**Wind Basics**

**Energy from moving air**

Wind is caused by the uneven heating of the earth's surface by the sun. Because the earth's surface is made of different types of land and water, it absorbs the sun's heat at different rates. One example of this uneven heating can be found in the daily wind cycle.

During the day, the air above the land heats up faster than the air over water. The warm air over the land expands and rises, and the heavier, cooler air rushes in to take its place, creating wind. At night, the winds are reversed because the air cools more rapidly over land than over water.

In the same way, the atmospheric winds that circle the earth are created because the land near the earth's equator is heated more by the sun than the land near the North Pole and the South Pole.

**Wind energy for electricity generation**

Wind turbines use blades to collect the wind’s kinetic energy. Wind flows over the blades creating lift (similar to the effect on airplane wings), which causes the blades to turn. The blades are connected to a drive shaft that turns an electric generator, which produces electricity.

In 2014, wind turbines in the United States generated about 4% of total U.S. electricity generation. Although this is a small share of the country's total electricity production, it was equal to the electricity use of about 17 million U.S. households in 2013.

**Wind speeds are not the same across the country**

Wind speed typically increases with altitude and increases over open areas without windbreaks. Good sites for wind turbines include the tops of smooth, rounded hills, open plains or shorelines, and mountain gaps that funnel and intensify wind.

Wind speeds vary throughout the United States. Wind speeds also vary throughout the day and from season to season. In Tehachapi, California, the wind blows more frequently from April through October than it does in the winter. This is a result of the extreme heat of the Mojave Desert during the summer months. The hot air over the desert rises, and the cooler, denser air above the Pacific Ocean rushes through the Tehachapi mountain pass to take its place. In a state like Montana, the wind blows more frequently during the winter.

Fortunately, the seasonal variations in California and Montana match the electricity demands of the regions. In California, people use more electricity during the summer for air conditioners. In Montana, people use more electricity during the winter.

Wind power projects with one or more large wind turbines were located in 39 states in 2014. The five states with the largest generation of electricity from wind in 2014 were Texas, Iowa, California, Oklahoma, and Kansas.

**Offshore wind power**

There is potential for significant electricity generation from wind energy in the waters off the coasts of the United States, and there are plans for several offshore wind projects in New England. There are many off-shore wind energy projects operating in Europe. However, electricity from offshore wind farms is more expensive than from wind turbines on land because of the greater costs of building offshore.

**Wind energy use expanded because of environmental concerns**

In the 1990s and 2000s, incentives for renewable energy were established in response to a renewed concern for the environment. In the United States, the federal government provided research and development funding to help reduce the cost of wind turbines. It also offered tax and investment incentives for wind power projects. State governments enacted requirements for electricity generation from renewable sources. Electric power marketers and utilities began to offer green power to their customers. These policies and programs resulted in an increase in the number of wind turbines and the amount of electricity generated using wind energy.

**Wind Energy & the Environment**

Wind is a renewable energy source, and overall, using wind to produce energy has fewer environmental impacts than many other energy sources. Wind turbines do not release emissions that can pollute the air or water (with rare exceptions), and they do not require water for cooling. Wind turbines may also reduce the amount of electricity generated from fossil fuels, which reduces the total amount of air pollution, carbon dioxide emissions, and water used for electricity generation.

A wind turbine has a small physical footprint relative to the amount of electricity it can produce. Collections of wind turbines, sometimes called wind farms, are located on open land or mountain ranges and can also be placed offshore in lakes or in the ocean.

Wind turbines have some negative impacts on the environment. Modern wind turbines are large machines, and some people do not like the visual impact they have on the landscape. Wind turbines have also caught fire, and some have leaked lubricating fluids, but this is a relatively rare occurrence. Some people do not like the sound that wind turbine blades make.

Some types of wind turbines and wind projects cause bird and bat deaths. These deaths may contribute to declines in the population of species also affected by other human-related impacts. Newer, taller wind turbines kill fewer birds and bats than older, shorter wind turbines. However, replacing the shorter turbines with taller, more efficient turbines costs an enormous amount of money, and some wind farm operators resist making the change.

Most wind power projects on land also require service roads that add to the physical impact on the environment. Wind turbines also require the use of rare earth minerals. These minerals are often located in countries with less stringent environmental standards than the United States, and the use of these minerals can cause negative impacts to land, water, and air. Making the metals and other materials used to make wind turbines and the concrete used for their foundations requires the use of energy, which may be produced by fossil fuels.

http://www.eia.gov/kids/energy.cfm?page=wind\_home-basics