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Alternative Power Sources

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OIT/Utah Showcase Industrial Energy Efficiency

On August 27-29, 2001, OIT and the State of Utah hosted the Utah 2001 Showcase at the Sheraton City Center in Salt Lake City. The event featured several advanced technologies and best practices in three of the most energy-intensive industries: aluminum, mining, and petroleum refining.

The showcase gave six manufacturing plants the opportunity to demonstrate the progress they've made toward improving efficiency, enhancing competitiveness, and reducing pollution. At the same time, the showcase demonstrated to about 400 attendees how a strategic partnership between OIT, the State of Utah, and industry has led to this progress—and how similar alliances can help industries across the nation continue to grow and prosper.

Plants Highlight Improvements

Critical factors, such as the rapid pace of technology change, rising energy costs, and competitive pressures led companies to take part in innovative partnerships that address these challenges. "The Utah Showcase brought focus to the synergy of partnerships with OIT and others," comments Jim Bollenbacher, Vice President of Environment, Health, and Safety for Alcoa's North American Extrusion unit. Alcoa, Kennecott Utah Copper, Magnesium Corporation of America (Magcorp), Chevron, Flying J, and Silver Eagle opened their doors to show what they have accomplished.

Aluminum

At the Alcoa Extrusion facility in Spanish Fork, visitors learned about energy efficiency projects, such as a compressed air system upgrade, which could yield energy savings of 1,500 million British thermal units (Btu) per year. As part of Alcoa's corporate energy conservation program, this facility is also evaluating a cooling tower control system, improved dross recovery, regeneration burners, alternative combustion methods, a vertical flotation melter, and advanced sensors.

Mining

Kennecott Utah Copper's showcase gave visitors a look at the immense Bingham mine and the Copperton Concentrator, where copper is recovered from the ore. Through a series of upgrades to its smelting operation, the company saves about 55% in energy use and has also achieved substantial emissions reductions.

Meanwhile, magnesium producer Magcorp showcased an upgraded electrolysis system that has reduced electric energy use by

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Plant tours were a highlight of the Utah 2001 Showcase, where six companies demonstrated advanced technologies and best practices in the aluminum, mining, and petroleum refining industries.

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Utah Showcase

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30% and has also reduced maintenance and labor costs. Magcorp's combined heat and power (CHP) system exceeds 75% overall thermal efficiency and the company is evaluating an upgrade for even better efficiency. (See page 1 of this issue's special supplement for more on Magcorp's CHP system.)

Photo courtesy of Alcoa/PIX 10233

A vertical flotation melter demonstration was part of Alcoa's plant tour.

Petroleum Refining

Chevron provided an overview of the plant's furnace efficiency and steam system management efforts and an air system capital project. In addition, Chevron highlighted its gas combustion research project.

Flying J featured several new technologies for saving energy and improving manufacturing efficiency, among them a reverse osmosis unit that will save the company an estimated $200,000 per year. Others include advanced process controls, variable frequency drives for highly throttled pumps, a new compact cracking process, and a plant-wide energy tracking system.

At Silver Eagle, the focus was on new technology in reforming operations and an efficient waste heat boiler system. Visitors learned how Silver Eagle has implemented recommendations from DOE assessments throughout the plant.

To learn more about the participating companies' projects, see the BestPractices case studies on Energy Matters Extra at **www.oit.doe.gov/bestpractices/energymatters/emextra**.

An Exchange of Ideas

Throughout the showcase, participants exchanged ideas with others who are focused on industrial efficiency. In the exhibit hall, more than 40 exhibitors demonstrated advanced technologies and practices. In addition, industry associations, the Utah Energy Office, and DOE staff offered information about partnerships, industry programs, and projects that are ready for plant floor application. During breakout sessions, presenters led discussions on research, plant technologies, business issues, and state initiatives that affect the showcase industries.

Keynote speaker Senator Orrin Hatch (R-Utah) addressed the importance of Utah's industrial sector to the state and the nation. He noted the value of OIT's partnerships with states and acknowledged that the showcase format hastens industry's understanding of new technologies.

During a congressional forum, Utah's three representatives, James Hanson, Chris Cannon, and James Matheson, heard testimony from three panels representing government, industry, and industry associations. Among the panelists was Denise Swink,

Photo courtesy of Rolf Butters

Industry leaders address Utah congressional representatives at a forum.

OIT's Deputy Assistant Secretary, who explained that through the Industries of the Future strategy, OIT helps accelerate new technology application, increases productivity, and helps save energy.

Showcase cosponsors were OIT, the State of Utah, the University of Utah, Alcoa, Kennecott, Magcorp, Chevron, Flying J, and Silver Eagle.

Take Part in a Showcase

Learn more about the benefits of hosting a showcase on the BestPractices Web Site at **www.oit.doe.gov/bestpractices/pdfs/showcase.pdf**. Watch *Energy Matters* or visit the BestPractices Web site at **www.oit.doe.gov/bestpractices** for details about upcoming OIT showcases. ●

Increased Efficiency through Waste Heat Recovery from Process Heating Systems

By Richard L. Bennett, President, Janus Technology Group Inc., Rockford, IL

Many industrial heating processes generate large amounts of waste energy that simply pass out the stacks and into the atmosphere. When energy is abundant and cheap, no one seems to notice, but when supplies get pinched and prices climb, people begin to realize just how much of their fuel dollar goes sailing into the blue.

Techniques for Heat Recovery

Stack exhaust losses are part of all fuel-fired processes, and they increase with the exhaust temperature and the amount of excess air the exhaust contains. At stack gas temperatures greater than 1,000°F, the heat that is carried away is likely to be the single biggest loss in the process. Above 1,800°F, stack losses will consume at least 50% of the total fuel input to the process. Waste heat recovery offers a great opportunity to put some of this energy to work, reducing energy consumption and emissions and increasing productivity. There are several techniques for heat recovery, all based on intercepting the waste gases before they leave the process, extracting some of the heat they contain, and recycling that heat.

ABOVE 1,800°F, STACK LOSSES WILL CONSUME AT LEAST 50% OF THE TOTAL FUEL INPUT TO THE PROCESS. WASTE HEAT RECOVERY OFFERS A GREAT OPPORTUNITY TO PUT SOME OF THIS ENERGY TO WORK, REDUCING ENERGY CONSUMPTION AND EMISSIONS AND INCREASING PRODUCTIVITY.

Direct heat recovery to the product. This is the most efficient method. It takes advantage of the fact that even in the highest temperature processes, the product or charge enters the process at ambient temperature. If exhaust gases leaving the high temperature portion of the process can be brought into contact with a relatively cool incoming load, energy will be transferred to the load, preheating it and reducing the energy that finally escapes with the exhaust.

More often, heat is transferred to a surrogate medium, like combustion air to the burner system. This reduces the amount of purchased fuel required to sustain the process. Figure 1 shows how preheating combustion air affects available heat, which is the thermal efficiency of the combustion process itself.

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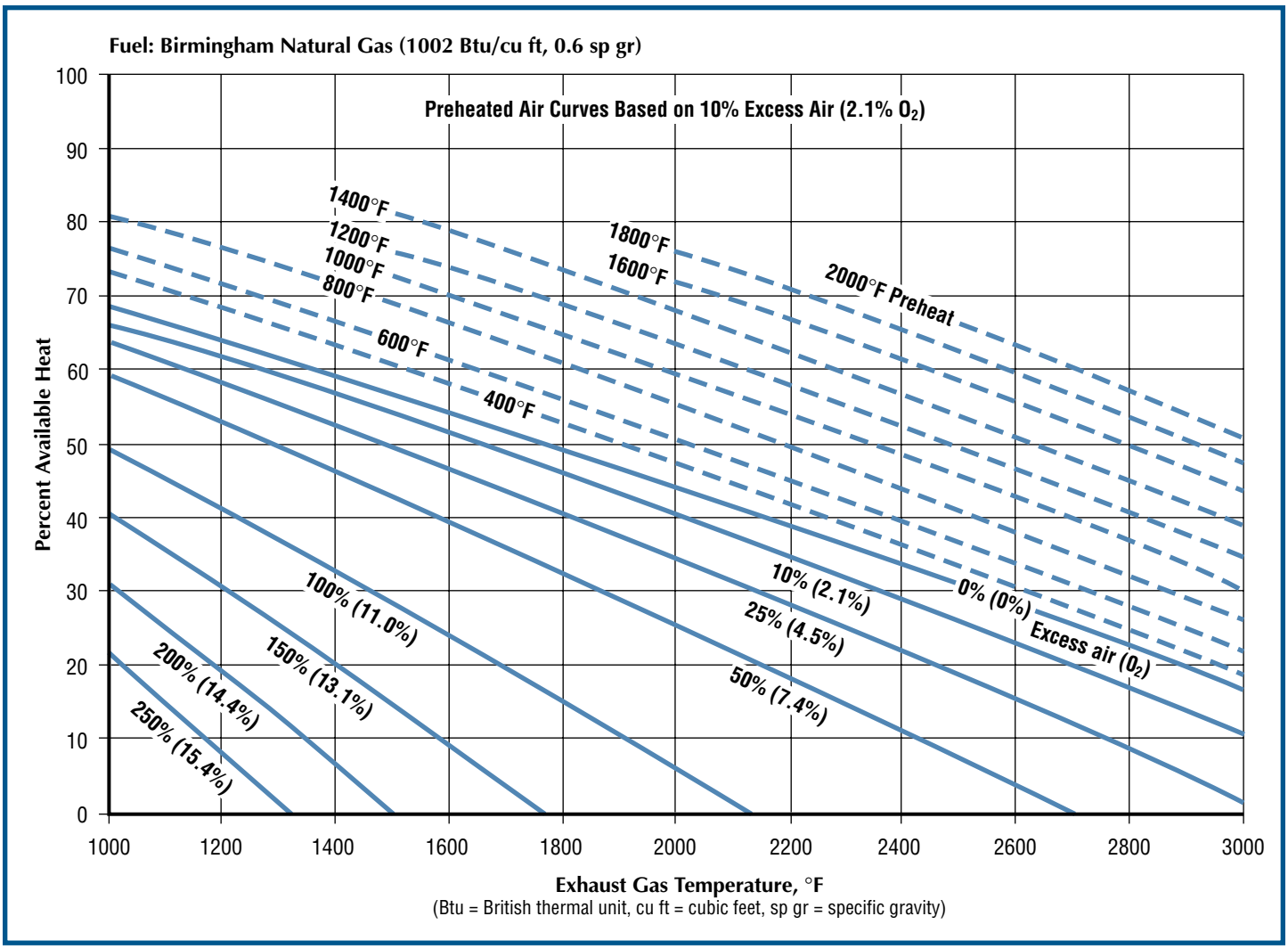

Figure 1. Effects of preheating combustion air on available heat.

continued from page 3

Recuperators. A Recuperator (Figure 2) is a gas-to-gas heat exchanger placed on the stack of the furnace. There are numerous designs, but all rely on tubes or plates to transfer heat from the outgoing exhaust gas to the incoming combustion air, while keeping the two streams from mixing. They are the most widely used heat recovery devices.

Regenerators. These are essentially rechargeable storage batteries for heat. A regenerator is an insulated container filled with metal or ceramic shapes capable of absorbing and storing relatively large amounts of thermal energy. During part of the operating cycle, process exhaust gases flow through the regenerator, heating the storage medium. After a while, the medium becomes fully charged, so the exhaust flow is shut off and cold combustion air is admitted to the unit. As it passes through, the air extracts heat from the storage medium, increasing in temperature before it enters the burners. Eventually, the heat stored in the medium is drawn down to the point where it is necessary to recharge the regenerator. At that point, the combustion airflow is shut off and the exhaust gases return to the unit. This cycle repeats as long as the process continues to operate.

Obviously, if the process is to operate without interruption, at least two regenerators (and their associated burners) are required—one to provide energy to the combustion air while the other is recharging. It is much like a using a cordless power tool—to use it continuously, you must have at least two batteries to swap out between the tool and the recharger.

The fundamental difference between recuperators and regenerators is the way they keep the exhaust gases and combustion air from cross-contaminating each other. Recuperators separate the gas streams with a physical barrier so they can operate continuously. Regenerators operate intermittently, keeping the streams separated by time.

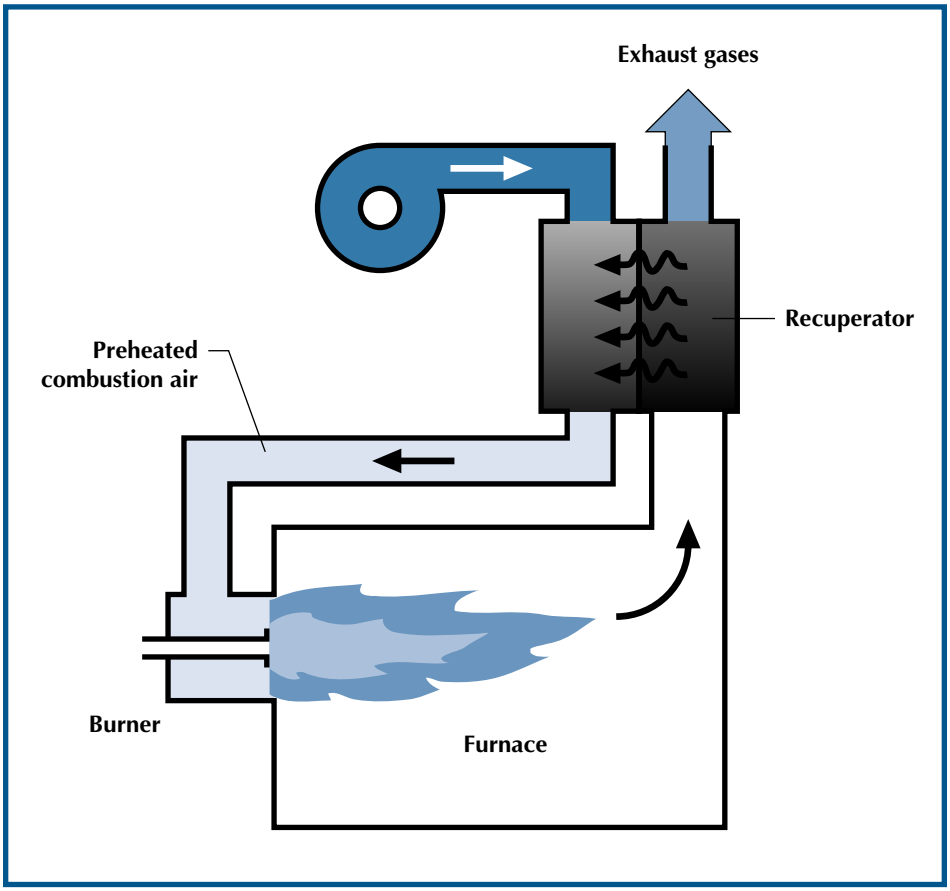

Figure 2. Recuperators transfer heat from outgoing gas to incoming combustion air without allowing streams to mix.

Waste Heat Boilers. Here is an option for plants that require a source of steam or hot water. They are similar to conventional boilers with one exception—they are heated by the exhaust gas stream from a process furnace instead of their own burners.

Making the Choice

How do you decide which recovery technique is right for your operation? In some instances, more than one might fill the bill, but here are some basic points that factor into the selection process.

- Direct heat recovery to the product has the highest potential efficiency, because it doesn't require any "carrier" to return the energy to the product. However, it does require a furnace or oven configuration that permits routing the stream of exhaust gases counterflow to incoming product or materials. This usually rules out most batch-type heating equipment.
- Recuperators are available in the widest range of sizes, configurations, and temperature ranges, and they don't require elaborate combustion control systems. However, they must be protected against overheating damage on high-temperature processes and may not be suitable for some corrosive or dirty exhaust gases.
- Regenerators can operate at temperatures beyond the range of recuperators and at higher efficiency ratings. They are highly resistant to corrosion and fouling, but because of their back-and-forth switching, they require more complex, expensive flow control systems than recuperators do.
- Waste heat boilers may be the answer for plants seeking more steam capacity, but keep in mind the boiler generates steam only when the process is running. Where this is a concern, boilers with auxiliary burners may be the answer. ●

Contact Richard Bennett by e-mail at janustech@compuserve.com, or by phone at 815-282-8044.

Industrial Manufacturers Help Develop Green Power Market

Some industrial operations not only work to improve their bottom lines and increase energy efficiency now, but also look ahead to using clean and renewable (or "green") sources of power, such as wind, solar, landfill gas, and fuel cells. Among the companies exploring these possibilities are Cargill Dow LLC, Alcoa Inc., and DuPont. Working with seven other companies within the Green Power Market Development Group (the Group), they are developing strategies to reduce green power costs, reduce market barriers, and help articulate the business case for green energy use.

Other member companies of the Group are General Motors, IBM, Delphi Automotive, Interface, Johnson & Johnson, Pitney Bowes, and Kinko's.

The Group, which is organized by the World Resources Institute and Business for Social Responsibility, acknowledges that green power has substantial challenges to overcome. As corporations work to optimize shareholder value, energy purchases are often made on the basis of price alone. However, not all of green power's attributes have monetary value, and there are some good business reasons for purchasing green power, according to the Group, which says that green power purchases can:

- Protect against volatile fluctuations in fossil fuel prices by providing an alternative to traditional power sources
- Provide financial value from avoided emissions
- Help corporations build leadership and trust in the public eye, while differentiating themselves from the competition.

One of the Group's goals is to work toward a sustainable energy future. Similarly, OIT and BestPractices are facilitating a sustainable U.S. industry by helping manufacturers boost energy efficiency and improve productivity. Learn more by logging on to the OIT Web site at **www.oit.doe.gov/** and the BestPractices Web site at **www.oit.doe.gov/bestpractices/**. To learn more about the Green Power Market Development Group, log on to **www.thegreenpowergroup.org**. ●

Ray Bleez, NREL/PIX 03890

Sacramento Municipal Utility District/PIX 01026

Warren Gretz, NREL/PIX 00043

Landfill gas, solar photovoltaics, and wind power are examples of "green" energy sources.

Jeff Kolstad, Chief Scientist, Cargill Dow LLC, is the company's representative in the Green Power Marketing Development Group.

Jeffrey Kolstad, chief scientist with Cargill Dow, represents the company in the Green Power Market Development Group. Cargill Dow uses annually renewable resources, such as corn, to produce its polylactide polymer, developed in partnership with DOE. These resins can be used as packaging materials or fibers for textiles, carpeting, and nonwoven applications. To reduce energy-related emissions generated in the polymer production process, Cargill Dow is working with the local utility to buy energy generated from wind or landfill gas.

According to Kolstad, "Cargill Dow is committed to reducing the environmental footprint of its polylactide polymer. Using green power will enable further reductions in fossil fuel use and greenhouse gas emissions, leading to a more sustainable future."

Black Liquor Gasification Expected to Yield Energy, Environmental, and Economic Benefits

Benefits

- *Reduces NO_x, SO_2, CO, VOC, and particulate emissions*
- *Expected air emission reduction of 90%*
- *Replaces existing smelters, eliminating threat of smelt-water explosions*
- *Reduces use of nonrenewable (fossil) fuels*
- *Increases energy efficiency*
- *Decreases capital and operating costs*
- *Provides hydrogen-rich, clean-burning fuel*

Georgia-Pacific (G-P) and OIT have teamed up to study and demonstrate black liquor gasification, which is expected to reduce air emissions by 90%, reduce operating costs, and increase energy efficiency at the G-P containerboard mill in Big Island, Virginia. It will be the first full-scale black liquor gasification system used in the commercial pulp and paper industry. G-P and DOE will share the project cost of approximately $85 million.

The system will replace two 50-year-old smelters and will provide the entire chemical recovery capacity for the G-P mill. It has potential for industry-wide applications to replace Tomlinson recovery boilers, which are the energy-intensive industry standard. The process is suitable for all pulping processes—carbonate, kraft, sulfite, nonwood, and others. Although the technology initially requires a higher capital investment, it will provide capital returns from reduced energy demands and help the forest products industry meet increasingly stringent Environmental Protection Agency (EPA) regulations.

Promising New Technology

Black liquor is a spent product of the chemical pulping/digesting process and a source of energy for the papermaking industry. Black liquor gasification, the conversion of leftover black liquor into a clean-burning fuel for use in burners, boilers, and gas turbines, is a promising new technology for reducing air emissions and increasing energy efficiency in the pulping process. The G-P project will employ a reactor in which tubes, heated by pulses of fired gas, are immersed in a mixture of sodium carbonate and spent black liquor. The pulsing enhances a heat exchange between the tubes and the mixture, which promotes the chemical reactions that produce the fuel. This process will treat all of the 400,000 pounds of black liquor solids that the mill produces each day.

The process differs from other technologies because it does not require partial oxidation of the liquor inside the gasifier. Its lower temperature allows the gasifier to convert black liquor organic material to gas at temperatures well below those required for smelt formation, eliminating the danger of smelt-water explosions in the recovery boiler. This equipment will maximize the recovery of energy and chemicals while producing a medium Btu fuel gas (200 to 300 Btu/scf [standard cubic feet]).

Demonstration Phases

The project is being conducted in two phases. Phase I focuses on validating the process design and solving any technology gaps. Phase II will focus on completing the engineering and construction and functional operation of the new system.

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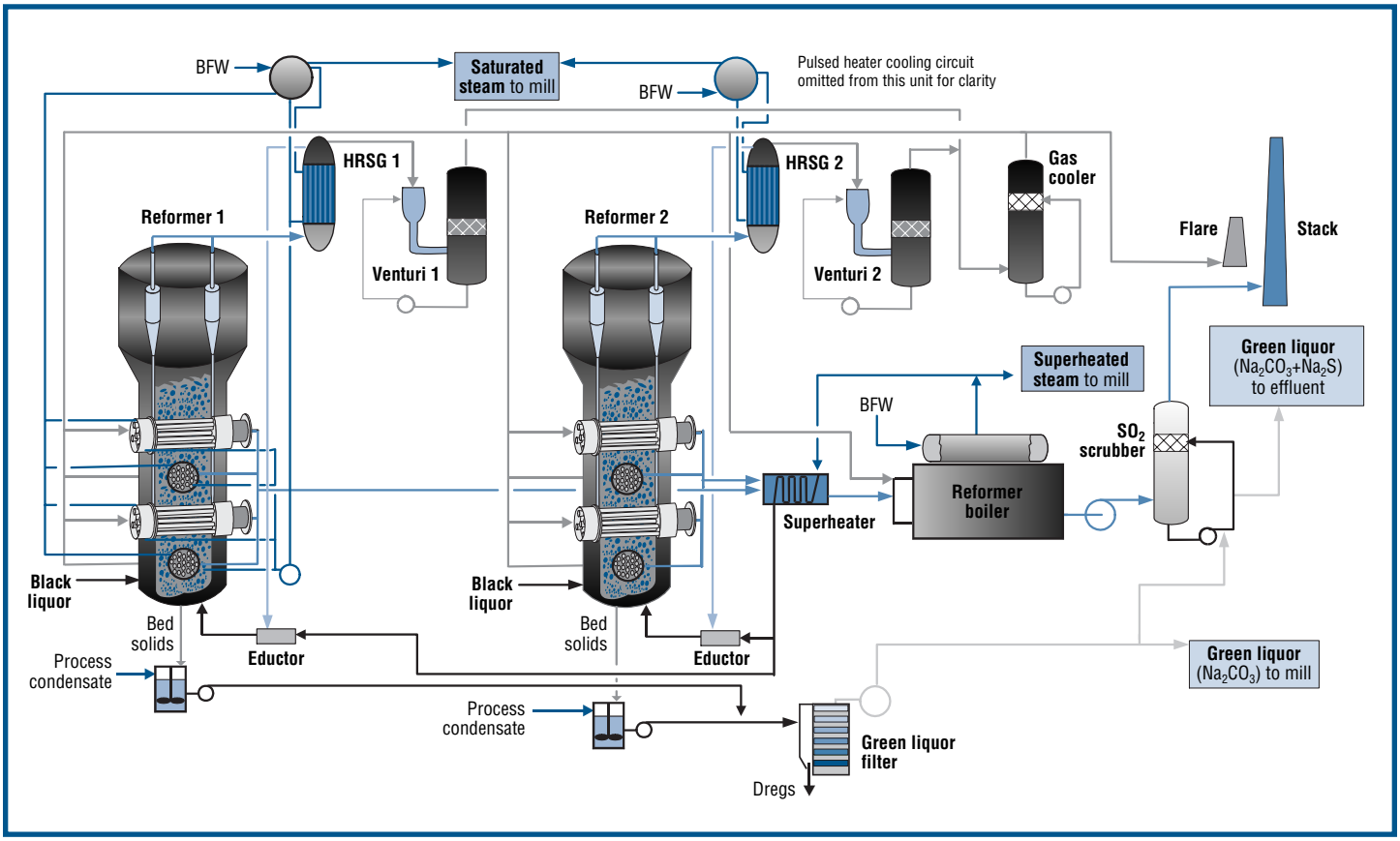

This figure depicts the black liquor gasification process to be implemented at Georgia-Pacific's Big Island, Virginia, containerboard mill.

The Power of the Wind

By Lynda Butek, representing the Electric Apparatus Service Association, Colton, CA, with guest editors Robert Thresher and Kathleen O'Dell, National Wind Technology Center, National Renewable Energy Laboratory, Golden, CO

For centuries, man has harnessed the power of the wind and put it to work. Throughout Europe, Asia, and the Americas, farmers used wind power to pump water and mill grains as far back as 300 B.C. The first turbines were developed in Denmark in the 1890s, and by 1900, small wind systems were generating direct current power for many rural homes and farms in the United States. With the advent of rural electric co-ops in the 1930s, small wind turbines were no longer used to generate electricity; however, faced with the ever-increasing cost of electric power, today we are again turning to the power of the wind to generate electricity for our homes and businesses.

Most states have enough wind to power wind turbines, and 37 states have wind resources that would support utility-scale wind power plants. The wind resource in the Great Plains, if properly developed, could supply a significant portion of this country's electricity needs. With today's wind turbine technology, the United States could supply 20% of its electricity needs from wind alone, and with cost-effective storage, wind could supply a much higher percentage.

Modern Wind Turbines

Today's wind turbines come in a variety of sizes and power ratings. Small turbines rated at 100 kilowatts (kW) and less can be used in applications such as supplementing power supplies for single-family homes and small businesses, water pumping, or communications. Large, utility-scale turbines rated as high as 2 megawatts (MW) are commonly grouped to form "wind farms" or wind power plants that are connected to the utility grid to provide power for hundreds of homes. A single 750-kW turbine can provide enough electricity to power approximately 250 average homes.

Like the windmills of old, modern wind turbines are mounted on tall towers to take advantage of the best wind resources. Utility-scale turbines are mounted on towers up to 200 feet high. Most of the turbines used today look much like a child's whirligig with two or more (commonly three) large propeller-like blades mounted on a shaft to form a rotor. The blades act much like airplane wings. When the wind blows, a pocket of low-pressure air forms on the downwind side of the blade pulling the blade toward it, causing lift. This lift force causes the rotor to spin, which turns the shaft that spins a generator to produce electricity.

In addition, wind turbines contain a speed control system or brake. Although wind is a natural part of our environment, too much of a good thing (high gusting or turbulent winds) can cause runaway generators that can overload and overheat if they are not controlled or braked. The margin of error between a full-loaded machine and one that is dangerously overloaded can be as little as 10%. Even though controls cause a loss of overall efficiency, they are necessary for safe operation of the units.

The obvious advantages of wind energy are that the fuel is free, renewable, and clean. Unlike conventional power plants, wind plants emit no pollutants or greenhouse gases. According to a study conducted by the University of California at Irvine, every 500 MW of wind generating capacity can reduce emissions of carbon dioxide, the leading greenhouse gas, by more than half a million tons annually, sulfur dioxide by 637 tons, nitrogen oxides by 1,496 tons, and particulate matter by 17 tons.

Barriers to Wind Power

Although wind energy was the fastest growing energy technology during the 1990s, before it can be developed to its full potential, researchers must find ways to overcome some barriers. One of those barriers is the cost of wind energy production. In 1980, wind energy cost as much as 30 cents per kilowatt-hour (kWh) to produce. Joint research by DOE and members of industry has helped decrease that cost by more than 80% to 4 cents per kWh. To compete with conventional fuels, the cost must be lowered further. Industry members expect to reduce the cost of production an additional 30% with continued research and the introduction of more advanced, efficient turbine designs.

Another barrier to wind energy development is that wind is a fluctuating resource. When the wind blows, it produces electricity. When the wind stops, that production stops. This creates an intermittent energy supply that may be difficult to integrate into the utility grids. In addition, good wind resources are often located in remote locations far from major population centers and transmission lines. By studying the nation's wind resources, its characterization, wind forecasting, the nature of current wind farms, and their impacts on the utility grids, researchers are identifying the best areas for development and demonstrating how wind energy can be integrated into the generation mix.

Several environmental groups have voiced concerns about the impacts wind turbines may have on avian populations, especially the raptor populations. In response to their concerns, DOE has worked with industry members to conduct studies on how birds interact with wind turbines. Their studies show that with proper wind farm siting, impacts on avian populations can be greatly reduced.

Despite the barriers facing the wind energy industry today, wind energy's potential to meet this nation's growing electricity needs remains immense. With continued research and development, barriers to wind energy development will be removed, allowing the technology to become a major player in the energy industry so that it can help stabilize energy supplies and pave the way to a cleaner energy future.

To learn more about wind technology research, its potential, and current applications, please visit the National Wind Technology Center Web site at **www.nrel.gov/wind**, or DOE's Wind Energy Program Web site at **www.eren.doe.gov/wind**.

Performance Optimization Tips

Measuring the Heart Rate of Motor Systems: Electric Current

By Don Casada, Diagnostic Solutions LLC, Knoxville, TN

Don continues his series on field measurements. To read previous columns, go to Energy Matters Extra at ***www.oit.doe.gov/bestpractices/energymatters/emextra*** *and select "Casada's Corner."*

The measurement of electric motor current is used in a variety of ways in industrial settings. Protective devices, such as fuses and thermal overload relays, work because of the heating effect of current, but current measurements usually rely on the magnetic field generated by the current passing through a conductor. Current transformers (CT)[1] are used to estimate this current. However, other devices, such as Hall-effect probes are also used.

Operations and maintenance personnel use current as an indicator of properly operating equipment, and use procedures or log sheets to specify "normal" current ranges. A newer use of current is to diagnose equipment health. Commercially available systems alert users to abnormal conditions, such as very lightly loaded motors (which might mean, for example, that a pump is running dry). More sophisticated techniques use information available in the motor current frequency spectrum to help evaluate the health of the motor and the device it drives.

For those of us doing energy work, current measurements often help estimate the motor load. While we're fundamentally interested in measuring input power, which requires current measurement, current alone can provide us with a means of *estimating* power, even when we don't have or can't use a portable power meter. For example, OIT's Pumping System Analysis Tool (PSAT)[2] uses average motor performance characteristics from the MotorMaster+ motor manufacturers database to estimate electric input power from current measurements[3].

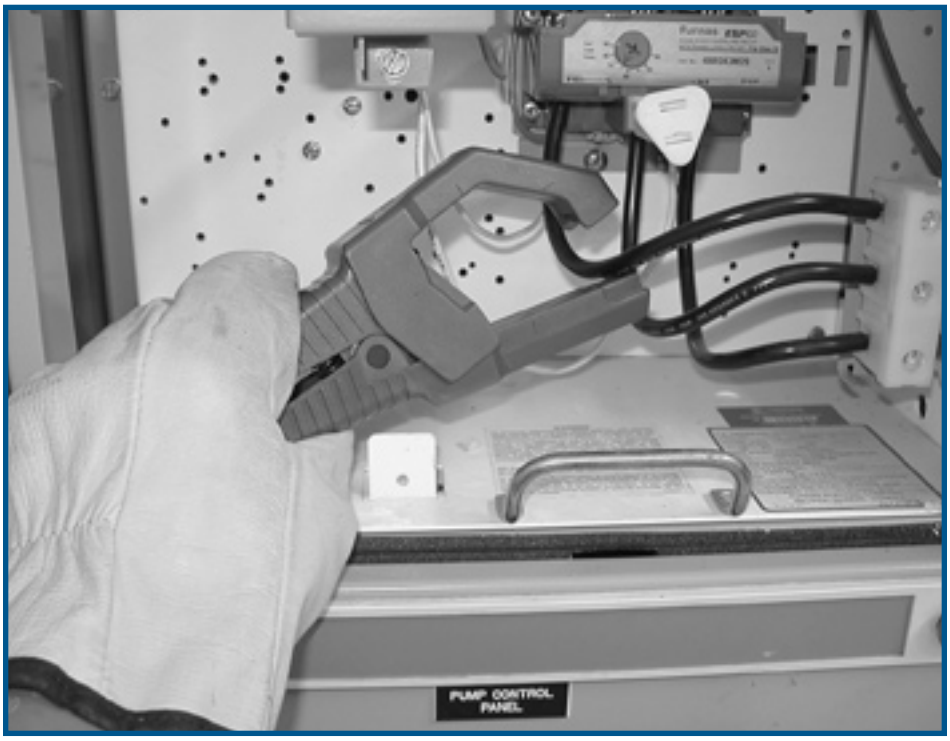

Figure 1: Installing a clamp-on current transducer.

Protective and operations support functions depend on permanently installed CTs. For energy measurements, we often resort to using temporary, clamp-on CTs, such as those shown in Figure 1. If a motor has permanently installed CTs (and you trust the indicator), those can be used.

Practical Considerations for Clamp-on CTs

It should go without saying that use of accurate test equipment is of fundamental importance. But, there are several important considerations that are specific to the field use of temporary, clamp-on CTs.

1. Make sure the jaws close properly. This is essential to completing the magnetic circuit of the CT. If there are tight clearances where the CT is used, the jaws can bind partially open, even when hand tension is released. The indicated current may be considerably in error. Figure 2 illustrates the effect when a fixed load current of approximately 100 amps was monitored with a) the jaws of the CT fully closed and b) a gap of 0.04 inches (less than the thickness of a dime) separating the jaw faces.

To ensure the jaws are fully closed, wigggle the probe a bit, making sure it moves freely and is not bound by adjacent wires or other obstructions. At higher current levels, a magnetic "buzz" created by a slight jaw separation can be heard and felt (through gloves, of course).

2. When possible, measure and average all three phases. This precaution applies to both permanent and temporary CTs. A small unbalance in the supply voltage can result in a large current unbalance among

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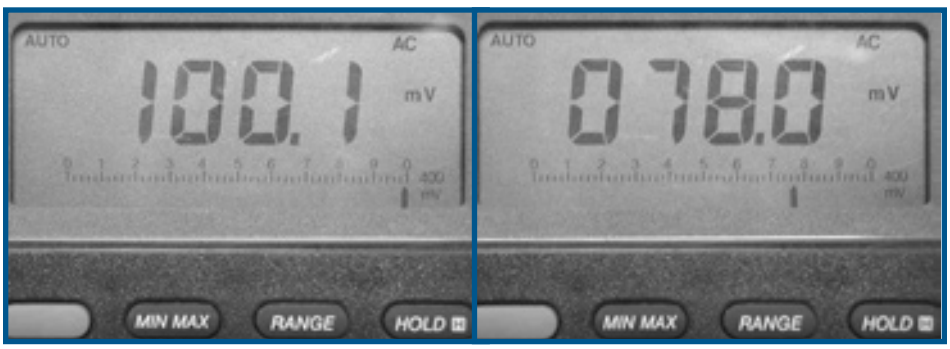

Figure 2: Current indicated by current transducer with fully closed jaws (left) and 40-mil gap (right) with constant load (1 millivolt/amp scaling).

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the three phases. As a rule, a 1% unbalance in voltage will result in roughly a 7% unbalance in current. Even in the presence of a balanced power supply, there may be current unbalance on the order of 5%.

3. Use properly sized CTs. Like most other measurement devices, CTs lose accuracy when operated at a fraction of their rated range. For example, using a 2,000-amp CT with 0.5% of full span accuracy (which is excellent) to measure a 20-amp current may result in a 50% measurement error.

4. Average current on fluctuating loads. Many motor loads are fluctuating in nature. The current for belt-driven equipment, for example, tends to fluctuate at belt- and sheave-pass frequencies. Some current monitoring devices grab a very short sample (a few cycles, or milliseconds) of data and display a fixed result. Other devices continuously update the data, but the fluctuations make it difficult to pin down.

A more representative measurement can be obtained on a multimeter with a min/max averaging feature. The multimeter shown in Figure 2 has this feature (note the MIN MAX button near the bottom of the picture). This feature is also helpful in averaging other system parameters that tend to fluctuate, such as pressure. If no such function is available, several samples can be statistically averaged. A computer-based data acquisition system or data logger simplifies the collection and analysis of many (and/or longer duration) samples.

5. Make sure the current measured is really the *motor* current. Power factor-correcting capacitor banks are often used with induction motors. When capacitors are used, particular care must be exercised in selecting the measurement location. The current from the line to the combination of the motor and the capacitor bank will be less than the motor current. This seemingly contradictory behavior is real, and it occurs because the current to the capacitor bank will lead the voltage by 90°, while the current to the motor will lag voltage by a variable amount, depending on load.

If the current will be used to estimate motor load, such as when it is an input to PSAT, the current going to the motor should be measured, not the incoming current from the line. Figure 3 illustrates the error that can occur when this is not

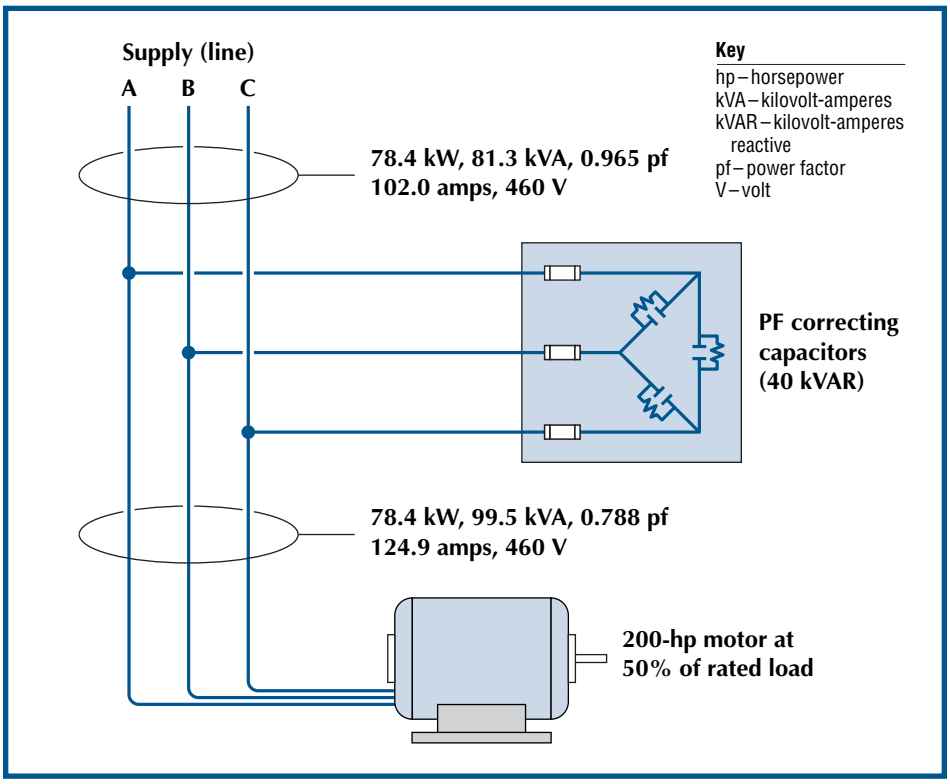

Figure 3. Motor measurements upstream and downstream of a paralleled capacitor bank.

done. The current to the motor is 22% greater than the incoming line's current to the motor and paralleled capacitor bank.

6. Take safety precautions. This is absolutely the most important consideration[4]. A 50% error in the current measurement because of failure to follow previously mentioned precautions or other mistakes could result in a poor diagnosis of equipment health or a loss in company profits. But, failure to exercise proper safety precautions during testing (such as wearing insulated gloves) could result in a poor diagnosis for *your* health or the company's loss being *you.* Be careful out there! ●

E-mail Don Casada at doncasada@icx.net.

[1] CT usually refers to current transformer. However, this discussion equally pertains to Hall-effect probes; for purposes of this article, CT stands for the broader term, current transducer.

[2] PSAT and MotorMaster+ are available free from the BestPractices Web site at **www.oit.doe.gov/bestpractices/software_tools.shtml**.

[3] Author's note: In my experience, the PSAT estimate of electric power (made from measured current and voltage) usually agrees with the measured power within a few percent.

[4] From strictly a safety perspective, I definitely prefer an instrument whose indication is NOT built into the CT. That way, I don't have to stick my nose into the electrical cabinet to get my reading.

*Here are some previous articles by Don Casada on field measurements. Log on to Energy Matters Extra at **www.oit.doe.gov/bestpractices/energymatters/emextra** to review these and other columns in "Casada's Corner."*

2000

Field Measurements in Pumping Systems, May/June—*Two methods of estimating flow rate in systems with no installed flow meters.*

Field Measurements in Pumping Systems, March/April—*Understand pumping system operations by maintaining a system perspective.*

1999

Field Measurements in Pumping Systems, September/October—*Velocity is the third element of pump head.*

Field Measurements in Pumping Systems, July/August—*Elevation is the second element of pump head.*

Field Measurements-Practicalities and Pitfalls in a Parabolic Context, May/June—*Continues the discussion on the changing picture of system operations.*

Understanding the Changing Needs of Your Systems, March/April—*Understanding the changing picture of system operations.*

1998

How to Cope with Potential Field Measurement Pitfalls, November/December—*Useful assessments of motor system efficiency and reliability depend on getting the right measurements in the right way.*

OIT Developing Portfolio of Plant-Wide Assessments

DOE is aiming to increase the use of efficient energy systems across U.S. industry. To that end, DOE is developing a portfolio of assessment methods that industry can use to identify energy- and cost-saving opportunities. One of OIT's roles in this effort is working in partnership with Industries of the Future (IOF) to perform plant-wide assessments. These assessments indicate areas in which plants can significantly reduce energy use, increase productivity and global competitiveness, and reduce waste by implementing appropriate technology. Through solicitations over the past 3 years, OIT has provided cost-shared funding and offered technical assistance to facilities to conduct such plant-wide assessments.

Specifically, these solicitations seek proposals in which teams consider adopting best available and emerging technologies using a variety of tools, information, process engineering techniques, and BestPractices plant support and process systems. In addition, projects that can be replicated by other plants are highly desirable. Only industrial sites that fall within the IOF strategy areas are considered for awards. These include agriculture, aluminum, chemicals, forest products, glass, metal casting, mining, petroleum refining, and steel. The purpose is to demonstrate projects or technologies that can be replicated by other industries, particularly in the IOF sector.

OIT launched the plant-wide assessment effort in 1999 to encourage industrial facilities to identify potential energy savings, process improvements, and opportunities for new technologies throughout the plant. With cost-shared funding and technical assistance from OIT, such assessments could facilitate improvements for industrial plants. So far, OIT has made awards to at least 23 plant-wide assessment projects.

You, too, are part of the vast potential for replicating energy savings, cost reductions, and productivity improvements. Get involved and help your company reap the benefits. Find out how you can take part in a plant-wide assessment at the BestPractices Web site, **www.oit.doe.gov/bestpractices/**. For case studies on how plant-wide assessments have helped U.S. companies improve efficiency and productivity and reach environmental goals, visit **www.oit.doe.gov/bestpractices/case_studies.shtml#assessment**, or view the *Plant Profiles: Industrial Energy Management in Action* brochure at **www.oit.doe.gov/bestpractices/pdfs/plantprofiles.pdf**. ●

AMCAST Industrial Corporation in Wapakoneta, Ohio, performed a plant-wide assessment that resulted in recommendations for 12 separate projects, including improvements to the process heating and compressed air systems. By investing an initial capital requirement of $1 million, AMCAST is expected to realize annual energy savings of at least $3.7 million. In addition, implementing these projects has the potential to reduce the plant's carbon dioxide emissions by more than 11 million pounds per year. The assessment approach could be applied at other aluminum casting facilities, and many areas of study could be included in the analysis of almost any industrial process facility.

Assessment of Compressed Air Market Now Available

Fully 70% of all manufacturing facilities in the United States use compressed air in their production processes. In fact, compressed air systems account for 10% of all electricity use and roughly 16% of the U.S. manufacturing industry's motor system use. However, more than 50% of industrial plant air systems could be optimized for large energy savings—with relatively small project costs.

OIT has recently released the *Assessment of the Market for Compressed Air Efficiency Services,* a comprehensive report of the compressed air market for services that lead to compressed air system energy efficiency. The assessment discusses key findings about supply and demand side views of compressed air system efficiency. This report is now available online in a PDF format at **www.oit.doe.gov/bestpractices/technical_publications.shtml#market.** Order the report in print from the OIT Clearinghouse by logging on to **www.oit.doe.gov/clearinghouse**, or by calling 800-862-2086. ●

Black Liquor Gasification

continued from page 6

During Phase I, G-P and OIT conducted an engineering study to define the scope of a full-scale demonstration of the technology. Process study areas include the reformer pressure vessel design and refractory system, the product gas clean-up, the pulse heater pressure design, the system start-up methodology, the liquor storage capacity, and the flare system. In addition, the Big Island mill signed an agreement with EPA to install and demonstrate the system under flexible regulatory terms. Phase I is nearing completion, and Phase II, which emcompasses gasifier construction and demonstration, will begin shortly. Site preparation work and demolition of existing structures is already underway.

For more information on the G-P black liquor gasification project, visit the OIT Forest Products Web site at **www.oit.doe.gov/forest/pdfs/factsheets/bigisland_va.pdf**, or contact Bob Gemmer, DOE program manager, at bob.gemmer@ee.doe.gov or Dan Cicero, DOE project manager, National Energy Technology Laboratory, at dcicer@ netl.doe.gov. Also contact Robert DeCarrera, Georgia-Pacific Corporation, at rdecarre@gapac.com. ●

Energy Solutions for California

In partnership with the California Energy Commission, OIT's Best Practices is hosting a series of one-day events to assist California industries in improving system efficiency and reducing electrical demand. The first of these events took place on August 14 in Sacramento, California. Keynote speaker for the event was California State Senator Michael Machado (D-Linden). Co-sponsoring organizations included the Association of California Water Agencies, California Farm Bureau Federation, California League of Food Processors, and the California Manufacturers and Technology Association.

More than 200 people participated in the event that included exhibitors from the BestPractices Allied Partner program and speakers offering practical advice and solutions for managing electrical demand and improving system efficiency. Case studies of California industries were also used to illustrate how electricity use can be reduced by using a systems approach. Participants commented that the event was "well worth the time" and that they were "looking forward to more."

The next event will be held on January, 16, 2002, at the San Jose McEnery Convention Center in San Jose, California. For information about the January event and a complete list of participants and case studies from the August event, go to the BestPractices Web site at **www.oit.gov/bestpractices**, or call 703-748-8608. ●

Participants in the Energy Solutions for California event met with exhibitors and attended presentations to learn practical ways to save energy and improve system efficiency in their plants.

Energy Matters Extra

Check out Energy Matters Extra for additional information on alternative power sources for industry. You'll also find more about OIT and BestPractices assistance.

Get more facts about on-site power generation by linking to the report *Assessment of On-Site Power Opportunities in the Industrial Sector*. Visit the Distributed Energy Resources Web site and find out why distributed generation may be part of your company's future. Learn more about the Green Power Marketing Development Group by linking to its Web site.

See how wind turbine manufacturing is becoming an emerging market for IOFs. In addition, access new BestPractices fact sheets that document recent energy-efficiency projects implemented by participants in the Utah Showcase.

Log on to Energy Matters Extra at **www.oit.doe.gov/bestpractices/energymatters/emextra/**. ●

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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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. ●

Editor's Notes

Megawatt Mix-up

We heard from a few readers about our use of the term "MW per hour" in the article "California Cement Plant Battles Electricity Interruptions with Its Own Cogeneration Plant," which appeared in the May/June 2001 issue of *Energy Matters.* We should have used "MW" throughout the article when referring to electrical load. Our sincere apologies to California Portland Cement Company for the error. Please take a look at a revised version of the article on Energy Matters Extra at **www.oit.doe.gov/bestpractices/energymatters/emextra**.

Thanks to the readers who let us know about the misprint.

A New Schedule for *Energy Matters*

Beginning with this issue, *Energy Matters* will be a quarterly instead of a bimonthly publication. However, each issue will be expanded to 12 pages instead of 8 pages. This new format gives us an opportunity to offer more in-depth coverage of technical topics while "living within our means." We hope you will continue to find the coverage in *Energy Matters* useful and informative, and, as always, we welcome your feedback. ●

Coming Events

Capturing the Value of Steam Efficiency Workshop

- November 27, 2001, Orlando, FL

For more information, contact Rachel Madan at the Alliance to Save Energy 202-530-4349.

Business Energy Solutions Conference & Expo

- November 28-29, 2001, Orlando FL

For more information, contact Ruth Whitlock at the Association for Energy Engineers at 770-447-5083.

Energy Solutions for California

- January 16, 2002, San Jose, CA

For more for information about this event, log on to **www.oit.doe.gov/bestpractices**, or call 703-748-8608. Also see page 11 of this issue for more about this series of workshops.

OIT Customer Appreciation Day 2002

- May 8-9, 2002, Washington, DC

For more information, log on to **www.oit.doe.gov** or call the OIT Clearinghouse at 800-862-2086. Watch for more details in future issue of *Energy Matters.*

Coming Next Issue:

The next issue of Energy Matters *will focus on smart systems with a look at the latest technologies for improving industrial energy efficiency.*

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/energymatters/emextra.***

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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/news/oittimes.shtml**.

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.

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