Governing—

Wind Generator Protection Strategy

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Derivation: From Greek kubernan, *to guide or steer.*

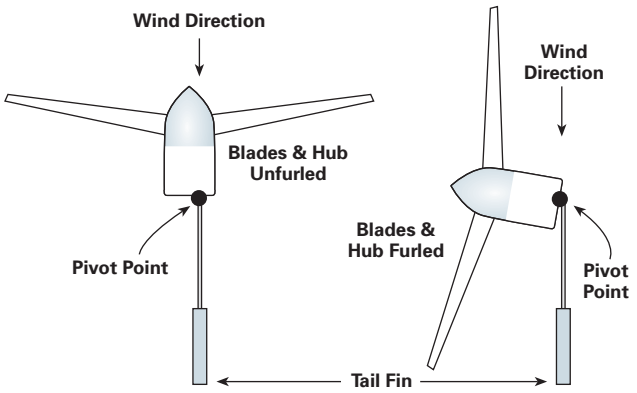
Everything has its limits, and wind generators are no exception. Though you might think you'd want to capture every scrap of energy available, any wind generator worth owning has a method of reducing its exposure to the wind and therefore its output—it's called "governing."

What is governing? It's a way to protect the wind generator from the incredibly strong forces in high winds. Wind energy increases by the cube of the wind speed, so when the wind speed doubles, the power available increases eight times. This is welcome in the winds you experience most of the time, but at high wind speeds, it means that the machines are subject to very strong—and potentially damaging—forces. Sailors know that there's such a thing as too much wind, and they furl or reef their sails to reduce the surface area in the wind's path. Governing in wind generators serves the same function.

Many wind turbines govern by reducing the swept area of the rotor (blades and hub) exposed to the wind—this is called "furling." Wind generator output and wind loading are both directly tied to how much of the rotor intercepts the wind. Moving the rotor out of the wind's path means less energy generated, and less force on your machine and tower.

Some rotors are hinged to move sideways, others tilt up, and some tip between horizontal and vertical to escape the wind. These methods all decrease the area of the rotor that catches the wind. A simple and common method is to combine a hinged tail and an offset rotor. Strong winds cause the rotor to swing sideways, exposing less of its surface to the wind.

Wind Turbine, Aerial View



Other machines reduce wind loading by changing the orientation of the individual blades. The early Jacobs machines use pitch control—a centrifugal system that swivels the blades as the machine's rpm increase. Less common methods of governing use electronics, air brakes, or other devices.

The goal of all these methods is to help the machine survive strong winds. Most of the energy on a typical wind site is in the medium-strength winds of 10 to 25 miles per hour (4.5–11 m/s). Though storm winds pack a punch, they occur only a very small percentage of the time. In off-grid systems, the battery bank is usually charged up in the first few hours of a storm, so no more energy is needed. Instead of looking to milk *all* of the energy out of these potentially damaging winds, savvy wind generator designers want their machines to survive for the next moderate winds that come along.

Governing systems should be distinguished from charge control, "braking," and manual furling and braking. Charge controllers regulate the charge going to the battery, frequently by routing excess energy to a dump load, usually a large resistor or an electric water heating element. Many wind generators with permanent magnet alternators use electrical or "dynamic" braking (shorting the three electrical phases) to stop the machines for servicing or other reasons. The user simply flips a switch, and in low to moderate winds, the rotor stops. Some machines have manual furling or braking, a user-implemented feature that uses a hand-cranked winch at the tower base to furl the machine or engage a brake.

A wind turbine's normal governing system, in contrast, must be automatic, and activated by the wind speed. The best governing systems attempt to have the machine continue to generate at a moderate level, and automatically come in and out of operation in a smooth and consistent way. This allows you to get the most out of your wind resource without risking your investment in wind energy equipment.

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"Rotor—Wind Collector," *Word Power*, by Ian Woofenden, in *HP106*