

The Facts of Water Use

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Water use consists of two distinct processes: withdrawal and consumption. According to the U.S. Geological Survey, thermoelectric power generation is among the smallest consumptive uses of freshwater by any economic sector, at 3.3 percent of total U.S. consumption—about one-half of residential consumption, at 6.7 percent. Thermoelectric power plants withdraw more water than any other economic sector, but they return 98 percent of the water they withdraw back to its natural sources. Thermoelectric power plants—fueled by nuclear energy, natural gas, oil, or coal—generate 90 percent of the electricity in the United States.

To put residential and thermoelectric power water consumption in perspective, a typical U.S. nuclear power plant supplies 740,000 homes with all of the electricity they use while consuming 13 gallons of water per day per household in a once-through cooling system, or 23 gallons of water per day per household in a wet cooling tower system. By comparison, the average U.S. household of three people consumes about 94 gallons of water per day for indoor and outdoor residential uses.

A once-through cooling system returns 99 percent of the water withdrawn back to the water body, at a somewhat higher temperature, as allowed by the plant's water permit. Wet cooling towers withdraw less water than a once-through system, and discharge water at a temperature only slightly above, or at, that of the water body. But cooling towers consume 70 percent of the water they withdraw. In effect, cooling towers consume twice as much water as a once-through system.

Once-through cooling systems may require plant operators to reduce electricity production to a small degree to observe the discharge water temperature limit during very hot days, while cooling towers do not have to reduce power for this reason. Most proposed new nuclear plants will employ cooling towers, where discharge water temperature will not be a consideration in electricity production.

Nuclear plants strive to be responsible stewards of the environment. Cooling system intake structures are designed to minimize aquatic life mortality, which is usually only one to two percent of the fish population in the water body. Scientific studies demonstrate that these cooling systems do not have any negative impact on the abundance of fish in the water body over time. Though cooling towers consume more water than once-through systems, cooling towers can consume as little as one to two percent of the annual flow of the rivers where they are located.

Key Facts

- Power plants circulate significant volumes of water in the process of generating electricity, but actually consume a small amount of water relative to other uses in the modern world.
- Of all the freshwater consumed in the United States, electricity generation accounts for 3.3 percent—less than half of the freshwater consumed by residential use (6.7 percent), according to the U.S. Geological Survey (USGS).
- Nuclear power plants circulate water to cool equipment. This water continuously is returned to its source and never is exposed to radioactive material.
- Nuclear power plants consume less water per unit of electricity produced than some forms of renewable energy.
- Nuclear power plants have a small environmental impact and produce reliable electricity in a wide range of weather conditions.

Defining Water Withdrawal, Consumption

All power plants that generate electricity by producing steam to move a turbine rely on water for cooling. These plants—fueled by coal, natural gas and nuclear energy—produce about 90 percent of all the electricity that powers America's homes and economy. This electricity also powers water purification systems, pumping stations and

waste-water treatment plants that residents, businesses and communities rely upon in society. In this way, electricity and water are interdependent.

The amount of water actually consumed by electric power generation is very small compared to other economic sectors. Thermoelectric power plants withdraw large volumes of water, but, depending on the design, most of the water is returned to its source.

A critical distinction is the difference between water *withdrawn* from a lake or river by a power plant and water actually *consumed* by the plant.

Plants that have an open-cycle cooling system withdraw water to cool steam and equipment through a system of pipes that circulates the water through components. After the water is withdrawn, virtually all of it is quickly returned to its source. This water never encounters the reactor or radioactive material.

For plants that have a closed-cycle cooling system using a cooling tower or cooling pond, water is withdrawn to cool steam and equipment through evaporation. Most of this water is not returned to its source.

Because rainfall in some areas of the country in 2007 was 15 to 20 inches below normal, energy companies have taken steps to reduce water consumption and otherwise conserve water supply.

Energy companies have worked with state and local governments and public water system operators to manage water use during drought conditions. In the Southeast, this coordinated approach to conservation resulted in more than a 20 percent water savings in 2007.

Electricity Generators Among Smallest Users

Electric power generation is among the smallest users of freshwater, accounting for about 3.3 percent of U.S. freshwater consumption, according to the USGS. This is about the same percentage of freshwater consumed by both industry and livestock raising. The largest consumption of freshwater is for irrigation (81.3 percent) and residential use (6.7 percent), the USGS said.

A typical nuclear plant supplies electricity around the clock for 740,000 homes. A nuclear power plant that returns cooling water directly to the source consumes the equivalent of six to 16 gallons of water per day per household. The same plant would consume the equivalent of 20 to 26 gallons of water per day per household if it used cooling tower systems. By comparison, the average U.S. household of three people consumes about 300 gallons of water per day for indoor and outdoor uses, according to the USGS.