

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

New hydropower technology tested in Hastings, Minn.

A young company in Houston, Texas, has teamed up with a small town on the north end of the Mississippi River to demonstrate a different way to generate power from America's number one renewable energy resource, water.

Hastings, Minn., became the home of the nation's first Federally-licensed hydrokinetic power project this summer, when Hydro Green Energy LLC completed the installation of a 100-kilowatt (kW) nameplate capacity turbine. With a second turbine (nameplate capacity of 150 kW) to be installed next year, the project could be able to generate up to 250 kW at U.S. Army Corps of Engineers' Lock & Dam No. 2.

The renewable energy developer built its patented hydrokinetic turbines at the city's 4.4-megawatt (MW), run-of-river hydropower plant at the lock and dam. Mounted on a barge downstream from the powerplant, the units will feed an estimated 70 kW

to the conventional plant over a connecting line. "It's not a huge amount of power," acknowledged Hastings Public Works Director Tom Montgomery. "We are primarily interested in helping the power industry develop new sources."



Hydro Green Energy's patented hydrokinetic turbine can be easily raised to the surface for safety inspections, adjustments or repairs. (Photo by Hydro Green Energy LLC)

Complementary systems

Hydro Green Energy approached Hastings, Montgomery said, because their location offered so many advantages—logistic, environmental and economic. In turn, the hydrokinetic barge complements the operation of the Hastings powerplant.

The facility is open year round and receives near consistent river flow, giving it a high capacity factor of more than 80 percent. "Rivers are ideal for this technology because the unidirectional current in an open river allows a facility to achieve a capacity factor of up to 99 percent," said Mark Stover, vice president of Corporate Affairs for Hydro Green Energy. "The hydrokinetic turbines supply predictable, base-load power, which is so valuable to system operators."

Also, the barge's location near the powerplant eliminates river traffic directly in front of the dam, increasing the safety of the installation. The hydropower plant filters debris from the water before it reaches the hydrokinetic turbines downstream.

Perhaps most important for a renewable energy project, the lock and dam have an existing transmission infrastructure. In an interview with Power Magazine, Hydro Green Energy CEO Wayne Krouse described the technology's ability to use existing infrastructure as one of its major attractions. "Our transmission line is less than 300 feet long," he said.

By building within the footprint of the Hastings facility, the hydrokinetic project was also able to "piggyback"

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New hydropower technology

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on the city's Federal license. "Going through our license was the easiest way for Hydro Green Energy to obtain the permit," recalled Montgomery.

The city applied to the Federal Energy Regulatory Commission (FERC) in April 2008 to amend its license. On Dec. 13, 2008, FERC granted the amendment, its first full license for an in-stream hydrokinetic power project. Hydro Green Energy fully complied with FERC requirements for stakeholder outreach and agency consultation, and covered all costs and technical work associated with the amendment.

Environmentally safe

As with any energy development project, the turbine's potential environmental impact is being carefully scrutinized. The company submitted a 65-page Fish Entrainment and Survival Monitoring Plan as part of the licensing process. Pre-installation computer modeling indicated an estimated 97.5 percent fish survival rate for the turbine.

Now that the project is operational, the real-world evaluation begins. Hydro Green Energy is performing comprehensive fish survival tests, monitoring critical aspects of water quality, studying its effect on birds and implementing a zebra mussel control program, some at the request of the National Park Service. "With regard to fish survival, it has exceeded our expectations and pre-installation modeling with more than 99 percent survival for fish that encounter the device," said Stover.

The technology's unique surface-suspended design makes it easy to address issues uncovered by testing. "While we've had no mechanical or structural problems, and the machine is working as designed, we've already taken the unit down on several occasions to conduct some fine tuning and to perform safety inspections," said Stover. "It only takes a few minutes to bring the turbine to the surface. Depending on the work we want to perform, we can make modifications in less than a day and put it back into operation."

The design also allows for upgrading should Hydro Green Energy develop advances that could increase power output at Hastings.

Bright future

Montgomery observed that if the demonstration goes well, Hastings might consider hydrokinetic power as a resource option in the future. For now, the city council considers the project a "low-gain, low-risk venture" that provides a small amount of revenue. Xcel Energy buys the power directly from Hastings, and Hydro Green Energy receives a portion of the power sales.

In the future, this type of project would serve as an equipment sale to the hydropower plant owner. Hydro Green Energy would enter into a maintenance contract and also receive a yearly royalty payment for the use of its technology.

And with so much interest in renewable energy, the technology has a promising future. A 2007 study by the Electric Power Research Institute found that the United States could develop a minimum 13,000 MW of river (in-stream) and ocean-based (wave, current and tidal) hydrokinetic power by 2025.

Hydrokinetic projects are eligible for the production tax credit (PTC) or Clean Renewable Energy Bonds (CREBS) and Recovery funding, too, even though the Hastings facility did not receive any Federal subsidies. The city would have qualified for CREBs as a public power entity, but the program was fully subscribed at the time of development. The important thing was to get the first FERC-licensed hydrokinetic project into the water, and the company's partnership with Hastings, Minn., made that possible. The lessons learned there can help other cities expand their hydropower potential. "Our technology can operate in a variety of settings, including in the tailrace of existing hydropower plants or in open rivers or tidal areas," said Stover.

The city of Hastings happened to be in the right place at the right time to make hydropower history. But there are still plenty of opportunities for utilities and municipalities interested in exploring the budding technology of hydrokinetic generation. ⚡

Energy Services Bulletin

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David City mines landfill for clean energy future

Less than two years ago, Butler County Landfill—the second largest in Nebraska—was reaching the point where something had to be done about methane emissions. Today, it supplies the gas needs of the largest manufacturer in David City, Neb., and tomorrow, it may generate 1.6 megawatts (MW) of renewable electricity, thanks to the vision of the city council and City Administrator Joe Johnson.

Tracy Thorne, Upper Great Plains Energy Services representative, praised the city for recognizing the landfill's potential and taking action. "This is a great example of a renewable energy project that makes sense on so many levels," he stated. The project began in a perfect storm of circumstances, Johnson recalled. "The city of David City, Butler County Development Board and the Butler County Landfill called Timberline Energy LLC, a company that specializes in methane collection systems, to ask them about possible uses for the gas," he said. "They wanted to know if we had any large industrial facilities in town."

Resolving concerns

As it happened, Henningsen Foods, Inc., an egg processing facility which employs 130 people in David City, is just the type of operation that requires a lot of heat. The plant system was able to use landfill gas in place of more-expensive natural gas, so the next step was to get the methane to the plant.

Timberline sunk 16 wells, 30-feet to 90-feet deep, into the oldest part of the landfill and built a compressor to pump the methane from the wells. The city of David City and Butler County Development Board had to



City, state and industrial partners team up to cut ribbon on landfill gas mining facility. Left to right: Greg Tilden, Timberline Energy, LLC; Jay Hopper, Timberline Energy, LLC; Nebraska Gov. Dave Heineman, Willow Holoubek, Butler County Development Board; Mary Plettner, Nebraska Public Power District; David City Mayor Dana Trowbridge; Joe Johnson, David City; Kelly Danielson, Butler County Landfill; Darrell Kahler, Henningsen Foods Inc. (Photo by David City, Neb.)

work with Butler County to build the six-mile pipeline to carry the gas to Henningsen Foods. Initially the County Board of Supervisors raised concerns about installing a privately-owned utility line in the county road right of way. However, the city determined that state law allows municipalities to own such a pipeline.

Within city limits, the project encountered brief resistance from residents along the street where the line was originally to be located. Timberline responded by designing the pipeline to be bored under the city right-of-way, an approach that minimized the need for trenching. In the end, there was very little opposition, Johnson noted. "The city council and our citizens were very supportive of turning a source of pollution into energy."

Ready for Phase 2

The project went commercial in July 2008, sending methane to

Henningsen Foods to fire its dryers and a large boiler. Black Hills Power continues to provide the company with natural gas as a back-up.

But the landfill produces methane to spare, so Mayor Dana Trowbridge hopes to take landfill development to the next level. "I'm sincerely hoping this leads us into phase two of the methane project, electricity generation," Trowbridge said.

David City is applying for Federal grants to add a landfill-gas generator to its existing powerplant. Having the expertise and infrastructure already in place helps with the project's feasibility, Johnson observed.

The next step would be to secure a power purchase agreement with David City's power wholesaler, Nebraska Public Power District (NPPD). The proposed 1.6-MW generator would supply less than a quarter of the city's average demand

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DOE adds utility-scale wind turbine to research tools

Towering over the grassy prairie at the National Wind Technology Center is one big guinea pig—a 1.5-MW wind turbine that will help researchers fill in some gaps in our knowledge of wind power, and maybe lower the cost of wind energy in the process.

Department of Energy (DOE) officials, industry representatives and managers from DOE's National Laboratories gathered near Boulder, Colo., Nov. 10 to cut the ribbon on "DOE 1.5." NWTC facilities will receive power from the state-of-the-art GE wind turbine—the first utility-scale unit owned by DOE—but its primary purpose is to serve as a research tool. "This turbine provides the foundation for long-term collaborative research among our DOE, university and industry partners," said Fort Felker, NWTC director.

Many of the partners were on hand to discuss the current state of wind technology, goals for the future and what they hoped to learn from DOE 1.5. Mark Handschy, Senior Advisor to DOE Under Secretary Kristina Johnson, put the challenges of wind power into perspective with excerpts from 200-year-old books on the subject. Statements about needing better storage systems and cheaper "dynamos"—generators—to make wind generation viable drew chuckles from the crowd. The need for research to address those challenges is also a constant.

Path to '20% by 2030'

General Electric, a frequent industry partner with the National Renewable Energy Laboratory (NREL), has spent \$1 billion on research and development since 2002,



State and Federal officials, industry partners and project team members celebrate the commissioning of DOE 1.5, a utility-scale GE wind turbine that will be used to research many aspects of wind technology.

said Matt Guyette, GE Renewable Energy Product Line leader. "The research being done at NWTC will be critical in driving up wind penetration," he added.

Bringing down the cost of the in-ground material could help reach the nation reach the goal of 20 percent wind generation by 2030, said Craig Mataczynski, CEO of Renewable Energy Systems (RES) Americas. For RES, the turbine presents an opportunity to measure loads inside and under the foundation of an operating wind turbine.

That's only the beginning of a long list of tests and studies to be performed on the heavily-instrumented DOE 1.5. Data will be collected to study the microclimate in which the turbine operates, the aerodynamics of

its design, the effects of turbulence on its load and performance and how the combination of these factors may affect wind plant performance. The turbine will also be used to educate budding wind engineers and researchers from universities, laboratories and companies nationwide.

NWTC is a unique site for putting a wind turbine through its paces, noted NREL Deputy Laboratory Director Robert McGrath. Rather than the steady winds optimal for wind generation, the foot of the Rocky Mountains annually receives more than 40 hours of winds in excess of 100 mph. The level of wind shear coming through the area is extremely high, as well. "This is a good place to see how a turbine acts under stress," McGrath said.

See WIND TURBINE page 7

Innovative efficiency measures

It is important for utilities to keep abreast of new technologies and strategies that may help curb energy use and demand. Five promising measures that have recently become commercially available are actually new applications of mature technologies rather than untried inventions. Credible reviews and studies, mostly from California, show these technologies cutting energy use by one- to two-thirds! Energy savings will vary with application, and savings from lighting controls are generally greatest in climates dominated by cooling.

These measures appear to be very cost-effective with non-energy benefits that add to, and may even eclipse their energy savings. Keep in mind, however, that the studies were done in California where energy costs are higher than most other areas. Assessing performance and potential market or supply barriers for different regions and varying electric rates is part of the adoption curve for any new technology.

With a huge number of potential applications, each measure could make a notable impact on regional energy use. However, no measure is right for all situations, so review all project specifications carefully when considering implementation.

The Western Energy Experts Hotline (1-800-769-3756) stands ready to provide additional information and equipment sources for any of these measures that might be a good fit for you or your customers. We are also interested in hearing about any

studies of these and other new and emerging technologies.

Controlled ventilation

Ventilation in commercial kitchens provides safety, comfort and odor control for customers and employees, but often wastes huge amounts of energy. According to the American Gas Association, most commercial kitchen ventilation systems operate at full speed the entire time the kitchen is open, wasting more than \$2 billion in energy annually in the United States alone. However, case studies show that full ventilation is typically required only a few hours per day.

A new control system allows kitchens to vary the exhaust to match the need for ventilation. Using feedback from temperature and smoke/vapor sensors to control variable-speed fans, the systems cut energy use without loss of performance. In a California study, fan energy use and demand were both reduced by over 60 percent. Additional energy savings are generated by reducing makeup air by about 30 percent. Savings will be greatest in areas with hotter summers and colder winters. Paybacks generally run from one to three years. Non-energy benefits of this technology include quieter and more comfortable kitchens.

Bi-level lighting

Parking lots, parking garages and stairwells all have intermittent occupancies but are lit while empty for many hours each day. While lighting is essential for safety, operating lights at full power during unoccupied

hours wastes a lot of energy. Reducing lighting levels during these periods cuts energy use, extends equipment life and increases security (the change in lighting level signals occupancy). Parking lots also experience reduced light pollution. A California study shows 63 percent annual energy savings from bi-level stairwell lighting. In a recent study of a Sacramento parking lot, metal halide luminaires, which drew an average of 346 watts, were replaced by LED luminaires, which drew an average of 149 watts on high power and 52 watts on low power, yielding a three- to five-year payback.

Wireless light controls

In many buildings, lighting equipment and controls were installed many years ago when energy costs were low and, in some cases, the building was used for a different purpose. However, adding controls to dim or turn lights off can be expensive and disrupt building occupants. Wireless controls are easy to install (which may actually make installation less expensive than hard-wired systems) and can cut energy use by adding scheduling, dimming, occupancy sensing, personal control and demand response. Some of these systems can be connected to HVAC and plug load controls. Non-energy benefits include longer equipment life, reduced maintenance costs (although sensor batteries need to be replaced periodically) and better working environment and flexibility

See *TECHNOLOGY SPOTLIGHT* page 7

Web site of the month:

Customer questions about online IRP Reporting system

We at Energy Services are happy to report that you, our customers, are wading into the new online IRP reporting system and coming up with feedback that is helping to make the system a more user-friendly experience.

Recently, a customer from a member-based association asked if the new system is able to support collecting data from multiple sources—that is, reporting members. Good question, and the short answer, is “Yes.” But a longer explanation will be more helpful.

Reports in two formats

Keep in mind that only one person may register to submit the integrated resource plan (IRP) via the online system, no matter how many member cooperatives are contributing information.

Using the system’s “Export” capability, the registered user can download the current report in one of two formats to send to members. Both the PDF replica of the actual report and the Excel-formatted spreadsheet display previously entered data to help reporting co-ops understand what information they must supply.

The advantage of the PDF file is that it looks very much like the online version, giving reporting co-ops a clear picture of how their information is being reported. The downside, however, is that the PDF is not editable—the reporting co-ops will have to send their data in a different type of file.

The Excel spreadsheet is editable,

The screenshot shows the 'Western Area Power Administration Application Self Registration' page. At the top, it says 'Already Registered? Manage Account'. Below that, a heading reads 'Registering for application access is easy!'. A sub-heading states: 'Registration can provide access to a number of Western Area Power Administration's applications. Please complete this form selecting the applications you need access. A service technician will contact you when your request has been approved.' The form is divided into two sections: 'Basic Information (Required)' and 'Requested Applications (Required)'. The 'Basic Information' section includes fields for First Name, Last Name, Email Address, Phone Number, Region Code (a dropdown menu), and Business Name (a dropdown menu). The 'Requested Applications' section has a checkbox for 'Integrated Resource Plan'.

and multiple entities can enter the exact reporting information the registered user requires to complete the IRP. The customer will need the Excel program to complete the spreadsheet. It is one of the most widely used software programs in business, so that should rarely pose a problem.

The reporting system does not have an “Import” function that allows the data from the Excel file to be loaded directly into the program. The registered user will have to compile the individual reports into a single summary and manually enter the data into the online system.

New version of old tool

Many Western customers are familiar with using Excel spreadsheets to collect the data for their IRPs. In fact, some of you still prefer to submit your reports the old-fashioned way, and that’s fine, too. It is not mandatory for customers to use the online reporting system—just easier.

However, we ask that you contact your Energy Services representative to get the most current IRP reporting spreadsheets. The latest versions include the compliance checklist to ensure that your report contains the standard information required by law.

Whether you use the online reporting system or the Excel spreadsheet, our goal is to simplify the reporting process so busy resource planners can spend time where it counts—planning. Those of you who have registered to use the online system have earned the appreciation not only of the Energy Services staff, but also of customers who will use it in the future.

Please keep the questions and suggestions coming, and we will periodically address them in Web site of the month. Your input has shown us how to improve and enhance a system that will help power providers get the most from their resources—their employees as well as their power. ⚡

Want to know more?
Visit www.wapa.gov/es/pubs/esb/2009/dec/dec095.htm

Technology spotlight

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in remodels such as reconfiguring workspaces.

Auto-on 50%

While bi-level lighting controls are used in many office buildings, nearly all such systems bring lighting on 100-percent power when you enter a room. However, the reality is that office workers spend most of their time operating computers, so lighting at 50 percent not only saves energy, it's actually more appropriate for that primary activity. This technology allows occupants to

easily increase lighting levels to 100 percent when needed, such as for a group of people reviewing a printed document. Most office functions require full light infrequently, and energy savings in California studies were about 50 percent. Combine these controls with daylight harvesting to increase energy savings.

Classroom lighting

While classrooms have evolved toward increased use of computer and multimedia equipment, most classroom lighting dates back to the days of "reading, writing, and 'rithmetic." A new type of control system tailors lighting more to

the needs of modern teaching strategies by combining a high performance direct-indirect light fixture with three high-efficiency Super T8 lamps. Operation varies with activity, and can accommodate general, multimedia, reading and/or white board activities. The system can also incorporate daylight harvesting, which can be significant in many classrooms. The result is reduced energy use—by 30-50 percent in California studies—as well as greater teacher and student satisfaction. Installed cost for the base system is typically less than for a conventional lighting control system. ⚡

Want to know more?

Visit www.wapa.gov/es/pubs/esb/2009/dec/dec094.htm

Wind turbine

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Caught on video

DOE invested more than \$5 million to procure and install this wind turbine, which was delivered to the NWTC in December 2008. Installation occurred between July and September. Crews began lifting the turbine's 262-ft. steel tower using a 320-ft. crane on Aug. 17 and finished with the installation of its nacelle and rotor on Aug. 21. The center created a time-lapsed video of the installation that shows the steps involved in installing a modern utility-scale wind turbine.

Construction relied on close coordination between every depart-

ment, from Procurement to Security, Felker said. During the pouring of the tower's concrete foundation, for example, a mixer truck arrived at the front gate every few minutes. The guards had to be able to check each one through security and get it to the site before the concrete set. Felker used the celebration to thank all of the team members who had worked long hours on completing the project.

Workshop offers tour

The celebration concluded with the ribbon-cutting, photos and a tour for visitors, but DOE 1.5's work is just beginning. We still have a lot to learn about one of mankind's oldest power sources, and a great

new subject for study.

Those attending the 2010 Wind Interconnection Workshop, Jan. 20 to 22, will have the opportunity to see the turbine up close. An optional tour of the National Wind Technology Center is part of an agenda that introduces the Utility Wind Integration Group's Internet-based tools for assessing a distributed wind project's impact on the local distribution system. Register online to reserve your place now, or contact Bob Putnam, CH2M Hill, at 315-751-2638 for more information. ⚡

Want to know more?

Visit www.wapa.gov/es/pubs/esb/2009/dec/dec093.htm

David City

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of 8.8 MW, but it fits into its power contract. "NPPD allows its wholesale customers to produce up to 2 MW of power from renewable energy," Johnson said.

The cost of a Caterpillar generator would make landfill power more expensive than NPPD power, but that is not a big stumbling block. "The city council understands that prices are going to change in five years' time," acknowledged Johnson. "We can lock in a stable price for a 40-year supply of methane, while

other resources keep going up."

State recognition

The David City methane project has been a win-win for all the partners, and could well provide more benefits to come. "This is a base-load resource that isn't going away soon," Johnson pointed out. "In fact, there will be room to expand, because the landfill is still in use."

Governor Dave Heineman joined Henningsen Foods, Timberline Energy, Butler County Landfill and David City to dedicate the facility last year. The governor called the project a truly remarkable col-

laborative effort. "And it's happening right here in David City. You don't have to be in a big city to do this," Heineman said.

The Nebraska Energy Office has supported the project all along, and the state Department of Economic Development gave the partnership its 2009 Community Improvement Program award. At the award dinner in Kearney, Neb., David City Mayor Dana Trowbridge said that it meant much more than just a shiny plaque for the city office wall. "It's this type of award that focuses positive recognition on a rural community," he said. ⚡

Want to know more?

Visit www.wapa.gov/es/pubs/esb/2009/dec/dec092.htm

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