Today's Wind Turbines

Like old-fashioned windmills, today's **wind turbines** use blades to capture the wind's kinetic energy. Wind turbines work because they slow down the speed of the wind. When the wind blows, it pushes against the blades of the wind turbine, making the rotor spin. The parts of a turbine work together to power a generator to produce electricity.

Most wind turbines have the same basic parts: blades, shafts, gears, a generator, and a cable. (Some turbines do not have gear boxes.) These parts work together to convert the wind's energy into electricity.

1. The wind blows and pushes against the blades on top of the tower. The blades catch the wind and spin the rotor.

2. The rotor is connected to a low-speed shaft. When the rotor spins, the shaft turns. The shaft is connected to a gear box. The gears in the gear box increase the speed of the spinning motion on a high-speed shaft. All of the gears are housed inside the nacelle.

3. The high-speed shaft is connected to a generator. As the shaft turns inside the generator, it produces electricity.

4. The electricity is sent through cables down the turbine tower to a transformer and then to a transmission line.

The amount of electricity that a turbine produces depends on its size and the speed of the wind. Wind turbines come in many different sizes. A small turbine may power one home. Large wind turbines can produce enough electricity to power up to 1,000 homes. Large turbines are sometimes grouped together to provide power to the electricity grid. The grid is the network of power lines connected together across the entire country.

Wind Power Plants

Wind power plants, or **wind farms**, are clusters of wind turbines used to produce electricity. A wind farm usually has dozens of wind turbines scattered over a large area.

Choosing the location of a wind farm is known as **siting** a wind farm. The wind speed and direction must be studied to determine where to put the turbines. As a rule, wind speed increases with height, as well as over open areas with no windbreaks.

Turbines are usually built in rows facing into the **prevailing wind**. Placing turbines too far apart wastes space. If turbines are too close together, they block each other's wind.

The site must have strong, steady winds. Scientists measure the winds in an area for several years before choosing a site. The best sites for wind farms are on hilltops, on the open plains, through mountain passes, and near the coasts of oceans or large lakes. Texas, the number one producer of wind energy in the U.S., has plentiful open space with steady winds. The Midwest and Rocky Mountain states are also prime states for wind energy production.

The wind blows stronger and steadier over water than over land. There are no obstacles on the water to block the wind. There is a lot of wind energy available **offshore**.

Offshore wind farms are built in the shallow waters off the coast of major lakes and oceans. Offshore turbines produce more electricity than turbines on land, but they cost more to build and operate.

Wind Turbine Diagram
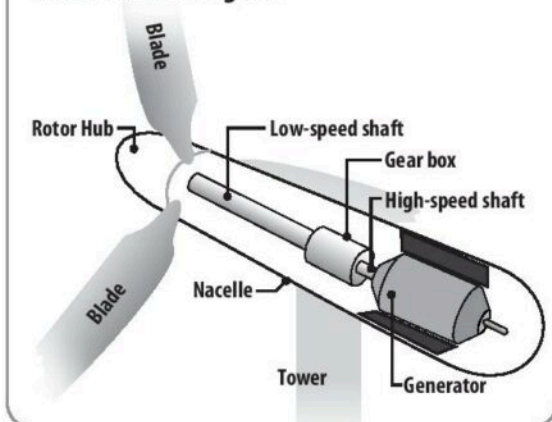
WIND FARM

The first offshore wind farm in the United States, off the coast of Block Island, Rhode Island, began operating in 2016. It includes five turbines that power 17,000 homes.

Wind Production

Wind produces only a small amount of the electricity this country uses, but the amount is growing every year. One reason wind farms don't produce more electricity is that they can only run when the wind is blowing at certain speeds. On Midwestern wind farms, the wind is optimum for producing electricity between 65 and 90 percent of the time.

Environmental Impacts

In some areas, people worry about the birds and bats that may be injured by wind turbines. Some people believe wind turbines produce a lot of sound, and some think turbines affect their view of the landscape.

On the other hand, wind is a clean, renewable energy source that produces no air pollution. And wind is free to use. Wind power may not be the perfect answer to our electricity needs, but it is a valuable part of the solution.