

# Small rooftop wind turbines

## Common questions and answers

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BIOMASS



SOLAR



WIND

**R**ooftop wind turbines are one of the most talked about trends in renewable energy. City dwellers and suburbanites, inspired by the spread of large turbines and intrigued by the idea of producing their own energy, are today inquiring about rooftop wind systems in record numbers.

But just how viable are these systems? Can small rooftop wind turbines ever produce enough electricity to make the investment worthwhile? Find out the answers to these and other commonly asked questions below.

### First things first: How do residential wind turbines work?

Like all renewable energy technologies, wind systems rely on two main parts: a collector to harness the energy and a generator with electronics to convert the collected wind energy into power we can use. In wind systems, the collector is the rotor, which is made up of a number of blades that rotate to power a generator that produces electricity. The electronics within the generator and inverter assure that the electricity generated is compatible with the utility.

Any renewable energy system's energy output is directly proportional to the size of its collector. In wind turbines, small rotors can only collect small amounts of wind and convert it into small amounts of electricity. Large turbines, such as found on wind farms, collect far more energy than small turbines due to their larger rotors.

In most residential wind energy applications, a home is served by both the wind turbine and a local utility simultaneously. When wind speeds are low and the turbine produces no output, all of the home's electricity is purchased from the utility. As wind speeds rise and the turbine output increases, the amount of power purchased



**This small rooftop wind system is located too close to rooftops, other buildings and trees; all of these cause turbulence that reduces the effectiveness and performance of the turbine..**

from the utility decreases proportionately. When the turbine produces more power than the house needs, the extra electricity is "stored" on the utility grid in the form of a credit to be used by the house when the wind is not blowing.

### Will a small rooftop turbine power my whole house?

No. Small turbines can only produce small quantities of electricity due to their small rotors.

Rooftops are ill-suited to harness the wind regardless of their location due to the trees and buildings surrounding a home. Rooftops in the city are particularly difficult places to harness the breeze. Not only are cities less windy than the countryside, but the air is turbulent because of trees and the variation in heights of buildings. Turbulence can wear out a turbine and reduce its life expectancy.

### Why must rooftop turbines be so small?

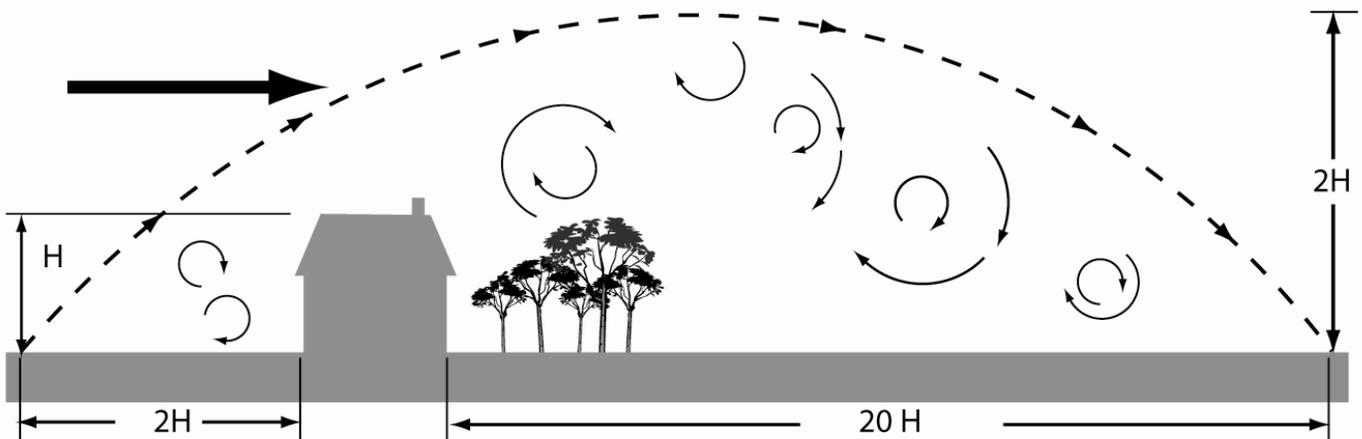
Rooftop turbines must be small to avoid damaging roofs and homes. The roofs of residential homes are simply not designed to accommodate the forces exerted on the wind turbine by the wind. In addition, insurance companies may look very skeptically at mounting such devices on roofs.

Contact Focus on Energy<sup>SM</sup> to learn about renewable energy options for your home, business or organization. Full program details, applications for awards and eligibility requirements are available from the Renewable Energy Information Center. Call 800.762.7077 or visit [focusonenergy.com](http://focusonenergy.com).



**focus on energy**<sup>SM</sup>

*The power is within you.*



This diagram shows how objects like buildings and trees can cause turbulence bubbles that affect the quality and the quantity of a wind turbine's fuel, the wind. From *Power from the Wind* by Dan Chiras. Used with permission.

### What size turbine do I need?

The answer to this question depends on how much electricity you consume on a monthly and yearly basis. The more electricity you use, the larger the turbine you'll need to help offset your consumption. You can contact your utility provider to learn specific details about your home's historic electricity use.

When considering a renewable energy system size, it's important to remember that the most cost-effective way to power your home is not to buy a larger, and therefore, more expensive wind turbine—but rather, to understand how your home currently uses electricity and identify ways to use less. It is always more cost effective to use energy more efficiently than to generate large amounts of electricity that may be wasted on inefficient appliances, products and practices. A consultant partnering with Focus on Energy can help you identify ways to save energy and money at home by identifying problem areas and recommending solutions.

### How do I know if wind power will work at my home?

Two questions are critical in determining whether your site is suitable for wind power:

#### 1. Do you have a wind resource?

First, you need to know the long-term average wind speed for your area at the height that the

wind turbine must be mounted to access the free flow of wind. The amount of electricity that a wind turbine can generate is a function of how much wind it can collect. If your site has at least a 10 mph average annual wind speed on top of a tower that clears all the trees in the area, you may have a minimally good site for a wind system. As a first rough approximation, you can consult the Wisconsin Wind Map ([focusonenergy.com/wisconsinwinddata](http://focusonenergy.com/wisconsinwinddata)) to see the estimated average wind speeds in your area. You can also see where other wind turbines are located by visiting the Focus on Energy Project Maps at [focusonenergy.com/renewablemaps](http://focusonenergy.com/renewablemaps). Please note that because the wind resource varies from site to site, the only reliable way to obtain an accurate estimate of the wind resource at your location is to schedule a site assessment performed by a trained and certified wind site assessor.

#### 2. Is the wind resource accessible?

Equally important is your access to the available wind. For performance and reliability, the general rule of thumb is that the entire rotor of the wind turbine must be situated at least 30 feet above the surrounding trees and buildings. This is why wind turbines are typically installed on taller towers. Wind systems positioned at or below the tree line will collect little energy due to low wind speeds and inconsistent, turbulent wind flow.

Focus on Energy partners with certified site assessors who can help you determine your site's suitability for wind power and other renewable energy systems by visiting your property and conducting a comprehensive site assessment. You can find details by visiting [focusonenergy.com/siteassessments](http://focusonenergy.com/siteassessments).

**What options do I have if a tall tower is out of the question?**

Sometimes zoning restrictions and neighborhood associations can make tall towers difficult to permit. Rather than compromising your wind system by installing a turbine on a tower that is too short to sufficiently reach above surrounding trees and buildings or on your roof, Focus on Energy recommends considering a different type of renewable energy, such as solar electric or solar hot water. Both of these technologies are often easier to permit and may be more economically attractive for use on residential properties. You can find more information about solar energy systems by visiting [focusonenergy.com/renewable](http://focusonenergy.com/renewable).

**Does Focus on Energy offer financial incentives for small rooftop wind systems?**

Not at this time. Focus incentives are based on annual energy output, and to date, it has not been possible to obtain accurate estimates of electricity production from small rooftop wind systems, and little objective documentation exists to support their effectiveness.

In addition, it is beyond the scope of wind resource maps to accurately predict wind speeds on rooftops and short towers, or in urban areas. For this reason, it is strongly suggested that you install a wind data logger to monitor wind speed in these difficult locations if you are interested in pursuing a small rooftop wind system or short tower that does not clear the trees in the area. Such data will help determine if you have a wind resource that is worth capturing with a wind turbine.

**What are my next steps?**

Focus recommends that you schedule a site assessment to determine whether a wind



**This is an example of a wind turbine that is tall enough and well-sited to access a good wind resource.**

system—or other type of renewable energy system—can help meet your energy needs. A certified wind site assessor will visit your home, assess its renewable energy potential, evaluate your energy needs and provide a written report containing detailed suggestions about size, siting and cost of a wind turbine. Focus on Energy may pay up to 50 percent of the cost of this site assessment. Contact Focus or visit [focusonenergy.com/siteassessments](http://focusonenergy.com/siteassessments) for details.

Focus also offers an array of educational fact sheets to help you learn more about renewable energy technologies and the financial incentives available for installing them. For details, call Focus on Energy at 800.762.7077 or visit [focusonenergy.com/renewable](http://focusonenergy.com/renewable).

PHOTO COURTESY ARCH ELECTRIC



**While urban rooftop wind turbines are usually poor energy producers, solar technologies are the ideal urban renewable energy generators.**

#### **About the author**

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#### **How energy efficiency can make a difference**

In Wisconsin, the average non-all-electric single-family home (that is, one that uses natural gas or propane in addition to electricity) consumes about 800 kilowatts of electricity per month, or 10,000 kilowatt-hours per year. Depending on the available wind resource and the tower height required to raise the turbine above the trees, a turbine sized to generate this amount of electricity could cost \$55,000 to \$70,000 installed before Focus on Energy incentives and federal grants and/or tax credits.

However, this size requirement can be reduced significantly through energy efficiency. If the home's occupants reduced their energy consumption to 550 kilowatt-hours per month by using high efficiency appliances and other energy-saving products and practices, the turbine's size requirements would shrink considerably, saving \$10,000 to \$20,000 on the cost of the turbine. By comparison, a homeowner would be hard-pressed to spend even \$10,000 to replace all of a home's major electrical appliances (refrigerator, dishwasher, microwave, air conditioner, all lighting, and other large energy consumers) with energy efficient models. A good rule of thumb to remember is that every dollar saved through energy efficiency saves three dollars on a renewable energy system.