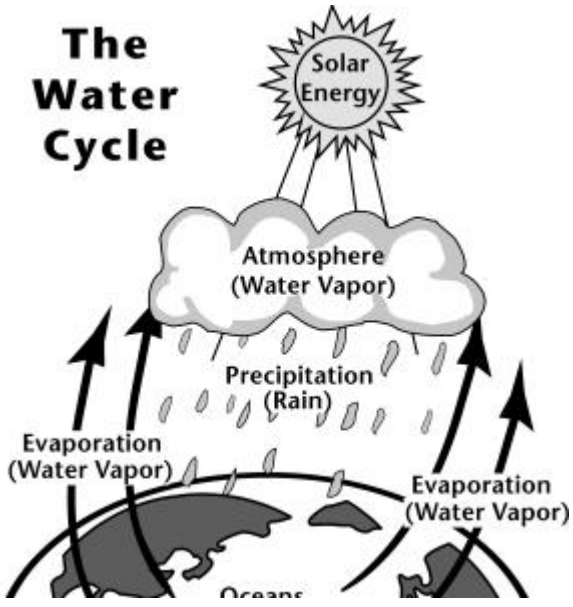
Hydropower -- Energy from Moving Water

HYDROPOWER GENERATES ELECTRICITY

Of the renewable energy sources that generate electricity, hydropower is the most often used. It accounted for 7 percent of total U.S. electricity generation and 75 percent of generation from renewables in 2004.

It is one of the oldest sources of energy and was used thousands of years ago to turn a paddle wheel for purposes such as grinding grain. Our nation's first industrial use of hydropower to generate electricity occurred in 1880, when 16 brush-arc lamps were powered using a water turbine at the Wolverine Chair Factory in Grand Rapids, Michigan. The first U.S. hydroelectric power plant opened on the Fox River near Appleton, Wisconsin, on September 30, 1882. Until that time, coal was the only fuel used to produce electricity. Because the source of hydropower is water, hydroelectric power plants must be located on a water source. Therefore, it wasn't until the technology to transmit electricity over long distances was developed that hydropower became widely used.

HOW HYDROPOWER WORKS



Understanding the water cycle is important to understanding hydropower. In the water cycle -

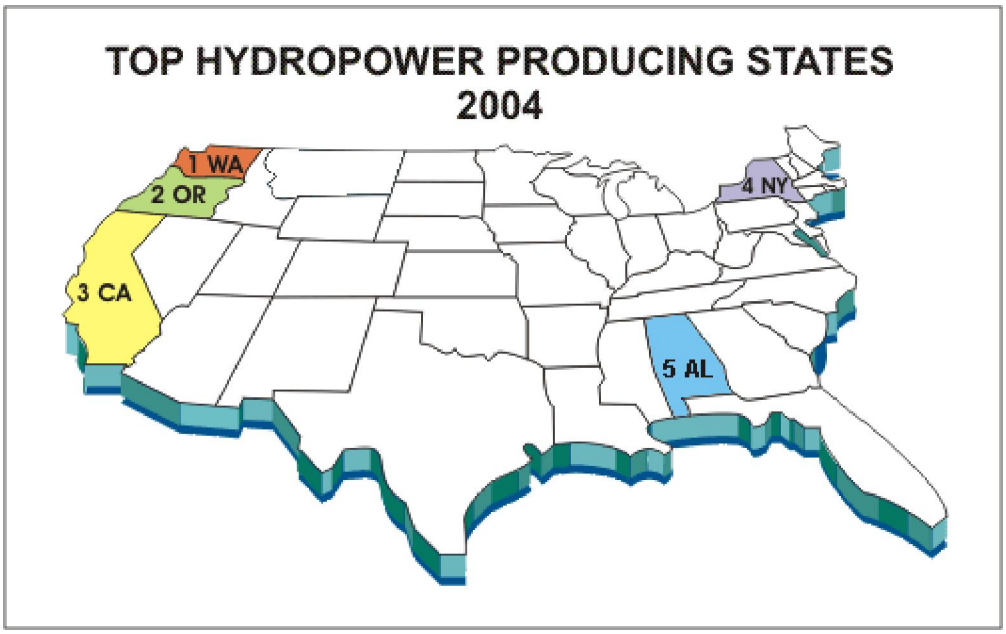
- Solar energy heats water on the surface, causing it to evaporate.
- This water vapor condenses into clouds and falls back onto the surface as precipitation.
- The water flows through rivers back into the oceans, where it can evaporate and begin the cycle over again.

Mechanical energy is derived by directing, harnessing, or channeling moving water. The amount of available energy in moving water is determined by its *flow* or *fall*. Swiftly flowing water in a big river, like the Columbia River along the border between Oregon and Washington, carries a great deal of energy in its flow. So, too, with water descending rapidly from a very high point, like Niagara Falls in New York. In either instance, the water flows through a pipe, or *penstock*, then pushes against

and turns
blades in a turbine to spin a generator to produce electricity. In a *run-of-the-river system*, the force of the current applies the needed pressure, while in a *storage system*, water is accumulated in reservoirs created by dams, then released when the demand for electricity is high. Meanwhile, the reservoirs or lakes are used for boating and fishing, and often the rivers beyond the dams provide opportunities for whitewater rafting and kayaking. Hoover Dam, a hydroelectric facility completed in 1936 on the Colorado River between Arizona and Nevada, created Lake Mead, a 110-mile-long national recreational area that offers water sports and fishing in a desert setting.

WHERE HYDROPOWER IS GENERATED

Over one-half of the total U.S. hydroelectric capacity for electricity generation is concentrated in three States (Washington, California and Oregon) with approximately 27 percent in Washington, the location of the Nation's largest hydroelectric facility – the Grand Coulee Dam.



It is important to note that only a small percentage of all dams in the United States produce electricity. Most dams were constructed solely to provide irrigation and flood control.

HYDROPOWER AND THE ENVIROMENT

Some people regard hydropower as the ideal fuel for electricity generation because, unlike the nonrenewable fuels used to generate electricity, it is almost free, there are no waste products, and hydropower does not pollute the water or the air. However, it is criticized because it does change the environment by affecting natural habitats. For instance, in the Columbia River, salmon must swim upstream to their spawning grounds to reproduce, but the series of dams gets in their way. Different approaches to fixing this problem have been used, including the construction of "fish ladders" which help the salmon "step up" the dam to the spawning grounds

upstream.

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Sources: Energy Information Administration, *Electric Power Monthly*, February 2005.
National Energy Education Development Project, *Intermediate Energy Infobook,* 2004-2005.

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