Distributed Wind Energy Market in Minnesota – Final Report

Presented by:

The Minnesota Renewable Energy Society and Project Partners

Thursday, June 26, 2014

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Agenda

Introduction: Lise Trudeau
Senior Engineering Specialist
Minnesota Department of Commerce
Division of Energy Resources

Presentation: John Dunlop
Principal
Renewable Energy Services

Q & A: **please type in questions during the webinar to be answered at Q&A**

Photo Credit: Minnesota Clean Energy Resource teams

Distributed Wind Background

Popular in Early 20th Century

- Mechanical water-pumping windmills most popular
  - Over **6 million** units sold in U.S. by 1930's
- Over **10,000** systems operating in U.S. by 1936
  - Primarily 32 Volt DC systems with batteries used for lighting, radios
- Rural **electrification** that began in the 1930's eliminated need for self-generation and wind was largely **abandoned**

Photo Credit: Jacobs Wind Electric, via earthtechling.com

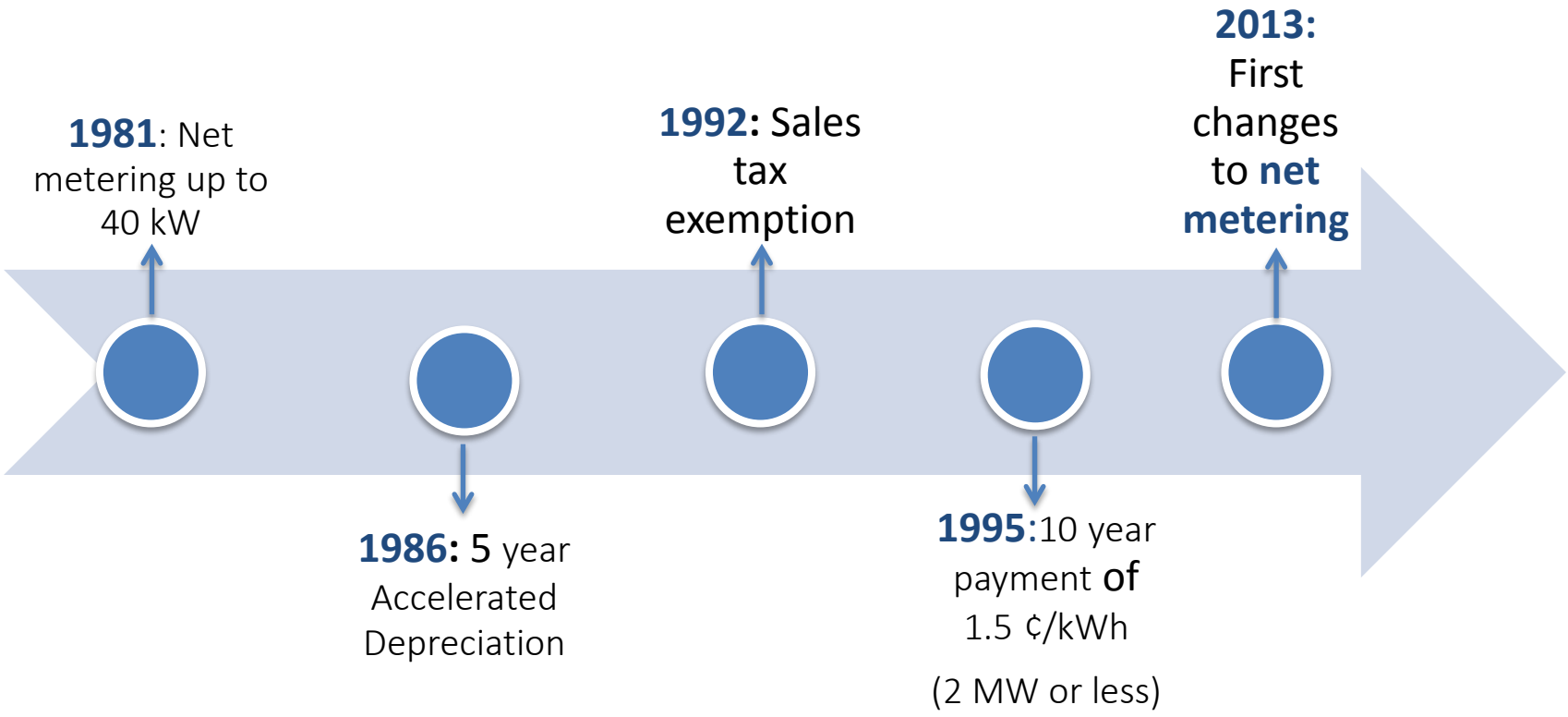
Wind Background

Resurgence of Wind Power

- International oil crisis of 1970s
- Modern world-wide industry launched in California in late 1970s
- Availability of tax credits and ability to interconnect with utilities
- U.S. small wind installations by 2013:
  - 222 MW of capacity
  - 157,000 turbines installed
  - $30 million invested annually, on average, since 1980
- Current interest is strong
  - Self reliance
  - Domestic energy source
  - Reduction in greenhouse gas emissions

Photo Credit: Minnesota Clean Energy Resource teams

History of Minnesota DG Wind Policy



Net Metering

All Utilities:

- Net metering <40 kW is unchanged
- Size independent of load
- Offset on-site electricity usage
- Utility pays average retail rate for excess generation
- Customer selects monthly check or credit carry-forward

Photo Credit: Simply Lets

Net Metering, cont'd.

Investor Owned Utilities (IOU):

- Cap raised to 1 MW
- Single-customer meter aggregation on contiguous property
  - Important for farmers *in IOU service territory*
- No standby charges < 100kW
  - PUC to review standby charges ≥100kW
- Systems 40 kW - 1,000 kW
  - Solar & other DG: sized to 120% of customer annual energy consumption
  - Wind: sized to 120% of customer *annual peak demand*
  - 12-month energy balance allowed
  - Allows excess generation in windy months to offset high consumption in other months

Photo Credit: Simply Lets

Solar Policy Strategies

2013 – Solar incentives adopted

- 1.5% solar electricity standard for IOUs
- Production-based incentive for MN-made solar panels
- Community Shared Solar
- Value of Solar Tariff
- other beneficial solar programs

2014 – What strategies will help the distributed wind industry grow?

The Need for Market Study

MN Dept. of Commerce is exploring ways to identify opportunities and barriers to distributed wind energy market

- Market Study Goals
  - Enhance outreach and communication with distributed wind energy market participants
  - Improve data on installation trends
  - Provide analysis of market activities, market participants, barriers to growth, and strategies to enhance consumer assurance

The Assessment Team

- Department of Commerce issued RFP competitive bid
  - selected Minnesota Renewable Energy Society and partners

  - **Laura Burrington,** Minnesota Renewable Energy Society (project coordinator)
  - **Brian Ross & Abby Finis**, CR Planning
  - **Fritz Ebinger**, The Minnesota Project
  - **Heather Rhoads-Weaver**, eFormative Options
  - **John Dunlop**, Renewable Energy Services

Market Assessment Methods

- Develop a **database** of distributed wind turbine installations
- **Survey** market participants: installers, dealers, manufacturers, tradespersons
- Convene a **roundtable** of industry experts
- Conduct **interviews** with industry members
- Develop **case studies** of successful installations
- Conduct public **webinars** on market developments and best practices

Photo: Unicorn Studio Products

Database

Sources of Data

- Utility lists
- FAA data
- REPI
- Treasury payments
- eFormative Options records
- USDA
- USGS
- MN Department of Commerce
- ARRA rebates
- County permits

Types of data collected

- Tower Height
- Manufacturer
- Capacity (MW)
- Location
- Owner
- Installer
- Year installed
- Power Purchaser

Geographic Coordinates

- Description of the location
- Confirm location visually using Google Earth
- Determine geographic coordinates from Google Earth
- FAA sites had identified the geographic coordinates

Database – As of June 2014

Confirmed, On-Site Only Turbines (Does not include Community Wind)

Number of Records	Number of Turbines	Capacity (MW)
165	167	17.06 MW

All Confirmed Turbines (Includes Community Wind)

Number of Records	Number of Turbines	Capacity (MW)
208	291	194.14 MW

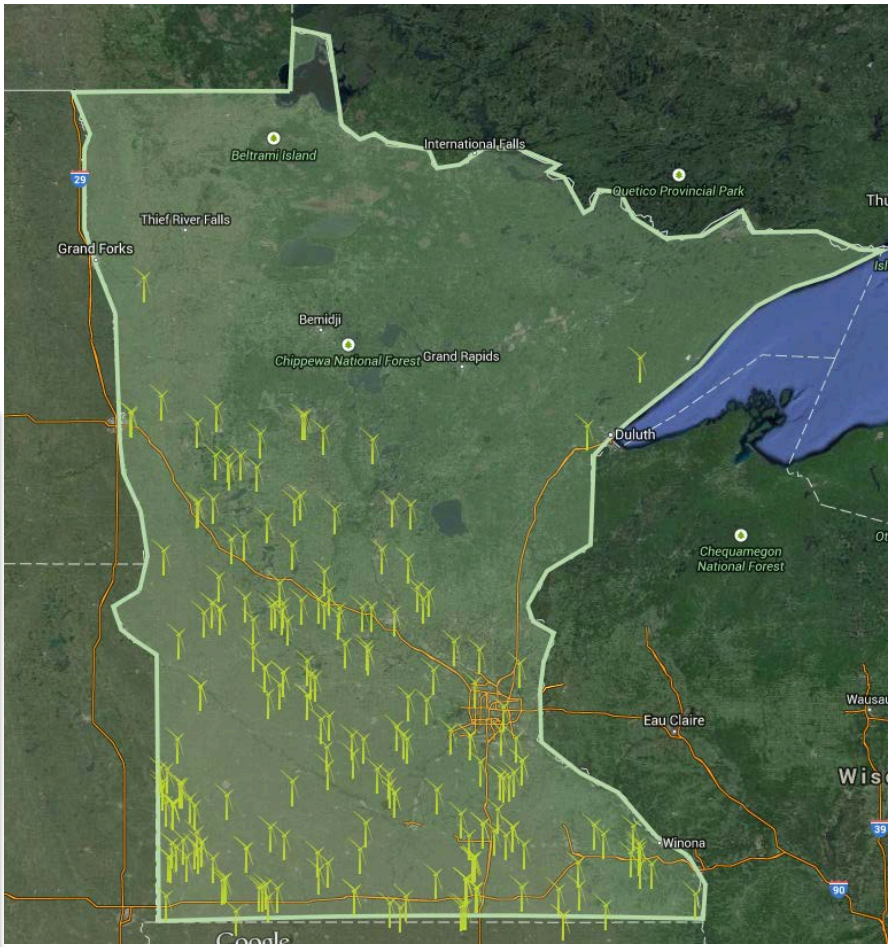
All Records (Unconfirmed and Confirmed, includes Community Wind)

Number of Records	Number of Turbines	Capacity (MW)
381	577	485 MW

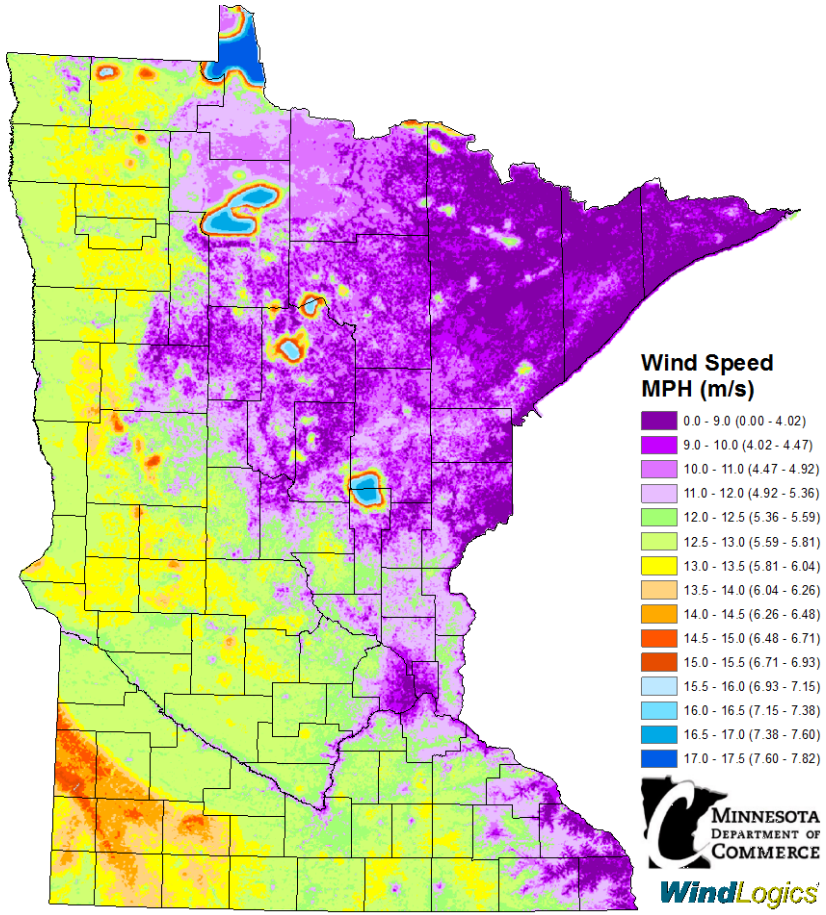
Photo: Clean Energy Resource Teams

Installation Distribution – Wind Resource

Distribution of Wind Turbines in Minnesota

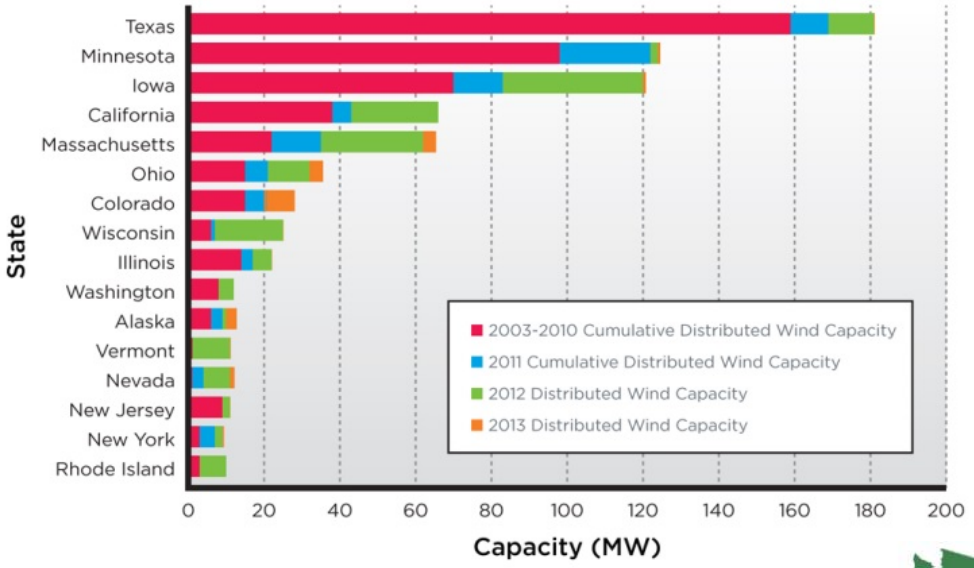


Minnesota Wind Resource at 30 Meters



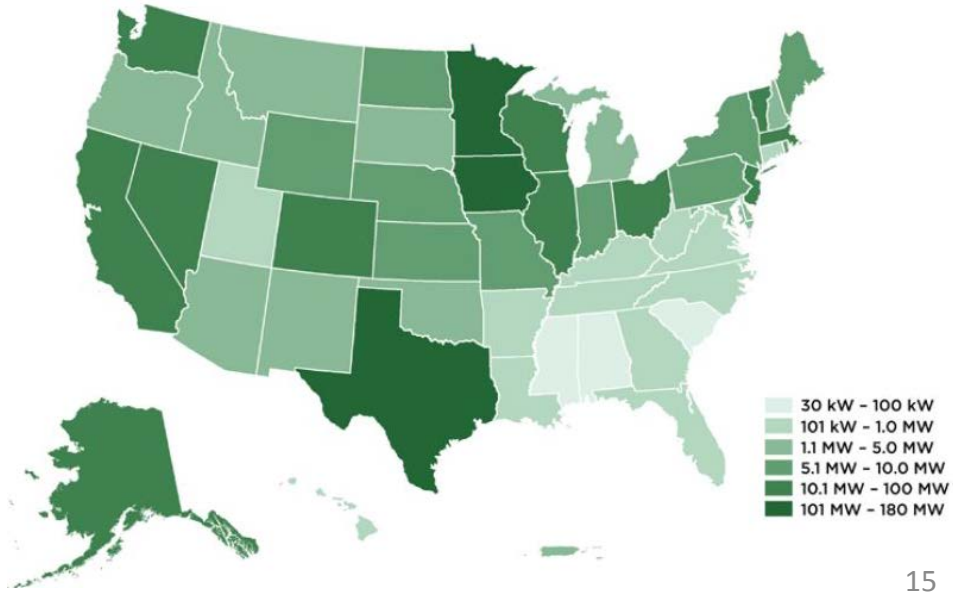
Source: Minnesota Department of Commerce, 2006

U.S. Distributed Wind Capacity 2003-2013



- Minnesota is #2 in nation for cumulative distributed wind capacity

- But ranks #11 for 2013 distributed wind capacity additions



Industry Survey

DG wind market and best practices

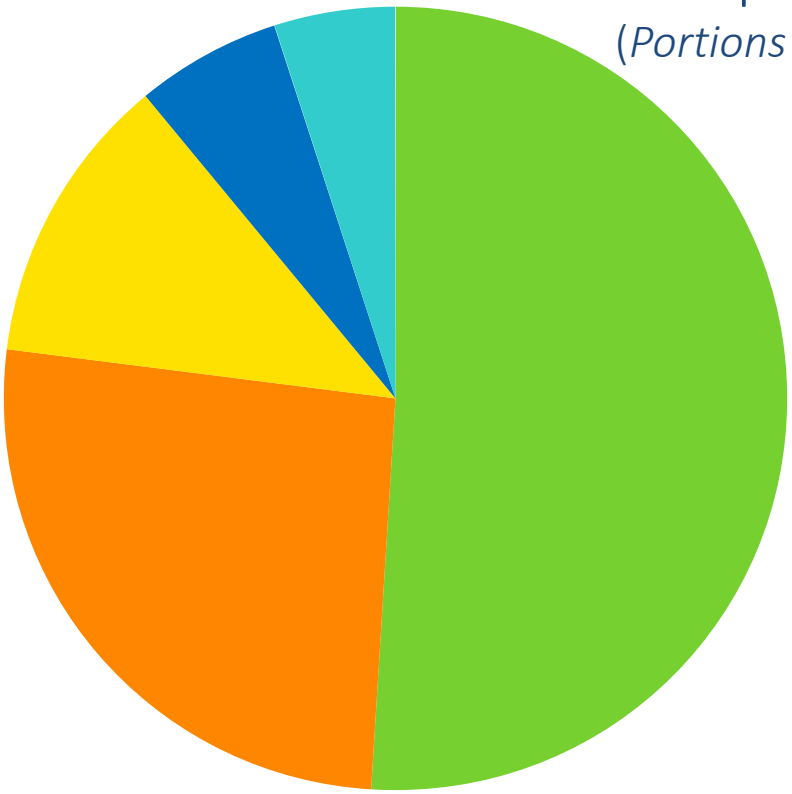
- Survey industry participants
  - 54 of 94 businesses responded
  - 57% response rate

- Jobs in the DG wind businesses who responded
  - 1,276 FTE jobs, 164 FTE jobs in Minnesota
  - Primary North American Industry Classification System (NAICS) occupations:
    - Turbine/tower installers
    - Technical consultants
    - Manufacturers

Survey Application

Snapshot of respondent activity.

(*Portions of wind turbines installed or serviced in Minnesota since 2012*)



- 51% Agriculture
- 26% Residential
- 12% Industry-Commercial
- 6% Government Institution
- 5% Educational Institution

Market Barriers

Lack of incentives and the need for zoning and permitting standards dominated the survey responses.

In your opinion, what are the most significant market barriers to the small (≤100 kW) and mid-sized (101 kW ≤ 1 MW) wind industry in Minnesota? Please explain.		
Answer Options	**Response Percent**	**Response Count**
Zoning and permitting standards	43.4%	23
Need for incentives	67.9%	36
Lack of market parity with other forms of renewable energy	30.2%	16
Consumer confidence	30.2%	16
High soft costs	13.2%	7
Need for consumer education	24.5%	13
Other (please specify)		10
	answered question	53
	skipped question	1

Market Barriers

Two thirds of “additional comments” on survey suggested the lack of market parity for **wind turbines vs. photovoltaics** is due to the lack of **incentives for DG wind systems.**

Photo Credit: Minnesota Clean Energy Resource teams

Roundtable with Industry Leaders

Eleven industry representatives were present:

- Manufacturers
- Installers
- Maintenance providers
- Refurbishing turbines
- Component supplier
- Wind-only businesses
- Multi-technology businesses (e.g. solar, energy efficiency, engineering, etc.)

Roundtable with Industry Leaders, cont'd

Topics discussed:

- Current state of distributed wind market
  - Definition
  - Current size
  - Future opportunities
- Best practices (from component supply to siting turbines)
- Perceived needs to achieve robust business activity
- Trusted sources of information
- Methods of communication within the industry
- Effective policies

Roundtable & Interview Findings

Primary Customers:

- Agriculture and rural businesses
- Market also includes municipalities and utilities

Additional Feedback

- Universal agreement amongst installers on 3rd party certification and use of listed products
- Manufacturers view third party certification of Minnesota products as a critical component to growing the industry
- Interviewee manufacturers find that third party certification remains a cumbersome and expensive process that creates market barriers to expansion and growth, particularly for start up companies and innovators

Roundtable & Interview Findings, cont'd

Additional Feedback

- No single centralized source of information on distributed wind in Minnesota, for either consumers or industry participants
- Little opportunity for industry members to participate in state distributed generation policy discussion
- Consensus on need for educating subcontractors and consumers: visible failures hurt the industry.

Best Practices and Case Studies

Best Practices for Distributed Wind reflected in criteria for selecting sites for case studies:

- Tower Height
  - At least 30 meters
- Wind Regime
  - Sites over 5 m/s average wind speed
    - Such as found in southwestern half of Minnesota
- Type of Interconnection
  - "Behind the meter" offsetting customer load
  - Single turbine installation

Photo Credit: Minnesota Clean Energy Resource teams

Best Practices and Case Studies, cont'd

Best Practices for Distributed Wind reflected in criteria for selecting sites for case studies:

Compliance with:

- Electric codes
- Interconnection standards
  - IEEE 1547
- Inverter standards
  - UL 1741
- Follow National Electric Code Article 694
- Recent installation
  - < five years

Photo Credit: Minnesota Clean Energy Resource teams

Best Practices and Case Studies, cont'd

Best Practices for Distributed Wind reflected in criteria for selecting sites for case studies:

- Evidence of quality
  - Small Wind Certification Council Certification (or comparable)
  - SWCC has also granted its first Wind Turbine Power Performance Certification for medium sized turbines
    - Tested in accordance with IEC 61400-12-1
  - Listing by the Interstate Turbine Advisory Council (Clean Energy States Alliance)
- Sited property
  - Bottom of turbine rotor at least 10 m above obstructions within 150 m
- Installations not previously publicized

Photo Credit: Minnesota Clean Energy Resource teams

Case Studies: Camden State Park

- Bergey Excel 10
- 35 m (120 ft.) tower (set back from Information Center and trees)
- Complies with the 10/150 meter siting guideline
- Part of DNR's Energy-Smart program
- Turbine offset all electricity consumed on site in 2012, close in 2013

Photo Credit: Fritz Ebinger

Case Studies: Camden State Park, cont'd

Photo Credit: Fritz Ebinger

Bottom of rotor…

Image: Google Earth, KML Circle Generator

10 m above obstructions within 150 m

Case Studies: The Rohlik Farm

Photo Credit: Fritz Ebinger

- Demonstration of value of due diligence
- Farm owner built tower for a TecWind 32 kW
- Owner later learned local authorities require UL-listed components
- TechWind electrical components were not tested and listed by UL
- Therefore: TechWind could *not* be installed

Case Studies: The Rohlik Farm

- Rohliks investigated the Ventera 10 kW turbine
- Components are all UL-listed and UL 1741 compliant
- Turbine manufactured in Duluth, Minnesota (which the owners liked)
- Installed turbine in W. Central MN – good wind regime
- Turbine produced above expected output in spring of 2014
- Owners are HAPPY

Photo Credit: Fritz Ebinger

Success Story

1. **Energy Efficiency**
2. **Explore renewable options**
3. **Select wind power**
4. **Use tall tower**

Producing electrical power of their very own

By Mark Peterson
STAR Editor

Alan and Kris Miller live in a comfortable country home about 1 1/2 miles east of Stewartville.

They greet their guests with a warm smile, introducing their German shepherd, their pointer and their cat.

And of course Alan, a native of England, can't resist offering a cup of tea while engaging his listeners in hale and hearty conversation, complete with a friendly English accent.

Whenever Alan Miller talks, the topic will inevitably turn to his love and concern for the environment.

When the Millers lived in Camarillo, California, a city of about 61,000 in Ventura County near Los Angeles, they installed solar systems on their house that provided hot water and electricity. Their decision soon inspired several of their neighbors to do the same. Alan had become an environmental Pied Piper of sorts.

"By the time we left California, many of our neighbors had installed similar systems," Alan said. "Theirs were double or three times the size of ours."

Looking back, the Millers are happy they switched to solar power.

"When we got solar, we were told that it would be nine years before we broke even (on the cost of the solar panels compared with the cost of electricity from a utility company.) In the end, it took us just over five years to break even. It's a hard decision to make when you first get started, but once we got it up, I'm glad we did it. We had no electric bills."

The Millers bought their current home in 2005. They rented it out a few years before moving into it themselves and fashioning a downstairs apartment for Carol Auel, Kris' mother.

After moving into their new home, they began thinking about ways to make the house more energy-efficient. They put 3 1/2 feet of insulation in the attic and started using LED light bulbs in their bathroom and for outdoor spotlights. They wondered if they should put solar panels on the house, but soon considered the power of the southeastern Minnesota winds.

"Looking at where the house is, we saw that there is a kind of a wind pattern through here," Kris said. "We looked at different styles of turbines."

The Millers hired Midwest Energy Products, Renewable Energy Solutions of Rochester, a company that specializes in solar and wind energy sales and installation. They decided to build a 140-foot tall turbine about 280 feet from their house. It weighs about 5,000 pounds, or 2 1/2 tons.

"If the tower is too low, it won't produce much electricity," Alan said. "Eighty feet is the shortest tower they'll build, and they get taller by 20-foot increments."

The turbine went up in January and began producing electricity for the Millers' home on Jan. 17. The tower now stands tall against a slate-gray March sky, its blades whipping in the powerful spring wind. Stewartville residents who buy their groceries from Fareway can see the tower by looking east from a spot just south of the store's parking lot.

Thus far, the system has produced 3,140 kilowatts of electricity, including 1,529 over the past month. If the Millers paid a utility company for their electricity, their bill would be about $185 to $190 per month, Alan said. But with the tower, they're producing their own electricity and receiving a monthly bill from their utility that says they owe exactly nothing. In fact, if their turbine produces enough electricity, the utility actually owes them money.

Midwest Energy Products charged the Millers $70,000 for the tower. The federal government will pay 30 percent of that cost, which will come off the Millers' taxes as a credit every year. The state will also help with a $10,000 cash payment.

Alan calculates that the turbine will pay for itself in about 8 1/2 years. If utilities increase their costs, it might not even take that long, he said.

"We got a letter from People's Coop saying that the cost of their electricity is going to increase by 2.2 percent," he said.

Although it takes time for a turbine to pay for itself, the investment is worthwhile because people will always need electrical power, Alan says.

"It may take eight to nine years to pay back (the cost," he said. "In nine years, I guarantee you'll still be using electricity, whether you make it yourself or pay the (utility company.")

Some residents who live near wind farms say that the large turbines produce a loud, repetitive "swishing" noise that can become difficult to bear. The Millers say their turbine does emit some noise, but indicate that it's not unbearable.

"The dogs look up at it and wonder what it is," Kris said. "You can hear the blades whipping and a humming noise."

The state of Minnesota requires the Millers to keep track of data they receive from the turbine, including kilowatt output per month, any dropoffs in electricity production and whether the turbine's rotating blades kill any birds.

Alan worked for 30 years as an electroplating supervisor at General Magnaplate Corporation in California, where he worked on parts for the Space Shuttle, the Space Station and military equipment. He also worked for the same company in Iran and England.

Kris, a nurse, also cares very much for the environment. At one point, she realized she was using huge amounts of gas to commute to her nursing job. She bought a Honda Civic Hybrid and saved both money and gasoline.

"Sometimes you do these things because it's the right thing to do," she said.

Alan was into ecology many years ago, when being into ecology wasn't cool, Kris said.

"At the plant he worked at, he got barrels that were used for recycling," she said.

Now retired, Alan enjoys working around his house and yard on projects to benefit the environment.

"My goal is to make a small footprint on the Earth," he said. "We should work to make the Earth better than when we came. We're trying to be a bit more environmentally friendly and a bit more self-sufficient."

Source: Stewartville Star, Producing Electrical Power of their Very Own, March 28, 2011

"After moving into their new home, they began thinking about ways to make the house more energy-efficient. They put 3 1/2 feet of insulation in the attic and started using LED light bulbs in their bathroom and for outdoor spotlights.

They wondered if they should put solar panels on the house, but soon considered the power of the southeastern Minnesota winds… with their [wind] tower they're producing their own electricity and receiving a monthly bill from their utility that says they owe exactly nothing."

Webinars: Market Development & Best Practices

Two Webinars held previously:

- Recordings available at: http://mn.gov/commerce/energy/topics/clean-energy/Wind/distributed-wind/MDWW.jsp
- Or, go to mn.gov/commerce then search on "**MN Distributed Wind Webinars**"

Webinars Summary

Distributed Wind Market Overview and Opportunities

Presentations by:

- **Market Developments**: Alice Orrell, Pacific Northwest Laboratory
- **Best Practices in Turbine Selection & Marketing**: Val Stori, Interstate Turbine Advisory Council
- **USDA Grant Application Process**: Charles Newcomb, Endurance Windpower

Summary:

- DW market environment is challenging
  - 2013 drop similar to large wind due to expiration of ITC and 1603 program, ramp down of many state incentives
- Quality assurance of equipment critical to incentive agencies
  - Certification and firm warranties essential
- USDA REAP is an important funding source, confirmed for next 5 years
  - Annual deadlines expected each October and April
  - important to contact local office prior to deadlines

Webinars Summary

Best Practices for Distributed Wind Project Development and Installation

Presentations by:

- **Performance Estimation**: Trudy Forsyth, Wind Advisor Team
- **Site Assessment Tools & Techniques**: Wes Slaymaker, WES Engineering
- **Guidelines for Installer Training**: Jenny Heinzen, Midwest Renewable Energy Association

Summary:

- High quality site assessment and training critical to successful DW projects
  - Numerous low-cost tools & resources available to assist
  - Publicly available maps
    - bins method can quickly screen many sites
- Potential buyers are advised to "do their homework" to ensure wind turbines will perform as expected
  - Plan for safe installation and ongoing maintenance by qualified personnel

Recommendations from Project Team

1. Business Support

- Assess and assist with streamlining wind permitting and zoning at the local level.
  - Establish a Helpdesk that would be available to developers of DG wind projects
  - Provide assistance to permitting and zoning officials in establishing and complying with siting and zoning requirements
- Establish a Minnesota Wind Industry Group
  - Meet regularly in person
  - Establish an electronic forum
  - Address best practices, issues, opportunities and barriers.
  - Perhaps initially supported by DER then transitioned to non-profit management

Recommendations

2. Evaluate the potential impacts of a Distributed Wind Subscription Program

- Individuals and businesses would subscribe to a portion of production from a single wind turbine or small cluster of turbines
- Subscribed electricity would be credited toward electricity consumption

3. Evaluate value of joint bulk purchases of turbines by multiple developers

4. Evaluate the stability DG wind brings to farmers experiencing the boom-bust agriculture market

Recommendations

5. Enhance data in existing DG Wind installation database & collect new install data

6. Develop policies and incentives comparable to those available for solar electric installations

- Made in Minnesota for wind turbines
- Incentives for wind installations

7. Publish success stories from other states demonstrating viable policy options for MN to consider

- Incentives
- Certifications

Recommendations

8. Develop assessment of opportunities for DG

- Demonstrate wind and solar production patterns are complementary
- Publicize high value DG wind applications
- Evaluate relationship between DG wind output and rural electric load profile
- Evaluate complementary DG wind output with resistive heating loads
  - Fund a pilot **demonstration project** with thermal energy storage

Recommendations

9. Assess the value of advanced inverter systems in addressing utility concerns

10. Present webinars on DG wind focused on:

- Utilities
- Local authority having jurisdiction (zoning official, city planners, etc.) responsible for permitting and zoning
- Assistance with applying for USDA grants
- Customers and potential customers
- Process for certifying small and medium wind turbines

Thanks for your interest in the distributed wind energy market in Minnesota!

John Dunlop

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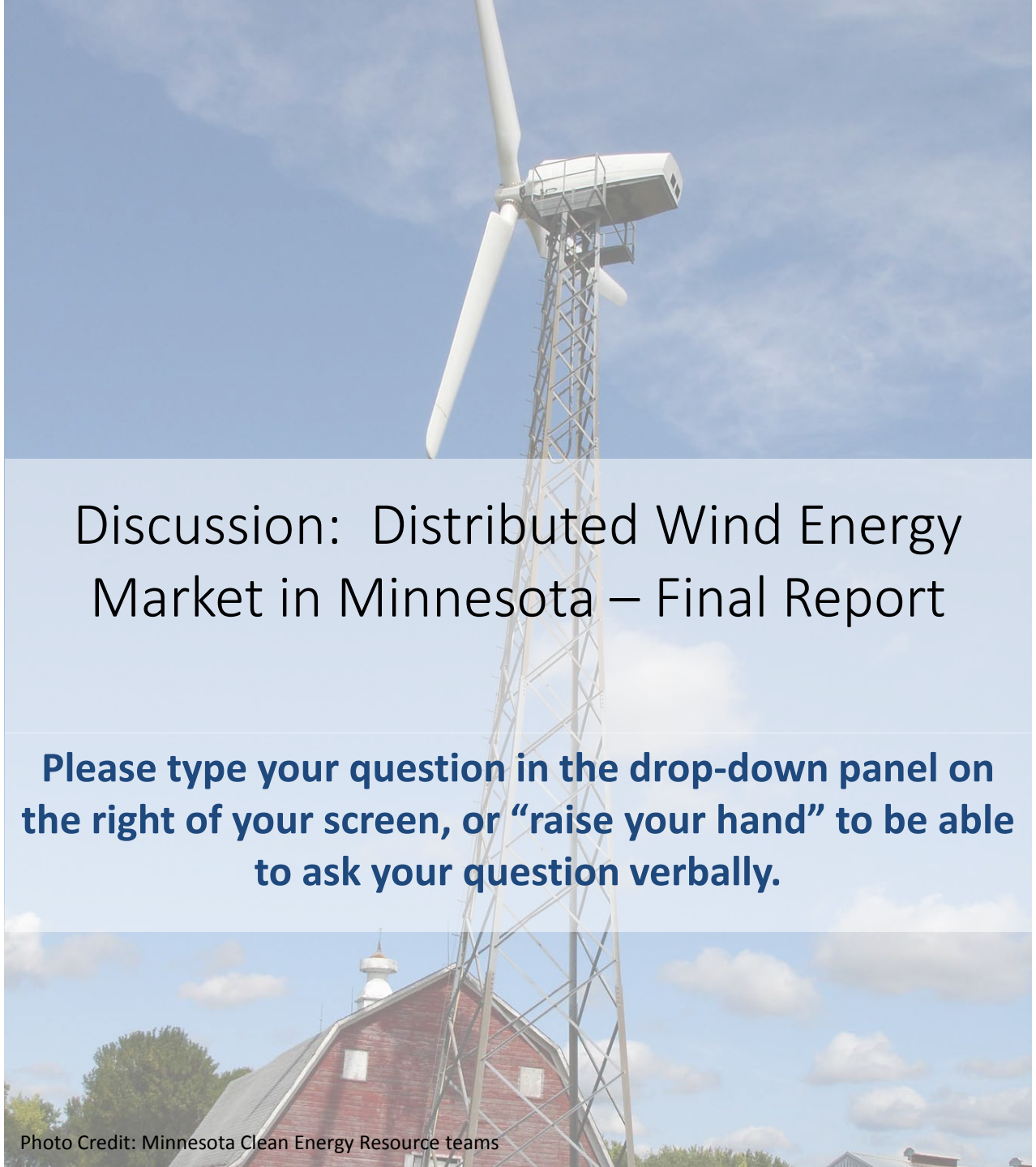
For the Minnesota Renewable Energy Society



Discussion: Distributed Wind Energy Market in Minnesota – Final Report

Please type your question in the drop-down panel on the right of your screen, or "raise your hand" to be able to ask your question verbally.

Photo Credit: Minnesota Clean Energy Resource teams