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Wisconsin Public Service has installed two Tacke 600 kW Turbines on the Zirbel Farm in Brown County, Wisconsin.

by Mick Sagrillo

It's no surprise that Wisconsin farmers are interested in harvesting wind energy. Wind turbines are well suited for agricultural settings because they operate most efficiently in open areas like cropland or pastures, yet take up very little land. Most of Wisconsin's wind generators are located in rural areas, where they are recognized as the latest cash crop.

Wind industry professionals are frequently asked, "How do I get a wind farm developer to put a turbine on my land?" or "How can I make money from all that wind on my farm?" This fact sheet addresses these questions and offers some alternatives that may appeal to individual farmers and landowners, depending on their situation.

IS WIND POWER RIGHT FOR YOUR FARM?

Considerations

- While wind energy is clean, renewable and readily available, it must also be noted that modern commercial wind turbines are complex devices requiring specialized expertise to install and maintain. Commercial wind turbines require professional operational experience.
- A wind turbine is an electrical generating plant that demands a certain level of commitment to maintenance, and since it is interconnected to the utility electrical distribution system, there will be contractual obligations as well.

- Financing the installation of a wind turbine must include the costs associated with its ongoing operation and maintenance.
- Wind turbines operate most effectively 120 feet to 250 feet up in the air, which means they require attention to tower construction and zoning considerations.

Options

There are essentially three options available to farmers and landowners who are interested in installing a wind turbine. These options involve varying levels of investment risk:

Hosting a wind turbine as part of a wind farm development.

This option involves the least financial commitment or risk. Farmers and landowners typically are paid about \$2,200 per megawatt (MW) of installed capacity. For a 660 kW V47 Vestas turbine, like the ones operating in Kewaunee County, Wisconsin, this amounts to \$1,400 per wind turbine (\$2,200 x 0.66 MW). For the 1.5 MW GE turbines located in Iowa County, Wisconsin, the amount is closer to \$3,400 per turbine (\$2,200 x 1.5 MW). Normally there is additional compensation for access roads and an escalation clause to assure that payments will keep pace with inflation.

The tower foundation and transformer for a commercial wind turbine typically occupy a space equivalent to a two-

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(right) Reconditioned 40 kW Vestas V-15 in Dodge County, Wisconsin.



car garage. An access road might add $\frac{1}{4}$ acre. In this scenario, wind might be the most valuable crop on a farm.

However, the opportunity to host a wind turbine requires a potential site located in the right place at the right time. First, a developer usually is not interested in installing only one or two turbines in any given area. To build a cost-effective project, developers must install many turbines in fairly close proximity. When evaluating a particular area for a wind farm, a developer's first consideration is access to a utility's transmission lines. The second priority is to find an area with enough available agricultural land to allow multiple installations while avoiding rural residential development. Finally, a developer will consider the wind resource.

Investing in a wind cooperative. Harvesting your farm's wind power still may be an option despite lack of interest from developers. A second possibility would be to organize a cooperative wind power venture. This investment strategy is similar, for example, to becoming a member of a cheese co-op. All members will share in the investment, risk and financial returns.

This strategy of cooperatively owned wind is quite common in Europe. Paul Gipe, author of *Wind Energy Comes of*

Age (see "More Information") has written extensively about cooperatively owned wind turbines in countries like Denmark, Germany and the Netherlands.

While there are no similar wind cooperatives established yet in the United States, the idea is showing some promise. Mary Myers (see "More Information") of Cooperative Development Services in Madison, Wisconsin, has developed a business plan for creating a cooperatively owned and operated turbine project, structured as a limited liability corporation (LLC).

Also, Dan Juhl, of DanMar & Associates in southwest Minnesota (see "More Information"), has helped develop and install farmer-owned small wind farms. Juhl sells both a notebook and consultation services to those interested in developing a cooperative wind power venture in their locale using a similar business model.

Installing your own wind turbine. For an individual farmer or landowner, this last option works best as an investment to save money rather than as a means to earn income from electricity sales. The decision will hinge upon the price a utility is willing to pay for the electricity generated. Since the farmer or landowner is the owner and operator of the system, this venture provides the greatest financial incentives, and carries the greatest risk.

A federal law known as PURPA (Public Utility Regulatory Policy Act) requires utilities to allow the interconnection of electrical generators (like wind turbines) to the utility grid and to feed excess electricity back into the grid. In Wisconsin, generating devices that have a cumulative nameplate capacity rating of 20 kW or less can interconnect with a net energy billing contract that essentially credits customer-generated electricity at the same retail rate the customer pays. However, for most farms, a 20 kW wind turbine will only provide 10 percent to 25 percent of the electricity consumed. A larger wind turbine would not qualify for a net energy billing contract, however.

It doesn't make sense to install a wind turbine larger than 20 kW if the utility's wholesale power purchase rate cannot make the project cost effective. It can make sense, however, to install a wind turbine large enough to offset a farm's demand for utility electricity but not so large that it feeds a lot of wholesale-rate electricity back to the grid. This strategy also avoids some of the taxes and other charges normally included on utility bills.

HOW TO PROCEED

If the option of hosting a utility wind turbine is not available to you but you are still interested in harvesting your farm's wind energy, how do you determine if a wind turbine will make economic sense? At a minimum you need to do the following:

Have a wind site assessment conducted at your farm or land. A certified assessor will visit your farm to discuss your ideas, plans and goals for installing a wind turbine. The assessor will examine the topography, density and height of trees in the area and also the surrounding terrain. The assessor's report will include wind turbine recommendations, a minimum acceptable tower height and a reasonable estimate of the wind resource at tower height based on available wind resource data and computer modeling.

Focus on Energy provides this wind site assessment service for a number of Wisconsin's utility ratepayers. However, there is a cost-share for all assessments except those installed for individual homeowners. Contact Larry Krom at 608.588.7231 or Mick Sagrillo at 920.837.7523 to arrange for a wind site assessment for your farm or land.

Choose a wind system installer. Once you have a wind site assessment and form a general idea of the wind system you want, you can proceed to get several quotes for the system and installation. Bids from prospective installers will include at a minimum: setting the tower, assembling and installing the wind generator, making all electrical connections and commissioning the wind system before it is ready to produce electricity. Some installers will allow the customer to contract separately for site preparation. You might save some money by serving as general contractor to secure the following services:

- soil tests
- foundation engineering
- excavation for the foundation, and backfilling after the foundation is complete
- pouring the concrete footings
- taking delivery on the wind turbine, tower and other components
- trenching in underground wiring
- assembling and wiring the tower
- a crane adequate to lift the tower and turbine

Be sure to discuss ongoing operation and maintenance costs with your installer. It is generally recommended that two percent of the installed cost of the system be set aside every year to cover annual operation and maintenance. Expenses tend to average out over the years.

Secure an interconnection agreement with your utility. Once you have determined your system size and costs, approach local utility about an interconnection agreement. Wisconsin has developed new interconnection rules for distributed electrical generators. Known as the PSC 119 rules, they can be found at wisconsin.org or at the Public Service Commission of Wisconsin's Web site <http://psc.wi.gov>.

The PSC 119 rules have standardized the procedure that both you and the utility must follow before your system is

interconnected to the grid. Pay particular attention to the sections that detail requirements for fees, inspections, safety equipment and insurance.

Secure a building permit from your local zoning authority. Wisconsin's Statute 66.0401 essentially states that a municipality may only place restrictions on the installation of a solar energy or wind energy system if it: (a) serves to protect public health or public safety, (b) does not increase the cost of the system or reduce its efficiency, or (c) allows for a suitable alternative. Zoning authorities cannot restrict the installation of a wind system unless they can prove that it will be a public health or public safety hazard. Also, they cannot limit height, as this essentially reduces the system efficiency, sometimes greatly, without a commensurate cost reduction.

A variety of questions may arise in your community when word gets around that you want to install a wind turbine. Be prepared to inform neighbors and local officials about your project and address inquiries with a spirit of cooperation. In addition, there may be other concessions that you can make to satisfy the concerns of your neighbors. For example, assure them that you won't use the tower for advertising or paint the blades "hunter orange."

Take it all to the bank. With installation quote, interconnection agreement and building permit in hand, it's time to approach your banker for financing. There are

(below) 50kW AOC 15/50 turbine at the National Wind Test Center in Golden, Colorado.

Tall Towers



The most critical, yet most often overlooked component of any successful wind turbine installation is the tower. Tall towers are essential for two reasons.

First, friction with the earth slows down moving air masses considerably. This is known as ground drag. As you move away from the surface of the earth, wind speed increases. Furthermore, wind turbine output increases at the cube of the wind speed. This means that if you can increase the available wind from 8 mph to 10 mph by increasing the tower height, the power available to the wind generator doubles!

Second, trees and other tall obstacles cause an enormous amount of turbulent air at ground level. This turbulence will not only reduce wind to your turbine, but also will cause the turbine to hunt around, chasing the ever-shifting winds. This motion both diminishes generation and increases turbine wear and tear, shortening the life of your system. Therefore, tall towers minimize the negative effects of both ground drag and turbulence, essentially prolonging the life of the system.



Reconditioned 40 kW Vestas V-15 in Dodge County, Wisconsin.

funding incentives available from the Focus on Energy Program (focusonenergy.com). There may also be grants for agricultural energy projects available from the federal government.

Place your order. Having successfully completed the above five steps, you are finally ready to place an order. While this may seem like a long involved process, a lot of money may be at stake. Go slowly, make informed decisions and don't cut corners. Remember that you are not necessarily interested in the cheapest technology in the marketplace, or the cheapest installation costs. These are merely the upfront costs, and don't necessarily reflect the "long haul." You should be interested in a wind system that will reliably generate electricity for 20 years to 30 years with little, if any, down time.

MORE INFORMATION

focusonenergy.com

Contact Focus on Energy to learn more about renewable energy choices: solar water heating, solar electricity, passive solar design and wind turbines. Incentives available. Call 800.762.7077.

General

Wind Energy Comes of Age

Paul Gipe, 1995, John Wiley & Sons. A comprehensive guide to wind energy.

Wind Power for Home and Business

Paul Gipe, 1993, Chelsea Green Publishing. This book is a guide to modern wind machines for homeowners, farmers and small business owners.

Do It Yourself Small Wind Project Manual

enXco Midwest Office, 625 8th, Ave. SE, Minneapolis, MN 55414; 612.331.1486
Details the steps for developing a wind project.

Harvesting Wind Energy as a Cash Crop: A Guide to Locally Owned Wind

Dan Juhl, DanMar & Associates, Inc., 996 190th Avenue, Woodstock, MN 56186; bcelaya@iw.net

Interconnecting to the Grid

Rules for Interconnecting Distributed Generation Facilities became Chapter PSC119 of the Wisconsin Administrative Code on February 1, 2004.

www.wisconsinenergy.org/library/1-AC-207%20Final%20Order%209-9-03.pdf

wisconsinenergy.org

Wisconsin Distributed Resources Collaborative:
The latest draft of the interconnection guidelines is below:
www.wisconsinenergy.org/library/InterconnectionGuidelinesDRAFT6_3.pdf

www.legis.state.wi.us/rsb/stats.html

Find Wisconsin Statute 66.0401 relating to solar and wind energy systems on the Revisor of Statutes Bureau Web site.

www.renewwisconsin.org

RENEW Wisconsin provides information on wind energy and interconnection guidelines.

Consultants/Manufacturers

Renewable Energy Yellow Pages

Wind energy businesses serving Wisconsin are listed in the Yellow Pages at focusonenergy.com

Cooperative Development Services, Mary Myers
608.244.0118

E-15 (remanufactured Vestas V-15)

Energy Maintenance Service, Inc., Steve Scott
605.272.5398, www.energyms.com

AOC 15/50

Southwest Windpower, Andy Kruse
928.779.9463
E-mail andy@windenergy.com
www.aocwind.net

Fuhrlander

Lorax Energy Systems, LLC, Henry du Pont
401.466.2883
E-mail: lorax@wind-power.com
www.lorax-energy.com

Norwin

Specialized Power Systems, Inc., John A. Proctor
304.781.2610
E-mail: sales@spswind.net
www.spswind.net/netscape/index.htm

Focus on Energy is a public-private partnership offering energy information and services to energy utility customers throughout Wisconsin. The goals of this program are to encourage energy efficiency and use of renewable energy, enhance the environment, and ensure the future supply of energy for Wisconsin. For information about the Focus on Energy services and programs, call 800.762.7077 or visit focusonenergy.com.