

# WINDLETTER

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## **SMALL TURBINE COLUMN:**

### **Planning Your Wind System—What Size System Do You Need?**

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

I am frequently asked by people, what size wind system do I need to power my house? There is no simple answer to that question, as there is no frame of reference on which to respond. If I asked a car dealer what size vehicle I need, the response would be: what do you need it for—basic commuter transportation? Got a passel of kids you transport to school every day? Need to haul a camper or a boat? Running a plumbing repair business out of it? Driving through fields? Moving cattle? Or shipping containers?

Your eyes narrow, but I'm not being a wise guy. A look at the vehicles on any highway results in the conclusion that vehicle size all depends on your use. The same holds true for what size wind turbine you need. It all depends on what you want to power.

#### **Get a handle on what you use and how you use it**

There are questions that need answers even before the wind generator enters the picture. First and foremost: what is your current usage, and what do you use electricity for? If you do not know what your current electrical consumption is, you need to, as this amount is what you are trying to displace. To quote Ian Woofenden at Home Power Magazine, "If you tell us you use a lot of electricity, we'll tell you that you need a really big wind generator." Seems logical, but is rarely thought about.

There are two ways to determine your present electrical usage. You can either add up kilowatt hours (kWh) listed on your past 12 electric bills, or you can call your utility and get your historic electric data for the past year. Either way, you have some frame of reference as to "how many wheels you need on your transport vehicle." For a frame of reference, the average home (whatever that is) in the United States uses nearly 1000 kWh per month, or about 12,000 kWh per year.

The average homeowner in the U.S., however, is clueless about energy efficiency or how much money he or she can save by replacing energy-squandering lights and appliances with highly efficient counterparts. Want to save 50% on the cost of your wind system? The average house in the U.S. can easily cut electric usage by 50% by replacing inefficient lighting and appliances, with no change in the "service" delivered by those

appliances. For example, the average home has 30 to 60 incandescent lights. Replacing these with comparably ‘lumened’ compact florescent lights, at an average cost of \$2 apiece, can easily save several hundred dollars on your electric bill per year. Every year.

Once you’re finished upgrading lights, move on to other large electrical consumers: your refrigerator, freezer, air conditioner, dishwasher, washing machine...the list goes on and on. While many balk at the perceived expense for such retrofits, remember that every dollar invested in efficiency will save three dollars in generating capacity required to meet the “demands” of inefficient appliances. Efficiency is the smartest investment you can make in preparation for a wind system, with a return on investment easily surpassing the best stock market yields. (For information on energy efficient appliances, see <http://www.aceee.org/Consumer/index.htm> )

### **How much fuel do you have?**

Once you have an idea of what you want to power (efficiently of course), the next step is to determine what your wind resource is, not at the ground level where you are but at the top of the tower where your wind turbine will be living and working. *Windletter* has published a number of columns that walk you through the process of how to determine what tower height you need for your site, and how to improve your wind resource by increasing tower height. (See the “Information for Homeowners and Installers” folder in the Small Wind Toolboxes at <http://www.renewwisconsin.org/wind/windtoolbox.html> The pieces titled “Planning Your Wind System” and “Towers” are the most pertinent.) The minimum tower height for any site gets the wind generator rotor at least 30 feet above the surrounding buildings and trees—and not just the height of the trees as they exist today, but the mature tree height over the 20 to 30 year life of the wind system.

After you have determined the minimum acceptable tower height for your site, the next step is to assess your wind resource by finding the wind resource map for your state. Wind resource maps are usually available from state energy offices, or you can visit Wind Powering America’s Web site to determine the wind resource in your area. (See [http://www.eere.energy.gov/windandhydro/windpoweringamerica/wind\\_maps.asp](http://www.eere.energy.gov/windandhydro/windpoweringamerica/wind_maps.asp) ) You may need to do some extrapolation up or down from the wind map to estimate the wind speed for your proposed tower height. This is a rather technical calculation, and is best done by a trained wind site assessor, but you should be able to get help from the wind turbine manufacturers or a wind installer in your area. If they cannot help, keep looking because without knowing what the wind speed is at your tower height, you are just guessing at how much fuel, your wind resource, you have to work with.

### **Load + Fuel = ?**

Once you’ve incorporated efficiency into your home, know your monthly or annual electricity usage, and have an idea what the wind resource at the tower height required for your site is, you still have another piece of the puzzle to find, assuming that your home is connected to a utility which provides your electricity. You need to have an understanding of the rate that your utility will credit you for excess electricity that you produce but cannot use when the wind blows hard, and therefore must be “stored” on the utility’s grid for retrieval when the wind dies. Often referred to as the “utility buy-back

rate,” this number will weigh heavily on the size turbine you install. While small-wind owners usually size a wind system to offset all of the energy they buy from their utility on an annual basis, this may not be the case for you, depending on the utility buy-back rate.

If, for example, your utility will credit you at the retail rate for all of the electricity you generate over and above your consumption, you may want to install the largest turbine you can and use the proceeds to help pay for the wind system. If, however, your utility will not pay anything for the excess electricity that goes onto the grid, then you will likely install a much smaller turbine, one that never generates more than you can consume at any give time. If your situation is somewhere in between, say they credit you the retail amount until you reach your average consumption, then pay you wholesale for any excess, your strategy will likely be to install a wind system that will meet, but not exceed, your annual energy needs. No sense in giving away your electricity for a fraction of what you are charged for it, or, worse yet, for free.

### **Educate yourself**

After all of this, you’re finally ready to go shopping for a wind turbine, right? Well, not quite yet. Your next step involves sizing the wind turbine to meet your now-reduced energy-efficient consumption. You could do this by requesting information for all models of wind turbines available from all manufacturers, but you can save time on this step. Ian Woofenden (of Home Power Magazine) and I have compiled a review of wind turbines that are available and supported in the U.S., *How to Buy a Wind Energy System*. The article summarized the design criteria that should be important to any serious wind turbine buyer, as well as monthly energy production data for the range of wind speeds available for most small turbine installations. You can find it in the Small Wind Toolboxes (Web address above), in the folder titled “Information for Homeowners and Installers”, or at <http://www.homepower.com/windelectricsystems2008> .

Keep in mind that the prices quoted in the article are for the wind system only, and do not include the tower, foundation, excavation or crane rental [edit correct?], electrical materials, shipping, and labor costs. You will need to get a complete project quote from your local wind system installer.

While you are researching wind turbines, check out who can install the system for you, and subsequently maintain and repair it over the 20 to 30 year life of the system. Get references and visit with some of the system owners they have installed for. You will need this person for a long time, so make sure that you are compatible.

### **Almost shopping time**

By now you have gathered almost all of the information you need to begin shopping for a wind turbine, including:

- your monthly electric energy consumption
- how much of that electricity can be eliminated with efficiency
- the approximate average annual wind speed at the tower height your site will require

- what your utility will credit you for electricity you store on the grid for later retrieval
- what wind turbines are available that will fit your needs, including your electric usage, budget, and inclination to maintain the system yourself or hire someone to do this.

Remember that what you can reasonably afford goes far beyond the initial cost of the turbine or system installation. Installing a wind turbine means you are essentially prepaying your utility bill for the next 20 to 30 years, provided you purchase a reliable turbine, attend to annual inspections and repairs as needed, and install it on a tower suitably tall enough for your site. And keep in mind that utility rates will invariably increase over that time, making your investment in a wind system that much more valuable.

Do your homework, then invest wisely!

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*Editor's note: The opinions expressed in this column are those of the author and may not reflect those of AWEA's staff or board.*