

Technical Assistance

TECHNICAL ASSISTANCE
OPENS THE DOOR TO
IMMEDIATE COST-SAVING
OPPORTUNITIES AND
PRODUCTIVITY IMPROVEMENTS
FOR U.S. MANUFACTURERS

*Cost-saving technology for today —
bringing practical energy-efficient and
pollution-preventing solutions to U.S. industry*



U.S. DEPARTMENT OF ENERGY
OFFICE OF INDUSTRIAL TECHNOLOGIES • ENERGY EFFICIENCY AND RENEWABLE ENERGY

Industrial systems targeted for energy savings

U.S. manufacturers are constantly looking for bottom-line improvements. There are many opportunities for improving profitability through energy efficiency. What are the leading energy-wasting culprits? Industrial processes driven by motors, steam, compressed air, and heating systems are just some examples. Because costs associated with these systems are many times not attached to a particular process or product, they are often treated as fixed costs of production and remain largely uncontrolled in many operations.

The good news is that practical, affordable, and proven improvements to these systems can yield immediate energy and materials savings — freeing up dollars that flow directly to the bottom line. These same improvements often reduce air emissions and other waste streams associated with energy and materials use. And in the process of making their operations more energy-efficient and materials-efficient, manufacturers often realize productivity and reliability increases as well.

The place to start

Focusing on overlooked energy-saving and cost-saving opportunities is the purpose of the portfolio of Technical Assistance resources under the Office of Industrial Technologies (OIT). Technical Assistance provides the tools and assistance to help manufacturers identify their best energy-efficient, pollution-preventing options, from a systems and life-cycle cost approach.

Technical Assistance can provide the latest information on both emerging and widely commercialized technologies. Technical Assistance seeks to accelerate the application of practical, proven energy-saving approaches in U.S. industrial facilities, particularly the most energy-intensive industries represented by OIT's Industries of the Future initiative. Technical Assistance provides a continuum of services — from conducting energy assessments and evaluations, to helping operators implement technologies in plant sites, to providing the tools and resources for measuring the effectiveness of new technologies.

Technical Assistance focuses on five key opportunities for energy efficiency and waste reduction: electric motors, steam, compressed air, combined heat and power, and the Industrial Assessment Centers (IACs). By the year 2000, these programs will reach an estimated 6,555 manufacturing plants and will achieve \$390 million in savings as a result of Technical Assistance.

Plant-wide energy assessments for small and medium-sized plants

Small and medium-sized plants stand to benefit greatly from energy-saving investments. In fact, depending on the industry, energy bills can account for 10 percent or more of their total operating costs. Yet many small and medium-sized facilities lack the resources and in-house expertise to systematically assess and identify the best approaches on their own.

OIT's Technical Assistance can help. Through no-charge audits conducted by the Industrial Assessment Centers, small and medium-sized manufacturers gain the assistance they need to implement cost-effective technologies that minimize energy and materials use, reduce pollution, boost productivity, and often improve product quality.

IAC analyses are performed by teams of engineering faculty and students drawn from 30 participating universities nationwide. In a typical analysis, a locally-based team conducts a one-day site visit, taking process measurements and evaluating equipment as a basis for engineering recommendations. Within 60 days, the team delivers a report to the client that details the analysis, findings, and recommendations; and in six to nine months the team performs a follow-up with the plant manager.

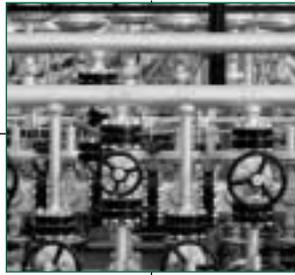
On average, a typical assessment identifies nearly \$55,000 in potential annual savings: more than \$20,000 in energy savings and the balance in waste-related and productivity savings.

Slashing electricity bills through motor system improvements

Working through OIT Technical Assistance, industry can gain new strategies for improving motor system efficiency. Motor system optimization can typically achieve 10 to 20 percent in energy savings over conventional systems, and often as much as 50 percent. Such improvements can translate into huge potential dollar savings in the U.S., where more than 20 million motor systems are currently in use in industrial locations. Motor-driven equipment accounts for 64 percent of electricity consumed by U.S. industry. Energy bills attributable to motor-driven equipment total six times the equipment's initial purchase price each year.

Industry has proven that using a systems approach can improve not only motor system efficiency, but also plant productivity and reliability. Factors contributing to motor system efficiency include the efficiency of individual components, but also and more important, how these components are integrated into a complete system.

Working with OIT, industry partners gain new strategies for improving motor system efficiency. They learn from other motor system users and get unbiased information and advice. By optimizing motor-driven technology and systems, participants in the program have racked up cumulative energy savings of \$50 million since 1994.



Reducing fuel use in steam systems

Over 33,000 large boilers are used by U.S. industry to produce steam. Steam production accounts for approximately two-thirds of all fuel burned by industrial plants, with an associated fuel cost of \$21 billion. Steam production has significant environmental implications, releasing 196 million metric tons of carbon equivalent each year, or 40 percent of total U.S. industrial emissions.

Optimizing operation, maintenance, and use of industrial steam systems represents one of the largest energy-saving and emissions-reduction opportunities in U.S. industry. Efficiency improvements of 30 to 40 percent are readily achievable through best-practice approaches and can result in large aggregate annual savings: decreasing industrial energy consumption by 2 quads, reducing energy costs by \$4.2 billion, and preventing 43 million metric tons of emissions.

OIT, the Alliance to Save Energy, and U.S. industry have partnered to provide plant operators with the tools and technical assistance they need to improve the efficiency of their steam systems. By lowering production costs and enhancing productivity, these improvements help plants gain a more solid competitive footing.

Optimizing compressed air systems to save electricity

Nearly every industrial plant has some type of compressed air system that is vital to its operations. In many plants, the compressed air system consumes more electricity than any other type of equipment. Across the U.S., these systems annually account for \$4.5 billion in industrial energy costs and one and a half percent of industrial air emissions.

Energy-saving opportunities in compressed air systems are frequently overlooked, even though many companies could potentially save thousands of dollars annually. Optimization of these systems can easily reduce energy consumption and costs by 20 to 50 percent while maintaining or even improving system performance and reliability.

Lack of information has been cited as a key reason why industry has not adopted energy-efficient measures for compressed air systems. Industry can gain the essential education and technical training needed to implement improvements.

A window of opportunity for combined heat and power

Within the next decade, a large proportion of industrial boilers will need to be replaced, opening an opportunity to upgrade this equipment with clean and efficient combined heat and power (also known as cogeneration) systems. These systems provide steam for industrial processes, just as conventional boilers do. But in addition, they generate electric power, and they also recover steam that would otherwise be lost, applying it to heating and cooling.

Combined heat and power systems capture a very large percentage of the energy value of the fuels they consume. In contrast, when electric power and thermal energy are generated separately by centralized plants and then transported to the factory through power and steam lines, the majority of the fuel's energy value is actually lost.

Because of their high efficiency, combined heat and power systems often provide a good energy value for industrial facilities. Per unit of energy produced, they also emit lower levels of air pollutants than conventional centralized power plants and thermal energy plants that are operated separately.

Restructuring of the electric power industry and new environmental regulations are key factors driving interest in combined heat and power as an efficient and cost-effective energy strategy. The combined heat and power program is creating a national dialog on this technology to raise awareness of its benefits and to promote innovative efforts to accelerate its use. The program brings together policymakers and industry representatives to promote collaboration, and leverages activities of other government and industry programs.



PORTFOLIO HIGHLIGHTS

A continuum of technical assistance

Technical Assistance's resources — information, tools, training, and direct plant-level assistance — can be accessed directly by working with a representative, calling the Information Clearinghouse or the OIT Resource Room, or accessing OIT's home page.

Direct plant-level assistance

- Energy, waste, and productivity assessments
- Showcase demonstration projects
- Plant energy profiles
- Technology surveys
- Plant benchmarking and energy performance comparisons

Tools

- Motor Master+3.0 software
- ASDMaster adjustable speed-drive evaluation methodology and application software
- 3E Plus software (steam program)
- The IAC database

Information

- Improving Compressed Air System Performance: A Sourcebook for Industry
- Energy Efficient Electric Motor Selection Handbook
- Fact sheets and case studies
- Steam Energy Efficiency Handbook
- The IAC Self-Assessment Workbook
- Market assessment studies
- *Energy Matters* newsletter
- Information Clearinghouse
- Industrial Projects Locator (IPLocator)
- OIT's Resource Catalog

Training

- Motor, steam, and compressed air systems training sessions

Industry defines its vision and R&D priorities

OIT's centerpiece strategy is the Industries of the Future, a partnership process that engages each participating industry in developing its vision of a more resource-productive, energy-efficient future, and in defining technology developments critical to realizing this vision.

Nine major industries — agriculture, aluminum, chemicals, forest products, glass, metalcasting, mining, petroleum, and steel — are participants in the Industries of the Future initiative. These energy-intensive industries account for over 75 percent of the energy consumed by U.S. industry and face significant environmental challenges.

OIT is working closely with the nine Industries of the Future to help them define their sustainable futures and prioritize their technology needs over the next two decades. This industry-driven strategy is central to helping align Federal R&D and other resources with industry priorities and improving access to a wide array of technical expertise and facilities.

As part of the Industries of the Future process in developing the visions and technology roadmaps, industry identified a need to address specific technology and materials requirements common to all of the vision industries. The goal of Technical Assistance is to work with industry partners to conduct cost-shared R&D which has application across all of the vision industries, as well as to provide the tools and technical assistance needed to speed the implementation of energy-efficient, clean manufacturing technologies.

Through the support of OIT's Technical Assistance, many technologies and processes are now part of the Industries of the Future R&D portfolio. Technical Assistance projects have supported many crosscutting technologies that have application across most energy-intensive industries.

Partnering for clean and competitive Industries of the Future

Our Nation's strength is based in large part on our access to affordable and reliable energy. As we move into the new millennium, our mission is to develop and deploy new ways to meet our energy needs and improve our environmental quality through use of renewable energy and increased energy efficiency.

Through Industries of the Future, the Office of Energy Efficiency and Renewable Energy is actively engaged with U.S. industry to capture energy and natural resource savings by developing and displaying clean and energy-efficient technologies and practices. Working with the Nation's most energy-intensive industries, we are mapping a vision of the energy future of American industry and developing the technology needed to implement that vision. This profile describes a few of the many ways that the DOE-industry alliance is working toward a more competitive future for U.S. industry and our Nation.



Dan W. Reicher
Assistant Secretary
Energy Efficiency and Renewable Energy

Technical Assistance helps Industries of the Future make a difference today

Agriculture—Process integration study results in savings at corn milling plant

OIT sponsored a process integration study with American Fructose, Inc.'s, wet corn milling plant in Decatur, Alabama. The plant installed a waste steam recovery heat pump recommended by the study. The new system is saving the company \$300,000 per year in energy costs with a one-year payback. The new system has also allowed increased production of product. Efficiency and productivity improvements such as these contribute to the overall health of the agricultural industry.

Aluminum—Fan systems analysis optimizes aluminum potline

Alumax Inc., explored ways to improve the energy efficiency of potline dust collection fan systems at its Mount Holly, South Carolina, aluminum refining plant. Alumax measured fan speed, air temperature, air flow, static pressure, and fan motor power consumption under three scenarios. This plant found that shutting off one of four fans in each potline fume-collection system netted an annual energy savings of more than \$103,000. The aluminum industry's *Partnerships for the Future* points to these types of energy conservation efforts as critical to meeting performance targets.

Chemicals—Motor systems optimization brings energy and cost savings

3M Corporation in Maplewood, Minnesota, successfully conducted an in-house performance optimization project that evaluated electric motor systems in 26 of its buildings. 3M applied a systems approach to optimize the performance of electric motor systems at all facilities on the corporate headquarters campus and achieved annual energy savings of 10.8 million kWh. When these electricity savings are combined with maintenance savings and reduced steam and chilled water, the annual cost savings amount to \$823,000. Upgrades included installing energy-efficient motors, variable speed drives, and a digital control system. This project is just one example of how Technical Assistance programs support the primary targets of the chemical industry's *Vision 2020*.

Forest Products—Steam-line insulation improves wood drying operations

The Georgia-Pacific plywood plant in Madison, Georgia, used the steam 3E PLUS software tool to determine the best insulation thickness for several steam lines leading to dryers. The computer analysis motivated the company to insulate 1,500 feet of steam lines, reducing fuel costs by \$50,000 and carbon emissions by 200 tons per year, as well as improving the efficiency of the drying process. The plant cut steam usage by approximately 6,000 lbs/hour and eliminated all natural gas purchases. Capital effectiveness and pollution prevention efforts such as these align with the goals and objectives of *Agenda 2020*, the forest products industry vision.

Metalcasting—Energy assessment improves efficiency at metalcasting plant

Amcast Precision Products manufactures aircraft parts for commercial and military use. Metal parts are cast in the plants' foundry using molds created on-site. The San Diego State University Industrial Assessment Center provided a no-cost energy audit in 1996. Implemented recommendations included modifications to the lighting system, worth \$17,400 annually in electricity savings, and changes in operating practices to reduce drag-out losses from process tanks, worth \$26,300 annually. Energy efficiencies such as these are in concert with the profitability and industry health goals outlined in the metalcasting industry vision, *Beyond 2000*.

Mining—Pump system enhances coal washing process

Peabody Holding, a large coal producer, upgraded six 100-horsepower cyclone pumps at its Randolph Coal Preparation Center. By optimizing the pump systems, Peabody reduced the operating cost of each pumping system by \$5,000 per year. Energy efficiencies gained through mechanical improvements such as those achieved at Peabody support the mining industry's goal of maintaining its competitive position, as outlined in its vision, *The Future Begins with Mining*.

Petroleum—Refinery cuts energy costs 30 percent through diesel hydro-treater pump system upgrade

Chevron's Richmond refinery typically processes 240,000 barrels of crude oil per day, with annual electricity costs exceeding \$25 million. Pump system efficiency upgrades on the refinery's diesel hydro treater (DHT) unit has reduced energy consumption by 1 million kWh per month, resulting in \$700,000 cost savings per year. In addition, mechanical reliability and process control have improved because efficient motor/pump systems have decreased the vibration levels, reducing the failure rates of seals and bearings. Currently under development, the petroleum refining industry's vision of the future will encompass efforts like these, which contribute to competitiveness and domestic energy security.

Steel—Motor systems modifications optimize hot strip mill process at steel works

LTV Steel Company has conserved water and energy, increased capacity, and improved operating efficiency through upgrades to the hot strip mill (HSM) process contact water system. Variable speed high-efficiency pump systems were installed, increasing HSM capacity without expanding the waste water treatment plant. Pump subsystems were tuned so they can be adjusted to efficiently match a new range of expected operating points. LTV is saving \$440,000 a year and contributing to improved production efficiency, a critical area outlined in the industry vision, *Steel: A National Resource for the Future*.

Case Study

Bethlehem Steel—an industry model for energy-efficient operations

Through the long-standing OIT and Bethlehem Steel partnership, an industry model of efficient plant design and operation has been created at the company's flagship facility in Burns Harbor, Indiana. The facility, which produces hot- and cold-rolled sheet and plate for the automotive, machinery, and appliance markets, has implemented over a dozen OIT-supported technologies and processes to help control energy costs and optimize productivity. Many of these technologies were developed jointly between the steel industry and OIT through the Industries of the Future initiative.

In 1987, Bethlehem Steel contracted with General Conservation Corporation to improve the energy efficiency of the basic oxygen furnace #3. By installing a variable frequency drive and modifying associated equipment to the induced draft gas removal fans, the fans' speeds were better matched to the furnace's varying requirements. Electrical usage dropped nearly 50 percent to 15,500 MWh, resulting in annual savings of \$620,100. Meade Industrial Services, Inc., performed the electrical installation on the project.

A concurrent Burns Harbor project focused on improving the performance of a steam turbine generator. The turbine was redesigned to use warm condenser cooling water for boiler feedwater instead of cool lake water. This project resulted in an annual savings of 40,000 MWh of electricity and 85,000 million Btu of natural gas, adding up to \$3.3 million in energy cost savings per year. Emissions also declined, with lower-temperature water discharges and decreased coke oven and blast furnace gas emissions.

These and other technologies and programs were showcased when the Burns Harbor facility hosted over 300 individuals and organizations interested in learning more about one of the world's most efficient steel mills. The event highlighted the technologies and programs being used or field-tested at the facility, as well as featuring demonstrations, tours, and seminars.

RESEARCH, SERVICES, AND RESOURCES

DOE programs encourage innovation in the most energy-intensive industries

OIT's Technical Assistance programs are a complementary portfolio of resources to promote the development and use of energy-efficient, pollution-preventing technologies.

To help industry access and ensure timely implementation of its technologies and capabilities, OIT is developing an integrated delivery approach for products, services, and emerging technologies. Through this process, companies are made aware of OIT's full portfolio of energy, environmental, and productivity enhancement technologies, matching the right resources to meet the customer's needs.

Enabling Technologies

AIM (Advanced Industrial Materials) develops and commercializes new and improved materials to increase energy efficiency, improve productivity, and enhance material longevity and product quality.

The **Combustion** program increases productivity, improves energy efficiency, reduces emissions, and enhances fuel flexibility by developing cost-effective and energy-efficient technologies that are necessary for global competitiveness.

Continuous Fiber Ceramic Composite Materials pursues ceramic composite technologies that improve productivity by utilizing higher process temperatures, extending component and system lifetimes, and reducing downtime.

Sensors and Controls develops and deploys integrated measurement systems for operator-independent control of the manufacturing process. Priority goals are improving technology both in sensors embedded in high-temperature and harsh environmental applications, and in information processing to detect and remedy malfunctions.

Distributed Generation Technologies

Cogeneration improves the efficiency of fuel use and reduces overall emissions. This program supports extensive research, development, and demonstration to meet the technical and market challenges associated with enhancing industrial cogeneration and moderate-size independent power production opportunities.

Financial Assistance

NICE³ (National Industrial Competitiveness Through Energy, Environment, Economics) is an innovative cost-sharing program that promotes energy efficiency, clean production, and economic competitiveness in industry by providing funding to State and industry partnerships for technology demonstration projects.

The **Inventions and Innovation** program provides financial assistance for establishing technical performance and conducting early development of innovative ideas and inventions. Ideas with potential for significant energy savings and commercial use are chosen for financial support through a competitive solicitation process. Technical guidance and commercialization support are offered to successful applicants.

Information Resources

Two resources that provide information on all of OIT's products are the IPLocator and the Resource Catalog.

IPLocator (www.oit.gov/locator) provides access to information on federally sponsored R&D projects that are ongoing or recently completed, optimizing the complementary research and development strengths of industry, universities, National Laboratories, and government.

OIT's Resource Catalog, available by calling 202-585-2090, describes over 400 publications and other information products of interest to our customers.

A network of technical support

Technical Assistance facilitates partnerships and alliances between industry and organizations to help increase energy efficiency and reduce emissions. By promoting the use of available technologies, Technical Assistance helps industry immediately impact its bottom-line performance and build its position in global markets.

There are many ways to get information and participate in any of the Technical Assistance resources.

- Contact the Information Clearinghouse at 1-800-862-2086 for access to all products and services.
- Receive additional materials by calling OIT's Resource Room at 202-586-2090.
- Browse the OIT home page at www.oit.doe.gov and directly connect to information about any of the industry areas and technical assistance programs.



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