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Wind power has been harnessed for centuries. The first recorded use of wind energy solution dates back to 200 BC when simple windmills were used to pump water and grind grain. Today’s wind turbines are highly efficient. On average, they convert about 40% of the kinetic energy in the wind into electricity, with some of the most advanced models achieving conversion rates of up to 50%.

A wind turbine is a machine for converting the kinetic energy in the wind into mechanical energy. Wind turbines are at the forefront of renewable energy generation when it comes to utilizing the power of the wind. These contemporary marvels come in a variety of sizes and forms, and each is made to effectively collect the kinetic energy of the wind. In this blog, we’ll look at the various kinds of wind turbines that are influencing the direction of clean energy in this blog.

Wind turbines like this usually have three blades, like airplane propellers. They’re placed on a tall tower, with all their parts, including the blades, shaft, and generator, on top. The blades point towards the wind, and the shaft is flat. Most of the wind turbines we see are horizontal wind turbine.

The most common type of vertical-axis turbine--the Darrieus wind turbine, named after the French engineer Georges Darrieus, who patented the design in 1931--looks like a giant, two-bladed eggbeater. Some versions of the vertical-axis turbine are 100 feet tall and 50 feet wide. Very few vertical-axis wind turbines are in use today because they do not perform as well as horizontal-axis turbines.

Wind turbines are classified based on their axis, which can be either horizontal or vertical. The primary classification revolves around the orientation of their rotor axis, leading to two main categories: horizontal-axis turbines (HAWT) are the most common and look like propellers on a tall tower and vertical-axis turbines (VAWT) have blades attached from top to bottom and are less common. HAWTs are the most common type, constituting approximately 97.3% of global wind power capacity in 2022, while VAWTs represented about 5%.

A wind turbine’s nacelle is like a control center. This is a protective enclosure that houses critical components such as transmissions, generators, and other electrical and mechanical systems. The nacelle is typically located behind the turbine blades and mounted at the top of the tower. It plays an important role in maintaining and controlling the operation of the turbine, converting the mechanical energy of the rotating blades into electricity, and ensuring efficient and safe operation of the turbine.

This is the most common type of wind turbine. The blades are designed to generate a lift force perpendicular to the direction of the airflow. The rotor diameter can be up to 100meters and the efficiency lies around 45%.

The output performance of modern horizontal axis wind turbines lies in the region of individual MW. If higher

output is required, wind farms are built with multiple turbines. The usual estimated life span of a wind turbine can be between 20 and 25years with 120,000hours of operation.

This vertical turbine was invented by the French engineer Georges Jean Marie Darrieus. The turbine usually consists of two or three aerofoil blades that rotate around a vertical axis creating a cylindrical, spherical or parabolic surface. Since blade speeds are many times faster than the wind speed, Darrieus turbines are considered high speed wind engines. That imposes high requirements on the blade material and the mounting of the blades since high centrifugal forces are involved.

One of the variants of the Darrieus turbine is the one with an H shaped rotor. It is easier to manufacture since the aerofoils are straight but the mounting must be stronger due to the significant centrifugal forces. To avoid pulsation, Darrieus wind turbines often use spiral blades which makes it possible to evenly distribute the torque.

Another disadvantage of two-bladed Savonius turbines is that they have a dead angle. When wind blows from this angle the turbine will not start turning on its own. Ways to resolve this are to use screw shaped blades or joining several turbines on one axis, each with the blades at a different position. In meteorology, some anemometers (for measuring wind speed) are based on the principle of the Savonius turbine.

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