Vertical axis 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.

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]

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 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.

Revolving wing wind turbines or rotating wing wind turbines are a new category of lift-type VAWTs which use 1 vertically standing, non-helical airfoil to generate 360-degree rotation around a vertical shaft that runs through the center of the airfoil.

When the velocity of a VAWT wind turbine grows, so does the power, however at a certain peak point, the power progressively decreases to zero even while the wind turbine velocity is at its greatest.[clarification needed] Such that, disc brakes are used to slow the velocity of a wind turbine at high wind conditions. However, sometimes due to disc brake overheating, the turbine can catch fire.[16]

VAWTs often suffer from dynamic stall of the blades as the angle of attack varies rapidly.[17][18][19]

The blades of a VAWT are fatigue-prone due to the wide variation in applied forces during each rotation. The vertically oriented blades can twist and bend during each turn, shortening their usable lifetimes.

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Other than the drag-types, VAWTs have proven less reliable than HAWTs,[20] although modern designs have overcome many early issues.[21][22]

A 2021 study simulated a VAWT configuration that allowed VAWTs to beat a comparable HAWT installation by 15%. An 11,500-hour simulation demonstrated the increased efficiency, in part by using a grid formation. One effect is to avoid downstream turbulence stemming from grid-arranged HAWTs that lowers efficiency. Other optimizations included array angle, rotation direction, turbine spacing, and number of rotors.[23]

The Windspire, a small VAWT intended for individual (home or office) use was developed in the early 2000s by US company Mariah Power. The company reported that several units had been installed across the US by June 2008.[25]

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