestPractices. As a result of that relationship, MotorUp has had these successes:



As an Allied Partner, APT relies heavily on the resources and expertise of the Industrial Technologies Program.

- Distributed more than 700 Decision Tools for Industry software CDs through its training seminars during 2002
- Gave 37 "Energy Savings Through Motor Management" seminars that included training on the use of *MotorMaster+3.0*
- Trained more than 350 individuals on the use of *MotorMaster+3.0*
- Distributed more than 50 DOE *Energy Management for Motor Driven Systems* booklets
- Electronically distributed more than 100 DOE technical documents.

The MotorUp Premium Efficiency Motor Initiative has resulted in approximately 3,600 MWh annual savings to the region, representing approximately 146,500 barrels of oil and over 100 million tons of carbon emissions avoided annually.

Allied Partner

MotorUp
Premium Efficiency Motor Initiative

APT

ASERTTI

Established in 1990, the Association of State Energy Research and Technology Transfer Institutions, Inc., (ASERTTI) is a confederation of state and regional organizations with energy research and development and technology transfer responsibilities. ASERTTI members have a demonstrated track record of supporting high-impact R&D and applying the resulting new technologies in cooperation with utilities and other private and public organizations in their states. ASERTTI members, managing more than \$200 million in energy research annually, are major contributors to our nationwide energy research capabilities.

ASERTTI's goal is to increase the effectiveness of energy research efforts in contributing to energy security, environmental quality, and economic growth. ASERTTI achieves this goal by:

- Collaborating on research projects with state, federal, and private partners
- Sharing technical operational information among members and associates
- Speaking with one voice on energy R&D policy issues to national, state, and local decision-makers.

ASERTTI and its individual members have had a long, productive working relationship with DOE's Office of Energy Efficiency and Renewable Energy (EERE). ASERTTI is a DOE Allied Partner. In addition, ASERTTI, NASEO, and DOE are working in new ways to leverage research, development and demonstration and deployment (RDD&D) resources.

ASERTTI, NASEO and DOE have formed a new partnership, called the State Technologies Advancement Collaborative (STAC), to co-fund RDD&D opportunities important to the states and Regions.

Representatives of the states that are members of ASERTTI and NASEO work together with EERE's representative to enhance communications between EERE and the states. This team also identifies areas of mutual interest and develops collaborative energy RDD&D programs and projects.

Representatives of the states that are members of ASERTTI and NASEO work together with EERE to enhance communications between EERE and the states.



Allied Partner

Augusta Newsprint

Augusta Newsprint's roots go back to 1965, when, as Cox Newsprint, it consisted of one paper machine and a groundwood mill. Today, the mill's facilities include two paper machines, a wood yard, a thermo-mechanical pulp (TMP) mill, a recycled newsprint mill, a bark boiler, utilities, and support areas. The company employs 390 people and produces 1,200 tons of newsprint per day.

In May 2000, the Institute of Paper Science and Technology introduced Augusta Newsprint and its parent company, Abitibi Consolidated, to EERE. EERE subsequently assisted mill management with assessing energy use and identifying energy-saving opportunities, plus sharing costs and providing technical assistance for improvements, helping Augusta save \$1.4 million and approximately 130 billion Btu per year.

The Augusta Newsprint Energy Showcase Event, held in March 2002, showcased some of the technologies that help Augusta save energy and money, including:

Compressed Air—After doing a compressed air survey, management decided to increase system storage capacity, tie two mill systems together with improved controls, and repair leaks. These actions, which cost \$75,000, are saving the mill \$60,000 per year. "It showed us that, even though we're experienced, we were unaware of some important issues," said Chuck Amos, Augusta Newsprint's Engineering Manager.

TMP LD Transfer Pump Upgrade—This project involved removing a 10-inch control valve and installing a variable-frequency drive. It required a \$15,000 investment, but will save the mill \$12,000 per year in energy costs on one pump.

#1 Paper Machine Fan Pump Motor Replacement—Augusta Newsprint replaced a 1,250-horsepower (hp) (900-rpm) motor with an 800-hp (720-rpm) motor. This achieved a total savings of 500 hp; the mill invested \$123,000 on this project and will save \$93,500 per year in energy costs.

Advanced Quality Control Project—This project aims to improve TMP quality. After investing \$1.4 million, the AQC project is expected to save Augusta Newsprint \$1.12 million per year and reduce consumption of kraft pulp by 2,000 metric tons. Furthermore, energy use may be cut by 7,200 MWh per year.



New 10,000-gallon compressed air storage tank



BJM Corporation

BJM Corporation provides equipment for predictive maintenance, quality control, and trouble-shooting of electric motors, coils, windings, and transformers. As an Allied Partner with the Industrial Technologies Program (ITP), BJM has worked closely with ITP to further the goals of energy efficiency and efficiency optimization.

The All-Test Pro Division of BJM Corporation provides digital static motor and winding-circuit analysis equipment through distributors, representatives, and agents; the division is involved with electric-motor system energy and reliability research. As an active Allied Partner with ITP, the All-Test Pro Division helped coordinate and fund a reliability upgrade to *MotorMaster+*, a motor catalog and motor analysis software package. BJM supported updates to the software to allow maintenance testing and data importation, two key functions of *MotorMaster+*. Howard W. Penrose, ALL-TEST Pro Division General Manager, explains, "We strive to incorporate energy and motor-system management concepts in all aspects of our instrument training and software solutions, including providing links between our flagship software and *MotorMaster+*."

BJM uses *MotorMaster+* in motors and motor-efficiency training and workshops. Workshop leaders introduce participants to the *MotorMaster+* software and explain the benefits and efficiency gains that facilities can experience by using the software. BJM also hosts additional systems-efficiency training, including *Pump Systems/ Pumping System Assessment Tool (PSAT)* Workshops.

In addition to its energy-efficiency work with motors, BJM Corporation distributes submersible pumps.

Electrical submersible pumps offer a noise- and pollution-free solution compared to gas and diesel pumps. Mike Bjorkman, BJM Pumps Division Sales Manager, says, "We design our submersible pumps for high efficiency and reliability, to serve our customers and the environment."



BJM technician performs a pump test

For more information about BJM, visit www.sce.com.

Allied Partner



Boise Cascade

BP

Boise Cascade has a long history of energy management policies aimed at eliminating waste, minimizing consumption, and maximizing self-generation. Over the years, the company has advanced these goals through collaborative efforts with the Office of Energy Efficiency and Renewable Energy (EERE), national laboratories, and other visionary organizations. Today, Boise Cascade generates 54 percent of its energy needs from renewable resources.

In 2000, Boise Cascade won a prestigious American Forest and Paper Association Annual Environmental and Energy Achievement Award for demonstrating Methane DeNOx, a technology that improves wood-fired boiler efficiency while reducing emissions. In 2001, the company followed up with investigations to utilize this same

technology at other locations and currently plans to implement a modified version at its DeRidder, Louisiana, paper mill. Boise Cascade is also working toward demonstration of an advanced gasification power generation process along with other EERE emerging technologies.

Boise Cascade is a strong supporter of plant-wide assessments. All five of its fully integrated pulp and paper facilities have been modeled and audited.

Boise Cascade is a strong supporter of plant-wide assessments. All five of its fully integrated pulp and paper facilities have been modeled and audited. A follow-up case study was completed in 2001, for one such project at the International Falls, Minnesota, paper mill, that was done in cooperation with Oak Ridge National Laboratory. The company estimates saving 45 MMBtu per hour from six successfully implemented projects and process modifications, and is presently investigating similar approaches at other facilities.

Progress is also being made in less energy intensive divisions throughout the company. The container and wood products facilities have benefited from case studies presented on the EERE Web page. Several plants have completed compressed air studies and many more are working on lessons learned from participation in EERE BestPractices for Steam. One of Boise Cascade's plywood plants performed upgrades on a wood-fired boiler that reduced emissions and decreased natural gas consumption by 46 percent.

In addition to optimization studies and technology demonstrations, Boise Cascade is actively involved in the development and review of its industry strategy and business plan. The company has participated in industry merit reviews, technology road-mapping, and planning for the Washington State Industries of the Future event held in April 2002. It anticipates continued joint success from participation in IOF programs.

BP is working in collaboration with DOE and other companies on the development of technologies that will be used in the next generation of petrochemical process industries.

BP is a diversified and global energy and chemicals corporation, and is part of one of the world's largest petroleum and petrochemical supply and process groups—BP p.l.c. These companies supply natural gas, crude oil, and refined petroleum throughout the United States. BP also owns a large solar energy equipment supply company.

BP has had a long and successful partnership with DOE's Industrial Technologies Program, starting in 1989 with a partnership for the development of advanced separation technologies. Today, BP is working in collaboration with the Industrial Technologies Program and other chemical and petrochemical companies on the development of a number of technologies.

These technology collaborations include the design and application of an adsorption cooler for the separation of a petrochemical product (para-xylene) commonly used for the manufacture of synthetic fibers; new membrane technology ("mesoporous" membranes) for the cost-effective separation of olefins from petrochemical cracking processes, and new membrane materials for efficient separations of products from corrosive oxidation processes.

BP is a member of a consortium of companies that has developed and tested new alloys used in tubes for the efficient cracking of hydrocarbons to ethylene. The company is also a member of an industrial consortium developing heat exchanger tubes used in fired process heaters.

BP is also working in collaboration with DOE and other companies on the development of technologies that will be used in the next generation of petrochemical process industries. These collaborations include process development for on-site manufacture of acetic acid from fermentation products, and completely new designs for ethylene manufacture from petroleum and natural gas fractions. The new designs will significantly improve the energy intensity currently required to manufacture these important products.



Cast Metals Coalition

CMC has sponsored showcases to demonstrate the tangible difference that DOE research is having in the metal casting industry.

The Cast Metals Coalition (CMC) facilitates DOE's partnership with the metal casting industry. The CMC is comprised of the Steel Founders' Society of America (SFSA), American Foundry Society (AFS), North American Die Casting Association (NADCA), and the Advanced Technology Institute (ATI). AFS, NADCA, and SFSA are the leading technical societies for the industry and collectively represent the majority of U.S. metal casters. ATI, a leading technology organization, provides management support on CMC activities and is involved in all stages of the partnership.

The CMC is an outstanding partner with DOE, enthusiastically supporting all aspects of the partnership—from the original Metal Casting Compact, Vision, and Roadmap to successfully implementing research and development (R&D) and disseminating results to industry. CMC continues to provide leadership as it renews its Compact with DOE and updates its Vision and Roadmap. The CMC provides technical oversight on metal casting R&D.

CMC members provide outreach and dissemination of R&D results to the industry through conferences, seminars, Web sites, and trade journals. They actively communicate opportunities available from DOE technical and financial assistance programs, demonstrated by metal casting industry participation in BestPractices, NICE³, Inventions and Innovation, and State IOF.

Since the beginning of its partnership with DOE, CMC has helped to implement and manage nearly 100 R&D projects involving dozens of universities and laboratories, more than 300 industry partners, and hundreds of students. CMC has consistently participated in numerous DOE Energy Efficiency events. CMC has sponsored events to demonstrate the tangible difference that DOE research is making in the metal casting industry. It facilitates advances in innovative casting techniques such as lost foam, and disseminates R&D results including casting guidelines, design tools, energy manuals, and mechanical properties data to reduce energy consumption and simultaneously produce higher-quality castings. CMC is currently sponsoring a benchmarking study on energy use in the industry to identify new opportunities for saving energy and measuring progress.



Caterpillar, Inc.

Caterpillar, Inc., is a leading manufacturer of construction and mining equipment, diesel and natural gas engines, and industrial gas turbines. The Technical Services Division, which functions as Caterpillar's Technical Center, is based in Peoria, Illinois, and undertakes product and process development. Caterpillar's Technical Center works on various initiatives with the U.S. Department of Energy's Industrial Technology Program (ITP) to perform fundamental and applied research.

Caterpillar Technical Center researchers working in materials processing, manufacturing technology, and structural design and analysis have worked with ITP on numerous initiatives. As part of ITP's Mining Industry of the Future effort, Caterpillar has teamed



with Oak Ridge National Laboratory (ORNL) to develop innovative wear-resistant coatings. More recently, Caterpillar is developing a unique system to model fabrication technology with help from ITP's Industrial Materials for the Future. The partnership between Caterpillar and ITP makes it possible for Caterpillar to work with ORNL and several major universities to develop sophisticated, energy-efficient, and readily applicable technology.

Working with the ORNL Metals Processing Laboratory Users Facility, Caterpillar has applied infrared technologies for wear-resistant coatings, developed true-stress/true-strain relationships for steels at elevated temperatures, studied sulfur segregation in steels using simulation technology, analyzed quantitative characterization of phase transformation and dilation strains of hypereutectoid alloy, and improved the capability of the detection of cracks in green powder compacts. Access to ORNL's specialized technical expertise and equipment is a significant contributor to the success of Caterpillar's materials processing research.

Additionally, Caterpillar is active in the Supporting Industries of ITP. Caterpillar engineers participated in Roadmap development for the powder metallurgy, heat-treating, forging, and welding industries. Partnering with ITP, other industry segments, and universities enhances Caterpillar's ability to develop technology that will significantly change the way we manufacture our products.



Commonwealth Aluminum

Commonwealth Aluminum is one of North America's leading manufacturers of aluminum sheet and tubing. Commonwealth Aluminum has unmatched cost-efficiency and manufacturing flexibility. The company manufactures more than 3,800 variations of aluminum sheet and tubing products to exacting customer specifications. Its production exceeds one billion pounds of aluminum products. These products are sold to distributors and end-users, principally for use in building and construction products such as roofing, siding, windows, and gutters; transportation equipment such as truck trailers and bodies, as well as automotive parts; and consumer durables such as cookware, appliances, and lawn furniture.

Commonwealth Aluminum has helped establish a history of collaboration with DOE's Office of Energy Efficiency and Renewable Energy (EERE) as a charter member of the aluminum research consortium, Secat, Incorporated. Commonwealth participates in six EERE Aluminum cost-shared R&D projects that address industry-defined priorities as well as national goals for energy and the environment. Projects include isothermal melting, reduction of oxidative melt loss, evaluation and characterization of in-line annealed continuous cast sheet, modeling optimization of direct chill casting to reduce ingot cracking, and structural factors affecting formability of continuous cast aluminum.

Commonwealth Aluminum recently completed EERE plant-wide assessments at two sheet production operations. The first is a continuous casting plant located in Newport (Urichsville), Ohio, and the second is a chill casting plant located in Lewisport, Kentucky. The two different processes will provide a direct comparison

Commonwealth Aluminum recently completed EERE plant-wide assessments at two sheet production operations.

of energy requirements and future savings opportunities for these two process technologies. The results of the plant-wide assessments are currently being finalized.



Compressed Air & Gas Institute

The Compressed Air & Gas Institute (CAGI), a trade association of manufacturers of compressed air systems equipment, joined with the U. S. Department of Energy in 1996 to improve the effectiveness and efficiency of compressed air systems. The Institute is focusing on education and training of users and purchasers of compressed air systems.

As part of its training and education initiative, CAGI has participated as a founding member of the Compressed Air Challenge in developing two training courses, *Fundamentals of Compressed Air Systems* and *Advanced Management of Compressed Air Systems*. The recommendations and knowledge provided in these courses will help users reduce the cost of operating their compressed air systems while simultaneously improving the performance of those systems. CAGI held thirteen training sessions in eight cities throughout the country in 2002. The institute has also developed a series of videos as a resource about compressed air systems. CAGI and DOE cooperated on the latest installment in the series, *How to Select an Air Compressor*, which helps buyers identify the items that will affect their decision. The video shows how approaching the purchase of a compressor with the entire system in mind, and using life cycle costs to analyze the many available choices, will allow purchasers to minimize overall cost and maximize performance of their systems.

To fulfill its mission of delivering information to users and purchasers, CAGI has created a standardized format for reporting performance. CAGI members have agreed to supply performance data on the standardized data sheets upon request. The members of CAGI have been determining performance according to recognized international standards for many years, and the standardized forms will clarify the data for easier comparison.

Most recently, CAGI has begun development of a curriculum for training design professionals on the systems approach to compressed air. CAGI also continues to be an active member of educational initiatives undertaken by the Compressed Air Challenge, including enhancements to the *AIRMaster+* software.

The Compressed Air & Gas Institute joined with DOE to improve both the efficiency and effectiveness of compressed air systems.

**Allied
Partner**



Compressor Distributors Association

A little-known benefit of the formation of the Compressed Air Challenge in 1998 was the idea that compressed air equipment distributors had a vested interest in working together as a single voice to make U.S. industry more competitive in a world market. The Compressor Distributors Association (CDA) was formed to share the expenses of becoming one of the original program sponsors. The CDA is an association of organizations representing over 500 independent businesses across North America.

Historically fierce competitors, the notion that representatives of the Gardner Denver, Sullair, CompAir, and Atlas-Copco equipment distributors could meet in the same room would be followed by jokes about a 911 phone call to the local authorities. Acronyms identify most of the syndicate families: Gardner Denver Distributors are represented by the ICDA (Industrial Compressor Distributor Association), Sullair members are represented by their Distributor Council, CompAir members are represented by the NAACD (North American Association of Compressor Distributors) and the Atlas Copco members are represented by the ACIDA (Atlas Copco Industrial Distributors Association).

Since 2000, CDA has trained more than six hundred distributor personnel in cities across the country. In addition, CDA supported an invitation from DOE to its members to become Allied Partners. More than 30 distributors have accepted. CDA continues its commitment to industrial energy-efficiency education by reviewing a compressed air manual being published by the Compressed Air Challenge and is working with Iowa State University and others to develop a new curriculum in compressor engineering.

CDA's primary emphasis is on educating and raising the bar for compressor distributors. As such, CDA is a very active supporter of the Compressed Air Challenge and its training program. Additionally, the CDA cosponsored an *AIRMaster+* Specialist Qualification training workshop in June 2002.

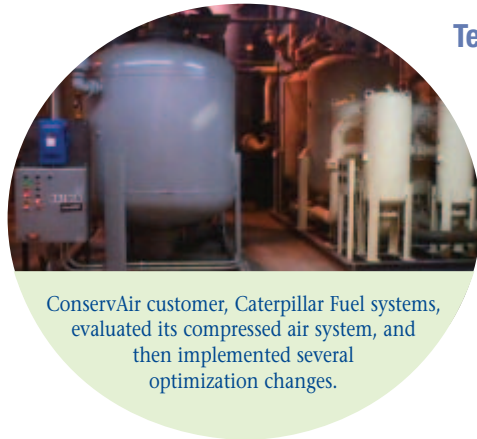
Compressed air equipment distributors serving as a technical resource, can contribute to and have a vested interest in working together as a single voice to make U.S. industry more competitive in a world market.

ConservAIR

Established in 1987 to help manufacturers use compressed air more efficiently, ConservAIR Technologies Company, LLP, develops products and application technologies to improve the performance of industrial compressed air systems. At the inception of the Compressed Air Challenge, ConservAIR recognized the need to actively participate in the process. ConservAIR is also an active participant in the *AIRMaster+* Ad Hoc Committee and is a DOE Allied Partner.

Teaming with DOE, ConservAIR has shared the knowledge and experience gained over a decade to save industry millions of dollars in energy costs. EERE has completed two studies utilizing ConservAIR application technologies with annual savings reported: Caterpillar Fuel Systems 5,280,000 kWh (\$226,000 per year); and Sanmina Corporation 742,000 kWh (\$63,000 per year).

Two people who work for ConservAIR are qualified *AIRMaster+* Specialists and have contributed to the *AIRMaster+* training curriculum. ConservAIR employees also include a Qualified *AIRMaster+* Instructor who was involved in formulating the Qualified *AIRMaster+* Specialist curriculum and exam, as well as instructors qualified to teach the Fundamentals and Advanced Management of Compressed Air Systems for the Compressed Air Challenge®. ConservAIR also encouraged several of its major distributors to attend an *AIRMaster+* Specialist Qualification Training and become Qualified *AIRMaster+* Specialists. Eight individuals from these various distributors were ultimately qualified.



ConservAIR customer, Caterpillar Fuel systems, evaluated its compressed air system, and then implemented several optimization changes.

Teaming with EERE, ConservAIR has shared the knowledge and experience gained over a decade to save millions of dollars in energy costs.

ConservAIR has co-sponsored several CAC training sessions and works with its distributors to promote the various DOE initiatives and disseminate information, including the *Assessment of the Market for Compressed Air Efficiency Services*. ConservAIR also participated in the California Energy Solutions events. ConservAIR is developing a new Web site that will serve two functions: providing customers with a single location for linking to other pertinent Web sites and a portal linking to an energy management system developed by ConservAIR, available only to subscribers. ConservAIR is committed to working in partnership with DOE EERE through ongoing and future efforts to establish standards for the compressed air industry and implement BestPractices efforts.

Allied Partner



Allied Partner

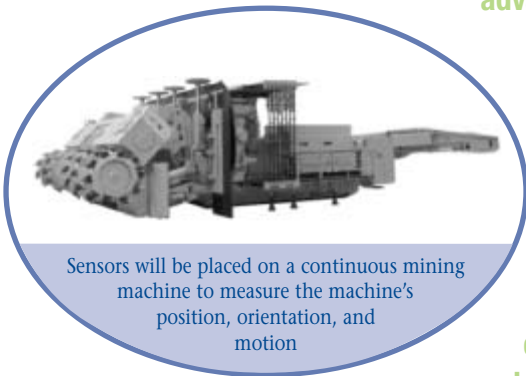


CONSOL Energy

CONSOL Energy, Inc., is among the nation's top energy companies, producing coal and natural gas. CONSOL Energy mines more high-Btu bituminous coal than any other producer in the United States and is one of the largest U.S. producers of coalbed methane. CONSOL Energy's Research & Development Department is a private research organization devoted to energy production and use. With an annual R&D budget of \$7 million, CONSOL Energy performs research to enhance safety, improve productivity, control emissions and by-products, and improve efficiency in energy production and use.

Led by the efforts of CONSOL Energy's vice president for Research and Development, CONSOL Energy has been a champion for the Mining Industry of the Future (IOF) since its inception. CONSOL Energy has provided leadership and technical expertise in all aspects of Mining IOF implementation.

One project alone, an advanced sensor to improve the ability to measure and analyze mineral seams, will save an estimated 6.4 trillion Btu per year by 2020.



Sensors will be placed on a continuous mining machine to measure the machine's position, orientation, and motion

CONSOL Energy has:

- Provided industry perspective and technical expertise in developing the Mining IOF Vision and three subsequent Mining IOF Technology Roadmaps
- Participated in EERE's Mining IOF Annual Portfolio Reviews and sponsored an independent project review to evaluate promising mining technologies
- Championed the State IOF strategy and is currently working with industry and government leaders in West Virginia to translate the benefits of the IOF strategy to companies in the state.

Most importantly, CONSOL Energy is contributing its R&D expertise to improving energy efficiency and competitiveness in U.S. mining. This includes R&D on advanced sensors to perform real-time stress measurement as well as technologies to perform imaging ahead of mining. These technologies will significantly reduce excavation requirements in mining, resulting in significant improvements in mine safety as well as reduced energy requirements. On one project alone, development of an advanced sensor to improve the machine's ability to measure and analyze mineral seams will save an estimated 6.4 trillion Btu per year by 2020.



Delphi Corporation



Nickel aluminide fixtures loaded with parts to be heat treated

Multi-national Delphi Corporation is a world leader in mobile electronics and transportation components and systems technology. Headquartered in Troy, Michigan, Delphi's three business sectors—Dynamics and Propulsion; Safety, Thermal, and Electrical Architecture; and Electronics and Mobile Communication—provide comprehensive production solutions for its customers.

Delphi has a long history of partnering with DOE's Office of Energy Efficiency and Renewable Energy (EERE). Delphi and EERE signed an initial cooperative research and development agreement in 1992 for Delphi to apply nickel aluminide alloys, including alloy development, welding, melting, and casting technologies in its manufacturing facilities. The new alloy enables a more energy-efficient manufacturing process not only for Delphi, but also for other U.S. manufacturers with similar needs.

More recently, Delphi engineers worked with the Oak Ridge National Laboratory, the inventors of the alloy, to apply the material in their heat treating facilities, changing more than 500 fixtures used in their carburizing furnaces. Carburizing furnaces are large gas-fired systems that heat treat many tons of steel per day. The nickel aluminide fixtures last three to five times longer than current high performance steel alloys, and are at least three times stronger at operating temperatures than conventional alloys. These properties enable improved energy and production efficiencies of up to 33 percent. Delphi's plant in Saginaw, Michigan, was the site of an event to highlight the commercialization and use of nickel aluminide fixtures in its heat treating furnaces.

Delphi also participates in the Green Power Market Development Group, which is developing strategies to reduce green power costs, reduce market barriers, and help articulate the business case for green-energy use, including wind, solar, landfill gas, and fuel cells.

The Dow Chemical Company

The Dow Chemical Company is a leading partner with DOE's Office of Energy Efficiency and Renewable Energy.

The Dow Chemical Company is a leading provider of chemical, plastic, and agricultural products and services to essential markets such as food, transportation, health and medicine, personal and home care, and building and construction. As a leader in innovation and development, Dow collaborates with the Office of Energy Efficiency and Renewable Energy (EERE) through the Chemicals Industries of the Future. Dow's activities include participation on the Vision2020 steering committee, the Vision2020 Chemicals Plus project, and the Vision 2020 Challenge initiative.

The company represented cross-cutting engineering science from the chemical industry at the Utah 2001 Industry Showcase, and chaired the steering committee for and hosted a plant tour at the EERE Texas Technology Showcase in March 2003. Dow has also joined with EERE in organizing a consortium of ten companies, seven universities, and six national laboratories researching multi-phase fluid dynamics.

Dow collaborates with EERE on several ongoing partnership projects:

- Corrosion Prediction in Mixed Solvents
- Solution Crystallization Tools
- Distillation Column Modeling Tools
- In-situ sensors for the chemical industry

The company has also improved its manufacturing operations with seven new cogeneration power facilities since 1994. The combined facilities have replaced less efficient energy generating facilities, reducing energy usage by approximately 23 trillion Btu per year and eliminating approximately 1.2 million metric tons of CO₂ emissions. At the EERE Texas Technology Showcase, Dow highlighted new methods for NO_x reductions in the chemical and petroleum industries.



DuPont

Two hundred years since their founding, DuPont is a global leader in science-based solutions in food and nutrition, health care, apparel, home and construction, electronics, and transportation. DuPont is an active partner with the Office of Energy Efficiency and Renewable Energy (EERE), heading two Vision2020 projects—direct capture of bio-based products and a biomass-to-energy conversion project. DuPont is leading a consortium of industrial companies (in cooperation with the American Institute of Chemical Engineers) for the development of software tools that will help EERE and the chemical industry identify important energy saving opportunities in process plants. In addition, DuPont supports technology roadmap development and participates on the Vision2020 Steering Committee.

DuPont is dedicated to innovation. An important aspect of that is research partnerships such as our projects with EERE.
—John Carberry
DuPont

DuPont is a partner for several technology development activities with the Industrial Technologies program:

- Corrosion Prediction in Mixed Solvents—For the development of software that will predict alloy corrosion in organic and mixed-solvent solutions. Projected benefits include an estimated energy savings of 33 million Btu per year per unit installed and elimination of shutdowns associated with overly complicated equipment.
- Molecular Simulation—Developing software tools with molecular modeling capabilities for design of improved membrane separation techniques. Projected benefits include elimination of certain steam-driven chemical separations and significantly reduced separation energy use.
- Resistance to Metal Dusting—Collaborating with a host of partners investigating the properties of materials resistant to corrosion associated with metal dusting in the high-temperature, high-carbon environments prevalent in many chemical and petrochemical processes. Projected benefits include operational savings of \$50,000 per year per plant and savings of \$200 to 290 million per year in the hydrogen industry.
- Computational Chemistry and Reaction Engineering Workbench—Developing a suite of graphical user interface modeling software that will replace the array of complicated, often unused chemical modeling tools existing today. Projected benefits include improved design of chemical processes and processing equipment and increased energy savings and efficiency.



Duraloy Technologies, Inc.

Duraloy Technologies, Inc., part of the Park Corporation, has been a technology leader in engineering, design, research, and the development and production of high-alloy heat-resistant castings since the firm's founding in the 1920s. Duraloy was the first foundry in the U.S. to centrifugally cast high alloys and it is a leader in alloy development. Duraloy has successfully blended its excellent technology and alloy base with the global sales and marketing support of another Park Corporation business unit, West Homestead Engineering and Machine Co. (WHEMCO), to establish the corporation as a world-wide leader in casting technology. Duraloy serves the steel, furnace builders, petrochemical, chemical, and commercial heat treating industries with cost-effective quality products, leading-edge alloys and innovative engineered solutions.

Duraloy's partnership with the Industrial Technologies Program includes the following activities:

- Worked with the Oak Ridge National Laboratory MPLUS user center to access computational thermodynamics and thermo-mechanical testing facilities for alloy optimization.
- Demonstrated the first commercial-scale manufacturing of centrifugally cast and welded nickel aluminide as part of the Industrial Materials of the Future (IMF) and the Steel Industry of the Future (IOF).
- Producing centrifugal castings of experimental alloys to support a Chemical IOF-led project on improved alloys for ethylene production.
- Leading a project to improve cast stainless steel alloys for applications under the IMF effort.



Nickel aluminide furnace rolls being manufactured at Scottsdale, PA facilities



Emerson

As a charter partner of the DOE Motor Challenge program in 1993, and a sponsor of the Motor Decisions Matter campaign, Emerson Motor Technologies has long understood the value of advancing industrial energy efficiency, and partnering with EERE to help make its energy-efficiency goals a reality.

Emerson Motor Technologies has made it a primary mission to seek out and participate in energy-efficiency programs that make business sense to the motor industry and economic sense to its customers. By looking at factory operations as a whole, instead of one motor at a time, Emerson Motor Technologies is helping its customers identify real energy-reducing solutions and process improvements.

This major focus is driving Emerson Motor Technologies' present and future energy-efficiency efforts. It is through previous involvement in energy programs that Emerson Motor Technologies has gained insights that help Emerson move forward with new premium motor programs.

In 1989, Emerson Motor Technologies became an original founder of EERE's Motor Challenge program, later expanded to include all of BestPractices. The program focused on energy efficiency within an entire motor system, looking at each element of a motor system, such as the motors, drives, controls, and pumps, rather than just the motor.

In 1997, Emerson Motor Technologies continued its dedication to energy efficiency by becoming one of the first motor manufacturers to conform to the federal Energy Policy Act (EPAct), which set the standards for energy-efficient motors.

In June 2001, Emerson Motor Technologies introduced its line of NEMA Premium™ motors. The extensive line of industrial, commercial, and HVAC motors meet or exceed the new National Electrical Manufacturers Association premium efficiency standards—the most comprehensive in the industry.

In 2001, Emerson Motor Technologies also became a sponsor of the nationwide Motor Decisions Matter (MDM) campaign, which promotes sound motor management and the use of NEMA Premium™ motors. The campaign has 29 sponsors, which also include DOE and the U.S. Environmental Protection Agency.

Emerson continues to be an active EERE partner by distributing publications and participating in Energy Solutions events in Buena Park and San Jose, California, in 2002.



Emerson Motor Technologies has made it a primary mission to seek out and participate in energy efficiency programs.

Allied
Partner



Energy Center of Wisconsin

The Energy Center of Wisconsin (ECW) provides objective research, information, and education on energy issues to businesses, professionals, and policymakers. To fulfill this mission, the Energy Center manages programs to help industry, hosts educational workshops, and makes information available through its Web site. The Energy Center is a private, non-profit organization.

As an Allied Partner, ECW works with DOE to raise awareness of energy efficiency technologies and practices for industry by leveraging the DOE Industries of the Future strategy and BestPractices. For example, ECW is working with the state's metal casters to adopt the DOE Metal Casting Roadmap and pursue priority projects. ECW recently developed a roadmap for Wisconsin papermakers, and now facilitates action teams working to accelerate deployment of advanced papermaking technologies.

ECW was selected to design and manage an expanded Wisconsin Industries of the Future effort for seven industries, funded by \$2.3 million of state public benefits charges.

Other recent collaborative activities include:

- Co-sponsored three Fan and Pump Optimization workshops.
- Co-sponsored six Compressed Air Challenge (CAC) training workshops. ECW is very active in the CAC
- Sponsored an *AIRMaster+* Specialist Qualification Training workshop at which an ECW employee became a Qualified *AIRMaster+* Specialist
- Provided a series of one-day steam training workshops and one motor systems training
- Facilitated Industries of the Future roundtable discussions for the Wisconsin printing, agricultural biotechnology, food processing, and plastics industries
- Managed events such as the Annual Governor's Business Roundtable on Energy and the Environment that promote EERE programs, products, and services
- Created new curricula modeled on DOE's BestPractices, including Industrial Energy Management, Ammonia Refrigeration, and Industrial Process Controls.



Wisconsin metal casters discuss DOE's Metal Casting Roadmap

We leverage EERE's industrial programs for Wisconsin. Our success is market proof that EERE does valuable work. —Kevin Grabner Senior Project Manager, Energy Center of Wisconsin



Allied Partner

Energy Research Company

Energy Research Company (ERCo) has successfully partnered with DOE's Office of Energy Efficiency and Renewable Energy (EERE), industry, and state agencies to develop and provide innovative technologies and services for industry's use. These projects have resulted in actual energy savings of 62,000 MMBtu per year and aluminum production increases of 46 million pounds per year.

ERCo achieved its first commercial success with sixteen scrap decoaters (NICE³ Project) sold throughout the world. Other projects are on the verge of commercial introduction. ERCo has participated in the following EERE efforts.

National Industrial Competitiveness Through Energy, Environment and Economics (NICE³):

- Demonstrated a decoating kiln now being commercially sold; it meets EPA standards and reduces energy use by 24 percent.
- Developed corrosion-resistant coatings for recuperators. A pilot-scale test was successfully completed and a full-scale demonstration is underway.

Inventions and Innovation (I&I):

- Inert anodes for the primary aluminum industry are being developed. These replace traditional carbon anodes, reducing energy use by 25 percent and eliminating green-house gas emissions.
- The first commercialized laser induced breakdown spectroscopy (LIBS) is expected to be sold in June 2003. Three are currently being demonstrated in the aluminum industry.

Sensors and Controls:

- Continued developing and testing an LIBS probe.



ERCo's innovative Vertical Flotation Melter Furnace

Energy Research Company has successfully partnered with EERE, industry, and state agencies to develop and provide innovative technologies.

Aluminum:

- A Vertical Flotation Melter (VFM) and decoater was pilot tested for the aluminum industry; the VFM reduces energy use by 60 percent.
- Applied the LIBS technology for in-situ, real-time measurement of melt constituents.

Glass:

- The LIBS technology was also adapted for measuring glass feedstocks and identifying cullet contaminants and cullet color.

Plant Assessments:

- Participated in plant assessments at Crucible Specialty Metals, Charter Steel, Utica Corporation, and Metlab.



ENERGY RESEARCH COMPANY

Energy Solutions Center, Inc.

The Energy Solutions Center, Inc., is a technology commercialization and deployment organization consisting of more than 40 energy utilities and municipal energy authorities. Over 20 equipment manufacturers and vendors participate as affiliate members. Energy Solutions Center's mission is to accelerate the market acceptance of new energy-efficient technologies.

The Center and EERE have worked together for several years to bring energy-efficient and environmentally sound equipment strategies to utility customers. EERE has been an active participant in the Center's Technology and Market Assessment activities, where new tools and resources to enhance the energy efficiency and productivity of industrial customers were introduced. These activities have also provided DOE with insights and information about the current market needs for the development and commercialization of new gas-fueled equipment.

By working with DOE, the Energy Solutions Center and gas utilities have been able to bring cost-effective and energy-efficient solutions to industrial customers.

Recent activities include the holding of a series of workshops on boiler and burner systems that include elements of the DOE BestPractices materials on steam generation. The Center has launched a successful Web site dedicated to air compression, which also highlights DOE's BestPractices material on air compression systems. A Center

consortium also participated with EERE and the Industrial Heating Equipment Association on the development and application of the Process Heating Assessment and Survey Tool (PHAST).

The Center's nationally recognized *Gas Technology* magazine, with a circulation of 60,000, has covered the successes of the DOE technology development program and has highlighted the DOE's BestPractices activities to enable end users to benefit from the myriad of DOE tools, data, and case studies.

The Center, its utility members, and other energy industry associations recently completed a year-long effort to define "Natural Gas Technology Priorities for Industrial Applications." With the guidance and assistance of EERE, members of the Center mapped out a strategy to overcome the obstacles to the development of more efficient technologies that would improve industrial productivity and competitiveness.

Fairbanks Morse Pump

Fairbanks Morse Pump has sponsored several training sessions in Virginia and Texas on pump energy reduction where the focus was on the use of PSAT.

For over a century, Fairbanks Morse Pump has been manufacturing a wide range of pumps for applications in public works and industrial installations. The Fairbanks Morse Pump manufacturing facility provides advanced engineering and technology, a major testing facility for product performance evaluation, and computerized machining centers for high-quality manufacturing techniques. Fairbanks Morse Pump sales and service facilities are located across the United States and throughout the world.

As a DOE Allied Partner, Fairbanks Morse Pump works with its customers to reduce energy consumption. The company's Director of Engineering is involved in a number of activities with DOE. Through his involvement in the Hydraulic Institute's (HI) Education Committee, he was able to guide the development of the Energy Reduction video program developed by HI and sponsored by DOE, as well as the development of Web-based training on pumping fundamentals.

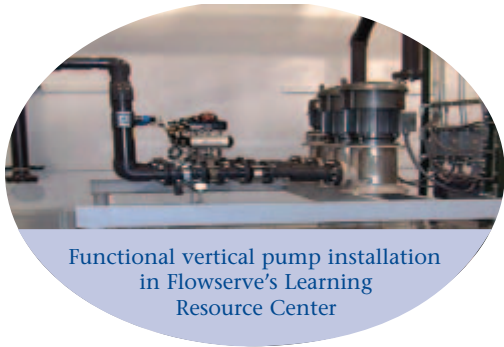
When DOE initiated its efforts to qualify instructors in the use of its *Pumping System Assessment Tool* (PSAT) software tool, a Fairbanks Morse Pump representative became a Qualified Pumping System Specialist as well as a DOE qualified instructor.

During 2002, Fairbanks Morse Pump sponsored ten end-user training sessions in Virginia and Texas on pump energy reduction where the focus was on the use of PSAT. In addition, they also conducted four shorter PSAT seminars for end users and a special introductory session for senior managers in Florida, Wisconsin, and Mississippi. Through these sessions, approximately 400 people have been trained in the use of PSAT and were provided with DOE's *Decision Tools for Industry Software* CD. This type of training is an exemplary model of partnering that helps to leverage limited resources and facilitates the dissemination of important energy-efficiency materials to industry.

Furthering its commitment to energy reduction for its customers, Fairbanks Morse Pump has also developed a graphical method of selecting pump control set points that allows for the efficient application of variable-speed pumps.



Flowserve Corporation



Functional vertical pump installation in Flowserve's Learning Resource Center

Flowserve Corporation is one of the world's largest manufacturers of pumping system equipment, producing engineered pumps, precision mechanical seals, automated and manual quarter-turn valves, control valves and actuators, and providing a range of related flow-management services, primarily for the process industries. Flowserve also provides repair and replacement services for pumping systems. Headquartered in Irving, Texas, Flowserve generated \$2.3 billion in 2002 sales.

Flowserve's products are found in various process industries, including: petroleum refining, oil and gas production, pipeline, chemical, power generation, pulp and paper, mineral and ore processing, water resources, pharmaceuticals and general industrial applications. Flowserve's product line includes pumps formerly sold under known names such as Ingersoll Dresser, Byron Jackson, Durco, Pleuger, and many others.

As an EERE Allied Partner, Flowserve has been a leader in adopting the Pumping System Assessment Tool (PSAT) software and the PSAT Specialist Qualification Training into its corporate training repertoire and in incorporating the training's assessment methodology into its sales and marketing strategies. Flowserve Educational Services group operates a state-of-the-art Learning Resource Center to provide training to customers' engineering, maintenance, and operations staff. This group has updated its existing customer workshops to include a PSAT overview and mention of EERE BestPractices activities. Specifically, the workshop entitled Pumping System Analysis—Level I (which includes PSAT software) presents how to analyze a pumping system for potential improvements.

Flowserve hosted one of the first PSAT Specialist Qualification Training workshops in 2001, and hosted two of these workshops in 2002. Twenty-three Flowserve staff have completed the training and passed the exam to become a Qualified PSAT Specialist, and Flowserve has one of the four PSAT Qualified Instructors to date.

Flying J Refinery

Flying J Refinery converts approximately 25,000 barrels per day of crude oil, natural gas liquids, and other feedstocks into diesel fuel, propane, gasoline, jet fuel, and specialty wax. The refinery has made great strides in keeping pace with advancing technology.

Flying J has demonstrated its commitment to improving process efficiency by making new capital investments in equipment and advanced process control and by participating in Office of Energy Efficiency and Renewable Energy (EERE) BestPractices activities and



Flying J Refinery hosted one of the 2001 Utah Showcase tours

Flying J was the first Utah refinery to agree to act as a Showcase plant and to display what can be accomplished when government and industry work together.

energy assessments. It was the first Utah refinery to agree to act as a Showcase plant and to open its gates to display what can be accomplished when government and industry work together. The on-site tour enabled Showcase attendees to view the new energy-saving, environmentally friendly technologies that Flying J has implemented. Learning first-hand about these new innovations and exchanging ideas with industry experts, researchers, colleagues, and EERE staff encouraged attendees to adapt these innovations in their own facilities. Flying J also participated in the briefing for high school students on professional careers in the refinery industry. Flying J's readiness to adopt new technologies and willingness to open its facilities says volumes about Utah's attitude toward business innovation, its concern for industry, and its understanding of the nation's energy needs and resources.

Flying J highlighted six different applied technologies and best practices at the Showcase. Together, these technologies have resulted in increased liquid volume yield of approximately 4 percent, reduced energy consumption of 53 billion Btu per year, reduced costs by more than \$320,000 per year, reduced carbon dioxide emissions by more than 4,600 tons per year, reduced SO₂ emissions of almost 6,400 pounds per year, reduced NO_x emissions by more than 11,300 pounds per year, and reduced fugitive emissions of VOCs of 10-12 tons per year.

A plant-wide energy efficiency assessment performed at the refinery identified \$1.2 million in savings and productivity improvement opportunities. This included electrical savings of 737 megawatt-hours per year and fuel savings of almost 300,000 million Btu per year.



**Allied
Partner**



FMC Corporation

The FMC Corporation is a focused chemical company supplying the agricultural, specialty, and industrial chemical markets. Utilizing advanced technologies and customer-specific R&D, FMC provides solutions to the food and agricultural, pharmaceutical, pulp and paper, textile, glass and ceramic, rubber and plastic, lubricant, structural pest control, turf and ornamental, specialty, and other related industries.

In August 2001, three divisions of FMC's Industrial Chemicals Group formed the first end-user Allied Partnership with the Office of Energy Efficiency and Renewable Energy (EERE). FMC Alkali Chemicals is the world's largest producer of natural soda ash and the market leader in North America in the production of sodium bicarbonate, sodium cyanide, sodium sesquicarbonate, and caustic soda. FMC Hydrogen Peroxide is a worldwide producer of hydrogen peroxide with manufacturing sites in the United States, Canada, Mexico, Spain, the Netherlands, and Thailand. FMC Active Oxidants is the world's leading supplier of persulfate products and a major producer of peracetic acid and other specialty oxidants.

FMC focuses heavily on improving resource efficiency, using site energy-reduction teams and energy-focused interdivisional technology support teams in the company's energy conservation efforts. As an EERE Allied Partner, FMC reviews the entire R&D project portfolio for opportunities to participate in the development and application of promising technologies. The company

engages in plant energy site surveys and enrolls its employees in EERE BestPractices training to improve the energy efficiency of its operations. The company also incorporates EERE products, tools, and services into its operations and promotes the use of those tools and strategies within the chemical industry.

The strong market positions held by our Alkali Chemicals, Hydrogen Peroxide, and Active Oxidants divisions are largely the result of innovative process technologies such as those developed through our partnership with EERE.

—Brian Wimer
FMC Corporation

The FMC Allied Partnership with EERE focuses on the following initiatives:

- Disseminating information on EERE and its resources
- Conducting energy assessments at multiple facilities
- Providing training workshops on energy efficiency
- Participating in Texas Industries of the Future activities
- Evaluating opportunities to implement emerging technologies

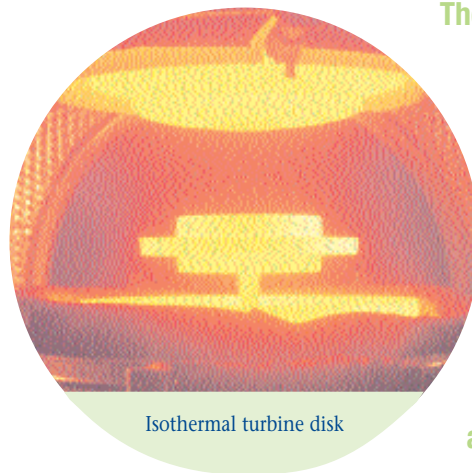
FMC is currently a partner in the development of a new reactor technology for the manufacture of hydrogen peroxide in collaboration with the Stevens Institute of Technology. The new reactor has the potential to lower costs of peroxide manufacture, as well as provide the opportunity to produce peroxide on-site at end user locations.

Forging Industry Association

The Forging Industry Association (FIA) provides its members with management, marketing, engineering, environment and safety, and regulatory assistance services. Its outreach programs include assistance to end-use customers, taking part in trade shows, and acquainting students at the university level with the forging process and production. FIA committees conduct conferences and seminars to assist members in the total operation of their organizations. FIA hosts Web-based interactive educational courses on forging technology and company management. Its Web site provides important information about the forging process, the North American forging industry, and the producers of forged products. The Forging Industry Educational and Research Foundation is a supporting organization that promotes formal education and scientific research. Through cooperative efforts with DOE's Office of Energy Efficiency and Renewable Energy (EERE), FIA has provided the leadership needed for the development and distribution of the Forging Industry Vision and Technology Roadmap. This roadmap established the strategy to ensure the forging industry's growth in the world markets, through improvements in its energy efficiency, productivity, product quality, and environmental performance.

Since 2000, the successes that have resulted from the FIA-EERE partnerships for implementing the forging industry Technology Roadmap, have included: (1) Formation of Center for Excellence in Forging Technology at Ohio State University; (2) Development of an Infrared Heating System for Dies and Billets; (3) Defense Logistics Agency Forging Initiative to significantly reduce lead time and component cost; (4) System for the Non-Contact Dimensional Inspection of Elevated Temperature Parts which accurately predicts Room Temperature Dimensions; (5) Galvanneal Temperature Measurement System; (6) Development of Replacement for Phosphate Coating Lubes; (7) Formation of a Precision Forging Consortium; and (8) Three EERE plant-wide assessment awards.

To leverage resources, FIA formed a Joint Industry Alliance with the American Iron and Steel Institute and the ASM Heat Treatment Society, with Oak Ridge and Sandia National Laboratories as the key technical partners.



The Forging Industry Vision and Technology Roadmap established the strategy to improve energy efficiency, productivity, product quality, and environmental performance.

Allied
Partner

FMC

Allied
Partner



In 2002, the Gas Technology Institute (GTI) and the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) continued their partnership toward advancing energy-efficient technologies for industry.

Selected project highlights include:

- GTI coordinated efforts with the American Gas Association and the Energy Solutions Center, to develop an Industrial Natural Gas Technology Roadmap. Other participants included industrial end users, Southern California Gas Company, manufacturers, and researchers. The roadmap will serve as a planning tool for both industry and government.
- Developed with GTI, DOE, and gas industry support, the Forced Internal Recirculation burner has achieved less than 10 ppmv NOx with natural gas in watertube boilers without external flue gas recirculation (FGR). External FGR requires parasitic (fan) energy and degrades boiler thermal efficiency. GTI licensed Johnston Boiler Company, Peabody Engineering, and COEN for different applications.
- Testing and evaluations of the METHANE de-NOX® process for environmental and energy-efficiency benefits in wood waste and sludge-fired stoker boilers used extensively in the paper and forest products industry. Results of earlier testing on a boiler in Minnesota documented 50–70 percent NOx reductions and boiler efficiency improvement of between 1–2 percent. GTI and its commercial partners are seeing significant industry interest in the technology.
- Field trials on oxy/gas burners on glass furnaces that provided positive data that a High Luminosity Burner could provide increased energy efficiency and reduced NOx emissions. Commercial introduction by Eclipse Combustion is anticipated in 2003.
- GTI's licensee, Johnston Boiler Company, sold the first commercial unit of the FIR burner in the firetube boiler market.

A major achievement of the Glass Manufacturing Industry Council (GMIC) in collaboration with EERE has been the completion of the Glass Industry Roadmap, which describes the path the industry is following to improved energy efficiency and productivity. The partnership has also produced a glass industry CD that provides complete information on all resources available in support of the industry, and a set of "Cost Reduction How-To" fact sheets that provide step-by-step approaches to identifying and eliminating energy inefficiencies in plant operations.

The GMIC has signed an Allied Partnership Agreement with EERE and is introducing BestPractices efforts throughout the industry. Support for the States Industry of the Future involves supplying coordinators in Florida, Indiana, New Jersey, North Carolina, Ohio, Pennsylvania, and West Virginia with information and contacts in the local glass industry and guidance in establishing their programs. Ohio is conducting research to improve fiberglass forming and has created an Energy Efficiency Practitioner's Network that will widely implement energy-saving practices. The GMIC is hosting a series of BestPractices training workshops around the country.

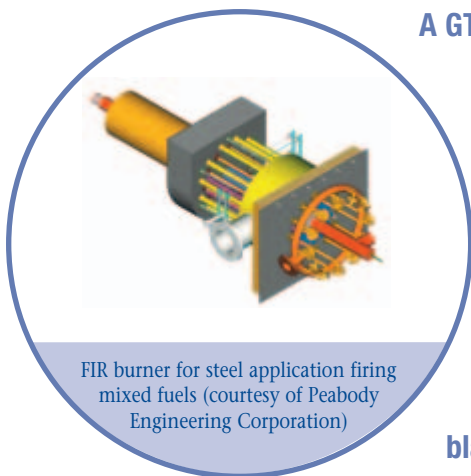
Capital costs and energy use are two of the major concerns regarding glass industry profitability. The GMIC initiated a long-term program to address these issues: the Next Generation Melting System (NGMS) Project is an effort to identify a new "Glass Business Model" that will lead to step changes in the efficiency and profitability of the industry. A Technical and Economic Assessment documents the current state of melting technologies and examines

The partnership between GMIC and EERE has led to a new level of collaboration and enthusiasm within the glass industry for improving energy efficiency and productivity.

past efforts to improve the process that will serve as a baseline for exploring new directions for the industry.

The G+ Program that permits individual member companies to pursue improvements in key areas of their operation with DOE national laboratory support is in its fourth year. Companies can obtain up to \$25,000 worth of research work to resolve specific problem areas in their operations. Results from these short-term projects are then shared with other members to obtain maximum effects. To date, 23 projects have been completed and 11 reports disseminated.

Over the past five years, the relationship between the GMIC, its members, and EERE, has developed into a truly dynamic public/private partnership through which the glass industry has experienced many tangible results.



FIR burner for steel application firing mixed fuels (courtesy of Peabody Engineering Corporation)

A GTI-DOE partnership with Peabody Engineering to develop a Forced Internal Recirculation (FIR) burner for applications firing mixtures of natural gas, coke oven, and blast furnace gases.

Hitchiner

The Hitchiner Manufacturing Co., Inc., has been an important partner with the Metal Casting Industry of the Future (IOF) and is taking a leadership role in advancing the state IOF efforts in New Hampshire and Massachusetts, as well as in disseminating information on BestPractices and other EERE services. The company has been an advocate for the IOF process and has championed the IOF strategy in national and state-level conferences and other events.

Hitchiner has invested the valuable time and expertise of the company's leadership, which has proven integral to the success of this research program. Senior executives from Hitchiner have participated in numerous EERE and program activities and energy efficiency events.

Senior Hitchiner executives have participated in numerous EERE and program activities, and energy efficiency events.

Hitchiner's Executive Vice President of Operations has been a champion of the IOF since its inception, serving on both the Industrial Advisory Board and the Industrial Oversight Panel.

In this capacity, he has provided expert input on the IOF's R&D portfolio, stressing foresight and energy efficiency. Hitchiner's president has provided his leadership to the industry's long-term visioning and roadmapping activities. He helped facilitate the Metal Casting "Future Think Forum," in which over 30 leaders from industry provided critical insights on the future of the industry. It was the first step in updating the Metal Casting Vision and Compact.

Moreover, Hitchiner has long been an advocate of Metal Casting IOF lost foam casting research. This has been a major success and was recently commended by the National Research Council. Hitchiner has been a leader in applying the results of lost foam and other metal casting research and has championed the application of advanced metal casting processes throughout the industry. These efforts are leading to significant improvements in casting productivity and are helping the industry to improve energy efficiency in casting processes.



Hydraulic Institute

As part of its ongoing commitment to pump system efficiency education and training, HI has launched a new web site that promotes fundamental understanding of pumps and pumping systems.

The largest association of pump producers in North America, the Hydraulic Institute (HI) is committed to raising awareness of new methods for increasing energy efficiency among manufacturers, purchasers, and users of pumps and pumping systems. HI joined the Motor Challenge Program as a charter member in 1993.

HI works with DOE on a variety of initiatives, with an emphasis on technical education and training in pump system efficiency. As part of its commitment to technical education, HI has recently launched an e-learning course, *Centrifugal Pumps: Fundamentals, Design and Applications*, at the e-Learning portal www.pumplearning.org.

The Energy Savings section of www.pumps.org, features many downloadable resources. HI helps promote DOE's *MotorMaster+* and the *Pumping System Assessment Tool* (PSAT). An excellent "Energy Reduction in Pumps and Pumping Systems" video-based education program, developed with DOE support is also available. HI encourages its members to support PSAT training. To date, nearly 100 people have attended instructor training and nearly 500 users, mostly engineers and facility operators, are learning how to accurately assess the operating efficiency of their pumping systems.

In 2000, HI and EUROPUMP, with support of DOE, developed and published *Pump Life Cycle Costs: A Guide to LCC Analysis for Pumps and Pumping Systems*. Nearly 3,000 hard copies of this guide were sold and 30,000 copies of the Guide's Executive Summary were freely downloaded. Copies have been translated into French, German, and Polish.

HI has recently formed a Market Transformation Committee to promote a life cycle cost approach to pumping systems, with a focus on pump systems optimization. Plans for new Web-based tools for pump LCC, Pumps Systems Analysis (PSAT) and education are being considered. Interest from other non-profit and government organizations is sought for this initiative.

For 85 years, HI has developed pump industry standards. HI is proud to partner with DOE and looks forward to helping make pump system energy efficiency and life cycle cost both a widely-accepted business strategy and an industry standard.

Allied Partner





It is the common goal of IHEA and DOE to promote increased energy efficiency for industrial process heating applications.

The Industrial Heating Equipment Association (IHEA) is a national trade association representing the major segments of the industrial heat process equipment industry. The organization counts among its members the leading designers and manufacturers of all types of heating equipment used for the melting, refining, and heat processing of ferrous and non-ferrous metals, and certain non-metallic materials. It is the common goal of IHEA and DOE to promote increased energy efficiency for industrial process heating applications.

IHEA is excited about progress made in the past year on a range of DOE-EERE sponsored projects. Cooperation with DOE was initiated with the development of a process heating roadmap document. Since its publication, areas of activity have been expanded and significant progress has been made. Primary among the activities are:

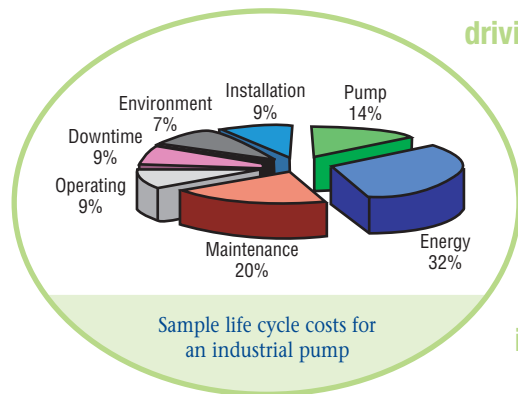
- Cooperative development of the DOE/IHEA *Process Heating Assessment Tool* (PHAST)
- Training on Process Heating Fundamentals and use of PHAST
- Tip Sheets and Technical Briefs
- Process Heating Sensors and Controls Forum
- Process Heating Materials Forum
- Launch of the Qualified PHAST Specialist training, resulting in nine Qualified Specialists
- Web site coordination

Projects planned for 2003 include expansion of the Qualified Specialist and training activities and development of *Improving Process Heating: A Sourcebook for Industry*.

IHEA members have been actively supporting collaboration with EERE through participation in subcommittees of the EERE/IHEA-sponsored Process Heating Steering Committee, which also includes a broad base of industrial end users, energy producers, and national laboratories. These subcommittees include: Tools and Training, Sensors and Controls, and Materials.

ITT Industries' Fluid Technology business, the world's leading pump producer, is dedicated to excellence in engineering, manufacturing, and applying pumping equipment. ITT Industries, Inc., (<http://www.itt.com>) supplies advanced technology products and services in key markets, including electronic interconnects and switches; defense communication, opto-electronics, information technology, and services; fluid and water management; and specialty products. Headquartered in White Plains, New York, ITT generated \$4.9 billion in 2002 sales. ITT is a DOE Allied Partner.

As one of the industry's forerunners and premier advocates for life cycle costing, the company has educated thousands of pump users on the subject. ITT has published multiple articles on the topic, and played a pivotal role in the development of a 200-page guide



ITT has been a driving force behind the Hydraulic Institute's work with the U.S. Department of Energy, which focuses on reducing industrial energy consumption and greenhouse gases.

entitled, *Pump Life Cycle Costs: A Guide to LCC Analysis for Pumps and Pumping Systems*. The guide was published jointly by the Hydraulic Institute and EUROPUMP, an organization comprised of various national pump associations in Europe.

ITT has also been a driving force behind the Hydraulic Institute's work with the U.S. Department of Energy, which focuses on reducing industrial energy consumption and greenhouse gases. These efforts have also strengthened the Hydraulic Institute's ties with DOE's Office of Energy Efficiency and Renewable Energy (EERE). ITT has also been a leading proponent in the development of the Hydraulic Institute's Market Transformation Committee.

ITT was also active in developing and participating in the Energy Solutions for California Industry events. Together with DOE, ITT has implemented several break-through showcases. Most recently, ITT participated in the EERE Texas Technology Showcase in Houston, Texas, in March 2003.

ITT is especially proud of its six employees that have become DOE Qualified Pump System Specialists. These employees were qualified after attending an ITT-sponsored Pump System Specialist Qualification training workshop.



Kaeser Compressor

Kaeser Compressors, Inc., has been in business for more than 85 years, providing quality compressed air products to the world-wide market. The company specializes in individually evaluating each customer's compressed air application, and providing the most efficient and effective air system solution.

Kaeser personnel know that 70 percent of compressed air cost is the electricity to run the compressor, and that getting more air for less energy can make a big impact on the facility's bottom line. Kaeser's extensive research and development team is committed to designing equipment that is energy-efficient, reliable, and requires minimal maintenance.

Furthering its commitment to providing end users with the most energy-efficient air systems, Kaeser Compressors is a proud member of the Compressed Air and Gas Institute (CAGI). The company was the first equipment manufacturer to publish its compressor's total package performance on the World Wide Web according to CAGI standards.

Kaeser helped DOE and the California Energy Commission develop "Solutions for California Industry," a series of informational seminars and conferences for industrial end users seeking to reduce energy consumption while improving operations and profitability.

Kaeser has established a recognition program for employees and distributors who complete an extensive training program that includes both Fundamentals and Advanced compressed air training offered by the Compressed Air Challenge and DOE, and for those who also become Qualified *AIRMaster+* Specialists.



Kaeser has established an internal recognition program for employees who complete compressed air training offered by the Compressed Air Challenge and DOE.

In 2002, Kaeser sponsored two internal Compressed Air Challenge Fundamentals and Advanced Training sessions for 48 employees of its Fredericksburg, Virginia, headquarters. Kaeser's goal is to have every employee with customer contact trained in the Compressed Air Challenge systems approach. Kaeser's Technical Director also became a Qualified *AIRMaster+* Specialist. Kaeser published a series of seven articles on system efficiency in industrial trade publications, and plans to publish another series of system-related articles this year.

Kaeser is a global force in the compressed air industry and continues to be committed to energy efficient air systems through training, education and innovative product designs.



Kennecott Utah Copper

Every year, Kennecott Utah Copper produces about 310,000 tons of refined copper—along with 450,000 ounces of gold, 4 million ounces of silver, about 22 million pounds of molybdenum, and over 1 million tons of sulfuric acid, a by-product of the smelting process. Kennecott Utah Copper is the second-largest copper producer in the United States, providing 15 percent of the country's copper needs. The copper comes from the Bingham Canyon Mine, the largest open pit copper mine in the world, located near Salt Lake City, Utah.

Kennecott Utah Copper was a key player in the Utah Industry Showcase in August 2001. One of the research projects showcased was the EERE Mining IOF project, "Three-Dimensional Simulation of Charge Motion in Semiautogenous Grinding (SAG) and Ball Mills for Energy Efficiency." This project is developing a three-dimensional simulation software application that optimizes the operating conditions of grinding mills and can save an estimated 10.5 trillion Btu annually by 2020. Kennecott Utah also worked with EERE's BestPractices team to initiate energy saving practices throughout its facilities to become more energy efficient.



SAG Mill at Kennecott Copper

Kennecott Utah also worked with EERE's BestPractices to initiate energy-saving practices throughout its facilities and to become more energy efficient.



Mercury Marine, Brunswick

Mercury Marine, Brunswick has been a consistent and valued partner since the inception of the Metal Casting Industry of the Future (IOF). The company promotes and advances energy efficiency as a national goal, providing the technical expertise of its management and staff. Mercury Marine has also provided valuable industry cost share on a long list of advanced metal casting research projects including Lost Foam, Clean Steel, Alternative Granular Molding Media, and many others.

Mercury Marine has been instrumental in applying and validating the results of this research through experiential data. For example, the company helped demonstrate that lost-foam casting has the potential to reduce energy consumption by as much as 27 percent compared to sand casting. Mercury Marine shared the results of its innovative applications for alternative granular molding media, calling it “one of the most significant advancements in lost foam since unbonded sand was patented in 1964.” The company has provided data to support outside reviews by the Centre for the Analysis and Dissemination of Demonstrated Energy Technologies and the National Research Council. Mercury Marine champions the Metal Casting IOF and has been an enthusiastic supporter of the industry Compact, Vision, and Roadmap. This support has continued throughout 2001 and 2002 as the industry updates these guidance documents.

The company's participation has been led by the Senior Director for Advanced Materials and Foundry Technology. He has consistently stressed the importance of national energy security and improved energy and environmental performance. He has participated in all industry vision, roadmapping, and compact activities, and shown leadership in State IOF activities in Wisconsin. He was Chairman of the Metal Casting Industrial Advisory Board and currently volunteers on the Industrial Oversight Panel. He has championed the IOF strategy and promotes EERE and Metal Casting IOF activities industry-wide.

Mercury Marine helped demonstrate that lost-foam casting has the potential to reduce energy consumption by as much as 27 percent compared to sand casting.



Metal Powder Industries Federation

The Metal Powder Industries Federation (MPIF) is a federation of six trade associations that deal with powder metallurgy parts, powder producers, processing equipment, refractory metals, advanced particulate materials, and metal injection molding. Through cooperative actions of its member companies, MPIF solves the problems of the constituents of its six trade associations. MPIF represents its members in the market place in achieving the acceptance of powder metallurgy as a viable technology for solving manufacturing problems, and providing value-added products for the industrial customer.

Through cooperative efforts with the DOE Industrial Technologies Program, MPIF provided the leadership for the development, publication, and distribution of the Powder Metallurgy and Particulate Materials (PM2) Vision and Technology Roadmap. This road map established the strategy to: 1) ensure PM2 industry growth in the current and new markets, and 2) improve PM2 industry energy efficiency, productivity, quality, and environmental performance.

Since becoming a DOE Allied Partner, MPIF has defined seven projects which not only address the priority research needs of the powder metallurgy industry but also link to the road map R&D needs of several other supporting industries (e.g., forging, heat treating, advanced ceramics), and the basic manufacturing industries recognized by the Industrial Technologies Program as Industries of the Future (IOFs).

Through cooperative efforts with the Industrial Technologies Program, MPIF provided the leadership for the Powder Metallurgy and Particulate Materials Vision and Technology Roadmap.

These projects involve development of:

- Advanced materials manufacturing using novel nano-phase materials
- Predictive tools to describe material properties at component level
- Feedback-control techniques to reduce process variations
- Electromagnetic circuit design using 3-D powder metallurgy magnets and components
- Joining of powder metallurgy components for greater functionality
- Full-density, high-tolerance components using single press and sintering
- 3-D forming for complex shapes.



MTI

The Materials Technology Institute (MTI) is a non-profit technology organization that has served the chemical process and allied industries for 25 years. MTI membership includes sixty-two corporations—from the chemical, petroleum, forest products, materials suppliers, and welding service industries. Member companies collaborate to leverage resources for non-proprietary materials technology R&D activities, which are of interest to the entire membership.

The MTI held a leadership role for industries in the preparation of the materials technology R&D strategic plan—*Technology Roadmap for Materials of Construction, Operation, and Maintenance in the Chemical Process Industries*. This roadmap identifies industry needs and technology barriers for the development of new industrial materials.

MTI is currently a member of the Chemical Industry Vision2020 steering committee, which promotes R&D collaboration across the chemical and allied-process industries.

MTI is currently a member of the Chemical Industry Vision2020 steering committee, which promotes R&D collaboration across the chemical and allied-process industries, especially in the materials development areas. MTI member companies currently contribute to several R&D technology development projects, including:

- Metal Dusting Phenomena R&D, to mitigate metal loss and fatigue in process equipment used in the chemicals industries
- Alloy Selection System, to select appropriate materials of construction for chemicals industry process equipment
- Mixed Solvent Corrosion, to identify the causes and mitigate synergistic corrosion effects in process equipment used in the chemical process industries.
- Materials for Ethylene Cracking R&D, to develop materials with increased carburization and coking resistance.



NASEO

NASEO is undertaking a number of activities to promote the EERE State Industries of the Future and emerging industrial technologies by facilitating electronic and print communications with the states.

For more than a decade, the National Association of State Energy Officials (NASEO) has provided leadership on energy issues, guiding regional, state and federal government officials toward a deeper understanding of energy's pivotal role in the economy and environment, and informing them about the specific energy priorities and concerns of the states and territories.

Affiliated with the National Governor's Association, NASEO members are officials from the State and Territory Energy Offices and affiliates from the private and public sectors. NASEO was created by the governors to improve the effectiveness and quality of state energy programs and policies, and to be a collector and repository of energy-related information. NASEO meetings and communications offer a forum for energy officials, policymakers, and others to exchange information and discuss issues with state, regional and national implications.

NASEO has partnered with DOE's Office of Energy Efficiency and Renewable Energy's Industries of the Future (IOF) to assist State and Territory Energy Offices and their industry partners. NASEO is an EERE Allied Partner.

A part of this effort was the establishment of NASEO's Industrial Committee at the February 2002 NASEO Energy Outlook Conference. State members of this new committee will work with NASEO and EERE staff to identify needs and opportunities and work to make new State Energy Special Project joint programs a success.

In addition, NASEO is undertaking a number of activities to promote the EERE State Industries of the Future and emerging industrial technologies by facilitating electronic and print communications with the states. NASEO is also increasing efforts to include important industrial topics on the agendas of NASEO's Annual and Energy Outlook meetings.

This year, NASEO, ASERTII and DOE have formed a new partnership called the State Technologies Advancement Collaborative (STAC), to co-fund RDD&D opportunities important to the States and Regions.

Allied Partner



National Grid

National Grid has been one of the most active partners in EERE's compressed air efficiency educational initiatives.

National Grid USA and its subsidiaries provide low-cost, reliable electricity delivery and responsive customer service to approximately 3.2 million residential, commercial, industrial, and municipal customers in upstate New York, Massachusetts, Rhode Island, and New Hampshire. National Grid also works with customers to help them use energy more efficiently.

National Grid's electricity distribution companies provide a broad range of programs and services for commercial, industrial, and municipal customers who want to use energy to their strategic advantage. These programs and services draw on National Grid's nationally recognized expertise in developing innovative energy solutions. National Grid has several energy efficiency, energy conservation, and related programs in New England including: (1) Energy Initiative, which provides energy efficient alternatives for existing buildings; (2) Design 2000plus, which assists customers in selecting efficient equipment and systems for new construction or renovations; and (3) Small Business Services which is tailored to the needs of smaller businesses using less than 100 kW of electricity and features energy-efficient lighting and low-cost refrigeration measures.

Over the past year-and-a-half, National Grid sponsored and hosted, in cooperation with other New England utilities and DOE's Office of Energy Efficiency and Renewable Energy (EERE), several Qualified *AIRMaster+* Specialist Training workshops and a number of CAC training workshops. These workshops have successfully trained 300 people. Two of National Grid's employees have qualified as *AIRMaster+* Specialists.

Recent collaborative activities include:

- Co-sponsoring five Compressed Air Challenge (CAC) Fundamentals of Compressed Air Systems workshops
- Co-sponsoring five CAC Advanced Management of Compressed Air Systems workshops
- Co-sponsoring an *AirMaster+* Orientation Session in September 2002
- Co-sponsoring four *AirMaster+* Specialist Qualification Training workshops between November 2001 and January 2003.

National Grid has been one of the most active partners in EERE's compressed air efficiency educational initiatives. National Grid remains a committed and active supporter of EERE's overall energy-efficiency goals and specifically EERE's education mission.



National Mining Association

The National Mining Association (NMA) was created in 1995 as a result of the merger of two major organizations representing the mining industry at the national level: the National Coal Association and the American Mining Congress. NMA's current members include coal, metal, and mineral hardrock mining operators, mineral processors, bulk transporters, mining equipment manufacturers, financial and engineering firms, and other businesses and associations related to the mining industry.

NMA is the industry partner of the EERE Mining Industry of the Future (IOF) initiative. Since signing its Compact with DOE in 1998, NMA has enthusiastically supported the Mining IOF, including the development of an industry vision, three technology roadmaps, and four research and development (R&D) solicitations. NMA coordinates broad industry participation in the IOF, including the 28 R&D

The NMA has enthusiastically supported the Mining IOF, including its efforts to develop an industry vision, three technology roadmaps, and four research and development solicitations.



projects that involve over 110 industry, university, and national laboratory partners. NMA, through its Technology Committee and Industry Oversight Panel, offers technical and portfolio guidance to the Mining IOF.

NMA has participated in events such as the EERE Energy Efficiency Expos, Customer Days, and the Utah 2001 Industry Showcase. NMA promotes the Mining IOF and disseminates R&D results to the industry and public through conferences, seminars, its Web site, and various publications. NMA is also an important national partner on climate issues.



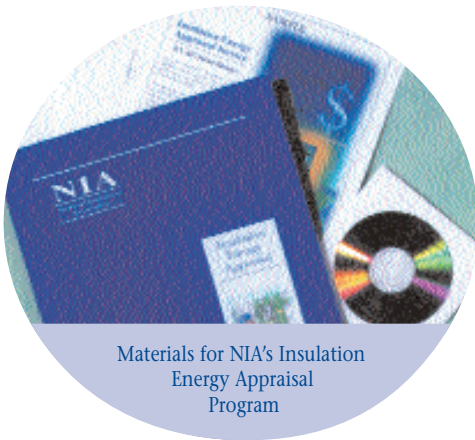
NIA

The National Insulation Association (NIA), a northern Virginia based trade association representing the mechanical and specialty insulation industry, was founded in 1953. It has approximately 450 member companies consisting of contractors, manufacturers, distributors, laminators, and fabricators.

NIA developed the Insulation Energy Appraisal Program (IEAP) in the fall of 2000. This program is a major industry initiative designed to give facility/energy managers a better understanding of the true dollar and performance value of an insulated system. The program is a tool that quantifies the amount of energy and actual dollars a facility is losing with its current in-place insulation system. To date, 215 industry professionals have earned the title of "Certified Insulation Energy Appraiser."

Students learn how to: determine the optimal insulation thickness and corresponding energy and dollar savings; interview customers to gather information for the appraisal; conduct a facility walk-through; use the *3E Plus*® computer software program; determine the amount of greenhouse gases saved through the use of insulation; analyze and complete the appraisal spread sheet; complete a final customer report; and market their new skills to potential customers.

There are a number of reasons why facility managers want to consider an insulation energy appraisal at their location. These reasons include the potential for hundreds of thousands of Btu savings, the opportunity to improve process control and efficiency, contributing to a cleaner environment through the reduction of emissions into the atmosphere, and saving money through reduced fuel costs.



Materials for NIA's Insulation Energy Appraisal Program

NIA believes that "the partnership of trade associations and government, such as NIA and EERE, has been one of the most outstanding successes of promoting the greater use of insulation. Because of this partnership, the recognition of industrial insulation's contribution to industry has risen significantly."

Because of this partnership, the recognition of industrial insulation's contribution to industry has risen significantly.
—Bill Pitkin
NIA



Allied Partner

NPRA

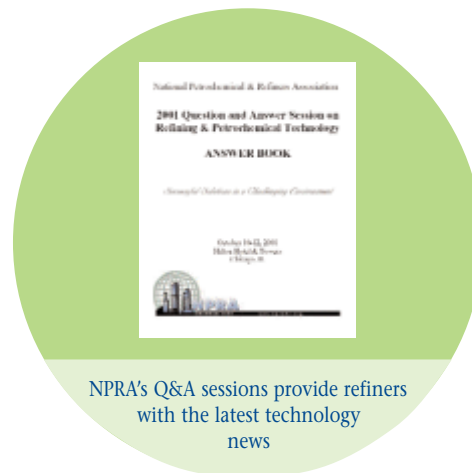
The National Petrochemical and Refiners Association (NPRA) represents approximately 460 companies. Primarily, these are the companies and suppliers that provide consumers with transportation fuels, home heating oil, and the petrochemicals that serve as building blocks in making everything from plastics and clothing to medicine and computers.

A number of NPRA activities support technical advancement and continued progress in safety and environmental performance. NPRA participates in the Responsible Care® Partnership Initiative designed to continually improve the industry's health, safety, and environmental performance. NPRA's Maintenance and Manufacturing Committees focus on the application of new technologies, technology transfer, and sharing of best practices to improve the operations of member companies. NPRA holds an annual Question and Answer Conference designed to provide for the discussion of issues, trends, and challenges focusing on the refining and petrochemical industries.

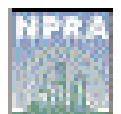
NPRA worked with EERE on the development of the *Technology Vision 2020—A Report on Technology and the Future of the U.S. Petroleum Industry*, and the *Technology Roadmap for the Petroleum Industry*. These documents focus on the research needed to strengthen the industry over the next two decades. The vision advocates cooperation among the petroleum industry, the U.S. Department of Energy, the national laboratories, and academia. NPRA members contribute to EERE activities in a number of ways. Members supported the EERE 2001 Utah Showcase, they provide sites for project demonstrations, and they provide valuable input on the portfolio of projects. NPRA co-sponsored the EERE Texas Technology Showcase, held in Houston, Texas, in March 2003.

EERE and NPRA continue to work together to develop joint strategies that address the needs of the refining industry and promote the adoption of technologies that will make the industry safer and more energy efficient.

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NPRA's Q&A sessions provide refiners with the latest technology news



Northeast Utilities

The Northeast Utilities Service Company (NU), at the forefront of energy efficiency programs for more than two decades, helps customers in Connecticut, Massachusetts, and New Hampshire save energy and money, and protect the environment while bolstering the local economy in each state.

Last year, by leveraging effective alliances such as its affiliation with DOE's Office of Energy Efficiency and Renewable Energy (EERE), sponsorship of the Compressed Air Challenge (CAC), and partnerships with Motor Decisions Matter and the Motor-Up Premium Efficiency Motor Initiative, NU, in cooperation with other New England utilities, sponsored and hosted many of the first Qualified *AIRMaster+* Specialist Training workshops and a number of CAC training workshops that successfully trained 216 people. Two NU employees have qualified as *AIRMaster+* Specialists. As a result of these efforts and the design and implementation of innovative energy-saving programs, NU has helped industrial customers save over 81,000 megawatt-hours.

Examples of these programs include The Connecticut Light and Power Company's (CL&P) PRIME (Process Reengineering for Increased Manufacturing Efficiency) program. CL&P, NU's Connecticut subsidiary, through PRIME and in partnership with CONNSTEP, a state-sponsored agency that helps manufacturers increase productivity by adopting LEAN-manufacturing processes, helped industrial customers increase throughput by \$44 million and preserve more than 20,000 jobs. Through its Custom Services Incentive program, CL&P showed Johnson and Johnson's Medical, Inc. how to transform an inefficient compressed air system into a state-of-the-art system that is saving the Southington, Connecticut-based company \$120,000 annually. CL&P's Research Development and Demonstration (RD&D) program supports new, cutting-edge technologies that might otherwise not get to market. One RD&D project, scheduled to be ready for market this year, combines traditional manufacturing processes with fuel cell plate production and could cut production costs by 50 percent.

These programs, partnerships, and initiatives are consistent with NU's promotion of its energy-efficiency ethic, encouraging customers to use energy wisely with an eye on the environment.

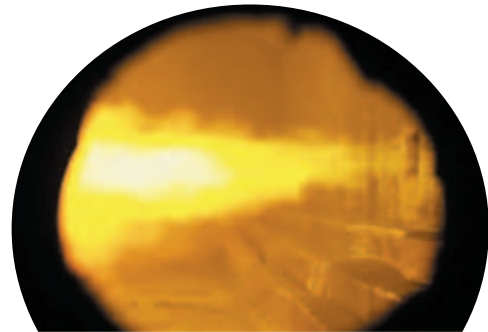
As we move to a fully deregulated environment and the price of electricity takes on more significance, so will NU's energy efficiency programs and services.
—Colin G. Odell
Senior Program Administrator

Owens Corning

Since inventing glass fiber insulation more than 50 years ago, Owens Corning has been a technological leader in the glass industry. With its leading position in the production of glass fiber materials for insulation and composites, Owens Corning has an impressive history of promoting and supporting the rational and productive use of energy, and has developed a comprehensive understanding of energy second to none.

Owens Corning promotes the development of new technology with its world-class science and technology team. Parallel engagements aimed at reducing energy waste and costs, increasing efficiencies, and advancing technology are at the core of Owens Corning's efforts. Owens Corning also understands the value and power of partnerships, whether with suppliers, customers, or others. Among these partnerships are two with DOE's Office of Energy Efficiency and Renewable Energy (EERE):

- Development and Validation of a Coupled Combustion Space/Glass Bath Furnace Simulation—Along with Argonne National Laboratory and other project partners, Owens Corning is participating in the development of a three-dimensional model that provides a more accurate representation of the entire melting process. Projected benefits include the optimization of melter operation and combustion process, improved production efficiency, and reduced costs and emissions.



GTI's high-luminosity burner firing at 3 MMBtu per hour in a fiberglass furnace

- High-Luminosity, Low-NOx Burner—Owens Corning recently hosted the first full-scale demonstration of a new burner developed by the Gas Technology Institute. The burner increases luminosity and radiant heat transfer in the glass furnace, and was successfully tested at an Owens Corning facility in New York. Projected benefits include increased thermal efficiency, thereby reducing energy consumption; reduced NOx emissions; and increased furnace productivity.

Along with these efforts, Owens Corning was a founding member of the Glass Manufacturing Industry Council (GMIC). The company has made significant contributions to implementing the EERE glass portfolio by evaluating research projects and serving on GMIC technical subcommittees; it also supports GMIC efforts to evaluate the potential for a next generation glass melting system.

PPG Industries

As a leading global supplier of flat glass, fiber glass, and coated glass products, PPG Industries has long been a technological leader in the glass industry. PPG business units are supported by a comprehensive program of research and development. Finding techniques that improve efficiency is a pillar of PPG's research efforts, as are ongoing efforts to make its production processes environmentally-friendly.

PPG conducts glass research in technical centers for both flat and fiber glass production. The company actively seeks research partnerships with universities and U.S. government agencies and laboratories, including the U.S. Department of Energy.

**PPG
research has resulted
in improved understanding of
the thermodynamics and
corrosion of refractors in
an oxy-fuel environment.**
—Dr. Amar Mishra
PPG Industries, Inc.

Among these partnerships are three with EERE:

- **Diagnostics and Modeling of Refractory Corrosion in Oxy-Fuel Furnaces**—Working with Sandia National Laboratories, PPG is determining corrosion factors and developing mathematical models that can predict corrosion rates, identify operating conditions that minimize corrosion, and define the attributes of improved refractories for oxy-fuel firing. Projected benefits include extended refractory lifetime, which reduces production costs, increased industry conversion to oxy-fuel firing, which reduces energy consumption and NOx emissions, and increases productivity.
- **Process Optimization Strategies, Models, and Chemical Databases for On-Line Coating of Float Glass**—Also working in conjunction with Sandia National Laboratories, PPG is developing new control strategies and process models to significantly improve the efficiency of depositing coatings on float glass. Modifications to the existing deposition technique as well as new coater designs are being evaluated. Projected benefits include higher yield of coated products, which reduces remelting energy use and costs, reduced raw material usage, and more efficient use of costly chemical precursors.
- **Clean, Efficient Glass Production Using High-Luminosity Oxy-Gas Burners**—During a planned conversion of a float glass furnace to oxy-fuel firing, PPG will demonstrate a new burner technology. Developed by the Gas Technology Institute and its marketing partner Combustion Tec, the burner increases luminosity and radiant heat transfer in the glass furnace. Projected benefits include increased thermal efficiency, which reduces energy consumption, reduced NOx emissions, and increased furnace productivity.

PPG was a founding member of the Glass Manufacturing Industry Council (GMIC), and is supporting GMIC efforts to evaluate the potential for a next-generation glass melting system.



Praxair

We need to think broadly about the chemical enterprise and involve all of the components that can bring or gain benefit. Each element of the enterprise adds to the ultimate value of the Chemical Industry Vision2020 Technology Partnership.

—Jack Solomon, Praxair, Inc.



Praxair, Inc., conducts cutting-edge R&D in connection with its position as a supplier of atmospheric, process, and specialty gases; high-performance coatings; and related services and technologies. In addition, the company designs, engineers, and builds advanced cryogenic and non-cryogenic supply systems. Founded in 1907, the company was the first to commercially separate oxygen using cryogenics.

Praxair complements its robust internal technology development program with a range of collaborative technology partnerships, including several ongoing R&D partnerships with the Office of Energy Efficiency and Renewable Energy (EERE):

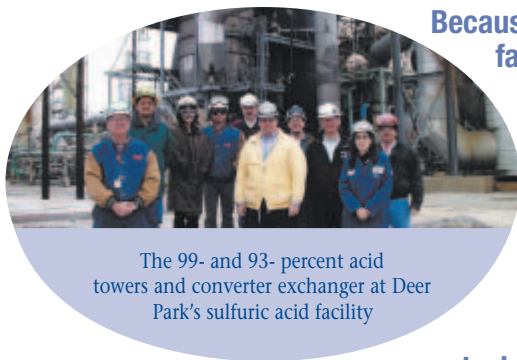
- **Advanced Sorbents for Gas Separation**—Working to develop a commercially viable oxygen-selective sorbent for separating commercial gases using pressure swing adsorption. This technology requires less energy for gas separation and provides high-purity gases at lower prices. Projected benefits include 4.2 trillion Btu per year saved from industrial use of low-cost gas and 25- to 30-percent reduction in production costs of industrial gases.
- **Oxidation Olefin Reactor**—Developing a novel process to replace energy-intensive steam cracking. The process employs a short reaction-time catalyst and advanced gas-mixing technology to lower energy use and production costs in ethylene manufacture and similar operations. Projected benefits include a 20-percent cost reduction and reduction in CO₂ emissions.

Under DOE sponsorship, Praxair conducted a demonstration of the world's first glass furnace converted to oxy-fuel combustion. The benefits of oxy-fuel combustion such as increased energy efficiency, improved productivity, sharply reduced emissions, and improved product quality have been so overwhelmingly positive that over 130 U.S. glass furnaces, representing 25 percent of all U.S. glass furnaces, have been converted. Additional furnaces throughout the world are being converted to this energy-saving technology.

Praxair's Director of R&D is currently chairing the Chemical Industry Vision2020 Technology Partnership steering group, while the company is participating in Chemicals Plus projects and in the first Vision2020 Challenge initiative.



Rohm & Haas Company



The 99- and 93- percent acid towers and converter exchanger at Deer Park's sulfuric acid facility

Because our Deer Park facility accounted for such a large portion of the company's total energy use, it was an ideal place to apply BestPractices techniques. With the

help of EERE's assessment project, we were able to reach our energy expenditure reduction goals 5 years ahead of schedule.

—Jeffrey Hackworth, Deer Park Plant Energy Manager

Rohm & Haas Company is one of the largest producers of specialty chemicals in the world. An array of industries use the Philadelphia-based company's chemicals in the production of paint and coatings, electronics, household products, detergents, personal care goods, water treatment products, adhesives, plastics, and salts.

Rohm & Haas stresses innovation in its 140 research and manufacturing sites around the globe. As a partner with the Office of Energy Efficiency and Renewable Energy (EERE), the company has performed plant-wide energy efficiency assessments (PWA) in its Knoxville plant and elsewhere to identify cost savings potential. The Knoxville PWA identified \$1 million in savings. The PWA method and results were then applied to similar plants in Kentucky and California where \$2.9 million in savings was identified. Rohm & Haas plans to replicate the PWA experience and apply the PWA results to all similar domestic plants.

The Rohm & Haas facility in Deer Park, Texas, is the company's largest monomer manufacturer, accounting for 35 percent of all Rohm & Haas corporate energy use. In 1996, an assessment of plant efficiency opportunities identified 125 areas in which the plant could implement cost-saving best practices. Over the past 6 years, EERE's BestPractices energy management techniques have reduced overall energy use at the facility by 17 percent and saved the company an average of \$15 million per year.

The Deer Park facility participated in the Texas Showcase event in March 2003. In support of that event they hosted one-day training sessions in pump, steam, compressed air, and process heating system optimization. These training sessions were open to other plants in the area. They also conducted a plant-wide assessment at the facility.

In addition to its BestPractices efforts, Rohm & Haas is a member of several EERE initiatives, including:

- Vision2020 Challenge
- BestPractices for Steam
- Vision2020 Steering Committee.

Rohm and Haas was the second industrial entity to have signed an Allied Partnership agreement with EERE. This cooperative agreement will help to raise awareness of EERE resources and information, promote EERE BestPractices, develop technology showcases, and participate in workshops and topical conferences.

Allied Partner



SECAT

SECAT, Inc., is a research consortium dedicated to facilitating cutting-edge research and development of innovative technologies and products for the aluminum industry. SECAT was established in August 1999 in Lexington, Kentucky, and became the first Aluminum Industry of the Future (IOF) Allied Partner in November 2001.

SECAT provides financial, project, and intellectual property management for aluminum research projects. SECAT and its sixteen aluminum industry members, in partnership with land-grant universities, other academic institutions, and national laboratories, have quickly established their places as collaborative partners with DOE's Office of Energy Efficiency and Renewable Energy on research and development of innovative processing technologies for the aluminum industry. SECAT, Inc., currently partners with EERE on four projects that include over thirteen industries, three national laboratories, and two university partners. SECAT is an active participant in updating the Aluminum Vision. It is a leader in the Kentucky State IOF.

As an Allied Partner, SECAT applies and promotes EERE programs and services to assist its members in the achievement of their long-range energy-reduction, pollution-abatement, and economic goals.

As an Allied Partner, SECAT applies and promotes EERE programs and services to assist its members in the achievement of their long-range energy-reduction, pollution-abatement, and economic goals. SECAT helps increase awareness of and disseminates EERE resources and information. SECAT encourages BestPractices energy assessments and training opportunities and facilitates the dissemination and replication of assessment results and recommendations throughout the industry. SECAT builds awareness of EERE to the aluminum and aluminum casting industries by promoting appropriate EERE emerging technologies through its Web site and other communications methods that focus on improving energy efficiency. SECAT promotes and assists in planning Showcases to highlight energy efficiency technologies and best practices, and encourages its members to participate in updating the Aluminum Industry Vision and Roadmaps.

SECAT actively participates in EERE's State Industries of the Future Programs in those states where its member companies have production facilities for the manufacture of primary aluminum, semi-fabricated aluminum products, and aluminum castings.

SECAT conducts R&D for improving energy efficiency in aluminum melting.

Allied Partner



Silver Eagle

Silver Eagle refines crude oil and markets refined petroleum products, including various grades of gasoline, kerosene, diesel fuel, waxes, and asphalt. It processes approximately 10,000 barrels per day of crude oil.

Silver Eagle was one of three Utah refineries to open its doors during the 2001 Utah Showcase. The technologies on display at Silver Eagle highlighted the advantages of government-industry cooperation. They also showed how EERE resources such as *3E Plus* insulation evaluation software and pump assessments can impact the operations of a refinery. The success of the technologies in use at the refinery encouraged attendees to adopt these innovations in their own facilities.

Silver Eagle showcased six different applied technologies and best practices at the Showcase. Together, these technologies have increased product yield by approximately one and a half percent, reduced energy use by more than 175 billion Btu per year, reduced operating costs by more than \$700,000 per year, and reduced CO₂ emissions by more than 10,000 tons per year. The technologies that produced these results include a boiler that uses waste heat, a new catalyst that reduces the use of platinum catalyst by two-thirds, an improvement to tank insulation using DOE's *3E Plus* software, and the applied results of a DOE pump assessment. The facility also showcased two emerging technologies: a cryogenic cooling system, which will improve waste-stream recovery; and a waste-heat recovery system, which will reduce the fuel required for steam production.

The technologies on display at Silver Eagle highlighted the advantages of cooperation between government and industry.



A Silver Eagle Facility Manager introduces a new energy-saving catalyst technology at the 2001 Utah Showcase

SMUD

The Sacramento Municipal Utility District (SMUD) has been an active Allied Partner for years. Sacramento's industrial customers have adopted many of the energy- and cost-saving strategies fostered by DOE's Office of Energy Efficiency and Renewable Energy (EERE). Industrial programs that contributed to the intense conservation efforts since 2001, included sponsoring numerous compressed air and motor system workshops and seminars hosted by SMUD's Energy & Technology Center (E&TC) and the Commercial Services Department. These encompassed four Motor Systems Management workshops, two Pump Systems workshops, two Adjustable-Speed Drive workshops, and an *AIRMaster+* Specialist Qualification workshop in February 2003. These events rely heavily on materials and expertise available through EERE programs. Separate from these training events, SMUD has also distributed DOE publications that support its energy-efficiency efforts. SMUD has distributed more than 200 Decision Tools for Industry CDs.

Lighting, architecture, manufacturing, and industrial processes are also featured in workshops throughout the year at the E&TC. The E&TC enables customers to take advantage of energy-efficient design, equipment, and facility management practices. Seminars are also offered on advanced processes that improve their bottom line and enhance their competitiveness.

A primary means of assisting industrial customers is the performance of system audits. SMUD maintains a staff of Commercial Services Account Representatives, assisted by other trained professionals, to assist customers in managing their energy use through retrofit projects. Compressed air and other motor system audits have resulted in a number of energy-saving projects. SMUD is a member of the Consortium for Energy Efficiency (CEE), and participates in a number of CEE managed programs, including the Motor Decisions Matter campaign.

SMUD was a sponsor of and participant in the Energy Solutions for California Industry events, held in Sacramento and San Jose, energy events organized by EERE and the California Energy Commission. SMUD referred a case study candidate used in the Energy Solutions events, "Pump System Improvement Saves Energy and Improves Production at a Construction Aggregates Company."

SMUD's industrial customers have adopted many of the energy- and cost-saving strategies fostered by DOE's Industrial Technologies Program.



**Allied
Partner**



SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT
The Power To Do More.™

Society of the Plastics Industry

Founded in 1937, the Society of the Plastics Industry (SPI) is the trade association representing the fourth-largest manufacturing industry in the United States. SPI's 1,400 members represent the entire plastics industry supply chain, including processors, machinery and equipment manufacturers, and raw material suppliers. The U.S. plastics industry employs more than 1.5 million workers and provides more than \$330 billion in annual shipments.

The plastics industry's annual energy bill is almost \$10 billion from the suppliers of plastic resins to the manufacturer of the final plastic part. The total energy consumption by the plastics manufacturing industry is 1.9 quadrillion Btu per year and is equivalent to the energy consumed by the State of Massachusetts each year—every car, house, factory, and commercial building.

Working as an Office of Energy Efficiency and Renewable Energy (EERE) Allied Partner, SPI increases the awareness and knowledge of energy-efficiency opportunities in the plastics industry. SPI activities with EERE, involve:

- Development and dissemination of information, tools and resources—jointly promote and disseminate EERE resources and energy-efficiency and renewable-energy products to SPI members, across all SPI business sectors at both the national and regional levels.
- Cooperate to organize training seminars for SPI members and the general audience of the plastics industry. Such events address a wide range of topics including new technologies and/or energy management best practices.
- Jointly pursue opportunities to co-author articles that promote energy-efficiency and renewable-energy technologies for commercial, residential, government, and industrial applications, as well as develop and/or promote case studies and summary reports used to promote such opportunities.
- Arrange for plastic manufacturing plant energy assessments to be conducted by DOE's Industrial Assessment Centers (IACs). IACs are teams of engineering faculty and students from the Centers, located at twenty-six universities around the country, that conduct energy audits or industrial assessments for small and medium-size manufacturers. They provide recommendations that help manufacturers identify opportunities to improve productivity, reduce waste, and save energy.

This year SPI and DOE plan to conduct and complete fifteen plant energy assessments and create success stories as testimonials so that all SPI member plants will be able to replicate the results achieved by the initial participating plants. The energy assessments will serve as a catalyst for a longer-term SPI-DOE energy efficiency initiative that strives to reduce the U. S. plastic industry's \$10 billion energy bill.



DOE Assistant Secretary David Garman (right) and SPI President Donald Duncan at the SPI EERE Allied Partner signing in September 2002.

**Allied
Partner**



Southern California Edison

Southern California Edison (SCE) is a U.S. electric distribution company that is dedicated to providing a wide variety of energy-efficiency information and assistance to customers. SCE has worked with the U.S. Department of Energy (DOE) on motor, compressed air, and pumping system efficiency by distributing information and hosting technical workshops for customers.

As part of its energy-efficiency efforts, SCE offers free hydraulic testing services, or pump tests, to its agricultural and pumping customers. The pump tests help farmers and water agencies contain costs, increase productivity, plan pump maintenance to avoid growing seasons and times of high demand, and predict irrigation costs. The tests also help prove growing capability when farmers apply for and secure loans.

The DOE Industrial Technologies Program (ITP) *Pumping System Assessment Tool*, or PSAT, is an important component of the SCE pump-testing program. The SCE testing team uses PSAT to identify specific inefficiencies and quantify energy problems using real numbers and clear graphics. Six SCE staff members hold PSAT qualification. "PSAT validates our work," says Dan Johnson, Hydraulics/Industrial Test Manager at SCE.

SCE technicians recently used PSAT to identify and quantify an efficiency problem at a new facility. An SCE technical specialist performed a pump test at the facility and determined that the new pumping system was not operating as efficiently as the contractor had anticipated. "The customer challenged the SCE test, so we plugged our information into PSAT," explains Johnson. "PSAT calculations validated that our pump test was accurate, and the customer was able to go back to the contractor with that validation."



SCE technical specialist tests a customer's pump

In addition to using PSAT, SCE has distributed thousands of ITP energy-efficiency publications and resources, hosted numerous workshops on motor systems, and contributed to compressed-air system efficiency efforts.

For more information about SCE, visit www.sce.com.

**Allied
Partner**



Spirax Sarco

Spirax Sarco has 3,900 employees in 32 countries who provide expertise and products for safe control and efficient use of steam and other industrial fluids. Through its mutually beneficial Allied Partnership with DOE's Office of Energy Efficiency and Renewable Energy (EERE), Spirax Sarco has distributed EERE Tip Sheets and Case Studies in over 80 percent of the training it conducts. (Two case studies highlight Spirax Sarco customers). Through its globally distributed *Spirax Sarco News*, the company has published six articles highlighting EERE and BestPractices Steam to raise awareness nationally and in Europe.

Spirax Sarco integrates EERE information and products in its workshops. Spirax Sarco also includes EERE personnel in its workshops given to individual customers, often firms with multiple plants.

Through its globally distributed *Spirax Sarco News*, the company has published six articles highlighting EERE and BestPractices Steam to raise awareness nationally and in Europe.



Spirax Sarco
Headquarters

Additionally, Spirax Sarco's all-day workshops for organizations such as the Association of Energy Engineers feature EERE personnel and state representatives and other BestPractices Steam partners, such as the National Insulation Association and ONDEO Nalco. Fruitful working partnerships for Spirax Sarco, and further communications with individuals at national laboratories, Industries of the Future Teams, and BestPractices, have revealed new resources and champions that strengthen Spirax Sarco's marketing and credibility.

Spirax Sarco was the co-developer of the recently released *Steam System Assessment Tool* and also helped develop EERE's *Steam Scoping Tool* software. *The Steam Assessment Tool* helps plant managers determine project priorities for plant improvements while taking into account cost, emissions, reliability, and efficiency for a variety of options. Spirax Sarco has also developed accompanying training aids to augment those already being used by nearly all of EERE's Industrial Assessment Centers. Spirax Sarco has also provided basic steam training to many of the Industrial Assessment Center Directors.

Spirax Sarco's Energy Services Group Manager has been an extremely active partner with EERE's BestPractices. He currently co-chairs the BestPractices Steam Technical Subcommittee and serves on the BestPractices Steam Steering Committee Executive Board. He also chairs the BestPractices Steering Committee, represents BestPractices Steam on the Committee, and has served on the Editorial Board for EERE's *Energy Matters* newsletter.

Allied
Partner

spirax
sarco

Steel Manufacturers Association

The
SMA seeks a grass-roots
involvement with the federal gov-
ernment as a way of advancing our
segment of the steel industry.
Partnerships with offices such as EERE
are important to our goals.

—Tom Danjczek
SMA

The Steel Manufacturers Association (SMA) brings together 57 North American companies that operate more than 130 steel plants and employ approximately 120,000 workers, as well as nine member companies outside of North America. In 2000, the SMA membership accounted for 59 percent of domestic carbon steel manufacturing and included a number of integrated (ore-based) steel makers and producers of hot-rolled steel products. The organization is the primary trade association for scrap-based electric arc furnace (EAF) steel makers.

The SMA focuses its activities in the areas of international trade, environmental control, energy policy, workforce matters, new materials, and products and technology. Towards that end, the association engages in a range of collaborative research projects in partnership with the Office of Energy Efficiency and Renewable Energy (EERE).

As an EERE partner, the SMA lends its industry expertise to EERE-sponsored studies that analyze energy use and emissions in steel-making processes to establish baseline data that will provide the foundation for future energy savings and productivity improvements in the U.S. steel industry. The association provided input into the development of the *U.S. Steel Industry Technology Roadmap* and currently collaborates with EERE on other ongoing projects:

- Fellowship Cooperative Education Initiative—Leading the design and establishment of a cooperative education program for selected college students who have completed the first or second year of a 4- or 5-year program. Selected students will participate on projects designed to increase their interest and experience in the steel industry. Projected benefits include an increased number of college graduates entering the steel industry and a more experienced entry-level steel industry workforce.
- Steelmaker Pilot (SP)—Developing an intelligent process-control system that integrates advanced knowledge-based computing techniques with the more traditional algebraic approaches for monitoring, optimizing, sequencing and controlling the steelmaking process and equipment.



Stolar Horizon, Inc.

Stolar's Cleaner ROM coal project won the 2002 R&D 100 Award.

Stolar Horizon, Inc., developed and patented the Radio Imaging Method (RIM) for tomographic reconstruction of images of geologic anomalies in the coal bed. From this pioneering background in electromagnetic wave imaging, Stolar participated in two advanced development and demonstration projects in the Industrial Technology Program Mining Industry of the Future.

Stolar Horizon, Inc., partnered with CONSOL Energy, Sandia National Laboratories, and West Virginia University to develop and demonstrate advanced RIM-IV instrumentation and 3-D imaging software. RIM-IV instrumentation has increased operating range to more than 2,000 feet in the coal bed waveguide.

Longwall mining machine efficiency is affected by paleochannels, which are often locations of rapidly thinning coal and hard sandstone rock. Along the margins of the channel, the roof rock is unstable and oftentimes falls into the run-of-mine (ROM) coal, increasing ash. By knowing where the margins of the channel occur, personnel can apply aggressive roof-control science to reduce ash in the ROM coal.

Cleaner ROM coal significantly increases the energy efficiency of the mining process, with a net benefit of \$1 per ton of mined coal. For each 1 percent reduction in ash, the electric generation cost is reduced by \$500,000 for every 500 megawatts of generation. This project received the 2002 R&D 100 Award.

Stolar also partnered with CONSOL Energy, Exxon Monterey Coal Mining, Blue Mountain Energy, Colorado School of Mines, and the Mine Safety and Health Administration (MSHA) in the development and demonstration of the Horizon Sensor. The Horizon Sensor enables selective mining, allowing the contaminated coal layer to be left behind in the mine.

The sensor has a look-ahead capability that was a design objective of MSHA and the National Mining Association. There are 416 underground coal mines operating near old works. The Horizon Sensor look-ahead feature can detect water-filled voids and prevent dangerous and costly mine accidents.



Superior Aluminum

The Superior Aluminum Company has championed the Metal Casting Industry of the Future (IOF) since its inception. Moreover, Superior has implemented many of the results and process improvements resulting from Metal Casting IOF research leading to opportunities for improved energy efficiency and productivity. As a champion of the Metal Casting IOF, Superior has consistently shared and disseminated the results of metal casting research at national conferences and other events. Superior demonstrates to the industry the value of participating in this industry-government partnership and applying clean and energy-efficient technologies on the plant floor.

Superior has enthusiastically dedicated the time and expertise of its employees to participating in EERE activities.

Superior has enthusiastically dedicated the time and expertise of its employees to participating in EERE activities. A representative of Superior Aluminum signed the original metal casting industry compact, which established the partnership between DOE and industry. The company has been instrumental in all facets of this successful partnership since its implementation, participating on both the Industrial Advisory Board and the Industrial Oversight Panel. They have provided expert insights on technical R&D and helped to ensure a balanced portfolio focused on improving energy efficiency in the industry. The company was also key in hosting the "Future Think Forum." It was at this forum that more than thirty industry leaders came together and provided critical insight into stating the various challenges that face the metal casting industry as a whole. The Forum laid the groundwork for the updated Metal Casting Vision and new industry Compact. The continued partnership with Superior is helping to lead the Metal Casting IOF into the 21st century.



TAPPI

The Technical Association of the Pulp and Paper Industry (TAPPI) and EERE have a long-standing relationship dating to 1994 that included the early development of the Forest Products Industry of the Future Agenda 2020 activities. They took that relationship a step farther on March 6, 2002, with the signing of an Allied Partnership agreement. As Allied Partners, TAPPI and EERE will work together to help the pulp and paper industry capture a part of the large energy-savings opportunities that exist within mills throughout the United States, and to help focus the industry on issues such as energy and environmental concerns.

TAPPI, DOE and the American Forest and Paper Association co-sponsored the Forest, Wood, and Paper Industry Technology Summit. A group of 147 pulp and paper industry experts gathered to determine the path for research to be pursued under Agenda 2020 to deliver commercially viable systems by 2008. The industry's vision is that integrated paper manufacturing will one day require no fossil fuel energy and even be a net exporter of electricity. Efforts currently underway as a result of this conference will provide the direction for an effective, industry-led public/private partnership for many years to come.

TAPPI is helping this partnership come to life by communicating Summit results through publications and conferences so it reaches the largest possible audience in the most efficient way. A series of articles on the technical and direction-setting substance of the Summit ran in the TAPPI journal *Solutions!*

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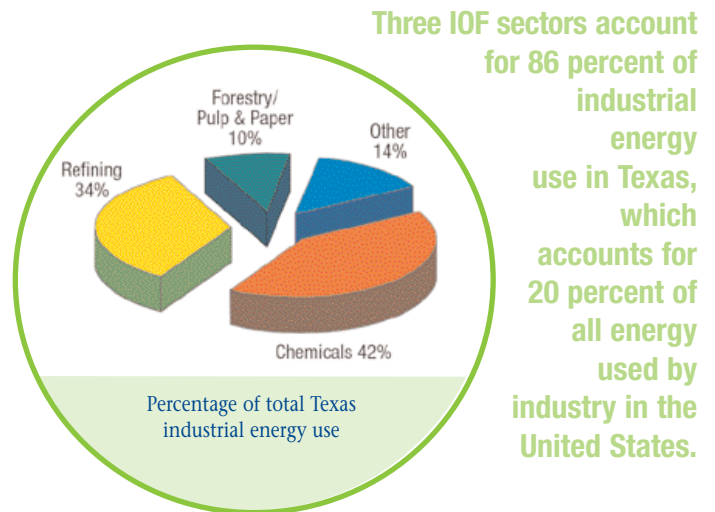
TAPPI and EERE created the Energy Results Showcase, held in March 2002, with presentations and sessions in Atlanta and a DOE showcase at Augusta Newsprint in Augusta, Georgia. The two groups identified topics and coordinated promotional efforts to deliver a complete program focused on methods to manage and lower energy costs.

Texas Energy Coordination Council

The Texas Industries of the Future (IOF) effort, sponsored by the Texas Energy Coordination Council, leverages the tools of the U. S. Department of Energy's Industries of the Future. Three IOF sectors, chemicals, refining, and forest products, account for 86 percent of the energy used by industry in Texas, and Texas industrial energy use accounts for 20 percent of all energy used by industry in the United States.

Texas IOF activities include:

- An executive steering committee, consisting of industry and academic advisors in chemicals, refining, and forest products, is guiding the Texas IOF strategy.
- Publicizing Texas IOF Best Practices training sessions to its mailing list and through trade associations. The training sessions are well received by industry.
- Held an EERE Texas Technology Showcase in March 2003 in Houston that focused on energy efficiency technologies and best practices that reduce NOx and VOCs in the chemical and petroleum refining industries. This first-of-a kind EERE-wide event showcased corporate commitment to enhance energy efficiency, cutting-edge commercialized technologies, and successful projects that resulted from public-private collaboration.



The Timken Company

The Timken Company’s commitment to innovation in the area of energy conservation drives the company’s involvement in partnerships with outside organizations. Timken serves a leadership role in strategic planning initiatives to further broad-based energy reduction efforts throughout the steel industry.

Timken also engages in several collaborative partnerships with the Office of Energy Efficiency and Renewable Energy (EERE), including revising and re-issuing the *U.S. Steel Industry Technology Roadmap*. The company participates in projects funded by the U. S. Department of Energy.

Timken collaborated with EERE on projects including:

- **Laser Ultrasonic Technology**—Developed a laser ultrasonic technology to measure the wall thickness of seamless mechanical steel tubing for use by mill operators in process control. Projected benefits include increased yield, reduced scrap and rework, and annual savings of \$4 million. Annual energy savings in tube making are 2.3 trillion Btu.
- **Controlled Thermo-Mechanical Processing**—Developing controlled thermo-mechanical processing technology in steel production to reduce heat-treatment cycles through control of the microstructure of steel. Projected benefits include more efficient processes and annual savings of \$16 million.
- **Nickel Aluminate Heat Treating Fixtures**—Timken is using nickel aluminate alloy trays and fixtures, developed under the Industrial Materials Program at Oak Ridge National Laboratory. The superior resistance of this material to carburization in heat treating environments, and the high-temperature strength, reduces the amount of material required for fabrication and improves the service life by at least four times. Approximately one third of the energy used for heat treating operations is saved by the new materials.

The Timken Company is a leading international manufacturer of bearings, alloy, and specialty steels and components, as well as related products and services. The company employs approximately 18,900 associates in twenty-four countries around the globe.

The Timken Company’s commitment to energy conservation makes partnerships with outside organizations necessary to achieve broad-based conservation objectives.
—William A. Fladung
The Timken Company



University of Utah

Several departments at the University of Utah, together with the University’s Utah Engineering Experiment Station (UEES), have been actively engaged in mineral and energy exploration and recovery. These partners have worked closely with the U.S. Department of Energy’s (DOE) Industrial Technology Program (ITP).

One example of their cooperation is the successful Utah 2001 Industry Showcase. This showcase focused on Utah’s Industries of the Future, including the mining, petroleum refining, metal casting, and aluminum industries.

The University and DOE have also worked together on the Intermountain Industrial Assessment Center (IIAC), a center that assesses small- and mid-sized manufacturing facilities to improve their productivity. Last year, these facilities implemented more than 70 percent of the IIAC cost-saving recommendations.

In collaboration with mining partners and DOE, the University of Utah has worked on innovative technologies to assist the mining industry. DOE awarded the UEES a grant to transfer such energy-related information and technology to the mining industry. In addition, the UEES is developing a technology-focused network in the Intermountain West to enhance technology and information transfer from universities and national laboratories to industries throughout the region.

Targeted facilities implemented 70% of the University’s IIAC productivity recommendations.

To further assist in technology and information transfer, the UEES also sponsors an annual “Inventions to Commercialization Conference” that instructs researchers and inventors on methods to bring their technologies to market. This year, a successful Innovation Showcase was held in conjunction with the conference. Universities, small businesses, and national laboratories exhibited fifty developed technologies. Since then, researchers have collaborated with venture capitalists, entrepreneurs, and other researchers who met each other at the showcase.



U.S. Steel

More than a century after its founding, the United States Steel Corporation remains the largest integrated steel producer in the United States. Headquartered in Pittsburgh, Pennsylvania, the company manufactures and sells a wide variety of steel sheet, plate, tubular and tin products, coke, and taconite pellets to customers around the world.

To maintain its station as an industry leader, U.S. Steel invests heavily in advanced technologies and continuous improvements in its operations. Working in conjunction with the Office of Energy Efficiency and Renewable Energy (EERE), U.S. Steel conducted plant-wide assessments of energy use and implemented several improvement projects at the company's Irvin and Edgar Thomson

Plants in Pennsylvania's Mon Valley. In 2001, the Edgar Thomson Plant was named the EERE Plant of the Year for its energy conservation improvements.

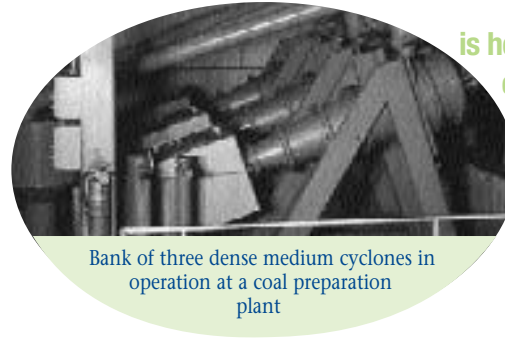
In addition to these efforts, U.S. Steel was the leading contributor to the development of the *U.S. Steel Industry Technology Roadmap*, with U.S.

Steel representative Mark Atkinson co-chairing the project. The company has also been a participant in several collaborative projects with EERE:

- **Blast Furnace Hot Oxygen Injection**—Collaborating on an effort to develop a system for direct injection of hot oxygen into blast furnaces to create improved mixing and combustion conditions for blast furnace coal injection. Projected benefits include reduced operating costs, energy consumption, and emissions, and savings of \$2.24 million each year per furnace.
- **Increased Uniformity of High-Strength, Low-Alloy Sheet Steels**—Helping to investigate the factors that reduce variability in yield strength and grain size of hot-rolled steel. This will strengthen the market for high-strength, low-alloy sheet steels, which are used primarily for automobile parts. Projected benefits include improved production yield and quality, and resulting savings, as well as increased fuel efficiency in automobiles.



Virginia Tech



Bank of three dense medium cyclones in operation at a coal preparation plant

Virginia Tech is helping to improve energy efficiency, productivity, safety, and environmental performance in the mining industry.

Virginia Tech Department of Mining and Minerals Engineering is home to two major mining and energy research centers: the Virginia Center for Coal and Energy Research (VCCER) and the Center for Advanced Separation Technologies. Major areas of research include:

- Mining Systems Simulation
- Virtual-Reality Applications in Mining
- Energy Planning and Management
- Rock Mechanics and Ground Control
- Solid-Solid Separation
- Solid-Liquid Separation
- Environmental Management and Control.

Research in these areas is helping to improve safety, energy efficiency, productivity, and environmental performance in the mining industry.

Virginia Tech brings this technical expertise to the Mining Industry of the Future partnership on a number of R&D projects. For example, a project team was assembled to develop and test innovative engineering tools to improve coal recovery.

Virginia Tech is also leading R&D on cyclone technologies to improve energy efficiency in separating coal and minerals from ore. As a result of the Mining IOF collaborative partnership with Massey Coal, Precision Testing Laboratory, and Partition Enterprises, Ltd., the Department of Mining and Minerals Engineering is implementing new operating and maintenance standards for the coal industry.

Michael Karmis, Stonie Barker Professor of Mining and Minerals Engineering and Director of the VCCER, is a State IOF champion in Virginia and at the national level. As president of the Society for Mining, Metallurgy, and Exploration, Inc., Dr. Karmis is working closely with EERE to communicate Mining IOF research priorities. Through a State IOF grant, Virginia Tech is holding seminars for the Virginia mining industry on energy management, reforestation, environmental remediation, novel training concepts, mining systems optimization, and implementation of fuel cell technologies in underground mining. This work supports vital technology transfer from research institutions to industry.



Weir Specialty Pumps



Roto-Jet pumps manufactured by Weir Specialty Pumps will be used for NOx suppression on gas turbine generators

Through its partnership with DOE, Weir Specialty Pumps has promoted energy efficiency in a number of ways in the past 3 years.

Weir Specialty Pumps™ (WSP) is part of the WEIR Group PLC in Glasgow, Scotland. The Group, founded in 1871 and today one of the world's top pump manufacturers, has nearly 10,000 employees with an extensive global network of manufacturing plants and service operations. The Group serves a number of global markets including power, oil/gas, water/sewage, marine, minerals processing, and general industrial.

Headquartered in Salt Lake City, Utah, WSP has been providing the world with specialized pumps and equipment for nearly a century. Municipal waste water and sludge, power generation, chemical processing, pulp and paper, phosphate and fertilizer, oil drilling, food handling, and high-pressure cleaning are just a few of the many industries served by WSP products.

Through its partnership with DOE, WSP has promoted energy efficiency in a number of ways:

- WSP co-hosted a *Pump Systems Assessment Tool (PSAT)* workshop in Houston, Texas.
- WSP's Director of Engineering and R&D participated in the PSAT Specialist Qualification pilot training workshop, passed the qualification exam, and became a Qualified Pump System Specialist. In May 2002, he qualified as an instructor.
- WSP became an Allied Partner with the DOE's Office of Energy Efficiency and Renewable Energy (EERE).
- WSP sponsored, with one of its distributors, a PSAT end-user workshop in Baton Rouge, Louisiana, and distributed fifty copies of the DOE Decision Tools CD.
- During the past three years, WSP supported efforts to produce the Hydraulic Institute's *Pump Life Cycle Costs: A Guide to LCC Analysis for Pumping Systems*.

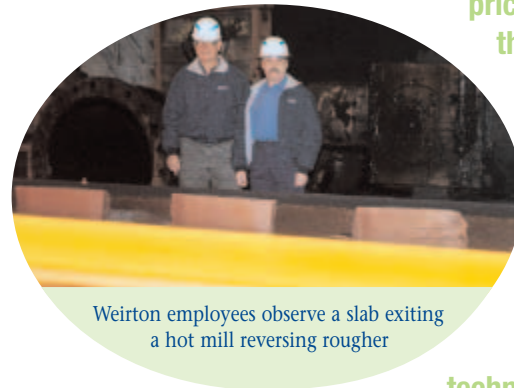
Weirton Steel

Founded in 1909, the Weirton Steel Corporation is a large integrated steel company and manufacturer of tin-plated steel. The company embraces innovation and partnerships dedicated to the advancement of the industry, including collaboration with the Office of Energy Efficiency and Renewable Energy (EERE) in a range of activities.

In May 2000, Weirton partnered with EERE in a demonstration of energy efficiency and productivity advancements in the Pittsburgh Regional Technology Showcase. The company provided guided tours and technical presentations of the cutting-edge technologies in use at its Weirton Steel Plant. The plant tours demonstrated how EERE-supported R&D and BestPractices are increasing the energy efficiency of steel production and improving its quality.

When spot natural gas prices hit \$10 per thousand cubic feet not too long ago, we were very lucky to have a project pipeline and network of technology support already in place.

—Phil Elbaz Weirton Steel



Weirton employees observe a slab exiting a hot mill reversing rougher

More recently, Weirton has undertaken a number of EERE-supported efforts directed at improving energy efficiency in its operations, including:

- Plant-wide Energy Efficiency Assessments—Evaluating its plant processes to uncover areas in which modifications in procedures or technologies could improve energy efficiency in the areas of compressed air system design, utilities automation, and water pumping. Projected benefits include: \$1 million per year from improved utilities automation and at least \$150,000 per year from reconfigured compressed air systems.
- Infrared-based Steel Strip Preheating—Working with the Oak Ridge National Laboratory to implement a system using infrared technology to preheat steel strip entering the furnace. Projected benefits include reduced energy use and increased throughput.
- Boiler Panel Overlay—Weld-overlaying boiler panels with new materials that will improve overall boiler efficiency and greatly reduce maintenance requirements. Projected benefits include savings of \$5.2 million in operating and maintenance costs.

In addition to these projects, Weirton is currently investigating efficiency improvements through the use of innovative materials in galvanizing pot hardware and recycling and/or marketing iron-bearing mill wastes, among other areas.

Weyerhaeuser

In 1994, the forest products industry signed a Compact with DOE's Office of Energy Efficiency and Renewable Energy (EERE), and the industry's technology visioning process, Agenda 2020, was born. Weyerhaeuser scientists, engineers, and executives have been strong participants in making the working groups of Agenda 2020 successful.

Weyerhaeuser has benefited in many ways from this important partnership. In 1994, the company received a grant from DOE to study the possibility of locating a biomass gasification combined-cycle technology at its mill in New Bern, North Carolina. As part of the same study, the potential of producing ethanol from biomass was also thoroughly evaluated. A follow-on grant in 1996 focused on a detailed feasibility study of the gasification plant and scoped the conditions that would be necessary for such a project to be economically sustainable. The results of this effort are still used as a primary reference for evaluating possible gasification applications in Weyerhaeuser mills.

Weyerhaeuser has worked with DOE in carrying out thermal and electrical conservation assessments. Currently, two assessments are underway at mills in Longview, Washington, and Plymouth, North Carolina. The company is an active participant in DOE's BestPractices activities and has taken advantage of best practice training in selected areas. An Allied Partner agreement is currently under development in order to allow a wider dissemination of the products offered by EERE.

Since the mid-seventies, the relationship between Weyerhaeuser and EERE has been an excellent example of an effective and efficient partnership between industry and government.

Most recently, the company has cooperated with EERE in hosting a Washington State Industry of the Future event at its technology center in Federal Way, Washington. Since the mid-seventies, the relationship between Weyerhaeuser and EERE has been an excellent example of an effective and efficient partnership between industry and government that has benefited Weyerhaeuser, its customers, its stakeholders, and the nation.

WPI—Center for Heat Treating Excellence

The Center for Heat Treating Excellence (CHTE) located at Worcester Polytechnic Institute (WPI) is dedicated to the advancement of heat-treating processes through collaborative research and development in accordance with the Heat Treating Technology Roadmap and the Current R&D Plan and Vision 2020 Document. Both of these documents were established through industry workshops sponsored by DOE's Office of Energy Efficiency and Renewable Energy. The Center was established in 1999 within the Metal Processing Institute (MPI) at WPI as an alliance between the industrial sector consisting of heat treaters, heat-treating suppliers and manufacturers of industrial products, and university researchers.

MPI's vision is to be the premier university-based research facility dedicated to advancing the state-of-the-art in near-net-shape manufacturing. Through its focus on metal processing, MPI brings fundamental understanding to existing processes, develops new methods, and addresses management-technology interface issues with input from its industrial partner. The CHTE member companies define and direct the needed research, whereas the WPI faculty members, and their respective research team members, address fundamentals that are needed to establish the knowledge base for the heat-treating sector.

CHTE develops innovative processes to control micro-structure and properties of metallic components, reduce energy consumption, reduce process time, reduce production costs, achieve zero distortion, increase furnace efficiency, and achieve zero emissions. The Center's consortium funded and launched four research projects in 2000. These are: Analytical Tools for Parts Loading Design and Temperature Control; Quenching Control Process; Distortion and Residual Stress Control; and Solution Heat Treatment of Aluminum Alloys. The following two new projects were added to CHTE's research portfolio in 2002: Quenching-Understanding, Controlling and Optimizing the Process, Phase II; and Enhancement of the Computer-Aided Heat Treatment Planning System. Visit www.wpi.edu/~mpi for more information.

CHTE is dedicated to the advancement of heat-treating processes through collaborative research and development in accordance with the Heat Treating Technology Roadmap and the Current R&D Plan and Vision 2020 Document.

Delivering Advanced Technologies to U.S. Manufacturers

Addressing National Energy-Efficiency and Environmental Objectives

Reliable, affordable, and environmentally sound energy for America’s future is the cornerstone of the National Energy Policy. Even so, an expanding economy, growing population, and rising standard of living create increasing demands for energy. In 2000, energy consumption in the United States exceeded domestic energy production by more than 25 quadrillion Btu. According to statistics from the Energy Information Administration, this number is the equivalent of five times the energy consumed every year in the state of New York. This energy imbalance challenges our economic competitiveness and our future energy security. The National Energy Policy states that the gap between domestic energy demand and supply must be closed by advances in technology.

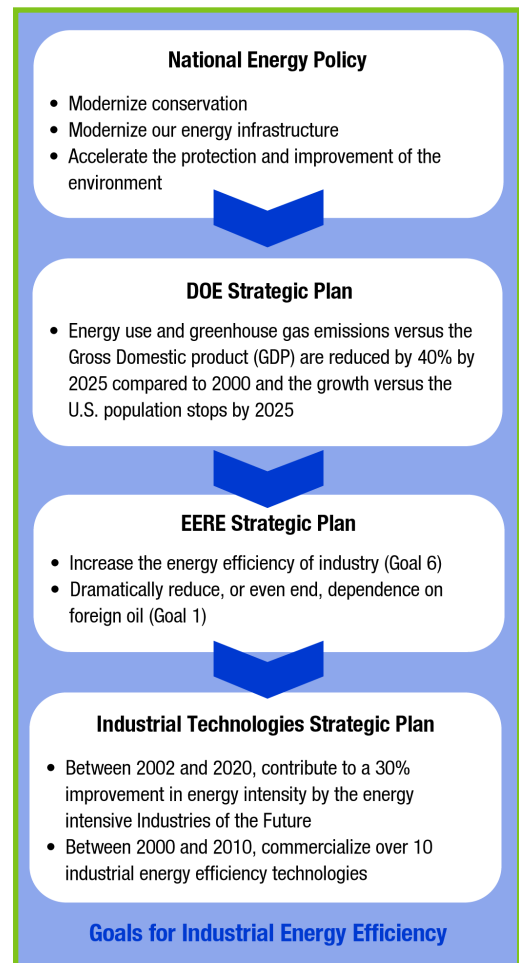
Through its energy strategy, the U.S. Department of Energy (DOE) protects national energy security by promoting a diverse energy supply and the delivery of reliable, affordable, and environmentally sound energy. One of the critical aspects of this goal is improving energy efficiency. DOE increases energy efficiency through its various programs in the Office of Energy Efficiency and Renewable Energy (EERE).

Of these programs, the Industrial Technologies Program (ITP) leads federal efforts to improve industrial energy efficiency and environmental



Photo courtesy Callidus Technologies, Inc.

Technology commercialization ensures that energy efficiency benefits are multiplied throughout industry. For example, this ITP-sponsored technology, an ultra-low emissions burner commercialized in 2000, reduces nitrogen oxide emissions by more than 80% in the chemical and refining industries.



performance. The industrial sector is the single largest consumer of energy, using more than one-third of the 96 quadrillion Btu consumed in the United States. While U.S. industry has become much more efficient over the past 30 years, it still offers excellent opportunities to increase efficiency. Cumulatively, from 1990 to 2002, the ITP portfolio of technologies has contributed to nearly 2 quadrillion Btu in industrial energy savings, which are valued at more than \$8 billion. ITP has set aggressive goals to commercialize more than ten new industrial energy efficiency technologies by 2010, and to contribute to a 30 percent improvement in energy intensity by 2020.

Targeting Energy Saving Opportunities

To achieve these goals, ITP works with critical, energy-intensive U.S. industries. The program facilitates

partnerships and addresses common goals to improve energy efficiency, increase productivity, and reduce waste. This strategy, known as Industries of the Future (IOF), helps industries maintain their competitive edge by developing and adopting energy-efficient and waste-reduction technologies and processes. It will be critical for the United States to accelerate industry's adoption of new technologies to reduce dependence on foreign sources of energy, and to help manufacturers remain competitive by saving millions of dollars per year, increasing output, decreasing waste, and lowering environmental emissions. The IOF technology delivery strategy is underpinned by relying on the private sector to cooperatively promote industrial energy efficiency with ITP in the marketplace.

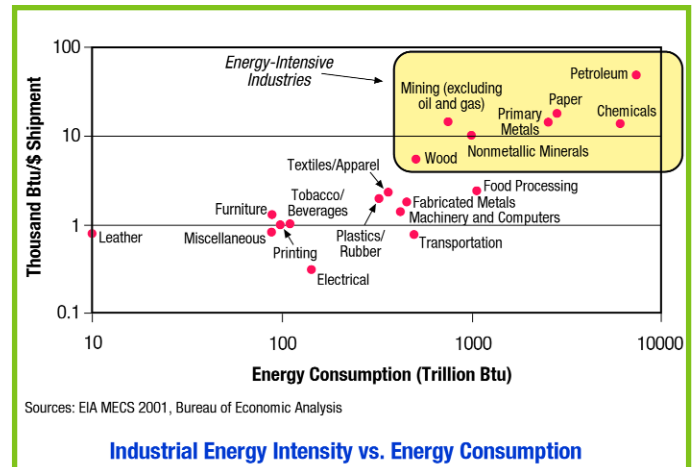
ITP partners with industry through a competitive solicitation process, providing financial assistance to selected research, development, and demonstration projects that can dramatically accelerate the pace of technology innovation. These partnerships bring the expertise of private companies, national laboratories, and universities to bear on solving critical technological challenges.

Industrial energy use is often determined by specific processes. 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 variations inhibit a one-size-fits-all approach to energy efficiency. However, by working with industry partners to guide research priorities, the Industrial Technologies Program invests in



Partners host plant tours during Showcase Demonstration events to highlight technology achievements.

research and development of technologies that will address these unique energy needs. In addition, by bringing partners together from different industries, ITP can identify and support those technology areas that can be applied to multiple industries. For instance, researchers at Oak Ridge National Laboratory and



their industrial partners received cost-shared support to develop an array of inter-metallic alloys. These novel materials, which resist corrosion and fatigue in harsh, high-temperature environments, and enable higher thermal efficiencies in industrial processes, address critical needs in the steel, metal casting, forest products, and chemical industries.

ITP leverages its research and development investments and builds exponentially on energy successes by replicating technologies and practices. Replication occurs at both the corporate and industry levels, that is, within companies with multiple facilities and within industries made up of manufacturers with similar processes. For example, DOE and Alcoa shared costs for a \$200,000 energy assessment of an Alcoa plant in Lafayette, Indiana. The assessment team identified nearly \$2 million in annual savings opportunities. The company is now using the tools and training acquired from that assessment to assess 10 more plants within the next year. Thus, Alcoa expects to find even more savings opportunities.

Energy Savings Results through Technology and Energy Management Best Practices

Manufacturers can save enormous amounts of energy right away by using off-the-shelf technologies and energy management best practices. This year, ITP has contributed to savings in excess of 200 trillion Btu by supporting such measures, which include plant-wide energy assessments, system assessment and optimization software tools and training, showcase demonstrations, and emerging technology validation.

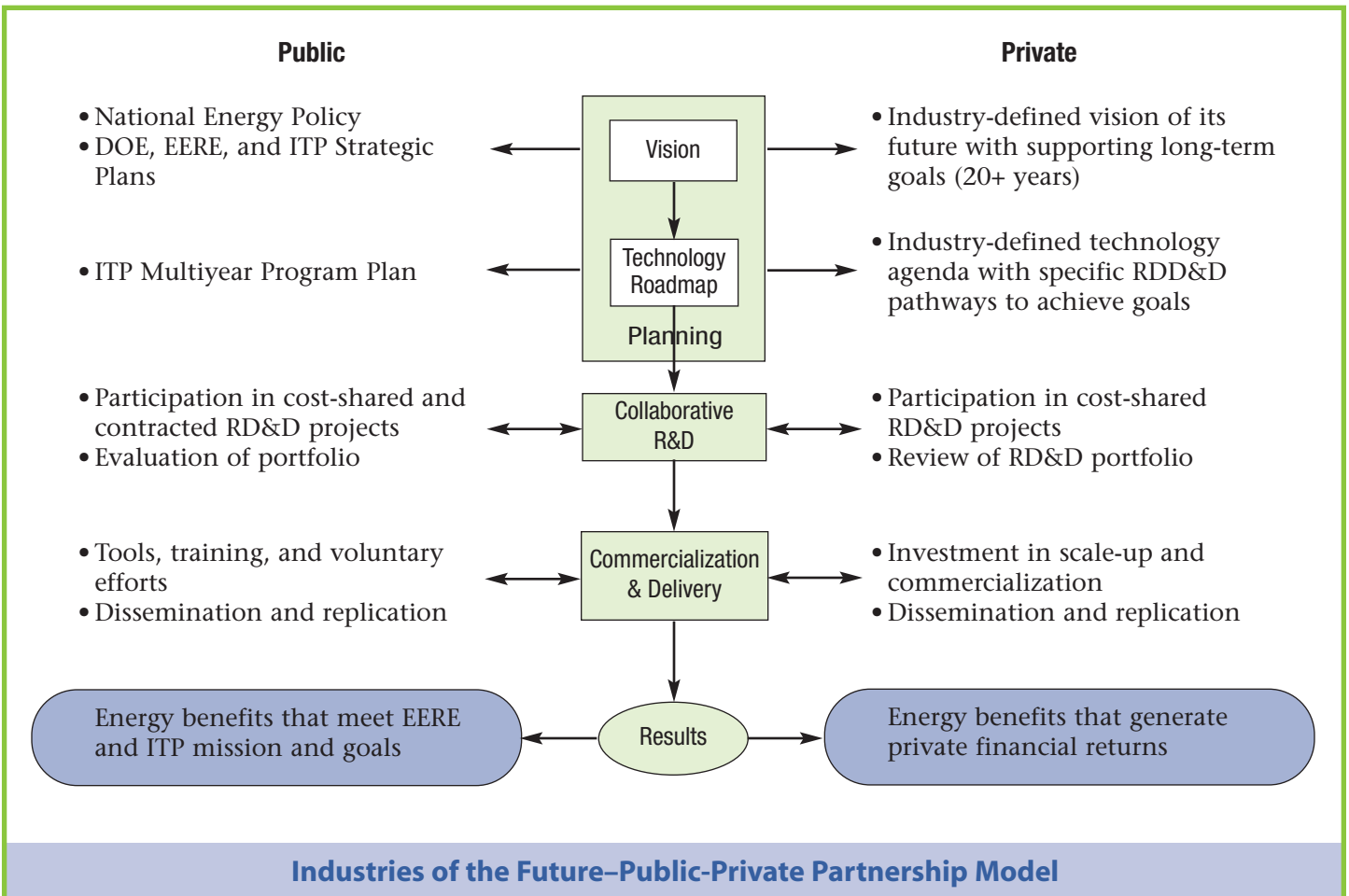
To date, more than 30 plant-wide energy assessments have been conducted through a cost-shared solicitation process. Typically, a DOE energy team will work with

plant personnel to conduct the assessment. Assessments usually include training in DOE’s diagnostic software tools that help plant personnel identify savings opportunities in industrial systems, such as motor drives, process heating, steam, compressed air, fans, and pumps. These tools facilitate repair/replace decisions about equipment to keep operations at optimal efficiency levels.

Immediate savings help balance the longer-term risk of investing in new technologies. ITP offers technology validation and showcase demonstrations to industrial partners to encourage adoption of new technologies. Technologies that are emerging from the research and development process must be validated in real-use conditions. ITP works in partnership with manufacturers who are willing to apply new technologies in their processes. Together, the organizations validate the technologies’ performance by testing and monitoring. Then the partners demonstrate the use and benefits of successful technologies in public events called Showcase Demonstrations.



Industrial energy assessments identify energy saving opportunities throughout plant operations.



Working with ITP

Manufacturers interested in working with the Industrial Technologies Program will find that there are a number of ways to become involved.

Partnership Opportunities

Public-private partnerships are the foundation of ITP's technology delivery strategy. This strategy is a successful model in bringing together the strengths of business and government to address complex energy issues. ITP includes its partners in every phase of the technology development process, including planning, collaborative research and development, and implementation. The process focuses scarce resources where they can have the greatest impact on industrial energy efficiency. To learn more, please visit our Web site at www.eere.energy.gov/industry.

- Collaborative, **cost-shared research and development** projects are a central part of ITP's strategy. Annual solicitations provide technology development opportunities in a variety of energy-intensive industries.
- **Industries of the Future Partnerships** increase the energy efficiency in the most energy-intensive industries—aluminum, chemicals, forest products, glass, metal casting, mining, petroleum refining, and steel—that supply 90 percent of the materials in the finished products we use every day. In addition to cost-shared research and development projects, industry partners participate in the development of vision and roadmap documents that define long-term goals, technology challenges, and research priorities.
- **Allied Partnerships** provide an opportunity for ITP to reach a broad audience of potential customers by allying with corporations, trade associations, equipment manufacturers, utilities, and other stakeholders to distribute industrial energy efficiency products and services. By becoming an Allied Partner, an organization can increase its value to clients by helping them achieve plant efficiencies.
- **State energy organizations** work with ITP in applying technology to assist their local industries. ITP assists states in developing IOF partnerships to mobilize local industries and other stakeholders to improve energy efficiency through best practices, energy assessments, and collaborative research and development. State partnerships ensure that ITP understands state priorities and that states become partners in the dissemination of EERE technologies.
- **EERE's technical programs** (of which ITP is one of eleven) give manufacturers access to a diverse portfolio of energy efficiency and renewable energy technologies

and bring advanced manufacturing technology to the renewable energy community. For more information access the EERE home page at www.eere.energy.gov/.

- The President's **Climate VISION** (Voluntary Innovative Sector Initiatives: Opportunities Now) effort also offers opportunities for manufacturers to pursue cost-effective actions that will reduce greenhouse gas emissions. See www.climatevision.gov for details.

Access to Resources and Expertise

The Industrial Technologies Program provides manufacturers with a wide variety of industrial energy efficiency resources to help your company cut energy use right away. Visit our site at www.eere.energy.gov/industry or call the EERE Information Center at 877-337-3463 to access these resources and for more information.

- ITP offers **energy management best practices** to improve energy efficiency throughout plant operations. Improvements to industrial systems such as compressed air, motors, process heat, and steam can yield enormous savings with little or no capital investment.
- Our suite of powerful system optimization **software tools** can help plants identify and analyze energy saving opportunities in a variety of systems.
- **Training sessions** are held several times per year at sites across the country for companies interested in implementing energy saving projects in their facilities. DOE software tools are used as part of the training sessions.
- ITP's qualified **industrial energy specialists** will work with your plant personnel to identify savings opportunities and train staff in the use of ITP software tools.
- Our extensive library of **publications** gives companies the resources they need to achieve immediate energy savings.
- **Plant-wide energy assessments** are available to manufacturers of all sizes interested in cutting their energy use. Cost-shared solicitations are available each year for plant-wide energy assessments. In addition, no-cost, targeted assessments are provided to eligible facilities by teams of engineering faculty and students from 26 university-based Industrial Assessment Centers around the country.
- The **DOE Regional Offices** provide a nation-wide network of capabilities for implementing ITP's technology delivery strategy. Regional Offices are located in Atlanta, Boston, Chicago, Denver, Philadelphia, and Seattle. Visit www.eere.energy.gov/rso.html for more information.

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About the Office of Energy Efficiency and Renewable Energy (EERE)

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 hydrogen technologies 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



For more information, please contact:

EERE Information Center
1-877-EERE-INF
(1-877-337-3463)
eereic@ee.doe.gov

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