

# ENERGY MATTERS



May/June 2001

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**The Volatile Energy Market**

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## California Cement Plant Battles Electricity Interruptions with Its Own Cogeneration Plant

California's energy crisis has hit the state's businesses hard, especially those in energy-intensive industries. But Gary Thornberry, environmental/service manager at California Portland Cement Company's (CPCC) Colton Cement Plant, says his company has a plan to combat power interruptions. This plan includes reactivating a mothballed coal-fired cogeneration plant that the company built back in the early 1980s, and reactivating two boilers that use waste heat from cement kilns.

The Colton Cement Plant has an interruptible power contract with its electricity provider, Southern California Edison Company. Thornberry says that power interruptions have caused multiple problems at the Colton plant, including wasted raw materials and unusually low inventories.

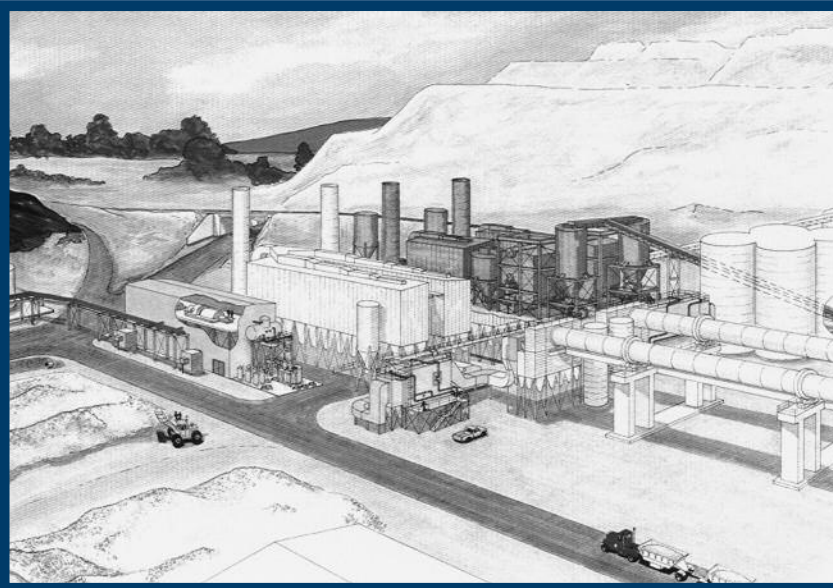
The Colton plant normally produces 750,000 tons of cement per year. The company was founded in 1891 and has provided cement for Arizona's State Capitol, the Los Angeles Colosseum, and the new

Disney California Adventure theme park, among many others.

The plant, which under ordinary circumstances would run 24 hours per day and 7 days per week, requires an average electricity supply of 14 MW per hour, with a peak load of about 20 MW per hour. Rotary kilns heat a mixture containing calcium, silica, iron, and aluminum to nearly 2800°F. Heating up the kilns often takes 8 to 12 hours, so when the power is interrupted, the kilns start to cool and a significant amount of energy is wasted. Furthermore, the cooling and heating cycles caused by the interruptions can result in expansion and contraction of the kilns and associated equipment, which shortens equipment life.

So CPCC's management has decided to take its cogeneration plant, powered by a fluidized bed coal-fired boiler, out of mothballs. The cogeneration plant exists because, in the early 1980s, electricity

*(continued on page 2)* ▶



*The Colton Cement Plant's cogeneration facility is represented by the darker structures in this artist's rendering.*

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## California Cement Plant *continued from page 1*

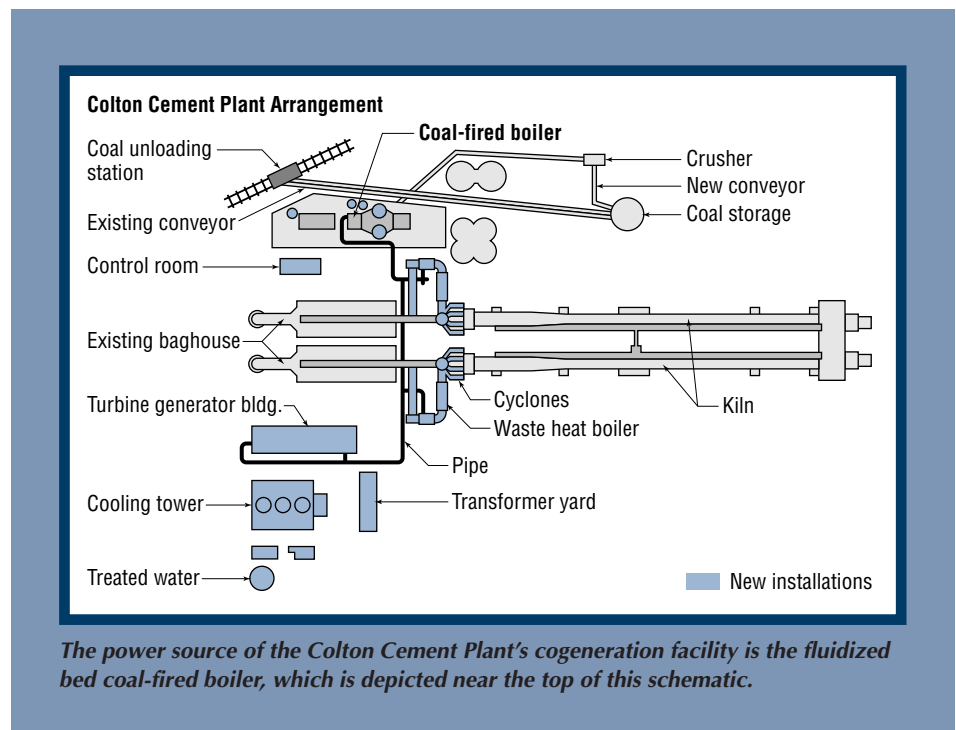
costs were projected to rise considerably. At that time, CPCC built the cogeneration plant to combat the higher electricity prices. However, once the plant was built in 1985, Southern California Edison offered electricity at a cost low enough to convince CPCC to deactivate and keep the cogeneration plant in reserve.

CPCC plans to have the coal-fired plant up and running in late June of 2001. At the same time, CPCC hopes to reactivate two waste heat boilers that produce 5 to 6 MW per hour. The boilers use waste heat from the cement kilns.

Burning coal does produce emissions,

but, Thornberry says, "The low operating temperature keeps the NO<sub>x</sub> down and the limestone injection system controls the SO<sub>x</sub> emissions. We are also in the process of installing an ammonia injection system to further reduce NO<sub>x</sub> emissions."

The cogeneration plant is expected to provide 20 MW per hour and CPCC plans to sell unused power, though a buyer has not been determined. At this point, Thornberry says, it hasn't been decided if CPCC will stay on the grid after the cogeneration plant is operating. Regardless, like many industrial sites in the region, CPCC must now seriously consider which power alternatives will ensure smooth and efficient operations. ●



## INDUSTRY SHOWCASE TO FOCUS ON THE LATEST IN METALS, MINING, AND PETROLEUM INDUSTRIES

The State of Utah and OIT will present The Utah 2001 Industry Showcase August 27-29, 2001, in Salt Lake City. The event is being held to support, promote, and highlight the use of advanced technologies in aluminum manufacturing, petroleum refining, metal-casting, and mining. Participants will be able to:

- Tour plants in which the newest technologies are operating
- Learn about new opportunities for funding plant improvements
- Hear the latest news on cost- and energy-saving methods
- Network with industry and government leaders
- Attend a Congressional Forum on the future of aluminum, mining, and petroleum

For details, log on to [www.oit.doe.gov/news.shtml](http://www.oit.doe.gov/news.shtml), or call OIT toll free at 877-648-7967.

## OIT Assists Industries Hard Hit by Volatile Energy Market

The high cost of energy is taking a toll on U.S. industry—but industry is fighting back, and OIT and BestPractices are helping. Here we present some brief observations of how three industries have been affected by, and are coping with, the volatile energy market. Plus, we provide examples of how OIT has helped companies in those industries improve energy efficiency and productivity, thus giving participants a competitive advantage. Your company might similarly benefit from OIT and BestPractices assistance. Read on to learn more.

### Aluminum Industry

Energy accounts for at least one-third of the cost of primary aluminum construction. It's no surprise then, that the aluminum industry has been one of the hardest hit by high energy prices and shortages, especially in the Pacific Northwest. California's demand for power and the Pacific Northwest's low water levels in hydroelectric project reservoirs have severely stressed the region's power supply, escalating prices to record levels. Robin King, vice president of public affairs at the Aluminum Association, says that of the 10 aluminum plants in the Northwest, only two are still operating, and minimally at that.

In the mean time, BestPractices has continued to work with the aluminum industry, offering tools to improve plant energy efficiency, enhance environmental performance, and increase productivity.

OIT, for example, has worked in partnership with Alcoa on a demonstration project

at an aluminum extrusion plant in Lafayette, Indiana. Alcoa had already implemented a strategy that included improvements to the compressed air system, furnace tuning and repair, pump optimization, and improved heat recovery. Encouraged by OIT, Alcoa performed a plant-wide energy efficiency assessment that identified eight areas for further analysis. These included energy- and cost-saving opportunities associated with high-pressure extrusion press pumps, an extrusion unit's billet heaters, an ingot plant water recirculation system, a compressed air system, plant lighting, plant steam boilers, melting furnaces, and energy monitoring. By addressing these issues, Alcoa is expecting to see annual savings of \$1.9 million from an initial capital investment of \$2.3 million, with a payback period of 1.2 years.

Read about the Alcoa case study and others on the BestPractices Web site at [www.oit.doe.gov/bestpractices/explore\\_library](http://www.oit.doe.gov/bestpractices/explore_library).

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*Some forest products manufacturers can offset high energy prices by producing some of their own electricity, but they also utilize BestPractices resources to save energy and money.*



*BestPractices works with aluminum manufacturers, which have been hit hard by high energy prices.*

### Forest Products Industry

High energy prices have also dealt the forest products industry some severe blows. Mill closings have plagued the Northwest, and energy prices have been a significant factor, according to Bill Nicholson, chair of the Energy Council, American Forest

Paper Association (AF&PA) and director of Corporate Energy and Environmental Services for Potlatch Corporation. However, he says, the forest products industry can generate some of its own electricity. In fact, there are some forest product companies that sell electricity to the grid. Potlatch, Nicholson says, is one of those.

Potlatch owns two facilities with small hydroelectric dams in Minnesota, and cogeneration plants in Idaho, Minnesota, and Arkansas. These power-producing facilities comply with the Public Utility Regulatory Policy Act (PURPA). "Those mills have a tremendous advantage," Nicholson says.

Nicholson further states that there is an extraordinary amount of interest in the black liquor gasification process. DOE-funded research and development in this area is focusing on advanced methods of processing spent pulping liquor from pulp mills into gas for use as an energy source.

*(continued on page 4) ►*

**OIT Assists Industries**  
*continued from page 3*

For more information on black liquor boiler projects, see fact sheets posted on the OIT Forest Products R&D Portfolio page at [www.oit.doe.gov/forest/page3a.shtml](http://www.oit.doe.gov/forest/page3a.shtml).

As with the aluminum industry, OIT has been working with forest products companies to help reduce energy use, improve productivity, and boost the bottom line. An example is the demonstration project at Boise Cascade pulp and paper mill in International Falls, Minnesota. Boise Cascade and OIT are partners in the project, which began with a cost-shared plant assessment that led to implementation of four projects and two process modifications. These include conserving mill water, rerouting turbine room steam trap condensate, using foul condensate heat for demineralized water makeup to hotwells, and modifying selected processes to decrease effluent flow and energy consumption.

These projects and modifications are expected to remove 45.6 MMBtu per hour from the effluent, exceeding the reduction target of 35 MMBtu per hour. In addition, it is expected that the mill will reduce steam use by 28,100 pounds per hour and effluent flow by 2.2 million gallons per day (an 8% reduction in total flow). To learn more about the Boise Cascade Mill Energy assessment and other assessments, visit the BestPractices Web site at [www.oit.doe.gov/bestpractices/explore\\_library](http://www.oit.doe.gov/bestpractices/explore_library).

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. The reward has been savings of 91 MMBtu per hour with an approximate value of \$3.4 million per year.

**Chemicals Industry**

Though the volatile energy market has not had as great an impact on other industries, many are still feeling constraints from high energy prices. Jeff Hackworth, energy manager for the Rohm and Haas chemical plant in Deer Park, Texas, says that high natural gas prices have cut into his company's profit margins. Yet, because Rohm and Haas began a serious energy-saving program in 1997, Hackworth says the company has received "tremendous benefits."

Part of that energy program included a project in which Rohm and Haas partnered with OIT and four other companies to do a plant-wide assessment for energy efficiency at the Deer Park facility. The team has identified more than 125 projects, more than 40% of which have been completed over the last 3 years, and additional projects are being evaluated.

Examples of energy-saving activities include a steam system leak and trap assessment, a compressed gas leak audit, an air compressor and dryer audit, a motor systems assessment, an infrared thermography audit, and more. The findings from these audits and assessments have led to modifications and improvements with dramatic impacts. Results have included a 17% energy reduction per pound of chemical produced and a 10% decrease in energy consumption, despite a 7.7% increase in production. Overall, on an annual basis, the plant has reduced energy use by 3.25 trillion Btu, reduced NO<sub>x</sub> emissions by 800 tons, reduced CO<sub>2</sub> emissions by 51,350 tons, and saved \$15 million. And they're not stopping there. "The higher energy costs are driving us to be more aggressive with energy efficiency progress," Hackworth says. "We'd like to

reduce energy use by an additional 5% to 7% or more by 2004." For more information on the OIT/Rohm and Haas project see page 10 of OIT's *Plant Profiles: Industrial Energy Management in Action* brochure at [www.oit.doe.gov/bestpractices/pdfs/plantprofiles.pdf](http://www.oit.doe.gov/bestpractices/pdfs/plantprofiles.pdf).



*The chemicals industry is another area in which BestPractices software, publications, and technical assistance have helped to improve plant efficiency, enhance environmental performance, and increase productivity.*

**Get Involved**

The technologies, processes, and equipment utilized in the preceding examples can be used in similar circumstances in many industries. There is vast potential for replicating the energy savings, cost reductions, and productivity improvements that have been demonstrated in these and other projects that OIT and BestPractices have supported. Don't miss out on these benefits for you and your company. Find out about best energy management practices, including the adoption of new, efficient technologies, by logging on to the OIT Web site at [www.oit.doe.gov](http://www.oit.doe.gov) and the BestPractices Web site at [www.oit.doe.gov/bestpractices](http://www.oit.doe.gov/bestpractices). You can read more about the projects discussed in this article by accessing the *Plant Profiles* brochure at [www.oit.doe.gov/bestpractices/pdfs/plantprofiles.pdf](http://www.oit.doe.gov/bestpractices/pdfs/plantprofiles.pdf). ●

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## A to Z of Restructuring Terms

With all the talk of restructuring and energy issues, there are many technical terms flying about. Here is a short glossary that may help you understand how restructuring may affect your facility. Sources are listed below and include Web site addresses for more complete glossaries and information.

**Average Cost**—The revenue requirement of a utility divided by the utility's sales. Average cost typically includes the costs of existing power plants, transmission, and distribution lines, and other facilities used by a utility to serve its customers. It also includes operating and maintenance, tax, and fuel expenses.

**Avoided Cost**—The cost the utility would incur but for the existence of an independent generator or other energy service option.

**Buy Through**—An agreement between utility and customer to import power when the customer's service would otherwise be interrupted.

**Direct Access**—A key feature of the restructuring process. Direct access is the opportunity for consumers to bypass their local utility, the generator of their electricity, and purchase electricity from the generator of their choice.

**Distributed Generation**—A distributed generation system involves small amounts of generation located on a utility's distribution system for the purpose of meeting local (substation level) peak loads and/or displacing the need to build additional (or upgrade) local distribution lines.

**Futures Market**—Arrangement through a contract for the delivery of a commodity at a future time and at a price specified at the time of purchase. The price is based on an

auction or market basis. A standardized, exchange-traded, and government regulated hedging mechanism.

**Independent System Operator (ISO)**—A neutral and independent organization with no financial interest in generating facilities that administers the operation and use of the transmission system.

**Independent Power Producer (IPP)**—Any entity not regulated by the government as a public utility that owns or operates an electricity generating facility and offers electric power for sale to utilities and/or the public (also known as Non-Utility Generator).

**Marginal Cost**—In the utility context, the cost to the utility of providing the next (marginal) kilowatt-hour of electricity, irrespective of sunk costs.

**Net Metering**—Allows the electric meters of customers with generating facilities to turn backwards when the generators are producing energy in excess of the customers' demand, enabling customers to use their own generation to offset their consumption over a billing period.

**PURPA**—The Public Utility Regulatory Policy Act of 1978. Among other things, this federal legislation requires utilities to buy electric power from private "qualifying facilities," at an avoided cost rate. This avoided cost rate is equivalent to what it would have otherwise cost the utility to generate or purchase that power themselves. Utilities must further provide customers who choose to self-generate a reasonably priced back-up supply of electricity.

**Restructuring**—The reconfiguration of the vertically integrated electric utility. Restructuring usually refers to separation of the various utility functions into individually operated and owned entities.

**Retail Competition**—A system under which more than one electric provider can sell to retail customers, and retail customers are allowed to buy from more than one provider.

**Spot Markets**—Any of a number of venues in which purchases and sales, as of electricity, are made by a large number of buyers and sellers, with new transactions being made continuously or at very frequent intervals.

**Unbundling**—Disaggregating electric utility service into its basic components and offering each component separately for sale with separate rates for each component. For example, generation, transmission, and distribution could be unbundled and offered as discrete services.

**Vertical Integration**—An arrangement whereby the same company owns all the different aspects of making, selling, and delivering a product or service. In the electric industry, it refers to the common arrangement whereby a utility owns generating plants, transmission systems, and distribution lines to provide all aspects of electric service.

Definitions have been excerpted and adapted from *The Glossary of Electric Utility Restructuring Terms:1996*, a National Council on Competition and the Electric Industry Web site at [www.ncouncil.org/pubs/glossary.html](http://www.ncouncil.org/pubs/glossary.html); *The Consumer's Glossary of Electric Utility Restructuring Terms*, AARP's Public Policy Institute; and the Green Power Network Web site at [www.eren.doe.gov/greenpower/home.shtml](http://www.eren.doe.gov/greenpower/home.shtml). ●

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## New Roadmap for Process Heating Technology Identifies Priority R&D Goals

Process heating technologies supply heat to nearly all manufacturing processes. Because they consume 17% of U.S. industrial energy, process heating technologies represent a significant opportunity to improve industrial productivity and energy efficiency. Advanced technologies and operating processes have the potential to reduce process heating energy consumption by 5% to 25% over the next decade.

The process heating community, led by the Industrial Heating Equipment Association and OIT, presents *Roadmap for Process Heating Technology: Priority Research and Development Goals and Near-Term, Non-Research Goals to Improve Industrial Process Heating*—a comprehensive plan for meeting industrial process heating needs now and in the future.

To learn more about the plan to achieve technological and process improvements in

process heating, download the roadmap from the BestPractices Web site at [www.oit.doe.gov/bestpractices/pdfs/process\\_heating\\_0401.pdf](http://www.oit.doe.gov/bestpractices/pdfs/process_heating_0401.pdf). You can also review the Process Heating Supplement, which appeared in the November/December 2000 issue of *Energy Matters* at [www.oit.doe.gov/bestpractices/explore\\_library/energy\\_matters.shtml](http://www.oit.doe.gov/bestpractices/explore_library/energy_matters.shtml). ●

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## Steam Workshops Offer Relief from High Energy Bills

Steam plants took a pounding from high energy bills last winter. Like many other steam plant managers, you might be seeking ways to tune up your operation using the latest energy efficiency measures. OIT's BestPractices can help.

BestPractices Steam program offers workshops specifically designed for energy managers. These workshops, organized in cooperation with the Alliance to Save Energy, utility companies, and trade associations, are venues for managers to gain knowledge about the technical, personnel, and financial aspects of efficient plant operations. Program tools, such as tip

sheets, case studies, diagnostic software, and information about training and financial assistance, help managers identify opportunities for improvement.

Steam workshops are held at locations across the country. Check the BestPractices training calendar at [www.oit.doe.gov/bestpractices/take\\_class/calendar.shtml](http://www.oit.doe.gov/bestpractices/take_class/calendar.shtml) for upcoming workshops in your area. The workshops are offered at no or low cost.

Take part in discussions and presentations on:

- The total-system approach to steam efficiency

- Financial benefits or outcomes of implementing efficiency
- An overview of steam reference materials (technical, managerial, and financial)
- Energy efficiency success stories

In addition, regional experts add technical discussions on topics, such as steam traps, water treatment, and combustion controls.

If you are an industry professional interested in giving an informational (non-commercial) presentation or case study at one of the workshops, please contact Christopher Russell of the Alliance to Save Energy at [crussell@ase.org](mailto:crussell@ase.org). ●

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## Efficient Pump System Performance Begins with Life Cycle Cost Analysis

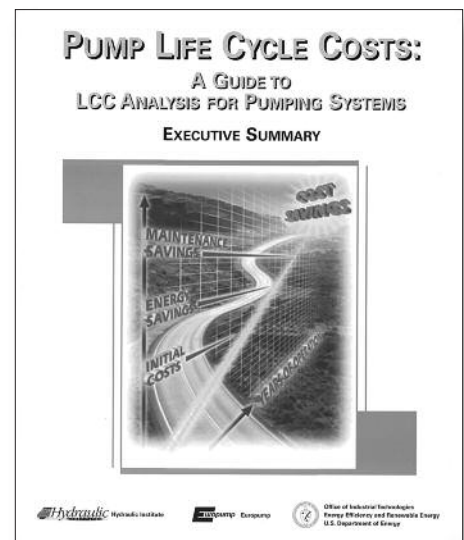
Pumping systems account for nearly 20% of the world's energy demand and, in some industrial operations, account for 20% to 50% of energy costs. However, because pumps function as a component of larger systems, companies may overlook opportunities to save energy and money and improve pump system performance.

Life Cycle Cost (LCC) analysis is a management tool that can help companies minimize waste and maximize energy efficiency for many types of systems, including pumping systems. The Hydraulic Institute and Europump, in cooperation with DOE, have developed *Pump Life Cycle Costs: A Guide to LCC Analysis for Pumping Systems, Executive Summary*. This overview document offers highlights

of a larger report that assists plant owners and operators in applying the LCC methodology to pumping systems.

The summary emphasizes the need to consider pump system costs that accrue over a lifetime of operation, not just the initial costs of installation or replacement. By understanding all of the components that figure into the cost of ownership, companies can dramatically reduce energy, operational, and maintenance costs.

Learn more about how you can apply LCC methods to pumping systems by downloading the summary from the BestPractices Web site at [www.oit.doe.gov/bestpractices/explore\\_library/technical\\_publications.shtml](http://www.oit.doe.gov/bestpractices/explore_library/technical_publications.shtml). ●



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## OIT Needs You for Steam System Opportunity

Oak Ridge National Laboratory (ORNL), in support of OIT, is performing a Steam System Opportunity Assessment and needs your input. The objective of this effort is to determine the savings available from steam system improvements and to increase awareness of these opportunities.

To date, the Steam System Opportunity Assessment has estimated the amount of steam generated and used in three of the most steam-intensive industries: Pulp and Paper; Chemical Manufacturing; and Petroleum Refining.

The next step is to estimate the size of the Steam System Performance Improvement Opportunities (PIO) that are available to these industries. ORNL is looking for assistance from steam system end users and steam system evaluation experts to identify and quantify Steam System PIOs. A questionnaire has been developed to obtain information on:

1. Typical savings associated with different PIOs,
2. The percentage of plants within these industries for which different PIOs are feasible, and

3. The primary rationale for implementing PIOs.

If you are interested in supporting this effort by completing the questionnaire, please contact:

Glenn McGrath, Resource Dynamics Corporation  
Phone: 703-356-1300, ext. 220  
E-mail: [mcgrath@rdcnet.com](mailto:mcgrath@rdcnet.com)

In exchange for providing input to this work, you will be acknowledged in and you will receive a copy of the final report. ●



## Ask the Clearinghouse

This column regularly highlights key questions from industrial customers. The questions are answered by the OIT Clearinghouse. Through the OIT Clearinghouse, you can access the full portfolio of OIT resources to help make your industry more energy efficient, productive, and competitive. The Clearinghouse can help you find resources, such as publications and software, or information about working with OIT and cost-sharing opportunities. You should also think of the Clearinghouse as a resource that specializes in providing technical advice about motor, steam, compressed air, and process heating systems.

Clearinghouse engineers and technical staff expertly answer a wide range of industrial efficiency questions, 11 hours a day, Monday-Friday. The Clearinghouse also has access to industry experts around the country. Call the OIT Clearinghouse at 800-862-2086, or go to [www.oit.doe.gov/clearinghouse/](http://www.oit.doe.gov/clearinghouse/) for additional information.

**Q: We are attempting to reduce our overall usage of plant air. The problem is that we cannot agree on the actual cost of compressed air. One claim is that compressed air costs \$0.12 per 1,000 cubic feet. Do you have any supporting data that either confirms or refutes this claim?**

**A:** Large manufacturing plants often employ centrifugal compressors to meet their compressed air needs. These compressors commonly provide from 1,000 to 5,000 cfm of airflow with discharge pressures up to 125 psig. They typically have an operating power requirement of 16 to 20 kW/100 cfm of air provided.

If an average centrifugal compressor consumes 18 kW/100 cfm, 3 kWh would be required to provide 1,000 cubic feet of compressed air:

$$\begin{aligned} &18 \text{ kW}/100 \text{ cfm} \times (10 \text{ min} \times \\ &100 \text{ cfm})/1000 \text{ cf} \times 1 \text{ hour}/60 \text{ min} \\ &= 3 \text{ kWh}/1000 \text{ cf} \end{aligned}$$

At an electrical rate of \$0.04/kWh, the cost for 1,000 cf of delivered air is exactly \$0.12.

Note that this compressed air cost rule-of-thumb can be modified based upon your compressor type and local energy rates. For instance, a double-acting reciprocating compressor typically requires 15 to 16 kW/100 cfm, while a single-stage lubricant-injected rotary screw compressor requires 18 to 19 kW/100 cfm. A lubricant-free rotary screw compressor typically requires 20 to 22 kW/100 cfm. Electricity prices also vary tremendously. Some areas of the country still have industrial energy rates as low as \$0.02/kWh, while others exceed \$0.10/kWh. ●



## Letters to the Editor

Energy Matters welcomes your typewritten letters and e-mails. Please include your full name, address, organization, and phone number, and limit comments to 200 words. Address correspondence to:

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1617 Cole Blvd.

Golden, CO 80401

E-mail: [michelle\\_sosa-mallory@nrel.gov](mailto:michelle_sosa-mallory@nrel.gov)

We publish letters of interest to readers on related topics, comments, or criticisms/corrections of a technical nature. Preference is given to articles that appeared in the previous two issues. Letters may be edited for length, clarity, and style. ●

### IN THE NEXT ISSUE...

Energy Matters will focus on Alternative Power Resources and will offer potential solutions to the power dilemma.

Don't miss the coverage on renewable energy technologies and other efficiency measures that could apply to your industry. We'll also include a special supplement to help you become more familiar with the potential of Distributed Energy Resources.

Watch for the next issue of Energy Matters.

## ENERGY MATTERS EXTRA

Look to Energy Matters Extra for more coverage on the Volatile Energy Market. Learn how OIT's BestPractices can help ease the impact of high energy prices and energy shortages by offering tools to improve your plant's efficiency and productivity.

Link to a report that evaluates the effectiveness of OIT's BestPractices Program. Download the Pump System Assessment Tool (PSAT), a software program that can help you assess pump system efficiency in your plant. You can also see a summary

report of *Pump Life Cycle Costs: A Guide to LCC Analysis for Pumping Systems*, featured on page 6 of this issue, for ideas on calculating the total costs of owning and operating pumping systems.

Find out more about the upcoming BestPractices workshop series "Energy Solutions for California Industry: Ways to Improve Operations and Profitability," designed to help industries improve system efficiency and reduce electrical demand. Get details and registration information for the first workshop scheduled for August 14 in Sacramento.

Browse through the roadmap for process heating technology to learn about the industry's goals for reducing energy consumption, while meeting industrial process heating needs now and in the future.

Be sure to check out the money-saving opportunities available through NYSERDA's Energy \$mart Program and the California Energy Commission's Emerging Renewables Buy-Down Program.

Log on to Energy Matters Extra at [www.oit.doe.gov/explore\\_library/emextra](http://www.oit.doe.gov/explore_library/emextra). ●

## Coming Events

### UTAH 2001 INDUSTRY SHOWCASE

The State of Utah and OIT will present this Showcase to support, promote, and highlight the use of advanced technologies in aluminum manufacturing, petroleum refining, metal-casting, and mining. Attend the event:

- August 27-29, 2001, in Salt Lake City, UT

Find out more about the Utah Showcase by logging on to [www.oit.doe.gov/news.shtml](http://www.oit.doe.gov/news.shtml), or by calling 877-648-7967.

### SPIRAX SARCO/AEE ENERGY EFFICIENCY EXPOSITION AND WORKSHOP

- August 24-26, 2001, in Atlanta, GA

For more information, please log on to [www.aeecenter.org/shows/](http://www.aeecenter.org/shows/).

### INTEGRATED ENERGY EFFICIENCY CONGRESS/FACILITIES MANAGEMENT AND MAINTENANCE EXPO

- August 29-30, 2001, in Cleveland, OH

For more information, log on to [www.aeecenter.org/shows/](http://www.aeecenter.org/shows/).

### NIA/OIT INSULATION ENERGY APPRAISAL PROGRAM CERTIFICATION CLASSES

- September 6-7, 2001, in Philadelphia, PA
- October 15-16, 2001, Omaha, NE

For more information, log on to the BestPractices calendar at [www.oit.doe.gov/bestpractices/take\\_class/calendar.shtml](http://www.oit.doe.gov/bestpractices/take_class/calendar.shtml), or call Wendy Schmutte at the National Insulation Association 703-683-6422.

### ENERGY AND ENVIRONMENTAL TECHNOLOGIES CONFERENCE

- October 16-17, 2001, in Atlantic City, NJ

For more information, log on to [www.eetec.org](http://www.eetec.org), or call 609-499-3600, extension 3.

To keep up-to-date on OIT training and other events, check the calendar regularly on *Energy Matters Extra* at [www.oit.doe.gov/bestpractices/explore\\_library/emextra](http://www.oit.doe.gov/bestpractices/explore_library/emextra).

## BestPractices

The Office of Industrial Technologies (OIT) BestPractices initiative and its *Energy Matters* newsletter introduces industrial end users to emerging technologies and well-proven, cost-saving opportunities in motor, steam, compressed air, and other plant-wide systems. For overview information and to keep current on what is happening office wide, check out the newsletter—*The OIT Times*—at [www.oit.doe.gov/oit-times](http://www.oit.doe.gov/oit-times).



### INFORMATION CLEARINGHOUSE

Do you have questions about using energy-efficient process and utility systems in your industrial facility? Call the OIT Information Clearinghouse for answers, Monday through Friday 9:00 a.m. to 8:00 p.m. (EST).

**HOTLINE: 800-862-2086**

Fax: 360-586-8303, or access our homepage at [www.oit.doe.gov/clearinghouse](http://www.oit.doe.gov/clearinghouse).

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# ENERGY MATTERS

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A data logger is set up to capture real-time motor systems data.



Instantaneous measurements are collected as part of the PAT motor systems analysis.

**PG&E SPONSORED A  
DEMONSTRATION PROJECT TO  
IDENTIFY AND QUANTIFY POTENTIAL  
MOTOR SYSTEM SAVINGS BY  
ACCURATELY MEASURING MOTOR  
PERFORMANCE.**

## PG&E Takes Market Approach to Establishing Motor Performance Analysis

With a service area of 70,000 square miles in Northern and Central California, Pacific Gas and Electric (PG&E) transmits and delivers energy to more than 13 million customers. That makes PG&E one of the largest providers of natural gas and electricity.

As part of its market transformation strategy, PG&E, an OIT BestPractices Allied Partner, works with industrial and commercial customers on improving efficiency and reducing energy demand. The company targets industrial energy systems as areas with significant potential for savings and improved performance and reliability. More and more, the utility's customers are seeking ways to unlock that potential. PG&E offers some of the keys in the form of technical assistance, such as training, testing, and system analysis.

Recently, PG&E sponsored a demonstration project to identify and quantify potential motor system savings by accurately measuring motor performance in a variety of industrial settings. The project involved developing and testing the Performance Analysis Testing (PAT) tool. The PAT tool uses a data logger to record real-time data to eliminate some of the guess work and to provide a standard method for analysis of motor systems.

What made the project unique is that PG&E demonstrated a viable market approach to motor performance analysis. The PAT tool project demonstrated that customers have a need for accurate motor performance analysis—and that the PAT analysis could be a service niche for trade allies.

### The PAT Tool

Development of the PAT tool began as an idea to engage the market with a method to assess motor system perfor-

mance and provide very accurate data. Jim Hanna, PG&E's Senior Project manager, oversaw development; Mats Falk of Flow-care Engineering, Inc. and Dr. Howard Penrose designed procedures; and field testing and PAT demonstration were completed by Colman Snaith of Newcomb-Anderson & Associates. According to Hanna, "Other software tools in the past have required the user to make some assumptions and haven't allowed for real-time readings." More accurate data not only helps identify opportunities, but also helps to justify improvements that lead to better motor efficiency and avoided motor failure.

Using OIT's *MotorMaster+* software as the basis, PAT provides a basic analysis to determine if motor replacement presents a good opportunity for improved efficiency. By inputting simple motor nameplate data and electrical measurements, the tool accurately determines if replacing an installed motor with a premium efficiency model makes sense for that facility.

In addition, PG&E added advanced analysis features designed to evaluate the mechanical and electrical condition of an installed motor. The advanced analysis features included motor circuit and vibration analysis.

The combination of information—and the accuracy with which it is obtained—showed PAT's potential as a good tool for motor repair versus replacement decisions. These features proved appealing to PG&E's customers and trade allies alike.

### Putting the Tool to the Test

The goals of testing PAT were threefold:

1. To help refine the tool itself and determine if it would achieve repeatable and accurate results,
2. To determine the energy- and cost-saving

(continued on page 2) ►

THE DEMONSTRATION REVEALED  
 THAT INDUSTRIAL CUSTOMERS  
 RESPOND POSITIVELY TO SUCH  
 A MOTOR PERFORMANCE  
 EVALUATION METHOD.



One of the PAT testing team checks connections through the data logger interface.



The tester reviews motor data before disconnecting the data logger.

PG&E Takes Market Approach  
*continued from page 1*

potential, and  
 3. To determine the marketability of a motor program based on the tool.

To accomplish these goals and get a fair assessment of the PAT method, PG&E targeted industrial customers with high energy intensities in their manufacturing processes.

When PAT was ready for testing, PG&E identified six industrial facilities within its service area to participate in the demonstration project. They included:

- A paper mill
- A petroleum extraction and processing plant
- A produce cooling and storage facility
- A granite quarry
- An onion and garlic dehydration and milling facility
- An engineered lumber product manufacturer

“We selected these companies because they had high energy use,” explains Hanna. “They also represent a diverse mix of IOF industries,” he adds. In addition, the processes at these facilities required long hours of motor operation, which allowed testing under variable conditions. Besides says Hanna, “Improvements are most cost-effective for motors that operate over a certain number of hours.”

Together with its demonstration partners, PG&E analyzed potential for improvements to 245 motors in the 5 to 200 hp range. At the same time, the company took stock of the overall PAT approach.

**Results**

The demonstration project identified significant opportunities for improvement at each of the facilities. Of the 245 motors

analyzed, 198 showed at least one deficiency. Many of the motors were oversized, overloaded, or inefficient. The results suggested that almost half of the motors analyzed should be replaced with properly sized, premium efficiency motors.

In addition, 20 motors were analyzed using the advanced condition evaluation techniques. Almost all of the motors included in the advanced analysis were identified during the basic analysis phase as having potential maintenance problems. This project confirmed that end users, such as those who took part in the testing, could use PAT to help establish their motor management policies. As part of an overall motor management strategy, the tool provides the means to both evaluate the potential benefits of upgrading motors and target potential maintenance needs.

Equally important, the PG&E demonstration revealed that industrial customers respond positively to such a motor performance evaluation method. “When we presented data to the companies, we received immediate feedback, and it was extremely positive,” says Hanna. “We heard remarks like ‘This is great! We haven’t seen this before,’ or ‘Can you test all our motors?’”

**Next Steps for PAT**

Although the PAT approach shows promise, PG&E is working with customers to solve immediate needs brought about by the energy situation in California. Thus, efforts to market the tool to trade allies are on hold for now. Meanwhile, PG&E will continue to fine-tune the tool, and Hanna says his company hopes to eventually market it as part of its motor efficiency program. “We’ve already done the hard work and proven the tool’s effectiveness,” he notes about the demonstration project’s success. ●

**THE ALLIED PARTNERSHIP ADVANTAGE**

*As an Allied Partner, PG&E has access to many BestPractices resources and tools that augment its industrial energy efficiency services. PG&E’s demonstration project is a good example of how one BestPractices tool, MotorMaster+, can be adapted and applied to meet customers’ needs. By applying a market approach, PG&E has increased its value to industrial customers and trade allies.*

*Likewise, your company can gain the competitive advantage of Allied Partnership. Expand your range of services by incorporating BestPractices software, publications, and training into your program. In addition, a partnership with BestPractices will reinforce your company’s credibility with customers—and can even increase its visibility when you share successes with others in DOE-produced publications and announcements.*

*Learn more by logging on to [www.oit.doe.gov/bestpractices/get\\_involved/](http://www.oit.doe.gov/bestpractices/get_involved/).*

Photos courtesy of Colman Snaith/Newcomb Anderson Associates.

## Independent Report: Motor Challenge Program Highly Cost-Effective

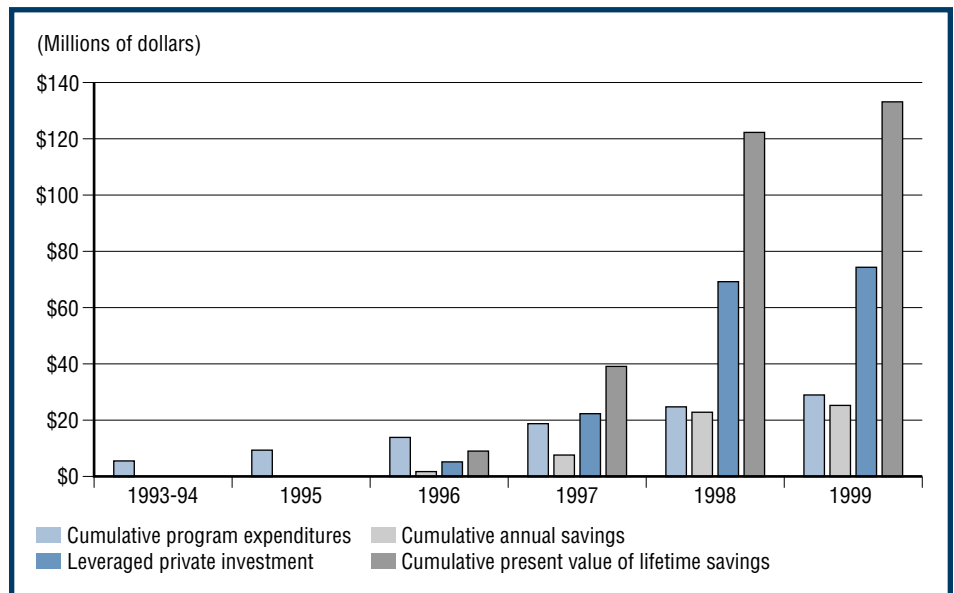
A recent independent evaluation of OIT's Motor Challenge Program concluded that the program has enabled industrial facility operators to significantly reduce energy consumption and has been "highly cost-effective." The report, entitled *Evaluation of the U.S. Department of Energy Motor Challenge Program*, was written by XENERGY, Inc., of Burlington, Massachusetts, a 25-year-old energy services and consulting company.

What does this mean to you? In a nutshell, by tapping into OIT's valuable tools and resources for improving plant efficiency, you can—and continue to—improve the bottom line.

Launched in the fall of 1993, the Motor Challenge Program was managed by OIT in partnership with U.S. industry. In winter of 1999-2000, all of OIT's Challenge programs became part of the BestPractices initiative. BestPractices delivers energy-saving products, services, and technologies to help industry increase efficiency, reduce waste, and boost productivity.

The Motor Challenge Program offered two kinds of program activities, which are still the basis of BestPractices.

■ **Motor Systems Efficiency Tool Development and Dissemination.** The Motor Challenge Program developed a set of project planning and preventive maintenance tools designed to help industry and industrial supply-chain vendors and consultants identify and cost-justify specific actions to reduce energy use in their motor systems. The most well known of these tools is the *MotorMaster+* motor selection and management software, which has been distributed to thousands of industrial end users, vendors, and consultants nationwide. On average, the registered *MotorMaster+* users are large industrial facilities. XENERGY estimated that they use roughly 20 times more motor system energy than the average manufacturing plant and 5 times as much as a typical utility-sponsored motor program participant. Altogether, the evaluation estimated that the population of registered



**Key cost and benefit outcomes of the Motor Challenge Program from program inception through September 1999.**

*MotorMaster+* users consumed 165,120 GWh per year in electricity versus 1.1 million GWh per year for industrial users as a whole. You can view the BestPractices Motors Web site and download *MotorMaster+* at [www.oit.doe.gov/bestpractices/motors/](http://www.oit.doe.gov/bestpractices/motors/).

■ **Partnership Programs.** The Motor Challenge staff worked with many different organizations to ensure that program tools reach end users and vendors when they are making motor system purchase, management, and maintenance decisions. The Allied Partner Program worked with more than 200 organizations including vendors and program operators, such as utilities, industry associations, and government agencies. Allied Partners are private companies that provide equipment and services to industry. Their primary activity is their involvement in project teams that assess plant efficiencies and demonstrate application of efficiency improvements. According to the report, Allied Partners can take credit for saving more than 200,000 MW per year, which translates into a savings of about \$9.8 million annually. To see how you can get involved in Allied Partners, access the BestPractices Allied Partner Web site at [www.oit.doe.gov/bestpractices/meet\\_partners/](http://www.oit.doe.gov/bestpractices/meet_partners/).

### Key Evaluation Results

Using a variety of research and analysis methods, XENERGY found the following.

- Information, motor management tools, and technical services delivered by the Motor Challenge Program from inception through September 1999 encouraged and enabled industrial facility operators to reduce energy consumption by 520 GWh per year. These savings are valued at \$24.9 million at current rates, with annual avoided air emissions of 130,000 metric tons of carbon equivalent per year.
- The program was highly cost-effective. Total program expenditures from inception through September 1999 amounted to \$29.2 million. Program activities stimulated nearly \$75 million of private investment in energy efficiency improvements to industrial motor systems. The discounted present value of lifetime savings from improvements attributable to Motor Challenge amounted to more than \$132 million—more than 4 times the amount of program expenditures from inception through September 1999.

(continued on page 4) ►

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## “NEMA Premium” Program Drives Application of Efficient Motors for Energy Cost Savings

*Benefits extend to end users, manufacturers, and environment*

The National Electrical Manufacturers Association (NEMA), announces its Premium Motor program, an initiative aimed at helping U.S. motor manufacturers expand the application of premium-efficiency three-phase motors and provide customers with a high level of motor performance. The program will focus on qualifying and labeling motors that meet an industry-defined standard of “premium efficiency.” For OEMs and end users, NEMA Premium labeling will

provide assurance that products meet the highest standards for energy efficiency.

Traditionally, there has been no industry-developed standard defining high-efficiency or premium-efficiency motors. Today, power supply issues and utility deregulation bring attention to the need to help motor users optimize motor system efficiency. The Energy Policy Act (EPA) of 1992 imposed energy efficiency standards on many classes of motors. Confusion remained, however, because of a lack of consistency in describing integral premium-efficiency performance.



The NEMA Premium campaign, driven by the NEMA Motor and Generator Section’s Energy Management Taskforce, addresses the confusion by going beyond EPA efficiency requirements while relying on its procedures and labeling methods of efficiency levels. NEMA Premium will cover more motor types and sizes than those covered under EPA, including 1

to 200 hp definite- and special-purpose motors, medium-voltage motors, and motors up to 500 hp.

The campaign is based on present-day NEMA Design A and B motor performance,

including locked rotor current requirements. The focus will be on proven NEMA motor designations to reduce users’ risk of motor misapplications. Products are tested in accordance with existing standards, including the NEMA MG1 standard.

End users will be able to identify premium efficiency motors by the “NEMA Premium” label and logo, to be used only with products that meet or exceed NEMA Premium motor efficiency levels. Partnering manufacturers will operate under a memorandum of understanding signed with NEMA to use the Premium label.

“NEMA Premium is unique because it’s a realistic standard, it’s straightforward to

implement, and it covers a huge range of products,” said Robert Boteler, chairman of the Energy Management Taskforce. “In addition, because it’s a voluntary program and is sponsored by an established and well-recognized manufacturers’ organization, it fits a national need for premium efficiency standards.”

Based on data from DOE’s *United States Industrial Electric Motor Systems Market Opportunities Assessment* report, Boteler estimates the program, including commercial and agricultural applications, could save 5,800 GW of electricity and prevent the release of nearly 80 million metric tons of carbon into the atmosphere over the next 10 years. “It would be the equivalent of keeping 16 million cars off the road in the next decade,” he noted.

DOE and NEMA plan to develop joint activities that will expand awareness of the benefits of premium-efficiency motors and efficient motor systems. These could include presentations and materials to educate users on premium-efficiency motors and motor systems. In addition, DOE and NEMA are collecting data on motor products, which will be included in the *Motor-Master+* database and will highlight NEMA Premium products.

*(continued on page 6) ►*

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### Motor Challenge Program Report *continued from page 3*

The figure on page 3 excerpted from the report, shows cumulative program expenditures, leveraged private investments in efficient motor system equipment, annual energy savings attributable to the program, and the present value of those savings for each year in the period under evaluation.

XENERGY used a variety of research methods to obtain the information to address the evaluation criteria. These methods included analysis of program records; interviews with end users, vendors, and government officials who participated in the program; and application of motor system inventory information from the *United States Industrial Electric Motor Systems*

*Market Opportunities Assessment (Market Assessment)*<sup>1</sup> to estimate energy savings.

In summary, the report concluded that the Motor Challenge efforts were very cost-effective. The same efforts are being continued under BestPractices.

Don’t miss out! If you haven’t yet checked into how BestPractices can help you save energy and money, log on to [www.oit.doe.gov/bestpractices/](http://www.oit.doe.gov/bestpractices/). ●

<sup>1</sup>XENERGY Inc. (1998) *United States Industrial Electric Motor Systems Market Opportunities Assessment*. U. S. Department of Energy’s Office of Industrial Technologies and Oak Ridge National Laboratories. See Section 1.2.1 of this report for more details and key findings.

### ENERGY MATTERS READERS’ IMPACT

Energy Matters, formerly Turning Point, has played a role in helping industry be more efficient. In the report, XENERGY cites an Energy Matters reader survey that indicated roughly one-third of you used information found in the newsletter to carry out some kind of motor system energy improvement. The report further cited an Energy Matters marketing assessment report that estimated that these actions saved more than 35,000 MWh per year, or nearly \$1.7 million.

## Qualification Workshops Meet the Need for PSAT Software Experts

On April 9th and 10th, 2001, in Blacksburg, Virginia, DOE held the first in a series of workshops to qualify pumping system professionals in the use of the Pumping System Assessment Tool (PSAT) software.

Pumping systems are among the most energy-consuming industrial systems. Several years ago, DOE began looking for a way to educate pumping system manufacturers, distributors, consultants, and end users on the benefits of applying a systems approach to improve pumping efficiency. This led to the development of the PSAT.

PSAT helps users assess energy savings opportunities in pumping systems, relying on field measurements of flow rate, head, and either motor power or current to perform the assessment. Using algorithms from Hydraulic Institute (HI) standards and motor performance characteristics from DOE's *MotorMaster+* database, PSAT quickly estimates existing pump and motor efficiency and calculates the potential energy and cost savings of a system optimized to work at peak efficiency.

The training workshop, which has been presented at more than 20 locations across the country since November 1999, helps users get the most benefit from the software, while emphasizing the systems

approach. According to Chris Cockrill of DOE, "The workshops have been a good way to introduce PSAT to end users, and we've seen a high demand for the software and the training."

He adds, "To meet this demand and increase the number of PSAT experts in industry to assist end users, DOE turned to the pumping industry and DOE's Allied Partnership with the Hydraulic Institute."

Last February, as a result of a PSAT demonstration at HI's annual meeting, several members decided to participate with DOE as BestPractices Allied Partners and to become qualified by DOE as Pumping System Specialists.

Don Casada of Diagnostic Solutions (formerly of Oak Ridge National Laboratory) designed the workshop, in collaboration with DOE and the pumping system industry. Casada, a recognized pumping system expert, also developed a pumping system prescreening tool. He was the instructor for the PSAT qualification workshop in Blacksburg, and for two additional qualifying workshops held this spring (April 26-27 for ITT Fluid Technology, in Morton Grove, Illinois, and May 14-15 for Flowserve Corporation, in Dallas, Texas). According to Casada, "What makes this workshop unique is its focus on practical analytical techniques for achieving greater system efficiency."



**Workshop participants gain hands-on experience with PSAT by conducting tests and collecting measurements at a VPI Water Authority pumping facility.**

The qualifying workshops prepare professionals with extensive experience in pumping systems to use PSAT in their system assessments. Participants learn:

- How to accurately acquire input data for PSAT
- How to prescreen pumping systems to select the "vital" systems for further review
- How to use the PSAT software
- The difference between measurements and requirements
- The importance of a system perspective.

To reinforce what was learned in the Blacksburg workshop, the class visited two pumping facilities of the Blacksburg-Christiansburg-Virginia Polytechnic Institute (VPI) Water Authority, where they conducted tests and collected measurements under different power scenarios. Participants entered the data into PSAT to determine each facility's pump efficiency and calculate the potential energy and cost savings for each power scenario. "The access granted by the Water Authority provided an exceptional learning laboratory for participants," Casada explained.

Participants who complete the workshop and pass a qualifying exam will be recognized by DOE as Qualified Pump System Specialists, and will be listed on DOE's BestPractices Web site at [www.oit.doe.gov/bestpractices](http://www.oit.doe.gov/bestpractices). Specialists assist

(continued on page 6) ►



**Back row (left to right): Arnold Sdano, Fairbanks Morse; Don Casada (Instructor), Diagnostic Solutions, LLC; Dewey Eanes, Jr., Blacksburg-Christiansburg-VPI Water Authority; Daryl Cox, Oak Ridge National Laboratory; Charles Karpa, Jr., Draper Aden Associates; and Mark Bihl, Sterling Fluid Systems (USA), Inc. Front row (left to right): Thomas Angle, EnviroTech Pump Systems; Fred Glaeser, Rutgers; Jeff van Huet, Science Center, University City; Tim Ritz, Fairbanks Morse; and Tom Brownfield, Hydro-Aire. (Not shown: G.W. (Jerry) Higgins, Blacksburg-Christiansburg-VPI Water Authority).**

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## California Workshops to Focus on Improving Efficiency and Reducing Demand

In partnership with the California Energy Commission, OIT's BestPractices will host "Energy Solutions for California Industry: Ways to Improve Operations and Profitability," a series of 1-day workshops to help California industries improve system efficiency and reduce electrical demand. The first event will take place on August 14, 2001, at the Radisson Hotel in Sacramento. The workshops are timely in view of California's energy supply dilemma, which will likely continue for some time. The events will be offered in cooperation with BestPractices Allied Partners, key industrial end user associations, and California utilities.

### Who Should Attend?

You should attend these workshops if you are interested in learning ways to manage and improve system efficiency in your plant. The August event will feature exhibits and speakers offering practical advice and solutions for managing electrical demand and improving system efficiency, while maintaining or improving productivity and profitability. Case studies will be presented to illustrate how electrical reduction can be achieved by using a systems approach.

The emphasis will be on financial, technical, and program assistance to help industries quickly and economically develop projects. Find out how to shop for financing and technical assistance. You

can also take away information and analytical tools that can help your facility increase energy efficiency and cost savings in the short term and long term.

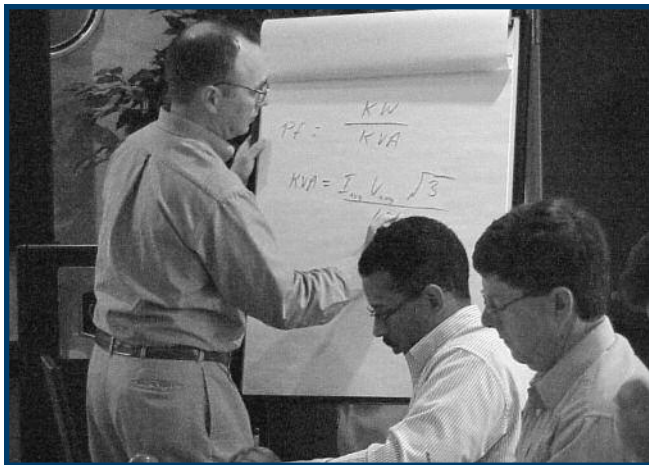
Cosponsors of the August event are the Association of California Water Agencies, the California Farm Bureau Federation, the California League of Food Processors, and the California Manufacturers and Technology Association.

### Find Out More

For more information and updates about the workshops, check the BestPractices Web site at [www.oit.doe.gov/bestpractices](http://www.oit.doe.gov/bestpractices). ●

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### Quantification Workshops continued from page 5



**Instructor Don Casada guides PSAT workshop participants through pumping system calculations.**

industrial customers in using PSAT to evaluate their pumping systems.

To date, these seven companies have signed on as Allied Partners with plans to qualify representatives as Pump System Specialists:

- Burgmann Seals
- EnviroTech Pump Systems
- Fairbanks Morse
- Flowserve Corporation
- HydroAire
- ITT Fluid Technology
- Sterling Fluid Systems (USA), Inc.

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### "NEMA Premium" Program continued from page 4

In addition, DOE's Industrial Assessment Center at the University Science Center in Philadelphia, Pennsylvania, has a qualified specialist.

If you are a pump system professional interested in the PSAT qualification process, please contact Vestal Tutterow, Lawrence Berkeley National Laboratory, at 202-646-7957 or [vtutterow@lbl.gov](mailto:vtutterow@lbl.gov). The PSAT software is also available for download from the BestPractices

Web site. Check the BestPractices training calendar regularly at [www.oit.doe.gov/bestpractices/take\\_class/calendar.shtml](http://www.oit.doe.gov/bestpractices/take_class/calendar.shtml) for announcements of upcoming PSAT qualification workshops. ●

"NEMA and its members have the technical standards, knowledge, and ability to help industrial motor users evaluate motor systems and select the best motor for specific applications," said Chris Cockrill of DOE. "Our research shows that energy efficiency is one of several important factors for achieving the best overall motor system efficiency. The NEMA Premium efficiency standard builds on NEMA's other standards to ensure that end users consider all system variables," he explained.

The 21 member companies of NEMA's Motor and Generator Section support this effort. These companies account for more than 1.5 million motors manufactured, or more than 80% of all motors sold annually in the United States. NEMA has also worked with other organizations and associations that share an interest in motor efficiency, such as the American Council for an Energy-Efficient Economy, the Electrical Apparatus and Service Association (EASA), and the Consortium for Energy Efficiency.

NEMA launched the program and hosted a booth at the EASA Convention in Chicago, Illinois, on June 24-27. For more information about the NEMA Premium program visit [www.nema.org](http://www.nema.org). ●