Vawt wind turbine diagram

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A vertical axis wind turbine has its axis perpendicular to the wind streamlines and vertical to the ground. A more general term that includes this option is a "transverse axis wind turbine" or "cross-flow wind turbine". For example, the original Darrieus patent, US patent 1835018, includes both options.

Drag-type VAWTs such as the Savonius rotor typically operate at lower tip speed ratios than lift-based VAWTs such as Darrieus rotors and cycloturbines.

Computer modelling suggests that vertical-axis wind turbines arranged in wind farms may generate more than 15% more power per turbine than when acting in isolation.[5][6]

It follows from geometric considerations of angular velocity as seen in the accompanying figure that:

Solving for the relative velocity as the resultant of the tangential and normal components yields:

Which when substituting the above yields:

A = Blade Area (not to be confused with the Swept Area, which is equal to the height of the blade/rotor times the rotor diameter),R = Radius of turbine

The amount of power, P, that can be absorbed by a wind turbine:

There are two main types of Vertical Axis Wind Turbines. I.e. Savonius Wind turbine and Darrieus wind turbine. The Darrieus rotor comes in various subforms, including helix-shaped, disc-like, and the H-rotor with straight blades. These turbines typically have three slim rotor blades driven by lift forces, allowing them to achieve high speeds.[1]

Various simple designs may exist for vertical wind turbines, as detailed below. In practice, you may come across a range of variations and combinations, with developers frequently demonstrating their creativity in crafting diverse forms of vertical wind turbines.

The Savonius wind turbine (SWT) is a drag-type VAWT. The common design includes a rotating shaft with two or three scoops that catch the incoming wind. Due to its simplistic and robust design and its relatively low efficiency it is used whenever reliability is more important than efficiency. One reason for the low efficiency of a Savonius wind turbine is that roughly only half of the turbine generates positive torque, while the other side moves against the wind and thus produces negative torque. A variant of SWT is the Harmony wind turbine[11] with helix-shaped blades and an automatic furling mechanism during high-speed wind conditions.

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The Darrieus wind turbine is a lift-type VAWT. The original design included a number of curved aerofoil blades with the tips attached on a rotating shaft. However, there are also designs that use straight vertical airfoils, referred to as H-rotor or Giromill Darrieus wind turbines. Furthermore, the blades of the Darrieus wind turbine can be shaped into a helix to reduce the torque ripple effect on the turbine by spreading the torque evenly over the revolution.

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