

plant profiles

Industrial Energy Management in Action



Office of Industrial Technologies



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

plant profiles

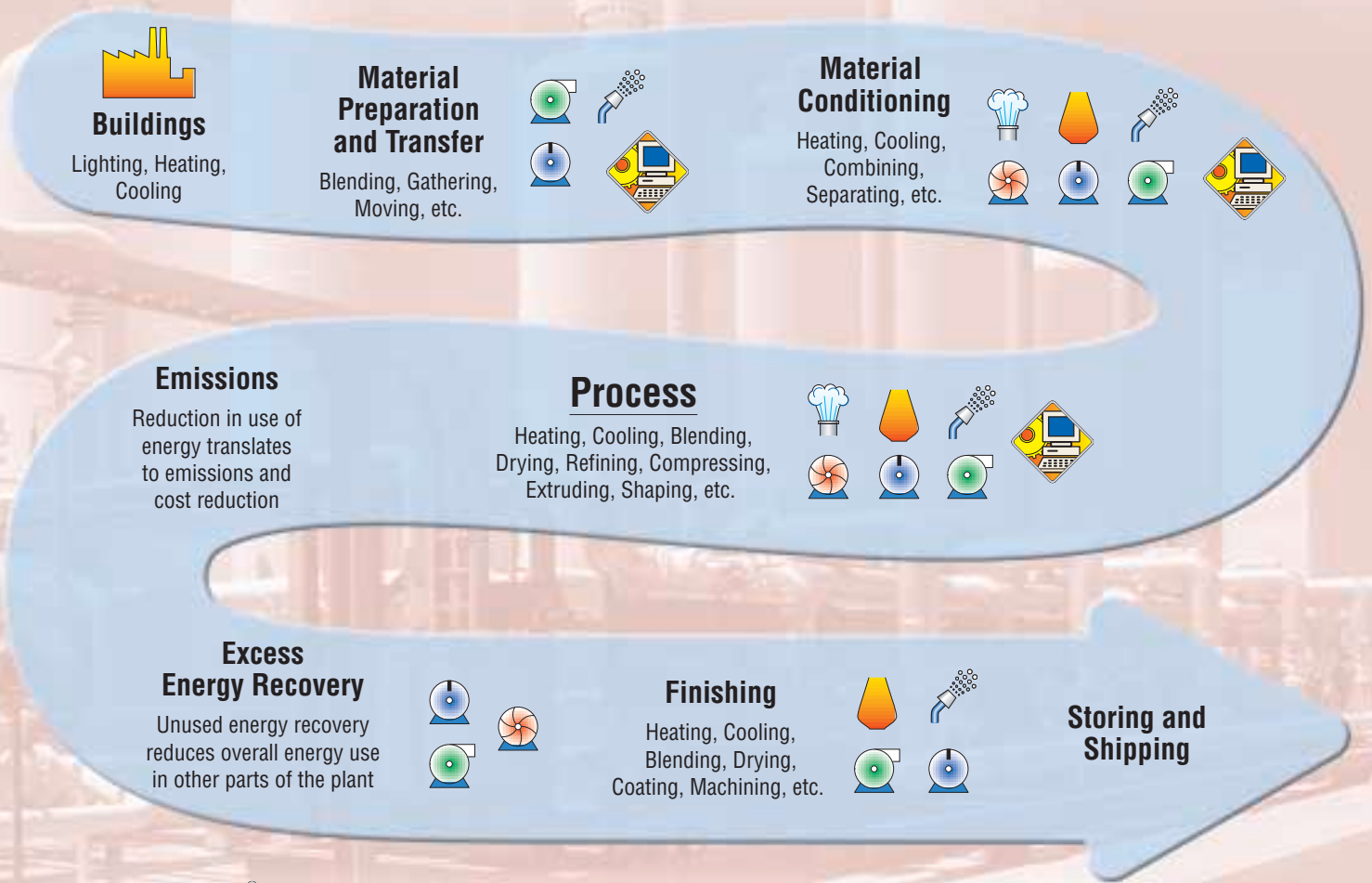
Plant Profiles: Industrial Energy Management in Action presents companies across America that have implemented best energy management practices in their manufacturing facilities. The six featured plants are active participants in OIT's Industries of the Future strategy, which seeks to boost efficiency and productivity for nine energy- and resource-intensive industries—agriculture, aluminum, chemicals, forest products, glass, metal casting, mining, petroleum, and steel—and all featured plants are nominees for the OIT 2001 Plant of the Year award. Project profiles are included of honorable mention companies that are also working to make their facilities more energy efficient and productive.

These facilities have implemented a number of new technologies that expand the potential for energy savings. By replicating technologies that have been demonstrated, they leverage limited research and development dollars and gain from the experiences of other manufacturers. In addition, the energy activities at all of these companies include plant-wide energy assessments that involve a review of industrial and process systems such as compressed air, motors, steam, and process heating.

Most of the activities and technologies presented here, and many others supported by OIT, are readily applied in similar industrial environments and should result in similar savings. To learn more about these activities, read the About OIT and About BestPractices sections of this brochure, visit our Web site at www.oit.doe.gov, or contact the OIT Clearinghouse at 1-800-862-2086.

Energy Use = Opportunities for Efficiency

The energy use diagram below shows areas of potential energy savings opportunities in the manufacturing process. Examples are presented of where in the process new and emerging technologies and systems improvements could be implemented such as those made by the companies presented in *Plant Profiles*.



Key to Energy Use Icons





welcome

Welcome to the inaugural edition of Plant Profiles.

As you read through these pages you'll discover what the forward-thinking companies profiled here already know. By applying energy- and process-efficient technologies, industrial manufacturers can cut costs, increase productivity, and improve their overall competitiveness.

These companies are working in partnership with the U.S. Department of Energy's Office of Industrial Technologies (OIT) and have committed to a comprehensive energy management strategy for their facilities. The achievements of these partners are remarkable. Collectively they will save \$51.6 million in energy costs, realize energy savings of 25.5 trillion Btu (equivalent to the energy consumption of about 255,000 typical U.S. homes), and reduce CO₂ emissions by more than 100,000 tons annually, while simultaneously increasing productivity.

Many of these companies are in the forefront of applying technologies that have emerged from research and development and are now ready for commercial demonstration. The plant-wide approach adopted by these partners includes an assessment of their energy use, an analysis of a variety of industrial systems (such as motors, steam, compressed air, and process heating), and implementation of improvements based on subsequent recommendations. In addition, the success these plants have achieved is due in part to a corporate-level commitment to cut energy costs and reduce environmental impacts, and to dedicated energy teams that make increased efficiency a priority in their daily operations.

Please join me as we congratulate these companies on their achievements. Many of the successes these partners have accomplished can be duplicated at most industrial facilities. I invite you to visit our Web site at www.oit.doe.gov and discover what similar energy management technologies can do for your company.

Sincerely,

Denise Swink
Deputy Assistant Secretary
Office of Industrial Technologies



**U.S. Steel Group, Mon Valley Works
Irvin Plant, West Mifflin, Pennsylvania;
Edgar Thomson Plant, Braddock, Pennsylvania**

U.S. Department of Energy
Office of Industrial Technologies
2001 Plant of the Year

Energy Management Activities:

USX Corporation's U.S. Steel Group (USS) has made heavy investments in advanced technology, which keeps the company in the forefront of American integrated steel makers. Helping them maintain a leadership position worldwide is their commitment to continuous improvement throughout their operations including dedicated energy conservation teams at their Irvin and Edgar Thomson Plants in Pennsylvania. These teams actively seek opportunities to make improvements that will decrease the company's overall energy use, thus decreasing their impact on the environment while simultaneously increasing productivity.

An energy inspection audit of the Mon Valley Works, which includes the Irvin and Edgar Thomson plants, was completed in late 1999. This audit focused on identifying piping-related (steam, compressed air, water, oxygen) energy losses in each area of operations throughout the Mon Valley Works.

In addition, at the Edgar Thomson Plant, several projects were implemented in conjunction with a DOE Showcase Demonstration including:

- Blast Furnace Burden Monitor
- Degasser combination lance
- Basic Oxygen Process (BOP) vessel off-gas sensor
- Scannerless Range Imaging (SRI) vessel contour sensor system

The Irvin Plant created an energy conservation team in 1999 consisting of personnel representing all production, maintenance, and utility areas. Initially, this team was charged with addressing the findings of the energy inspection audit and working with the Edgar Thomson Energy Team on effectively utilizing byproduct (coke oven gas) from the USS Clairton Plant.

Other Energy Achievements:

Additional energy projects at the Mon Valley Works include:

- Installing a coke oven gas compressor station at the Edgar Thomson Plant to increase gas from 10 to 55 psi for injection at the Blast Furnace Tuyere, which eliminated the purchase of natural gas for this

“ At the Edgar Thomson Plant we have saved approximately \$2.6 million in production and energy costs and realized a 9.3% reduction in energy use. DOE projects have resulted in optimization in maintenance and production in several areas.”

Bill Federoff
Power, Steel, and Environmental
Facilities Supervisor



Potential Annual Savings: All Mon Valley Works facilities, \$2.6 million

Potential Energy Savings: All Mon Valley Works facilities, 7.8 MMBtu per ton produced

Plant Manager Ken Sapos (l), MVW General Manager Fred Harnack (c), and MVW Director of Plant Services, Jack Helfrich (r) in front of the slab runout area at the state of the art dual strand caster at the Edgar Thomson Plant.

process while utilizing the by-product gas from USS Clairton Works. This project resulted in annual savings in excess of \$6 million.

- Working with a subcontractor to supply oxygen for the Edgar Thomson Plant and nitrogen for use at Edgar Thomson, Irvin, and Clairton plants. This contract permitted the closing of the less energy efficient Edgar Thomson Oxygen (Air Separation) Plant and the Air Products Nitrogen Plant at the Irvin facility. This resulted in significant savings in the price of gases and in the cessation of operation of two inefficient facilities.
- Installing a hydrogen extraction plant to supply gaseous hydrogen at the Irvin facility. This plant will reduce the cost for hydrogen and create a more reliable local operation than transporting it in a liquid and vaporizing it to a gaseous state.

Industry-wide Application:

The Mon Valley Works plants share their technology advancements. As an example, their Energy Management System was expanded to gather data for USS Fairless Works and Clairton Works.

Mon Valley Works personnel attend the yearly American Iron and Steel Institute (AISI) Boiler/Power House Workshop and play an active role in presenting information and answering questions concerning their energy successes. In 1999, Mon Valley Works hosted the AISI Workshop. New technologies are also shared among the participating nationwide steel companies.

On May 3-5, 2000, the Mon Valley Works played a major role in the DOE/OIT Pittsburgh Area Technology Showcase. Mon Valley Works sponsored a main booth designed to showcase information and advancements, conducted plant tours of the Edgar Thomson Plant, demonstrated the Low NO_x Combustion Burner Design and Hi-Efficiency Pump Technology, featured four major Showcase projects, and developed two DOE case studies.

Industry Partners:

U.S. Steel Group; U.S. Department of Energy, Office of Industrial Technologies; Associated Construction Management



*Members of the Edgar Thomson Plant Energy Team
Top row (l to r): Jeff Wilson, Jason Osekowski, Jim Antenucci, Fred Maddalena, George Walters, Jim Cramer, Jack Wilson.
Middle row (l to r): Dave Suhoza, Dean Rapacchietta, Rick Maitland, Dave Goode, Tim Fenton, Alex Drain, John Lackovic, Bob Stough, Howard Rumbaugh, Matt Kuta.
Bottom row (l to r): Ken Pollock, Brian Noftsier, Sam Hutton, Bill Federoff, Kevin Sarnowski, Mark Jeffrey.*

Corporate Commitment:

The Mon Valley Works has an Energy Management System (EMS) that monitors and logs data for over 2,000 energy points throughout the USS Mon Valley Works and Clairton Works. The EMS monitors and controls all energy sources on a real time basis while maintaining historical data for future reference and billing. The system is constantly updated to incorporate new facilities and data required to efficiently use energy while maintaining operations.

USS plans to continue the activities of the Energy Conservation Teams at the Edgar Thomson and Irvin Plants. Their strategy is to publicize the teams' activities and continue to expand efforts to involve all Mon Valley Works personnel in the energy saving process.



Alcoa North American Extrusions, Alcoa, Inc.

Lafayette Operations aluminum extrusion plant,
Lafayette, Indiana

Energy Management Activities:

Alcoa, the world's leading producer of primary and fabricated aluminum and alumina, continues to hone its competitive edge by pursuing a proactive energy management strategy. This strategy—which includes improvements to their compressed air system, furnace tuning and repair, pump optimization, and improved heat recovery—will result in significant cost savings and productivity increases for its Lafayette, Indiana, aluminum extrusion plant.

A plant-wide energy efficiency assessment identified eight areas for further analysis based on the results of a preliminary assessment, departmental energy use, and estimates of savings opportunities for major energy users, including:

- high-pressure extrusion press pumps
- Extrusion Unit #2 billet heaters
- Ingot Plant cooling water re-circulation system
- compressed air system
- plant lighting
- plant steam boilers
- melting furnaces
- energy monitoring

As part of the assessment, furnaces and combustion systems were also analyzed, and opportunities were identified for improved heat recovery methods and furnace operations. Energy monitoring methods were also reviewed and savings opportunities from improved metering and development of process energy use targets were identified.

Other Energy Achievements:

Underscoring its commitment to energy management, Alcoa North American Extrusion hosted three days of DOE BestPractices training for its engineering and maintenance personnel that focused on motors and pumping systems, compressed air systems, and variable speed drives. The training helped identify energy savings opportunities at several other Alcoa facilities with potential annual energy savings of \$28,000.

“ Alcoa North American Extrusions is committed to identifying better, more efficient uses of energy in the manufacturing process. Through partnerships with the U.S. Department of Energy, the Office of Industrial Technologies, and area universities, we are understanding how to be more efficient and take advantage of new, energy-efficient technologies. ”

Jim Bollenbacher
NAE Vice President, Environment,
Health and Safety



Potential Annual Savings: \$1.9 million estimated

Initial Capital Requirements: \$2.3 million

Payback Period: Approximately 1.2 years

Energy accounts for approximately one-third of the cost of primary aluminum production. System improvements like those made by Alcoa North American Extrusions should result in similar energy savings for other aluminum manufacturers.

Alcoa North American Extrusions also requested that Colorado State University (under the direction of the DOE Industrial Assessment Center) perform an assessment of the Spanish Fork, Utah, operation which includes ingot casting, extrusion, and fabrication in its facility processes. The recommendations for energy reduction and pollution prevention would save approximately \$842,630 in annual energy costs and bring a six-month payback.

Industry-wide Application:

Many of the applications identified for the Lafayette plant, such as improvements in compressed air systems and furnace maintenance, represent saving opportunities for other aluminum processing facilities. Additional opportunities include the evaluation of adjustable speed drives for AC electric motor systems and pump optimization analyses. The methods employed in the Alcoa project can be applied to any industry using these components.

Industry Partners:

Alcoa North American Extrusions; U.S. Department of Energy, Office of Industrial Technologies; Colorado State University

Corporate Commitment:

Alcoa North American Extrusions has established a corporate goal to reduce overall energy costs by 15% by the year 2003. To achieve their energy and waste reduction goals, the company has developed a corporate cost cutting plan by:

- ◆ Designating a single person to focus on energy assessments and technology
- ◆ Focusing on the plant with the greatest need
- ◆ Identifying specific projects, programs, and/or resources for individual locations
- ◆ Performing a plant-wide energy cost reduction assessment at its Spanish Fork and Plant City, Florida, plants

Benefits resulting from the plant-wide energy assessments have included development of an energy reduction plan and the establishment of an energy cost baseline for each plant assessed. Specific areas identified for further analysis were the plant electrical, compressed air, pumping, and lighting systems, motors, HVAC, cooling towers, production processes, and combustion equipment efficiency.

Alcoa North American Extrusions has agreed to host a Showcase at its Spanish Fork location to demonstrate the benefits of implementing DOE BestPractices and Aluminum Industry of the Future co-funded technologies, such as air/oxy fuel burners, a vertical floatation melter, and a rotary dross furnace. Alcoa is also considering installing some of these technologies at its Massena, New York; Elizabethton, Tennessee; Cressona, Pennsylvania; and Lafayette facilities.



*Members of Alcoa's Spanish Fork Energy Team
Bob Morrison, Spanish Fork Operations Manager (l);
Scott Evans, Spanish Fork Mechanical Engineer (c);
Garry Goehring, Alcoa NAE Environmental
Engineer (r); Jim Bollenbacher, Alcoa NAE
Vice President of Environment, Health and Safety
(far right).*

Energy Management Activities:

AMCAST Industrial Corporation is known for its expertise in developing unique metal products with high-technology content, and its ability to offer appropriate manufacturing processes to meet customer requirements. A variety of niche markets utilize AMCAST's spectrum of metal process technologies that are used to manufacture automotive and flow-control products. The company has 17 operating locations throughout the U.S. and Europe, and its Wapakoneta, Ohio, plant has approximately 300 employees and produces 20-25 million pounds of aluminum per year. AMCAST is employing the same innovative approach it uses in developing its products to help the company realize significant energy savings and productivity improvements.

In early 2000, AMCAST's Wapakoneta plant undertook a plant-wide energy assessment to evaluate energy savings and waste reduction opportunities. AMCAST, DOE, independent contractors, and representatives from the Ohio Department of Development, Office of Energy Efficiency, participated as partners in the assessment. The assessment resulted in 13 recommendations for process improvements and plant modifications, including:

- Switching to aluminum-titanate riser tubes from previously used dense fused silica material
- Using electric infrared heaters to pre-heat dies
- Improving tooling and tool maintenance
- Hiring engineers to reduce scrap rate
- Using exhaust heat from reverberatory melt furnaces in heat treating furnaces
- Using exhaust heat from heat treating furnaces in aging ovens
- Implementing identified energy savings opportunities for reverberatory furnaces
- Relocating jet melt furnace
- Installing adjustable-speed drives on casting machines
- Improving process flow
- Using a blower to pressurize die cast hold furnaces
- Using a cooling tower to cool compressed air
- Using exhaust heat from heat treating furnaces for scrap preheating

“ We expect to attain the \$3.6 million in savings and also anticipate additional savings through other initiatives that have been identified as a result of the Department of Energy and AMCAST's assessment. The energy assessment has initiated a plant-wide awareness that is acting as a catalyst for overall cost reduction throughout all areas of the plant. This has had a positive team-building effect at our facility. ”

Ronn Page
General Manager,
Wapakoneta Plant



Potential Annual Savings: \$3.7 million in immediate savings; additional savings expected

Initial Capital Requirements: \$1 million

Payback Period: Variable, depending on project, but some as little as 3 months

Potential Emission Reductions: 11 million pounds of CO₂

George Mauk (l) assists Daniel Bowers (r) with the installation of a new aluminum-titanate riser tube into a pressurized furnace on top of a mold machine.

Several of the recommendations have already been implemented and the results to date have been dramatic. Energy costs per part have decreased more than 20%, and productivity has increased by more than 75%, allowing AMCAST to change from a 7-day-a-week to a 5-day-a-week schedule.

Other Energy Achievements:

AMCAST Wapakoneta has already implemented or is in the process of implementing many of the assessment recommendations. In addition, Wapakoneta is reviewing or implementing the following:

- Reducing heat treating cycles
- Improving tooling designs
- Enhancing metal delivery
- Briqueting chips and flash
- Using exhaust heat from melting furnaces for ingot pre-heating
- Using a new method for sprue melting
- Applying robotic deburring of parts
- Installing a charging conveyor on jet melt furnace

Industry-wide Application:

The energy-assessment survey conducted at the Wapakoneta plant involved the review of primary plant systems, such as major gas and electrical equipment, plant lighting, and compressed air systems. Although the study resulted in recommendations for specific conservation measures and savings estimates for the Wapakoneta plant, the assessment approach was generic in nature and could easily be applied at other aluminum casting facilities. Many of the areas the study addressed, including plant lighting and compressed air systems, could be included in the analysis of almost any industrial process facility.

AMCAST plans to replicate many of the recommendations from the Wapakoneta's facility assessment. Implementation at other AMCAST facilities will be based on lessons learned at Wapakoneta.

Industry Partners:

AMCAST Industrial Corporation; U.S. Department of Energy, Office of Industrial Technologies; Ohio Department of Development, Office of Energy Efficiency



Wapakoneta Plant General Manager Ronn Page (r) and Tim Dripps, Plant Engineer (l), inspect a new aluminum-titanate riser tube.

Corporate Commitment:

AMCAST is a technology-driven company that promotes innovation. This commitment is passed to the many operating divisions and plants worldwide. Customers expect AMCAST to set the tone for new approaches in parts production, thereby reducing waste and costs.

Plans for future activities include:

- ◆ Continuous heat treating
- ◆ Infrared die temperature control
- ◆ Inert gas mold injection
- ◆ Alternative material compositions
- ◆ New metal filtration techniques

The Wapakoneta plant has also committed to reducing costs for FY 2001 by \$10 million.

Energy Management Activities:

Boise Cascade is a major pulp and paper producer with five U. S. paper mills, two paper-converting facilities, and six distribution centers. The company manufactures a wide variety of paper products, made from both virgin and recycled fibers, which are essential to the business, printing, and packaging industries. Boise Cascade's leadership in adopting new technologies has helped the company achieve considerable energy savings and process improvements.

A plant assessment was performed using an energy analysis methodology known as "Pinch Technology" to identify means for reducing the effluent heat load, which, in the summer, forces the mill to operate cooling towers, causing increased energy consumption. This assessment was performed in a cost-shared project with DOE that identified 17 potential projects to assist in effluent reduction. Of these, four projects and two process modifications were selected and subsequently implemented. Specific projects implemented include:

- Conserving base mill water
- Rerouting turbine room steam trap condensate
- Using foul condensate heat for demineralized water makeup to hotwells
- Modifying selected processes to decrease effluent flow and energy consumption.

These projects and modifications would remove 45.6 MMBtu/hr from the effluent, exceeding the reduction target of 35 MM Btu/hr estimated in the study. In addition, the projects would reduce steam use by 28,100 lb/hr and effluent flow by 2.2 million gallons/day (an 8% reduction in total flow).

“Partnering projects like these, where everyone wins, are important not only to our mill, but the entire industry. We are proud to be a successful part of this joint effort with the Department of Energy.”

Miles Hewitt
Vice President,
Minnesota Operations



Potential Annual Savings: \$707,000

Initial Capital Requirements: \$2.1 million

Payback Period: 3 years

Potential Energy Savings: 45.6 MMBtu/hr

The forest products industry is one of the most energy-intensive of all U.S. industries. Technology applications like those implemented at Boise Cascade could be installed at other pulp and paper mills with similar results.

Other Energy Achievements:

Boise Cascade's International Falls Mill has a tradition of identifying and implementing energy projects that improve process efficiency and reduce environmental impact. Over the last 5 years, the mill has identified and completed a number of energy projects in addition to those identified in the recent assessment. Three of the larger projects include bleach plant effluent heat exchangers, non-contact water recycling, and contaminated condensate heat exchangers. These projects resulted in savings of 91 MMBtu/hr with an approximate value of \$3.4 million/year.

In addition, a METHANE de-NOX[®] process was applied to the mill's refuse-fuel fired boiler. The project increased waste solids burning threefold, reduced natural gas consumption by 30%, and increased boiler efficiency 1.5%, all while reducing NO_x emissions by 40%. The increased waste solids burned would have otherwise been disposed of in a landfill. The project saved \$500,000 annually.

Industry-wide Application:

The technologies, processes, and equipment at all kraft pulp and paper mills are similar, and the same improvements at Boise Cascade can be applied to other mills with similar results. A study at Boise Cascade's Wallula, Washington, mill resulted in a 25% reduction in water use. Another study was also conducted at the company's Jackson, Alabama, mill to consider the installation of a 1,000 ton-per-day fine paper machine. As a result of the study, the mill installed the machine without any increase in total mill water use. Boise Cascade's examples substantiate the potential for energy savings and reduced environmental impact at other mills.

Industry Partners:

Boise Cascade Corporation; U.S. Department of Energy, Office of Industrial Technologies

Boise Cascade's Andrew Wright, Engineering Project Manager (l) and Miles Hewitt, Vice President, Minnesota Operations (r), verify efficiency of the project's heat exchanger that reclaims heat from wastewater used in the papermaking process.



Corporate Commitment:

Boise Cascade has spent considerable effort over the last 5 years specifically benchmarking its paper mills' energy use compared to the overall pulp and paper industry, and to the most energy-efficient paper mills in North America. As a result, corporate goals have been established to reduce energy consumption by 9% over the next 3 years. The company will identify projects that not only save energy, but also reduce water use, increase yield, and reduce environmental impact. Once implemented, these projects would amount to savings of 80 MMBtu/hr with an estimated value of \$3 million/year.

All Boise Cascade mills have a "Totally Optimized Process" (TOPS) plan that generates specific energy and environmental projects. Each mill develops its own optimally configured mill and compares it to actual operation. The difference between the model and actual operation creates the energy projects. In addition, the mills are now joined together in developing a comprehensive energy strategy for the corporation to further define policies and strategic and tactical plans for implementing TOPS projects.

Rohm and Haas Texas Incorporated

Deer Park, Texas, monomers manufacturing facility

Energy Management Activities:

Rohm and Haas Company is a large, highly diversified chemical company that has achieved sizeable energy efficiency gains by capitalizing on a plant-wide systems approach and integrating energy management in its largest facility. The Deer Park, Texas, site serves as the company's flagship plant and is the largest monomer manufacturer for key Rohm and Haas products. The energy team's early emphasis was to identify and champion projects to increase overall site energy and utility efficiency. Primary goals focused on cost reductions to help the plant meet short-term business budget requirements and included:

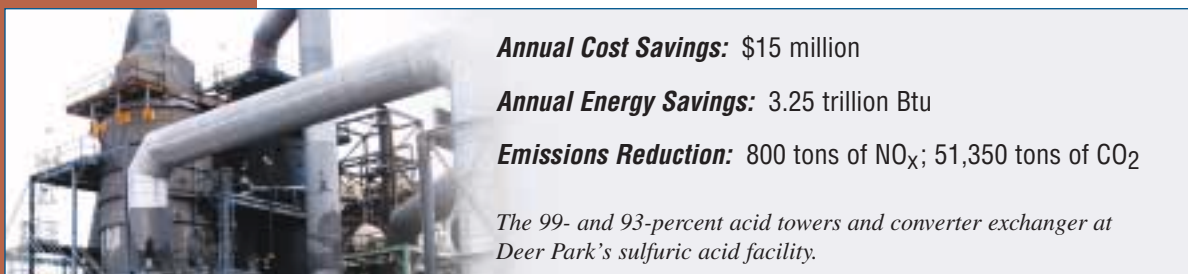
- Identifying and promoting energy efficiency and process improvement opportunities at utility and process levels
- Communicating to management and operational staff metrics to track progress
- Staying on track by decreasing budgeted energy use as projects were implemented
- Developing sufficient knowledge of plant utility systems to enable proper technical and financial analysis of energy opportunities
- Recommending and implementing a plant-wide energy management system that provides real time energy cost information and optimization options
- Shifting plant distributed energy and utility costs from allocated to actual usage where appropriate

To date the team has identified more than 125 projects; more than 40% have been completed over the last 3 years, and additional projects are being evaluated. Examples of energy-saving activities include:

- Plant energy assessments (internal and external)
- Use of a real time energy optimization program to monitor site
- Develop and implement operational best practices to reduce energy consumption
- Steam system leak and trap assessment
- Compressed gas leak audit
- Air compressor and dryer audit
- Energy technology assessments (pinch, combustion control, atomization, flares)
- Fired equipment audit
- Motor systems assessment
- Infrared thermography audit

“The DOE-OIT pump survey program identified a significant energy savings opportunity in one of our large water circulation systems. We were impressed with their willingness to help us and with their assessment capabilities. Their friendly, hands-on technical approach was greatly appreciated. It is nice having access to a program that helped us achieve our energy goals.”

Jeff Hackworth
Energy Manager



Annual Cost Savings: \$15 million

Annual Energy Savings: 3.25 trillion Btu

Emissions Reduction: 800 tons of NO_x; 51,350 tons of CO₂

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

The findings from these audits and assessments have led to modifications and improvements with dramatic impact to Rohm and Haas Texas' energy efficiency and productivity. These include a 17% energy reduction per pound of chemical produced and a 10% decrease in energy consumption, despite a 7.7% increase in production.

Other Energy Achievements:

A DOE-sponsored pump system survey using OIT's Pumping Systems Assessment Tool (PSAT) was conducted in 1999. Four large 1000 HP cooling tower pumps in the Acrylates unit were assessed. To date, three of the four pumps have been modified, increasing energy efficiency 9% (from 76% to 85%) and improving capacity roughly 25%. Power consumption increased by about 5%, therefore, \$50,000 in annual energy costs have been saved. The improved circulation capacity and flexibility allows the unit to reduce power costs by operating fewer pumps during part of the year and operating one pump on interruptible power, saving an additional \$50,000 per year.

Industry-wide Application:

The Deer Park facility is now viewed as the model of energy efficiency within Rohm and Haas. The integration of best energy management practices is proceeding across the corporation, particularly between larger sites. Many of the projects implemented at Deer Park, such as compressed air, steam, motor, and energy system improvements can be applied by other chemical manufacturing facilities with similar results.

Industry Partners:

Rohm and Haas Texas Incorporated; U.S. Department of Energy, Office of Industrial Technologies; Reliant Energy Solutions, LLC; Armstrong Service, Inc.; Planergy; PetroChem

Members of the Deer Park Energy Team, left side (l to r) Bob Skloss, Tony Dafft, Andrea Hernandez, Tim Fox, Mike Joyce, Mayra Cochran, Jeff Hackworth. Right side (l to r): Connie White, Chris DeLeon, Greer Parr, Keith Briegel, Stephen Reynolds. Not pictured: Dave Anton, Fred Fendi



Corporate Commitment:

Key to Deer Park's success in energy efficiency was a willingness by its production units to work as a team. The cross-functional energy team was started in 1997 with dedicated resources consisting of various plant and corporate engineering functions (utility, power, project, electrical, process), the plant energy manager, and others. The energy team had strong support from plant and corporate management and used several methods to ensure a successful program, including:

- ◆ A well-defined mission and energy management strategy to deliver the lowest total long-term production cost
- ◆ The establishment of energy program critical success factors
- ◆ A willingness to expand its resources by reaching beyond the plant to understand best practices in energy efficiency, and developing a comprehensive inventory of knowledge, resources, and opportunities

“Rohm and Haas Company is committed to ensuring that our operations and products meet present needs without compromising the ability of future generations to meet their needs. Energy use reduction is part of that commitment. Recently, our Deer Park Plant, our largest energy user, surpassed our goal of a 15% reduction in energy consumption per pound of production, five years ahead of schedule. We are using the momentum from that achievement to make further gains in Deer Park and throughout the company.”

**Raj Gupta
Chairman and CEO
Rohm and Haas Company**

Energy Management Activities:

Weirton Steel Corporation is a major integrated steel producer and is the second largest producer of tin mill products in the United States, with a 22% market share. The company employs more than 4,000 people, and its Weirton, West Virginia, mill has a 3 million ton annual production capacity. The company's commitment to reducing energy costs through the application of new technologies and a plant-wide systems approach at the Weirton plant helps them maintain a competitive edge.

In early 2000, Weirton participated in the Pittsburgh Regional Technology Showcase sponsored by DOE. At the event, Weirton featured several new technologies that were installed in the plant to increase efficiency and productivity including:

- Nickel aluminide radiant tubes and seal furnace rolls
- BOP laser off gas sensor for the prediction of liquid steel characteristics
- Infrared-based preheating of steel strip

In addition, several energy-saving projects were demonstrated in the showcase, including optimizing pumping systems, modernizing the plant utility control system, upgrading the plant steam system (including performing a plant-wide insulation assessment), and developing a retrofit technology for improving efficiency and reducing NO_x emissions from high-temperature furnaces.

Completed in 1998, the utility control system project included construction of a central control facility to monitor and control utilities such as the plant steam system, basic oxygen plant, and an electrical generation system. The new control system enables the use of energy byproducts from blast furnace gas and waste steam to generate electricity and additional steam from waste heat instead of relying on the use of purchased fuel.

In 1999, Weirton completely overhauled the compressed air system at its tin mill. The installation of new compressors, the addition of air treatment equipment, and the repair of leaks significantly reduced compressor shutdowns, production downtime, and product rejects.

“A strong team was brought by DOE to assist Weirton Steel to identify energy saving opportunities. The assistance complemented the Weirton team with valuable knowledge and experience. This included trouble shooting, technology, analyses, planning, and reporting. The skills of the DOE team were exceptionally good.”

Howard Snyder
Technical Director,
Operations



Potential Annual Savings: Utility control system, \$12 million; compressed air system upgrades, \$136,000

Initial Capital Requirements: Compressed air system upgrades, \$246,000

Payback Period: Compressed air system upgrades, 1.8 years

Weirton's Dave Yelegol (l) and Rick Martin (r) observe a slab exiting hot mill reversing rougher.

Other Energy Achievements:

With assistance from OIT, Weirton discovered that additional savings could be gained from insulating steam pipes after applying 3E Plus Insulation Thickness software. Plant personnel realized that for every 100 feet of piping insulated, energy savings could be an additional \$19,000 each year. In addition, a review by OIT's BestPractices staff confirmed that, with proper level control, the boiler at the basic oxygen furnace could be operated with a single pump, dropping energy consumption by about two-thirds of the original level.

Industry-wide Application:

The projects and technologies demonstrated at the Pittsburgh Regional Technology Showcase are designed to be reapplied throughout the steel-making industry. The techniques and tools used to assess the pumping and steam systems can be used in almost any industrial facility. Any manufacturing facility with interrelated control systems could potentially benefit from the additional level of process control and integration that a modern, computerized control system can provide.

Compressed air systems are found throughout industry and consume a significant portion of the electricity used in the manufacturing sector. Specifying and maintaining the proper air treatment equipment can improve the performance of any industrial compressed air system.

Industry Partners:

Weirton Steel Corporation; U.S. Department of Energy, Office of Industrial Technologies

Members of Weirton Steel's Energy Team (l to r), Dick Sakara, Wally Jancura, Dave Velegol, Duane Ramsey, and Rick Martin are Utilities Department Supervisors in Weirton's Utilities Automation Control Room.



Corporate Commitment:

Weirton has established a Plant-wide Energy Management Initiative with objectives to:

- ◆ Organize a Plant-wide Energy Management System
- ◆ Develop a tracking mechanism to monitor weekly activities
- ◆ Identify high-cost energy sources by area and process, conduct comparative analysis benchmarking, and develop action plans to achieve overall reduction in usage
- ◆ Analyze, establish, and control energy requirements in the most economic manner, ensuring the most efficient use can be accomplished
- ◆ Integrate energy projects into area business plan objectives as a \$/ton measure
- ◆ Communicate energy management plans to all area teams, utilizing information to accomplish stated goals and improve process efficiency
- ◆ Utilize DOE and the national laboratories for assessments and recommendations

The Energy Management Initiative has already identified specific energy savings opportunities in the utilities, primary operations, strip steel, sheet mill, and tin mill areas of approximately \$5.3 million.

project profiles

Company name: **BWX Technologies**

Plant location: Lynchburg, Virginia

Facility type: Metal welding plant

Products: Structured metal nuclear reactor fuel system components

Project description: Steam system upgrade—installed a new boiler combustion control system and replaced 90% of the plant's steam traps.

Annual savings: \$120,000

Annual energy savings: 2,400,000 kWh

Savings as a percentage of energy costs: 8%

Non-energy savings/impact: \$30,000 in savings from reduced use of water and boiler chemicals

Industry application: Improved effectiveness of condensate recovery system

Project cost/payback: \$250,000/1.5 years

Project partners: BWX Technologies; U.S. Department of Energy, Office of Industrial Technologies; Babcock & Wilcox; Phillips & Loveless

Company name: **Caraustar Industries**

Plant location: Rittman, Ohio

Facility type: Recycled paperboard plant

Products: Uncoated recycled paperboard, gypsum wallboard, clay coated boxboard

Project description: Plant-wide assessment with system and process optimization and upgrade goals—plant evaluated systems and identified several steam and motor projects to be implemented in the next 4 years.

Potential annual savings: \$1.2 million

Non-energy savings/impact: Reduced air emissions; corporate procurement program developed for purchase of power transmission and electrical and related industrial equipment through a single source

Industry application: Application of these efficiency measures are being reviewed for other Caraustar locations, and have potential for similar savings at other paper mills

Project cost/payback: \$2.9 million; project payback periods vary from 4 months to 2.5 years

Project partners: Caraustar Industries; U.S. Department of Energy, Office of Industrial Technologies; Sterling Energy Services, LLC



project profiles

Company name: ExxonMobil Corporation

Plant location: Baton Rouge, Louisiana

Facility type: Chemical plant

Products: Ethylene, isoprene, olefins, rubber polymers, solvents, industrial alcohol and plasticizers

Project description: System upgrade—modernized the plant's control systems by replacing the pneumatic controls on all motor systems within the plant's isoprene recovery unit (heating, cooling, steam) with sophisticated digital controls linked to a centralized computer control system.

Annual savings: \$1,000,000

Annual energy savings: 43,000,000 Btu

Savings as a percentage of energy costs: 20%

Non-energy savings/impact: Lower maintenance costs, better product quality

Industry application: Similar upgrades could be made at other plants with similar units

Project cost/payback: \$4,000,000/4 years

Project partners: ExxonMobil Corporation; U.S. Department of Energy, Office of Industrial Technologies

Company name: Georgia Pacific Corporation

Plant location: Madison, Georgia

Facility type: Plywood plant

Products: Plywood

Project description: System optimization and partial upgrade—the plant insulated its steam piping network, which reduced steam loss. In addition, they replaced 70 thermal steam traps, which increased the condensate return and required less steam to be produced.

Annual savings: \$139,000

Annual energy savings: 63,000,000 Btu

Non-energy savings/impact: Reduced emissions: 34.6 million lbs. of CO₂, 3460 lbs. of SO₂, 26,000 lbs. of NO_x; increased plant safety by reducing surface temperature of steam lines

Industry application: Enhanced performance of dryers from reduced heat loss

Project cost/payback: \$69,000/6 months

Project partners: Georgia Pacific Corporation; U.S. Department of Energy, Office of Industrial Technologies; North American Insulation Manufacturers Association; Rockwood Manufacturing, Inc.

project profiles

Company name: **Inland Paperboard and Packaging**

Plant location: Rome, Georgia

Facility type: Paper mill

Products: Linerboard, used in construction of corrugated cardboard boxes

Project description: Plant-wide assessment with system optimization and upgrade goals—plant evaluated steam, water, and energy use and identified 31 energy-saving opportunities with 7 projects scheduled for implementation in the next 4 years. Projects include improving steam utilization and condensate collection systems; optimizing mill water for reuse and upgrading to variable frequency drives and motors.

Potential annual savings: \$9.5 million

Non-energy savings/impact: Reduced air emissions, decreased water usage

Industry application: Similar applications at other paper plants should result in similar energy and water savings

Project cost/payback: Average yearly cost, approximately \$4.5 million; average payback, approximately 6 months

Project partners: Inland Paperboard and Packaging; U.S. Department of Energy, Office of Industrial Technologies; Dean Oliver; ITT Gould

Company name: **Modern Forge of Tennessee**

Plant location: Piney Flats, Tennessee

Facility type: Steel/forging mill

Products: Forged metal automotive components

Project description: Compressed air system optimization and partial upgrade—replaced control system with a PLC system, replaced dryers, added 7500 gallons of storage and two pressure flow controllers. Modified piping distribution system and performed comprehensive leak detection and repair.

Annual savings: \$120,000

Annual energy savings: 2,400,000 kWh

Savings as a percentage of energy costs: 8%

Non-energy savings/impact: \$40,000 in annual maintenance savings (total savings \$160,000), more consistent product quality, cost avoidance of \$120,000 from not purchasing an additional compressor, better productivity due to fewer production rejects

Industry application: Similar project was replicated at the Chicago subsidiary of Modern Forge

Project cost/payback: \$105,000/8months

Project partners: Modern Forge of Tennessee; U.S. Department of Energy, Office of Industrial Technologies; Compressed Air Management





project profiles

Company name: **Nalco Chemical Company**

Plant location:	Bedford Park, Illinois
Facility type:	Chemical plant
Products:	Specialty chemicals for water and industrial process treatment systems
Project description:	Steam system optimization—plant evaluated end-use applications and found that they could operate effectively at lower steam pressure levels. Steam header pressure reduced from 125 psig to 100 psig.
Annual savings:	\$142,000
Annual energy savings:	57,000,000 Btu
Savings as a percentage of energy costs:	8%
Non-energy savings/impact:	Reduced wear and tear on condensate system components, 3300 ton decrease in CO ₂ emissions
Project cost/payback:	Project required no capital investment
Project partners:	Nalco Chemical Company; U.S. Department of Energy, Office of Industrial Technologies

Company name: **Solutia, Inc.**

Plant location:	Greenwood, South Carolina
Facility type:	Chemical plant
Products:	Synthetic textiles, resins and polymers
Project description:	Compressed air system optimization and partial upgrade—installation of three pressure flow controllers and one back pressure flow controller with 60,000 gallons of storage, installation of new dryers and mist-eliminating filters, installation of a new PLC control system with a management information system, installation of new piping and reconfiguring of some existing portions of the piping system. Repair and cleaning of sub-optimally performing compressors and aftercoolers.
Annual savings:	\$512,000
Annual energy savings:	15,000,000 kwh
Savings as a percentage of energy costs:	6%
Non-energy savings/impact:	\$192,000 in annual savings from reduced need for chilled water/refrigeration
Industry application:	Cooling tower—reduced demand/stress on water chillers
Project cost/payback:	\$1,500,000/2.1 years
Project partners:	Solutia, Inc.; U.S. Department of Energy, Office of Industrial Technologies; Plant Air Technology

project profiles

Company name: **Texas Petrochemicals Corporation**

Plant location:	Houston, Texas
Facility type:	Chemical plant
Products:	Petrochemicals, octane boosters
Project description:	Steam system upgrade and optimization—replaced a defective turbine and reconfigured the piping distribution network to allow steam from the new turbine to return to the main steam line.
Annual savings:	\$1,900,000
Annual energy savings:	2,400,000 kWh
Savings as a percentage of energy costs:	5%
Non-energy savings/impact:	\$400,000 in savings from reduced maintenance, chemical use, chilled water and pumps
Industry application:	Cooling towers (reduced need for chilled water), pumping system
Project cost/payback:	\$650,000/3 months
Project partners:	Texas Petrochemicals Corporation; U.S. Department of Energy, Office of Industrial Technologies

Company name: **Visteon Corporation**

Plant location:	Monroe, Michigan
Facility type:	Auto parts plant
Products:	Heat-treated metal automotive components
Project description:	System optimization—the plant performed a comprehensive leak detection and repair initiative on their compressed air system, and expanded it to an ongoing leak management program. Once the leakage rate was reduced, the pressure level was decreased leading to significant energy savings.
Annual savings:	\$560,000
Annual energy savings:	8,900,000 kWh
Savings as a percentage of energy costs:	11.5%
Non-energy savings/impact:	Reduced wear and tear on all components within the system (compressors, dryers, piping, filters, end-use applications) due to lower plant pressure
Industry application:	Knowledge gained from results of project exported to 12 other plants
Project cost/payback:	Project costs not available
Project partners:	Visteon Corporation; U.S. Department of Energy, Office of Industrial Technologies; Detroit Edison; Ford Motor Land Development Corporation; Scales Air Compressor Corporation



recognition

OIT Partner Recognition and Awards

OIT offers its industrial partners many opportunities to receive recognition for their energy management achievements. The successes of Industries of the Future partners and BestPractices Allied Partners alike are communicated through the publication of case studies, articles in the *OIT Times* and *Energy Matters* newsletters, and annual program reports. This information is shared with industry and national media and is posted on the OIT Web site.

In addition, annual awards for Partner of the Year, Technology of the Year, and Plant of the Year are presented at the OIT Expo and Customer Appreciation Day events (held in alternating years). OIT's **Partner of the Year** exhibits extraordinary initiative and commitment to advancing the goals of IOF partnerships. They promote and advance energy efficiency as a national goal beyond the needs of their organization or industry, and engage in innovative approaches to joint public-private partnerships. The **Technology of the Year** award goes to an OIT-supported technology that exhibits exceptional commercialization potential and significant potential for energy efficiency improvement, and economic or environmental benefits. The winner also exhibits considerable actual or potential widespread industry use. The **Plant of the Year** award is based on documented energy savings, replication of emerging technologies, the plant's history of progressive efforts to reduce energy use, strategies for continuous improvement for energy efficiency, and use of a project implementation plan that includes funding commitments and ongoing validation of completed projects.

If you are interested in joining the ranks of other companies that have realized significant energy savings and productivity improvements at their plants—and being recognized for those achievements—we invite your participation. To be considered for recognition and awards, your company or plant can choose to participate in any number of OIT efforts, including:

- Investing in technology R&D through cost-shared agreements
- Participating in a plant-wide assessment
- Implementing new and emerging technologies, and participating in technology validation and verification projects
- Hosting a Showcase Demonstration
- Contributing industrial case studies

This is the first year for OIT's Plant of the Year award. In future years we will work with representatives of each of the Industries of the Future to solicit nominees and promote the awards process. In collaboration with OIT, key industry representatives and organizations will review nominations and help make final selections. Watch our Web site at www.oit.doe.gov for additional details on upcoming awards.





Industrial Technologies

About the Office of Industrial Technologies

The U.S. Department of Energy's (DOE) Office of Industrial Technologies (OIT), through partnerships with industry, government, and non-governmental organizations, develops and delivers advanced energy efficiency, renewable energy, and pollution prevention technologies for industrial applications. OIT is part of DOE's Office of Energy Efficiency and Renewable Energy.

OIT encourages industry-wide efforts to boost resource productivity through the Industries of the Future (IOF) strategy. The industry-led IOF strategy focuses on these energy- and resource-intensive industries:

- > Agriculture
- > Aluminum
- > Chemicals
- > Forest Products
- > Glass
- > Metal Casting
- > Mining
- > Petroleum
- > Steel

These nine industries account for more than 80% of the manufacturing sector's energy use. In addition, they account for over 80% of the volume of all waste and pollution generated in manufacturing, and about two-thirds of all pollution control expenditures in manufacturing.

To help industries begin saving energy, reducing costs, and cutting pollution right away, OIT offers a comprehensive portfolio of emerging technologies, best energy practices, tools, information, and resources in a variety of application areas. Visit our Web site at www.oit.doe.gov to find out more about OIT and how your company can get involved.





bestpractices

About OIT's BestPractices

BestPractices is part of OIT's Industries of the Future strategy. BestPractices brings together the best available and emerging technologies and practices to help companies immediately begin improving energy efficiency, environmental performance, and productivity.

In addition to bringing new and emerging technologies closer to commercialization, BestPractices focuses on plant systems, where significant efficiency improvements and savings can be achieved. Industry gains easy access to near-term and long-term solutions for improving the performance of motor, steam, compressed air, and process heating systems. Industrial Assessment Centers provide comprehensive industrial energy, waste, and productivity evaluations to small- and medium-sized manufacturers.

BestPractices also works with an extensive network of Allied Partners to help deliver energy efficiency information, training, and assistance to industry. Allied Partners enhance the Industries of the Future strategy by working with these industries to engage in pre-competitive RD&D, test and validate emerging technologies, and adopt proven technologies and best energy practices.

BestPractices offers a wide range of resources—including software, training, tip sheets, case studies, sourcebooks, and a bi-monthly newsletter—to industry on how to take advantage of emerging and existing energy and cost saving opportunities in their facilities.

Visit our Web site at www.oit.doe.gov/bestpractices to learn more about BestPractices.





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