Selecting turbine model and tower height

There are several buying guides to assist consumers in purchasing a wind system. You might consider using Home Power Magazine's annual buying guide. Until the Small Wind Certification Council's (SWCC) data is more robust, this is one of few sources that provide side-by-side comparisons of wind turbines.

Photo credit: DOE NREL, Doug Nelson

Assessing information provided

Information varies by manufacturer until testing standards become more widespread. Ask about turbines and power production estimates to get a sense of which turbine is right for you.

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 sell equipment with long-term product performance records. There is nothing wrong with buying from a newer company, but tread carefully if they don't have long-term product performance records.

☐ Yes ☐ No ☐ Uncertain

Is estimated energy production consistent with other turbines with the same rotor diameter? 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 reported by the SWCC or the Home Power Buying Guide. Ask for an annual energy output calculation. Ask how they arrived at their calculations. Test their assumptions, especially those concerning 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 to your site?

☐ Yes ☐ No ☐ Uncertain

Was the turbine's performance measured in a field test? Not all wind turbines have been field-tested. Some manufacturers 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 records from these tests?

☐ Yes ☐ No ☐ Uncertain

Has the turbine's performance been independently verified? Ask for independent third-party tests of the turbine. You want to know if someone other than the manufacturer can verify the system performance. Examples of third parties include

universities, the National Renewable Energy Laboratory (NREL) or the SWCC.

☐ Yes ☐ No ☐ Uncertain

Is the turbine labeled for compliance with Underwriters Laboratories 1741? This means 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 the turbine has been certified as safe by electrical code standards.

☐ Yes ☐ No ☐ Uncertain

Is there a supplier of parts or service in your area? When the system requires maintenance, how quickly can you get parts or assistance? Does the turbine come with a service contract?

☐ 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 and how many are still operational?" Some manufacturers may claim a high number of installed systems, but not all of those systems are still operational.

☐ Yes ☐ No ☐ Uncertain

Do you know the tower top weight? Turbines with heavier tower top weights can typically 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

Capacity factor is a ratio of a turbine's actual output to its theoretical output operating at full capacity all of the time. There are several reasons this measure is not helpful. Some experts do not consider the use of capacity factors in discussing small wind installation to be appropriate (Gipe, 2006). However, many consumers find their manufacturer or installer will quote capacity factors during the sales process. Instead, ask for annual energy output calculations. However, if you are quoted a capacity factor, be aware that capacity factors in small wind range from 9 to 22 percent. A higher number is better, but capacity factors above 22 percent are unrealistic 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 attainable for small wind turbines.

Site visit

Speak with a current owner of the turbine model you are considering about their experiences with the turbine. Your manufacturer or dealer should be able to provide you with a list of current owners. How much power does the turbine generate, and how does that compare with estimates provided at the time of installation? Visit an installed system to develop realistic expectations of a wind turbine system. It will also give you a chance to hear the noise generated and see the turbine's visual impact on the property.

Selecting tower height

The tower should be tall enough that the bottom edge of the turbine blades be at least 30 feet above the tallest obstacle within 500 feet. Many small wind manufacturers recommend a minimum tower height of 65 feet. To better understand the importance of tower height in capturing a wind resource, refer to the *Assessing Your Wind Resource* guide in this module.

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

- Think long-term and plan for the future. Trees will grow, so consider their final or mature height. Are there any structures planned nearby?
- Are 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 unsuitable for your needs, you might want to consider another renewable energy technology. Remember that placing a wind turbine on a short tower is similar to placing a solar panel in the shade.
- Are there zoning or homeowner association restrictions that would limit your tower height?

References

Sagrillo, M. (2008). Questions Any Small Wind Turbine Manufacture Should Be Willing and Able to Answer About Their Products. *Windletter, 27.9*. Retrieved December 2010 from RenewWisconsin.org: http://www.renewwisconsin.org/wind/Toolbox-Homeowners/Questions%20Any%20Manufacturers%20Should%20Answer.pdf

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

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, such as a light pole?	Manufacturers will typically not honor warranties for systems not mounted on approved towers. Wind systems endure a lot of load and torque, and the margin between a well-balanced and functioning system and system failure is small. For any wind system, the tower should be rated for the turbine you intend to install and suitable for the winds in your area.
My neighbor has a turbine mounted on a shorter tower than what is suggested here. Can I do that?	Wind turbines are site-specific, so what works for your neighbor or even another site on your property may not be appropriate for the site you are considering.
I want to save money on tower expenses. Can I install the system on a short tower?	Balance energy output and economics. Towers lower than 45 feet usually compromise energy output. Some situations call for a 30-foot tower, but those are the exception. Using a shorter tower than is appropriate for your site means a lower upfront investment, but a longer simple payback and lower energy production.

Gipe, P. (2000, Summer). Testing Power Curves of Small Wind Turbines. *Wind-Works.org*. Retrieved from http://www.wind-works.org/articles

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

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

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

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

Notes

Original work created by Montana State University Extension and the University of Wyoming.
Adapted with permission by University of Missouri Extension.

UNIVERSITY OF MISSOURI Extension

■ Issued in furtherance of the Cooperative Extension Work Acts of May 8 and June 30, 1914, in cooperation with the United States Department of Agriculture. Director, Cooperative Extension, University of Missouri, Columbia, MO 65211 ■ an equal opportunity/ADA institution ■ 573-882-7216 ■ extension.missouri.edu

em505

New 12/14/POD