

A VISUAL EXPLORATION OF SCIENCE

A VISUAL GUIDE TO ENERGY AND MOVEMENT



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Uses and Applications

WIND ENERGY
Wind is one of the most promising renewable resources. Many countries take advantage of the wind's force to generate electricity or to pump water.



Early humans relied on their own brute force and the energy supplied by animals. Later, humans discovered coal and petroleum (along with another hydrocarbon,

natural gas). Petroleum reserves are finite and increasingly in demand around the world, however. In addition, petroleum extraction and combustion produce pollution.

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For all these reasons, humans have experimented with alternative sources of energy. Some are clean but are not very efficient. Others are inexhaustible, efficient, and “green,” but are very

expensive. In the following chapter, you will discover how each of these new alternative energy sources works, as well as their advantages and disadvantages. ●

Wind Energy

One of the most promising renewable energy resources is the use of wind to produce electricity by driving enormous wind turbines (windmills). Eolic power is an inexhaustible, clean, nonpolluting source of energy with more advantages than disadvantages. The most important disadvantages are our inability to predict precisely the force and direction of winds and the possibly negative impact that groups of large towers could have on the local landscape. ●

The Turbine

converts the wind into electrical energy through the use of simple technology based on mechanical gears.

1

The wind moves the blades of the wind turbine, producing mechanical energy, which is then converted into electrical energy.

Brakes

are activated when the winds surpass 74 miles per hour (120 km/h), preventing damage to the wind turbine.

Low-speed axle turns slowly, between 20 to 35 revolutions per minute (rpm).

Multiplier With gears, it multiplies by 50 the speed of rotation of the high-speed axle.

High-speed axle turns at around 1,500 rpm, allowing it to operate the generator.

Generator produces electric energy from the mechanical energy of the axle.

Computer controls the conditions of the wind turbine and its orientation.

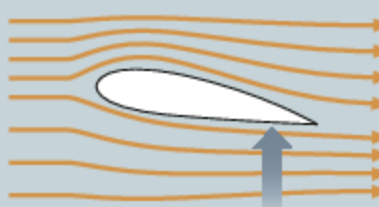
Cooling system cools the generator with a fan. Also uses oil to cool the multiplier lubricant.

432,883

megawatts is the installed capacity of wind farms in the world. The leading country is China, followed by the United States and Germany.

The blades

are movable. They can be oriented both to take maximum advantage of the wind and to slow down the turbine when the winds are too strong.



When facing the wind, their shape causes a pressure difference between the two faces of the wind turbine's blades. The pressure on the blades produces a force that turns the rotor.

2

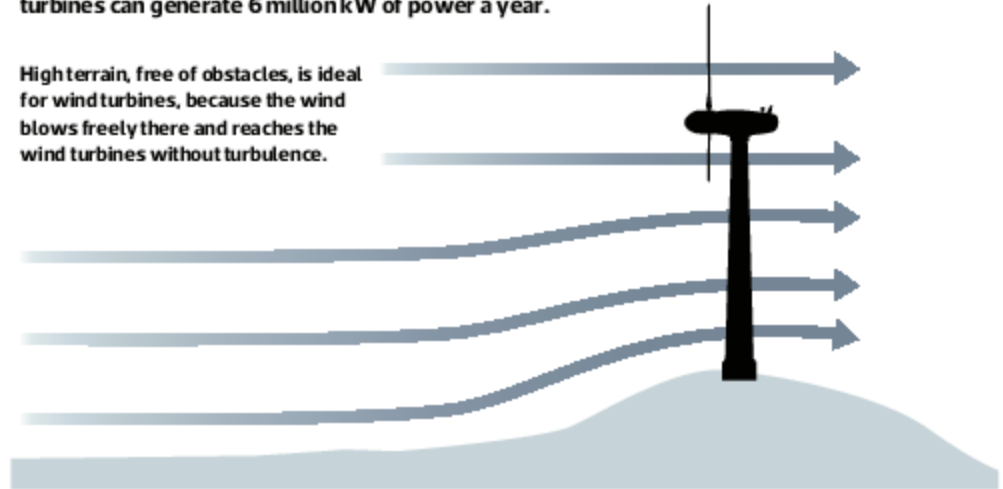
Energy

The electric energy produced by the generator goes down the cables to a converter.

Wind Turbines

These modern, large wind turbines, between 150 and 300 feet (45 and 90 m) high, tend to be grouped in windy, isolated, mostly deserted regions. The most modern wind turbines can generate 6 million kW of power a year.

High terrain, free of obstacles, is ideal for wind turbines, because the wind blows freely there and reaches the wind turbines without turbulence.



The wind turbines are grouped into wind farms to maximize the potential of transmitting energy from only one location. This has the advantage of lowering costs and reducing environmental impact on the landscape.



The Journey of Electricity

The energy produced in wind farms can travel through the main power grid together with energy generated by other sources.

