Wonders of Water

Teacher Guide

2017-2018

A STEM-based unit that introduces elementary learners to the forms of energy, electricity, electric circuits, properties of water, and how water can be used as an energy source. Concepts are reinforced through hands-on investigations and language arts activities.

Grade Level:

Elementary

Subject Areas:

- Science
- Social Studies
- Math
- Language Arts
- Technology

NEED
National Energy Education Development Project

Teacher Advisory Board

NEED Mission Statement

The mission of The NEED Project is to promote an energy conscious and educated society by creating effective networks of students, educators, business, government and community leaders to design and deliver objective, multi-sided energy education programs.

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Teacher Advisory Board

In support of NEED, the national Teacher Advisory Board (TAB) is dedicated to developing and promoting standards-based energy curriculum and training.

Energy Data Used in NEED Materials

NEED believes in providing teachers and students with the most recently reported, available, and accurate energy data. Most statistics and data contained within this guide are derived from the U.S. Energy Information Administration. Data is compiled and updated annually where available. Where annual updates are not available, the most current, complete data year available at the time of updates is accessed and printed in NEED materials. To further research energy data, visit the EIA website at www.eia.gov.

NEED
National Energy
Education Development

1.800.875.5029
www.NEED.org

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Wonders of Water
Teacher Guide

Wonders of Water **was developed by The NEED Project with funding and technical support from the National Hydropower Association and the Hydro Research Foundation.**

Wonders of Water Kit

- 6 Wallpaper pans
- 6 400 mL Beakers
- 36 1" Foam balls
- 3 Bundles wooden spoons (~100)
- 1 Spool of thread
- 1 Box of large paper clips (100)
- 1 Box of push pins (50)
- 1 Hydropower poster
- 30 Student Guides

Science of Electricity Model

- 1 Small round bottle
- 1 Spool of magnet wire
- 1 12" x 1/4" Wooden dowel
- 4 Rectangle magnets
- 1 Foam tube
- 1 Set of alligator clips
- 2 Rubber stoppers with 1/4" hole
- 1 Multimeter
- 1 Small nail
- 1 Large nail

Table of Contents

NHA National Hydropower Association

HYDRO RESEARCH FOUNDATION

PROUD MEMBER OF IREC Interstate Renewable Energy Council

Standards Correlation Information

www.NEED.org/curriculumcorrelations

Next Generation Science Standards

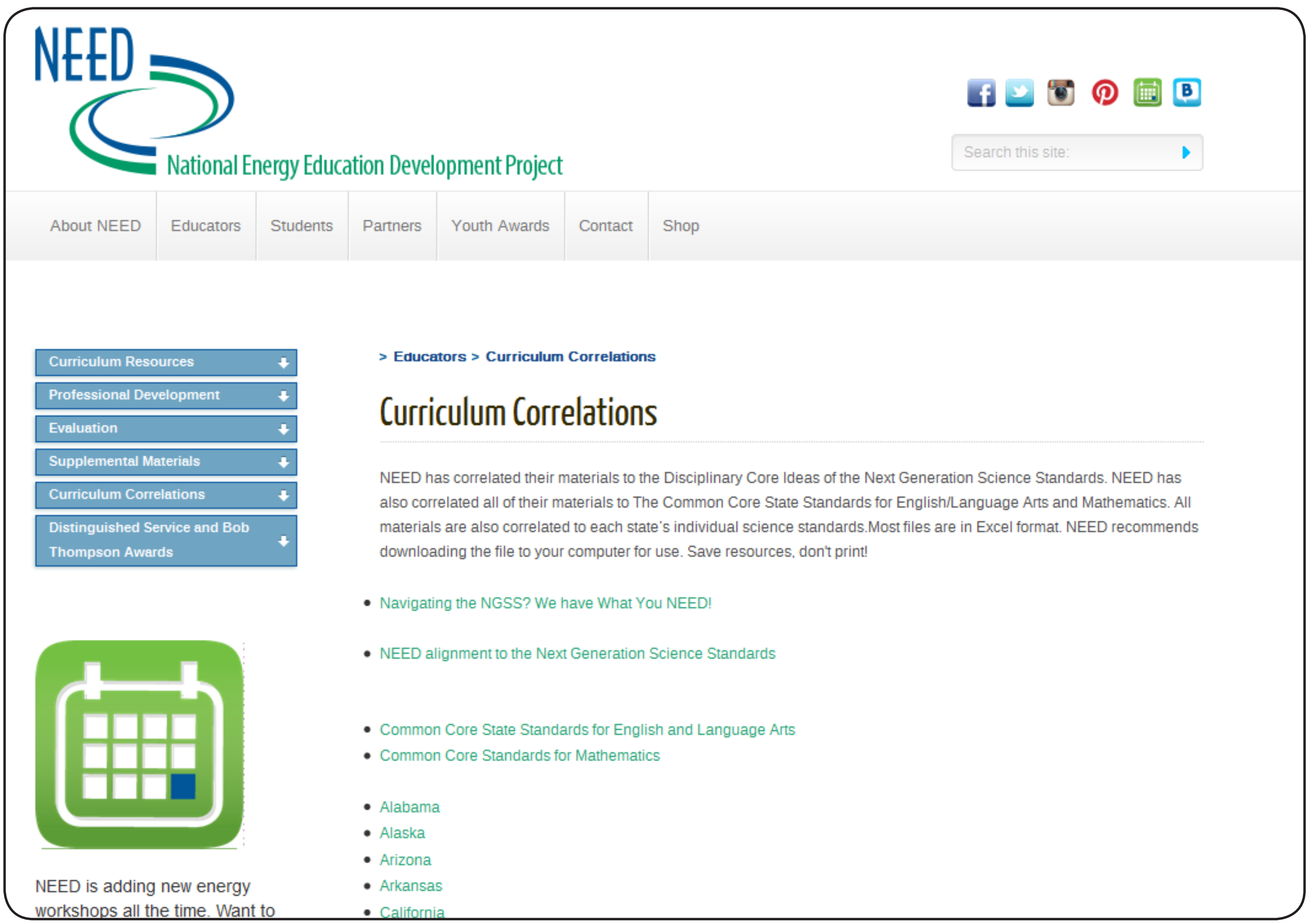
- This guide effectively supports many Next Generation Science Standards. This material can satisfy performance expectations, science and engineering practices, disciplinary core ideas, and cross cutting concepts within your required curriculum. For more details on these correlations, please visit NEED's curriculum correlations website.

Common Core State Standards

- This guide has been correlated to the Common Core State Standards in both language arts and mathematics. These correlations are broken down by grade level and guide title, and can be downloaded as a spreadsheet from the NEED curriculum correlations website.

Individual State Science Standards

- This guide has been correlated to each state's individual science standards. These correlations are broken down by grade level and guide title, and can be downloaded as a spreadsheet from the NEED website.



Wonders of Water Materials

ACTIVITY	MATERIALS IN KIT	ADDITIONAL MATERIALS NEEDED
Electromagnetism and the Science of Electricity Model Demonstration	▪Small bottle ▪Rubber stoppers with holes ▪Wooden dowel ▪Rectangle magnets ▪Foam tube ▪Nails ▪Small spool of magnet wire ▪Multimeter ▪Alligator clips ▪Push pin	▪Permanent marker ▪Sharp scissors ▪Masking tape ▪Fine sandpaper ▪Ruler ▪Hand operated pencil sharpener ▪Utility knife (optional)
Land and Water, Part 1	▪Wallpaper pans ▪Beakers ▪Nails	▪Fine sand ▪Rulers ▪Water ▪Sink or bucket
Land and Water, Part 2	▪Wallpaper pans ▪Beakers ▪Nails	▪Fine sand ▪Rulers ▪Water ▪Sink or bucket ▪Additional "earth materials" (optional)
Water as an Energy Source	▪Hydropower poster ▪Science of Electricity Model	
Water Can Do Work	▪Heavy duty thread ▪Foam craft balls ▪Wooden spoons ▪Large paper clips	▪Foam cups or containers* ▪Round barreled pencils ▪Fast–drying glue ▪Ruler ▪Scissors ▪Water ▪Tape
Force of Water	▪Wallpaper pans ▪Push pins	▪Duct tape ▪Two–liter bottles ▪Rulers ▪Permanent markers ▪Towels or paper towels ▪Water

***The foam cups or containers used need to be tall and wide enough to house the foam ball with wooden spoon blades. It may be necessary to test this ahead of time to ensure the activity will work. The easiest solution is to trim the wooden blades, but students may have other suggestions. Don't be afraid to let them explore.**

Teacher Guide

Grade Level

- Elementary, grades 3–5

Time

- Approximately 20 30–minute class periods to conduct all of the activities and evaluation

Additional Materials

NEED has several supplementary titles that can serve to enhance instruction during your hydropower unit. Download the titles below, and more, from www.NEED.org.

- *Elementary Energy Infobook*
- *Energy in the Balance*
- *Energy Flows*
- *Energy on Stage*
- *Energy Stories and More*

Background

Wonders of Water is a kit–based unit that includes introductory information on energy, electricity, electric circuits, water, and hydropower with graphic organizers, hands–on activities, and language arts activities. Students will also explore how the force of water can change the Earth's surface, and do work to make things like electricity.

Concepts

- Energy is the ability to do work or make a change.
- We use many sources of energy to do work.
- Energy sources can be renewable or nonrenewable.
- We use many energy sources to generate electricity.
- Water exists on Earth in three states: solid, liquid, and gas.
- Water moves between the atmosphere and the Earth in a continuous cycle called the water cycle.
- The flow of water through the water cycle changes the Earth.
- Water is pulled from higher places to lower places by the force of gravity—the force of attraction between all matter.
- Water moves across the surface of the Earth to form streams, rivers, lakes, and oceans.
- People have built dams to control the flow of water in streams and rivers for many years.
- Water has been used as an energy source for many years.
- Moving water contains energy that can be used to generate electricity.
- A hydropower dam uses the energy of moving water to generate electricity.
- Hydropower has advantages and disadvantages.

Preparation

- Become familiar with the Teacher and Student Guides. It is suggested that the teacher conduct the hands–on activities before assigning them to students.
- Gather the materials needed to conduct the activities using the materials list on page 5. Some materials listed are not included within the kit, but most are common science lab supplies or classroom materials that are easily available.
- Assemble the *Science of Electricity Model* on pages 20–22 and practice operating it with the multimeter (for multimeter instructions, see page 23).
- Make copies of the *Hydropower Assessment* on page 32 to be used as a pre- and post-assessment for the unit.

Science Notebooks

Throughout this curriculum, science notebooks are referenced. If you currently use science notebooks or journals, you may have your students continue using them. Rubrics to guide assessment of student notebooks can be found on page 18-19 in the Teacher Guide.

In addition to science notebooks, student worksheets have been included in the Student Guide. Depending on your students' level of independence and familiarity with the scientific process, you may choose to use these instead of science notebooks. Or, as appropriate, you may want to make copies of worksheets and have your students glue or tape the copies into their notebooks.

Activity 1: Introduction to Energy

✪ Objective

- Students will be able to list facts and prior knowledge about energy.

Materials

- Student Guides
- Copies of the *Hydropower Assessment,* page 32 of the Teacher Guide

Time

- 30 minutes

✔ Procedure

1. Introduce the unit by administering the *Hydropower Assessment* as a pre-assessment.
2. Ask the students, "What do you think you know about energy?" Have the students use the *Energy KWL Chart* in the Student Guide (page 21) or make one in their science notebooks and individually list what they know and would like to know about energy. Then, have each student exchange his/her information with a classmate. You may also want to record ideas on a class chart, using the board, interactive board, or chart paper to record their thoughts for future lessons.
3. Facilitate a class discussion about what students know and want to know about energy. Make note of student misconceptions to correct as you move through the unit.
4. Play *Hydropower Bingo* with students to give them a feel for what to expect in the unit. Instructions begin on page 16.

Activity 2: Forms of Energy

✪ Objectives

- Students will be able to define energy as the ability to do work or make a change.
- Students will be able to list forms of energy.

Materials

- Student Guides

Time

- 30 minutes

✔ Procedure

1. Have the students read about energy and forms of energy on pages 2–4 in the Student Guide, adding new information to their *Energy KWL Charts*. Add new student thoughts to your class chart, if applicable.
2. Using page 22 in the Student Guide, take the students on a tour around the school—inside and outside—to observe energy doing work and energy in different forms.
3. Have the students share with a partner or the class what they observed.

Activity 3: Sources of Energy

✪ Objectives

- Students will be able to list sources of energy used in the United States.
- Students will be able to explain the difference between renewable and nonrenewable sources of energy.

Materials

- Student Guides

Time

- 30 minutes

✔ Procedure

1. Have the students read about sources of energy on page 5 in the Student Guide, adding new information to their *Energy KWL Charts*. Add new student thoughts to your class chart, if applicable.
2. Facilitate a discussion of the major sources of energy we use today, renewable and nonrenewable, and the major tasks performed by the energy sources.
3. Have the students complete *The Energy We Use* graph on page 23 of the Student Guide. Review as a class. Project the master on page 30 as needed.

Activity 4: Introduction to Electricity

✪ Objective

- Students will be able to describe why electricity is important to our lives.

Materials

- Student Guides

Time

- 30 minutes

✔ Procedure

1. Ask the students, "What do you think you know about electricity?" Have the students use the *Electricity KWL Chart* on page 24 of their Student Guides, or their science notebooks. Instruct them to individually list what they know and would like to know about electricity. Then, have each student exchange his/her information with a classmate. You may want to record ideas about electricity on a class chart for future lessons.
2. Facilitate a class discussion about what they know and want to know about electricity. Make note of student misconceptions to correct as you move through the unit.
3. Have the class investigate the classroom and note all of the ways electricity is being used.
4. For homework, instruct students to investigate their homes and make lists of the ways they use electricity.

Activity 5: Learning About Electricity

✪ Objectives

- Students will be able to describe what electricity is.
- Students will be able to explain that magnetism and electricity are related or work in pairs.
- Students will be able to describe how electricity is generated.

Materials

- Student Guides

Time

- 30 minutes

✔ Procedure

1. Have the students read about electricity on pages 6–10 in the Student Guide, adding new information to the *Electricity KWL Charts* they constructed. Add new student thoughts to your class chart, if applicable.
2. Facilitate a discussion of atomic structure, electricity and magnetism, and electricity generation.
3. Have the students complete *The Electricity We Use* graph on page 25 of the Student Guide. Review with the class.

Magnet Safety

The neodymium magnets contained in your kit are very strong and need to be handled with care. Please follow these safety guidelines.

- Use caution when handling the magnets. Fingers and other body parts can be severely pinched between two attracting magnets.
- Wear safety glasses when handling magnets.
- When separating the magnets, slide them apart as if you were dealing playing cards. Do not pull them apart.
- Do not place magnets near electronic equipment, appliances, magnetic I.D. cards, or credit cards.
- Do not allow the magnets near a person with a pacemaker or similar medical aid. The magnetic field can affect the operation of these devices.
- Magnets are choking hazards. Do not place magnets in your mouth.

Activity 6: Electromagnetism and the Science of Electricity Model Demonstration

NOTE: This is a demonstration activity. There are enough materials in the kit for the teacher to make one *Science of Electricity Model*. The model should be assembled prior to this activity.

Objectives

- Students will be able to describe what electricity is.
- Students will be able to explain that magnetism and electricity are related or work in pairs.
- Students will be able to describe how electricity is generated.

Materials

- *Science of Electricity Model* (assembled)
- Multimeter
- Set of alligator clips
- Student Guides

Time

- 30 minutes

Preparation

- Assemble the *Science of Electricity Model* and practice using the multimeter with the model.

Procedure

1. Review the information learned about magnetism and electricity.
2. Show the students the multimeter and explain that it measures electricity.
3. Show the students the *Science of Electricity Model*, pointing out the magnets and coils of copper wire.
4. Connect the model to the multimeter using the alligator clips.
5. Demonstrate how the model works by spinning the dowel by hand.
6. Have students brainstorm other ways to spin the turbine.
7. Have the students complete the *Science of Electricity* activity on page 26 of the Student Guide as an assessment of student understanding. Review essential knowledge with the class and correct any misconceptions that are apparent at this time.

Extensions

Explore more magnets activities using NEED's *Wonders of Magnets* or *ElectroWorks* curriculum, available for download from www.NEED.org.

Activity 7: Introduction to Water

✪ Objectives

- Students will be able to list the properties of water.
- Students will be able to list the states of matter, and how they are identified using water as an example.
- Students will be able to explain or create a diagram describing the water cycle.

Materials

- Student Guides

Time

- 30 minutes

✔Procedure

1. Ask the students, "What do you think you know about water?" Have students use the *Water and Energy KWL Chart* (page 27 of the Student Guide) or make one in their science notebooks and individually list what they know and would like to know about water. Then, have each student exchange his/her information with a classmate. You may want to record ideas about water on a class chart for future lessons.
2. Facilitate a class discussion about what they know and want to know about water and the water cycle. Make note of student misconceptions to correct as you move through the unit.
3. Have the students read about water's states of matter and the water cycle on pages 11–12 of the Student Guide, adding new information to their *Water and Energy KWL Charts*. Add new student thoughts to your class chart, if applicable.
4. Have the students complete *The Water Cycle* activity on page 28 of the Student Guide. Review essential knowledge with the class and correct any misconceptions that are apparent at this time.

Language Arts Extension

Make copies of *The Tale of Annie Soakley* and *Review Questions* on pages 24–25 of the Teacher Guide. Have the class read and illustrate the story and make a book for primary students. Have a science writing day for students to answer the review questions on page 25 after they have completed activities 8-11.

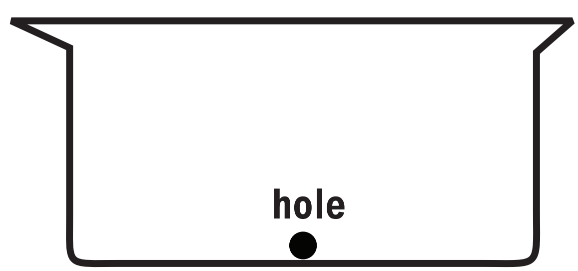
Activity 8: Land and Water, Part 1

✪ Objective

- Students will be able to identify and describe ways water changes the Earth's surface.

Materials *AT EACH OF SIX CENTERS*

- 1 Wallpaper pan as a stream table
- 1 Beaker
- 1 Bag of fine sand
- 1 Nail
- 300 mL of Water
- Ruler
- Sink or bucket



Time

- 30–45 minutes

Preparation

- Set up six student centers with the materials above.
- Use the nail to make a hole at one end of each of the wallpaper pans near the bottom, as shown in the diagram above.

✔Procedure

1. Divide the students into six groups and assign each group to a center. When assigning students to groups, be cognizant of students' abilities to develop plans for their own investigations.
2. Review the *Land and Water 1* procedure on page 29 of the Student Guide with the students. Instruct the students to write their hypotheses.
3. Instruct the students to proceed to their assigned centers and complete the activity, recording their observations on *Land and Water 1 Observations* on page 30 of the Student Guide or in their science notebooks.

Activity 9: Land and Water, Part 2

✪ Objective

- Students will be able to identify and describe ways water changes the Earth's surface.

Materials *AT EACH OF SIX CENTERS*

- 1 Wallpaper pan as a stream table
- 1 Beaker
- 1 Bag of fine sand
- 300 mL of Water
- 1 Ruler
- Sink or bucket
- Additional "earth materials" (optional)

Time

- 30–45 minutes

Preparation

- Set up six student centers with the materials above.
- Make sure the wallpaper pans have all been given holes near the bottom, as shown in the diagram on page 11, activity 8.

✔ Procedure

1. Review the *Land and Water 2* assignment on page 31 of the Student Guide with the students. Discuss variables and the scientific process with the students, as necessary.
2. Instruct each group to choose a variable and develop a plan for the investigation. Review each plan, suggest revisions as necessary, and approve each plan before allowing the investigations to begin. If any plans require additional materials, such as rocks to place in the path of the water, make sure those are available.
3. Have the students complete their investigations, recording their observations on the *Land and Water 2 Observations* sheet on page 32 of the Student Guide, or in their science notebooks.
4. Have the groups share what they have learned with the class.

Extension

Review both of the *Land and Water* investigations. Ask students what they are still wondering about. Brainstorm questions with the class and have students conduct new investigations to answer their questions.

Activity 10: Water as an Energy Source

✪ Objectives

- Students will be able to describe how a hydropower plant does work to create electricity.
- Students will be able to label the parts of a hydropower plant.

Materials

- Hydropower poster
- Student Guides
- *Science of Electricity Model* (assembled)

Time

- 30–45 minutes

CONTINUED ON NEXT PAGE

✔ Procedure

1. Have the students read about water as an energy source and hydropower dams on pages 13–14 of the Student Guide and add new information to their *Water and Energy KWL Charts*. Add new student thoughts to your class chart, if applicable.
2. Use the hydropower poster and facilitate a discussion about the parts and functions of a hydropower facility. Demonstrate the *Science of Electricity Model* again to reinforce understanding.
3. Have the students complete the *Hydropower Plant* activity on page 33 of the Student Guide as a way to build vocabulary. Review essential knowledge with the class and correct any misconceptions that are apparent at this time.

Extension

Read and discuss "Building Hoover Dam" on page 15 of the Student Guide. Have students brainstorm and write about the challenges of building a dam from the perspective of one of the workers.

Activity 11: Water Can Do Work

Objective

- Students will be able to describe how a hydropower plant does work to create electricity.

Materials *FOR EACH STUDENT*

- 1 30–cm Piece of heavy duty thread
- 1 Foam craft ball
- 1 Round–barreled pencil
- 2 Tall foam cups
- 2 Wooden spoons
- Fast–drying glue
- Large paper clips
- Ruler
- Scissors
- Water
- Tape
- Student Guides

Time

- 60 minutes

Preparation

- Gather the necessary materials from the list above.
- It may be preferable to have the students cut or snap the two wooden spoons in half, creating four blades. This may also be necessary to make sure the spoon blades will fit inside the cup when assembled. Glue these blades to the foam balls the day before doing the first investigation. Adult or older student helpers can be helpful with this process, depending on the abilities of your students.

✔ Procedure

1. Review the *Moving Water Can Do Work* procedures on pages 34–35 of the Student Guide. Students may use these pages or their science notebooks to write a hypothesis and record data and conclusions.
2. Instruct the groups to go to their centers and complete the investigations, recording their data and observations in their Student Guides or in their science notebooks.
3. Have the students complete the conclusion section in their Student Guides or in their science notebooks with their groups.
4. Review the results and conclusions with the class.

Extension

Students can experiment with differing numbers of blades or redesign their system to do more work. If time allows, students can continue the testing and redesign process.

Activity 12: Force of Water

Objective

- Students will be able to define or describe a penstock's role within a hydropower facility.

Materials *AT EACH OF SIX CENTERS*

- 1 Wallpaper pan
- 1 Push pin
- Duct tape
- 1 2–Liter bottle
- 1 Ruler
- 1 Towel or paper towels
- 1 Permanent marker
- Water

Time

- 30 minutes

Preparation

- Cover the holes (created in an earlier activity) in the wallpaper pans securely with duct tape on both the inside and outside of the pans so they will not leak.
- Set up six centers with the materials listed above.
- Divide the students into six groups.

✔ Procedure

1. Review the *Effect of Penstock Height on the Force of Water* procedure on pages 36-37 of the Student Guide with the students. Students may use pages 36-37 or their science notebooks to write a hypothesis and record their data and conclusions.
2. Instruct the groups to go to their centers, complete their investigations, and record their data. All groups should calculate the averages for each height and complete the conclusion section after their investigation.
3. Review the results and conclusions with the class.

Activity 13: Advantages and Disadvantages of Hydropower

Objective

- Students will be able to list advantages and disadvantages of using hydropower to generate electricity.

Materials

- Student Guides

Time

- 30 minutes

Preparation

- Make copies of the story *When They Dammed the River* on pages 26–28 of the Teacher Guide.
- Make copies of *Advantages and Disadvantages of Hydropower* on page 29 of the Teacher Guide.

✔ Procedure

1. Have the students read about the advantages and disadvantages of hydropower on page 16 of the Student Guide and add new information to their *Water and Energy KWL Charts*. Add new student thoughts to your class chart, if applicable.
2. Have students complete *Advantages and Disadvantages of Hydropower* after reading.
3. Read the story with students.
4. Have the students write a personal response to the story.
5. Facilitate a discussion of the advantages and disadvantages of using hydropower to generate electricity and how all sources of energy have advantages and disadvantages—some cause air pollution, some are very expensive, some damage the Earth when they are extracted. Use NEED's *Elementary Energy Infobook* as a resource for extra information, if necessary. Infobooks can be downloaded at www.NEED.org.

Language Arts Extension

Have the class illustrate the story and make a book for primary students.

Activity 14: Future of Hydropower

✪ Objective

- Students will be able to list or describe one or two new or emerging technologies in the hydropower industry.

Materials

- Student Guides

Time

- 30 minutes

✔ Procedure

1. Have the students read about new technologies for generating hydropower on pages 17–20 of the Student Guide and add new information to their *Water and Energy KWL Charts*. Add new student thoughts to your class chart, if applicable.
2. Have the students complete *Future of Hydropower* on page 38 of the Student Guide.
3. Facilitate a discussion of emerging technologies in hydropower.

☑ Evaluation

Materials

- Copies of the *Hydropower Assessment,* page 32 of the Teacher Guide
- *Hydropower Bingo*, pages 16-17 and 31 of the Teacher Guide
- *Evaluation Form*, page 35 of the Teacher Guide

✔ Procedure

1. Have the students take the *Hydropower Assessment* as a post–unit assessment.
2. Play *Hydropower Bingo* with the class as a formative assessment. You may have them research the answers to clues prior to playing, or adjust clues and answers to more accurately reflect your students' needs. Instructions for the game are found on pages 16-17.
3. Evaluate the unit with the students using the *Evaluation Form* and return it to NEED.

Hydropower Assessment Answer Key

1. a	3. c	5. d	7. d	9. d
2. a	4. a	6. c	8. b	10. b

Hydropower BINGO Instructions

***Hydropower Bingo* is a great icebreaker for a NEED workshop or conference. As a classroom activity, it also makes a great introduction to an energy unit.**

Preparation

- 5 minutes

Time

- 45 minutes

Bingos are available on several different topics. Check out these resources for more bingo options!

- Biomass Bingo—*Energy Stories and More*
- Change a Light Bingo—*Energy Conservation Contract*
- Energy Bingo—*Energy Games and Icebreakers*
- Energy Efficiency Bingo—*Monitoring and Mentoring* and *Learning and Conserving*
- Hydrogen Bingo—*H_2 Educate*
- Nuclear Energy Bingo—Nuclear guides
- Oil and Natural Gas Bingo—Oil and Natural Gas guides
- Science of Energy Bingo—*Science of Energy* guides
- Solar Bingo—Solar guides
- Transportation Bingo—Transportation guides
- Wind Energy Bingo—Wind Energy Guides

Get Ready

Duplicate as many *Hydropower Bingo* sheets (found on page 31 of the Teacher Guide) as needed for each person in your group. In addition, decide now if you want to give the winner of your game a prize and what the prize will be.

Get Set

Pass out one *Hydropower Bingo* sheet to each member of the group.

Go

PART ONE: FILLING IN THE BINGO SHEETS

Give the group the following instructions to create bingo cards:

- This bingo activity is very similar to regular bingo. However, there are a few things you'll need to know to play this game. First, please take a minute to look at your bingo sheet and read the 16 statements at the top of the page. Shortly, you'll be going around the room trying to find 16 people about whom the statements are true so you can write their names in one of the 16 boxes.
- When I give you the signal, you'll get up and ask a person if a statement at the top of your bingo sheet is true for them. If the person gives what you believe is a correct response, write the person's name in the corresponding box on the lower part of the page. For example, if you ask a person question "D" and he or she gives you what you think is a correct response, then go ahead and write the person's name in box D. A correct response is important because later on, if you get bingo, that person will be asked to answer the question correctly in front of the group. If he or she can't answer the question correctly, then you lose bingo. So, if someone gives you an incorrect answer, ask someone else! Don't use your name for one of the boxes or use the same person's name twice.
- Try to fill all 16 boxes in the next 20 minutes. This will increase your chances of winning. After the 20 minutes are up, please sit down and I will begin asking players to stand up and give their names. Are there any questions? You'll now have 20 minutes. Go!
- During the next 20 minutes, move around the room to assist the players. Every five minutes or so tell the players how many minutes are remaining in the game. Give the players a warning when just a minute or two remains. When the 20 minutes are up, stop the players and ask them to be seated.

PART TWO: PLAYING BINGO

Give the class the following instructions to play the game:

- When I point to you, please stand up and in a LOUD and CLEAR voice give us your name. Now, if anyone has the name of the person I call on, put a big "X" in the box with that person's name. When you get four names in a row—across, down, or diagonally—shout "Bingo!" Then I'll ask you to come up front to verify your results.
- Let's start off with you (point to a player in the group). Please stand and give us your name. (Player gives name. Let's say the player's name was "Joe.") Okay, players, if any of you have Joe's name in one of your boxes, go ahead and put an "X" through that box.
- When the first player shouts "Bingo," ask him (or her) to come to the front of the room. Ask him to give his name. Then ask him to tell the group how his bingo run was made, e.g., down from A to M, across from E to H, and so on.

- Now you need to verify the bingo winner's results. Ask the bingo winner to call out the first person's name on his bingo run. That player then stands and the bingo winner asks him the question which he previously answered during the 20-minute session. For example, if the statement was "can name two renewable sources of energy," the player must now name two sources. If he can answer the question correctly, the bingo winner calls out the next person's name on his bingo run. However, if he does not answer the question correctly, the bingo winner does not have bingo after all and must sit down with the rest of the players. You should continue to point to players until another person yells "Bingo."

ANSWERS

A. Knows the percentage of U.S. electricity supplied by hydropower

B. Knows another name for the water cycle

C. Knows the process by which water becomes a gas in the water cycle

D. Knows the form of energy of the water stored in a reservoir

E. Can explain what a generator does

F. Knows the federal agency that regulates public hydropower dams

G. Can name the device in a hydropower plant that captures the energy of flowing water

H. Can name the energy source that supplies most of U.S. electricity

I. Knows the source of energy that drives the water cycle

J. Knows what energy source causes ocean waves

K. Can explain the force that produces tides in the ocean

L. Knows the three main parts of a hydropower plant

M. Knows the process by which water vapor becomes a liquid

N. Knows the state that produces the most hydropower

O. Can explain what a pumped storage facility does

P. Knows how many hydroelectric power plants there are in the U.S.

A 5-10% depending on amount of rainfall	**B** hydrologic cycle	**C** water becomes a gas through evaporation	**D** gravitational potential energy
E generator converts kinetic energy into electricity	**F** FERC Federal Energy Regulatory Commission	**G** a turbine captures the energy of flowing water	**H** coal produces about 33% of U.S. electricity
I solar energy drives the water cycle	**J** ocean waves are caused primarily by wind	**K** tides are formed by the gravitational pull of the moon	**L** reservoir, dam, and power plant
M condensation	**N** Washington State	**O** it has two reservoirs at different heights and circulates water between them	**P** about 2,200 hydroelectric power plants

Rubric for Assessment

Student Guide/Science Notebook Rubric

GRADE	SCIENTIFIC CONCEPTS	SCIENTIFIC INQUIRY	PRESENTATION
4	Student demonstrates thorough understanding of concepts through pictures, writing, and verbal communication.	Student is able to follow all steps of the scientific process: predicting, observing/recording data, and drawing a more complex conclusion related to his/her data. Student shows higher level thinking by asking his/her own questions.	Handwriting is legible. Pictures are realistic and include labels. All parts of the assignment are complete.
3	Student demonstrates understanding of concepts through pictures, writing, and/or verbal communication.	Student is able to predict, observe/record data, and draw a basic conclusion.	Handwriting is legible. Pictures are realistic and include most labels. All parts of the assignment are complete.
2	Student demonstrates a beginning understanding of concepts, may have a couple of lingering misconceptions.	Student is able to do two of the following: predict, observe/record data, draw conclusions.	Words and/or pictures may be hard to decipher at times. Pictures are present but are missing labels. The notebook has some missing components.
1	Student demonstrates confusion about concepts. Many misconceptions remain.	Student is able to do one or fewer of the following: predict, observe/record data, draw conclusions.	Words and/or pictures are hard to decipher. They may not be connected to the investigation. The notebook has many missing components.

Science Skills Checklist

Designed to be a formative assessment tool, you may find this checklist useful as you work with students. Put all of your students' names down the left hand side. When you look at a child's notebook or Student Guide and see a skill demonstrated, put a dot in the box. Decide how many times (typically 3-5) you want to see the student use the skill independently before checking off the box as a sign that the student has mastered this skill.

Student Name	Drawings	Picture is realistic (colors, shape, size).	Includes appropriate labels.	Notes and Observations	Uses senses to record observations.	Observations are "big picture."	Observations focus on details.	Graphs and Charts	Data is accurate.	Includes appropriate labels.	Clear presentation.	Communication	Communicates verbally.	Communicates in writing.	Makes predictions.	Makes predictions with reasoning.	Uses evidence to support reasoning.	Compares and contrasts.	Communication is personal.

Science of Electricity Model

✪ Objective

To demonstrate how electricity is generated.

Caution

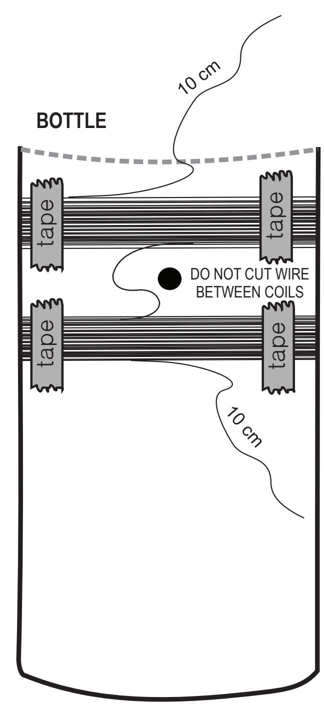
- The magnets used in this model are very strong. Refer to page 10 of this guide for more safety information.
- Use caution with nails and scissors when puncturing the bottle.

Materials

- 1 Small bottle
- 1 Rubber stopper with ¼″ hole
- 1 Wooden dowel (12″ x ¼″)
- 4 Strong rectangle magnets
- 1 Foam tube
- 1 Small nail
- 1 Large nail
- Magnet wire
- Permanent marker
- 1 Pair sharp scissors
- Masking tape
- Fine sandpaper
- 1 Push pin
- 1 Multimeter with alligator clips
- Hand operated pencil sharpener
- Ruler
- Utility knife (optional)

Preparing the Bottle

1. If needed, cut the top off of the bottle so you have a smooth edge and your hand can fit inside. This step may not be necessary. If necessary, a utility knife may be of assistance.
2. Pick a spot at the base of the bottle. (HINT: If the bottle you are using has visible seams, measure along these lines so your holes will be on the opposite sides of the bottle.) Measure 10 centimeters (cm) up from the base and mark this location with a permanent marker.
3. On the exact opposite side of the bottle, measure 10 cm up and mark this location with a permanent marker.
4. Over each mark, poke a hole with a push pin. Do not distort the shape of the bottle as you do this.
   CAUTION: Hold a rubber stopper inside the bottle behind where the hole will be so the push pin, and later the nails, will hit the rubber stopper and not your hand, once it pokes through the bottle.
5. Widen each hole by pushing a nail through it. Continue making the hole bigger by circling the edge of the hole with the side of the nail. (A 9/32 drill bit twisted slowly also works, using a rubber stopper on the end of the bit as a handle.)
6. Sharpen one end of the dowel using a hand operated pencil sharpener (the dowel does not have to sharpen into a fine point). Push the sharpened end of the dowel rod through the first hole. Circle the edge of the hole with the dowel so that the hole is a little bigger than the dowel.
7. Remove the dowel and insert it into the opposite hole. Circle the edge of the hole with the dowel so that the hole is a little bigger than the dowel. An ink pen will also work to enlarge the hole. Be careful not to make the hole too large, however.
8. Insert the dowel through both holes. Hold each end of the dowel and swing the bottle around the dowel. You should have a smooth rotation. Make adjustments as needed. Take the dowel out of the bottle and set aside.
9. With a permanent marker, label one hole "A" and the other hole "B."

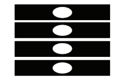


Generator Assembly: Part 1

1. Tear 6 pieces of tape approximately 6 cm long each and set aside.
2. Take the bottle and the magnet wire. Leave a 10 cm tail, and tape the wire to the bottle about 2 cm below hole A. Wrap the wire clockwise 200 times, stacking each wire wrap on top of each other. Keep the wire wrap below the holes, but be careful not to cover the holes, or get too far away from the holes.
3. DO NOT cut the wire. Use two pieces of tape to hold the coil of wire in place; do not cover the holes in the bottle with tape (see diagram).
4. Without cutting the wire, move the wire about 2 cm above the hole to begin the second coil of wraps in a clockwise direction. Tape the wire to secure it in place.

5. Wrap the wire 200 times clockwise, again stacking each wrap on top of each other. Hold the coil in place with tape (see diagram).
6. Unwind 10 cm of wire (for a tail) from the spool and cut the wire.
7. Check your coil wraps. Using your fingers, pinch the individual wire wraps to make sure the wire is close together and close to the holes. Re-tape the coils in place as needed.
8. Using fine sandpaper, remove the enamel coating from 4 cm of the end of each wire tail, leaving bare copper wires. (This step may need to be repeated again when testing the model, or saved for the very end).

Diagram 1



Stacked Magnets End View

Diagram 2

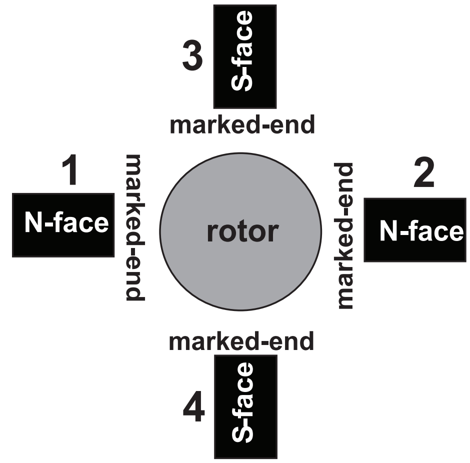
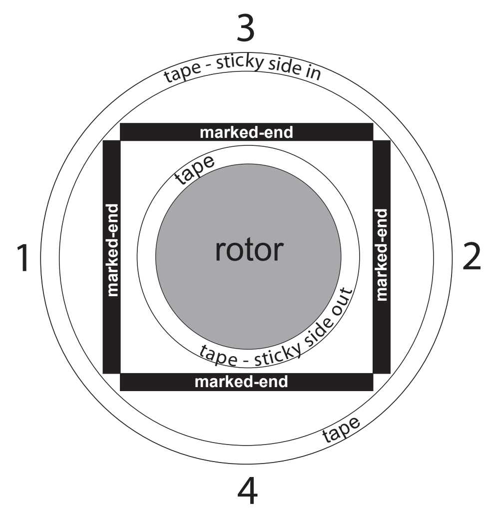


Diagram 3



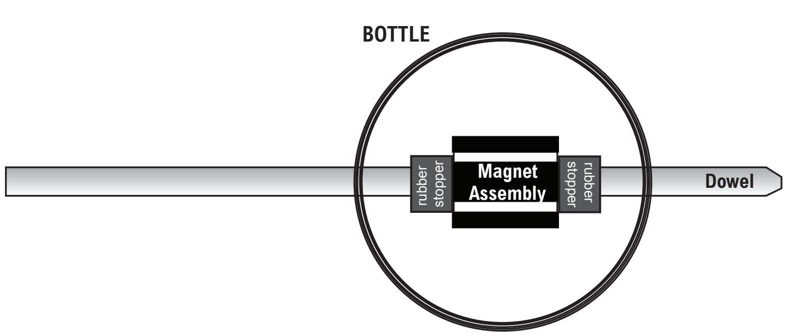
Rotor Assembly

1. Measure 4 cm from the end of the foam tube. Using scissors, carefully score a circle around the tube. Snap the piece from the tube. This piece is now your rotor.
2. On the flat ends of the rotor, measure to find the center point. Mark this location with a permanent marker.
3. Insert the small nail directly through the rotor's center using your mark as a guide.
4. Remove the small nail and insert the bigger nail.
5. Remove the nail and push the dowel through, then remove the dowel and set aside. Do **NOT** enlarge this hole.
6. Stack the four magnets together. While stacked, mark one end (it does not matter which end) of each of the stacked magnets with a permanent marker as shown in Diagram 1.
7. Place the magnets around the foam piece as shown in Diagram 2. Make sure you place the magnets at a distance so they do not snap back together.
8. Wrap a piece of masking tape around the curved surface of the rotor, sticky side out. Tape it down at one spot, if helpful.
9. Lift the marked end of Magnet 1 to a vertical position and attach it to the rotor. Repeat for Magnets 2, 3, and 4.
10. Secure the magnets in place by wrapping another piece of masking tape over the magnets, sticky side in (Diagram 3).

*WARNING: These magnets are **very** strong. Use caution when handling. See page 10 for more information.*

Generator Assembly: Part 2

1. Slide the sharp end of the dowel through Hole A of the bottle.
2. Inside the bottle, put on a stopper, the rotor, and another stopper. The stoppers should hold the foam rotor in place. If the rotor spins freely on the axis, push the two stoppers closer against the rotor. This is a pressure fit and no glue is needed.
3. Slide the sharp end of the dowel through Hole B until it sticks out about 4 cm from the bottle.
4. Make sure your dowel can spin freely. Adjust the rotor so it is in the middle of the bottle.



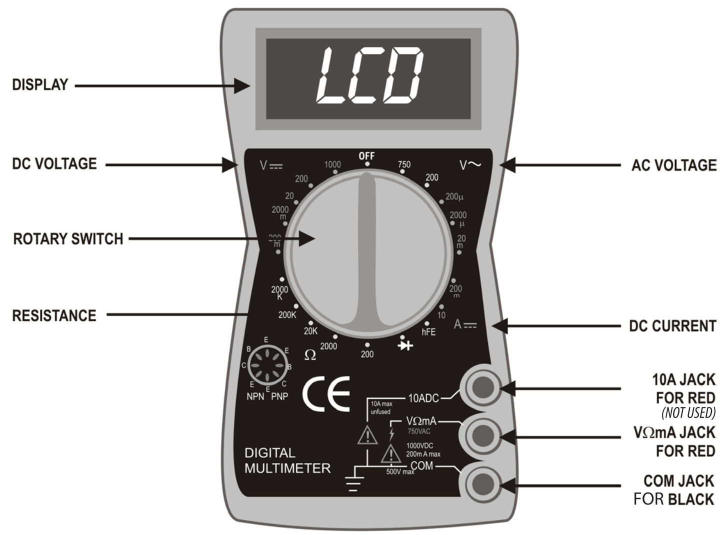
Assembly Notes

- The stoppers can be cut in half so that one stopper is made into two, to allow for more materials. These often slide more easily on the dowel. This must be done using sharp scissors or a utility knife, and can often be dangerous. As this step is not required (the kit supplies you with two stoppers to use), exercise extreme caution.
- If the foam rotor fits snugly on the dowel, put the stoppers on the outside of the bottle to help center the rotor in the bottle. Leave enough space to allow free rotation of the rotor.
- The dowel may be lubricated with lip balm or oil for ease of sliding the stoppers, if necessary.
- If a glue gun is available, magnets can be attached to the rotor on edge or on end to get them closer to the coils of wire. Use the magnet to make an indentation into the foam. Lay down a bead of glue, and attach the magnets. If placing the magnets on end, however, make sure they clear the sides of the bottle for rotation.

Testing the Science of Electricity Model

1. Connect the leads to the multimeter to obtain a DC Voltage reading.
2. Connect one alligator clip to each end of the magnet wire. Connect the other end of the alligator clips to the multimeter probes.
3. Set your multimeter to DC Voltage 200 mV (millivolts). Voltage measures the pressure that pushes electrons through a circuit. You will be measuring millivolts, or thousandths of a volt.
4. Demonstrate to the class, or allow students to test how spinning the dowel rod with the rotor will generate electricity as evidenced by a voltage reading. As appropriate for your class, you may switch the dial between 200 mV and 20 volts. Discuss the difference in readings and the decimal placement.*
5. Optional: Redesign the generator to test different variables including the number of wire wraps, different magnet strengths, and number of magnets.

*Speed of rotation will impact meter readings.



Note: Your multimeter may look different than the one shown. Read the instruction manual included in the multimeter box for safety information and complete operating instructions.

Troubleshooting

If you are unable to get a voltage or current reading, double check the following:

- Did you remove the enamel coating from the ends of the magnet wire?
- Are the magnets oriented correctly?
- The magnet wire should not have been cut as you wrapped 200 wraps below the bottle holes and 200 wraps above the bottle holes. It should be one continuous wire.
- Are you able to spin the dowel freely? Is there too much friction between the dowel and the bottle?
- Is the rotor spinning freely on the dowel? Adjust the rubber stoppers so there is a tight fit, and the rotor does not spin independently.

Notes

- The *Science of Electricity Model* was designed to give students a more tangible understanding of electricity and the components required to generate electricity. The amount of electricity that this model is able to generate is very small.
- The *Science of Electricity Model* has many variables that will affect the output you are able to achieve. When measuring millivolts, you can expect to achieve anywhere from 1 mV to over 35 mV.
- For your reference, more information about measuring electricity can be found in NEED's *Secondary Energy Infobook*. You may download this guide from www.NEED.org.

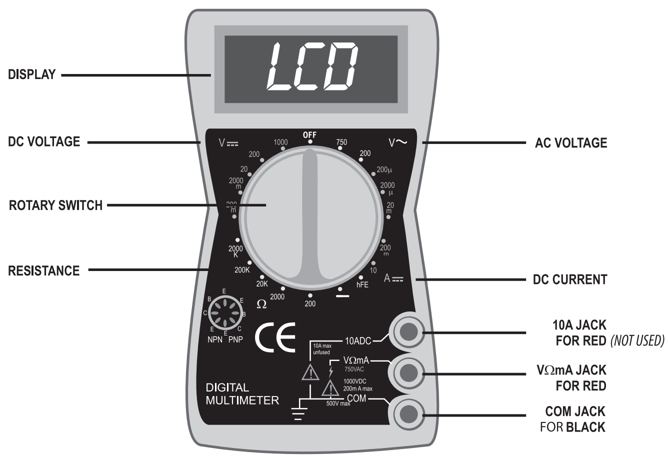
Measuring Electricity

Included in the kit is a multimeter, a tool to measure electricity. The multimeter allows you to measure current, resistance, and voltage, and displays the reading numerically.

When using the multimeter it should be noted that some measurements will never "stay still" at a single repeatable value. This is the nature of the variables being monitored in some circumstances. For example, if you were to measure the resistance between your two hands with the ohmmeter setting on the multimeter (megohm range—millions of ohms), you would find that the values would continuously change. How tightly you squeeze the metal probes and how "wet" or "dry" your skin is can have a sizable effect on the reading that you obtain. In this situation you need a protocol or standardized method to allow you to record data.

We recommend that you discuss with your class the variability of measurement and let them come up with a standard for collecting data. They may decide to go with the lowest reading, the highest reading, or the reading that appears most frequently in a certain time period.

Digital Multimeter

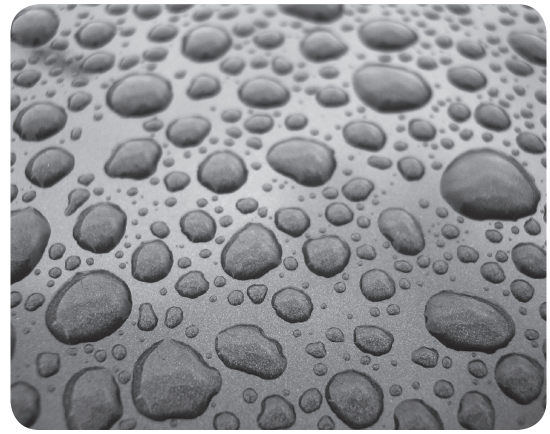


Directions:

DC VOLTAGE

1. Connect RED lead to VΩmA jack and BLACK to COM.
2. Set ROTARY SWITCH to highest setting on DC VOLTAGE scale (1000).
3. Connect leads to the device to be tested using the alligator clips provided.
4. Adjust ROTARY SWITCH to lower settings until a satisfactory reading is obtained.
5. With the generator, usually the 200mV DCV setting provides the best reading.

The Tale of Annie Soakley



I'm Annie Soakley. I am a world traveler. Let me tell you about my last trip. It began in the Pacific Ocean. I was floating in the waves with my friends. We were bobbing up and down, watching the sun rise over the mountains. What a beautiful sight!

The sun climbed higher in the sky. I began to get warm. I got warmer and warmer. Suddenly, I rose out of the water. I floated toward the sky. I grew bigger. My molecules got farther and farther apart. I expanded.

I didn't look like a drop of water anymore. I was invisible. I had turned into water vapor. I had evaporated! I rose high into the sky. Many of my friends came with me. They had evaporated, too. Together, we formed clouds.

The wind pushed us through the sky. We sailed over the ocean toward land. The people on the beach were sad to see us. We blocked the sun.

We passed over them and headed for the mountains. The wind kept pushing us. We reached the mountains as the sun set. The air over the mountains was cold. It made me cold. As I cooled, I grew smaller. My molecules got closer together. I turned into a drop of water again. I condensed.

I was too heavy for the cloud to hold me. I began falling toward the Earth. I was a rain drop! My friends condensed, too. As we fell through the air, we got colder and colder. Our molecules got closer together. We froze and became snowflakes. We all looked different and beautiful!

We fell on top of a tall mountain. When the wind pushed the clouds away, the sun came out. We began to get warmer. Our molecules pushed away from each other as they absorbed energy. We finally melted and began to trickle down the mountain. Gravity was pulling us down.

Soon, other drops of water joined us and we turned into a small creek. As we flowed down the mountain, more creeks joined us and we grew. We turned into a roaring river. We were moving very fast. We had a lot of energy.

Gradually, the land became flatter and we stopped moving so quickly. We flowed more slowly through farms and towns. Other rivers joined us until we turned into one big, wide river.

Boats and barges floated on top of us. Fish and other living things swam through us. Plants grew from our riverbed. Animals came down to our banks and drank from us.

We just kept flowing through it all, pulled by gravity. Finally, we reached the ocean. I floated out into the waves, glad to be home again. It had been an exciting trip through the water cycle.

The Tale of Annie Soakley
Review Questions

1. Think about your investigations and reading. Explain how land and water affect each other.

2. List three ways you could change the design of your water wheel to do more work.
   a.
   b.
   c.

3. Which change do you think would be the best at getting the turbine to do more work? Why do you think this?

When They Dammed the River

Billy and his Grandpa were fishing in their favorite spot down river from the hydropower plant. They had caught many fish in this spot over the years. From where they were sitting they could see workers placing a new turbine into the plant.

“What are they doing, Grandpa?” Billy asked.

“They are replacing an old turbine with a new, more efficient turbine. The new turbine will be able to produce more electricity with the same amount of water,” Grandpa explained. “It sure is a lot different today than when I was your age.”

Billy was confused, “What do you mean?”

“When I was your age the dam and the hydropower plant weren’t here. It was a big change for our community when they decided to dam the river and put the hydropower plant in. I still remember the day I found out. I had heard at school that we were all going to have to move and I rushed home to look for my mom…

“Mom! Mom! Where are you, Mom?” I looked all around our little cabin, but my mother wasn’t there. I found a note on the kitchen table. It said:

"Fred, I went to town with Grandma. I’ll be back after supper. There is a sandwich in the refrigerator. Please do your homework before you go fishing. I love you."

I wasn’t hungry, but I ate a sandwich anyway, then wandered aimlessly around the cabin. Finally, I picked up my fishing pole from behind the door. I had homework to finish, but I was too upset to read anything. I headed down the path to the fishing hole.

I climbed out on the low branch of my sycamore tree and dangled my feet in the water. This was my favorite place in the world, the place where I came whenever I needed to be alone to think. I’d spent all last summer here. Now I needed to think about the story I’d heard at school that day.

As the sun went down, I slowly reeled in my line. I hadn’t even checked the bait the whole evening. I’d had too much on my mind. As I walked back up the path, I heard my grandma’s old Ford coming up the hill. I ran to meet my mother.

When I saw her face, I knew that she’d heard the story, too. “Mom, is it true? Are we really going to have to move?”

“Oh, Fred!” she said and pulled me close to her. “I’m so sorry!”

We stood silent, our tears shining in the moonlight. Finally my mother shook herself and said, "Let's go inside and have some hot chocolate. I'll tell you all about it."

"Mom, we have to do something. We can't just let them take this all away. Please, Mom, can't we stop them?"

The lights in the cabin flickered off and on. I quickly lit the kerosene lantern that we kept on the table.

My mother pointed over to the city. "See those lights, Fred? That's why. Everybody wants electricity—they want radios and refrigerators, all kinds of new things that run on electricity. That's what the meeting was about in town tonight—building a dam to make enough power for everybody in the valley."

"I know that, Mom. But why here? Why can't they build it someplace else?"

"They've studied the whole river valley, Fred. They showed us the maps tonight. This is the best place. There's always lots of water in the river here and the valley is shaped right."

"But we'll have to move. I love this place."

"There isn't one place on this river, Fred, where there isn't a boy just like you who's got a special place. Most of the towns in the valley are right on the river. You know that. This is the only place where a whole town won't have to be moved."

“Mom, isn’t there any other way to make electricity?” I asked.

“Yes, some places burn coal, natural gas, or even trash and get their energy from the sun. The people at the meeting say the dam will be a lot cheaper and cleaner than the other options.”

My mom put her arm around my shoulder and said, “I don’t want to move either, Fred. But the dam will mean new industry. I’ll be able to get a job. They’ll pay us good money for this place, too. Enough to buy a nice house with a refrigerator and our own car.”

“This river is my life, Mom. What’ll I do without it?” I asked.

“Fred, the river isn’t going to disappear. They’re going to dam it up and make a big lake, but the river below the dam and above the lake will still be there. And the lake will be a great place to fish and swim. I won’t take you away from the water, Fred. I promise. Maybe we can get a new place right on the lake.”

I was quiet for a moment, then asked, “How does damming the river make electricity, anyway?”

“There will be big turbines and generators at the bottom of the dam to make the electricity. It takes a lot of force to spin the turbines, so they dam the river to raise the water level. The bigger the distance between the water level and the turbines, the larger the force of the water. The dam will have gates in it to let the water flow into big pipes that channel the water to the turbines. They say it’s a sight to see.”

Finally I smiled for the first time that day. “They ought to hire you, Mom, to do their talking for them.”

“Oh, Fred,” she said, “I know this is going to be hard. I just figure we should look for the good in things rather than the bad. Let’s take our hot chocolate down to the river and sit awhile.”

...We were able to move just a short distance away, and my mother did get a job at the hydropower plant, just like she said she could. And, we still have lots of good places for fishing, just like this one here."

“Wow, Grandpa. Damming the river sounds like it was a big project, but I’m glad they did,” Billy said.

“I'm glad, too, Billy.”

Advantages and Disadvantages of Hydropower

1. Describe three advantages of using hydropower to generate electricity.

   a. ______________________________

   b. ______________________________

   c. ______________________________

2. Describe three disadvantages of using hydropower to generate electricity.

   a. ______________________________

   b. ______________________________

   c. ______________________________

3. How would you feel if a new hydropower dam was planned for a river near you to provide electricity? Would you support or fight the building of a dam? Write a paragraph explaining your position, including the advantages and disadvantages.

U.S. Energy Consumption by Source, 2015

NONRENEWABLE

PETROLEUM 37% *
Uses: transportation, manufacturing - includes propane

NATURAL GAS 29% *
Uses: heating, manufacturing, electricity - includes propane

COAL 16%
Uses: electricity, manufacturing

URANIUM 9%
Uses: electricity

PROPANE
Uses: heating, manufacturing

*Propane consumption is included in petroleum and natural gas totals.

RENEWABLE

BIOMASS 5%
Uses: heating, electricity, transportation

HYDROPOWER 2%
Uses: electricity

WIND 2%
Uses: electricity

SOLAR < 1%
Uses: heating, electricity

GEOTHERMAL < 1%
Uses: heating, electricity

**Total does not add up to 100% due to independent rounding.
Data: Energy Information Administration

HYDROPOWER BINGO

A. Knows the percentage of U.S. electricity supplied by hydropower

B. Knows another name for the water cycle

C. Knows the process by which water becomes a gas in the water cycle

D. Knows the form of energy of the water stored in a reservoir

E. Can explain what a generator does

F. Knows the federal agency that regulates public hydropower dams

G. Can name the device in a hydropower plant that captures the energy of flowing water

H. Can name the energy source that supplies most of U.S. electricity

I. Knows the source of energy that drives the water cycle

J. Knows what energy source causes ocean waves

K. Can explain the force that produces tides in the ocean

L. Knows the three main parts of a hydropower plant

M. Knows the process by which water vapor becomes a liquid

N. Knows the state that produces the most hydropower

O. Can explain what a pumped storage facility does

P. Knows how many hydroelectric power plants there are in the U.S.

A NAME	B NAME	C NAME	D NAME
E NAME	F NAME	G NAME	H NAME
I NAME	J NAME	K NAME	L NAME
M NAME	N NAME	O NAME	P NAME

Hydropower Assessment

1. The part of a hydropower plant that holds back water is the _____________.

a. dam b. spillway c. penstock d. turbine

2. How many of the 84,000 dams in the U.S. can produce electricity?

a. very few b. three-fourths c. half d. all

3. The process that draws water from oceans into the atmosphere to form clouds is ______________.

a. sublimation b. deposition c. evaporation d. precipitation

4. The energy of moving water is fueled by ______________.

a. gravity b. solar energy c. the water cycle d. precipitation

5. A dam on a river can provide ______________.

a. electricity b. flood control c. irrigation d. all of these

6. The center of an atom is called the ______________.

a. neutron b. proton c. nucleus d. electron

7. A device that captures the energy of moving water in a hydropower plant is called a ______________.

a. motor b. generator c. electrometer d. turbine

8. A hydropower generator uses ______________ to produce electricity.

a. radiant energy
b. motion energy
c. chemical energy
d. thermal energy

9. Technologies are currently available to use the energy of ______________.

a. ocean currents
b. ocean tides
c. ocean waves
d. all of the above

10. Hydropower produces what percentage of total electricity generation in the U.S. today?

a. 1–3% b. 5–10% c. 15–17% d. 25–27%

NEED's Online Resources

NEED'S SMUGMUG GALLERY

http://need-media.smugmug.com/

On NEED's SmugMug page, you'll find pictures of NEED students learning and teaching about energy. Would you like to submit images or videos to NEED's gallery? E-mail info@NEED.org for more information.
Also use SmugMug to find these visual resources:

Videos

Need a refresher on how to use Science of Energy with your students? Watch the Science of Energy videos. Also check out our Energy Chants videos! Find videos produced by NEED students teaching their peers and community members about energy.

Online Graphics Library

Would you like to use NEED's graphics in your own classroom presentations, or allow students to use them in their presentations? Download graphics for easy use in your classroom.

AWESOME EXTRAS

Looking for more resources? Our Awesome Extras page contains PowerPoints, animations, and other great resources to compliment what you are teaching in your classroom! This page is available under the Educators tab at www.NEED.org.

THE BLOG

We feature new curriculum, teacher news, upcoming programs, and exciting resources regularly. To read the latest from the NEED network, visit www.NEED.org/blog_home.asp.

EVALUATIONS AND ASSESSMENT

Building an assessment? Searching for standards? Check out our Evaluations page for a question bank, NEED's Energy Polls, sample rubrics, links to standards alignment, and more at www.NEED.org/evaluation.

E-PUBLICATIONS

The NEED Project offers e-publication versions of various guides for in-classroom use. Guides that are currently available as an e-publication can be found at www.issuu.com/theneedproject.

SOCIAL MEDIA

Stay up-to-date with NEED. "Like" us on Facebook! Search for The NEED Project, and check out all we've got going on!

Follow us on Twitter. We share the latest energy news from around the country, @NEED_Project.

Follow us on Instagram and check out the photos taken at NEED events, instagram.com/theneedproject.

Follow us on Pinterest and pin ideas to use in your classroom, Pinterest.com/NeedProject.

NEED ENERGY BOOKLIST

Looking for cross-curricular connections, or extra background reading for your students? NEED's booklist provides an extensive list of fiction and nonfiction titles for all grade levels to support energy units in the science, social studies, or language arts setting. Check it out at www.NEED.org/booklist.asp.

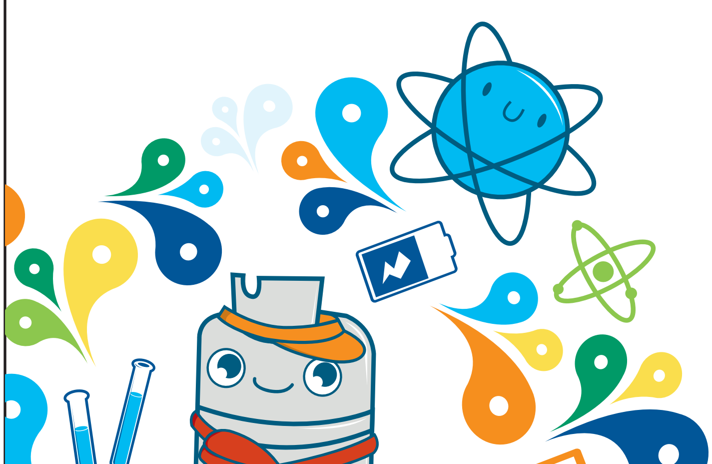
U.S. ENERGY GEOGRAPHY

Maps are a great way for students to visualize the energy picture in the United States. This set of maps will support your energy discussion and multi-disciplinary energy activities. Go to www.NEED.org/maps to see energy production, consumption, and reserves all over the country!

YOUTH ENERGY CONFERENCE AND AWARDS

The NEED Youth Energy Conference and Awards gives students more opportunities to learn about energy and to explore energy in STEM (science, technology, engineering, and math). The annual June conference has students from across the country working in groups on an Energy Challenge designed to stretch their minds and energy knowledge. A limited number of spaces are available for a special two-day pre-conference event, which allows students access to additional information, time to discuss energy with their peers, and access to industry professionals. The conference culminates with the Youth Awards Ceremony recognizing student work throughout the year and during the conference.

For More Info: http://tinyurl.com/youthenergyconference



YOUTH AWARDS PROGRAM FOR ENERGY ACHIEVEMENT

All NEED schools have outstanding classroom-based programs in which students learn about energy. Does your school have student leaders who extend these activities into their communities? To recognize outstanding achievement and reward student leadership, The NEED Project conducts the National Youth Awards Program for Energy Achievement.

Share Your Energy Outreach with The NEED Network!
This program combines academic competition with recognition to acknowledge everyone involved in NEED during the year—and to recognize those who achieve excellence in energy education in their schools and communities.

What's involved?

Students and teachers set goals and objectives and keep a record of their activities. Students create a digital project to submit for judging. In April, digital projects are uploaded to the online submission site.

Want more info? Check out **www.NEED.org/Youth-Awards** for more application and program information, previous winners, and photos of past events.

Wonders of Water Evaluation Form

State: ____________ **Grade Level:** ____________ **Number of Students:** ___________

1. Did you conduct the entire unit?	❑ Yes	❑ No
2. Were the instructions clear and easy to follow?	❑ Yes	❑ No
3. Did the activities meet your academic objectives?	❑ Yes	❑ No
4. Were the activities age appropriate?	❑ Yes	❑ No
5. Were the allotted times sufficient to conduct the activities?	❑ Yes	❑ No
6. Were the activities easy to use?	❑ Yes	❑ No
7. Was the preparation required acceptable for the activities?	❑ Yes	❑ No
8. Were the students interested and motivated?	❑ Yes	❑ No
9. Was the energy knowledge content age appropriate?	❑ Yes	❑ No
10. Would you teach this unit again?	❑ Yes	❑ No

Please explain any 'no' statement below.

How would you rate the unit overall?	❑ excellent	❑ good	❑ fair	❑ poor
How would your students rate the unit overall?	❑ excellent	❑ good	❑ fair	❑ poor

What would make the unit more useful to you?

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Other Comments:

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Please fax or mail to: **The NEED Project**
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