

Can I have a wind turbine, please?

Can I put one on my roof/in my yard?

Wind turbine towers can vary in height from 100 feet (30m) for small towers to 492 feet (150m) for industrial towers. Typically, wind turbine manufacturers recommend siting a tower on a minimum of a half to 1 acre of land without trees or buildings. Roof or building mounted turbines are an emerging technology and may require additional reinforcement and support to avoid structural damage from strong wind and vibration. Vibration from building mounted units can also result in loud noise.

What building/zoning codes apply to wind turbines?

Some jurisdictions restrict the height of the structures permitted in residentially zoned areas, although variances are sometimes obtainable. Most zoning ordinances have a height limit of 35 feet. You should speak with local representatives to determine any building permits, electrical permits, approvals, and certification that is needed prior to installing a wind system. This is a critical phase and it is vital that you have all approvals in place before beginning any installation or ordering your equipment. Your installer should have experience helping customers secure necessary permits.

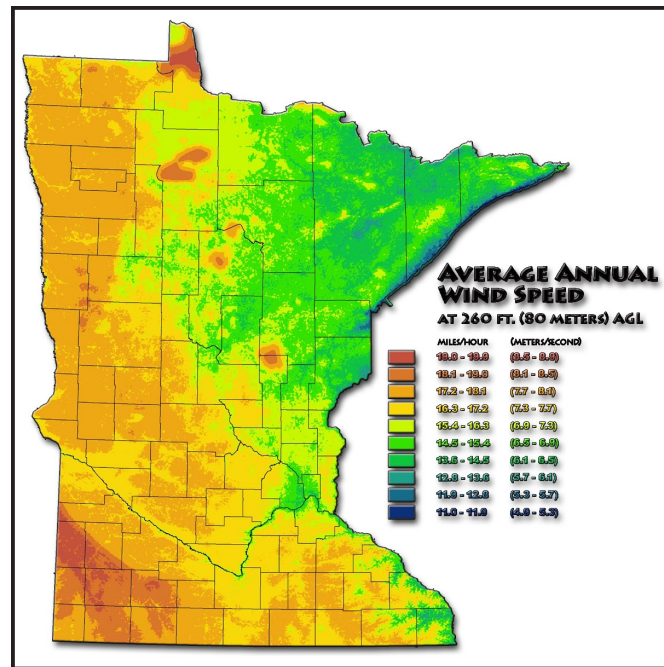
How much of my house can I run off a turbine?

A typical Minnesota home uses approximately 810 kWh of electricity per month. Depending on the average wind speed, a wind turbine rated from 5 to 15 kilowatts would be required to make a significant contribution to this demand. A 1.5- kW wind turbine will meet the needs of a home requiring 300 kWh per month in a location with a 14-mile-per-hour annual average wind speed.

How can I store electricity for later use?

Battery systems can be installed to store electricity for off-grid installations. Battery back-up for an off-grid site is an advantage when the cost to connect to the grid is significantly more than the cost of a wind energy system with battery back-up. The cost of interconnection starts to become

The Minnesota Office of Energy Security has a series of wind speed maps (www.energy.mn.gov) that can help determine likely locations for wind turbines. An annualized average of 12 mph at the rotor height is recommended as a minimum for a successful wind installation.



comparable at distances over a half-mile. Off-grid wind systems are typically combined with a solar electric system and/or a back-up propane, diesel or gas generator to provide more reliable power under a variety of seasonal weather conditions.

Installation and maintenance of battery systems adds significant up-front and maintenance costs to a wind energy system, so they are not generally recommended for sites that are already connected to the utility power-grid. Costs vary widely depending on the back-up power needs, but typically add 25% to the up-front cost of the system. Battery life is typically 4-10 years depending on battery type. Most electricity storage systems use lead-acid batteries. Once spent, the batteries must be properly disposed of. Where a grid connection is already available, connecting to the grid without batteries is the most cost-effective *and* environmentally friendly way to go.

What kind of maintenance is needed?

Wind turbines operate thousands of hours per year, often under harsh conditions. The wear and tear on a small wind turbine has been compared to putting 100,000 miles a year on a car. As a result, periodic maintenance is required to maintain bearings and lubricants. The maintenance costs of a wind turbine depend both on the quality of the turbine and the local climatic conditions such as the amount of turbulence at the site. For basic maintenance, not including major overhaul or repair costs, the average annual repair costs are approximately 1% of the original turbine cost. With proper maintenance, a wind turbine should last 20 years or longer.

How much does it cost?

A general rule of thumb for estimating the installed cost of a residential turbine is \$5,000 to \$10,000 per kilowatt, depending on size, application, and service agreements with the manufacturer. Wind energy becomes more cost effective as the size of the turbine's rotor increases. Although small turbines cost less in initial outlay, they are proportionally more expensive. For a wind tower that is tall enough to take advantage of available wind (100-120 feet for small wind systems) the tower itself is often just as expensive as the turbine equipment – a fact that is frequently overlooked in reports of wind system pricing.

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How much money will I save?

Depending on your wind resource, and the size of the turbine, a small wind energy system can lower your electricity bill by 50-90%. If you generate 400 kWh/month (4800 kWh/yr) and you pay \$0.08/kWh, you can save \$384 per year in offset electricity costs. In Minnesota, if you generate more electricity than you use in a month, the utility must pay you the average retail rate for the excess electricity. If your excess electricity is 100 kWh/month and you pay \$0.08/kWh, then the utility will pay you \$8.00/month.

How long before my system is paying for itself?

It can take anywhere from ten to forty years to recapture costs of equipment and installation, depending on the size and complexity of your installation, the wind resource, price of electricity (or distance from the grid), electricity usage, finance rate, and available rebates or incentives.

Where do I find a good manufacturer/installer?

The Office of Energy Security does not endorse any particular manufacturer or installer, however, the OES can provide a list of renewable energy dealers and installers. You can also call or go to the manufacturer's website to see who distributes their equipment in Minnesota. When shopping for a wind turbine system, you should compare warranties, predicted lifetimes, and the manufacturer's and turbine model's reputation for quality and service.



How can I invest in wind systems?

Even if building a wind turbine on your property is not an option, there are a number of options to invest in wind power. Green Pricing programs are available from your utility so that you can offset your electricity usage by investing in new wind energy development. You can also purchase Renewable Energy Certificates from the Chicago Climate Exchange through a variety of brokers. See the Department of Energy's website at www.eere.energy.gov/greenpower/markets/ for more information. Communities can take advantage of Minnesota's Community-Based Energy Development (C-BED) tariffs that provide higher payments from utilities for community-based projects.

Why do I have to pay extra for Green Pricing?

Green pricing is an optional utility service that allows customers an opportunity to support a greater level of utility investment in renewable energy technologies. Participating customers pay a premium on their electric bills to cover the incremental cost of developing new renewable energy generation facilities. In Minnesota, utilities cannot use green pricing energy generation to satisfy renewable energy mandates, so the green pricing program is a way for customers and utilities to go above and beyond the minimum standard.

Aren't turbines noisy and dangerous to birds?

Wind turbine noise levels from small wind turbines are comparable to the noise level that a refrigerator or air conditioner would be from an adjacent room. Noise level issues from industrial size wind turbines are mitigated by setback requirements that specify an acceptable decibel level, comparable to natural background noise levels. Bird deaths due to wind development will never be more than a very small fraction of those caused by other commonly accepted human activities. The modern wind turbine is far less harmful to birds than are tall buildings & windows, domestic cats, vehicles, pesticides, radio towers, and airplanes. Summaries of available wind studies can be found at www.currykerlinger.com and at www.nationalwind.org. Wind power does not create any carbon dioxide or toxic byproducts, so compared to the noise levels and environmental effects of conventional fossil fuel energy sources, wind is an optimum environmental option.



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