

## Producing Electricity Using Hydropower



### Summary

Kinetic energy is the energy of motion. A hydroelectric power dam uses the concept of kinetic energy in fast flowing water to produce electricity.

### Engineering Connections

Use evidence to construct an explanation. Make observations to produce data to serve as the basis for evidence for an explanation of a phenomena or test a design solution. Apply scientific ideas to solve design problems. Describe and graph quantities such as area and volume to address scientific questions. Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem. Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles. Develop a model to describe unobservable mechanisms. Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon.

### Objectives

- Students will be able to explain how water is used to produce electricity.
- Students will be able to explain how kinetic energy and a hydroelectric dam are related.

### Standards

[4. PS3.1](#)

[4.PS3.2](#)

[4.PS3.4](#)

[4.ESS3.1](#)

[5.ESS2.2](#)

[5.ESS3.1](#)

[6.ESS2.4](#)

[7.PS3.5](#)

[8.PS2.3](#)

**Materials List:** (If you need to check out a kit go to [OREEP.org](http://OREEP.org) and fill out the form.

\* Items in the kit.)

- Black Hub from the Kid Wind wind kit \*
- Motor from the Kid Wind solar Kit \*
- 6 mini wooden spoons for paddles \*
- Multimeter from the Kid Wind wind kit \*
- 2 jumper wires with alligator clips \*
- Tape Measure \*
- Tub to catch water
- Water source - 2L pop bottle with water inside. (Any container will work to hold the water.)

## Worksheets and Attachments

PowerPoint - Producing Electricity using Hydropower (ppt)

PowerPoint - Producing Electricity using Hydropower (pdf)

Student Worksheet for Producing Electricity using Hydropower (doc)

Student Worksheet for Producing Electricity using Hydropower (pdf)

Answer Sheet for Producing Electricity using Hydropower (docx)

Answer sheet for Producing Electricity using Hydropower (pdf)

**Engagement** Watch the PowerPoint *Producing Electricity using Hydropower*.

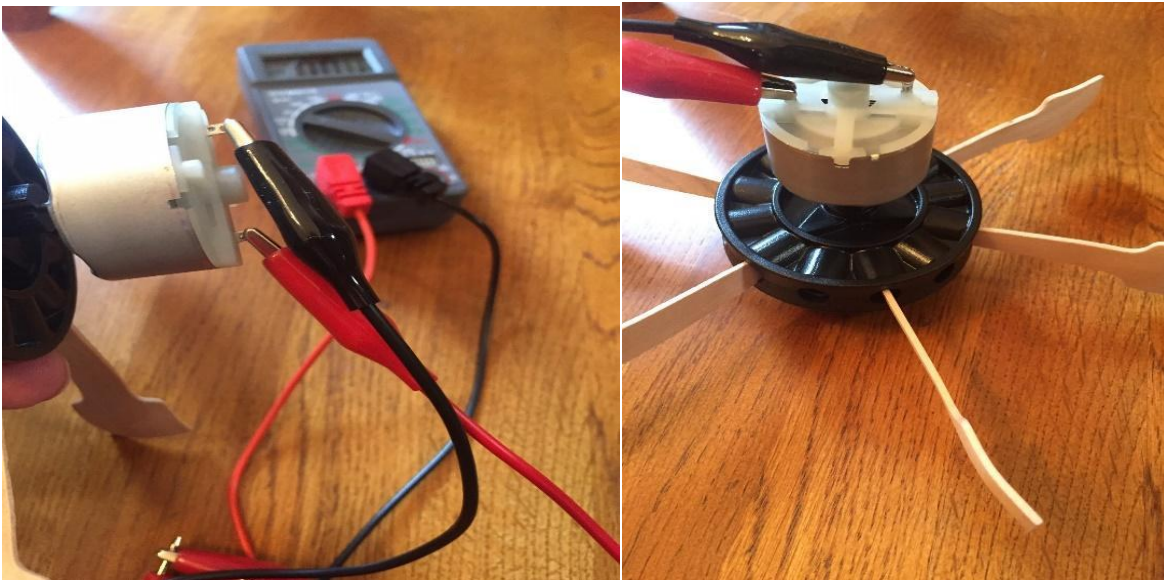
## Exploration

In this activity we will build a model turbine connected to a generator to produce electricity. We will demonstrate the relationship between the amount of kinetic energy in falling water and the amount of electrical energy produced by having the water fall from various heights. The amount of electrical energy will be determined by using a multimeter to measure the voltage produced by the model turbine in units of volts.

## Procedure

1. Connect the wooden spoons to the hub making sure all the paddles are facing the same direction.
2. Connect the hub to the motor.
3. Connect the alligator clips to the pins on the back of the motor.

4. Connect the other end of the alligator clips to the multimeter, and turn the multimeter to 20 DVC.
5. Look at the picture below to make sure you have connected everything correctly.
6. Working as a team, have one person hold the tape measure, one to read the multimeter, one to pour the water, and one to make sure the water is going in the tub. Someone also needs to be responsible for recording the results.
7. Pour the water over the paddles from a height of 1 meter, with the water falling in the tub. Record the voltage from the multimeter in the data table.
8. Pour the water over the paddles from a height of 50 cm. Record your results in the data table.
9. Pour the water over the paddles from a height of 25cm. Record your results in the data table.



## Extension

Have the students look at the following web site

[https://www.swt-wc.usace.army.mil/ops\\_hydropower/hydromainpage.html](https://www.swt-wc.usace.army.mil/ops_hydropower/hydromainpage.html)

The students can see the hydropower operations in Oklahoma. The map shows the different sites and when they click on each Lake below, it tells the number of turbines online, the elevation of the headwaters, elevation of the tailwaters, outflow from turbines only, and the hydropower generated. Using this information, the students can make their own tables showing elevation change between headwater elevation and tailwater elevation. Putting the waterflow from greatest to least and total hydropower from greatest to least.

## Questions for Discussion

Which hydropower plant had the greatest outflow turbine power?

Which hydropower plant had the greatest total hydropower generation?

Which hydropower plant had the greatest change in elevation?

## Evaluation

1. How is electricity produced in a hydropower plant?  
*Water flows through the dam turning turbines which produce electricity.*
2. What are the factors that affect the amount of electricity that can be produced in a hydropower plant?  
*The speed of the water, the elevation that the water falls through the dam, and size of the turbines are factors that affect the amount of electricity produced.*
3. Before the water flows through the dam does it have potential or kinetic energy?  
*Potential energy*

## Adapted From

[https://www.teachengineering.org/lessons/view/cub\\_dams\\_lesson04](https://www.teachengineering.org/lessons/view/cub_dams_lesson04)

<https://www.energy.gov/eere/water/types-hydropower-plants>