ENVIRONMENTAL AND ENERGY STUDY INSTITUTE
122 C STREET, N.W., SUITE 630 ■ WASHINGTON, D.C., 20001 ■ 202-628-1400 ■ www.eesi.org

Renewable Energy Fact Sheet

CAROL WERNER
EXECUTIVE DIRECTOR

Release: May 2006

Contact:
Fredric Beck (202) 662-1892, fbeck@eesi.org

Hydropower
Using water movement to generate electricity

Key Facts

- Hydroelectric power is produced by large turbines that convert the energy of falling or running water into electricity.
- Hydropower provides 20 percent of the world's electricity, and 7-9 percent of US electricity. Nearly 80 percent of renewable energy used in the United States comes from hydropower.
- The United States currently has a hydroelectric capacity of about 80,000 megawatts (MW). An additional 30,000 MW of potential hydroelectric generation capacity exists at 5,677 US sites, many of which already have dams, according to the US Department of Energy. Approximately 21,000 MW of that additional capacity could be realized through more efficient turbines without constructing new dams. Only 3 percent of the more than 75,000 dams in the United States are currently used to generate hydroelectricity.

Hydropower Technology

- *Impoundment:* The most widespread form of hydroelectric generation, impoundment, involves a dam that blocks a river and forms a reservoir. This reservoir releases water down a channel, or penstock, where it flows past turbines to generate electricity. Water can be released consistently, thereby maintaining a fixed reservoir level and providing base-load power. Alternatively, the water's release can be timed to match periods of high energy demand, providing peak-load power.
- *Diversion:* Instead of blocking the entire river, diversion involves sending only a section of the river past the turbines. Some diversion systems use a dam to form a small reservoir, while *run-of-river* systems divert water directly from the river with no dam or water storage. Diversion systems provide consistent, base-load power.
- *Pumped storage:* When consumer demand for electricity is low, pumped-storage technology raises water from a lower reservoir to a higher one. When electricity is needed, water is allowed to fall back into the lower reservoir, providing peak-load power.
- Most hydroelectricity comes from large facilities with generating capacities of more than 30 MW. These facilities are used for central power generation. Small plants have capacities ranging from 100 kilowatts (kW) to 30 MW, and micro plants have capacities below 100 kW. Small and micro plants are generally used for distributed power generation to supply energy to a rural home or a small town.

Benefits

- *Jobs and security:* Hydropower is produced domestically, providing jobs for Americans and inexpensive electricity for US homes, businesses, and industries without the security concerns associated with depending on foreign countries for oil and natural gas.

- *Pollution prevention:* Hydroelectric power generation releases few greenhouse gases or other pollutants. According to the US Office of Energy Efficiency and Renewable Energy, if fossil fuels had been used to generate the energy that hydropower plants produced in 1999, 77 million metric tons of carbon would have been emitted into the atmosphere, equivalent to the amount of carbon emitted by half the passenger cars driven in the United States in 1999.

Cost

- Hydroelectricity provides the lowest cost power of any electrical power source—at approximately 0.6 cents per kWh, it costs significantly less than conventional fossil fuels or nuclear energy. US dams were built decades ago, and they now have minimal capital costs or debt service. Hydroelectric power generation has no fuel costs, as well as low maintenance and operational costs.

Issues

- According to the National Hydropower Association, current federal policies raise substantial barriers to hydroelectricity generation. Through 2017, the government will require over half of the non-federal hydroelectricity plants to participate in an eight to ten-year federal relicensing process. Between 1986 and 2001, 246 plants went through this process and incurred an average annual generation loss of 4.2 percent, due to increased environmental and health regulatory requirements that relicensing plants must satisfy.
- Droughts, as experienced in much of the western United States over the past several years, reduce dams' capacity to generate hydroelectric power.
- Hydroelectric power generation often impedes water flow, lowers oxygen levels in water, and impacts downstream habitats, affecting fish, raptors, and other species in the food chain. Dams are physical barriers that can kill fish and block their migratory routes. Reservoirs are often land intensive, flooding acres of land, infringing upon critical habitats, and sometimes forcing people to relocate. The hydroelectric industry continues to develop technologies to mitigate these issues, including diverting water flow around dams, building fish ladders, and improving turbines.

For More Information

Idaho National Engineering and Environmental Laboratory http://hydropower.inl.gov/hydrofacts
National Hydropower Association http://www.hydro.org/hydrofacts/index.asp
DOE Office of Efficiency and Renewable Energy
http://www.eere.energy.gov/windandhydro/hydro_technologies.html
US Department of the Interior, Bureau of Reclamation http://www.usbr.gov/power/

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