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## Hydropower



Wind & Hydropower Technologies Program Web Site

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## Hydropower Topics

Hydropower (also called hydroelectric power) facilities in the United States can generate enough power to supply 28 million households with electricity, the equivalent of nearly 500 million barrels of oil. The total U.S. hydropower capacity—including pumped storage facilities—is about 95,000 megawatts. Researchers are working on [advanced turbine technologies](#) that will not only help maximize the use of hydropower but also minimize adverse environmental effects.

[More basic information about hydropower is also available.](#)

### Types of Hydropower Impoundment

An impoundment facility, typically a large hydropower system, uses a dam to store river water in a reservoir. The water may be released either to meet changing electricity needs or to maintain a constant reservoir level.

#### Diversion

A diversion, sometimes called *run-of-river*, facility channels a portion of a river through a canal or penstock. It may not require the use of a dam.

#### Pumped Storage

When the demand for electricity is low, a pumped storage facility stores energy by pumping water from a lower reservoir to an upper reservoir. During periods of high electrical demand, the water is released back to the lower reservoir to generate electricity.

### Sizes of Hydropower Plants

Facilities range in size from large power plants that supply many consumers with electricity to small and micro plants that individuals operate for their own energy needs or to sell power to utilities.

#### Large Hydropower

Although definitions vary, DOE defines large hydropower as facilities that have a capacity of more than 30 megawatts.

### Hydropower News

- [DOE to Guarantee Billion in Loans for Clean Energy Projects](#)  
August 07, 2006
- [G8 Leaders Address Global Energy Security and Climate Change](#)  
July 19, 2006
- [Rhode Island Approves Bills to Encourage Efficiency and Renewables](#)  
July 19, 2006

### **Small Hydropower**

Although definitions vary, DOE defines small hydropower as facilities that have a capacity of 0.1 to 30 megawatts.

### **Micro Hydropower**

A micro hydropower plant has a capacity of up to 100 kilowatts (0.1 megawatts).

## **Turbine Technologies**

There are many types of turbines used for hydropower, and they are chosen based on their particular application and the height of standing water—referred to as "head"—available to drive them. The turning part of the turbine is called the runner. The most common turbines are as follows:

### **Pelton Turbine**

A Pelton turbine has one or more jets of water impinging on the buckets of a runner that looks like a water wheel. The Pelton turbines are used for high-head sites (50 feet to 6,000 feet) and can be as large as 200 megawatts.

### **Francis Turbine**

A Francis turbine has a runner with fixed vanes, usually nine or more. The water enters the turbine in a radial direction with respect to the shaft, and is discharged in an axial direction. Francis turbines will operate from 10 feet to 2,000 feet of head and can be as large as 800 megawatts.

### **Propeller Turbine**

A propeller has a runner with three to six fixed blades, like a boat propeller. The water passes through the runner and drives the blades. Propeller turbines can operate from 10 feet to 300 feet of head and can be as large as 100 megawatts. A Kaplan turbine is a type of propeller turbine in which the pitch of the blades can be changed to improve performance. Kaplan turbines can be as large as 400 megawatts.

## **Issues**

### **Environmental Issues and Mitigation**

Current hydropower technology, while essentially emission-free, can have undesirable environmental effects, such as fish injury and mortality from passage through turbines, as well as detrimental effects on the quality of downstream water. A variety of mitigation techniques are in use now, and environmentally friendly turbines are under development.

### **Legal and Institutional Issues**

Legal and institutional issues include federal licensing as well as state and local permits, laws for historic and cultural preservation, and recreational requirements.

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