Rotor—Wind Collector

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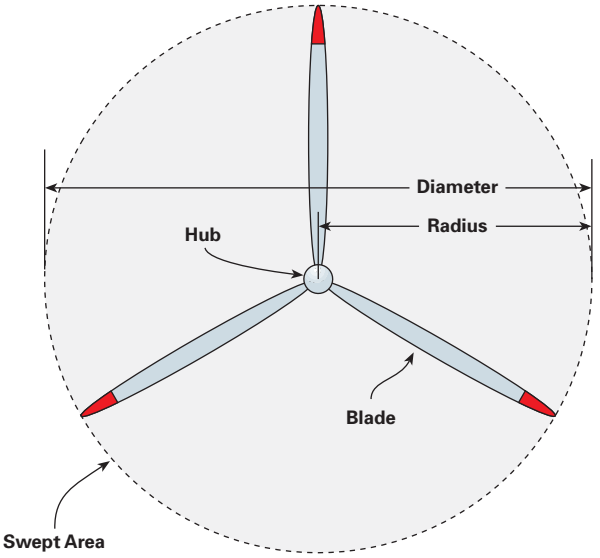
Derivation: Contraction of "rotator" from Latin rota, *wheel.*

The rotor of a wind generator is the blades and hub—the visible part that rotates. (The moving part of the alternator is also called a rotor, but that's not what I'm talking about here.) The blades travel around the hub, describing a circle known as the "swept area." Just as the area of a solar-electric or solar hot water panel is what collects the sun's energy, the swept area of a wind turbine is its collector.

A wind generator's blades take the horizontal motion of the wind and translate it into rotary motion to drive the generator. But don't assume more blades are better. Fewer blades generally mean higher rpm, which is what you want for generating electricity. More blades generally mean more torque, which is what you want for doing mechanical work, like pumping water. Most modern wind-electric generators have three blades—a good compromise between speed and rotor balance. Water-pumping windmills use a large number of blades to do their low-speed work.



Judging and comparing the size of different wind generators is not particularly intuitive. Even from a distance, it's pretty easy to make a good guess about a person's height. Basketball player Wilt Chamberlain was never confused with jockey Willie Shoemaker. But judging the swept area of a wind generator based on its blade length isn't as easy, and comparing different rotors is even more difficult. For example, just adding 1 foot to a 10-foot blade will increase the swept area by 20 percent.

The formula for the area of a circle is *pi* (roughly 3.14) multiplied by the radius squared. So a 6-foot-diameter rotor sweeps about 28 square feet (3 x 3 x 3.14). Double the diameter to 12 feet and the swept area quadruples to about 113 square feet (6 x 6 x 3.14). Double it again and the swept area will quadruple again.

Why is this important? A small collector will gather a small amount of energy; a larger collector will gather more. Just as two, 100-watt PV modules will generate twice as much electricity as one, doubling your swept area will roughly double the energy into your batteries or onto the grid, all other things being equal.

Understanding how to choose the right size wind generator for a given application is difficult. Wind nerds argue ad nauseam about average wind speed, wind distribution, efficiency, capacity factor, and other techie details. Looking at the collector size cuts through much of this technical fog.

As wind-energy journalist Paul Gipe says, "Nothing outside the wind itself…is more important in determining a wind machine's capability of capturing the energy in the wind than the area swept by the rotor." So if you're confused about what to expect from a wind generator, look *first* at the rotor size. Don't expect a small rotor to deliver a lot of energy. It takes a big collector to capture big energy.

See Mick Sagrillo's wind-generator comparison article for the square footage of most home-scale North American wind generators, and Hugh Piggott's article on estimating energy from the rotor size. Next column, I'll talk about how a wind generator furls.

Access

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"Apples & Oranges 2002: Choosing a Home-Sized Wind Generator," by Mick Sagrillo in *HP90,* and on the *HP* Web site

"Estimating Wind Energy," by Hugh Piggott in *HP102*