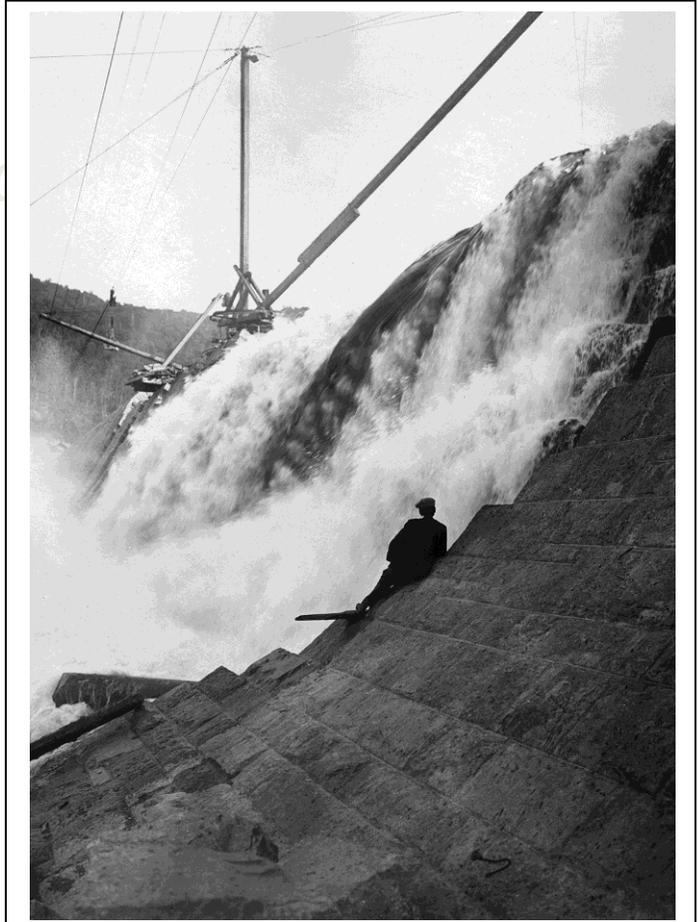


Harnessing The Hudson

The building of the
Spier Falls Dam
near Glens Falls
at the turn of the
20th century.



Teacher Resource Guide

The introduction of local history – or place based education – into any curriculum has a huge impact in engaging students. They can readily relate what they are learning about the larger world to their own environment and experience. The study of the Spier Falls Dam in South Glens Falls fits into many curriculums: Social Studies, Science and Technology, and Math. There are two powerpoints, one focusing on the Social Studies aspect and the other on the Science, Technology and Math, and worksheet and experiments as well. The curriculum is suitable for grades 4-8.

NYS Standards addressed are: Social Studies 1.1, 1.3, 3.1, 3.2, 4.1; MST standards 3, 4, 6.



Innovation in technology around the turn of the 20th century resulted in tremendous growth of industry. In turn, the demand for electricity grew. The direct current that was originally used to supply electricity was insufficient for the increased demands. The advent of alternating current made it possible to supply more electricity and with greater reliability.

Since the settlement of Queensbury and the surrounding areas in the 1700s, the Hudson River has always played a large part in providing necessary energy for mills and other industries. So it was natural to turn to the River to provide power to generate electricity for lighting and industrial uses.

Introduction to Hydropower

Hydropower is using water to power machinery or make electricity. Water constantly moves through a vast global cycle, evaporating from lakes and oceans, forming clouds, precipitating as rain or snow, then flowing back down to the ocean. The energy of this water cycle, which is driven by the sun, can be tapped to produce electricity or for mechanical tasks like grinding grain. Hydropower uses a fuel – water – that is not reduced or used up in the process. Because the water cycle is an endless, constantly recharging system, hydropower is considered a renewable energy.

When flowing water is captured and turned into electricity, it is called hydroelectric power or hydropower. There are several types of hydroelectric facilities; they are all powered by the kinetic energy of flowing water as it moves downstream. Turbines and generators convert the energy into electricity, which is then fed into the electrical grid to be used in homes, businesses and by industry. www1.eere.energy.gov

Harnessing the Hudson - Essential Questions

- ▶ **Why was the Hudson River, and its tributaries, so important to early settlers?**
- ▶ **What were some of the problems people faced from using the river as a source of energy prior to the construction of Spier Falls and Conklingville Dams?**
- ▶ **How has technology changed the way we use the river?**
- ▶ **What are the elements – environmental, legislative and mechanical - needed to generate electricity through a hydroelectric power plant?**

- ▶ **Why was the Hudson River, and its tributaries, so important to early settlers?**

Discussion Questions:

1. Where was the first settlement in the Town of Queensbury, and why?

Glens Falls was originally a village within the Town of Queensbury (it became a town in 1908). From the earliest days of Quaker settlement in the 1700s, the main village was Glens Falls because of its proximity to water, and the tremendous power of the falls. Saw mills, grain mills, tanneries, stonecutting and other operations all grew up along the river.

2. How were the first industries powered?

Water was essential in powering the early industries – either by water wheel or steam engines.

3. Have the students list the type of industries that are still located along the river.

- ▶ **What were some of the problems people faced from using the river as a source of energy prior to the construction of Spier Falls and Conklingville Dams?**

Discussion Question:

1. What affected the level and amount of water to run the water wheels and steam engines?

The early industries were subject to inconsistencies in the water flow that they needed to generate the power to run their businesses. Sometimes the river dried out and other times it flooded. In 1913 the high water led to a flood that destroyed the bridge across the river that connected Glens Falls and South Glens Falls.

- ▶ **How has technology changed the way we use the river?**

Discussion Questions

1. The invention of direct current electricity and the incandescent light bulb changed Glens Falls dramatically. Name some machines, transportation vehicles and devices that used electricity in the late 1800s.

Sample answers: Trolleys, Telephone, Sewing machines, Street lights, Sawmills, Grinders

2. Why was direct current electricity insufficient to supply the area with its growing demand for electricity?

Direct current could not deliver electricity very far. DC, or direct current means the electrical current is flowing in only one direction in a circuit. Batteries are a good source of direct current (DC), but solar cells, fuel cells, and even some types of generators can provide direct current.

3. What was the advantage to alternating current?

It could deliver electricity over large distances. AC, or alternating current means the electrical current is alternating directions in a repetitive pattern. AC is created by generators in power plants, and other sources. This AC current is delivered to our homes and

businesses by the power lines we see everywhere. The frequency of repetition of this current is 60 Hertz. This means the direction of the current changes sixty times every second.

NOTE: The first company to demonstrate alternating current was Westinghouse at the 1893 Chicago Exposition. Although Westinghouse was the corporate exhibitor, the inventor of alternating current was Nikola Tesla with whom George Westinghouse had collaborated. "In February 1882, Tesla discovered the rotating magnetic field, a fundamental principle in physics and the basis of nearly all devices that use alternating current. Tesla brilliantly adapted the principle of rotating magnetic field for the construction of alternating current induction motor and the polyphase system for the generation, transmission, distribution and use of electrical power. ... Electricity today is generated transmitted and converted to mechanical power by means of his inventions. Tesla's greatest achievement is his polyphase alternating current system, which is today lighting the entire globe." *teslasociety.com*

To learn more about Nikola Tesla, visit
<http://www.teslasociety.com/biography.htm>

4. What company in this region began producing electric turbines and motors?

G.E. in Schenectady.

5. Where was the first hydroelectric plant in the U.S.?

"Nikola Tesla and George Westinghouse built the first hydroelectric power plant in Niagara Falls and started the electrification of the world." *teslasociety.com*

The years 1895 through 1915 saw rapid changes occur in hydroelectric design and a wide variety of plant styles built. *ppl.com*

► **What are the elements – environmental, legislative and mechanical - needed to generate electricity through a hydroelectric power plant?**

Discussion Questions:

1. What are some of the types of legal obstacles Mr. Ashley had to overcome before he built the Spier Falls Dam?

He had to get permission from the New York State Legislature.

Also, because the valley behind the dam needed to be flooded, he had to gain title to all of the lands that would be flooded, and sometimes that involved court action.

2. What environmental factors are necessary for a hydroelectric power plant?

Good topographical location: The section of the river intended for a power plant needs to have the right terrain to create a reservoir. These tend to be in hilly areas where there is a wide and flat valley.

Right geological structure: The rock structure on which the dam will be constructed should be strong enough to sustain the weight of dam and water stored in the dam. The rock structure should be stable and building should not be placed in an area where there are many earthquakes that could undermine the integrity of the dam.

Sufficient water is available: The flow of water where dam is constructed should be sufficient enough to fill the dam.

3. What are the major mechanical elements needed for a hydroelectric plant?

Turbines: As water flows past the turbine, the blades begin to turn; this also turns magnets inside the generator which is attached to the turbine.

Generator: As the large magnets inside the generator rotate past a copper coil, electrons move around and create alternating current.

Resources for Additional Information:

www.brookfieldpower.com

Check out their virtual Hydro Power tour and other educational information. Brookfield Renewable Energy Partners operate the Spier Falls Dam and are the underwriters for the Chapman Historical Museum's online curriculum on Spier Falls Dam.

www.pplweb.com

Curriculum material on Hydropower, Calculating Wattage Costs, Careers in the Power Industry, and Understanding Air Quality and Air Monitoring

www.edinburgny.com/ReservoirHistory.html

Concise history of the Conklingville Dam and Sacandaga Reservoir

www1.eere.energy.gov

Department of Energy website, Energy Efficiency and Renewable Energy. Lesson plans and educational materials for a variety of green energy sources. Data for energy analyses and maps also available.

www.fwee.org

Foundation for Water & Energy Education. Timeline and a walk through a hydro project.

www.ga.water.usgs.gov

Information on the advantages and disadvantages of hydroelectric power and information regarding the sources of electricity in the U.S.

www.need.org

National Energy Education Development Project's website provides energy information, curriculum guides and activities for students.

Rodger, Marguerite. *Hydroelectric Power: Power from Moving Water*. 2010. Crabtree Publishing Co., NY NY

The Story of a Great Enterprise: The Story of its Works at Spier Falls
Published by the Hudson River Water Power Company, 1903
Chapman Historical Museum Collection