Green Energy for your Home ~ A Series ~ Part 6

Reap The Wild Wind

Catherine the Great once said "A great wind is blowing and that gives you either imagination or a headache". We've certainly had some great winds of late and I think many of us may suffer the latter effect but wind is an amazing resource that with a little imagination and the right tools can be tapped for a lot of energy.

The invention of the first electricity generating wind turbines took place in 1887 attributed to both a Scotsman named Blyth and an American named Brush. According to the story Blyth's machine provided power to the local lunatic asylum in Maykirk, Scotland and I think it's safe to say that ever since that time the interest in electricity generating wind machines has followed a very bipolar path moving between periods of high public acceptance and near absolute indifference. There's also something about wind turbines that attracts an element of unscrupulous marketers and over the 125 year history of the device there have been more than a few scams by those who re-invent the idea with their own version of a breakthrough design. On the plus side there are a some companies that have good track records and excellent warranties for their products.

If you are considering a wind generator the very first step is to determine the value of the wind resource you have on your property. The scientific way to approach this matter is to get a recording anemometer and collect the wind speed and power data over a period of one-year. The anemometer should be at hub height meaning the same elevation as the top of the tower you intend to use for the wind turbine. The data is of little use if you intend to put a wind generator at 80 feet and you've done measurements on a tower at 20 feet. However, the cost of a recording anemometer and tower can be from $500 - $1500 and the length of time needed to get useful information is too long to be of practical use to the average homeowner.

A well-designed and properly sited wind turbine will be able to produce a meaningful amount of power at an average wind speed of just over 19 km/hr (12 mph). Wind follows some predictable patterns over time and Environment Canada has published the Canadian Wind Energy Atlas online to provide historical data for many regions throughout the country. Unfortunately this information isn't very precise and if I relied on it I would probably decide that a wind turbine is of no use in the Cariboo-Chilcotin. On the contrary I have installed many wind turbines throughout this region and they have provided their owners with significant amounts of energy, particularly in the fall and winter seasons when solar energy is at it's lowest ebb. Unlike solar, wind can provide energy any time day or night.

So what is a useful and pragmatic way to decide it you have enough wind energy to justify the investment in a wind machine? The answer pretty much comes down to empirical observation. What can you see? Do the tops of the trees nearby move and sway in the wind, are the grasses in open spaces bent in one particular direction, are there trees that have decidedly more branches on one side than the other (flagging)?

All of these things are clues. Environment Canada has a great chart on their wind chill page that describes how to estimate wind speed. A wind that you can feel on your face is about 10 km/hr, a wind that will extend small flags is about 20 km/hr, a wind that makes small tree branches move is about 30 km/hr, small trees begin to sway and flags will flap in a 40 km/hr wind.

Once you can associate wind speed numbers to your experience of the wind then you have to become conscious of how often it seems to blow. Is it really all the time or only once in awhile on stormy days. Do you have a 20-40 km/hr wind often enough to provide an overall average of 20 km/hr?

Wind is very site specific and if you live on an open prairie, a wide open lake, a large river valley or a rise of land then you may very well have the geographical advantage that will tip the scales in your favour. Remember that in a hybrid renewable energy system consisting of solar and wind power the wind doesn't have to provide all the power, it just has to make a contribution.

Wind generators are rated in watts, like 400 watts or 1 kilowatt. This refers to the amount of power the wind machine can generate each hour at its maximum rated speed. Every wind generator has an operating range including a startup speed (when the blades will start turning); a maximum rated speed (the top speed of the generator before it regulates itself; and a survival speed (the maximum wind speed before the blades fall off). Assuming a startup speed of 10 km/hr and a regulation speed of 45 km/hr. then you will make an increasing amount of power as the wind increases from 10 to 45 km/hr. After 45km/hr an internal braking device will operate to slow the blades and prevent damage.

The method that a wind generator uses to regulate itself will determine, to some extent, the noise level it will produce in high winds. The small 200 – 400 watt models regulate by creating an instant reversal of the current. This acts like a brake and makes a loud sound kind of like a giant duck, QUACKKK!! This doesn't hurt the machine but it may hurt your ears if you like peace and quiet and live in a gusty location. The smaller wind generators also have a higher ambient noise so if you're noise sensitive it's a good idea to locate these models well away from the house. The mid size wind generators have larger blades and spin more slowly to achieve the same amount of power so they are considerably quieter. Their method of regulation is different and does not produce the tortured duck sound. The more expensive mid size models are much heavier units because they have larger generators; they spin much more slowly and therefore quietly.

Choosing the site and tower for a wind generator needs to be done with care if you want to get the maximum power and life expectancy from the unit. A rule of thumb is to put the generator at least 20 feet above the nearest competing obstacles within a 300 - 500 foot radius. Competing objects include trees, buildings and hills. The power of the wind increases exponentially with height. Choose a higher tower wherever possible. Standard tower heights for small wind turbines range from 30 feet to 80 feet.

Realize that the power available in the wind increases proportionally to its speed (velocity) cubed (v3). This means that the amount of power you get from your generator goes up exponentially as the wind speed increases. For example, if your site has an annual average wind speed of about 12.6 miles per hour (5.6 meters per second), it has twice the energy available as a site with a 10 mile per hour (4.5 meter per second) average.

As with solar energy the power generated from your turbine will usually be stored in a battery and drawn out using an inverter to power your household loads. Direct grid-tied turbines are available if you are connected to the grid in which case your power will not be stored and will not be available if the grid power is down during a storm or emergency situation.

Oh and by the way, here's the correct terminology: a windmill is for grinding grain and pumping water, a wind generator is the electrical component inside the wind turbine that makes electricity, the entire device is called a wind turbine or if you're from Arizona they pronounce it wind "turban", and they kid us Canadians about our 'accent'.

"The pessimist complains about the wind; the optimist expects it to change; the realist adjusts the sails." *William Arthur Ward*

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