Wind Generator Rated Power

A Marketing Point

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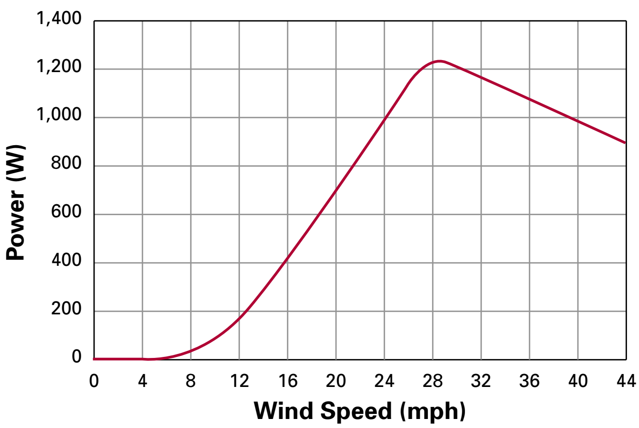
Derivation: "Rated" is from Latin rata, *fixed or settled, from Latin* reri, *to consider or reckon.*

When people ask me, "What size is that wind turbine?" I tell them the diameter of the rotor—which defines the turbine's swept area or collector size. This frustrates some people, because they are used to talking about the size of wind turbines based on their rated power—600 watts, 1.5 KW, or 10 KW, for example. But, for several reasons, the rated power of a wind generator is little more than a marketing point.

Wind Generator Power Curve

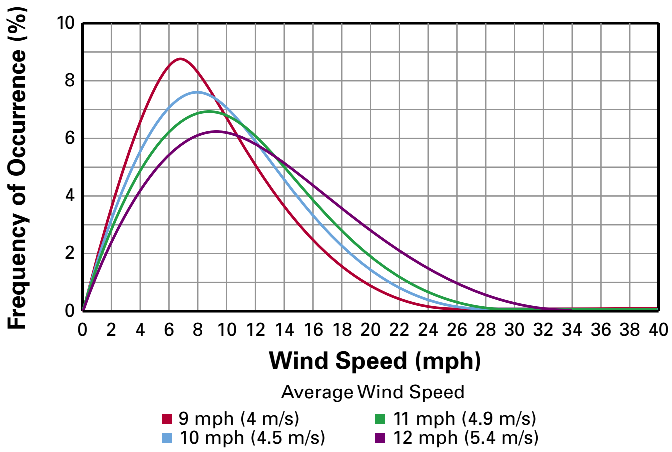


A power curve shows the output of a wind generator over its normal operating range. Look at the curve above, and notice where your eye goes. Right to the top, doesn't it? Now look at the wind speed needed to generate that peak power. For most turbines, it's in the 25 to 30 mph (11–13 m/s) range.

Now look at the wind distribution curve. This shows the percentage of time that a typical wind site experiences each wind speed. Notice where this curve peaks, and more important, the range in which most wind occurs. How often is your wind turbine going to experience 25 to 30 mph? A very small percentage of the time. Most of its energy-generating life will be spent in the 10 to 20 mph range.

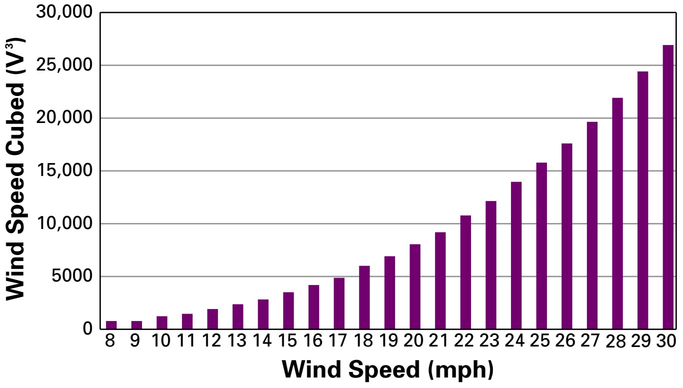
That's one reason why talking about wind generators by using the rated or peak power is misleading. It's kind of like talking about cars by their top speed instead of their range or their fuel economy at typical driving speeds.

Wind Distribution Curve



Because the power available in the wind increases in proportion to the cube of the wind speed (V^3), small variations in wind speed can mean very large changes in the available power. For example, the power difference between 10 and 12 mph, or 25 and 30 mph is a factor of almost two to one (10 x 10 x 10 = 1,000; 12 x 12 x 12 = 1,728; 25 x 25 x 25 = 15,625; 30 x 30 x 30 = 27,000). So not only is rated power a distracting point to focus on, it's an inconsistent one, since there is no standard

V^3 with Increasing Wind Speeds



rated wind speed used by all manufacturers (some rate at the peak output, and others at an arbitrary point).

In the real world, wind turbines with similar rated or peak power can produce widely different amounts of energy. I lived for several years with both a "900-watt" turbine and a "1,000-watt" turbine in similar wind conditions. The turbine with the *lower* rated output produced more kilowatt-hours by a factor of about 2.3—it had a larger collector area, even though it didn't have high peak power.

Rated power depends on the rated wind speed, the efficiency of the complete turbine, and the design philosophy behind the machine. Some designers (my favorites) don't focus on high peak power, since they know that performance in moderate winds is the crucial factor. Also, trying to effectively capture the energy in high winds adds greatly to the weight and material cost of the wind generator, for relatively little return.

Because the wind is variable, and the power available depends on the cube of the wind speed, power curves and rated power have little if any value to consumers trying to understand how much energy they will get from a given turbine. Energy estimates from real-world testing would be best, but short of that, using rotor diameter as a quick way to identify turbines will help you think more intelligently about wind turbine capacity.

So what size is that turbine? Mine are 8, 9, and 12 feet in diameter…

Access

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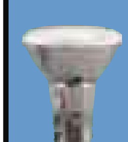
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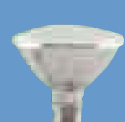
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