

Western's bi-monthly energy efficiency and renewable energy newsletter dedicated to customer activities and sharing information on energy services.

Sun, wind electrify Navajo Nation

Combining the age-old tradition of living off the land with 21st century technology, the Navajo Tribal Utility Authority recently completed a renewable energy and distributed generation project that is producing electricity for remote households on the Navajo Nation.

A Western customer since the 1980s, NTUA provides utility services to the Navajo people living on 25,000 square miles spread across northeastern Arizona, northwestern New Mexico, and southeastern Utah. The project built and installed 63 new wind-solar hybrid systems to bring power to some of the Nation's nearly 18,000 families living beyond the grid. "A lot of those people are

five to seven miles from the nearest power line and the cost of running a line starts at \$27,000 per mile," said Renewable Energy Specialist Larry Ahasteen. "Mother Nature gave us a more affordable option."

Families using the hybrid units pay NTUA only a monthly maintenance fee of \$75.

Solar training

The tribe issued a request for proposals and invited vendors to Albuquerque. NTUA wanted the systems to be built on the reservation, using Navajo labor to integrate the units and complete the inspection criteria. Since NTUA electricians had not worked with solar technology before, the vendor would have to provide classroom and hands-on training as well.

"We now have 16 fully qualified solar electricians doing installation, deployment, monitoring and maintenance," Ahasteen said proudly. "A lot of them have learned to design systems, too."

Assembled in Ft. Defiance, Ariz., the systems consist of eight solar panels in an 880-watt array, a 400-watt Air-X turbine, and four 6-volt, 770-amp-hour batteries in series to create a 24-VDC configuration. The PV array generates a minimum of two kWh per day and the battery bank can operate an air-conditioning



Navajo Tribal Utility Authority is using solar/wind hybrid systems to bring electricity to off-grid homes like this one in Shiprock, N.M. (Photo courtesy of NTUA)

load for five days without recharging. A meter installed inside the home allows homeowners to monitor the battery charge.

An important feature of the hybrid system is its portability. The systems are built on steel modulars that electricians can pick up and move to new locations as needed.

Greater energy efficiency

The next step, said Ahasteen, will be teaching homeowners to get the most out of their systems. "At 2 kWh per day, these are not powerful generators," he noted. "There are a lot of simple and inexpensive measures people can take, like compact fluorescent bulbs, for instance, to use energy more efficiently."

Ahasteen said, "We see renewable systems mainly as an opportunity to bring electricity to remote areas. Our mission, above all, is to provide quality utility services to our customers." ⚡

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IID Energy sees voluntary RPS as goal to beat

In states where renewable portfolio standards target investor-owned utilities, a growing number of municipalities and electric cooperatives have recognized the wisdom of diversifying energy resources and are voluntarily adopting their own standards, as IID Energy recently did.

The Imperial Irrigation District's board of directors voted in May to establish a 20 percent minimum for the use of green energy resources by 2017, paralleling California's RPS. Complying with the state law, which exempts IID's electric utility division, was a fringe benefit of the decision, said Systems Planning and Engineering Superintendent Juan Carlos Sandoval.

"The main reason was to reduce our dependency on fossil fuels and our customers' exposure to the economic risk of relying too heavily on one resource," he explained. "And, it's good for the environment."

"There are lots of good reasons," agreed Robert Fugett, energy services superintendent in charge of member services. "We'd like to actively pursue all possibilities, especially the ones in our own backyard."

That attitude makes 20 percent into a mere benchmark that IID Energy expects to surpass easily. A 2001 agreement to purchase 170 MW of geothermal power from CalEnergy Company, Inc., will boost IID Energy's renewable resources above the required percentage by 2007. CalEnergy is building a 185-MW geothermal facility off the Salton Sea shore. Salton Sea Unit 6 received its permit late last year and is slated to be online in 2006.

"Having the plant right here in our territory reduces the need for substantial transmission and improves system reliability," noted Sandoval, "and it stimulates local development. That doesn't affect the price of energy but it is good for the community."

Earlier this year, IID Energy agreed to invest \$28.5 million in interconnection facilities to Salton Sea Unit 6 and ancillary services for the geothermal purchase. CalEnergy will pay just over \$4 million for necessary system upgrades, receiving transmission credits in equal amount.

IID Energy General Manager Glenn Steiger called the agreement an important element in the utility's pursuit of clean, renewable energy resources to serve its growing customer base. "The added benefit is the increased independence from coal and fossil fuel," stated Steiger.

Renewable energy already plays a significant role in IID Energy's resource mix, which includes steam, diesel fuel, natural gas, nuclear and coal. The utility owns the All American Canal, which supplies 35 to 45 MW of "run-of-canal" hydropower. "The canal has an 85-MW capacity,



Imperial Irrigation District Energy purchased 170 MW of geothermal energy from CalEnergy's company's new Salton Sea Unit 6 to meet its renewable portfolio standard requirement. (Photo courtesy of CalEnergy)

but the generation comes from water delivery to our irrigation customers," said Sandoval, "so our hydro generation is dependent upon agricultural demand."

Western supplies additional hydropower of about 26 MW in the winter and 33 MW in the summer. IID Energy is also developing three new mini-hydro sites and upgrading some of its existing hydro facilities. Those projects could add up to 2.5 MW in the future.

The Imperial and Coachella valleys have other renewable resources that IID may be able to tap. The utility receives frequent inquiries about solar development. "Facilities that provide peaking power would be consistent with our goals," said Sandoval.

IID Energy has negotiated to buy biogas captured from local cattle feedlots. Although the project has changed from the initial plan to build four digesters, it could still yield 20 MW of renewable energy and offer a solution to the ongoing problem of agricultural waste disposal.

"The RPS is a means to an end," Fugett concluded. "Reliable power supply and stable rates. The scarcer fossil fuel becomes, the better diversity is going to look." ⚡

Energy Services Bulletin

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Kit Carson joins team to grow solar industry in northern New Mexico

At the North American Energy Summit, held in April in Albuquerque, N.M., four companies announced a public-private partnership that could turn the state's abundant sunshine into renewable energy and turn renewable energy into economic development.

Kit Carson Electric Cooperative and SolarPort engineering group, both of Taos, N.M., signed an agreement with PV manufacturer Spire Corporation and New Energy Capital investment firm to locally produce solar modules and install arrays in northern New Mexico's rural communities.

The project highlights the potential of renewable energy to bring jobs and revenue to rural areas. "This is going to be a local product, built and installed by local employees, putting energy onto the local grid to sell to local markets," said Kit Carson CEO Luis Reyes.

Under the agreement, Spire Corporation will build a Taos facility to assemble solar panels. Kit Carson and SolarPort will install the panels and provide maintenance, and Kit Carson will purchase the electricity from the system owners. New Energy Capital is assisting with financing arrangements for the project and helping the companies do due diligence for the factory construction. The power purchasing agreement is currently being negotiated.

Marketing experience

The project's goal is to deploy 1.5 MW of solar panels in three years. Other New Mexico utilities may

buy some of that power to fulfill the state's renewable portfolio standard of 10 percent energy from renewable sources by 2014.

As a cooperative, Kit Carson is not subject to the state standard, but Reyes believes there will be a market for local renewable product in the Taos Valley. "We've done a lot of grassroots work, polling consumers and holding town meetings. The three main issues we hear are renewables, reliability and rates," he said. "For the people interested in renewables, that is their No. 1 concern."

Public education is the key to expanding that interest, the CEO continued. "Kit Carson offers its members a green power option through Tri-State [Generation and Transmission Association], our wholesaler. There are only 350 subscribers right now out of 25,000 members, but every time there is a local news story about it, we gain 10 or 20 customers," Reyes noted.

Supporting Reyes's view, participants included in the agreement the creation of an education, public awareness and marketing campaign to increase the use of solar energy. PowerTaos! will seek to involve local, state and Federal agencies, local businesses, non-profit organizations, national laboratories and the utility customers of northern New Mexico.

One unique form of outreach will involve placing "tracker boards" in communities with solar arrays to show how much energy the panels are generating. A phone bank will be established to continue polling, answer customers' questions about



Kit Carson Electric Cooperative hopes its solar partnership will increase the use of solar power by grid-connected residences and businesses. (Photo courtesy of NREL)

solar energy and encourage support of renewable energy, either through green power subscriptions or installing solar panels.

Reyes is confident that the marketing experience the utility gained running propane and Internet businesses will serve the solar project well. "We learned how to compete successfully in a private marketplace," he explained. "The same rules apply to positioning renewables. The competition is fossil fuels, and people need to know the pros and cons to make an informed decision."

Jobs, local involvement

"The level of social awareness and the lifestyle here encourage people to respect and appreciate the environment," Reyes observed. "And our members are used to seeing solar panels on off-grid homes around the valley. What the solar project aims to do is make the technology available and improve the pricing so that it becomes feasible to integrate solar into downtown Taos."

Incentives will be necessary to accomplish that feat, Reyes acknowledged. In addition to buying solar power back from PV owners, Kit Carson plans to offer some sort of installation incentive."

See SOLAR INDUSTRY, page 13

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Renewable hydrogen future begins now in Ft. Collins, Colo.

There are people who wait until the bugs are worked out to adopt a new technology and there are adventurous souls who take each new gadget apart to figure out how it works—and how to make it work better. The city of Fort Collins, Colo., is taking the latter approach to hydrogen energy systems.

“We want to educate ourselves about producing and using hydrogen, about the costs, equipment and options,” said Gary Schroeder, an energy services engineer with the city utility. “I’m a great believer in learning from projects.”

Hands-on education

Fort Collins is preparing to launch the first phase of a multi-faceted hydrogen plan that will provide the municipality with the hands-on education that Schroeder advocated. This fall, one of the city’s compressed natural gas-powered Transfort minibuses will be converted to run on Hythane. The ultra-low emissions fuel developed by Hydrogen Components, Inc. of Littleton, Colo., mixes compressed hydrogen gas with compressed natural gas to burn cleaner than CNG alone. Minor tuning of the CNG engine will optimize emission reductions.

Part of the project will include gathering data to compare emissions from the Hythane bus with the city’s CNG buses. If the bus performs well on the hybrid fuel, Fort Collins will convert up to five more minibuses and a fleet vehicle to Hythane.

City builds filling station

These vehicles will eventually run out of fuel, of course, bringing up the question of fueling infrastructure. Fort Collins is addressing that issue by building a fast-fill CNG station that will pump Hythane, and speed up refueling time for conventional CNG vehicles. Funding for the specialized equipment is coming from the Colorado Governor’s Office of Energy Management and Conservation and the Congestion Mitigation and Air Quality Improvement Program, a Federal program, jointly administered by the FHWA and the Federal Transit Administration.

Hythane requires a dual tap dispenser to mix CNG with H₂. The filling station will also have a pure hydrogen dispenser, developed by HCI. “That was actually Phase II of the plan,” observed Schroeder, “but HCI had the dispenser ready to go, so we decided to install it now.”

Innovative electrolyzer

Adding initiative to innovation, the station will be outfitted with an electric-powered electrolyzer to produce its own compressed hydrogen. The Hydrofiller 175-6000G, made by Avalence LLC Hydrogen Energy Systems, extracts hydrogen from water—about 1 kg., roughly equivalent to the energy in a gallon of gas—per 60 kWh.

Using off-peak electricity and not factoring in the cost of the equipment, the price of the fuel is about \$1.80 per gallon. “Off-peak electricity is very efficient and inexpensive



The Hydrofiller 175-6000G extracts about 1 kg. hydrogen from water per 60 kWh. (Photo courtesy of Avalence LLC Hydrogen Energy Systems)

so it helps keep the cost down,” said Schroeder.

The fact that the electrolyzer compresses the hydrogen at 6,000 pounds per square inch in the production process somewhat improves the efficiency. “Most electrolyzers produce hydrogen at slightly above atmospheric pressure. It has to be compressed in a separate process before it can be mixed with CNG,” Schroeder explained. “This model eliminates the need for a compressor.

Biomass-to-hydrogen

The energy services engineer stressed again that the hydrogen economy is still very much in its infancy.

“Most of the talk about hydrogen technology places it 10 years or more in the future,” he said. “Our goal is to get some hardware on the ground now, to make it real to people.” ⚡

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Plankinton, S.D., rebuilds school with eye on efficiency, safety

Among the virtues of geothermal heating and cooling, low electric bills, year-round comfort and minimal maintenance get a lot of attention, but to Plankinton, S.D., Public School, the safety of its geothermal system is as important as its efficiency.

The combined elementary and high school opened in early 2003, replacing a propane-heated, 1940s-era building that had been located a few blocks from the new facility's site. On Nov. 17, 2000, a propane explosion and fire destroyed that facility, killing the head custodian and superintendent, and severely injuring a volunteer firefighter.

The building was empty except for school officials and firefighters investigating the leak when the blast occurred later that evening. The explosion damaged the structure so heavily it had to be demolished.

High installation costs

The school board raised money to finance a larger, modern facility. The new school would boast state-of-the-art classrooms, a wellness center, computer-equipped community library and a teleconferencing center for distance learning. It would also be equipped with an efficient heating and cooling system, the school board decided. The question was, what kind of system?

Geothermal proponents initially met with some resistance from the school board and the public because of high initial costs. The wells alone were a big expense, Gary Kristensen, Plankinton school board vice



At 65,000 square feet, the new Plankinton Public School in South Dakota is nearly 20,000 feet larger than the old facility and is air-conditioned in the summer.

president and Central Electric Cooperative member services advisor, recalled. The system would require 300 wells, each 225 feet deep, to heat and cool the expanded facility.

Taxpayers benefit

Visits to three South Dakota schools—one in Elk Point and two in Hamlin—helped make the case. “Those systems let us compare the higher installation costs with long-term payback and overall efficiency,” explained the member services advisor. “Having some figures, even for other facilities, helped to bring people around.”

“Residential customers may not be sure they are going to stay in a house long enough to see the payback of an initially expensive system,” he said. “But that school is going to be in use for a long time, and taxpayers will always be paying for its operating costs. Suddenly, that investment starts to look like a pretty good deal.”

Central Electric, in cooperation with its power wholesaler East River

Electric Cooperative, sweetened the deal more with a rebate of \$13,500, based on residential incentive programs. The utility also gave the school a special rate of 3.3 cents per kWh on heating and cooling costs.

Expanded facility

The 65,000 sq. ft. building is nearly 20,000 sq. ft. larger than the old school, and unlike its predecessor, is air-conditioned. Yet, the combination of geothermal technology, efficient windows and insulation and special electrical rates saved the school \$24,000 in energy costs the first year of its operation.

Lower operating costs, more efficient energy use and, best of all, a clean, safe learning environment for Plankinton students is a pretty good return on investment. The old school may be gone, but alumni will remember it as the place where they learned to recognize opportunity and to respond to adversity by building something better. ⚡

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Snowmass Golf Clubhouse goes for the gold with green construction

Where environmentally responsible business practices are concerned, Aspen Skiing Company's motto seems to be, "If at first you succeed less spectacularly than you would like, try, try again."

The resort pioneered "green construction" in 1999, building one of the first structures in the world to be certified by the U.S. Green Building Council's Leadership in Energy and Environmental Design program. The Sundeck restaurant used recycled building materials, featured energy-efficient systems and ran on 30 percent wind power purchased from ASC's utility, Holy Cross Energy. Such measures earned the restaurant a bronze-level LEED certification, and the distinction of being one of only four LEED buildings in Colorado.

Whether in skiing or sustainability, though, true champions always have their eye on the gold. So ASC set out to break its Sundeck record by building a facility that was, in the words of ASC Environmental Affairs Director Auden Schendler, "unbelievably green. We think the Snowmass Golf Clubhouse will qualify for a gold LEED certification," he declared.

Commissioning practices

The clubhouse's chances for a gold certification look good. Once again, Holy Cross is supplying wind power, this time for 100 percent of the facility's energy needs. But it is the way the building uses that energy that makes it truly green. An energy computer model of the building against a base case beat the Snow-

mass energy code by 60 percent. It takes 63 percent less energy to heat and cool its 10,714 square feet than the typical Snowmass Village building, thanks to the combination of a highly efficient building envelope and ground source heat pumps. The roof is insulated to R55.5 (compared to the R37 required by the Snowmass building code), the walls are R20, and the basement walls R17.5.

Schendler's choice of heat pump system took environmental commitment to the next level. Most closed system pumps use antifreeze containing chlorofluorocarbon to keep the heat-exchanging medium in the condenser coils liquid. Some models replace CFC with less toxic hydrochloroflourocarbon. "Our system contains neither CFC or HCFC," Schendler said proudly.

The pump came from Canadian manufacturer, Ice Kube Systems Inc. "It cost us more and it's not a feature that the community can see, let alone appreciate," he admitted. "But it was worth it to eliminate the use of ozone-depleting chemicals in our operation."

In building the Sundeck, Schindler learned that a second opinion could mitigate some of the super-green system's expenses. One of the LEED requirements for certification is commissioning—having an independent engineer inspect the HVAC system to make sure it is operating according to specifications. "In most buildings, they don't," said Schendler. "An architect draws the system, a mechanical engineer designs it, a contractor builds it and the owner operates it, and they never



The Snowmass Golf Clubhouse in Aspen, Colo., was built with the latest in green construction technology. Owner Aspen Skiing Company has applied for a LEED gold certification. (Photo courtesy of Aspen Skiing Company)

talk to each other. We realized how valuable it was to have that third-party inspection when we had it done for the Sundeck."

The resort made it a policy to have all their buildings commissioned, and brought in an engineer at the beginning of the design process for the Snowmass Clubhouse. "He told us that we didn't need as many heat pumps as we thought to heat the building. We saved \$10,000 right there and paid for his fee," Schendler recalled. "It was a classic victory for green techniques."

Sustainable wood product

A tight building envelope makes indoor air quality all the more critical, a factor LEED certification takes into account. All carpet, paint, sealants, glues, plywood and particle-board in the Snowmass Clubhouse contain low levels of volatile organic compounds. The carpets are made of 30-percent recycled and 100-percent recyclable material. "It's a healthier work environment and a pleasant place to visit, albeit lacking the 'new car' smell," added Schendler. "That is mostly the result of chemical offgassing."

Half the wood in the building is certified as “sustainably harvested,” meaning no old growth or clear-cutting methods were used in harvesting. No trees died for the cabinets, which are made from an agricultural waste product called Strawboard.

That may not be good enough to earn the LEED credit for wood. A building must use 50 percent wood that is certified by the Forest Sustainability Council, but only 30 percent of the clubhouse wood carries that designation. As an alternative to FSC choices, the contractor suggested Weyerhaeuser Lyptus, a eucalyptus wood grown in South America in a sustainable and environmentally responsible manner. “Unfortunately, Lyptus doesn’t meet the LEED standard,” said Schendler. “We ended up spending about \$12,000 more and not getting the credit.”

High efficiency plumbing

As stringent as they are, LEED standards don’t address all building code requirements, which can pose challenges for the committed green builder. To cut water use, Schendler selected flow restrictors, 1.8-gpm showerheads and special toilets that use 30 percent less water than conventional high-efficiency models through a low flush option. “I was telling the contractor about these great dual-flush toilets, and he asked, ‘Are they ADA certified?’” recalled Schendler. “Embarrassingly, I answered, ‘AD what?’”

In his excitement at finding a toilet that radically reduced water use, the environmental director forgot to check whether the fixtures complied with the Americans With Disability

Act for handicap accessibility. “We finally found an Australian company, Caroma, that manufactured accessible dual-flush toilets. Luckily, we also found a Denver distributor for the Caroma Caravelle, so it didn’t cost significantly more than we had planned.”

What’s inside isn’t all that counts in green building. ASC landscaped the clubhouse grounds with native plants and installed an advanced irrigation system to water them. The landscaping can be maintained with half the water the previous site required.

Contractor buy-in

ASC held the grand opening for the Snowmass Golf Clubhouse June 16, but doesn’t expect a verdict on the LEED certification until early fall. If the building gets the gold, said Schendler, ASC will share that accomplishment with the contractors. “If we learned one thing from the Sundeck, it is that the architect and the engineer have to buy into the project. They have to be zealots,” he advised anyone considering building green. “Start early and get an integrated team that shares your vision. If the team doesn’t understand, the project is sunk before it comes off the drawing board.”

Since green building comes with a price tag, committed contractors can help owners get their money’s worth.



Technicians install the Ice Kube geothermal heat pump system for Snowmass Golf Clubhouse. ASC went to a Canadian company to find a unit that did not use ozone-depleting chemical in the condenser coil liquid. (Photo courtesy of Aspen Skiing Company)

Schendler estimates that green measures added about \$100,000 or 3 percent to a \$3 million project. “We’re looking at a 10-year payback, not bad for a public building.”

In the end, however, it is not about money for Schendler and the Aspen Skiing Company. “Real green development is the responsible way to smooth local government approvals, appease the public and improve corporate perception,” he explained. “Our company believes in protecting the mountain environment that provides our jobs.”

Spoken like a true champion. ⚡

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Reverse osmosis gives Julesburg, Colo., water supply new lease on life

Getting the best performance from a new appliance or system involves a certain amount of trial and error, whether it is a home theater, a lawn mower or—in the case of Julesburg, Colo.—a reverse osmosis water treatment facility.

The town is located in the state's northeast corner, surrounded by farms and feedlots. Nitrates from fertilizer and manure leach into the groundwater, driving the mineral concentration in the town's three wells as high as 16 parts per million, compared to the state limit of 10 ppm. "We've been looking for better water since 1949," admitted Julesburg Utility Manager Allen Coyne, "but it was hard for the town council to justify the kind of investment a water treatment plant required."

State and Federal regulations have a way of forcing hard decisions, however. In 2000, the Colorado Department of Public Health and Environment ordered Julesburg to clean up its water supply.

Point-of-use technology

The council began to weigh options for bringing its water quality up to standard. Those options included digging a new well field or importing higher quality water from the Ogallala Aquifer, but complicated water transfer rights ruled out both alternatives.

Another possibility was installing point-of-use filters on every metered customer—768 individual units.

That approach presented a whole new set of problems. "Only water from indoor taps would meet drinking standards. Filters would have to be changed every six months, so our service technicians would have to be bonded to go into homes. Owners would want to be home when the workers were there," he ticked off the disadvantages.

While point-of-use units ultimately proved too expensive and inefficient to pursue, the technology suggested an answer to Julesburg's water treatment woes. Many residents had already installed their own point-of-use reverse osmosis filters to remove the nitrates from their drinking water. "We knew RO was very effective at a residential scale, and we knew that Brighton, Colo., was using RO to treat its water," he said. "Once we started doing the research, it was clear that reverse osmosis was the best way to treat water for the entire town."

Computer-controlled motors

The system draws water from the town's three wells, each of which is fitted with a 100-hp pump operated by a computer-controlled, variable-speed drive. The four RO pumps are powered by 75-hp motors and 35-hp booster motors.

For every 350 gallons of water the system treats, 250 denitrified gallons are sent to two storage facilities



Four reverse osmosis pumps remove nitrogen and other impurities from Julesburg, Colo.'s well water. The purified water would leach minerals from the town's ductile iron water pipes, so it must be blended with well water to restore its pH balance. (Photo courtesy of Julesburg Utilities)

totaling one million gallons, and 100 gallons of highly concentrated water goes to Julesburg's upgraded sewage treatment plant. The town built a \$1.7 million package sewer plant to take care of the excess water.

Tinkering saves electricity

At the storage facility, the purified water is blended with untreated well water. "Our water lines are ductile iron, and purified water sucks the minerals right out of the metal," explained Coyne. "Mixing well water and purified water restores enough of the pH to protect the pipes."

In its first year of operation, the plant sent out a 50-percent treated/50-percent well water mix and had an electrical bill of \$42,000. At the council's request, Coyne boosted the ratio to 65/35 the next year and watched the plant's electrical costs go up to \$51,000. "For each 5-percent

See REVERSE OSMOSIS, page 11

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APPA guidebook aims to increase small utilities' use of renewables

Small and medium municipal utilities face unique challenges in trying to add more renewable energy to their power mixes, but a new tool will soon be available to answer questions and aid in the planning process.

The American Public Power Association's Demonstration of Energy-Efficient Developments Program, Gila Resources, Western Area Power Administration, the U.S. Department of Energy GeoPowering the West Program, DOE Wind Powering America Program and the Public Renewables Partnership teamed up to create An Implementation Guidebook to Expand the Role of Renewables in an Energy Supply Portfolio.

Step-by-step manual

The step-by-step manual targets smaller, member-owned utilities, and draws on strategies other utilities have used to increase their percentage of renewable energy.

"The guidebook lays out the process for considering renewable resources—especially wind and geothermal—in smaller public power system resource portfolios, an analytical process normally afforded to larger utility companies," said Western's Renewable Resource Program Manager Randy Manion.

Scheduled for release in August 2004, the guide walks utility managers through key resource planning considerations, including measuring, analyzing and comparing alterna-

tives. An available Excel-based software tool allows utilities to evaluate the costs, benefits and risks of adding renewable energy to their resource mix in increments of 2, 5, 10 or 20 percent.

Western builds partnership

Figuring out how to meet the specific needs of a small public utility was a valuable learning experience for Gila Resources, which became a test case for the guidebook and the project sponsor.

"A critical difference is that compared to investor owned utilities, public power providers are usually understaffed and have less money," said Brian Walshe, president of Altera Energy Consultants. "When you don't have the staff or budget for planning, it's more difficult to evaluate and understand the trade-offs with whatever green power product the provider offers."

Small utilities also have different types of contracts, making the cost-vs.-risk of adding renewables to their portfolio different from IOUs, noted Ken Mecham, Gila President and CFO. Like many small utilities, Gila Resources is a full requirement customer, meaning that it purchases all its power from a power wholesaler.

"Typically, we might contract for firm delivery of a small portion of renewable energy at a higher cost than what we are paying for conventional generation," Mecham said. "We can plug those numbers into the spreadsheet program and see what the

effect of the purchase will be. If the renewable energy replaces peaking power bought at market rates, the cost might be offset."

Brian Walshe agreed, "With the guidebook and software, a small utility can see the benefits of adding renewables from other sources, including their own small generation."

The completed *Implementation Guidebook to Expand the Role of Renewables in an Energy Supply Portfolio* will be available to APPA's DEED members, and available for purchase by other interested parties.

Customized planning

The guidebook will help to remove some constraints that stand in the way of small utilities wishing to add more renewables to their portfolio, Walshe believes. "It will give them the ability to create their own customized, comprehensive resource plan," he said, "and that's where renewable energy emerges as a cost competitive option."

Manion agrees that small utilities will find the publication an invaluable tool. "There are many reasons to invest in renewable resources, from environmental stewardship to energy price risk mitigation," said Manion. "The Guidebook will serve as a roadmap to determine why to invest in renewable resources, how to conduct resource analyses, how to determine safe project investments, how to involve the public and how to deliver information to the board of directors or city council." ⚡

Want to know more?

Visit www.wapa.gov/es/pubs/esb/2004/august/aug049.htm

Geothermal workshop reacquaints utilities with valuable resource

In the large family of renewable resources, it seems that geothermal is sometimes the unseen renewable, a situation Western and GeoPowering the West are setting out to change with workshops targeting public power utilities.

Southern California Public Power Agency and Northern California Power Agency each hosted a December 2003 workshop, in Pasadena and Sacramento respectively. Speakers from the Public Renewables Partnership, U.S. Department of Energy GeoPowering the West Program, and GeothermEx energy developers shared the latest news about a resource already familiar to the public power providers in attendance.

“California and Nevada get four to five percent of their electrical energy from geothermal plants, so it’s not new to utility managers in these states,” said GPW Technical Director Roger Hill. “Our goal was to remind utilities of the advantages of the technology and let them know about recent progress in the field.”

Baseload capabilities

Those benefits include one compelling advantage over intermittent renewables: geothermal electricity can provide baseload power since it is not limited by intermittency. The plants typically operate at capacity factors of more than 90 percent. That means that a geothermal power plant delivers close to its maximum output most of the time.

Since virtually all the nation’s via-

ble geothermal generation and direct use resources are located in the western United States, geothermal energy represents an economic development opportunity for the region. The lack of a production tax credit for development and a limited renewable energy market has kept geothermal resources from being a larger fraction of the generation portfolio. However, the same factors that have made other renewable energy sources more cost competitive—rising natural gas prices, revenue from tradable renewable credits, and national security concerns—are having the same effect on geothermal generation.

Development of geothermal resources languished in the ‘90s when the price of wholesale power dropped, but the current decade has seen a comeback. The current administration’s move to ease restrictions on energy development on Federal lands may lead to more geothermal exploration and development. Workshop participants all agreed that a production tax credit would be necessary to reinvigorate the industry and tradable tax-credits for consumer-owned utilities are essential.

Crash course

The workshops opened with an overview of geothermal energy, geothermal resources worldwide and geothermal use presented by Earth Scientist Jim Lovekin of Geothermex and Technical Program Manager Ray Dracker. Attendees learned about



These geothermal resource maps show a great potential for development of this renewable energy source in the western United States. (Maps courtesy of Idaho Engineering and Environmental Laboratory)

environmental benefits and challenges, siting issues and policy issues pertaining to geothermal energy.

Lovekin and Dracker particularly emphasized the findings of a \$6 million research program funded by the Public Interest Energy Research of the California Energy Commission through the city of San Francisco, California. The study includes evaluation of geothermal resources and transmission constraints in California and Nevada. A key conclusion of the study was that the region’s geothermal capacity has the potential to conservatively expand as much as 4,000 MW. The agenda also covered economic concerns, emerging technologies and transmission issues. Studying the possibility of installing a mid-point tap on the Pacific-DC

Want to know more?
Visit www.wapa.gov/es/pubs/esb/2004/august/aug0410.htm

Intertie that transfers electricity between Oregon and southern California was also discussed. That pathway could be critical for carrying electricity generated by existing and planned geothermal plants.

Future workshops

Audience participation was strong, with a large portion of the workshop devoted to answering questions from utility representatives and listening to their comments. Gaining feedback was one of Western's goals in sponsoring the workshops with GeoPowering the West and PRP.

"It was an excellent opportunity to talk to our customers and find out what they know about geothermal energy, what additional information they'd like to have, and how best to

deliver this information to them," said Renewable Resource Program Manager Randy Manion.

Participants expressed an interest in learning more about the characteristics associated with geothermal energy, transmission issues and development opportunities. Many had questions about the large-scale project at the Salton Sea in the Imperial Valley. However, aggregated joint projects may be the answer for smaller municipal utilities looking to procure new renewable energy in small chunks.

Western and GeoPowering the West believed that the geothermal utility workshops set the stage for future outreach efforts in other states where a rich renewable resource hides below the surface, waiting to be tapped.

Renewable resources

"Geothermal energy is classified as renewable generation in many states' renewable portfolio standards," said Hill. "It's important for utilities to be aware of the option and include it in their planning for renewable resources."

Western and GeoPowering the West are planning a series of geothermal workshops and Web casts specifically for utility resource decision makers as a result of these two past workshops in California. The geothermal industry will be included as participants in these proceedings. Utilities interested in learning more about these workshops and geothermal power opportunities should visit the PRP Web site for more information. ⚡

Reverse osmosis

from page 8

increase in the amount of treated water in the blend, we found there was roughly an 8-percent increase in electrical costs," Coyne estimated.

The plant reduced the mix to 60/40 this year and expects to see a corresponding drop in electrical use. Coyne believes that the 50/50 mix may turn out to offer the best return on water and electricity while protecting the town water lines.

The five-year drought cycle gripping the west must also be factored into water use and operating costs, he pointed out. In 2001, the

town used 165 million gallons. The following year—the same year the water plant experimented with a higher treated-water mix—was one of the driest on record, and Julesburg residents used 185 million gallons. "The more water they use, the more we have to make, the higher the operating costs," the utility manager said.

In the meantime, the utility continues to collect performance data on its RO water treatment plant and fine tune its operation. Adding a new function to a system may increase



The blended water in this 750,000-gal. water tank supplies Julesburg residents with clean, safe water that meets the state's standards for nitrogen concentration. (Photo courtesy of Julesburg Utilities)

its energy use, but efficiency can still be part of the package, if you take the time to get to know your equipment. ⚡

Power Line shows supermarkets how to shop for energy savings

Editor's note: This is the first of two stories from the Power Line on energy efficiency measures grocery stores can use to control operating costs. Look for more tips for energy efficient grocery stores in the October Energy Services Bulletin.

For small rural electric cooperatives and municipal utilities, grocery stores can represent large key accounts, ones that are particularly vulnerable to fluctuating energy prices. A Western customer recently asked the Power Line, the Western-sponsored energy information clearinghouse, about ways to improve energy efficiency in a grocery operation. The Power Line responded with a wealth of suggestions, many targeting the food sales industry's single largest energy user.

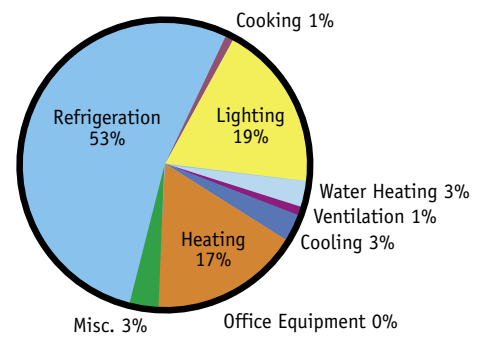
The key to conserving energy in any business is knowing which operations consume the most energy. Like other businesses, lighting, heating and cooling and office equipment are a part of supermarkets' energy use profile. Typically, however, grocery stores use more energy for refrigeration than the other operations put together.

Several measures can reduce the cost of refrigeration. Some are inexpensive while others require a significant investment, but conservation in this area gives a double hit on savings. Cold air from refrigerated cases and walk-in coolers enters the store, increasing the energy needed to heat the building in winter so reducing refrigeration also translates to lower heat bills.

On the no-cost side, Energy Star offers the following refrigeration tips to help grocery stores save money and energy on refrigeration needs:

- **Keep doors shut**—Repeated fluctuations in temperature will damage food quality and cost money.
- **Check temperature settings**—If settings are lower than necessary, the system may be wasting energy. The most common recommended settings are between 14 degrees below freezing and 8 degrees below freezing Fahrenheit for freezers and between 35 degrees and 38 degrees Fahrenheit for refrigerators.
- **Clean cooling and evaporator coils**—Dirt accumulation impairs heat transfer and lowers the efficiency and capacity of refrigerators. Keep evaporator coils free of ice build-up. Don't forget the condenser coils, usually located on the building roof. Also, do not put a sprinkler on the roof to help cool the condenser coil, as domestic water contains mineral that can damage the coil.
- **Check door seals**—Tight seals and properly closing doors prevent warm air from entering the unit, which reduces cooling energy and prevents frost buildup. If a dollar bill slides easily into the seal, have the seal adjusted.
- **Maintain equipment**—Performing scheduled maintenance on any type of business equipment improves an operation's efficiency.

Taking common sense to the next level provides more refrigeration efficiency. Stores that do not operate 24



Typical Energy Consumption in Supermarkets*

*Climate Zone 1, less than 2,000 cooling degree days, greater than 7,000 HDD.
Source: U.S. Energy Information Administration

This pie chart shows that refrigeration consumes more than half of the average grocery store's energy budget. Lighting and heating are the second and third greatest energy consumers, respectively. (Graph courtesy of the U.S. Energy Information Administration.)

hours a day can save energy on their open-air cases by installing curtains to cover the case openings. This acts like a closed door on the case, sealing in the cold and significantly reducing the load on the refrigeration system.

When products are being moved to and from walk-in coolers, the doors are often left open for extended periods of time. Cold air flows into the store, creating a load on the heating system, while the refrigeration system tries to cool the space the heating system is warming up.

A simple solution is to add strip curtains. This minimizes the loss of cooling from the walk-in while the door remains open for staff and equipment to pass through. Since cold air sinks, the curtains should reach the floor to keep cold air from escaping at the bottom.

Automatic doors offer a more complete, but more expensive solution. The strip curtains should still be used with doors that close and open by a pull cord or button.

Lighting fixtures in older re-

frigerated cases can be big energy consumers. Many use high output ballasts because they work better at colder temperatures than regular ballasts. Try the new “cold weather” electronic ballasts that can be used with the lower wattage T-8 bulbs, measuring one inch in diameter, and 5/8-inch T-5 bulbs. These lower wattage bulbs often put out more and better quality light than older ones, and add less heat to the case. This savings potential could be as high as 10 percent.

Adjust energy use

Environmental conditions—ambient temperature, humidity, etc.—affect most electrical equipment and this is especially true of refrigerator units. Adding a variety of controller units to different system components can yield significant energy savings.

Most head pressure controls, as these are called, are set to a level that remains fixed regardless of the outside temperature. However, the system should not have to work as hard in cool weather since the condenser—

the coil on the roof that cools the refrigerant—is in cooler air. By installing floating head pressure controls, the controller can automatically adjust downward as conditions allow for energy savings of 3 to 10 percent.

The condenser, which exhausts heat from the refrigeration system, and the evaporators that cool the walk-in cooler and product cases use electric motor-powered fans to cool the fins. High-efficiency motors do the same work with less energy. Changing to energy-efficient motors can save between 5 and 13 percent per year.

Evaporator fans that operate continuously to mix cold air and distribute it to products also generate heat. Several manufacturers make controllers that reduce the fan motor’s speed to minimize the heat when cooling is not needed. The fan continues running at a reduced speed until the thermostat calls for cooling. Then, it speeds up to blow air over the evaporator coils and cool the space. Contact the Power Line for more information about this equipment.

Many freezer cases have glass doors, which are excellent at saving energy and maintaining product quality. However, when the door is opened, moisture from the warmer store air condenses on the glass fogging it, so the product can’t be seen. Door manufacturers solve this by installing anti-sweat heaters to keep the door glass warm.

Glass fogs less during winter months and in dryer climates where the moisture content of the air is lower. Adjustable anti-sweat heater controls detect these differences in the environment and pulse the heaters on and off to save between 6 and 20 percent, depending on conditions. These controllers are relatively easy to install and can be adjusted automatically. In some cases, the refrigeration system may already have this feature and it just needs to be hooked up.

Western’s Energy Solutions offers information specific to grocery stores and anti-sweat controls. ⚡

Want to know more?

Visit www.wapa.gov/es/pubs/esb/2004/august/aug047.htm

Solar industry

from page 3

One reason governments subsidize industries is to create jobs, and solar has great potential in that department. Statistics compiled by SolarPort indicate that photovoltaic production creates eight times more jobs per megawatt/hour than coal or gas and three times more jobs than wind or biomass. Participants expect the New Mexico

project to create initially about 30 jobs in solar panel assembly, installation and related work. The prospects for additional jobs are significant as state utilities buy increasing amounts of renewable energy to comply with the RPS and to earn the extra credit the new law provides for solar power.

In a region that relies heavily on tourism and agriculture, the prospect of job growth will no doubt help to build the case for renew-

able energy. In Reyes’s opinion, however, local generation may be the strongest marketing tool for the project. “It’s hard to sell people renewable energy that’s coming from Salt Lake City. They don’t know what the source is,” he asserted. “But those solar panels give them something to believe in—clean energy, economic development. They will pay for something they can see.” ⚡



TOPICS from the POWER LINE

Many software packages can help predict energy use

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.

Question:

An individual recently contacted us for energy usage information on a proposed new 67,000-square-foot assisted living center. It will have common areas, pool, full kitchen and dining facilities and 100 rooms with air-conditioning and heating. Gas will be used for water heating and cooking. The walls will be insulated to R-20, and R-38 in the ceiling. Do you know of any software that can be used to predict energy use for facilities?

Answer:

The best place to see most of the software packages available and compare their features is at the U.S. Department of Energy's Web site. The Tools Directory lists building energy software at "Whole Building Analysis." This site gives full descriptions of each software package and highlights those that are free.

Here are some of the more common packages:

- **EnergyPlus** is a new generation building energy simulation program that builds on the most popular features and capabilities of BLAST and DOE-2. EnergyPlus includes innovative simulation capabilities, including time steps of less than an hour, modular systems and plant integrated with heat balance-based zone simulation, multi-zone air flow, thermal comfort and photovoltaic systems. **Cost: Free**
- **EZ Sim** is a quick spreadsheet tool that is equivalent to sophisticated engineering analysis. The program uses utility bills to calibrate a simulation of a commercial facility in an interactive graphic window. **Cost: \$199 and \$299**
- **eQUEST** is a sophisticated, yet easy-to-use, freeware building energy use analysis tool which provides professional results with an affordable level of effort. It allows the user to perform detailed comparative analysis of building designs and

technologies by applying sophisticated building energy use simulation techniques without requiring extensive experience in the "art" of building performance modeling. **Cost: Free**

- **DOE-2** offers an hourly, whole-building energy analysis program for calculating energy performance and life-cycle operation cost. It can be used to analyze energy efficiency of given designs or efficiency of new technologies. **Cost: Free**

- **PowerDOE** is a powerful and flexible building energy use and cost estimation tool. It includes a graphical user interface that provides 2-D and 3-D displays of your building layout, including architectural and HVAC features, as well as graphical modeling results. **Cost: \$278**

This is just a sampling of what is available. We encourage you to take the time to look through the whole list of available software before you make your decision to choose the appropriate software to meet your project's needs. ⚡

Want to know more?
Visit www.wapa.gov/es/pubs/esb/2004/august/aug0411.htm

Technology Spotlight: Exploring power factor myths

This column features helpful information, innovative equipment, systems and applications utilities can use to save energy and improve service.

by Johnny Douglass

Power factor is the most misunderstood and dreaded electrical phenomenon outside of ball lightning and zaps from door handles during cold dry weather, but in reality, it should not be that mysterious.

In AC circuits, simple resistance loads like incandescent light bulbs and baseboard heaters draw electrical current (the flow of electrons) exactly in sync with the voltage. Other loads, most notably induction motors, exhibit something like electrical inertia. They like to keep the current flowing in the same direction, which delays its rise and fall a few milliseconds relative to AC voltage. This delay is called phase lag.

Why does phase lag matter? Power is delivered to the load any instant during which current is moving in the direction voltage is trying to move it. AC voltage changes polarity 120 times per second. When there is a phase lag, current still coasts

in the contrary direction for a few milliseconds after each change of AC voltage polarity. In those moments, the load is actually sending some of the energy back into the line.

That requires a higher capacity distribution system sized to handle all the energy traffic, not just that which flows in the desired direction. Power factor is the ratio of the net energy flowing to the load to the total energy traffic both to and from the same load. Reactive power is just the back and forth portion of the gross energy traffic.

There are quite a few myths about power factor. These myths need to be busted:

Myth 1A: Using capacitors to correct power factor of a motor helps the motor run better, cooler and more efficiently.

Fact: Correcting power factor only affects the electrical system ahead or upstream of where the capacitors are added. The motor does not even know the power factor has been corrected; the power factor at the motor terminals is unchanged.

Myth 1B: Efficiency and reliability are reduced for all devices powered from an electrical system

with low power factor.

Fact: Connected devices only respond to voltage. They cannot detect or experience effects of reactive power flowing in the system from other loads.

Myth 2: Reactive power is a strange or weird form of power that represents energy somehow escaping from doing useful work.

Fact: There is no mysterious escaping energy associated with reactive power. There is just a small increase of additional distribution losses because the distribution system is carrying more current.

Myth 3: Correcting power factor brings large double-digit energy savings from the reduction of distribution losses in a facility's conductors and transformers.

Fact: The total distribution system losses on the customer's side of the meter from both reactive and real power are usually not more than 2 percent and very rarely as high as 4 percent. You cannot save more than you were losing in the first place.

(Note: Douglass is a registered professional engineer with the Energy Services Clearinghouse.)

Want to know more?

Visit www.wapa.gov/es/pubs/esb/2004/august/aug04spot.htm

New diagnostic tools

Western's Energy Services Equipment Loan Program recently purchased an ultrasonic leak detector and two infrared cameras.

The ultrasonic leak detector is simple to use and can interpret a broad band of high frequency sound. This instrument senses the sound from the turbulence given off by a leaking gas, liquid or vacuum, or

the sound from mechanical systems, such as worn or failing bearings or gearboxes. It can also be used to check for the proper operation of valves and steam traps, for electrical arcing, loose or wearing belts, leaking ductwork and hydraulic leaks.

The two new infrared cameras are digital imagers that save the images to a flashcard. They include a removable high-resolution LCD monitor

with controls to operate the imager remotely, a higher capacity belt-mounted battery and report processing software.

For more information on the uses of these and other instruments available through the Equipment Loan Program, contact Rich Burnkrant at 720-962-7420. Equipment can be reserved with the online equipment request form. ⚡



Energy Shorts

New guide is primer on pumping system efficiency

Since pumping systems account for nearly 20 percent of the world's energy used by electric motors, they offer tremendous opportunities for energy savings. Users can realize those savings with *Variable Speed Pumping: A Guide to Successful Applications*, now available through the U.S. DOE Industrial Technologies Program.

The cost for Variable Speed Pumping: A Guide To Successful Applications is \$95. A free copy of a 16-page Executive Summary of the Variable Speed Pumping Guide can be downloaded at the Office of Industrial Technologies Web site.

Biodiesel fueling stations spread through Colorado

Denver (Colorado) Mayor John Hickenlooper and Blue Sun Biodiesel announced the opening of 10 new Colorado B20 (20 percent biodiesel-80 percent diesel) biodiesel stations in May.

With the opening of the new stations, diesel vehicles will be able to fill up with cleaner burning fuel at 13 retail locations: Offen Petroleum in Denver, Bartkus Oil and a RTD fueling site in Boulder, Shoco Oil in Commerce City, Heartland Town and Country in Fort Morgan, Acorn Petroleum in Pueblo, Acorn Petroleum in Colorado Springs, Ampride 1 in

Sterling, Brennen Oil in Durango, Catherine store in Carbondale, Cox Oil Company in Greeley, LaSalle Oil in LaSalle and Poudre Valley Co-op in Fort Collins.

ACORE publishes renewable energy finance directory

The American Council on Renewable Energy released a draft of its soon-to-be-published North American Renewable Energy Finance Directory at its June 23 finance conference in New York.

The directory is designed to assist project developers and entrepreneurs seeking capital and investors looking for financing vehicles. It will contain information on sources of finance for renewable energy and energy efficiency in the United States. Information for each funding source includes program terms, sectors served and contact information. Project debt, project equity, mezzanine financing and venture capital are among other topics covered in depth. In addition, the matrix includes Federal agencies, state and local agencies and foundations.

ACORE is accepting additions at its Web site.

Riverside Public Utilities programs win PR awards

The California Inland Empire Chapter of the Public Relations Society of America recently honored

the City of Riverside Public Utilities Department for several public information programs.

CIEC-PRSA's highest honor, the Polaris Award, went to RPU's Green Power and Tree Power campaigns. The Green Power campaign successfully developed customer awareness and support for the utility's increasing use of renewable wind, water, solar, landfill gas and geothermal energy resources.

Bacon Elementary wins Wirth Chair award

At a March awards luncheon, a group of Fort Collins, Colo., students were named Environmental Ambassadors of the Year by the Wirth Chair in Environmental and Community Development at the Graduate School of Public Affairs, at the University of Colorado, Denver. The annual awards honor group and individual contributions to advancing sustainable development strategies, policies and programs.

The students of Bacon Elementary participated in a class to learn about their new state-of-the-art, energy-efficient building and then gave tours to the public while explaining how a number of sustainable systems work.

Calendar of events

Visit Western's regularly updated Energy Event Calendar for a complete list of seminars, workshops and conferences.
<http://www.wapa.gov/es/pubs/esb/2004/june/jun04coe.htm>

Want to know more?
Visit www.wapa.gov/es/pubs/esb/2004/june/jun04spot.htm