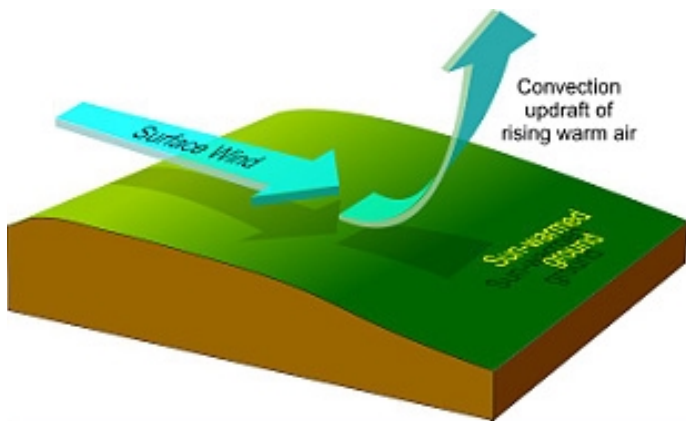


The sun has a lot to do with creating winds. Winds above continents and oceans occur because of temperature differences around the world. Some places, especially those near the Equator, receive far more direct sunlight than those closer to the Earth's north and south poles. As a result, the air over these areas warms up and then rises. Cooler air from the surrounding area rushes in to fill the space left by the rising air, creating a surface wind.



Surface winds occur when sunwarmed air rises, and cooler air rushes in to fill the space left behind.

*The Pembina Institute*

Air is constantly on the move. In some places, especially along coastlines and in mountains, it provides a highly reliable source of mechanical energy. Humans have invented an amazing array of devices that can harness the energy of the wind and put it to practical use.

## Capturing Wind Energy

### Sails

One of the oldest uses of wind energy is transportation. The first primitive sails were probably made from woven mats held aloft by wooden poles or human hands. Modern sailboats have very efficient sails and masts constructed from strong, lightweight materials such as Kevlar (the material used in bulletproof vests) and titanium. They work like aircraft wings to generate forces that pull the boat in the desired direction.

### Pumping and Grinding

Long before the invention of electricity, early wind turbines did very useful work.

Windmills were used in many places in Europe over the last several centuries to turn heavy granite disks called millstones. The millstones were used to crush dry grains such as wheat, barley, and corn to make flour or meal.



Modern sailboats and sailboards use high-tech materials and sophisticated designs to reach high speeds, even in light winds.

The Netherlands is famous for its windmills. In truth, most of these structures are not mills at all, but water pumps.

The Dutch created new farmland along the coast by building dikes around low-lying estuaries and mudflats and pumping out all the seawater. The “windmills” provided a steady supply of mechanical energy to lift seawater into the canals, allowing the new farmland to dry out.



Windmills have been in use in Europe for centuries.

In the past, windmills were common on farmsteads across Canada. They were often used to pump water from wells to watering troughs for cattle and to generate electricity at the farmhouse. When rural areas finally received electricity, many of these windmills fell into disuse and disrepair. Recently however, small windmills are becoming popular once again for bringing water to livestock.

## Generating Electricity

One of the most popular uses of wind turbines is to generate electricity. To make electricity, the shaft of the turbine must be connected to an electrical generator. Through gearboxes, the generator converts the mechanical energy of the spinning turbine shaft into



Wind turbines are gaining popularity with cattle ranchers for watering their livestock.

electricity. Generators are small and light enough that they can be housed under an aerodynamically designed cover at the top of the pole or tower. Wires running down the tower carry electricity to the grid, batteries or other appliances, where it is stored, and/or used.

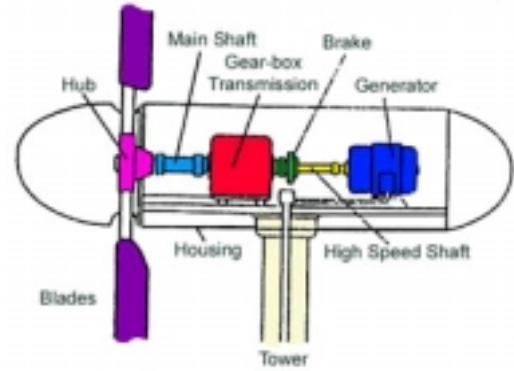


Photo courtesy of Australian Renewable Energy web site

Electricity is now being generated on a commercial scale at large installations called “wind farms” in several places around the world. Wind farms consist of rows of towers, sometimes 90 metres high, equipped with giant wind turbines for producing electricity. In Canada, the first commercial wind farm was built in southern Alberta near the town of Cowley, in a region famous for its strong, steady winds. Commercial wind farms have also been established in Germany, Denmark, the United States, Spain and India. Denmark and Germany have pioneered the development of commercial wind power, one of their fastest-growing industries.



The wind farm at Castle River, Alberta, generates enough electricity to meet the needs of several thousand Canadian homes.

Photo courtesy of Vision Quest Windelectric Inc.

# Background Wind Energy

Some companies are now installing wind farms in shallow waters near coastlines in small countries with little available land area. These “offshore wind farms” are a promising new source of electricity. Toronto Hydro is installing such a turbine offshore on Lake Ontario.



Photo courtesy of AMEC Border Wind

Commercial wind energy is one of the most economical sources of new electricity available today. Wind turbines can be set up quickly and cheaply compared with building new coal-fired generating stations or hydroelectric facilities. Modern wind generating equipment is efficient, highly reliable, and becoming cheaper to purchase. The environmental impact of large wind turbines is negligible compared with an open pit coal mine or a reservoir, and during their operation produce no air pollution. Because of these factors, wind energy is recognized as the world’s fastest-growing new energy source.

Small, highly efficient wind turbines are becoming popular as a source of electricity for rural homes. The cost of installing one comes close to that of put-

ting up poles, overhead power lines and other equipment necessary to connect to the electrical grid. The advantage is that the homeowner owns the generating equipment and is freed from paying monthly electrical bills!



Small, lightweight turbines are available to make electricity for single homes.

Photo courtesy of Bergey Wind Power

## Questions

1. What causes winds to blow on the surface of the Earth?
2. What are some of the environmental benefits of using wind power?
3. Describe some ways wind energy is used in the region where you live.
4. What is a “wind farm”?

Contact us at: [education@pembina.org](mailto:education@pembina.org).

## Notes:

