Hawt wind turbine diagram

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The vast majority of wind turbines seen around the county on wind farms (both on-shore and off-shore) are standard 3 blade designs. However, a number of different styles/types of turbines exist and the way in which they harness kinetic energy from the wind is quite different.

The two main types of turbines are Horizontal-axis Turbines (HAWT) and Vertical-axis turbines (VAWT). HAWT have the rotating axis oriented horizontally. They typically feature 3-blades and are designed to face to the wind. VAWT have the rotating axis aligned vertically and are designed to harnesses kinetic energy in the opposite direction.

Apart from HAWT and VAWT there are other iterations of the turbine that are worth exploring.

The most common type of wind turbine is the "Horizontal Axis Wind Turbine" (HAWT). It is referred to as a horizontal axis as the rotating axis lies horizontally (see diagram, below).

A HAWT needs to point directly into the wind to operate at maximum efficiency, and the whole head is designed to turn to face the wind. As the wind changes direction, so the head must turn (or "yaw") to stay pointing into the wind.

HAWTs are chosen for off-shore wind farms and on-shore wind farms where the land is largely flat and open, because they work more efficiently than VAWTs in areas where the wind is not turbulent.

While there are plenty of small-scale HAWTs commercially available for energy conscious home owners, one of their big advantages is that they scale well for manufacture and can be built VERY BIG. This is another reason why they are used for wind farms. It is much more cost effective to build and operate one 10 megawatt (MW) turbine than five 2 MW turbines.

The largest wind turbine in the world (as of Summer 2021) is the Vestas V236 turbine1, with a rated power output of 15 megawatts (MW). It has a blade rotor diameter of 236m - more than twice the height of the Statue of Liberty! One single rotation of its blades will provide enough electricity to run an average household for a day.

A less efficient and less common turbine is the "Vertical Axis Wind Turbine" (VAWT). It is referred to as vertical axis as the rotating axis is aligned vertically upwards (see diagram, below).

It is not possible to build VAWTs at the large scales we see in HAWT wind farms. The biggest VAWT ever built was the 110m tall, 3.8MW "?OLE" turbine in Quebec, Canada2. However the rotor bearing failed in 1993 under the 880 ton weight it had to support. It has been non-operational since then, and is now a curiosity

for tourists. It is highly unlikely anyone will try to build a VAWT bigger than this due to the engineering problems associated with directly supporting such heavy weights on a single bearing.

Although smaller, the main advantage that VAWTs have over HAWTs is that they do not need to yaw. They collect wind energy from all directions all the time. Because of the way the blades are designed, they always spin the same direction, no matter where the wind is coming from.

VAWTs take up less room than an equivalent power HAWT, and are often chosen for areas where space is limited.

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