

Creating Electricity

Wind **power** is converted to **electricity** by a **wind turbine**. In a typical, modern, large-scale wind turbine, the kinetic energy in the wind (the energy of moving air molecules) is converted to rotational motion by the **rotor** – typically a three-bladed assembly at the front of the wind turbine. The rotor turns a **shaft** which transfers the motion into the **nacelle** (the large housing at the top of a wind turbine **tower**). Inside the nacelle, the slowly rotating shaft enters a **gearbox** that greatly increases the rotational shaft speed. The output (high-speed) shaft is connected to a **generator** that converts the rotational movement into electricity at **medium voltage** (a few hundred volts). The electricity flows down heavy electric cables inside the tower to a **transformer**, which increases the voltage of the electric power to the **distribution voltage** (a few thousand volts). (Higher voltage electricity flows more easily through electric lines, generating less heat and fewer power losses.) The distribution-voltage power flows through underground lines to a collection point where the power may be combined with other turbines. In many cases, the electricity is sent to nearby farms, residences and towns where it is used. Otherwise, the distribution-voltage power is sent to a **substation** where the voltage is increased dramatically to **transmission-voltage** power (a few hundred thousand volts) and sent through very tall transmission lines many miles to distant cities and factories.

Applications

Wind turbines come in a variety of sizes, depending upon the use of the electricity. The large, **utility-scale** turbine described above may have blades over 40 meters long, meaning the diameter of the rotor is over 80 meters – nearly the length of a football field. The turbines might be mounted on towers 80 meters tall (one blade would extend about half way down the tower), produce 1.8 **megawatts** of power (1.8 **MW** or 1800 **kilowatts**, 1800 **kW**), supply enough electricity for 600 homes, and cost over a million and a half dollars!

Making an Impact

The wind resource in the United States is vast. Using today's technology, there is theoretically enough wind power flowing across the country to supply all of our electricity needs. North Dakota alone could supply about one third of the nation's electricity. Adequate winds for commercial power production are found at sites in 46 states. However, less than 1% of the nation's electricity is currently supplied by wind power. Only a small portion of the country's vast potential will likely be tapped in the near term unless there is a shift in our energy policy priorities toward long-term support for renewable energy development. President Bush has stated that wind energy can provide as much as 20% of the nation's electricity.