

WINDLETTER

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SMALL TURBINE COLUMN:

Back to the Basics 7: Wind Resource Maps and Wind Site Assessments

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How many times have you heard a person insistent on buying a wind turbine say, “It’s always windy here”, or “We’ve got plenty of wind. It will generate all the electricity we need.”

On the other hand, wind is an energy resource that many renewable energy practitioners are quite uncomfortable with. It so unlike other renewable energies, so...intangible.

With photovoltaics (PV) and the sun, you know your resource. It’s bright, warm, and very reliable. Even when it overcast, we know that the sun will come up every morning, and go down every night (if it ever doesn’t, we’ll have other problems to worry about). There are even sun hour maps to quantify the amount of sunlight that falls on virtually every square foot of the planet. PV systems are simple to design for.

The same is true for anyone interested in a hydroelectric generator. Assuming decent snow and rainfalls in the watershed, the creek will rise in the spring or the river will run all year long. Local Soil and Water Conservation District offices track water flow and channel capacities, and can cite the historic highs and lows for most watercourses. Design your hydro plant within these extremes and you’ll never be without electricity.

But that wind. Sometimes it here, but sometimes it’s not. The wind seems so ephemeral, right? A very fickle renewable source of energy, right?

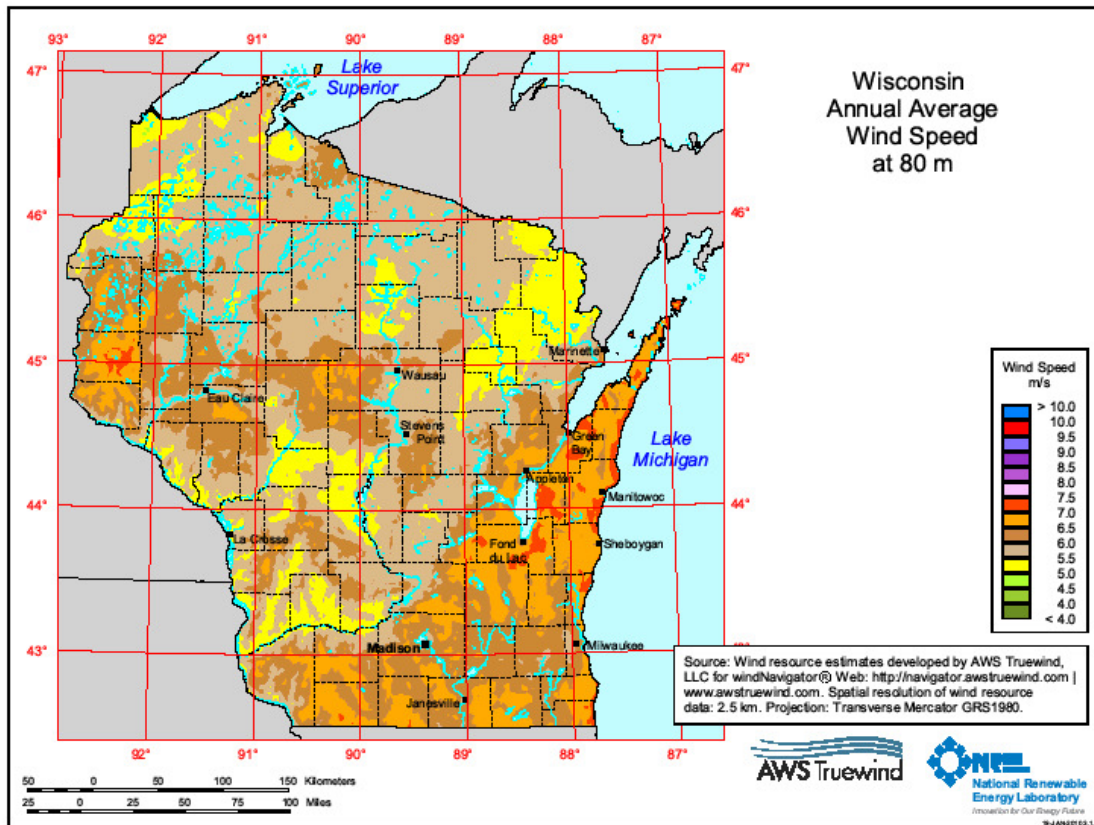
Actually, that’s not quite the case. Wind, like sunlight quantified as sun hours or water flow in a river, has been documented for decades. It is part of what we log as “climate.” In many places, it is definitely seasonal, while in other locations, there is a strong diurnal resource. The wind may not be as “reliable” as “the sun will come up every morning”, but it has very distinct patterns and quantities.

The National Renewable Energy Laboratory, Pacific Northwest Laboratory, AWS Truewind, 3Tier, WindLogics, and others have spent considerable time and resources developing wind maps that characterize the wind resources in the US. These tools are

used by wind farm developers to screen for windy locations in a given area with wide open spaces, large tracts of farm land, and proximity to transmission access. Once identified, a developer will commission a meteorological tower to monitor the wind resource for a year or longer—a requirement for financing large wind farm projects where financial institutions wish to minimize risk.

These same wind maps, the screening tools for wind farm developers, work well enough as is for siting small wind turbines, however, without the requirement to monitor the site for a year. They work provided one follows best practices for siting small wind turbines. First and foremost of these practices is the “30 foot” rule covered in a previous Back to the Basics column “Determining the Minimum Tower Height for Your Site.”

Below is the new wind map developed by AWS Truewind and NREL for my state, at 80 meters above the “ground level.” These are great screening tools for wind prospectors, as well as the basis of understanding of local wind resources for wind site assessors.



However, wind maps are not quite easy enough to use that anyone can pick one up and prospect for the wind. It takes quite a bit of training to interpret and understand what a wind resource map is saying. For example, they do not work below the tree line of an

area, at roof top locations, or in urban areas, locations with very complex terrain, or situations with a lot of ground clutter.

A person trained for the task, however, would be able to do the interpreting for you. Such people are known as wind site assessors, and are available for hire to evaluate the wind potential for a small wind turbine on your property. Such services are typically provided to residences, farms, businesses, and school districts, all common locations for a small wind turbine for “behind the fence generation,” one where all the electricity is consumed on site to offset electricity that would otherwise be purchased from the local utility.

Among other things, a wind site assessor will be versed in such esoteric aspects of wind maps as:

- extrapolating the average wind speed down to your tower height;
- wind shear, which affects the wind speed as you extrapolate up or down in elevation on the wind map;
- displacement height, which affects the “ground level” at which the wind begins with considerable vegetative cover;
- turbulence intensity, a measure of the gustiness of the site due to trees and buildings;
- Rayleigh distribution, which will affect the wind power density of the wind resource; and
- the wind rose, a metric which reveals the prevailing wind directions for the location and wind power densities in all directions.

All of these parameters will affect the annual energy output, or kilowatt hours per year, for the wind systems of interest. And none of this is as simple as referring to the manufacturer’s product brochure to ballpark the amount of electricity a wind turbine will generate at your site.

So, what does such a service cost? Depending on the cost share offered by your state’s public benefits program or your utility’s renewable energy program, the complexity of your site and situation, and the level of risk you are willing to assume (usually more risk for a smaller turbine), and the detail you wish in the report, a wind site assessment can cost anywhere from a few hundred dollars to a few thousand dollars.

If you balk at spending a few hundred dollars to get an educated estimate of your wind resource at your home, put the service in perspective: you are pondering spending \$20,000 to \$80,000 or so dollars on a residential wind turbine (before any incentives). People interested in the larger turbines in the small wind category will spend multiple hundreds of thousands of dollars for a system to supply all the electricity for their farm, school, or business. Realistically, a wind site assessment is a very small percentage of the total system cost, and could make the difference between wishful thinking and a substantial lowering of your utility bills.

If you are interested in such a service, contact your state public benefits program for assistance. In addition, some manufacturers are now training their dealers and installers in the art of wind resource assessment, and more are sure to follow as criteria for funding renewables projects inevitably tighten. In June, the North American Board of Certified Energy Practitioners (NABCEP) embarked on developing a job-task analysis for professional small wind site assessors. This will lead to NABCEP testing and certification of wind site assessors, hopefully by the end of the year.

On the other hand, if you are content installing a wind turbine with little or no understanding of how much wind you have with nothing more than a wet finger in the air to determine your wind resource...

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