Vertical axis wind turbine disadvantages

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Learn about the two types of vertical-axis wind turbines: Darrieus and Savonius, and their working principles, advantages and disadvantages. Compare them with horiz...

When people think of wind turbines, they often visualize the expansive rotors of a horizontal-axis system. A vertical axis wind turbine (VAWT) has blades mounted on the top of the main shaft structure, rather than in the front like an aircraft rotor. The generator is usually placed at the tower base.

Used less often than their horizontal counterparts, VAWTs are more practical in residential areas. Two common designs include a turbine that resembles two halves of a 55-gallon drum, each mounted to the rotating element (Savonius rotor), and a smaller model that looks somewhat like an egg beater (Darrieus model). Savonius models are more commonly used and let air in through a hub to turn a generator; the turbine spins via rotational momentum when air passes through the blades.

The unit has two or three blades and can be shorter and closer to the ground than a horizontal system. A Giromill also features an egg beater design but has two or three straight blades on the vertical axis. Helical blades constitute another design, which resembles a structure like DNA. In general, vertical axis wind turbines come with their own advantages and disadvantages when compared to alternative configurations.

These turbines have fewer parts than those that orient the rotary mechanism and blades horizontally. That means fewer components to wear out and break down. Also, the supporting strength of the tower doesn"t need to be as much, because the gearbox and generator are near the ground. Parts for controlling pitch and yaw aren"t needed either.

The turbine doesn"t have to be facing the right wind direction either. In a vertical system, air flowing from any direction or speed can rotate the blades. Therefore, the system can be used to generate power in gusty winds and when they"re blowing steadily.

According to the Institution of Mechanical Engineers, vertical axis wind turbines are more suited for being installed in denser arrays. Up to 10 times shorter than horizontal models, they can be clustered into arrays that even create turbulence from one turbine to another, which helps increase the flow around them. Therefore, wind speeds up around each one, increasing the power-generated. A low center of gravity also makes these models more stable for floating in offshore installations.

The vertical design allows engineers to place the turbines closer together. Groups of them don"t have to be spaced far apart, so a wind farm does not have to take up as much ground area. The proximity of horizontal wind turbines to one another can create turbulence and reductions in wind speed that affects the output of neighboring units.

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A 2017 report in the Journal of Renewable and Sustainable Energy, cited by Phys , noted that although vertical axis wind turbines produce less energy per tower, they have the potential to generate as much as 10 times more power over a comparative area of land when placed in arrays.

Not all of the blades produce torque at the same time, which limits the efficiency of vertical systems in producing energy. Other blades are simply pushed along. There is also more drag on the blades when they rotate. Although a turbine can work in gusty winds, that is not always the case; the low starting torque and dynamic stability problems can limit functionality in conditions the turbine wasn"t specifically designed for.

Since the wind turbines are lower to the ground, they do not harness the higher wind speeds often found at higher levels. If installers prefer to erect the structure on a tower, these are more difficult to install in such a way. However, it is more practical to install a vertical system on a level base, such as the ground or the top of a building.

Vibration can be an issue at times, and even increase the noise produced by the turbine. Air flow at ground level can increase turbulence, thereby increasing vibration. This can wear out the bearing. At times, this can result in more maintenance and therefore more costs associated with it. In earlier models, blades were prone to bending and cracking, causing the turbine to fail. Small units atop buildings or other structures may be subject to jostling forces, which add lateral stress that warrants ongoing maintenance and the use of stronger, more sturdy materials.

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