Small Wind Guide

A basic overview about small wind electric systems to help you decide if wind energy is right for you.

Can I use wind energy to power my home, farm or small enterprise?

A small wind electric system will work for you if:

- There is enough wind where you live
- Tall towers are allowed
- You have enough space
- You can determine how much electricity you want to produce
- You want some energy independence
- You can afford to invest for the future
- You want your energy to be clean and renewable

Wind energy systems are among the most cost-effective renewable energy systems available today. Depending on your wind resources, a small wind energy system can lower your electricity bills by 50%-90%. Some people are off the grid entirely.

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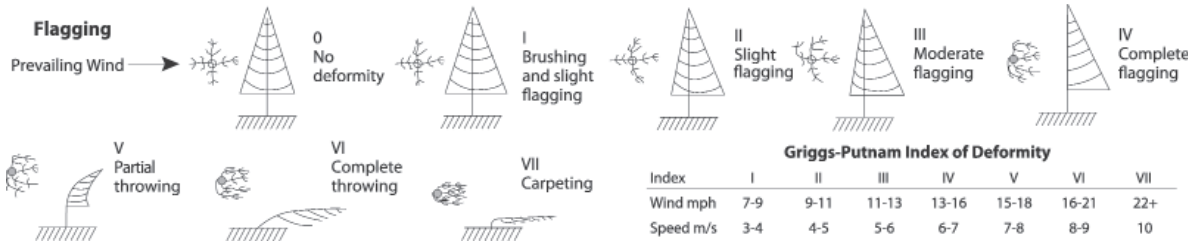
Is my site suitable for wind?

The amount of energy in the wind depends, far more than anything else, on wind speed. In fact there is 8 times as much energy in 10mph wind as there is in 5 mph wind. So, finding a suitable site is largely about finding where the wind blows. Winds can vary significantly over just a few yards. Below are some of the first steps that will go a long way in answering the question: is my site suitable for wind?

Wind resource maps, like the one on the opposite page, can be used to estimate the wind resource in your region. In Minnesota, as a rule of thumb you need a wind resource of at least 11mph for a small wind turbine to be economical. The wind resource estimates on this map generally apply to areas that are well exposed to the wind, such as plains and hilltops. The online resource, http://www.mngeoserver.admin.state.mn.us/WindSpeed/ provides a value based on the data behind the wind resource map and the coordinates of your location. As you can see from the map, most of Region 9 has at least 12mph wind.

Flagging can be useful in some locations that have regular prevailing wind to quickly figure out if your area has good wind resources.



Griggs-Putnam Index of Deformity

Index	I	II	III	IV	V	VI	VII
Wind mph	7-9	9-11	11-13	13-16	15-18	16-21	22+
Speed m/s	3-4	4-5	5-6	6-7	7-8	8-9	10

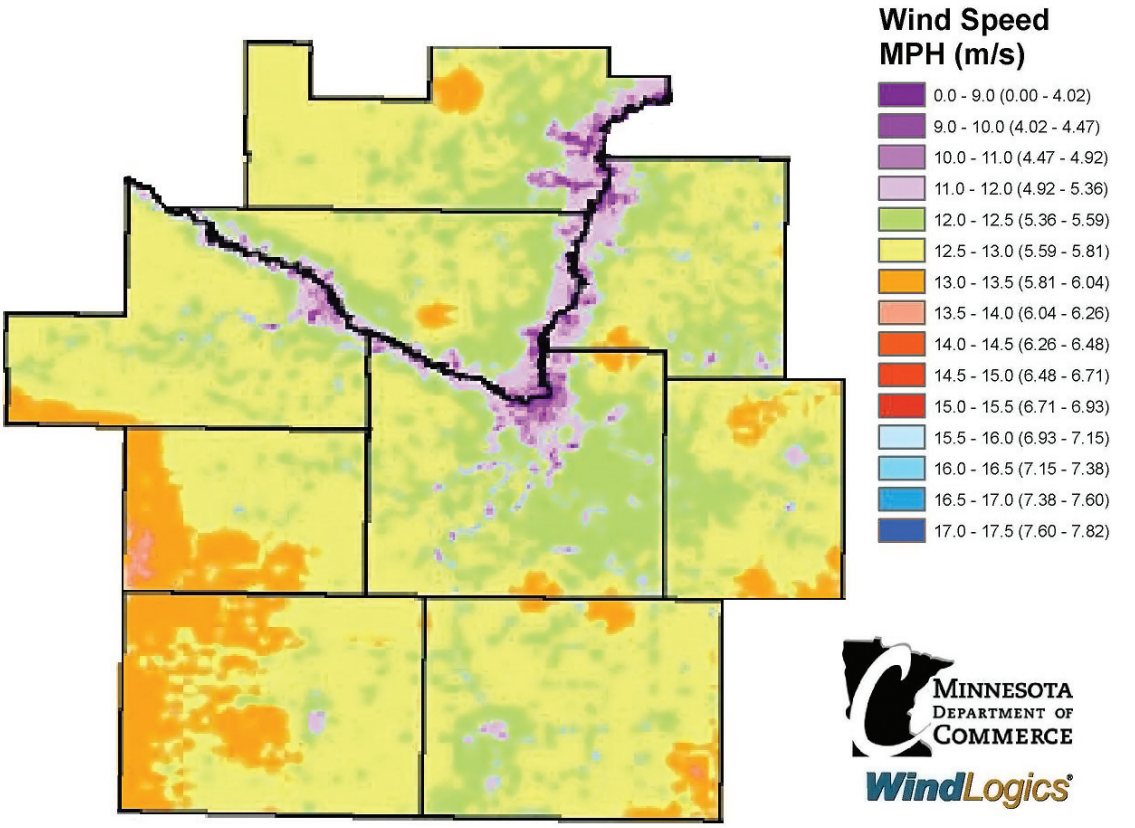
Direct monitoring by a wind resource measurement system at a site provides the clearest picture of the available resource. The most useful readings are those taken at hub-height, the elevation at the top of the tower where the wind turbine is going to be installed.

You can hire professional wind assessors to assist with the monitoring and with micrositing. Prevailing winds, geological formations, trees, buildings and future obstructions need to all be considered when choosing a site. Turbines should be sited upwind of buildings and trees, at least 30 feet above anything within 300 feet.

The site with the best wind is probably your highest piece of ground, but that may be far from the facilities that will be using the power. The cost of running the power from one to the other may make a closer site with slightly lower quality wind more economical.

The Region Nine Wind Resource Center has experts available to help determine if you have a site that will work for you. Contact Jon Hammel, jon@rndc.org, 507-389-8863, to take advantage of this service.

Region Nine's Wind Resource by Wind Speed at 30 Meters

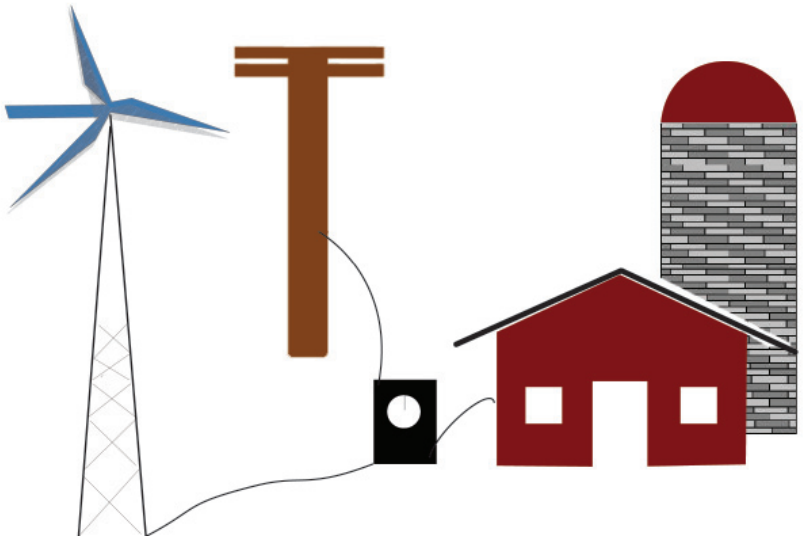


This map has been prepared under contract by WindLogics for the Deapartment of Commerce using the best available weather data sources and the latest physics-based weather modeling technology and statistical techniques. The data that were used to develop the map have been statistically adjusted to accurately represent long-term (40 year) wind speeds over the state, thereby incorporating important decadal weather trends and cycles. Data has been averaged over a cell area 500 meters square, and within any one cell there could be features that increase or decrease the values shown on this map. This map shows the general variation of Minnesota's wind resource and should not be used to determine the performance of specific projects.

Economics and Net Metering

Net metering allows the wind energy that you don't use to not only go onto the grid, but to be banked for you so you can draw against it or be paid full price for it. In Minnesota the law requires your utility to provide you this service if your turbine is less than 40kW in nameplate capacity. Minnesota laws provide for a uniform contract between small wind project owners and utilities. As the diagram below shows, the wind turbine and grid are both connected to a central meter, grid-tie inverter and controller from the grid to your home. The meter runs backwards when your turbine is producing more energy than you are using at the time. (Reference: Minnesota Rules 7835.3300 & 7835.9910)

Federal regulations require utilities to offer interconnection, but you will need to enter into an interconnection agreement with the utility, as well as a power purchase agreement. Minnesota has a standard application for interconnection, as well as a standard fee schedule. For a 20kW-250kW project, the fees should not exceed approximately $900. Contacting your local utility is one of the first steps in getting the process started, since they have information on details like interconnection requirements, insurance and indemnification.



Choosing a Turbine

Other things equal, larger turbines produce energy more efficiently than smaller ones. With Minnesota net metering, this suggests that your best bet is a turbine rated at just under 40kW. But turbines are not all equally reliable. A smaller, more reliable turbine, can be a better choice than a larger, less reliable one. Then, of course, larger turbines cost more up front. Windustry and the R9 Wind Resource Center can help you evaluate turbine models.

Electricity Costs

Region Nine is served by 9 different energy cooperatives, as well as Xcel Energy, Alliant Energy and 18 municipal utilities. Each utility sets its own rates for electricity per kWh, and the price fluctuates, usually by season. You can find out your average cost per kWh by looking at your utility bill or by calling your utility. Generally, at this time, 2011, the cost per kWh in the area is between 8 cents and 12 cents. The higher the cost, the sooner your turbine will payoff.

KWH Usage History

Cost per kWh isn't always simple to calculate. It is best to get a year's worth of usage and rates.

Current Bill Information

Meter #	Current Reading	Current Date	Present Reading	Present Date	Multiplier	Usage	Amount
1954	12952	12/31/10	12096	1/31/11	1.0	856	
2516	21857	12/31/11	20424	1/31/11 1	.0	1433	
		ENERGY CHARGE		856 KWH@ .113000	=		96.73
		ENERGY CHARGE		1433 KWH@ .075000	=		107.47
		POWER COST ADJ		856 KWH@ .00930	=		7.96
		POWER COST ADJ		1433 KWH@. 00470	=		6.73
		FIXED CHARGE					15.00
		STATE TAX					11.23
					TOTAL BALANCE		245.12

Incentives

Governments, utilities and other partners offer incentive opportunities

- **For the most complete and updated information,go to www.dsireusa.org.**
- Minnesota information can also be found at Minnesota Office of Energy Security at www.energy.mn.gov.
- Your utility company might also offer some kind of incentive. Some of the highlights include:
  - » **Federal Small Wind Turbine Treasury Grant:** The grant is equal to 30% of the basis of the property for small wind turbines.
  - » **USDA REAP Grant and Loan Guarantee**: These grants will fund up to 25% of the hard installed cost of a small wind project. This program also offers loan guarantees.
  - » **Minnesota Property Tax Exemption:** 100% exemption from the personal property taxes on systems under 250kW.
  - » **Agricultural Improvement Loan:** Low interest "Aggie" loans administered by the Minnesota Department of Agriculture through the Minnesota Rural Finance Authority.
  - » **Sustainable Agriculture Loan Program:** Loans of up to $40,000 to help finance projects that make agricultural practices more sustainable. More specifics can be found at: http://www.mda.state.mn.us/en/grants/loans/esaploan.aspx.

Region Nine Small Turbine Pro Forma Example 2011

Assumptions (Inputs in Yellow Cells)

Estimated Avg Wind Speed	11.5	mph
Initial Cost	$92,700	
USDA Grant? (25%)	No	
ITC as Grant? (30%)	Yes	
Other Grant ($)	0	
Actual Installed Cost	$64,890	
Annual Energy Output	32,070	kWh*
Electricity Cost ($/kWh):	$0.110	
Electricity Inflation Rate	5.00	%
Loan Downpayment (%):	10	%
Down Payment ($):	$6,489	
Amount of Loan ($):	$58,401	
Interest Rate on Loan	6.00	%
Loan Term (Years):	10	
Net Federal Tax Rate	35	%
O & M Cost ($/kWh):	$0.013	
O & M Inflation Rate	3.00	%
General Inflation Rate	2.50	%
Bulk Buy Discount	10.00	%

Results

Internal Rate of Return

Years 1 to 25:	16.8%

Loan Payments

Monthly Payment ($):	($661)
Value of Interest Deduction ($):	$60
Net Monthly Payment ($):	($602)

Ave. Monthly Income/Savings on Bill

Year 1 ($):	$294
Year 10 ($):	$479
Year 20 ($):	$780
Last Year ($):	$996

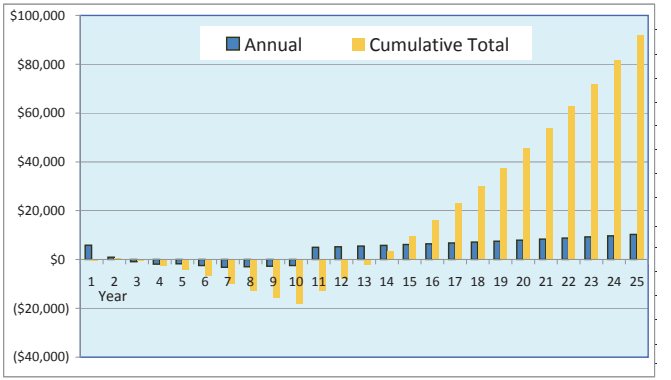
Total Upkeep Cost

($):	($20,481)

Turbine: 20kW*

Selected Annual Cash Flows

Year	Net Energy	Upkeep Costs	Net Deprec.	Net Loan Payments	Annual Cash Flow	Total Cash Flow
0					($6,489)	
1	$3,528	($417)	$9,993	($7,220)	$5,883	($606)
5	$4,288	($645)	$1,831	($7,220)	($1,746)	($4,194)
10	$5,473	($743)	$0	($7,220)	($2,491)	($18,016)
15	$6,985	($856)	$0	$0	$6,129	$9,690
20	$8,914	($986)	$0	$0	$7,929	$45,553
25	$11,377	($1,136)	$0	$0	$10,242	$91,904



Simple Payback

Years:	13.4

Max Annl Out-of-Pocket **In Year**

($):	($3,176)	7

Net Profit Over 25 Yrs

($):	$91,904

Total Out-of-Pocket **Over Yrs**

($):	($18,016)	1 to 10

Max Annl Out-of-Pocket is for the years 1-25.
Conservative assumption of no scrap value after turbine lifetime.
Cash flow is pre-tax.
Depreciation is 5 year MACRS.
Upkeep cost includes insurance including for major repair & replacement.

*The use of 'kW' (for kilowatt) to describe the turbine is just a way of indicating the size or capacity of the machine. This is analogous to describing an engine in terms of horsepower. kW should not be confused with kilowatt-hours (kWh). A kilowatt-hour is a quantity of energy. It is the amount of energy it would take to run a 1,000-watt blow dryer for an hour.

Disclaimer:

The information presented here is based on published material from sources we believe to be reliable. The results come completely from the assumptions and estimates made. No project will match these assumptions exactly. This example represents just one possible future that might come to pass. The Region Nine Wind Resource Center can work with you to look at other options to help you evaluate potential economics for other turbines and other scenarios.

Permitting

While the state of Minnesota has some basic requirements for wind projects, many of the zoning and permitting issues are handled by the county. Since the rules vary from county to county, it is best to get in contact with your local environmental services or planning and zoning staff before going ahead with a project. In the Region Nine area, average fees for wind turbine permits range from $100-$300. The Region Nine Wind Resource Center can also point you in the right direction.

Installation

Installation should be done by a credible installer who can provide many services. The Minnesota Office of Energy Security (OES) lists installers at www.energy.mn.gov, or see REDI Resources http://www.rediresources.org/, or, check with Region 9. It is important to ask for references, check out past projects and ask a lot of questions. While wind turbines are sturdy, they do require maintenance. It is also good to find out if your installer can also provide service and maintenance.

Risks and Rewards

Figuring out how to finance a wind project is one of the most important and, possibly, one of the most daunting tasks. It is important to know what your goals are before going headlong into the project. Are you hoping to produce electricity at a lower rate than retail? Do you want energy independence? Do you want to help the environment? How long are you willing to wait to see a payback on your investment? How much risk can you take on?

What is the potential?

If your approach to a wind turbine is solely as a financial investment, you'll want to consider the risks and potential rewards. From this perspective both the risks and potential rewards are large. Investing in a wind turbine should be approached in somewhat the same way as buying a house, because it is a long-term investment, as well as an investment in security and independence.

Regardless of the eventual financial outcome, a well thought-out small wind turbine also provides important public benefits: it reduces demand on existing infrastructure, it reduces pollution, it helps the local economy by keeping more energy dollars local, it contributes to energy independence and it encourages others to do the same. **What is the value of knowing you made this contribution?**

Resources

Books:

Any book by Paul Gipe
Wind Power for Dummies, Ian Woofenden
Power from the Wind, Paul Chiras

Websites:

US DOE: www.eere.energy.gov
Windpowering America: www.windpoweringamerica.gov
MN OES: www.energy.mn.gov
MN wind speed estimator tool:
www.mngeoserver.admin.state.mn.us/WindSpeed/
American Wind Energy Assn: www.awea.org/smallwind.html
Distributed Wind Energy Assn: www.dwea.org
Windustry: www.windustry.org
National Renewable Energy Lab: www.nrel.gov
Database of State Incentives for Renewable Energy:
www.dsireusa.org
Small Wind Certification Council:
www.smallwindcertification.org
North American Board of Certified Energy Practitioners:
www.nabcep.org/certification/small-wind

Periodicals: *Home Power Magazine*, www.homepower.com

Acknowledgments
USDA
Gustavus Adolphus College

REGION NINE
RENEWABLE ENERGY TASK FORCE

About R9 Renewable Energy Task Force (RETF)

RETF is a partnership of small businesses, local units of government, educational institutions, non-profits and citizen leaders who have come together to focus on renewable energy development opportunities within the nine counties in the south central Minnesota region.

WINDUSTRY®

About Windustry

Windustry is a non-profit organization based in Minneapolis, MN. We have more than a decade of experience advocating for community wind energy.

Mission: Windustry promotes progressive renewable energy solutions and empowers communities to develop wind energy as an environmentally sustainable, community-owned asset. Through member supported outreach, education and advocacy we work to remove the barriers to broad community ownership of wind energy.

Do you have questions about community wind energy? Call the Wind Information Hotline: 612-870-3469 or 800-946-3640 and online: **info@windustry.org**

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