November 2007

Energy Services BULLETIN

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

Community colleges fill need for trained wind technicians

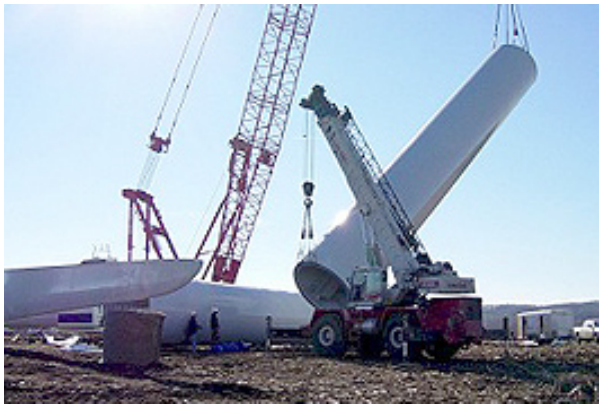
Job creation is considered one of the great fringe benefits of renewable energy technology, but sudden growth—particularly in solar and wind development—has created something else: a shortage of qualified employees to fill those jobs. Fortunately for the wind industry, some progressive community colleges are preparing students to take their place in the new energy economy.

New program

The Wind Energy and Turbine Technology program at Iowa Lakes Community College started three years ago as an idea to reduce operating costs. The Estherville campus had the twin distinction of having the highest electric bills and the best wind resources in Iowa Lakes' five-county service area, so the board decided to install a wind turbine.

In the course of researching installation, a logical question arose: Who was training the technicians to work on wind turbines? Al Zeitz, a site supervisor for GE at the time, told the board, "No one was doing training. Basically, wind development companies were just competing for each other's employees," he said.

Iowa Lakes recognized an opportunity to fill a gap while ensuring that there would be qualified technicians to service its new, 1.65-MW, Vestas V-82 wind turbine. Zeitz became the program's first instructor, and was joined the next year by another teacher. The program recently added two more instructors with engineering backgrounds.



Iowa Lakes Community College built a wind turbine to cut electrical costs and started a program to train wind technicians. Students get hands-on experience operating the school's V-82 turbine. (Photo by Iowa Lakes Community College)

The first year Iowa Lakes offered the program, 15 students enrolled. Current enrollment includes 45 new students and 22 students returning from summer internships. "We expect about 90 students to sign up next year," he said. "We've had to limit the class size to ensure the quality of the training."

Industry support

Designed to train entry-level wind technicians, the program offers a one-year diploma and a two-year associate degree in applied sciences. The one-year curriculum provides a solid background in electrical theory, motors, hydraulics and business skills, as well as wind basics. Students who choose the degree program also learn about meteorology, turbine siting, associated computer applications, component repair and management.

The program is well equipped to teach students the wind trade. Using equipment from other electrical training programs, students start learning the basics and work up to operating the campus's turbine. Last year, Vestas donated a nacelle (the top portion of a wind turbine) and some gearboxes to give students hands-on experience with components they will find on the job. TriCo TCWind, a local wind repair company, contributed trucking to deliver the components to campus, and PPM Energy gave the school $100,000 to double the program's building space.

A paid summer internship at a wind site is part of the diploma program. Vestas has placed students on wind construction projects all over

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Wind technicians

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the country. This year, three students went to Ireland to work on a project for B9 Energy Group. "Companies encourage students to come back and finish their associate degree, and then offer them jobs," said Zeitz. "I've heard about project supervisors fighting over who is going to get a student after he graduates."

Iowa Lakes invited partnership from the beginning, and the wind industry has been incredibly supportive, Zeitz acknowledged. An advisory committee of wind development professionals meets with the instructors twice a year to discuss curriculum and shape the program's direction. "Anyone can throw together a curriculum," said Zeitz, "but to do it right—to graduate students with the necessary job skills—you have to get input from the industry."

New Mexico program

Zeitz pointed to Mesalands Community College as a school committed to "doing it right." The Iowa Lakes program has shared lessons learned to help the Tucumcari, N.M., community college establish its own program, the North American Wind Research and Training Center.

Energy Services Bulletin

The Energy Services Bulletin is published by Western Area Power Administration for its power customers. The mailing address is Western Area Power Administration, P.O.Box 281213, Lakewood, CO 80228-8213; telephone (720) 962-7065.

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NAWRTC will offer high-quality training for operations and maintenance and wind farm management starting in fall 2008. Technology Director Jim Morgan share's Zeitz's view that industry input is critical to a training program's success. "We are developing a curriculum based on industry need," he explained.

According to NAWRTC's 2005 feasibility study, the industry needs innovation and best practices for wind turbine operations and maintenance. As Morgan explains it, the wind industry initially focused on getting turbines up, while research concentrated on making turbines more powerful and efficient. "Now that wind is more mainstream, there is a need to pay more attention to the business aspects of wind generation—reliability and facility management," he said.

NAWRTC's research program will explore operations and maintenance efficiencies, wind energy storage technologies and other public and commercial issues. Sandia National Laboratories and New Mexico State University will conduct research at the center based on industry needs.

Turbine for work, research

Just as important as the research is the hands-on experience the training program plans to provide. NAWRTC is waiting to open its doors until it has its own wind turbine. "Our research partners need to be able to run tests on an operating turbine, and students need to know what it's like to climb up a real tower," said Morgan.

The college approved a $2.2 million contract with GE in July for a 240-foot wind turbine. Funding came from the state legislature and Department of Labor. The state has been very supportive of NAWRTC, maybe not surprising, since New Mexico has two U.S. senators (Pete Domenici and Jeff Bingham) on the Senate Energy and Natural Resources Committee, and Gov. Bill Richardson is a former U.S. Secretary of Energy.

The turbine is scheduled to be completed by the time classes start in November 2008, though Morgan noted, "It would be great to have a summer session so students could participate in installation."

Looking for instructors

In the meantime, the center must clear the hurdle of finding qualified teachers, a challenge Iowa Lakes has also faced. "We see two types of candidates," said Morgan, whose own background is in nuclear engineering. "Good teachers who know electrical theory but don't know wind, and wind industry professionals who haven't taught."

Another problem is that teaching salaries can't compete with what wind developers are offering technicians. "But we've managed to round up some very promising candidates," said Morgan. "Maybe some will see this story and apply," he added.

It isn't easy to design a training program for a new technology, but Iowa Lakes and Mesalands are willing take on the challenge. The colleges are being rewarded with a strong positive response from both students and the wind industry. After all, people need jobs in an industry with a bright future, and wind power needs qualified workers if it is to keep growing. And in between is an opportunity for visionary community colleges to meet a real need.

Want to know more?
Visit www.wapa.gov/es/pubs/esb/2007/nov/nov071.htm

LADWP explores O&M options for utility-owned wind facilities

Maintenance is a responsibility of ownership, and a very good reason why utilities seeking wind power often opt to purchase it from facilities owned and operated by private developers. The Los Angeles Department of Water and Power may become the first utility in the country to accept that responsibility for its new Pine Tree Wind Farm project.

The municipal utility is building the 120-MW Pine Tree Wind Farm to contribute to the city's goal of obtaining 20 percent of its power from renewable energy resources by 2010. Eighty General Electric turbines will occupy a remote site partly owned by LADWP, and partly leased from a nearby rancher. LADWP is in the process of improving roads to the area and plans to begin construction by the end of the year.

Utility-owned generation

"LADWP's goal is to be self-sustaining," said Electrical Services Manager Steve Fuller. The utility already owns and operates several small hydroelectric plants, a large pump storage hydroelectric facility and several steam plants, he noted. "It makes sense to take the same approach to wind energy."

That experience has created a deep pool of engineering and construction talent within the heavily union-operated utility. It was at the request of its union, the International Brotherhood of Electrical Workers Local 18, that LADWP decided to keep the operation and maintenance of the wind farm in-house. The standard GE warranty uses GE technicians to operate and maintain the LADWP equipment for two years, and covers labor and parts for warranty repairs. Because LADWP is performing its own operations and maintenance, GE will only be covering parts for the two-year warranty period.

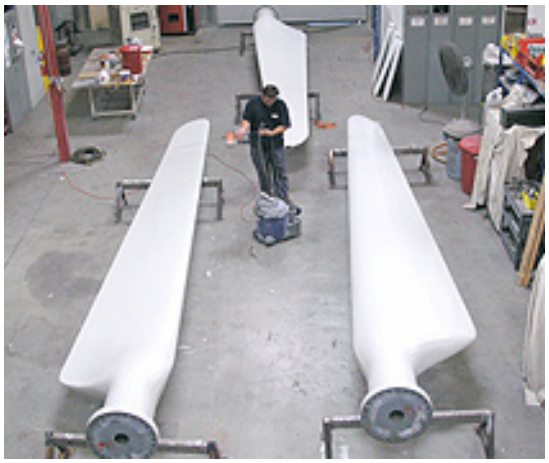
Figuring out how "wind smiths" and other O&M positions fit into existing union job classifications is proving to be a challenge, however. To find out how other utilities did it, Fuller contacted the U.S. Department of Energy's Wind and Hydropower Technologies Program. What he learned was that other utilities weren't doing their own O&M. "Several owned wind farms, but contracted out the operation," he said.

"Public power providers are just beginning to construct their own wind facilities. Outside of companies that do it for a living, and outside the maintenance manuals provided by the turbine manufacturers, there aren't any 'how-to' guides on setting up an in-house O&M program," said Randy Manion, Western's Renewable Energy program manager.

Partnership supports utilities

An active member of many renewable energy industry groups, Manion also coordinates the Public Power Partnership for DOE's wind power program. The partnership, which includes Western, American Public Power Association and National Rural Electric Cooperative Association among other organizations, works to facilitate utilities acquiring wind energy.

DOE wind program managers asked Manion to help LADWP learn about what was involved in launching a wind turbine O&M program. Recognizing a unique opportunity to start to fill in some knowledge gaps, the DOE program also provided a grant to the partnership to fund a case study on the ambitious project.



LADWP representatives visited EnXco's Palm Springs plant to learn more about wind turbine operations and maintenance. Western helped set up a tour of the facility.

Manion introduced LADWP to the Utility Wind Integration Group. Through the partnership, he also arranged for LADWP representatives to tour the EnXco wind maintenance facility in Palm Springs, Calif. EnXco has 20 years' experience developing, building, operating and managing wind projects throughout North America. The Palm Springs plant provides a full range of turbine component repair.

LADWP questions

In addition to Fuller, several LADWP managers and IBEW business representatives joined Manion and energy professionals from Sandia National Laboratory and CH2M Hill at EnXco Sept. 28. Larry Barr, EnXco vice president of Operations and Maintenance, hosted a presentation

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O&M options

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designed to answer a list of questions LADWP supplied in advance. The questions reflected the utility's concerns about safety, quality control, equipment needs, staffing and training. The company faces the same challenges as other wind developers in finding qualified employees, acknowledged Operations Manager Rick Wehrhan.

Robert Putnam of CH2M Hill, who visited the EnXco plant last year with Manion, said he learned a lot from this tour and presentation. "Instead of focusing on retrofitting, as the previous tour did, this presentation covered issues associated with a new wind farm," he explained.

Following the presentation, the group visited the plant floor and a nearby wind site. "EnXco provided a very detailed, comprehensive picture of wind operations and maintenance, and I think LADWP got everything they anticipated from it," said Putnam.

LADWP representatives found the tour very informative, Fuller agreed. "It was helpful just to see the equipment and hear about rescue training and climbing precautions," he observed.

Maintenance options

The EnXco tour suggested several approaches a utility might take to setting up a wind O&M program. Utility employees might train with a wind maintenance provider to learn the skills needed for the jobs. A contract that allowed utility employees and a provider to team up on maintenance duties, and then transferred responsibilities to the utility over time could be another possibility. "There are lots of partnering opportunities here," observed Putnam. "EnXco is a good resource because the company has been involved in such partnerships before."

LADWP, however, is committed to the do-it-yourself plan, said Fuller. "The wind turbine technician combines four job classifications that the union already has," he said. "It's just a matter of coming up with a plan that uses the classes as efficiently as possible."

Fuller is part of a committee of LADWP managers working with the union on that plan. The next step, he said, is for the committee to visit the Pine Tree site, get inside the turbines and get a "hands-on" feel for the type of equipment the O&M staff will be working on. The committee plans to have the staff on board and trained before construction begins.

Many parties will be following LADWP's progress with interest, but some utilities are not waiting for the completion of the case study. "We have one very large electric cooperative constructing a 200-MW wind farm and they must decide if they will do their own maintenance," Manion said.

Western customers interested in learning more about the LADWP wind turbine O&M program should contact Manion for more information.

Want to know more?
Visit www.wapa.gov/es/pubs/esb/2007/nov/nov072.htm

Western seeks customers for cost-share wind integration study

Of all of the questions utilities have about wind power, the most fundamental may be, "How will a variable generation source effect our power system operations?" Western is looking for consumer-owned utilities interested in finding the answer.

Western, DOE's Wind and Hydropower Technologies Program and the National Renewable Energy Laboratory are teaming up to conduct wind energy integration studies. Specifically, the study will look at the potential impact to the consumer-owned utility's transmission or distribution system, balancing operations and cost of service. "These are basic concerns that stand in the way of utilities placing wind generation in their service territories," said Western Renewables Program Manager Randy Manion. "The data from the studies could potentially pave the way to wider wind adoption."

RPSs drive studies

The partnership is looking for public power providers in Western's 15-state territory that are interested in sharing the cost of the study. The project is focusing on consumer-owned utilities because they have lagged behind their investor-owned counterparts in addressing integration issues, explained Brian Parsons, NREL Wind Applications project manager. "IOUs had to meet renewable portfolio standards, so they were motivated to figure out how wind would affect their operations," he said. "Now that RPSs are starting to include municipalities and co-ops, they need to answer these questions, too."

The fact that consumer-owned utilities often have limited staff has prevented them from examining the effects of wind integration, Parsons added. "The cost-sharing aspect of the program is intended as an incentive," he said.

Subject to funding availability, the qualifying utility(s) will receive a minimum of $200,000 to participate. Parsons estimated that the study would take from nine months to one year.

Operations data needed

The project is different than a conventional interconnection study, which assumes that a wind facility is operating at full nameplate output under the worst conditions of the year. "An operational study takes into account the affect of variability on a system," explained Parsons. "Accommodating variability requires a utility to adjust its generators in different ways to balance the load."

"The cost-sharing aspect of the program is intended as an incentive."

Applicants do not need to have an operating wind farm in their service territory or own their own generation and transmission systems. NREL will provide wind data from a Meso model of the selected applicant's service territory. A Meso model is a computer model of the atmosphere containing all the weather data for one or more years from which site-specific data can be estimated.

Utilities will contribute operational data to the studies, including historic load data and, if possible, load forecast data. This information creates an hour-by-hour simulation of system conditions. Wind data is then applied to the simulation to show how the system will change with the addition of the wind resource. "An important part of the study is that the utility sees the results for itself," said Parsons.

Application information

Utilities wishing to apply for the study should develop a comprehensive wind energy integration analysis proposal. The proposal should demonstrate how the utility will lead the study work and identify key internal staff and/or consultants to conduct the analysis. The Utility Wind Integration Group offers examples of wind grid integration studies and operating impact studies. Participants should be prepared to discuss the results at utility and wind industry forums.

To learn more about the Consumer-owned Utility Wind Grid Integration Cost-share Program, the partnership recommends interested utilities attend a conference call Dec. 6, 11 a.m. MST. Representatives from Western, DOE and NREL will explain the program in depth and answer questions. Contact Debbie Rock at 720-962-7271 to register. Participants will receive conference call instructions the week before the event.

Want to know more?
Visit www.wapa.gov/es/pubs/esb/2007/nov/nov073.htm

TOPICS from the POWER LINE

Answering questions about wind power

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:

I lead bus tours that travel past the huge wind farm at San Gorgonio Pass near Palm Springs, Calif. Can you give me answers to some frequently-asked questions about wind generation?

Answer:

The questions your passengers are asking are the same ones many consumers have about wind power. We hope this helps you on your tours and increases your understanding of wind power, as well.

Q: What is the proper name for the units?

A: The machines are called wind turbines, and a cluster of wind turbines is known as a "wind farm" or a "wind powerplant." In addition to wind turbines, a utility-scale wind farm includes an underground power transmission system, control and maintenance facilities and a substation that connects the wind farm with electric utility transmission and distribution systems (the "grid").

Q: What states are using wind farms?

A: According to the American Wind Energy Association, the total installed wind energy capacity in the United States is 12,634 MW as of June 30, 2007. Texas currently leads the nation with 3,352 MW, followed closely by California. In all, 33 states have or are planning wind facilities. The country with the highest total installed capacity is Germany with 20,621 megawatts.

Q: How do wind turbines work?

A: The kinetic energy of the wind can be changed into other forms of energy, either mechanical or electrical. For centuries in Holland, mechanical energy from windmills has been used to pump water from low-lying areas.

Wind turbines create electrical energy. The wind spins the turbine's rotor blades, which are attached to a hub mounted on a low-speed turning shaft. The low-speed shaft goes through a gearbox that increases the 19-to-30-rpm speed to approximately 1,500 rpm.

A generator then converts the mechanical energy of the high-speed shaft into electrical energy. Modern rotor blades are designed much like airplane wings. Most need wind speeds above 12-14 miles per hour to turn the rotors fast enough to generate electricity. However, if the wind gets too high, the turbine has a brake to stop the rotor blades.

Q: Why are there different sizes and types?

A: There are several reasons why a wind farm might contain different sizes and types of turbines. Part of the answer may be that different areas of the farm have different wind characteristics, and thus the tower height and rotor size were selected to optimize those winds.

Also, a farm may contain several "generations" of turbines; new designs are constantly improving the technology. For example, the "Eiffel tower" framework designs at San Gorgonia had high maintenance costs because the wind stressed nuts and bolts, so operators switched to tubular steel towers. Similarly, some early designs had two, rather than three, rotor blades, but "drag" reduced efficiency as the lower blade passed by the tower.

Q: Do computers control the turbines?

A: A computer monitors the direction of the wind, controlling electric motors that then turn the unit into the wind. The computer also continually monitors the condition of the turbine, checking for malfunctions, such as overheating gearboxes or generators.

Q: Is there any way to store the electricity wind turbines generate?

A: The electricity currently generated at the San Gorgonio farms is distributed for immediate use. Energy storage is an important technical challenge that wind farms must address in the future. For small

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Want to know more?
Visit www.wapa.gov/es/pubs/esb/2007/nov/nov074.htm

Web site of the month:

Online wind resources

In case you hadn't noticed, the November Energy Services Bulletin is dedicated to wind power—not simply wind projects, but the business issues associated with a growing, mainstream energy resource. That is a lot of material for one Web site to tackle, so this issue will highlight a number of useful, wind-related Web sites.

DOE Wind Program

The U.S. Department of Energy's Wind and Hydropower Technologies program is a good place to get the basics. You'll learn how a wind turbine works, the history of wind power, wind power's advantages and disadvantages, U.S. wind energy potential and current research. Utilities will find the list of Consumer FAQs helpful for answering customer questions and some of their own, as well.

The Wind Powering America Initiative, part of DOE's wind and hydro program, goes beyond education to encourage the dramatic increase of wind energy use in the United States. The site lists state and regional activities, turbine siting information, tribal activities and resources for agricultural development and publicly-owned power providers.

AWEA

Continue your wind education with the American Wind Energy Association. AWEA's mission is to promote wind power growth through advocacy, communication and education. Check out the fact sheets, tutorials and comprehensive listings of projects by state. The events section lists AWEA and other industry gatherings where wind newcomers and veterans can meet, network and expand their knowledge about the latest industry developments.

Public Renewables Partnership

Inspired by all the advantages and opportunities wind power offers, your utility is ready to add this renewable resource to its portfolio. To build, buy direct or purchase renewable energy credits, those are the next questions. The Public Renewables Partnership can help you decide which option is right for you. PRP Tools connect visitors with resources to help in the decision-making process. A collection of case studies by individual utilities and on specific technologies offers real-world examples and lessons learned.

True to its name, the PRP facilitates partnerships to help utilities adopt renewable resources. The Partnership Opportunities Program helps consumer-owned utilities team up for projects such as applying for a grant, structuring a peer-match, conducting a workshop or facilitating transmission studies, among other possibilities.

Utility Wind Interest Group

Your research and networking with the PRP led to the conclusion that building a wind turbine or buying from a nearby facility is a viable choice for your utility. Now comes the challenge of integrating that wind power with your other generation sources, and that is where the Utility Wind Integration Group can help. UWIG brings together utilities, Federal agencies, trade associations and industry research organizations to promote wind power integration into the electrical system.

Visitors can download a variety of operational studies and wind integration studies without joining the group. Member benefits include training opportunities, cost-sharing programs with Federal and private organizations and collaborative research projects

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Want to know more?
Visit www.wapa.gov/es/pubs/esb/2007/nov/nov075.htm

Topics from the Power Line *from page 7*

wind farms, particularly in areas not connected to the utility transmission and distribution grid, battery storage may be cost-effective. As an example, the wind farm tour vehicle operates on batteries that are charged by wind power electricity.

For large wind farms, pumped hydro storage may be an option. This strategy uses excess wind energy to pump water from a lower reservoir to an upper reservoir. When electricity is needed, the water is released through a dam to generate hydropower. The paper entitled "Wind Energy as a Significant Source of Electricity" by R. Gerald Nix, National Renewable Energy Laboratory, contains additional information on this topic.

Q: How effective are wind turbines in generating electricity? Is it an experiment or an established power generation source?

A: Wind turbines are commercially proven and produce electricity at a competitive price today. Growing concerns about the environment and energy independence, coupled with production tax credits in the 2005 Energy Policy Act, are pushing wind development. The PTC was set to expire Dec. 31, 2007, but the 109th Congress extended it through the end of 2008.

Q: Who regulates the construction and operation of wind farms?

A: The U.S. Department of Energy and other Federal agencies regulate development and operation of power generating plants. In addition, state and local regulations and ordinances apply, such as property deed restrictions, construction engineering codes and requirements for connecting to a utility grid.

Q: How many turbines are on the San Gorgonio wind farms? How much acreage is used? Who operates the wind farm? Who owns the land?

A: Based on statistics from AWEA and the California Wind Energy Association, there are currently about 2,600 turbines on less than 1,500 acres. As older turbines are replaced, the newer ones are larger and more efficient; therefore, the farms need fewer turbines to generate the same amount of electricity. The San Gorgonio Pass area contains 30 separate farms operated by 15 different companies (corporations or individuals). Some of the operators own the land, while others lease the property from the Bureau of Land Management.

Website of the month *from page 7*

on topics related to wind power on utility power systems.

Members also have the chance to research issues in depth by participating in UWIG user groups. Topics the groups cover include operating impacts and integration studies, wind plant modeling and interconnection studies, distributed wind applications, market operation and transmission policy best practices and wind turbine operations and maintenance.

Wind on renewables sites

Like the PRP, organizations promoting renewables in general provide wind power information. The Interstate Renewable Energy Council has a Small Wind Energy program to provide a forum for information exchange on small wind issues. Other IREC programs, such as Workforce Development and Connecting to the Grid address issues that apply to all renewable resources.

The National Renewable Energy Laboratory has a wind research program and operates the National Wind Energy Center. Wind research at NREL is divided into two categories: turbine research and development, and technology applications and testing.

No overview of wind resources on the Internet would be complete without a visit to Western's Energy Services Web site. Visit our Renewable Energy Resources page to learn more about government policy, green power markets, state activities, funding opportunities and more. You will also find links to renewable resource maps and data.

Note: If there is an energy- or utility-related Web site that you find especially useful, let us know. Contact the editor with your suggestion for Web site of the Month.