



## Discover Portage Road Lesson Plan

### Niagara Power Project

Subject Area: Science

**Grades 6-12**

**Subject Area**      Science

#### **New York State P-12 Common Core Learning Standards for Mathematics, Science and Technology**

Standard 1: Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seeks answers, and develop solutions.

##### 1.1 Scientific Inquiry

1.11 The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process

1.12 Beyond the use of reasoning and consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity

Standard 2: Students will access, generate, process, and transfer information using appropriate technologies

##### 2.1 Information Systems

2.11 Information technology is used to retrieve, process, and communicate information and as a tool to enhance learning.

#### **Niagara Power Project**

Niagara Falls helps generate some of the least expensive electricity anywhere. For over 50 years, the United States and Canada have shared the Niagara River's water power.

They also are both committed to preserve the beauty of the Fall.



With a new federal license which took effect September 1, 2007, the Niagara Power Project will continue to produce steady supplies of clean, carbon-free hydroelectricity for

## Discover Portage Road Lesson Plan

decades to come. At the time the Niagara project produced its first power in 1961, it was the largest hydropower facility in the Western world. Niagara is the currently the biggest electricity producer in New York State, generating 2.4 million kilowatts. It produces enough power to light 24 million 100-watt bulbs at once. With this low-cost electricity, the state's residents and businesses save hundreds of millions of dollars a year.

In 2006, the Power Authority completed a \$300-million upgrade and modernization at the project's Robert Moses Niagara Power Plant. All 13 turbines have been replaced. Also, other improvements were made to generating equipment in the power dam, enabling the project to operate at maximum efficiency well into the 21st century. In 2012, the New York Power Authority began a \$460 million upgrade to the project's Lewiston Pump-Generating Plant.

located about 4 1/2 miles downstream from the Falls, the Niagara project, consists of two main facilities: the Robert Moses Niagara Power Plant, with 13 turbines, and the Lewiston Pump-Generating Plant, with 12 pump-turbines. Between the two plants, there is a forebay capable of holding about 740 million gallons of water. Behind the Lewiston plant, there is a 1,900-acre reservoir that holds additional supplies of this liquid fuel.

The Niagara Power Project diverts water from the Niagara River. At rate of up to 375,000 gallons a second, it conveys the water through conduits under the City of Niagara Falls to Lewiston. From there, water flowing through the Robert Moses plant spins turbines that power generators. It thus converts mechanical energy into electrical energy.

At night, when electricity demand is low, the Lewiston units operate as pumps, transporting water from the forebay up to the plant's reservoir. During the daytime, when electricity use peaks, the Lewiston pumps are reversed and become generators, similar to those at the Moses plant. With this method, the water can be used to produce electricity twice, increasing production and efficiency.

In 1950, United States and Canada signed a treaty in 1950 that regulates the amount of water diverted for hydroelectricity production. This treaty balances the need for power with a desire to preserve the beauty of Niagara Falls. more than 200,000 cubic feet per second (cfs), or 1.5 million gallons of water a second averagely flow from Lake Erie into the Niagara River. The 1950 pact requires that at least 100,000 cfs of water spill over the Falls during the daylight hours from April through October, the tourist season.. This flow may be cut in half at night during this period and at all times the rest of the yea

In cooperation with Ontario Power Generation, the New York State Power Authority prevents ice on the upper Niagara River from blocking power production and causing the flooding of shoreline property. One of our joint efforts is an 8,800-foot-long ice boom, consisting of steel pontoons that are linked together and anchored to the river bottom at Lake Erie's outlet to the Niagara River. Although the boom prevents the buildup of ice, it allows water to continue flowing downstream. When gale winds blow and temperatures drop below zero, three special-duty boats are used to patrol the river. These boat break up the ice and maneuver it over the Falls. The William H. Latham is the Power Authority's primary icebreaker. It is a 77-ton vessel that literally glides over the top of

## Discover Portage Road Lesson Plan

the ice, crushing it into manageable chunks. The Breaker, a modified tugboat, assists the Latham. Ontario Hydro operates a similar icebreaker called the Niagara Queen.

The history of Niagara Falls begins with ice. Some 12,000 years ago, the ice that had blanketed North America began to thaw. This water gradually formed the Great Lakes, carving out the Niagara Gorge and the 350-foot drop that enables us to produce our power today.

The first hydroelectric generating station on the Niagara River was built in 1881. An 86-foot cascade of water generated electricity, which ran the machinery of local mills and lit up some of the village streets.



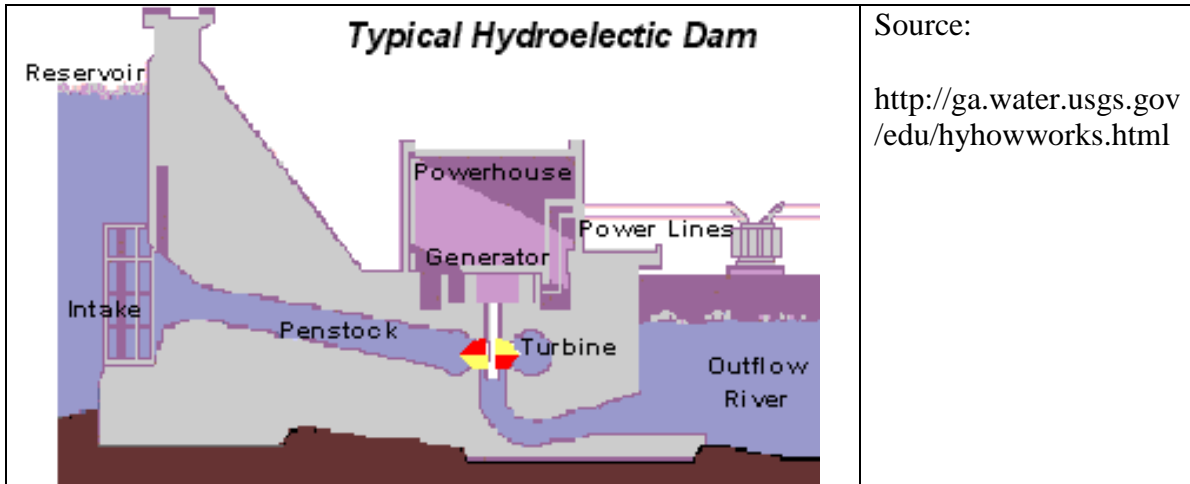
By 1896, the first long-distance transmission of electricity began flowing from Niagara Falls to Buffalo, some 26 miles away. The success of hydropower plants was evident with additional generating stations built along the Niagara River. But disaster struck in 1956 when the region's largest hydropower station was partially destroyed in a landslide.

With power production drastically cut, tens of thousands of manufacturing jobs were at stake and a long-simmering debate over Niagara's hydropower rights had come to a head. In 1957, Congress passed the Niagara Redevelopment Act, which granted the Power Authority a federal license to fully develop the United States' share of the Niagara River's hydroelectric potential. Under the direction of Robert Moses, the "Master Builder" and then chairman of the Power Authority, the Niagara project produced its first power within three years. According to President John F. Kennedy, the Niagara Power project is "an outstanding engineering achievement" and "an example to the world." New York Power Authority's visitors' center focuses on the Niagara Power Project/

Students will:

- Access Hydroelectric power: How it works at <http://ga.water.usgs.gov/edu/hyhowworks.htm>
- Read the article about how hydroelectricity is generated,
- Study the following diagram,
- Write a brief essay on how hydroelectric power is produced

## Discover Portage Road Lesson Plan



### **References**

*Hydroelectric power: How it works* at <http://ga.water.usgs.gov/edu/hyhowworks.htm>

*Niagara Power Project. New York Power Authority* at  
<http://www.nypa.gov/facilities/niagara.htm>