

Overview

Students will observe how varying the distance that water falls and the volume of water impacts the amount of electricity produced by hydroelectric power.

Student Learning Objectives

- Recognize that hydroelectric power uses the energy of falling water to produce electricity.
- Describe the effects of head height (the distance water falls) and water volume on the amount of electricity produced by hydroelectric power.

Exploration Procedure

Explain that the purpose of this exploration is to learn about hydroelectric power — how it is produced and how it is used.

Student Performs Exploration

1. Tell students how much time they will have to complete the Exploration and the student worksheet.
2. Explain how students should proceed:
 - Read the questions before starting the Exploration.
 - Follow the instructions on the worksheet to perform the Exploration.
 - Record their findings.
3. Respond to the questions in writing.
4. Explain that you will be available to help any students who need assistance.
5. Address any questions that the students might have.
6. Tell students to begin the Exploration.
7. When time is up, ask students to share their results.
8. Talk about the Discussion Question below.

Teacher Performs Exploration

1. Read the Introduction and click the **Continue** button.
2. Note the components of the picture on the right. Water is stored in a reservoir on the left side of the **dam**. The **gate** controls the volume of water flowing through the **penstock** to spin the **turbine**. The turbine connects to the **generator**, which produces electricity. The resulting electricity moves through power lines to provide electrical power to homes.
3. From the drop-down lists on the left, select varying combinations of head height and volume of water. Then click the **Play** button and observe the results.
4. Note the trend as you increase head height but not water volume, increase water volume but not head height, and increase both. Point out the action of the gate.
5. Pose each of the Check for Understanding questions on the next page and ask for answers from the class. Replay parts of the exploration as necessary to illustrate the answers.
6. Facilitate a class discussion of the Discussion Questions on the next page.

Optional: Use this Exploration as a small-group activity at a computer station. Assign it to students who need specific reinforcement of the concept.

Questions

1. Did raising only the volume of water always increase the amount of electricity produced?

Answer: Yes.

2. Did raising only the head height always increase the amount of electricity produced?

Answer: Yes.

3. What happened to the gate as you increased the volume of water?

Answer: It lifted to allow more water into the penstock.

4. What are some of the advantages of hydropower?

Answer: Advantages include no pollution to the air, land, or water; the source of the energy (rushing river water) is free, renewable, and reliable; and it often can be generated near where it is needed.

Discussion Questions

1. **Why do you think we aren't building more hydroelectric power plants?**

Possible answers:

- There are few new sites where effective dams and plants could be built.
- Dams are expensive to build.
- Dams often disrupt the wildlife that live on or near the river.

2. **What are some of the disadvantages provided by other types of fuel (coal, oil, gas)? What about nuclear fuel?**

Possible answers:

- The use of coal, oil, and gas depletes valuable and limited natural resources.
- Coal, oil, and gas can produce a lot of pollution.
- Coal, oil, and gas require mining or drilling into the Earth.
- Nuclear power plants encounter waste disposal problems and can pose extreme danger to surrounding populations in cases of malfunction.