



STEP 5

Steps in the Small Wind Series

1. Understand Small Wind
2. Electricity Consumption and Installation Options
3. Assessing Your Wind Resource
4. Estimating Energy Production
- 5. Selecting Turbine Model**
6. Economic Considerations and Incentives
7. Siting and Permitting
8. Operation and Maintenance
9. Living with Small Wind
10. Wind for Pumping Water

E³A: Small Wind Energy Applications for the Home, Farm, or Ranch

Selecting Turbine Model and Tower Height

There are a number of buying guides to assist consumers in purchasing a wind system. You might consider using *HomePower Magazine's* Annual Buying Guide. Until the Small Wind Certification Council data is more robust, this is one of the few sources that provide side-by-side comparisons of wind turbines.

Assessing Information Provided

Information will vary by manufacturer until testing standards become more common. It is a good policy to ask questions about the turbine information and power production estimates.

Questions to Ask About a Turbine

Here are a few questions to ask an installer or manufacturer:

- **Is this a well-established manufacturer?** Some small wind manufacturers have been in business for decades. These companies often have equipment with long-term product performance records. There is nothing wrong with buying from a newer company, but more caution may be warranted if long-term product performance records do not exist.
 - Yes
 - No
 - Uncertain
- **Is the estimated energy production consistent with other turbines with the same rotor diameter?** Remember that power production and rotor diameter (or swept area) are directly related. Be wary of turbines that claim a much higher power output than their rotor diameter (as indicated by SWCC or the Home Power Buying Guide). Ask for an annual energy output calculation. Ask questions about how this calculation was completed. Test the assumptions, especially the wind resource at your site. Ask for actual energy output from installed turbines. How much power was generated? Are there customers in your area that you could contact about their experiences?
 - Yes
 - No
 - Uncertain
- **Is the installer using a good resource for wind data?** Good wind data is one of the most important factors in selecting an appropriate turbine and estimating power output. Ask where they are getting their wind data. Is it detailed enough to be specific for your site?
 - Yes
 - No
 - Uncertain
- **Was the turbine performance measured in a field test?** Not all wind turbines have been field-tested. Some manufactures have only tested their equipment in wind tunnels. System performance may vary in an actual installation. Ask for specific locations of tests so that you can check to see that field-testing did occur. Can the manufacturer provide a record of these tests?
 - Yes
 - No
 - Uncertain
- **Has the turbine performance been independently verified?** Ask for independent third-party tests of the turbine. You want to know if someone other than the manufacturer will verify the system performance. Examples of third-parties might be universities, the National Renewable Energy Laboratory or the Small Wind Certification Council.
 - Yes
 - No
 - Uncertain

- **Is the turbine labeled for compliance with UL 1741?** This means that the turbine has been certified as safe for connection to the utility grid.
 - Yes
 - No
 - Uncertain
- **Is it compliant with International Electrotechnical Commission (IEC) design and safety standards?** This means that the turbine has been certified as safe by electrical code standards.
 - Yes
 - No
 - Uncertain
- **Is there a supplier of parts and/or service in your area?** When the system requires maintenance, how quickly can you get parts or assistance? Is there a service contract with the turbine?
 - Yes
 - No
 - Uncertain
- **Does the turbine come with a warranty? If so, what is covered and how long is it in effect?** Is the company financially sound enough to pay warranty claims?
 - Yes
 - No
 - Uncertain
- **Can the manufacturer provide a record of the performance?** Questions about performance might include: How many of these turbines are installed? How many are still operational? Some manufacturers may claim a large number of installed systems, but not all of those systems are still in operation.
 - Yes
 - No
 - Uncertain
- **Do you know the tower top weight?** Typically, turbines with heavier tower top-weights can withstand higher winds and have longer life expectancy. You can also use the Home Power Buying Guide to compare tower top-weights.
 - Yes
 - No
 - Uncertain

Capacity Factors

The use of capacity factors in discussing small wind installation is not considered appropriate by some experts. (Gipe, 2006). However, many consumers find that their manufacturer or installer will quote capacity factors during the sales process. You should instead ask for Annual Energy Output calculations. Capacity factor is a ratio of the actual output of the turbine over the amount of output that it could have if it operated at full capacity 100 percent of the time. There are a variety of reasons that this measure is not helpful. However, if you are quoted a capacity factor, be aware that capacity factors in small wind range from nine to 22 percent. A higher number is better, but capacity factors above 22 percent are not realistic for small wind. Capacity factors of

30 to 45 percent and higher are typical for commercial machines of 1.5 to 2.5 megawatts, but are not possible for small wind turbines.

Site Visit

Visit with a current owner of the turbine model you are considering. Your manufacturer or dealer should be able to provide you with a list of current owners. Ask about their experience with the turbine. How much power is generated by the turbine and how did that compare with the estimates provided at the time of installation? Make time to visit an installed system. A site visit will help you create realistic expectations about wind turbine ownership. It will also give you a chance to hear the noise generated and to see the turbine footprint and visual impact to the property.

Selecting Tower Height

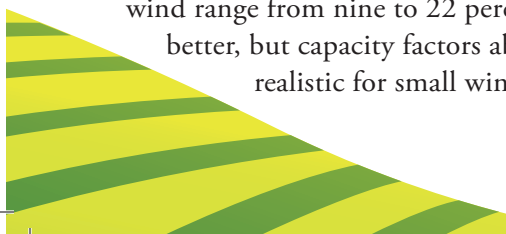
The tower should be tall enough for the bottom edge of the turbine blades to be at least 30 feet above the tallest obstacle within 500 feet. Many small wind manufacturers recommend a minimum tower height of 65 feet (20 meters). To better understand the importance of tower height in capturing the wind resource, refer to Step 3—Assessing Your Wind Resource Fact Sheet in the E3A series.

Here are a few things to keep in mind on tower height:

- Think long term! Trees will grow. What is their final or mature height? Are there any structures planned nearby? Plan for the future.
- Are there a variety of tower heights sold in your area? In some areas, dealers may only carry two or three tower heights. If the tallest available tower is not right for you, you might want to consider another renewable energy technology, such as solar. Remember that a short tower on a wind turbine is akin to placing a solar panel in the shade.
- Are there zoning or homeowner association restrictions that would limit your tower height?



Courtesy of DOE/NREL: Credit Warren Gretz



What about...?

Here are common questions with regard to using short towers:

Question	Answer
Can I make my own tower or use another type of tower (lighting, cell, etc) instead?	Manufacturers will typically not honor warranties for systems that are not mounted on approved towers. Wind systems encounter a lot of load and torque and the margin between a well-balanced and functioning system and a system failure is very small. For any wind system, make sure the tower is rated for the turbine you intend to install and is suitable for the winds in your area.
My neighbor's turbine is mounted on a shorter tower than what is suggested here. Can I do that?	Remember that wind turbine siting is site specific – what is appropriate for your neighbor's property, or even another site on your property, may not be appropriate for the site you are considering.
I really want to save money on tower expense. Can I install the system on a short tower?	You must balance energy output and economics. Towers under 45 feet usually compromise energy output. There are situations where the site and wind are suited for a 30-foot tower, but these sites are the exception. The decision you make when you use a shorter tower than is appropriate for your site is one of lower upfront investment, but longer simple payback and lesser energy production.

References

Association, A. W. (2008). *Windletter*. Retrieved December 2010, from www.awea.org/wind/Toolbox-Homeowners/Questions%20Any%20Manufacturers%20Should%20Answer.pdf

California Energy Commission Renewable Energy Program. (2002, February). *Buying a Small Wind Electrical System*. Retrieved April 2010, from Buying a Small Wind Electrical System Publication Download: http://www.consumerenergycenter.org/erprebate/documents/2002-05-01_WIND_GUIDE.PDF

Gipe, P. (2006, January 23). *Wind-Works.org*. Retrieved April 14, 2011, from Generator Ratings and Capacity Factors: Why You Should Avoid Them: <http://www.wind-works.org/articles/generatortestingandcapacityfactors.html>

NREL. (2005). *US Small Wind Consumer's Guide*. Boulder: NREL.

NREL, Rebecca Meadows. (2009, December 7). *Basics of Farm/Residential Small Wind Turbines*. Presentation . Great Falls, MT: NREL.

Sagrillo, M. (2002, August & September). *Apples and Oranges 2002: Choosing a Home-Sized Wind Generator*. Home Power Magazine, pp. 50-66.

Wind Works: Paul Gipe. (2000, Summer). *Testing Power Curves of Small Wind Turbines*.



