

# Wind Energy

*for North Dakota Homeowners, Farmers and Small Businesses*

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*Adapted from Wind energy for Colorado homeowners, farmers and small businesses.  
Rebecca Cantwell, Colorado Harvesting Energy Network and Irene Shonle,  
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## 1. Is wind energy practical for me?

A small wind energy system may provide you with an economical source of electricity if you live in an area with fairly steady, strong winds and at least one-half acre of open land.

Personal impressions of the windiness of a site are often not accurate. Using an objective determination method is better. The most useful information will be obtained from placing an anemometer (a device that measures wind speed) on your site for at least one year. The Energy and Environmental Research Center at the University of North Dakota has an anemometer rental program ([www.undeerc.org/wind/default.asp](http://www.undeerc.org/wind/default.asp)).

A faster (and sometimes less expensive) method is to look up wind data from the National Renewable Energy Lab ([www.windpoweringamerica.gov/wind\\_maps.asp](http://www.windpoweringamerica.gov/wind_maps.asp)). Winds on your site should be at least class 2 (annual wind speeds averaging 9.8 to 11.5 mph at 50 meters above ground level) to be suitable for wind generation.

The U.S. Department of Energy has more information on siting turbines ([www.windpoweringamerica.gov/ne\\_siting.asp](http://www.windpoweringamerica.gov/ne_siting.asp)), and the American Wind Energy Association has a detailed siting handbook ([www.awea.org/sitinghandbook/](http://www.awea.org/sitinghandbook/)).

You will have to make sure your local zoning codes or covenants allow wind turbines and the fairly tall towers that make them work. Wind turbines are getting larger and evolving rapidly, so you need to do enough research to learn whether a turbine will pay for itself quickly enough to meet your financial requirements.

The number of small wind systems designed for individuals, businesses and farm or ranch operators are growing dramatically. The industry group American Wind Energy Association predicts a 30-fold increase in the U.S. in the next five years.

## 2. How does it work?

A wind turbine works by catching the energy in the wind, using it to turn blades, and converting the energy to electricity through a generator in the part of the turbine called a nacelle.

The turbine is only one part of the system, however. A tower will put the blades high in the air where the wind is better. Winds are more powerful and less turbulent higher off the ground, thus the taller the tower, the greater the turbine's energy production.

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In addition, the presence of ground clutter greatly reduces the wind resource and increases wind turbulence. One rule of thumb is that the bottom of the blade-swept area should be a minimum of 30 feet above any trees or buildings within 300 to 500 feet.

For systems with batteries, a controller manages the electrical input to the batteries or the inverter. In an off-grid system, or an on-grid system with battery backup, batteries will store the power. An inverter will convert direct current (DC) electricity to alternating current (AC).

### 3. Grid-tied vs. off the grid

Until recently, most of the small wind turbines in North Dakota were installed by people who lived “off the grid,” that is, away from a power company that supplied them electricity. They relied on their own ability to make power with a wind turbine or perhaps solar panels and backup batteries to store power.

But that is changing. Some states have passed legislation that requires all utilities to allow residential and commercial users up to a certain size to connect to the grid and to sell any excess power they generate back to the utility at the retail rate. This “net-metering” law has sparked a lot more interest in small wind turbines that connect to the power grid. Because these turbines are tied directly into the electricity system, they will not work when the power goes out unless they have a battery backup system.

In North Dakota at present, the rates at which utilities buy excess power are generally much lower than the rates individuals pay to buy power.

### 4. How big of a system do I need?

Most small wind turbines have a rating or size based on the maximum electricity they can generate, such as 1.8 kilowatts or 5 kilowatts. But that is not a very useful number for most consumers. This is because rated output is the peak production at a specific (and usually high) wind speed, and different manufacturers use different wind speeds to determine rated output.

Using turbine power curves to estimate output is better. Any reputable small wind turbine representative will supply you with a power curve showing how much electricity the machine produces at a given wind speed. Use this to estimate how much energy in kilowatt-hours (kwh) the turbine will produce each month

or year at the average wind speed you expect or measure at your site. Match this output with your annual energy consumption. To determine this number, check your monthly bills to come up with the annual total of kwh of electricity you use.

Once you have determined your annual electricity use, you can decide how much electricity you want to offset with a turbine, based on budget and other considerations. For example, if you want to offset nearly all your electricity use and have determined you have annual usage of 10,000 kwh, select a turbine that will produce that much power in the course of a year at your average wind speed.

### 5. How much will it cost?

The cost of residential wind turbines varies depending on how much power they can produce and other factors. A rough range is \$4,000 to \$8,000 per rated kilowatt. A system that would offset most of an average home’s electricity use (10,000 kwh/year) will cost roughly \$50,000 before incentives. Again, if you don’t have consistent wind speeds high enough (10 to 12 mph), to spin the turbine regularly, the investment probably doesn’t make sense.

### 6. How do I calculate a payback?

Determine the amount you paid on electrical bills before you installed your system. If your system offsets all your electricity, once you know its cost, you can divide that by the annual bill and determine how many years you will need to pay it off. If you are offsetting only part of your use, you will need to adjust the calculation accordingly.

Windustry has a wind energy payback period worksheet ([www.windpoweringamerica.gov/docs/small\\_wind\\_economic\\_model.xls](http://www.windpoweringamerica.gov/docs/small_wind_economic_model.xls)) that goes into more detail, and the National Renewable Energy Laboratory has a calculator (<http://analysis.nrel.gov/windfinance/login.asp>) and a paper on the economics of grid-tied small wind energy systems ([www.nrel.gov/docs/fy00osti/26975.pdf](http://www.nrel.gov/docs/fy00osti/26975.pdf)).

### 7. Sticker shock?

No matter what kind of electricity you are using, the best way to reduce expenditures is to use less. That means both making your home more efficient and also finding ways to cut your use, such as opening

your windows on cool nights and closing them as the day heats up. Turning off lights and unplugging appliances when not in use also can really add up.

For more information, see fact sheet 10.610, "Energy Conservation in the Home" ([www.ext.colostate.edu/pubs/consumer/10610.html](http://www.ext.colostate.edu/pubs/consumer/10610.html)).

## 8. What are the rebates or other incentives?

You've never had a better time to buy a small wind turbine in terms of incentives. The federal Investment Tax Credit now offers 30 percent of the total cost of an installed system as a credit against income taxes owed. This is the first time small wind energy development has had such a generous federal incentive. Some local utilities also may have rebate programs.

At the state and local level, a number of additional small wind energy system incentive programs are available. Check with your local utility to see if you are eligible for rebates or other programs. The Database for State Incentives for Renewable Energy and Efficiency ([www.dsireusa.org/](http://www.dsireusa.org/)) maintains a list of rebates and incentives.

## 9. What zoning issues might I run into?

Zoning regulations vary dramatically across states, counties and municipalities. Check with your county planning and zoning office before proceeding. In many urban counties, height restrictions may rule out a wind tower. Discussing the idea with your neighbors always is a good idea because they may have input on placement.

## 10. What kind of maintenance will I need to do?

Maintenance varies by system, so ask when you are considering which to buy and when you are reviewing literature from different manufacturers. Wind turbines require regular maintenance, which generally consists of periodic inspections and adjustments. Due to the height of the towers, most owners are not going to be able or willing to service them. Representatives of manufacturers can give you an idea of the expected maintenance schedule and help you arrange maintenance.

## 11. How long will the system last?

When you are considering buying a system, ask about its anticipated lifespan. Most reputable small turbines should perform well for many years with only periodic maintenance required. Buy a turbine that has a very good track record and a good warranty – at least five years is preferable. A warranty is one indication of the manufacturer's confidence in its product and its intention to stand behind the turbine. In general, you can expect 20 years from a properly maintained turbine from a reputable manufacturer.

## 12. Where can I go to research more about specific components of my system?

Resources provided at the end of this publication will help get you started. The National Renewable Energy Laboratory is testing numerous small turbines and making all the information publicly available on its Web site ([www.nrel.gov/wind/smallwind/independent\\_testing.html](http://www.nrel.gov/wind/smallwind/independent_testing.html)).

## 13. Where can I find an installer?

Installation generally is arranged by representatives of the manufacturer. Several have a very precise way of handling installation, including determining the best place on your property to place the turbine and catch the best wind. The American Wind Energy Association has a list of turbine manufacturers in the United States ([www.awea.org/smallwind/smsyslst.html](http://www.awea.org/smallwind/smsyslst.html)).

## 14. Do I have to think about insurance?

Yes, you will want to insure your turbine, and some counties require liability insurance. Ask your property insurance company whether it will insure the turbine.

## 15. How will it affect the value of my house/ranch/farm?

A small wind turbine, like other capital investments, should increase the value of your property. If you can tell a prospective buyer that your electricity bills are almost nothing, the value of the installed turbine may be an attractive incentive. However, you have an equal chance that a wind turbine may negatively impact values if the system is not maintained.

## 16. What is the impact on the environment?

Small wind turbines emit no pollution and need no water. They also reduce the amount of pollutants that your utility would emit if you were relying instead on electricity from burning coal, for example.

According to the American Wind Energy Association, during its life, a small residential wind turbine can offset approximately 1.2 tons of air pollutants and 200 tons of greenhouse gas pollutants (carbon dioxide and other gases that cause global warming).

Although the impact of wind turbines on wildlife, especially birds, is of concern to many people, research has shown that bird impacts with small, unlighted turbines are quite rare. House windows and outdoor cats have a much greater negative impact. The National Wind Coordinating Collaborative has a list of wildlife/wind interaction publications for more information ([www.nationalwind.org/publications/wildlifewind.aspx?](http://www.nationalwind.org/publications/wildlifewind.aspx?)).

Most modern residential turbines are quite quiet; the noise they produce is similar to ambient noise levels under average wind conditions.

## 17. What other renewable energy resources should I think about?

Before considering adding any renewable energy to your home, ranch or farm, experts advise you to do everything reasonable to reduce the energy you are using through conservation and efficiency.

After that, adding renewables depends on your location and budget.

Solar photovoltaic panels may make more sense than small wind turbines in most urban areas. A combination of the two, perhaps with a diesel generator backup, often makes sense for people who want to live completely independently of the power company.

A ground-source geothermal heat pump, which takes advantage of the relatively uniform temperature of the earth, makes sense for heating and cooling, especially in new construction. And if you have water running downhill on your property, a micro-hydro generator might be a good option to consider.

### Further Resources

Wind Powering America's Small wind for homeowners, ranchers, and small businesses  
([www.windpoweringamerica.gov/small\\_wind.asp](http://www.windpoweringamerica.gov/small_wind.asp))

Small wind from American Wind Energy Association ([www.awea.org/smallwind/](http://www.awea.org/smallwind/))

National Renewable Energy Laboratory (<http://nrel.gov/>)

Hundreds of small wind turbines ([www.allsmallwindturbines.com](http://www.allsmallwindturbines.com))

Windustry's Home and farm scale wind  
(<http://windustry.org/your-wind-project/home-and-farm-scale-wind/home-and-farm-scale-wind>)

Farm wind resources from the National Sustainable Agriculture Information Service  
([http://attra.ncat.org/farm\\_energy/wind.html](http://attra.ncat.org/farm_energy/wind.html))

**For more information on this and other topics, see: [www.ag.ndsu.edu](http://www.ag.ndsu.edu)**

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