Hydropower

Hydropower is the energy captured from moving water. It is often used to make electricity, usually at dams. A renewable energy source, hydropower produced 6% of the United States' total electricity and accounted for 67% of electricity generation from a renewable source in 2008. Hydropower produces about 20% of the electricity used worldwide, according to the US Energy Information Administration.

How Hydropower is Formed

Nature's water cycle is important to making hydropower work. The sun heats water on the Earth's surface, causing it to evaporate. The water vapor condenses into clouds and then comes down as rain or snow. The precipitation collects and flows via rivers into the ocean, where it evaporates again and begins the cycle anew.

The amount of energy in water depends on its flow or fall. Swiftly flowing water and water that descends from a very high point (a waterfall) both have lots of energy.

The mechanical energy of the flowing water turns turbines to run generators that convert energy into electricity.

How a Dam Works

Most hydropower projects use a dam and a reservoir to retain water from a river. When the dam gates are opened, water flows through a pipe called a penstock and applies pressure to turbines, making them turn. The turbine's rotation spins electromagnets that generate a current in stationary coils of wire. Finally, the current is put through a transformer where the voltage is increased for long-distance transmission over power lines. The power of water is harnessed to provide electricity for our homes, make machines work and more.

Dams must have a powerful stream flow and enough vertical distance for the water to flow between the reservoir and the river below the power plant to effectively produce electricity.

Other hydropower plant projects do not require dams. Instead, the force of the river current that is diverted into canals or pipes applies pressure to the turbine blades to produce electricity.

Uses for Hydropower

Water has been used to power machinery for thousands of years—water wheels have been used to grind grain into flour and pound linen to be turned into paper ever since ancient times! Today, hydropower usually refers to dams that have been built to generate electricity.

Demand for Hydropower

Globally, hydropower supplies nearly one-fifth of the world's energy each year, making it the most commonly used renewable energy source. Hydroelectric power generates more electricity worldwide than solar, wind, biomass and all other renewable sources combined.

And hydropower may be gaining popularity. China's Three Gorges Dam will be the largest power plant in the world and is expected to produce 100 billion kilowatt-hours of electricity per year. In early 2010, the Brazilian government approved plans for a $17 billion hydroelectric dam in the Amazon rainforest.

Wave Power

If you've ever been to the beach and taken a dip in the ocean, you know firsthand that waves can be very powerful! Scientists want to figure out a way to harness that power to produce electricity.

The US Energy Information Administration estimates that the wave energy off the US coasts could potentially generate 7% of the country's electricity consumption. The coasts off New Zealand, Europe and Japan are also ideal for producing wave power. The key now is to develop that potential into real results.

One way to focus wave energy is to increase waves' power and size by directing them into a narrow channel, where they can spin turbines to create electricity. Technological advances are being made in the area of wind energy, including pumps, deep-water oscillations and more. The world's first commercial wave farm, which opened in 2008 off the coast of Portugal, can generate enough electricity to power about 1,500 Portuguese homes.

Tidal Power

The ocean's tides have enormous power and are caused by the moon's and sun's gravitational pull and the rotation of the Earth. One way to use tidal power for energy is by using tidal barrages, which are dams built across inlets that use gates to control water levels and flow rates. The water flows in during high tide and fills a reservoir, and as the water flows out again, it goes through a system of turbines that turn and generate electricity. Tidal fences differ from tidal barrages because they have vertical axis turbines mounted to a fence, and all the water that passes through is used to turn turbines. Tidal turbines are essentially the same as wind turbines, but because they are underwater and water is much more powerful than wind, they must be much sturdier than wind turbines.