



Harvesting the Wind

Minnesota's Growing Wind Energy Industry

Tall towers topped by giant turbine blades are altering the landscape of southwestern Minnesota. Just as silos signify the importance of corn and soybeans to this region, the wind turbines mark the initial growth of another cash crop—wind energy.

Spurred by the desire for an environmentally clean and renewable fuel to help meet growing demand for electricity, wind energy development is also seen as a potential source of economic benefits for western Minnesota farms and communities.

A combination of programs and policies contributes to the development of Minnesota's wind energy resource: mandates by the state legislature, tax credits and other financial incentives, greater understanding of the state's wind resource based on more accurate studies and analyses, and world-wide advances in technology.

The Minnesota Department of Commerce, the agency responsible for helping to develop state energy policies, recognizes the many benefits of wind energy: its ability to reduce harmful environmental impacts of energy use; to bring economic growth, especially to rural Minnesota communities; and to diversify Minnesota's electric energy fuel resources. The Department is committed to policies that encourage continued development of the wind energy market.

Wind energy—where we are now

More than 800,000 megawatts-hours (MWh) of wind-generated electricity is produced annually in Minnesota and transmitted and distributed to consumers through the electric grid.* This amounts to roughly 1.5 percent of Minnesota's total electric use and is enough to power more than 101,000 average residential households for a year

(based on a statewide annual average consumption of 7,900 kWh per household). It places Minnesota second only to California among the states in its use of wind power.

Most of the power—more than 90 percent—is produced on utility-scale wind farms typically equipped with 750 kilowatt (kW) turbines. The remainder comes from smaller turbines independently owned and operated. Turbines are rated by power capacity; the power produced is measured in kilowatt (or megawatt) hours. A 750 kW turbine, running at full capacity for one hour, produces 750 kilowatt-hours (kWh) of electricity. Since the turbines do not operate continuously and at full power throughout the year, their annual power output is less than 100 percent of rated capacity.

Electric utilities, other wind energy developers, and individual farmers and landowners are the major participants in Minnesota wind energy industry. Here is a rundown on their roles:

Large-scale utility wind farms

Northern States Power (NSP), Minnesota's largest electric utility, purchases the bulk of the wind energy produced. As mandated by the Minnesota legislature, NSP is committed to contracting for 425 MW of newly installed wind energy capacity by 2002. When that commitment is met, NSP will be purchasing in excess of 1.3 million MWh of wind-generated electricity annually. NSP is required to contract for an additional 400 MW of wind energy by 2012, provided wind proves competitive with other generation sources.

The wind installations established under contract with NSP are concentrated mainly along the Buffalo Ridge in southwestern Minnesota, near the community of Lake

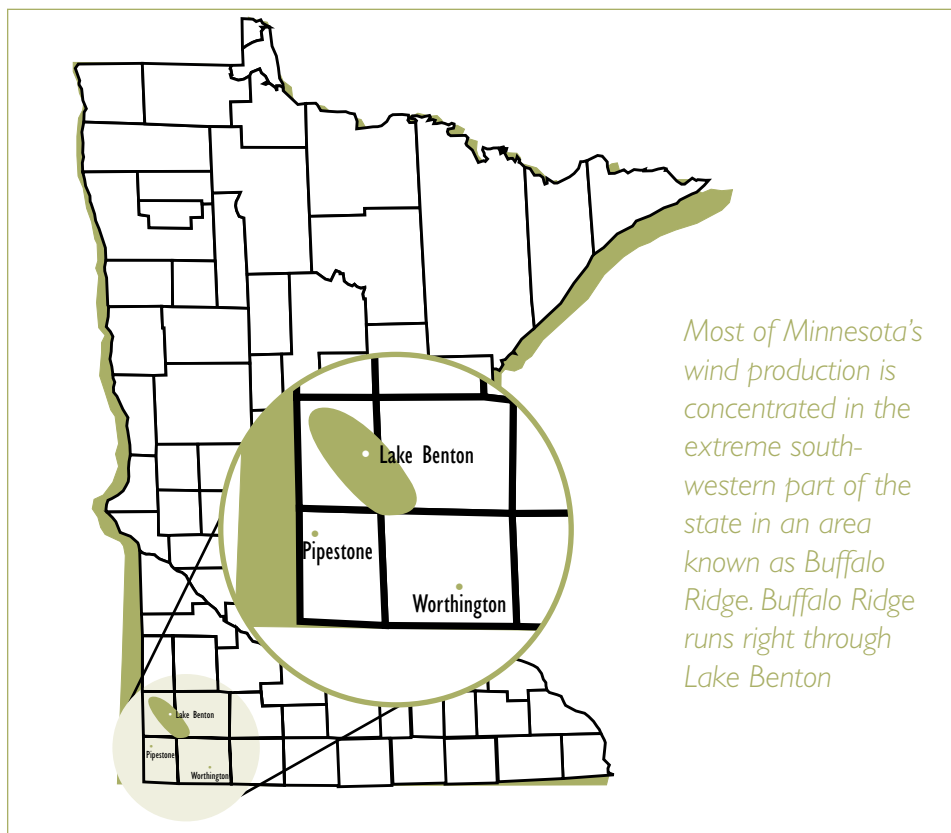
* Based on installed capacity operating in the fall of 1999. The number does not include the additional capacity to be contracted for by Northern States Power, including 156 MW by 2002.

WIND

Benton in Lincoln County; other installations are located in, or being considered for, Clay, Pipestone, Murray, Lion, and Sherburne counties.

NSP is the power purchaser. Under a state-approved bidding process, wind developers compete for a contract to supply NSP with a stated amount of wind-power capacity; the turbines are actually owned, installed, and operated by the developer. (See section on developers below.)

Great River Energy and its member electric cooperative utilities established the 2 MW capacity



Most of Minnesota's wind production is concentrated in the extreme southwestern part of the state in an area known as Buffalo Ridge. Buffalo Ridge runs right through Lake Benton

Chandler Hills Wind Farm based on support for wind energy among their customers. Great River asked customers voluntarily to sign up if they were willing to pay a slight premium for electricity generated from wind. The electricity is from newly installed wind turbines and replaces power generated from coal. Within a year enough customers signed up to make the program financially feasible. The utility also finances the program with the help of state incentive payments available to wind facilities of 2 MW or less. The project began operating in 1999 and is owned and operated by a developer on privately-owned land located in Murray County, along the Buffalo Ridge.

The wind-generated electricity is sold in blocks of 100 kilowatt-hours (kWh) for approximately an additional \$2 per block per month. Subscribers may buy up to as many

blocks as total their average monthly use. Currently, 1500 customers, including some business as well as residential consumers, buy 4,200 blocks. The utility also has a subscriber waiting list, which it hopes will increase to the point where the program can expand.

Moorhead Public Service utility's Capture the Wind project is another program based on voluntary support. Less than three weeks after the utility offered the program, more than 400 customers had signed up, enough to support installation of a 750 kW wind turbine on city

property near the northeast edge of the city. Residential customers had the choice of paying a half penny more per kilowatt-hour for all their electricity or for a block of 1,000 kWh per month. For the average residential customer, this means about \$5 more per month. Commercial customers could pay the higher rate for all their electricity, or buy blocks of 1,500 kWh per month. The turbine is owned and operated by Moorhead Public Service, the municipal utility serving Moorhead. The utility has a waiting list of 150 for the Capture the Wind program.

Lac Qui Parle Valley School wind turbine is a special, cooperative project of the school and the Minnesota Department of Commerce. Although the project is not utility-sponsored, the size of its turbine—225 kW—places it above the size of turbines normally installed and operated independently by farmers and small landowners. The school received a

\$60,000 grant and a \$199,500 interest-free loan from the Minnesota Department of Commerce to buy and erect the turbine on the school grounds. The turbine was up and running by late 1997; most of the electricity produced is used to supply the school's own power. Surplus electricity generated in off-peak hours or when the school is not in session is sold to the local utility, Otter Tail Power.

Developers and manufacturers

Developers of Minnesota wind farms range from major U.S. and foreign companies to smaller, Minnesota-based organizations. **Enron** Wind Corporation is a California company whose subsidiaries developed NSP's largest wind farms. It has about 50 percent of the U.S. market for wind facilities. Enron's subsidiary, Enron Wind

Development Corp., has offices in Minnesota and Iowa, where it has developed a 193 megawatt wind farm near Storm Lake in the northwest part of the state in addition to the 211 MW in Minnesota

NEG Micon, general contractor for the Moorhead facility and the Lac Qui Parle Valley School project, is a Denmark-based firm; it has a maintenance office in Marshall, Minnesota. The company has manufactured more than 6,500 turbines worldwide. The developer of the Great River farm, **enXco** (formerly FORAS) is based in California and is the largest operator of wind turbines in the world. The Great River installation is comprised of wind turbines manufactured in Denmark by **Vestas** Wind Systems. Vestas has almost 8,000 turbines operating in more than 25 countries.

Northern Alternative Energy (NAE), Minneapolis, is a home-grown developer. It assists with all aspects of wind farm development, from site and wind turbine selection to financing and installation. It developed two of NSP's wind installations, the 11.25 MW Lakota Ridge Wind Farm and 11.88 MW Shaokatan Hills Wind Farm, both in Lincoln County. Micon and Vestas are the manufacturers of the turbines on these sites. NAE has contracted to build additional capacity for NSP in various locations in southwestern Minnesota, and also has projects in Iowa, Wisconsin, and as far west as Wyoming. It is building a maintenance and visitor center on Buffalo Ridge, near the town of Hendricks, that is expected to be open to the public by September, 2000. **Woodstock Windfarms**, another home-grown company, is developer of a 10.2 MW wind facility for NSP. Developer Dan Juhl is a long time supporter of wind energy in Minnesota. He sells and installs wind energy equipment; his NSP site is equipped with turbines manufactured by Vestas. Paul White heads **Project Resources Corporation**, another local company offering expertise in wind farm development, including feasibility studies, construction, and operation and management. The company has worked on a number of projects in the Midwest, including the Chandler Hills Farm and the wind program of Traverse City Light and Power, Michigan.

Farmers and other individual and small group landowners

Developers of large utility-scale wind projects in Minnesota do not own the land but are the liaison between the landowner and the utility or power purchaser. Various arrangements are made with landowners. In some cases, the landowner receives a one-time payment; in others, a minimum payment plus a percentage of the revenue from the electricity generated is paid. Written wind easements also are agreed to that allow the wind

developer access to the site for maintenance; the agreements may also restrict some activities and structures from adjoining land. More than 150 landowners, many of them farmers, have some sort of arrangement with developers of utility-scale wind farms. One turbine and an access road take about one-quarter acre of land out of production. In exchange, farmers receive an estimated income of \$2,000 a year per turbine.

Other production of wind-generated electricity comes from turbines of less than 40 kW capacity that are owned and operated independently by individuals or groups. In 1999, utilities reported that these smaller turbines produced sales totaling 642 MWh, with the output coming from 99 facilities in rural areas, mostly farms.



High tech wind turbines are much larger than the old windmills you are used to seeing in the country side. Zond is a major manufacturer of wind turbines operating on Minnesota wind farms.

Photo ©1995-2000, Enron Wind Corp., photographer: Lloyd Herziger

What's ahead for Minnesota's wind energy

In addition to the 825 MW of capacity required of NSP, no other specific plans for utility development have been announced. Great River has indicated its desire to expand its voluntary program depending on customer support.

For the immediate future, the policy of the Minnesota Department of Commerce is to encourage the market for wind energy, expanding its benefits to more farmers, small landowners, and communities. In addition to expanding the benefits of wind energy, this policy of encouraging distributed energy reduces reliance on long-range transmission lines.



Helping wind energy grow

Tax credits and other financial incentives, as well as information, research, and analysis, are among the aids to wind energy development. Here is a brief summary:

Tax credits and other financial assistance. Both federal and state incentives are available. The federal Public Utilities Regulatory Policy Act (PURPA) requires utilities to purchase electricity from certain qualifying renewable energy facilities. The federal government previously offered a tax credit for wind-generated electricity produced by a qualifying facility and sold to another entity. This credit recently was reinstated, effective through December 31, 2001. In addition, the state of Minnesota provides incentive payments for any power sold to utilities by qualifying facilities under 2 MW.

Another Minnesota program, net metering, allows home and building owners to install wind generation under 40 kW and connect to the grid. Utilities track the amount of electricity generated and credit the owner for the electricity produced. Any excess electricity not used by the owner is bought by the utility at the average retail rate. Other incentives available from the state include low interest loans and sales tax exemptions. For more information, call the Minnesota Department of Commerce at the number below.

Education. Windustry, a project of Minnesota's Institute for Agricultural and Trade Policy, has developed a curriculum to educate farmers, rural landowners, and rural community leaders on all aspects of wind energy development. With support from a Department of Commerce grant, Windustry is holding a series of workshops for small landowners and community leaders. For more information, see below.

Information and analysis. The most accurate and extensive source of public information on Minnesota's wind energy resource is the Minnesota Department of Commerce Wind Resource Assessment Program (WRAP). Beginning in 1982, the state has monitored wind speeds and other data at sites throughout the state and published periodical reports. Recent upgrading of sites and of monitoring and analytical equipment is producing increasingly accurate assessments of Minnesota's wind resource. Maps showing results of geographical-based analysis of Minnesota's wind resource can be produced for areas as small as a township.

For more information



MINNESOTA
DEPARTMENT OF
COMMERCE

Minnesota Department of Commerce
Energy Information Center
651-296-5175
statewide toll free 1-800-657-3710
www.commerce.state.mn.us

U.S. Department of Energy

Office of Energy Efficiency and Renewable Energy
1000 Independence Ave. SW
Washington, DC 20585
www.eren.doe.gov/

American Wind Energy Association

122 C St. NW
Suite 380
Washington, DC 20001
202-383-2500
www.awea.org/

Minnesotans for an Energy Efficient Economy

Minnesota Building, Suite 600
46 E. 4th St.
St. Paul, MN 55101
651-225-0878
www.me3.org/

Windustry

1916 2nd Ave. S.
Minneapolis, MN 55403
612-872-3280
www.windustry.org/