// WINDLETTER

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## SMALL TURBINE COLUMN:

### Planning Your Wind System—Evaluating Your Wind Resource

**--Mick Sagrillo, Sagrillo Power & Light**

So you want to buy a wind generator. You pay a visit to your local sales and installation company, and the first thing they ask you is . . . "How much money do you have?" No, no, my mistake, that's the used car dealer. The first question they ask you is, "What is your average wind speed?"

Good question. In order to determine what size wind generator you need, the sales rep needs to know what your load is and how much wind you have available at your site. Once those two have been identified, it's fairly easy to size a wind system to suit your needs.

**Assessing Load**

Determining your load is fairly simple. About 99.5 percent of the population of the U.S. gets their electricity from an electric utility. Since they also get a monthly electric bill, this information is easily accessible if you save your utility bills. If not, you can always contact your utility, give them your customer number, and they will provide you with your historic electric usage.

The reason your dealer wants annual or monthly electric consumption data is because wind generator manufacturers calculate the annual energy production for their turbines. Matching up your usage is therefore relatively straightforward, provided you know how much wind blows across your property over that same time frame. So, next question: how do you determine the average wind speed for your site?

**Misleading advice**

From here the discussion digresses into two polarized categories. The first is the customer or installer who is confident that "It's always windy here!" Why bother determining wind speed, he or she asserts. Just put up a wind turbine and generate electricity!

At the opposite end of the spectrum are the ultra conservative, mostly solar folks who caution that you "need to monitor the wind speed at your site for at least one year before investing in a wind turbine." If they happen to be dealers, they might next tell you to please turn to page 467 of their on-line catalog for product information on monitoring equipment and towers, which they just happen to sell.

Who do you believe? As usual, the truth lies somewhere in between these two extremes.

If you were to accurately "monitor the site for at least one year," you would need the appropriate equipment for the task. This is essentially a tower tall enough to get the anemometer up to the intended hub height of the proposed small wind turbine, plus a data logger to record the wind speeds.

Are you sitting down to hear the cost for this? A temporary tower to get you up to a typical hub height of 100 to 120 feet will cost from $3,500 to $4,500. Add the data logger, shipping, installation tools, and labor and you are easily over $5,000 at the low end. I think you can see where this is going: it just doesn't make sense to spend $5,000 to $15,000 monitoring the fuel for a small wind turbine (1kW to 100kW in capacity) that costs $15,000 to $130,000—not to mention having to wait a year for the data.

On the other hand, it also does not make sense to use the wet finger method of determining your wind resource either. So, how do you adequately determine your wind resource without investing a prohibitive amount of time and money?

The experience of the solar resource provides somewhat of a parallel answer. I have always found it curious that folks interested in installing a photovoltaic (PV) or solar water heating system do not need to go through this sort of expensive and lengthy research project. Solar site assessors need only look around at a site to determine whether the homeowner has a resource and where that resource can be accessed on the property—not much different than the effort cats have expended for the past 50 million years or so to determine good solar sites. However, solar site assessors do have one additional tool that cats do not: maps that define the number of hours of available usable sunlight by season across the United States. With a quick look in a readily available book or web site, and perhaps a brief assessment using a relatively inexpensive Solar Path Finder to determine where shading might occur, the solar site assessment is done.

But if we want to install a small wind turbine from 1kW to 100kW in capacity and we want to do something more reliable than wet finger prospecting, we need to purchase and install $5,000+ worth of equipment and record data "for at least a year?" What gives?

I do not think that this is a conspiracy by the solar purveyors who are competing for customers interested in renewably generated electricity in order to get a leg up on wind installers and sell more of their goods instead. Rather, I believe that this attitude reflects considerable inexperience with wind resource evaluation.

**The work's done for you**

Unlike the solar resource, which any cat can quantify from the comfort of its own living room, the wind seems to come and go at its own schedule. Sometimes it's there, while shortly after, it disappears. Sometimes the wind is blustery to the point of destructive, while other times it is quite gentle—rather erratic, or so it seems. Wind is often criticized as being unreliable. Therefore, you in fact do "need to monitor the wind speed at your site for at least one year before investing in a wind turbine," correct?

Not exactly. Solar site assessors rely on maps that delineate the number of usable hours of sunlight for large geographic areas to specify their systems. These maps are based on decades of data amassed by weather bureaus and climate research institutions. Even though cloud cover, which throws a monkey wrench into a PV panel's ability to generate electricity, is more or less random on any given day, the cyclic daily and seasonal nature of the sun conveys a sense of reliability to the solar resource that does not readily appear with the wind resource.

The wind resource, like the solar resource, has been documented by weather bureaus and climate research institutions, and for comparable periods of time. Interestingly, there are daily and seasonal patterns for the wind, just as there are for the sun. In most locales, the wind resource picks up in the fall, blows throughout the winter and spring, then ebbs to a low in the summer. Similarly, many locations show diurnal wind peaks during the afternoon, coincidental to the daily solar resource, which actually drives the wind across large areas of the Earth.

Like random cloud cover that affects the solar resource, variable daily winds represent weather, or short duration samples of the wind. Solar site assessors are not concerned about any given cloudy afternoon, focusing instead on the long view; annual climate is quite stable from year to year, whereas daily weather can be variable, sometime quite a bit so. Likewise, small-wind site assessors also need to focus on annual climate data, not variable daily weather.

Wind site assessors actually do have similar tools available to them: the state wind maps that have been developed by a few highly specialized companies in conjunction with the National Renewable Energy Laboratory. These maps have been developed using long term climatologocal data from numerous sources. The better ones have been fine tuned to specify wind speed at different heights corresponding to tower heights. Many have been funded under the assumption that wind farm developers will use them in prospecting for potential wind sites.

In reality, utility-scale wind farm developers need to actually do a long-term resource assessment for any given site, as this information is still required by financial institutions funding wind projects. And while wind farm developers can get quite neurotic about accurately characterizing the wind resource at their proposed wind farm location, the financial stakes are high enough that they do need to go through a full-blown wind resource assessment to determine the profitability of any given project. However, this is simply not the case for small wind turbines installed for homes, farms, schools, or small businesses.

So, where do you access these maps? Go to Wind Powering America's web site http://www.eere.energy.gov/windandhydro/windpoweringamerica/

Near the bottom of the left hand side of the opening page, you can click on the link for wind maps. Most states either have an updated wind map or are in the process of acquiring one.

**Interpreting the maps**

One caution about these maps. Often you will find not only wind speeds for various areas of a given state, but also a subjective evaluation about the wind resource for various areas within a state. Consider the target audience–usually utility-scale project developers—when evaluating these subjective comments. For example, large areas for the map of Wisconsin, where I live, are deemed “poor” in terms of a wind resource. Yet an Energy Center of Wisconsin study found that 85.2% of the state has a 10 to 12 mile per hour average wind speed, which is well suited to small wind turbines.

No one who is familiar with the high value of these wind maps advises monitoring “for at least one year,” or any other length of time for that matter, to determine the wind resource available for a small wind turbine. There is simply no reason to justify expending either the time or money on such exercises given the value of wind maps for qualifying the wind resource in states where such maps exist. Such stringent requirements simply drive folks interested in renewable electricity generation away from wind and towards PV, where such monitoring requirements do not exist.

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