Exploring Energy: Hydroelectric Power

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***Chem.Info*'s recurring Exploring Energy feature provides readers with a chance to familiarize themselves with energy technologies and processes, both new and old. In this installment, we explore hydroelectric power.**

Hydroelectric power makes up the greatest share of renewable energy sources in the U.S. and can be traced back to the 1800s. According to the Worldwatch Institute [1], over 16 percent of power generated globally came from hydroelectric systems. This figure is up five percent between 2009 and 2010. According to the Foundation for Water & Energy Education (FWEE), approximately 3 percent of dams in the U.S. produce energy.

Hydroelectric power plants can be especially efficient solutions because they can rely on naturally occurring forces like water pressure and gravity to aid in power generation. Found inside many of the world's largest dams, hydroelectric power is generated by water that falls inside the dam from the higher altitude upstream water level to the lower water level downstream. The U.S. Geological Survey [2] compares the internal process, in which a turbine activates an electric generator to produce power, to that of "coal-fired power plants."

Because of the flow of water through a dam is theoretically endless, once a hydroelectric system is built, it will be able to produce energy continuously for as long as adequate maintenance and upkeep are performed.

Because water is clean and natural, and the external components needed to operate a hydroelectric system are relatively minimal, the emissions are essentially nil, yielding an almost completely carbon neutral power generation system.

Hydroelectricity has its limits, however, as power can only really be generated through this method in geographical regions in which rivers are present. This leaves

a substantial portion of the U.S. — and the world — with little hope for hydroelectric power generation.

And though the power generated through such a system is cheap, reliable and emission-free, there are some concerns over the impact of dams on local ecosystems. The FWEE describes a process by which stratification [3] can occur in the reservoirs that form downstream from dams. These manmade lakes have a greatly increased surface area compared to the rivers in which they form. This surface area can be warmed by the sun, causing cooler water to sink to the bottom. The oxygen-deprived water at the bottom of the reservoir can kill off fish and other wildlife, having a long-term detrimental impact on the river's ecosystem. Other ecological concerns include sedimentation and erosion, which can also have an impact on the river and surrounding areas.

While no power generation process will provide a zero-impact energy generation solution, hydroelectric power can provide cheap, fairly clean energy to a large portion of the country. Hydroelectric power, though by no means a stand-alone solution, can be an important cost reduction component to any energy portfolio.

Links:
[1] http://www.worldwatch.org/node/9527
[2] http://ga.water.usgs.gov/edu/hyhowworks.html
[3] http://fwee.org/environment/how-a-hydroelectric-project-can-affect-a-river/changes-to-the-ecosystem/