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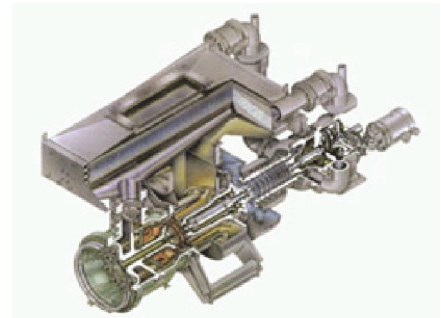
IRP helps Arkansas River Power Authority plan for future generation

Every five years, Western customers must look into a crystal ball to predict their future electric requirements and the energy resources available to meet them, an exercise welcomed by Arkansas River Power Authority in southeast Colorado.

That crystal ball is integrated resource planning, mandated by the Energy Policy Act of 1992 and Western's Energy Planning and Management Program. The plan requires utilities to forecast their loads and evaluate a wide range of resource alternatives and energy efficiency options to ensure reliable, affordable electric service. With that information, utilities develop an action plan, solicit public comment on it and submit the IRP to Western along with strategies to measure its effectiveness.

It is a work-intensive process, but the benefits are well worth the effort, said ARPA General Manager Jim Henderson. "People sometimes forget to look at all the options," he noted, "but the IRP makes us focus on all the possibilities."

ARPA provides wholesale electricity to seven municipalities: Holly, La Junta, Lamar, Las Animas, Springfield and Trinidad, Colo., and Raton, N.M. Nearly half—48.4 percent—of that power is generated with coal,



The 4-MW Mercury 50 combustion turbine, the most efficient gas turbine of its size in the world, is not yet available commercially. ARPA member Lamar, Colo., installed a second-generation demonstration model at its powerplant to help offset the rising cost of natural gas. (Artwork courtesy of Arkansas River Power Authority)

while Federal hydropower from Western accounts for 26.2 percent and natural gas for 25.3 percent. Integrated resource planning has helped the joint action agency improve the efficiency of its conventional facilities and add more renewable energy to its mix.

Ongoing challenges

Aging generation facilities, the West's worst drought in 350 years and skyrocketing natural gas prices have all affected ARPA's power supply in the years between its first IRP in 1996 and the most recent plan. The first concern is long-standing and will continue to challenge the seven

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Power Authority

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rural communities into the next five years. "The first IRP identified plants and equipment that needed to be retired," recalled Henderson. "Upgrading takes time, so some of those facilities are still on-line and they are five years older."

Based on recommendations in the 1996 plan, the town of Trinidad retired its aging coal-fired, baseload plant in 1998. Supplemental power purchases and three 1,880-kW diesel back-up engines replaced the unit.

One thing the IRP couldn't predict was the spike in natural gas prices, Henderson noted. "In 1996, we were looking at five years of adequate energy supplies at affordable prices. In 2003, natural gas prices have doubled and will probably stay high for the next five to seven years," he said.

To offset the cost of natural gas, ARPA is improving the efficiency of existing facilities. In Raton, N.M., it broke ground in December 2002 on a 7.5-MW, gas-fired internal com-

bustion engine project. The efficient, low-emission unit will provide back-up power for Raton's coal-fired, baseload unit and replace the current backup unit, an outdated 3.75-MW coal-fired unit.

At the Lamar, Colo., powerplant, ARPA arranged for the installation of a highly efficient, 4-MW Mercury 50 combustion turbine, the most efficient gas turbine of its size in the world.

ARPA issued a request for proposals last spring to supply a portion of its energy requirements when its contract with Tri-State Generation and Transmission Association expires in 2004. The IRP recommends that new contracts provide flexibility to acquire power through sources as ARPA-owned generation projects, partially owned large generating facilities and renewable energy opportunities.

Energy portfolio diversity

The 2003 IRP contains plans for adding more renewable energy to ARPA's portfolio. Some of the agency's members are experimenting with photovoltaic applications, such as powering streetlights and traffic signs. Raton is negotiating a land lease agreement for a potential 25 to 35 MW, independently developed biomass plant. ARPA invited biomass developers to respond to the supplemental power RFP it issued in the spring.

Feasibility studies give good reason for enthusiasm. "This is an incredibly rich area for wind," Henderson asserted. "One site near Springfield, Colo., rates its net capacity factor at 39 percent, with

more than 90 percent of the hours in a year producing energy," the general manager added.

ARPA expects to begin constructing a 1.5-MW turbine on the site in January. The unit could supply 41.2 percent of the town's energy needs. Lamar, Colo., is planning its own three-turbine project, in addition to another same-sized unit ARPA will build near the town.

Conservation important

It might be expected that a resource management plan for a wholesale power supplier focused on developing renewable resources, identifying supplemental power suppliers and upgrading or building conventional generation, but ARPA's IRP did not neglect demand-side management. Members are already involved in several on-going DSM programs including energy audits for commercial/industrial customers and rebates on compact fluorescent bulbs for residential customers.

Based on a 2001 consumer survey, ARPA is focusing on a conservation information campaign for residential customers. The 2003 IRP recommended a similar survey of commercial/industrial customers to determine what energy efficiency measures they would be most likely to adopt. "Utilities have to encourage conservation of all resources," Henderson stated. The benefits of conservation, a diversified energy mix and efficient facilities and equipment only come to those who look into the future and have a plan, he concluded. "ARPA is a better utility because of the IRP process," Henderson declared. ⚡

Energy Services Bulletin

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Rosebud turbine leads development of Native wind resources

The May 1 dedication of the nation's first tribal-owned and -operated, utility-scale wind turbine gave new meaning to the name of the Rosebud Sioux—the Voice of the Four Winds People. It also launched the first stage of large-scale development of Native American-owned renewable energy across the Great Plains.

The Rosebud tribe and the utility commission began measuring wind resources near the tribe's Rosebud Casino in 1995. The installation of the 750-kW NEG MICON unit marked the beginning of what the Intertribal Council on Utility Policy hopes will be a broad, multiphase deployment of wind turbines on tribal lands throughout the Dakotas.

"It's a triumph for the Rosebud Sioux Tribe, for the Northern Plains Tribes and all Native Americans, and for everyone concerned about our energy and environmental future," said ICOUP President Pat Spears.

Project road map

A grant from the Department of Energy and a low-interest loan from the U.S. Rural Utility Service helped fund the project. The funding broke new ground in several respects. The \$566,000 cooperative agreement was DOE's first with a tribe for a commercial wind turbine, and its largest tribal renewable energy grant ever. It was also the Rural Utility Service's first loan to an American Indian tribe for a utility-scale wind turbine to be interconnected to the transmission grid.

The turbine is expected to supply up to 80 percent of the Rosebud

Casino and Motel complex's energy needs. It will also generate income from the sale of power and green tags. The unit is interconnected through the complex to Basin Electric Power Cooperative.

Beyond those returns, the project gave the tribe, TUC and ICOUP their first taste of negotiating interconnection agreements, power purchase contracts and selling "green tag" benefits to off-reservation markets. "The lessons we learned developing and operating the single turbine will provide a trail for our future renewable energy projects and for other tribes in the region looking to enter the green power market," said Spears.

The tribe has started a study, including environmental assessments, to look into building a 50- to 100-MW wind farm on the reservation. "Developing the reservation's renewable energy resources will help us achieve energy self-sufficiency in a way that is compatible with Native American history, philosophy and cultural and spiritual values," Spears stated.

Green tag sales

Basin Electric will purchase the electricity the casino-hotel complex does not consume. The renewable energy will be delivered through a cooperative effort with Nebraska Public Power, Basin Electric and Western.

Ellsworth Air Force Base, near Rapid City, S.D., reached an agreement to buy the first five years worth of the turbine's green tag generation directly from the tribe.

NativeEnergy, a national marketer



The 750-kW turbine on the Rosebud Sioux reservation is the first commercial wind turbine installed, owned and operated by an American Indian tribe. The turbine is connected to the grid at the Rosebud Casino and Hotel complex. (Photo courtesy of Intertribal Council on Utility Policy)

of renewable energy certificates, acquired the environmental attributes of the next six through 20 years for an upfront cash contribution to the tribe that completed the funding needed for turbine construction. The Shelburne, Vt.-based company uses green tags to provide Carbon dioxide offset services to its business partners, including Ben & Jerry's Homemade Ice Cream, The Timberland Company, Stonyfield Farm, the Dave Matthews Band and individual members across the country.

"NativeEnergy's purchase commitment represented about 25 percent of the cost of the Rosebud wind turbine," Spears asserted. "Ultimately, the payment was critical in covering costs for this turbine and funding the work we've begun to expand

See TURBINE, page 6

Pilot project could yield fountain of water, energy savings

An alliance of growers, government agencies and energy suppliers planted an experimental crop in eastern Colorado this spring that could result in a big harvest for the region's agriculture, conservation and electricity industries over the next three years.

The seeds in this case are not some miracle grain but high-efficiency irrigation equipment and the latest water conservation strategies. The anticipated bounty is information on water and energy use that could make farms more efficient while helping to preserve the Ogallala Aquifer.

Total system approach

The Ogallala is the water source for approximately 2,400 irrigation wells in Yuma and Washington counties. Since 1986, the Colorado Department of Agriculture Conservation Board has worked with the soil conservation districts in the two counties, Western, the USDA Natural Resources Conservation Service, and other partners to protect this valuable resource.

Now, a joint project partially funded by the Colorado Office of Energy Management and Conservation is giving the conservation board the opportunity to evaluate its irrigation water management program "from planting to harvest," as board Irrigation Specialist Dave Keeler put it.

The demonstration updated 10 irrigation systems that draw on the Ogallala Aquifer with the latest in efficient watering technology. Y-W Well Testing Association will collect the resulting water management data for the next three years and measure it against baseline data it has on file.

Useful findings

There was no lack of partners interested in getting that information, the conservation board learned. After receiving the \$40,000 OEMC grant in April 2003, the board quickly found three growers who were willing and able to match the funding to upgrade their irrigation systems. Other criteria included a record of conservation efforts and a current system evaluation on file with the well-testing association.

Participants agreed to allow researchers access to their production and expense records, before the upgrades for baseline information and after the improvements, for the duration of the study. The Colorado Corn Growers Association provided the demonstration farms with computer hardware and software to track the data.

Tri-State Generation and Transmission Association paid participants an \$18-per-horsepower incentive for replacing old electric pump motors with efficient new ones. The producers' electrical co-ops, Y-W Electric Association, Inc. of Akron, Colo., and Highline Electric Association of Holyoke, offered another \$2-per-horsepower rebate to their customers. Y-W Electric contributed additional funding to the project.


"Irrigators are some of our customers' biggest end users," noted Energy Services Manager Peggy Plate of Western's Loveland, Colo., office. "New irrigation technology has the potential to help co-ops with load management while making their customers' operations more cost-efficient."

Western has supported the well testing association since its inception and provides education and technical assistance to the program. "If the project can demonstrate the benefits of the system approach, it may bring bankers to the table to fund improvements," she added. "Information lessens the risk for everyone in the farming industry."

"If we can show that the improvements return the investment in water and electricity savings over the three-year period, we can attract more funding partners," said Conservation Director Bob Zebroski of the state agriculture department. "Ideally, we would like to see 50 to 75 outdated systems replaced in the next year."

Big picture

Participants received help with management strategies, such as irrigation scheduling and using the appropriate amount of water for the type of crop. The test also monitored soil moisture retention with gypsum blocks buried at intervals in a single hole, 54 inches deep in cornfields and 5 feet deep in alfalfa. Association irrigation technicians Keeler, Devin Ridenour and Duaine Doddsworth check the blocks weekly to see if the crops are getting the optimum amount of water. "It's like a gas gauge that lets you know how much is in the tank," said Keeler.

Researchers recorded water and electricity use throughout the 2003 growing season and will compare that data with the well testing association's baseline figures and with data collected from the next two seasons 

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Visit www.es.wapa.gov/pubs/ESB/Current/esb103.htm

California universities share PV system lessons learned

Even the best and brightest can expect to learn a thing or two when adopting new technology, as Loyola Marymount University in Los Angeles, Calif., and California State University, Hayward, discovered while installing large photovoltaic systems on the campuses.

“Historically massive” might be a more accurate description of the two milestone projects and would serve to put the lessons into perspective. LMU expected to complete its 723-kW peak solar system in April, while CSUH hoped to flip the switch on a 1.05-MW, 110,000 sq. ft. installation in July. Both projects are moving steadily toward completion, but both universities had to adjust their timelines.

Delays are not uncommon when working on projects with public institutions, according to Marketing Vice President Estreilla Zulch of PowerLight Corporation, the solar technology company installing both systems. “Basically, these are big capital projects, and they can involve extensive permitting and applications,” she said.

Knowledgeable vendor

Paperwork notwithstanding, LMU Energy-Utilities Engineer Gerald Robinson enthusiastically embraces the technology. “It’s great to have it up and running without intervention,” he said. “It is very easy ownership.”

Much of the credit, Robinson noted, belonged to PowerLight, too. He praised the company’s professionalism, pointing out, “It’s really important to go with an outfit with a proven track record. If the panels aren’t installed properly, you won’t



The solar array on top of LMU’s University Hall was the first of three rooftop systems PowerLight Corporation installed for the university. It generates between 230 and 240 kW. (Photo courtesy of PowerLight Corporation)

get a good performance.”

The modules atop University Hall were the first to begin operation in April. Typical output ranges between 230 and 240 kW at peak, although the system has generated as much as 280 kW. As soon as a meter is installed, the solar array on Von der Ahe Library will go online, to be followed by a third and final installation on Gersten Pavilion. The completed system will cover 81,000 square feet of rooftop and generate approximately 660 kWh, slightly less than the 723 kWh of the original plan.

The university chose poly- and single-crystalline panels for their long-term stability. “We learned that thin-film panels are good for applications like fragile rooftops or vaulted roofs with lots of curves, but in most situations poly- and single-crystalline units pack the most kilowatts into minimal square footage,” said Robinson.

Supportive utility

LMU collaborated on the solar project with the Los Angeles Department of Water and Power and the Southern California Gas Company. The installation’s estimated total expense of more than \$4.3 million was offset by rebates of \$3.7 mil-

lion from LADWP and \$325,000 from the gas company. As a result, the university’s actual cost was only \$325,000. SCGC’s incentive was part of a statewide program implemented by the California Public Utilities Commission.

Before LMU could complete the installation on Gersten Pavilion, however, LADWP’s rebate program changed, causing a construction delay. Gersten is back on track and slated for completion this fall.

Robinson’s advice to anyone considering a large solar installation is to move forward quickly. “Funding programs change frequently, so when the money is there, take it,” he urged. “It never pays to wait.”

Rebate, energy savings

California State University at Hayward would probably second that recommendation, since a \$3.55 million rebate from CPUC is helping the university to install one of the nation’s largest single-source solar electrical systems.

The university’s share of the PV system’s cost will be approximately \$3.55 million, financed over 15 years through utility savings from the project, according to Richard Metz, vice president of administra-

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Lessons *from page 5*

tion and business affairs. “The system will give the university a hedge against fluctuating energy costs and related supplies, lower annual maintenance costs and increase the life of the buildings,” Metz explained.

Metz’s support for renewable energy was crucial in getting the project approved, said Energy Management Director Terry Beebe. “He really stepped up to the plate. Financials are pretty tight right now, but he was committed to the long-term benefits,” Beebe stated. “Solar power will lock us into a fixed cost for electricity over the next 25 years.”

Policy, training issues

The initial plan was for a 1.05-MW, combination roof- and ground-mounted system to supply 30 percent of the campus’s peak electricity demand during the summer. Such an ambitious project was bound to undergo some fine-tuning. To comply with the CSUH procurement code, the university broke construction into phases and will bid the ground system separately later. Selecting a fourth building site brought the system’s total generation back to the original 1-MW level. “And that rooftop needed to be reinforced and the solar array sized down,” Beebe said.

Interfacing a solar system of that size with the existing electrical system was also a learning experience. “The facilities staff were going to pull together the plans and specifications for permitting, so they had to be educated about PV,” Beebe said.

Those plans are now awaiting review by the state fire marshal, and once again, the permitting process slowed progress. “It’s not a complicated application, but the fire marshal’s office is very backed up

right now, and we have to wait our turn,” said Metz. “A sister campus has an application farther along in the queue, and I asked if it might want to trade places. The answer was no, of course.”

Integrating systems

In spite of a few administrative delays, Beebe anticipates that the bulk of the solar system will be installed by Dec. 1. His only regret is that the project came together too quickly to integrate other energy-efficiency measures. “We are looking at incorporating a small thermal storage system and electric motors. The big savings come from a multifaceted renewable energy and

efficiency plan, like the Alameda County correctional facility has,” he said. “The Santa Rita Jail PV project was the model for CSUH.”

When the Hayward campus solar project is completed, California State University’s 23 campuses will have a new role model for renewable energy use. University President Norma Rees admitted as much in an announcement to the press last May. “We hope to set an example for the entire CSU system, as well as universities across the country,” she stated.

And like any good institution of higher learning, CSUH will undoubtedly be happy to share what it learns with others. ⚡

Want to know more?

Visit www.es.wapa.gov/pubs/ESB/Current/esb104.htm

Turbine *from page 3*

wind development on the Rosebud Reservation.”

Green tag sales will be critical for expanding Native American wind development on the Northern Plains. Even with customers like Ellsworth Air Force Base, there isn’t a big enough market for premium-cost green power within reasonable transmission distance of the Northern Plains wind resource. Using green tags, the tribes sell the power locally at market rates and recover the pollution-avoidance value by selling the environmental benefits to renewable energy supporters anywhere in the country.

O&M training

Cash is not the only commodity needed for expansion, however. Operating an industrial wind farm

requires trained personnel, an issue addressed with a novel arrangement in the tribe’s purchase contract with NEG MICON. The tribe bought a 5-year extended warranty for parts, labor and operations and maintenance. During the initial two-year period, NEG MICON will conduct O&M training sessions for tribal members. DOE, in cooperation with Sinte Gleska University, is providing additional technical assistance from the DOE national laboratories to teach tribal members how to maintain system sustainability.

“The vision of the Intertribal COUP is that we can use modern technology to protect the earth and to provide economic restoration for indigenous people,” declared Spears. “The Rosebud turbine is a big step toward making that vision a reality.” ⚡

Want to know more?

Visit www.es.wapa.gov/pubs/ESB/Current/esb102.htm

Proposed hydro project keeps SMUD's options opened

When Sacramento Municipal Utility District applies to renew the hydroelectric operating license for its Upper American River Project, the application will include the Iowa Hill pumped-storage facility, even though it does not exist—yet.

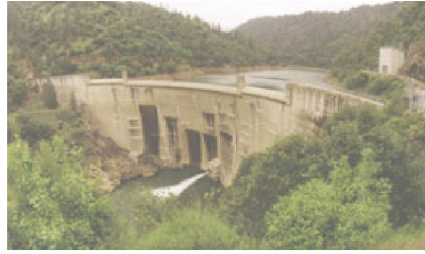
The board of directors has not approved construction of the proposed project, either, and if they do, it wouldn't come on line before 2013. But by performing necessary studies for Iowa Hill during the Federal Energy Regulatory Commission review process, SMUD will save several million dollars in process costs. "Incorporating the proposed facility into the UARP application will add about \$1 million to the 2003 relicensing budget," hydro relicensing project manager David Hanson explained.

SMUD's original 50-year license to operate the hydroelectric system will expire in 2007, and the utility intends to submit its relicensing application in 2005. "If we wait until after the license is granted, we will have to petition FERC to amend it, and that could cost from \$5 million to \$10 million," said Hanson.

Pumped storage

In the earliest stages of a project intended to protect ratepayers from volatile energy markets and uncertainties about the future course of deregulation, SMUD is thinking ahead and thinking big. The proposed pumped storage development could generate up to 400 megawatts, significantly increasing the UARP's existing 688-MW capacity.

In a presentation to the integrated resources and customer services committee, Hanson told directors



The Slab Creek Reservoir, part of SMUD's Upper American River Project hydroelectric development, would supply the water for the proposed Iowa Hill pumped storage facility. (Photo courtesy of Sacramento Municipal Utility District)

that the facility would consist of an underground powerhouse built into Iowa Hill, next to the Slab Creek Reservoir. To feed the new powerhouse, SMUD would build a 100-acre, off-stream storage reservoir atop the hill, some 1,200 feet above the reservoir.

Water would be pumped from Slab Creek Reservoir up to the new reservoir when electricity costs are lowest—typically at night—or when surplus power from renewable resources is available. During the day, when air conditioners are laboring and power demand is highest, water would be released from the hilltop reservoir to flow down through the turbines, generating a tremendous amount of clean electricity. "One of the great things about the project is that we would not be damming any streams," said Hanson. "SMUD could resolve about half its unmet future power needs with very little environmental impact."

Coupling another form of renewable energy with the hydro development would reduce the environmen-

tal impact of Iowa Hill even more. Much of the electricity for the pumping station may come from SMUD's Solano County wind farm. There, it turns out that the most consistent wind is after sunset. "The on-going challenge of wind energy, of course, is that the wind blows when it blows. Pumped storage creates a kind of battery for the wind farm," Hanson observed.

New twist

Using wind to power the Iowa Hill pumps adds a new twist to an idea SMUD has been considering since 1972. The Bechtel Corporation performed preliminary studies on the project, including geological and geoseismic surveys. SMUD already owns the land, so acquiring the site would not add anything to the projected \$400 million cost of construction.

Whether the board will approve such a massive project is a question for the future. The decision to build the Iowa Hill development would have to come around the time FERC grants SMUD its new license. "We'll have to look at all the available options and weigh the investment against the benefits to our customers," said Hanson.

Sacramento residents are in good hands. Any utility that includes a proposed facility in its relicensing process just to save a few million dollars knows how to think ahead, keep its options open and look out for its customers' best interests. ⚡

Want to know more?

Visit www.es.wapa.gov/pubs/ESB/Current/esb105.htm

MRES practices energy efficiency at home, too

Utilities give consumers energy saving advice all the time, but Missouri River Energy Services proved that what is good for the customer is good for the energy supplier by building a super efficient new headquarters in Sioux Falls, S.D.

Not that the energy supplier is trying to be a role model to the 57 communities it serves, but as MRES Member and Public Relations Director Bill Radio said, “We’re in the energy business; we should be concerned about saving energy. Our members expect our headquarters to reflect that priority.”

Employee input

Every feature in the 25,000-square-foot facility has an efficiency goal or standard. However, guests who attended the August 13 open house seemed just as impressed by the building’s aesthetics. “People commented on the natural lighting, the high ceilings and the quietness,” observed MRES Human Resources and Risk Manager Roy Stromsness, who oversaw the design and construction of the building.

That may be because MRES asked its employees what features they wanted in the new headquarters. Designers Van De Walle & Associates and consulting engineering firm EDA, Inc., incorporated employees’ suggestions in ways that saved energy and created a more pleasant working environment at the same time.

“There is nothing experimental here,” acknowledged Stromsness. “We went with state-of-the-art versions of tried-and-true measures. These are off-the-shelf technologies

available to everyone.”

Efficiency efforts focused on the building envelope, lighting, heating and cooling systems, water heating for personal use, a back-up generator and strategic tree planting.

High-efficiency ballasts, indirect ceiling lights and T-8 lamps are an important part of the new headquarters’s lighting system, but large windows, 10 skylights and several glassed-in areas reduce the need for artificial light.

The heavy double-paned windows measure 8 feet, 8 inches high and are insulated with argon gas, which increases their R value while cutting down on UV rays. The high R value of the walls comes from 2x6 construction and blown-in-blanket insulation. BIB eliminates the air pockets associated with conventional batting rolls. Double sheet rocking both internal and external walls gave additional noise and climate control.

Building automation

For heating and cooling savings, MRES installed an automated climate control system. The computer monitors 50 different zones adjusting to individual preferences, and automatically setting the temperature back 10 degrees when a zone is not occupied. A 50-ton condensing unit heats and cools the building with a four-step modulation system that uses only as much of the unit’s capacity as necessary at a given time. A variable air volume unit mixes in outside air, when appropriate, to add to cooling efficiency.

A tempered-water system was

coupled with a high-efficiency water heater to produce hot water for personal use. This safety feature mixes hot water from the heater with cooler water before it leaves the machine room. Water of the desired temperature is then piped throughout the building conserving heat and preventing scalding water from running through faucets.

To protect these systems—and its phone and computer network—against power interruptions, MRES installed a 400-kW Caterpillar generator. Initially intended as a backup, the generator is equipped with a “make-before-break” switch that synchronizes its operation with the local power provider. When the unit receives a signal that a power interruption is about to occur, it switches on within 8 seconds.

The system worked so well, MRES has gone on an interrupted power schedule with its electricity provider, switching to the generator during peak hours. During a recent power outage, the unit saved real-time data as well as money when it prevented MRES’s wide area network from crashing.

Stromsness added that most of the energy efficiency measures MRES built into its new facility did not increase construction costs. The trick, he explained, is to hire a good architect.

Those aren’t words of wisdom, Stromsness is quick to insist. Think of it instead as a test-driven recommendation from a utility that believes in taking its own advice. ⚡

Want to know more?

Visit www.es.wapa.gov/pubs/ESB/Current/esb106.htm

Converting to electric heat earns school district big savings

A partnership between the Kansas City, Kan., Public School District and the Kansas City Board of Public Utilities saved the school district more than \$300,000 in annual operating costs and made classrooms a more comfortable place to learn.

The savings—from a combination of energy efficiency measures and replacing natural gas heaters with electric units—may explain why the utility is doing less selling but writing more orders these days, according to Economic Development and Retail Services Director George Powell. “Customers are just moving in that direction, and we are doing everything we can to make electric service more economical,” he said.

Special rate, rebate

That attention to customer service is evident in the utility’s partnership with the school district. In 2000, Kansas City voters overwhelmingly approved a \$120 million bond issue to air condition schools, improve technology and make other upgrades to schools and public libraries. Understandably concerned about how the improvements would impact its 15- to 17-MW load, the school district approached BPU for advice.

While discussing a variety of energy efficiency options to help manage the load, Powell learned that the district planned to replace some old heating units. “Gas was their first idea,” he recalled. “It’s the most common in this area, and the initial cost is cheaper. Operating costs are higher, though, especially because a school district isn’t going to be as sophisticated about purchasing natural gas as, say, a large industrial user.”



Converting facilities like Wyandotte High school from gas to electric heat helped Kansas City, Kan., Public School District to save thousands of dollars in annual operating costs. (Photo courtesy of KCKPS.)

The utility’s answer was to offer a special contract heating rate, consolidated billing, an incentive for using electric heat and technical assistance for energy efficiency measures. In return, the school district would replace gas heaters with electric units wherever feasible.

The heating rate was based on character of use—the way each school used electricity. This method allowed some buildings to still heat either partially or entirely with natural gas. On the consolidated billing schedule, the district pays a flat rate for electricity 11 months a year. In the twelfth month, BPU rebates the school’s money saved by heating with electricity instead of natural gas. The seven-year billing agreement is now in its third year, after which the school district has the option to renew.

Efficiency measures

The improvement project began at the same time as the billing agreement, and BPU’s recommendations have helped the school district maximize energy savings.

Schools, some built in the 1930s and ‘40s, increased insulation, resealed or replaced windows and doors, tightened vestibules and atriums, incorporated temporary classrooms into main building structures and improved lighting. BPU helped design task-appropriate lighting for shop and maintenance facilities and replaced transformers at some schools.

And, of course, electric heaters replaced natural gas units. The type of unit depended on the building design, with boilers, VAV boxes, geothermal heat pumps and resistant heating systems all pressed into service. “They didn’t replace gas units that still had life, but most of the gas-heated schools have backup systems,” said Powell. “Some installed electric heat for backup but ended up using the gas for backup instead.”

Cost-effective heat

The combination of great rates and great service has been instrumental in creating partnerships that benefit both BPU and its customers. Like other Kansas electric providers, the utility experiences its highest electricity demand during the summer cooling season. During the winter, BPU has far greater capacity than it can typically sell. By partnering with large users, BPU can sell excess energy at off-peak rates that would otherwise go unused. “Any collaboration that helps us promote energy efficiency using electricity and helps our customers do business more effectively is a win-win situation for the community,” Powell declared. ⚡

Want to know more?

Visit www.es.wapa.gov/pubs/ESB/Current/esb107.htm

Initiative creates one-stop green power resource

The Public Renewables Partnership Web site brings together the latest information on the use of green power, and developments and events in the industry.

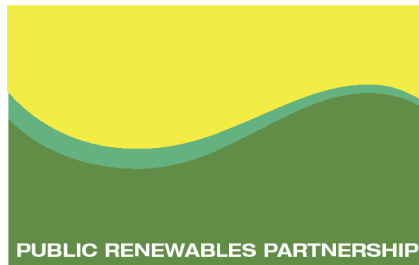
To make it easier for electric co-ops, municipal utilities and tribal utility authorities to increase their use and promotion of renewable energy technologies, Western teamed up with several organizations to form the Public Renewables Partnership. "Effective partnerships are what it's all about," said Randy Manion, manager for Western's Non-hydro Renewable Resource Program.

"The initiative brings together diverse stakeholders to share experiences, reduce duplication of effort, ensure maximum distribution of essential technical and outreach information, identify potential research and study collaborations and aggregate demand for utility- and distributed-scale renewable energy projects," he explained.

Site organizes resources

The hub of the partnership is the PRP Web site, developed with support from APPA's Demonstration of Energy-Efficient Developments program. Much of the information is available to all visitors, while other pages are restricted to PRP members only. Visitors may access the following pages:

- **Calendars of events** — a comprehensive list of links with information on workshops, seminars, state working group meetings and conferences.



- **State activities/resources** — information about wind and geothermal working groups in each state.
- **National activities/resources** — links to organizations
- **Key industry contacts** — renewable energy experts at Federal, state and local levels.
- **Grants, funding and RFPs** — Federal, state and other funding sources
- **Certified green power suppliers** — programs and organizations that currently offer green power certification services.
- **Consumer education** — Information ranges from that suitable for the general public to curriculum ideas for kindergarten through high school.
PRP members benefit from a variety of resources for planning, marketing and procurement, including:
- **Tools for marketing renewable resources and conducting market research with customers** — proven marketing material.

- **Tools for identifying and screening renewable energy projects** — the best resources for evaluating renewable resource potential and technology application.
- **Reports and publications** — literature about renewable energy resources and technologies.
- **Project development case studies** — an assortment of case studies to help utilities evaluate a technology and application before investing in it. Members may also share their own case studies for posting.
- **Partnership opportunities** — a log of member utilities seeking partners for renewable energy projects. An on-line form helps connect members with others interested in similar projects.
- **Tools for presentation** — a database of PowerPoint presentations on topics covering clean air, wind, geothermal, solar, economic development and more.

Enjoy PRP benefits

PRP membership is opened to all consumer-owned utilities. Utilities may join through the National Rural Electric Cooperative Association's Cooperative Research Network or APPA's DEED program. Current CRN member should contact Ed Torrero for a password to the PRP site's members-only section. Current DEED members can call Michele Ghosh at APPA for their password.

Visit the Public Renewables Partnership Web site and see what membership has to offer. ⚡

Want to know more?
Visit www.es.wapa.gov/pubs/ESB/Current/esb109.htm

Western says goodbye, good luck to retiring employees

Many an old blues song will tell you that you don't know a good thing until it's gone, and it often seems that way when a talented and dedicated employee retires.

Take, for example, the retirements of Energy Services managers Bob Parkins, of Western's Sierra Nevada region, and Stephen Szarka of the Desert Southwest office. On Sept. 30, Western said goodbye to a total of 68 years of expertise in renewable energy, energy efficiency and customer service. As Energy Services Manager Ron Horstman noted, "Western and Western's customers have recognized and come to depend on Bob's and Steve's professionalism and expertise in addressing energy matters. In a time when some are questioning the value of energy services, both of these men continued to champion its benefits and the need for innovative approaches and solutions to a host of energy issues," he added.

Passion for solar energy

Parkins worked 30 years for the Federal government

Parkins became a civilian employee with the U.S. Army Corps of Engineers and got his first taste of public works planning, facility design and construction management. Projects took him to Germany, Turkey and throughout the United States, where he headed up a design and project management team responsible for energy projects on 15 Air Force bases in the Western. "It was during this time that I became interested in renewable energy, particularly the limitless possibilities of solar," Parkins remembered.

In 1990, Western offered Parkins the opportunity to build on his early photovoltaics experience. He joined the Sierra Nevada Regional Office as the area engineering and construction manager. Parkins evaluated, designed, installed, and consulted on more than 2,500 kW of passive and active PV projects.

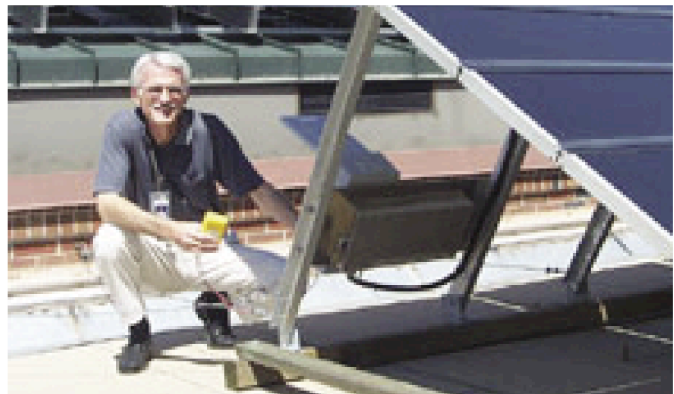
"When your career is also your passion, phenomenal things happen. Bob has solved many engineering problems for me and has been a great teammate," observed Rocky Mountain Regional Energy Services Manager Peggy Plate. "I hope Western looks for that kind of passion when replacing him."

Parkins's greatest pride is a 50-kW PV technology demonstration project at the Western regional office in Folsom, Calif. Parkins devised the project with its three beta test sites to field test new PV module and inverter technology, to develop improved PV mounting systems and to demonstrate PV technology to the public.

Commitment to renewables

The word "retirement" doesn't accurately describe Parkins' post-Western plans. He will continue to spread the renewable energy gospel as a photovoltaics consultant and look for new dreams to fulfill.

Stephen Szarka chose to go



Sierra Nevada Regional Energy Services Manager Bob Parkins takes measurements on a 1-kW beta test site of advanced technology thin-film PV modules.

straight from high school into military service, beginning 38 years of employment with the Federal government. He was assigned to Air Force civil engineering squadrons, where he



Szarka retired from Western Sept. 30, ending 38 years of service to the Federal government in military and civilian positions.

worked as a steamfitter and in building maintenance and operations.

Szarka moved into civil service, continuing to build on his utility and energy management experience. He held civilian operations positions at Beale and McClellan Air Force bases and Camp Pendleton Marine Corps Base, all in California.

The Bureau of Indian Affairs' San Carlos Indian Irrigation and Electric Power project employed Szarka as a public utilities specialist from 1990 to '93.

Szarka became the Energy Services manager for Western's Desert

See RETIREES, page 13

Bright idea leads to bio-friendly transformer oil

The cliché about the Chinese character for “problem” and “opportunity” being the same turned out to be true for Waverly, Iowa, Light and Power General Manager Glenn Cannon when a PCB spill gave him the idea for an earth-friendly transformer oil, now available to all utilities.

“I was pretty upset,” said Cannon of the 1994 accident caused by a truck hitting one of the few remaining WL&P transformers containing PCB.

The resulting spill cost the small, northeastern Iowa utility \$27,000 to clean up, and it got Cannon thinking about alternatives to the toxic lubricant. “I thought, wonder if you could use soybean oil in a transformer,” he recalled.

That not-so-idle question eventually became soy-based BioTrans. Cannon holds five patents on the biodegradable, recyclable transformer fluid that is naturally fire resistant and extends transformer life by retaining more moisture than petroleum or synthetic oils.

R&D support

Many utilities, especially ones as small as WL&P with only 26 employees and fewer than 4,300 customers, might leave the development of a green transformer oil substitute to another organization. That would not be the kind of thinking that made WL&P a national leader among utilities in environmentally responsible energy service, however.

The Waverly utility board hired Cannon in 1990 because it wanted a manager who would emphasize environmental protection, conser-



Luis del Valle (right), global marketing director of Cargill Industrial Oils & Lubricants, accepts one of Waverly Light and Power's first BioTrans transformers from WL&P General Manager Glenn Cannon for display in Cargill's Minneapolis headquarters. (photo courtesy of American Public Power Association)

vation, demand-side programs, efficiency and renewable energy. The general manager carried out his mission by promoting the Good Cents energy-efficient housing program to local builders, adopting an aggressive rebate program for high-efficiency appliances and by establishing the Iowa Energy Tags program in 2001. WL&P was the first Iowa utility to offer outsiders the opportunity to invest in renewable energy.

“This wasn't one of our typical programs,” Cannon admitted, “but it was finding a better way of solving a common utility problem. The board saw the potential benefits and was very supportive.”

Having a handy research facility close by also helped. The University of Northern Iowa Ag-Based Industrial Lubricants Research Program in Waverly was doing research on

industrial uses for soybean oil.

Cannon contacted Dr. Lou Honary of ABIL, who was intrigued by the potential application. Over the next four years, ABIL researchers and Cannon worked together to develop an environmentally safer alternative to petroleum-based transformer oil.

That research would not have been possible without assistance from agencies that shared Cannon's commitment to environmental stewardship. “As a small utility, we didn't know what was involved in product development. After the preliminary studies, there was more research and development to do,” Cannon noted.

A timely grant from the American Public Power Association's Demonstration of Energy-Efficient Developments program provided critical start-up funding. Tennessee Valley Authority Public Power Institute contributed funding and technical expertise. Later in the project, some of TVA's member systems participated in field studies. “We would never have been able to do the BioTrans project had it not been for APPA, DEED and PPI,” declared Cannon.

A long-time APPA member and current chair of the association's board of directors, Cannon calculates that WL&P would have to pay dues to the DEED program for 150 years to repay the value of the DEED grants.

Manufacturing partner

In the early stages of research, Cannon and UNI applied for patents on their unique product and began looking for a partner to manufacture and market it. “Utilities don't adopt new technology overnight,”

he stated. “We didn’t want logistics to stand in the way once the product was ready.”

In 1997, WL&P became the first utility to retrofill transformers with BioTrans. Now every new transformer in its distribution system uses the soy-based lubricant. PPI, Nashville Electric Service, Nebraska Public Power District and other utilities in Iowa, Missouri and Tennessee are currently field or lab testing BioTrans oil.

A collaboration with Cargill Industrial Oils and Lubricants and Electric Research and Manufacturing Cooperative will soon make BioTrans more widely available to electric utilities. Cargill purchased Waverly’s technology and patents about a year ago with plans to make the soy-based product the cornerstone for a line of biobased transformer fluids. ERMCO offers BioTrans fluid in its electrical transformers and has

exclusive rights to market BioTrans fluid to the industry in Canada, the United States and Mexico.

Cargill improves product

Cargill used its expertise to make improvements in BioTrans and develop a second product, BioTrans 5000, which contains a synthetic ester for enhanced stability. “Because BioTrans is based on an edible oil, it contained antioxidants that were harmless to the human system but potentially toxic to simpler animals like fish and algae,” explained Technology Manager Brent Aufdembrink. “We reformulated it with safer antioxidants that reduced its already low toxicity.”

Thanks to the manufacturer’s improvements, Cannon pointed out, BioTrans now meets or exceeds the new standards for natural ester transformer oil set by ASTM Internation-

al. He is also pleased about Cargill’s help on the regulatory front. “WL&P couldn’t begin to sort out all the environmental regulations specific to dielectric fluid,” he said. “Cargill has the staff, resources and experience to make a case for BioTrans with the government agencies.”

By Cargill’s estimate, there are now 15 to 18 utilities using BioTrans, either in new transformers or retrofills, and more are showing interest every day. For Cannon, it is just part of turning the challenges facing all public utilities into a chance to give better service. “I tend to look at the service we provide as a public good,” he said. “With the responsibility of providing that public good comes the moral obligation to be more environmentally responsible.” ⚡

Want to know more?

Visit www.es.wapa.gov/pubs/ESB/Current/esb0108.htm

Retirees *from page 9*

Southwest region in 1998. His accomplishments at DSW included coordinating funding for a 4-kW photovoltaic electric vehicle charger station installed at DSW’s visitor parking area.

Szarka’s efforts to promote and reward energy efficiency at U.S. military installations continued at Western.

Retirement for Szarka will be a time of rest and recreation, initially at least.

Looking back on their years with Western, both Parkins and Szarka mentioned people—coworkers and customers—as the thing they would miss most in retirement. “I’ve been privileged to work with highly motivated folks who are dedicated and competent,” said Parkins. “It made working a pleasure.”

“There are people with whom you work well, ones who taught me a lot and who were always willing to help,” Szarka concurred. “That’s

what I enjoyed most about working at Western. That, and helping customers who really needed the Energy Services program. At times like that, you know you’ve made a positive difference.”

The Western Energy Services staff knew perfectly well what it lost September 30—two valued and valuable employees. We wish them good luck and all the best for the future. ⚡

Want to know more?

Visit www.es.wapa.gov/pubs/ESB/Current/esb01010.htm



ENERGY SHORTS

Historic perspective helps today's energy dilemmas

The Center of the American West at the University of Colorado at Boulder recently released "What Every Westerner Should Know About Energy," a roadmap to Western regional energy issues.

The report contains the findings of 16 prominent experts on energy and the American West who gathered for a two-day workshop in May 2002.

Contents of the full report are available for free on the Web. Printed copies are available for \$5 plus \$2 shipping and handling. To order or for more information, call the CU-Boulder Center of the American West at 303-492-4879.

Wind power program sells one-penny electricity

Southern Minnesota Municipal Power Agency has lowered its wholesale price for wind power to member utilities from \$2.90 per 100 kWh block to \$1 per block, making it one of the five lowest green power pricing programs in the country.

The new price reflects the cost of production from SMMPA's new turbines near Fairmont, Minn. ⚡

DOE funds tribal energy development

Secretary of Energy Spencer Abraham announced that the Department of Energy Office of Energy Efficiency and Renewable Energy is making \$2.2 million available to seven Na-

tive American tribes to support the development of renewable energy resources on tribal lands.

Among those receiving awards are the Assiniboine and Sioux Tribes at the Fort Peck Reservation in Poplar, Mont. By developing their wind resources, the tribes hope to increase opportunities for employment and education.



Solar rebate expands to single-family homes

Riverside, Calif., Public Utilities recently decided to expand its rebate program encouraging residents to install solar systems.

The utility's residential customers can look forward to rebates of \$2 per watt or 50 percent of the project cost, whichever is less. Based on a 2-kW photovoltaic system for an average home, homeowners would receive a \$4,000 rebate. ⚡

TOPICS from the POWER LINE

Research, software helps size transformers

Editor's note: The Energy Services Bulletin features real answers to real questions posed to our staff at the Energy Services Power Line. We hope you find it useful.

Q: Is there a "rule of thumb" for utilities to use in determining transformer sizing of residential distribution loads? Something based on monthly kWh usage, or house size, etc....something our lineman can use in the field. We have a large electric heat load, so that type of load must be factored in also.

A: According to retired Electrical Distribution Engineer Dennis Greys, no "rule of thumb" would accurately provide this information. Many utilities do a series of correlation studies for the most loaded months—in your case, winter. This is done every three or four years for different groups, i.e. residential, light commercial, etc. A simple regression

analysis is studied and data collected for the energy and capacity. Utilities use this information to size transformers for residential loads. Your current transformer suppliers may also have information on this topic.

You should definitely consider the use of high-efficiency transformers, which include both amorphous core and high-efficiency silicon-steel core transformers, both of which can play an important role in reducing energy losses. The EPA Energy Star Transformer Program is a good starting point to find out more about this.

Also, consider integrating software programs into your electrical distribution group to make better transformer decisions. Considering that residential transformers can last 45 years and commercial transformers 35 years, this would be a prudent strategy in the long run. ⚡

Calendar of events

Oct. 5-6	5-6—Tour of Solar Homes; Northern Colorado Renewable Energy Society; Denver and Boulder, CO. Contact: N-CRES; phone: 800-472-2306.
Oct. 5-11	Public Power Week; American Public Power Association.
Oct. 6-7	Infrared Camera Workshop; Western, ND State Energy Office, University of ND; Grand Forks, ND. Contact: John Pankratz; phone: 406-247-7392; FAX: 406-247-7408.
Oct. 7-9	Air Conditioning & Refrigeration; National Technology Transfer, Inc.; Salt Lake City, UT. Contact: Customer Service; phone: 800-922-2820; FAX: 800-338-8441
Oct. 7-9	Instrumentation & Process Control; National Technology Transfer, Inc.; Seattle, WA. Contact: NTT; phone: 800-922-2820; fax: 800-338-8441.
Oct. 7-11	SWH International Conference; Segovia, Spain. Contact: Kathleen Terryll; phone: 34 91 640 74 40.
Oct. 8	Western States Renewable Energy Summit; National Wind Coordinating Committee; Reno, NV. Contact: Misty Young; phone: 775-686-7402.
Oct. 8-9	Infrared Camera Workshop; Western, ND State Energy Office, University of ND; Grand Forks, ND. Contact: John Pankratz; phone: 406-247-7392; FAX: 406-247-7408.
Oct. 8-11	UPEx 03: Photovoltaic Experience Conference; Solar Electric Power Association; Scottsdale, AZ. Contact: Holly Riester; phone: 202-857-0898; FAX: 202-223-5537.
Oct. 9	Power Quality/End Users Seminar; Rocky Mountain Electrical League; Colorado Springs, CO. Contact: RMEL; phone: 303-695-0089; fax: 303-695-0704
Oct. 11	Introduction to Renewable Energy; Solar Energy International; Guemes Island, WA. Contact: SEI; phone: 970-963-8855; fax: 970-963-8866.
Oct. 11-12	Hydrogen Consumers Tour and Expo; Hydrogen.com, Ford, Honda, Colorado School of Mines, National Renewable Energy Laboratory; Denver, CO. Contact: Gina Yoo; phone: 303-534-2500.
Oct. 13-15	International Conference for Enhanced Building Operations; The Energy Systems Laboratory, Texas Engineering Experiment Station; Berkley, CA. Contact: Jim; phone: 979-845-1508; FAX: 979-862-8687.
Oct. 13-18	Photovoltaic Design & Installation; Solar Energy International; Guemes Island, WA. Contact: SEI; phone: 970-963-8855; fax: 970-963-8866.
Oct. 14-15	NRECA Regional Wind Energy Workshop; Department of Energy's Wind Powering America and the Cooperative Research Network; Huron, SD. Contact: Michele Weiss; phone: 518-437-8650; fax: 518-437-8659
Oct. 14-16	Hydraulic Training National Technology Transfer, Inc.; Seattle, WA. Contact: Customer Service; phone: 800-922-2820; FAX: 800-338-8441.
Oct. 14-16	Air Conditioning & Refrigeration National Technology Transfer, Inc.; Denver, CO. Contact: Customer Service; phone: 800-922-2820; FAX: 800-338-8441.
Oct. 14-16	Solar Energy System Symposium; Sandia National Laboratories; Albuquerque, NM. Contact: Connie Brooks; phone: 505-844-4383.
Oct. 15-17	Light Emitting Diodes 2003; Rubicon Technologies Inc.; San Diego, CA. Contact: Patricia Kinzer; phone: 207-781-9604; fax: 207-781-2150.
Oct. 17-19	Educating Towards Sustainability; Environmental Education Association of Oregon; Bend, OR. Contact: EEA0; phone: 503-234-3326.
Oct. 20-25	Wind Power; Solar Energy International; Guemes Island, WA. Contact: SEI; phone: 970-963-8855; fax: 970-963-8866.
Oct. 20-24	Certified Key Account Executive Fast Track & Exam; National Rural Electric Cooperative Association, Tampa, FL. Contact: Angie Hylton; phone: 703-907-5656.
Oct. 21	Green Power Options Seminar 2003, Green Power Magazine, Boston, MA. Contact: Marsha Hanrahan.
Oct. 21-23	Hydraulic Training National Technology Transfer, Inc.; Portland, OR. Contact: Customer Service; phone: 800-922-2820; FAX: 800-338-8441.
Oct. 21-23	Instrumentation & Process Control; National Technology Transfer, Inc.; Sacramento, CA. Contact: Customer Service; phone: 800-922-2820; FAX: 800-338-8441.
Oct. 21-23	Labs for the 21st Century, 2003 Conference; U.S. Environmental Protection Agency; Denver, CO. Contact: Labs21 Conference; phone: 781-674-7374.
Oct. 23	Human Interaction with Light; Lighting Design Lab; Spokane, WA. Contact: Elizabeth Ellisor; phone: 800-354-3864; fax: 206-329-9532.
Oct. 27-29	Brownfields 2003 - Growing A Greener America; U.S. Environmental Protection Agency, City of Portland; Portland, OR. Contact: US EPA; phone: 202-566-2777; fax: 202-566-2757
Oct. 28	Design Considerations for Energy-Effective Lighting; Lighting Design Lab; Spokane, WA. Contact: Elizabeth Ellisor; phone: 800-354-3864; fax: 206-329-9532; e-mail: elizabeth@lightingdesignlab.com
Oct. 28-30	Instrumentation & Process Control; National Technology Transfer, Inc.; Oakland, CA. Contact: Customer Service; phone: 800-922-2820; FAX: 800-338-8441.
Oct. 28-29	Federal Energy and Water Management Awards; Federal Energy Management Program; Washington, DC. Contact: Nellie Tibbs Greer; phone: 202-586-7875; fax: 703-921-1610
Nov. 2-5	Customer Connections Conference; American Public Power Association; Savanna, GA. Contact: Ruth Newberry; phone: 202-467-2958.
Nov. 3-4	North American Gas Strategies Conference; Ziff Energy Group; Calgary, AB Canada. Contact: Paula Arnold; phone: 403-234-4279; FAX: 403-237-8489.

Nov. 3-5	Eighth National Green Power Marketing Conference; U.S. Environmental Protection Agency, U.S. Department of Energy, Center for Resource Solutions; Chicago, IL. Register online.
Nov. 3-7	Comprehensive 5-Day Training Program for Energy Managers; Association of Energy Engineers; Anaheim, CA. Contact: AEE, Elaine Berkheimer; phone: 770-447-5083; fax: 770-446-3969.
Nov. 4	Design Considerations for Energy-Effective Lighting; Lighting Design Lab; Eugene, OR. Contact: Elizabeth Ellisor; phone: 800-354-3864; fax: 206-329-9532.
Nov. 4	Design Considerations for Energy Effective Lighting; Lighting Design Lab; Boise, ID. Contact: Elizabeth Ellisor; phone: 800-354-3864; fax: 206-329-9532.
Nov. 4-5	Summit on Energy Efficiency; Alliance to Save Energy & The Geothermal Heat Pump Consortium; Washington, DC. Contact: Alliance to Save Energy; phone: 202-857-0666; FAX: 202-331-9588.
Nov. 4-6	Hydraulic Training; National Technology Transfer, Inc.; Sacramento, CA. Contact: Customer Service; phone: 800-922-2820; FAX: 800-338-8441.
Nov. 4-6	Instrumentation & Process Control; National Technology Transfer, Inc.; Ontario, CA. Contact: Customer Service; phone: 800-922-2820; FAX: 800-338-8441.
Nov. 5	Design Considerations for Energy Effective Lighting; Lighting Design Lab; Portland, OR. Contact: Elizabeth Ellisor; phone: 800-354-3864; fax: 206-329-9532.
Nov. 5	Design Considerations for Energy Effective Lighting; Lighting Design Lab; Pocatello, ID. Contact: Elizabeth Ellisor; phone: 800-354-3864; fax: 206-329-9532.
Nov. 6-15	Building Operator Certification LEVEL I Training; Northwest Building Operators Association; Boise, ID. Contact: Connie Searles; phone: 208-345-3072; FAX: 208-343-8046.
Nov. 11	Green Power Options Seminar 2003, Green Power Magazine, Ft. Lauderdale, FL. Contact: Marsha Hanrahan.
Nov. 11-13	Instrumentation & Process Control; National Technology Transfer, Inc.; Orange, CA. Contact: Customer Service; phone: 800-922-2820; FAX: 800-338-8441.
Nov. 11-13	Hydraulic Training; National Technology Transfer, Inc.; Orange County, CA. Contact: Customer Service phone: 800-922-2820; FAX: 800-338-8441.
Nov. 12-14	Greenbuild International Conference and Expo; U.S. Green Building Council; Pittsburgh, PA. Contact: Tom Corcoran; phone: 312-541-0567; FAX: 312-541-0573.
Nov. 12-14	World Energy Engineering Congress; Association of Energy Engineers (AEE); Atlanta, GA. Contact: Elaine Berkheimer; phone: 770-447-5083; FAX: 770-446-3969.
Nov. 13-14	Electric Substation Workshop; League of Nebraska Municipalities; Lincoln, NE. Contact: LNM; phone: 402-476-2829; FAX: 402-476-7052.
Nov. 17	Design Considerations for Energy Effective Lighting; Lighting Design Lab; Billings, MT. Contact: Elizabeth Ellisor; phone: 800-354-3864; fax: 206-329-9532.
Nov. 18-19	Northwest Environmental Conference; Northwest Environmental Business Council, Portland, OR. Contact: Cara Bergeson; phone: 503-227-6361; FAX: 503-222-5050.
Nov. 18-20	Instrumentation & Process Control; National Technology Transfer, Inc.; San Diego, CA. Contact: Customer Service; phone: 800-922-2820; FAX: 800-338-8441.
Nov. 20	Design Considerations for Energy Effective Lighting; Lighting Design Lab; Missoula, MT. Contact: Elizabeth Ellisor; phone: 800-354-3864; fax: 206-329-9532.
Nov. 19-22	IEPEC's 2003 Conference: Evaluation, Meeting Diverse Needs; National Energy Program Evaluation Conference, Inc., Seattle, WA. Contact: Cara Lee Mahany Braithwait; phone: 608-231-2552; e-mail:
Dec. 2-4	Hydraulic Training; National Technology Transfer, Inc.; San Diego, CA. Contact: Customer Service; phone: 800-922-2820; FAX: 800-338-8441.
Dec. 3-5	Hydrogen Production & Storage Conference; Intertech Conferences Washington, DC. Contact: Brian Santos; phone: 207-781-9618; fax: 207-781-2150.
Dec. 4	Design Considerations for Energy Effective Lighting (); Lighting Design Lab; Spokane, WA. Contact: Elizabeth Ellisor; phone: 800-354-3864; fax: 206-329-9532.
Dec. 9-11	Mid-West Electric Consumers Association Annual Meeting; Denver, CO. Contact: Fara Tippit; phone: 303-463-4979
Dec. 9-13	80th Annual Congress of Cities and Exposition, The National League of Cities, Nashville, TN. Contact: Registration; phone: 888-319-3864; fax: 202-626-3043.
Dec. 10	Lighting Design Lab Open House; Lighting Design Lab; Seattle, WA. Contact: Elizabeth Ellisor; phone: 800-354-3864; fax: 206-329-9532.
Dec. 16-18	Instrumentation & Process Control; National Technology Transfer, Inc.; Phoenix, AZ. Contact: Customer Service; phone: 800-922-2820; FAX: 800-338-8441.