Wind power generation system

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If you place an object like a rotor blade in the path of that wind, the wind will push on it, transferring some of its own energy of motion to the blade. This is how a wind turbine captures energy from the wind. The same thing happens with a sail boat. When moving air pushes on the barrier of the sail, it causes the boat to move. The wind has transferred its own energy of motion to the sailboat.

When you talk about modern wind turbines, you"re looking at two primary designs: horizontal-axis and vertical-axis. Vertical-axis wind turbines (VAWTs) are pretty rare. The only one currently in commercial production is the Darrieus turbine, which looks kind of like an egg beater.

Unlike the old-fashioned Dutch windmill design, which relied mostlyon the wind"s force to push the blades into motion, modern turbines usemore sophisticated aerodynamic principles to capture the wind"senergy most effectively. The two primary aerodynamic forces at work inwind-turbine rotors are lift, which acts perpendicular to the direction of wind flow; and drag, which acts parallel to the direction of wind flow.

To calculate the amount of power a turbine can actually generate from the wind, you need to know the wind speed at the turbine site and the turbine power rating. Most large turbines produce their maximum power at wind speeds around 15 meters per second (33 mph). Considering steady wind speeds, it"s the diameter of the rotor that determines how much energy a turbine can generate. Keep in mind that as a rotor diameter increases, the height of the tower increases as well, which means more access to faster winds.

Probably the most commonly activated safety system in a turbine is the "braking" system, which is triggered by above-threshold wind speeds. These setups use a power-control system that essentially hits the brakes when wind speeds get too high and then "release the brakes" when the wind is back below 45 mph. Modern large-turbine designs use several different types of braking systems:

Globally, at least 50,000 wind turbines are producing a total of 50 billion kilowatt-hours (kWh) annually. In the next section, we"ll examine the availability of wind resources and how much electricity wind turbines can actually produce.

On a global scale, wind turbines are currently generating about as much electricity as eight large nuclear power plants. That includes not only utility-scale turbines, but also small turbines generating electricity for individual homes or businesses (sometimes used in conjunction with photovoltaic solar energy). A small, 10-kW-capacity turbine can generate up to 16,000 kWh per year, and a typical U.S. household consumes about 10,000 kWh in a year.

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