The 1914 S.U.M. Great Falls Power Plant

The Great Falls Power Plant has been generating electricity for nearly 100 years. The plant produces hydroelectricity from the energy of falling water. When the plant opened in 1914, its primary purpose was to supply electricity to Paterson's mills. Today, the refurbished plant distributes electricity to homes and businesses throughout the region.

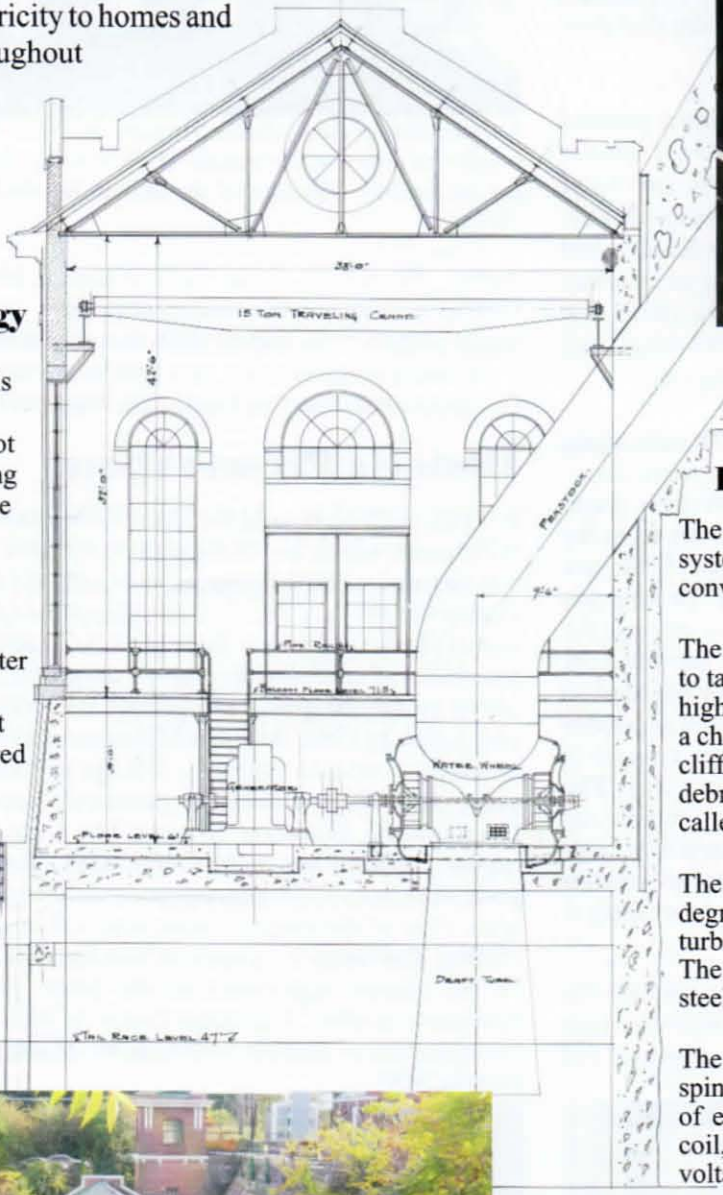


Photo of the power plant, shortly after it opened in 1914 (above). A cross-section showing the original penstock, turbine, and generator (left).

Green Energy

Hydroelectricity is "green" energy because it does not require the burning of fossil fuels, like oil or coal. The power plant produces no significant waste material. The water is returned to the river as clean as it was when it entered the plant.

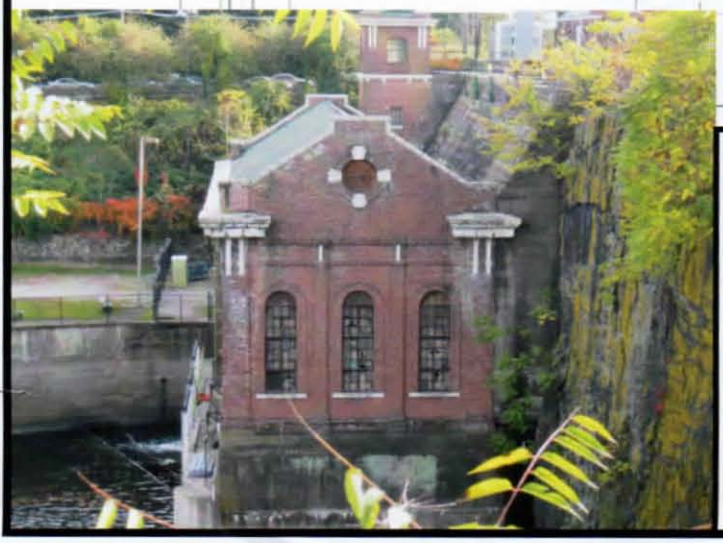
How Does Hydroelectricity Work?

The power plant is more than a building. It's an entire system for capturing the energy in falling water and then converting it into electricity.

The power plant is situated at the base of the Great Falls to take advantage of the natural geography of the 77-ft.-high falls. Water is drawn from the river above the falls in a channel called the forebay cut into the hard rock of the cliff. Gates control the water's flow, and screens capture debris and trash in the water before it enters steel tubes called penstocks.

The penstocks, which are angled down at about 45 degrees, direct the rushing water to one of three active turbines. The turbines look like propellers or pinwheels. The water rapidly spins the turbines, the turbines spin steel shafts, and the shafts turn generators.

The generators transform the mechanical energy of the spinning turbine into electrical energy using properties of electromagnetism. A wound copper wire, called a coil, spins between the poles of magnets creating a high-voltage electric current.



Power Plant Facts

Capacity: 10,950 kw (service for approx. 11,000 homes)
Net Head-Rated: 67.9 ft.
Type of Units: Three, vertical, Kaplan turbines.
Adjustable five-blade units and wicket gates.
Turbine efficiency: 92.1%
Operating speed: 400 rpm
Generator Type: Synchronous, vertical direct drive
Phase/Voltage/Frequency: 3 phase/4,160v/60Hz
For tour information, call the Historic District Cultural Center (973) 279-9587

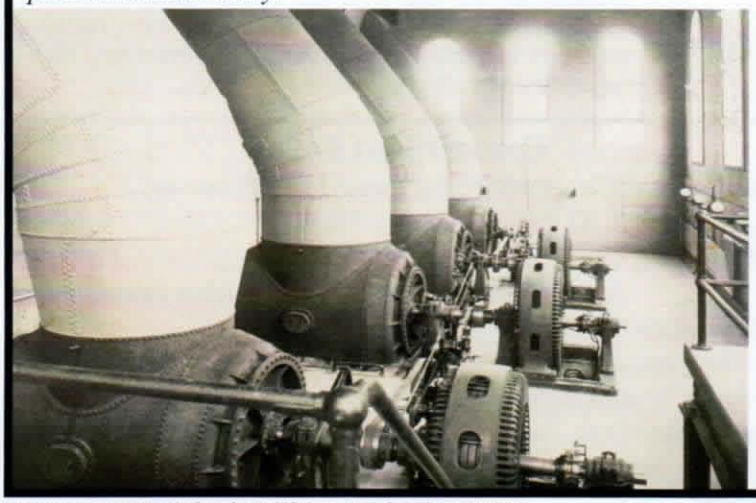
The S.U.M.

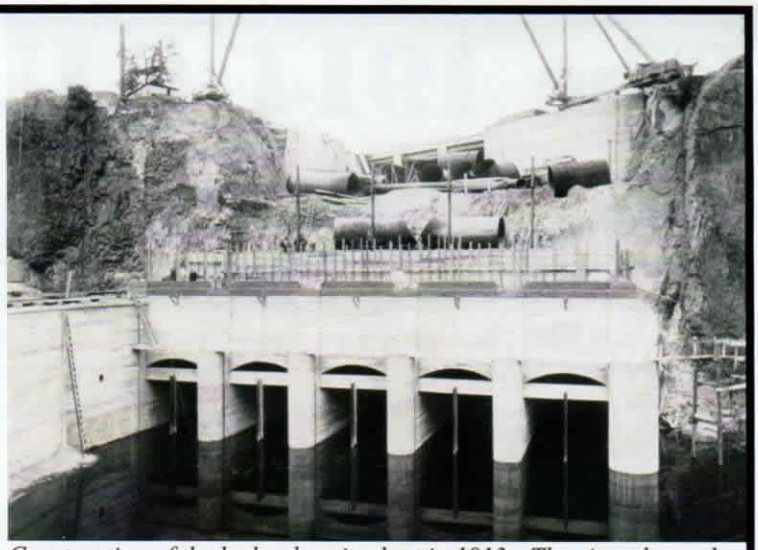
Above the door of the power plant are the initials "S.U.M." and the dates 1791 and 1914. S.U.M. stands for the Society for Establishing Usefull [sic] Manufactures. The S.U.M. built the plant in 1914, but the S.U.M. was established in 1791 during George Washington's presidency to develop the power potential of the Great Falls. Waterpower has been used since ancient times to turn mill waterwheels that were used to supply power directly to machines through systems of shafts, gears, pulleys, and belts. Alexander Hamilton, the first U.S. Secretary of the Treasury, created the S.U.M. to help America achieve economic and industrial independence from Europe. The key to Hamilton's plan was a system of factories powered by water from the Great Falls.

The S.U.M. ranks as America's first effort to create a planned community devoted to manufacturing. The S.U.M.'s charter gave it control of the lands around the Great Falls and water rights to the Passaic River. The S.U.M. soon discovered that the water was its most valuable asset. By 1838, the S.U.M. had completed an impressive three-level, power-canal or raceway system that exists in Paterson to this day. By the 1850s, the factory sites along the raceway had been filled and what had been rural farmland was turned into a great manufacturing city.

In the early 1910s, the S.U.M. decided to convert the mills along its raceways to electric power because of chronic water shortages. As northern New Jersey's urban population grew, water companies took increasing amounts of valuable water from the river. Sometimes water levels fell so low that the S.U.M. was unable to provide water to its industrial customers. To meet this challenge, the S.U.M. joined in agreements to better manage the water supply. Eventually, the S.U.M. fell under the financial control of a trust company that decided that the water used to power Paterson's mills would be more profitably used as potable water. The S.U.M. built the electric power plant as a means to ending the mills' reliance on water from the raceway. The hydroelectric plant used about half the water to generate the same amount of power. The S.U.M. also built an auxiliary coal-fired steam plant (demolished in 1960) that supplied electric power when the river ran low, as well as steam for processing in the mills.

Interior views of the power plant in 1914 (left) and today (right). The plant was refurbished in 1986 with new turbines and generator units replacing the original ones. The newer equipment produces 125 percent more electricity.





Construction of the hydroelectric plant in 1913. The view shows the reinforced-concrete foundation. A channel has been cut into the cliff for the forebay. Sections of the tubular penstock are waiting to be placed.

Today, the S.U.M./Great Falls National Historic Landmark District preserves and commemorates the remarkable achievements of the S.U.M. and the mills that produced textiles, locomotives, and a range of other products using waterpower. In 2009, Congress established the Great Falls National Historical Park.

Historic Preservation

In 1945, the S.U.M. sold the Great Falls Power Plant to the City of Paterson, which leased the plant to PSE&G. In 1969, the plant was shut down due to its age, modest size, and need for upgrades. During the 1970s, a group of citizens interested in the preservation of the S.U.M./Great Falls Historic District looked into the possibility of returning the plant to operation. Through a combination of federal grants and private investment, they came up with a plan. In 1980, the City of Paterson established the Paterson Municipal Utilities Authority (MUA) to own and operate the plant. The MUA eventually partnered with the Great Falls Hydroelectric Company to raise $14.5 million from private capital; no local tax dollars were used. The old turbines and generators from 1914 were replaced with more efficient, modern units. One of the original units was left in place as a historic display. The modern equipment was installed with little impact on the historic appearance of the plant. The plant resumed operations in 1986. Algonquin Power of Toronto, a specialist in the operation of smaller hydroelectric plants, took over operations in 2000.

Paterson Municipal Utilities Authority, 2009