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SMALL TURBINE COLUMN:

Planning Your Wind System—Improving the Wind Resource at Your Site

--Mick Sagrillo, Sagrillo Power & Light

Vendors unfamiliar with the resource that fuels wind turbines often state that "wind is site specific" and therefore any prospective wind system owner needs to monitor his or her wind speed "for at least one year before investing in a wind generator." Due to the exorbitant cost of the monitoring equipment relative to the cost of a small wind system (i.e., wind system capacities of 1-100 kW), plus the length of time required to document the wind speed, prospective wind system owners simply abandon their interest in wind.

In reality, state wind maps, like their counterpart solar sun hour maps, fairly accurately delineate the wind speeds for small turbines over large areas of any given state, making lengthy monitoring unnecessary. To access the maps, go to www.eere.energy.gov/windandhydro/windpoweringamerica/ . But if you don't monitor, how do you know that your wind system will actually deliver its expected output?

Wind as the fuel that drives a wind turbine has two characteristics that affect the output of a wind turbine: quantity, or the speed of the wind, and quality. Fortunately, there is a simple way of maximizing both.

Quantity + Quality = More Electricity

Wind speed increases with distance above the ground. Wind, like water, is a fluid and, therefore, follows the same set of rules as water. If you have ever watched a river flow, you'll notice that the water is quite sluggish near the bank, but its speed increases with distance away from either bank. The river flows fastest in its middle, the greatest distance away from the bank. This is due to the friction that occurs between the moving fluid and the stationary bank. Increased separation reduces this friction, resulting in greater velocity of the fluid.

This is precisely what we want for our wind turbine: greater fluid (that is, wind) velocity. Ground drag, the friction between the moving winds and the fixed earth, is reduced

considerably with tower height. Reduce ground drag and you increase wind speed. This is why wind farm turbines are placed on such tall towers.

The second component of the wind, quality, refers to the turbulence caused by the ground clutter around where you live. Trees and buildings cause the wind to tumble and swirl, which reduces the energy available in the wind that you can convert to electricity with your wind system, as well as cause increased wear and tear on the equipment. Wind farm developers strive to site wind farms a fair distance away from farm buildings, fence rows, and woodlots to minimize the amount of turbulence from these obstacles. Therefore, wind prospectors scour the countryside seeking elevated, well exposed property with sufficient horizontal separation from trees and buildings.

Since most of us are stuck with a given piece of real estate, and that property likely is cluttered with houses, barns, and trees, we cannot achieve the horizontal separation wind prospectors look for. Therefore, we minimize turbulence by increasing vertical separation with tower height.

Assessing Your Site

How can you apply these concepts to your situation? Certainly not by "monitoring your wind speed for at least one year" because "wind is site specific." If the wind map for your area shows that you have a decent wind resource, then it is just a matter of getting away from the "bank," so to speak, and into the free flow of the stream. You do this by increasing your tower height.

But by how much? This depends on your "neighbors." The importance of micro siting a wind turbine is to pay attention to your "neighbors" rather than whatever product any given manufacturer or dealer is selling at the moment. For the most part, your "neighbors" will not be the people living next door, but the trees that populate your community. Tower height, which results in access to increased winds and therefore increased electricity production, is the key to micro siting a wind system on any given piece of property.

The rule of thumb that is used to site small wind turbines is that the entire rotor must be at lease 30 feet above anything within 500 feet, or the area's treeline, whichever is taller. And keep in mind that, over the 20 to 30 year life of your wind system, the trees will invariably grow, so you are interested in the mature height of the trees in your area, not necessarily their current height.

(Considerably more information on sizing and siting towers and tower heights, published as previous AWEA *Windletter* columns, can be found at www.renewwisconsin.org Click on the Small Wind Toolbox in the lower left hand corner. Look for the series of articles on towers, plus "Rules of Thumb for Siting Wind Turbines" in the "Information for Homeowners and Installers" folder.)

How tall is tall enough?

A tower tall enough to clear the tree line in your area, with consideration for future growth, will give you the minimum separation that you are after. Cut corners on tower height, especially to save money, and you will pay the price in disappointing electrical generation. This is the simple economics of dealing with the physics of the wind.

Some folks, however, may be interested in the tallest tower that they can install for a given wind system. How do taller towers figure into your consideration? This becomes a different issue that requires a cost versus energy output calculation. Taller towers invariably result in increased electrical generation, but at an additional cost, sometimes considerable cost. The only way to compare the economic tradeoff of increased cost versus increased output is to project both on a spreadsheet, something any experienced wind site assessor, dealer, or installer should be able to do for you.

[Editors Note: The opinions expressed in this column are those of the author and may not reflect those of AWEA staff or board.]