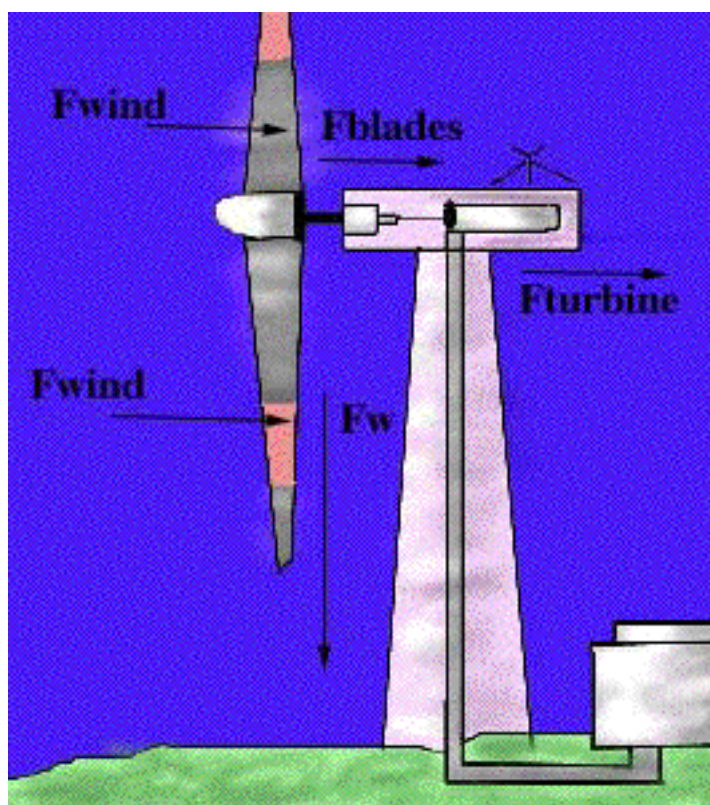


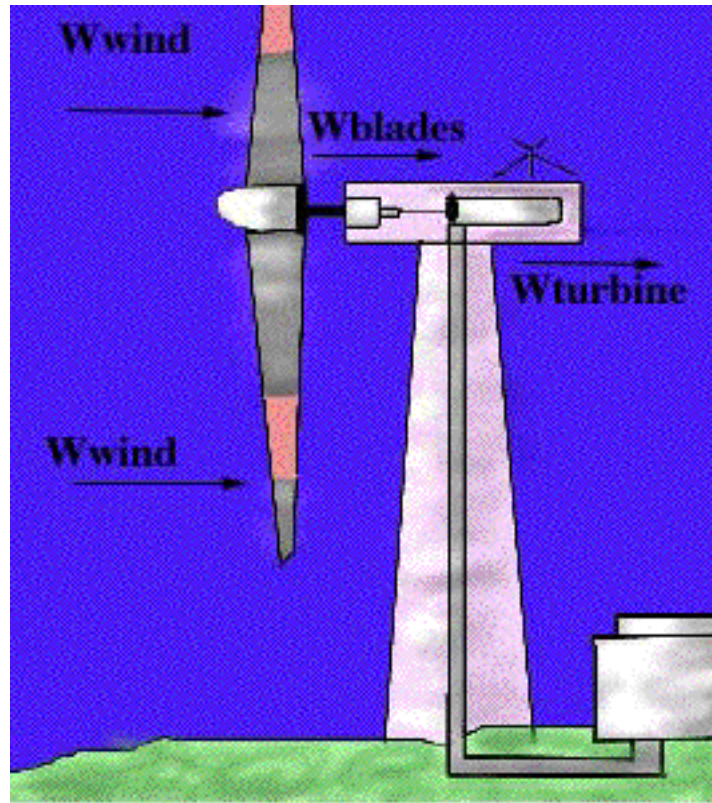
## Wind Power Systems

Forces play a part of every action that occurs anywhere at any time. Force is the foundation that the technology of both wind power and hydroelectric power utilize. Wind power harnesses the forces in the horizontal direction of motion, while hydroelectric power derives energy from the vertical direction of motion. But of course wind does not operate only in the horizontal direction. One definite hindrance of wind power is that the blades must turn along only one axis. This page will analyze the forces that act in the horizontal direction of motion, and will for the most part neglect vertical force vectors. If any of the terminology so far presented is unclear, please read the help guide at the link for [Forces & Vectors](#). It is also important to understand the parts of a wind tower. Please read up on the parts and what they do at the [Wind system](#) web page.

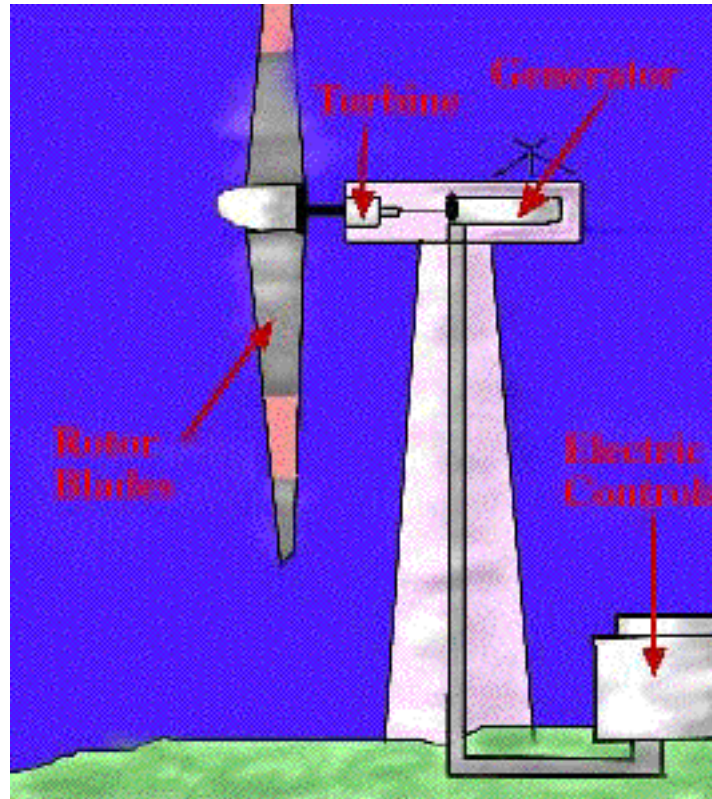
The following diagram illustrates the forces that are important when analyzing the physics of wind power. Because the wind must physically push the blades of the wind tower, the wind force must overcome the weight of the blades. If the force of the wind is not enough to spin the blades, then a wind tower will obviously not produce energy. Although making the blades of a wind power lighter, a reduction in weight will often mean the blade is less strongly connected to the turbine. As synthetic materials become stronger and more flexible, the weight of the blades will decrease while not sacrificing safety and reliability. The force vectors for the weight of the blades are drawn in the next diagram downward:



Wind power is optimized in locations where wind is strong. The wind speed is defined as the distance that wind travels divided by the amount of time that it takes the wind to travel that distance. Several factors limit the amount of energy that can be harvested from wind. If you have already read the information about nuclear power physics, read on, because the same concepts are discussed here, but using vectors to represent the forces, work done, and motion that takes place. The next diagram shows that work is done in the direction of force, the wind doing work on the blades, that do work on the turbine, that then does work on the generator:



It is helpful to compare the diagram on this page with the diagrams of [nuclear power](#), and [hydro power](#). The diagram on this page represents a wind power system that is used to generate electricity for many people connected by wires to the electric grid. In a home wind power system, the electric controls are different because the electricity generated must be monitored and converted to the exact specifications needed for the home. In a home powered by wind power, the energy will be stored in batteries, another piece of equipment that will be inside the electric control room.



### Definitions of the Parts of a Wind Power Station:

**Turbine** - The turbine is always found in an alternative energy power station or system before the electric generator. A wind turbine is made of two parts, the blades that move the turbine and cause it to spin, and transferring part that connects to the electric generator. The turning motion of the turbine is the motion that causes the generator to create electricity.

**Generator** - The generator is the part of the wind energy station that changes mechanical energy into electrical energy. For the physical process behind the generator, go to the [Magnetism](#) web page.

**Blades** - The blades are the equipment that utilize the kinetic energy of the wind. The blades are connected to the wind turbine. The rotation of the turbine is caused by the wind moving the blades.

**Electric Controls** - As in every alternative energy system, special controls are used to monitor the energy production process. In a home power system batteries keep excess power. Controls that monitor the charge of the batteries will be used to predict how much power usage the system can handle. If the things in the house are not made for direct current, then an electric inverter is used to create the alternating current wave that most appliances and electric objects need. When the system is not for home power, electric lines take the electricity out to the electrical grid.

Study this page and previous diagrams so that you take a [quiz](#) on the parts of the diagram when you are ready.