

# energy EXCHANGE

The National Energy Education Development Project

November 2008

## NEED Welcomes New Staff

Fall is a time of change, and that is true this year for NEED. Looking forward to the future, NEED is pleased to welcome three new staff: Hallie Mills, Wendi Moss and Melanie Harper. The growing NEED team will help us meet the increasing demand for energy education and training.



As Curriculum Director, **Hallie Mills** will lead the NEED curriculum team in creating exciting energy education activities and units. She grew up on South Whidbey Island, Washington. She is a NEED Teacher Advisory Board (TAB) member and a science teacher. Her recent contributions to NEED

include working on the wind and hydropower curriculum teams. A graduate of Seattle Pacific University (BA) and Walden University (Master's in Science Education), Hallie enjoys traveling, camping, hiking and playing golf. Want to meet Hallie? She will be at the Portland, Oregon NSTA conference and would be happy to talk about energy, NEED, or even the Seattle Mariners and Seahawks!

Customer Service Specialist **Wendi Moss** will increase the efficiency at the office by making sure orders are accurate and timely as well as keeping the database up-to-date. She comes to NEED after a break from the "land of the working" to spend time raising her two children. Prior to that, Wendi worked in the broadcasting industry. She worked in the traffic department—that is, radio commercials, not roads and accidents. A graduate of Washington Business School, Wendi is excited to be at NEED and balances work with family life and painting.

After 30 years of teaching, **Melanie Harper** joined the national NEED staff as a Program Associate. She manages the TXU Energy Solar Academy program and provides teacher training in all NEED program areas. Melanie has been a member of the NEED TAB since 1997. A graduate of Western New Mexico University, and living in Texas, Melanie states, "I'm having the best time of my life working with NEED and bringing energy curriculum materials to education." When not busy with NEED, Melanie spends her time with her family, fishing or collecting nostalgic glassware.

## NEED, PG&E, and Friends

The NEED Project was honored to join California partner Pacific Gas and Electric (PG&E) in celebrating the grand opening of the California Academy of Sciences in San Francisco on Saturday, August 27, 2008. This world-class museum is the only place on the planet with an aquarium, a planetarium, a natural history museum, and a four-story rainforest all under one roof. PG&E is contributing \$1.5 million to the Academy in their efforts to promote climate change awareness and sustainability. NEED is entering its fifth year with PG&E in delivery of the PG&E Solar Schools program ([www.need.org/pgesolarschools/](http://www.need.org/pgesolarschools/)), the largest effort of its kind in the nation.



Actor and energy awareness advocate Ed Begley, Jr. was among the visitors on opening day. A friend of NEED, Ed dropped by the Solar Schools booth to visit. Pictured from left: NEED program coordinator Barry Scott, Ed Begley, Jr., PG&E program director Karalee Browne, and Greg Holman, master teacher from Evergreen Sixth Grade Academy in Paradise, California.

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## The NEED Project

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The NEED Project is a 501(c)(3) nonprofit education association providing professional development, innovative materials correlated to the National Science Education Content Standards, ongoing support and recognition to educators nationwide.

### National Staff

Mary Spruill—Executive Director  
Hallie Mills—Curriculum Director  
Keith Etheridge—Training Director  
Rebecca Lamb—Program Director  
Karen Reagor—State Program Director  
Barry Scott—State Program Director  
Amy Constant—Program Associate  
Samantha Forbes—Program Associate  
Melanie Harper—Program Associate  
Vernon Kimball—Program Associate  
Todd Rogers—Program Associate  
Annie Rasor—Curriculum Associate  
Cindy Welchko—Curriculum Associate  
Lillian Dean—Office Administrator  
Wendi Moss—Customer Service



A list of NEED sponsors is available at [www.need.org](http://www.need.org) and in the Annual Report.

*Energy Exchange* is published five times a year by NEED for educators and students, and is available at [www.need.org](http://www.need.org).

NEED welcomes questions, comments, and suggestions. Please contact [info@need.org](mailto:info@need.org).

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## Calendar of Events

### November 2008

- 6 Colorado Energy Resources Workshop sponsored by EnCana - Denver, CO
- 6-8 NEED sessions at Conference for the Advancement of Science Teaching - Fort Worth, TX
- 6-8 NEED sessions at KY Science Teachers Association Conference - Lexington, KY
- 11 Houston Energy Workshop for Middle School Teachers sponsored by Shell - Houston, TX
- 12 Houston Energy Workshop for High School Teachers sponsored by Shell - Houston, TX
- 12 Kentucky NEED Workshop - Prestonburg, KY
- 12 NEED Energy Detectives Workshop sponsored by National Fuel - Jamestown, NY
- 12 Illinois Solar Schools Workshop sponsored by Illinois Clean Energy Community Foundation - Springfield, IL
- 12-14 NEED Sessions at Independent Petroleum Association of America Fall Meeting - Houston, TX
- 12-14 NEED sessions at American Oil and Gas Historical Society Annual Meeting - Houston, TX
- 13-15 NEED sessions at Virginia Association of Science Teachers Conference - Hampton, VA
- 16-19 NEED at American Council for an Energy-Efficient Economy Conference - Sacramento, CA
- 18 Illinois Energy Workshop sponsored by ComEd - Crystal Lake, IL
- 18 Kentucky NEED Workshop - Cave City, KY
- 19 Illinois Energy Workshop sponsored by ComEd - Tinley Park, IL
- 19 Michigan NEED Workshop - Niles, MI
- 19 Colorado Energy Resources Workshop sponsored by EnCana - Denver, CO
- 19-22 NEED sessions at NSTA Regional Convention - Portland, OR
- 20-21 NEED sessions at CO Association of Science Teachers Conference - Denver, CO
- 22 NEED Energy Detectives Workshop sponsored by National Fuel - Buffalo, NY
- 25 Kentucky NEED Workshop - Grayson, KY

### December 2008

- 4-6 NEED presentations at the California School Boards Association - San Diego, CA
- 4-6 NEED sessions at the NSTA Regional Convention - Cincinnati, OH
- 8-10 Green Schools Summit - Anaheim, CA
- 9 Illinois Energy Workshop sponsored by ComEd - Oak Brook, IL
- 10 Illinois Solar Schools Workshop sponsored by ComEd - Oak Brook, IL
- 12-13 NEED at the Kentucky School Boards Association Conference - Lexington, KY
- 12-13 NEED Staff and Curriculum Committee Meeting - Roanoke, VA
- 16 Illinois Energy Workshop sponsored by ComEd - Chicago, IL
- 17 Illinois Solar Schools Workshop sponsored by ComEd - Chicago, IL

### January 2009

- 7-9 Kentucky Leadership Training - Jabez, KY
- 13 Illinois Energy Workshop sponsored by ComEd - Oak Brook, IL
- 22 Illinois Energy Workshop sponsored by ComEd - Chicago, IL
- 31 Colorado Energy Workshop sponsored by ConocoPhillips - Golden, CO

### February 2009

- 4-6 NEED sessions at Hoosier Association of Science Teachers, Inc. Conference - Indianapolis, IN

For additional workshops and upcoming events, visit [www.need.org/calendar.php](http://www.need.org/calendar.php).  
For more information, email [info@need.org](mailto:info@need.org) or call 800.875.5029.

## Energy Exchange in the Classroom

This issue of *Energy Exchange* focuses on hydropower. Teaching your students more about energy and hydropower is exciting with these **new** NEED materials:

**Hydropower Kits** include backgrounders and hands-on experiments to explore the science of the water cycle and how we utilize the energy in moving water.

- Water and Energy Kit (primary)
- Wonders of Water Kit (elementary)
- Energy of Moving Water Kit (intermediate)
- Exploring Hydroelectricity (secondary)

**Energy on Stage** was updated this year to include a hydropower play titled "Today's Special Report: Splish, Splash, Hydropower."

Visit [www.need.org](http://www.need.org) to download *Energy on Stage* or for more information about the Hydropower Kits.

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# NEED News

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## Energy Exchange & Career Currents in 2008-2009

In an effort to keep costs low, and reduce the use of energy resources for printing and mail, NEED will begin delivering its Career Currents and Energy Exchange newsletters electronically. Recipients of the newsletters may elect to receive an email announcing that the newsletters have been posted online. To view the newsletters each month, and to access back issues, visit [www.need.org/newsletters.php](http://www.need.org/newsletters.php). To make sure you can receive email from NEED, set your spam blocker to accept email from need.org.

## EIA Renewable Energy Slideshow

Looking for a multimedia way for students to learn more about renewable energy? Check out the Energy Information Administration (EIA) *Energy in Brief* audio slideshow about renewable energy. Visit [http://tonto.eia.doe.gov/energy\\_in\\_brief/slideshows/renewable\\_energy.html](http://tonto.eia.doe.gov/energy_in_brief/slideshows/renewable_energy.html).

## Congratulations, Regina!

Regina Donour, Letcher County Central High School teacher and NEED TAB member, was honored as a recipient of the 2009 Ashland Inc. Teacher Achievement Award. She is now in the running for Kentucky Teacher of the Year.

## NEED Curriculum Online

A recent survey of NEED teachers found that many wanted more access to electronic versions of our guides to save paper, shipping costs, and to reduce our carbon footprint. We listened! It's now easier than ever to find—and download—most of our Curriculum Guides online. Browse our materials by [Subject Matter](#), [Name](#), or [Grade Level](#). Go to [www.need.org/curriculum.php](http://www.need.org/curriculum.php) to get started.

## New Nuclear Module Coming!

Working with Washington and Lee University and the Council on Foreign Relations, NEED has embarked on an expansion of its nuclear education materials. The funds for the nuclear education project have been provided by grant to Washington and Lee University from Mr. H. F. Lenfest, a distinguished alumnus of the University. The partnership ensures dissemination of information on issues associated with nuclear power to a broad audience which includes educators, students, policy makers and the general public. NEED's role includes assisting in the development and distribution of a curriculum resource for nuclear power for use in grades 8-12 and providing a series of workshops to assist teachers in using these materials. In summer 2009, NEED will facilitate a multi-day nuclear education conference for educators.

## Lights, Camera, Action!

NEED's energy plays provide students with an entertaining way to learn, and share, important energy lessons. For a rainy day activity or outreach project, we've got two new plays your students will love.

### *Bathman*

Can the fearless duo of Bathman and Bobbin save their city from chilling peril and certain doom? Will they find a way to heat the water so Bathman can get back to his afternoon bubble bath? It will take cooperation from all the renewable energy leaders to solve this caper.

Our beloved *Bathman* is back! We've updated and renewed this old favorite with more facts and speaking parts for the whole class. It includes a teacher guide with vocabulary, assessment questions and extension ideas. If you are teaching the renewable sources of energy, download *Bathman* from NEED's Energy on Stage at [www.need.org/Guides-Title.php](http://www.need.org/Guides-Title.php).

### *Today's Special Report: Splish, Splash, Hydropower*

Splash Waverly, Riley Riverton, Tide Turner and Elsie Sparks are a few of the roving reporters out on location today bringing viewers a special report on hydropower as an energy source. Reporting live from inside the water cycle, at a dam, at a hydroelectric power plant, and at the ocean shore, our reporters share the advantages and disadvantages to using hydropower, and introduce us to some ocean energy technologies in use today. Don't change that channel—you don't want to miss this special news report.

This play is filled with information and has a speaking part for everyone. It includes a teacher guide with vocabulary, assessment questions and extension ideas. If you are doing a water unit or teaching about hydropower, download *Today's Special Report: Splish, Splash, Hydropower* from NEED's Energy on Stage at [www.need.org/Guides-Title.php](http://www.need.org/Guides-Title.php).

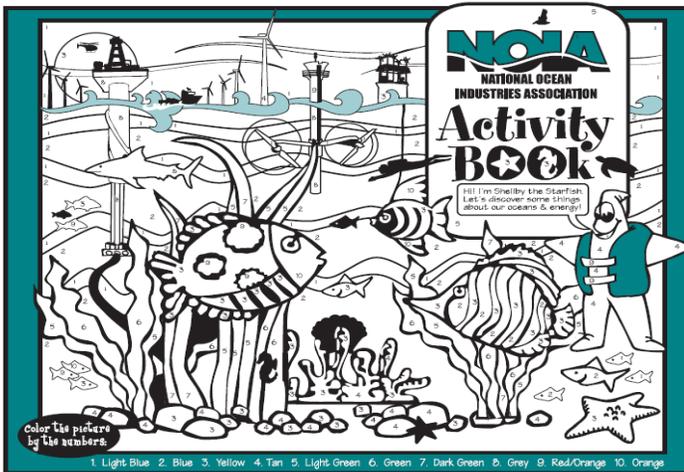
## NEED and the Society of Petroleum Engineers

Over 70 educators had the opportunity to learn more about energy with NEED and the Society of Petroleum Engineers (SPE) at the SPE Annual Conference hosted in Denver last month. Educators participated in NEED activities, toured the energy technologies on the exhibit floor, and spoke with energy professionals about careers in the energy industry. Special thanks to Darci Ramirez and Margaret Watson of SPE for their support of NEED's efforts!

# NEED News

## Want to Learn More about Energy from Our Oceans? Check Out the NOIA Activity Books!

The National Ocean Industries Association (NOIA), the Minerals Management Service, and the U.S. Department of Energy sponsored the NOIA Energy Activity Book in partnership with NEED. The Activity Books—perfect for elementary school students—are packaged in class sets of 30. To request a set, email [info@need.org](mailto:info@need.org).



## ENERGY STAR®

### Help NEED Reach Our Goal

As part of the **Change the World, Start with ENERGY STAR®** campaign, NEED made a goal to prevent 5,198,000 pounds of greenhouse gas emissions by making energy efficient choices in our homes and schools. By replacing lighting with CFLs, purchasing new ENERGY STAR® qualified appliances, powering down computers and monitors when not in use, or setting a programmable thermostat, every small change makes a big difference in the fight against climate change.

In order to meet this goal, we want every NEED student to spread the word about energy efficient choices to their parents and community members, and to encourage them to take the ENERGY STAR® Pledge.

This year, you can enter your Pledge more than once. You can Pledge today to change your furnace's air filter, and if you decide to purchase a new computer monitor for Christmas, you can sign the pledge again. **We are counting the total amount of greenhouse gas emissions we prevent from now until Earth Day (not the number of pledges we collect).** We don't have much time to spread the word and collect Pledges, so go to [www.need.org](http://www.need.org) to download the teacher guide and get started. Visit [www.energystar.gov/changetheworld](http://www.energystar.gov/changetheworld) to learn more about the campaign.

### ComEd

The ComEd sponsored Illinois Energy Workshops and Illinois Solar Schools Workshops have been scheduled. These one-day workshops provide participants with hands-on science kits, class sets of home energy efficiency kits for their students, and access to NEED resources. To learn more or to register for a workshop, visit [www.need.org/ComEd](http://www.need.org/ComEd).

### New York - Energy Detectives

NEED is pleased to partner with National Fuel—the Buffalo-based Natural Gas provider—on their Energy Detectives program. Participating teachers attend workshops, receive hands-on kits and are provided class sets of the Energy Detectives Home Energy Efficiency Kit that includes energy conservation measures to be installed in the home. Students educate their families about energy conservation and efficiency.



Kentucky NEED students educate consumers at a local hardware store about the benefits of CFLs.

### Kentucky

Last year Kentucky NEED had great success with its Change a Light, Change the World campaign. This year participants will again have the opportunity to receive \$350 mini-grants in partnership with the Kentucky Department for Energy Development and Independence. New for the 2008-2009 campaign is an emphasis on educating consumers about the ENERGY STAR® Label. The Kentucky NEED Change the World, Start with ENERGY STAR® campaign launched during the October 6-7, 2008 Governor's Conference on the Environment in Lexington, Kentucky.

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# NEED News

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## Thank You, Zarin!

Congratulations to Zarin Sidiqi, NEED's Office Administrator, on her recent marriage! Zarin and her husband Samir are relocating to New York, NY. We will miss you! Zarin's constant support of programs and the high level of customer service she provided to teachers and students helped make NEED successful at the local, state, and national level. Zarin, thank you for your service to NEED!

## RETECH - The Renewable Energy Technology Conference and Exhibition - February 25-27, 2009

Join us at RETECH! The largest trade gathering of the all-renewable energy industry in the United States, RETECH is an unparalleled opportunity to network with industry leaders and forward-thinking, focused organizations with a global view. The NEED Project is proud to be an official Supporting Organization of RETECH 2009. To learn more, visit [www.retech2009.com/?src=need](http://www.retech2009.com/?src=need).

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## NEED in Action

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### NEED and Normalcy After the Storm

Thanks to Nina Corley, fourth/fifth grade teacher at Satori School in Galveston, Texas for sharing her experience.

"Students recently returned to Satori Elementary School after Hurricane Ike devastated Galveston Island. The students who have been able to return so far were all adversely affected by Ike and yet appeared excited to get back to classes. NEED helped make the transition easier for the students with t-shirts, water bottles and hands-on kits. We were back to doing experiments. The students even took the solar balloon out to the newly bleached playground for our first outside recess. We were able to compare this to the balloons we had been experimenting with hot and cold water before the storm. We decided to use the Monitoring and Mentoring Kit to make sure repairs on the school were energy efficient. It was wonderful to hear the "oohs" and "aahs" with smiles on their faces as they were running through the school checking the footcandles of each room (which also gave me the chance to double check for any damage that might have been missed before). They were also excited to have NEED bottles to be able to refill from a parent supplied water cooler until we get potable water again. The students feel like they are helping to conserve energy by not using a different water bottle each time they want a drink. I just wanted to say thanks to NEED. This is the first day it has seemed close to normal again, with the security for all of us that comes with the normalcy and excitement of learning."

## American Electric Power Foundation CFL Distribution

This fall, fourth grade students in Michigan, Indiana, Ohio, Kentucky, Virginia, West Virginia, Tennessee, Arkansas, Oklahoma, Louisiana, and Texas are receiving compact fluorescent light bulbs compliments of the AEP Foundation. Over 150,000 CFLs will be distributed as part of NEED's ENERGY STAR® Change the World campaign.



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## Energy Connections

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Use this song during Language Arts or Music to help reinforce the concept of the water cycle. The song is sung to the tune of "Oh! Susanna."

Note: It helps keep the rhythm of the song if "keep it" and "electricity" are sung quickly.

The sun shines down and heats the land  
It heats the water, too  
The water then evaporates  
Makes clouds for me and you

CHORUS:

Water cycle

Each day you are renewed  
Snow and sleet and rain and fog  
All life depends on you

Condensation makes the clouds  
From water in the air  
Precipitation from the clouds  
Sends raindrops everywhere

CHORUS

The water seeps into the ground  
To places we can't see  
It runs off into lakes and streams  
Keep it clean for you and me

CHORUS

The water's used in many ways  
In everything we do  
Swimming, drinking, washing clothes  
Making electricity, too

CHORUS

*Thanks to the TAB Language Arts committee members Linda Fonner, Linda Hutton and Hallie Mills for creating this song.*

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# Primary Activity: Make a Water Wheel

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## Concept

- The position and motion of objects can be changed by pushing or pulling. The size of the change is related to the strength of the push or pull. (NSECS K-4 Physical Science 2c)

## Materials

(per student)

1 heavy duty or coated paper plate

6 Dixie cups

Pencil (unsharpened)

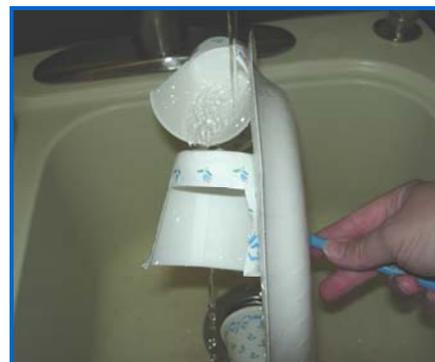
2 rubber bands or clay

Scissors

Stapler

(for whole class)

source of water



## Preparation

1. Make an example water wheel for the students to model, if needed.
2. Poke a hole into the center of each plate.
3. Recruit parent volunteers if students will have difficulty with some of the tasks.

## Introduction

1. Have students brainstorm all the ways people use water. Be sure to include drinking, growing crops, keeping bodies and clothes clean, and recreational activities.
2. Share with students the idea that water can help us do work if it was not included in the brainstorming. Ask students if anyone has seen a water wheel. Allow time for sharing.
3. Give students a basic background of water wheels and hydropower use using the Primary Energy Flipbook ([www.need.org/curriculum.php](http://www.need.org/curriculum.php)).

## Activity

1. Explain to students that they are going to make a model water wheel. Distribute the materials to each student.
2. Instruct students to cut a rectangle into each cup about 1.5 inches long and 1.25 inches wide (measuring is not needed and each cup does not need to be identical, just close).
3. Have students staple each cup to the edge of the paper plate with the top of each cup facing the bottom of the next cup. All openings should be facing the outside edge of the plate and the cups should be fairly evenly spaced.
4. Instruct students to wrap one rubber band around the pencil about halfway on the pencil and then push the pencil through the hole. Have students wrap the other rubber band around the pencil on the opposite side of the plate. There should be one rubber band on each side of the plate, stabilizing it. (If using clay, put pencil through hole and place clay on both sides of the plate to stabilize it.)
5. Give students the opportunity to use their water wheel under a stream of water by holding the pencil lightly in both hands. Allow students to experiment with different amounts of water (strength of flow) and different orientations of their water wheels within the stream of water.
6. Ask students what they observed about how their water wheels turned in the stream of water. Observations may include turning faster/slower with more/less water, turning better/worse when facing towards or away from the water, turning better/worse when holding pencil lightly/tightly.
7. Discuss with students why there were differences in how the water wheels operated. Be sure to include the concept that a stronger push will move the water wheel more than a lighter push. If time permits, have students demonstrate light water pushes and strong water pushes to the class to demonstrate the difference in how the water wheel moves.

## Assessment

Have students share three ways humans use water as a resource. Have students explain why a water wheel would be used in a river instead of a lake.

## Extensions

1. Alternate version of activity: Have ice, steam and liquid water available. Build a water wheel and test in front of the class which form of water moved the wheel the best. Discuss as a class why liquid water is used for water wheels instead of solid or gas (liquid water is prominent on earth, liquid water is easier to move and contain than gas, liquid water is easier to maintain at normal temperatures than solid).
2. Give students the opportunity to make changes to their water wheels to improve how well they operate.

# Elementary Activity: Height and Force of Water

## Concept

- The height of water affects its force.

## Materials (1 set per group)

2-liter bottle, pushpin, duct tape, wallpaper pan, ruler, towel, marker, water

## Prediction

Read the procedure. Write what you think will happen in your science notebook.

## Preparation

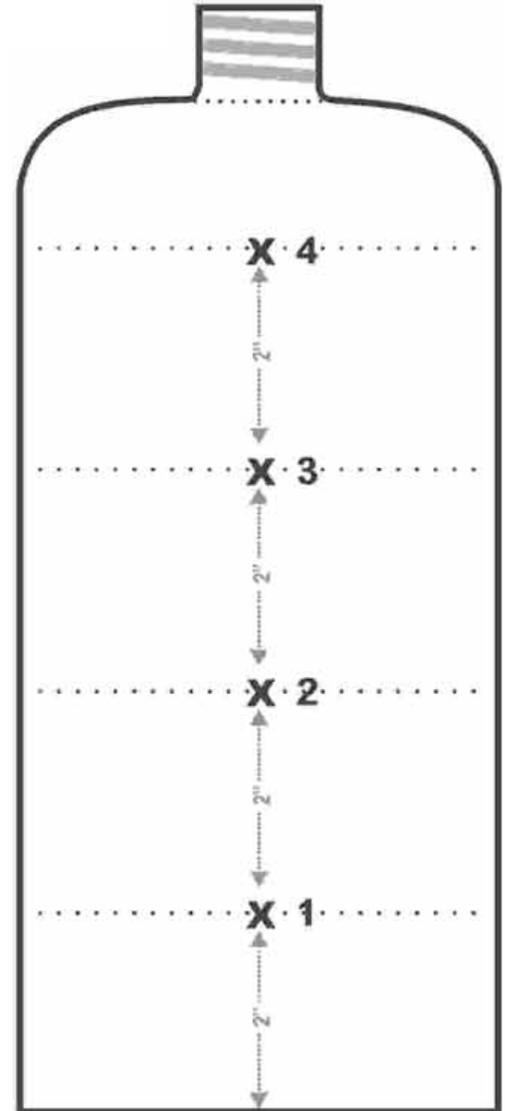
- Use the marker and ruler to draw Xs and lines on the bottle as shown in the diagram to the right.
- Use the pushpin to make small holes through each X. Cover all of the holes securely with separate pieces of duct tape.

## Procedure

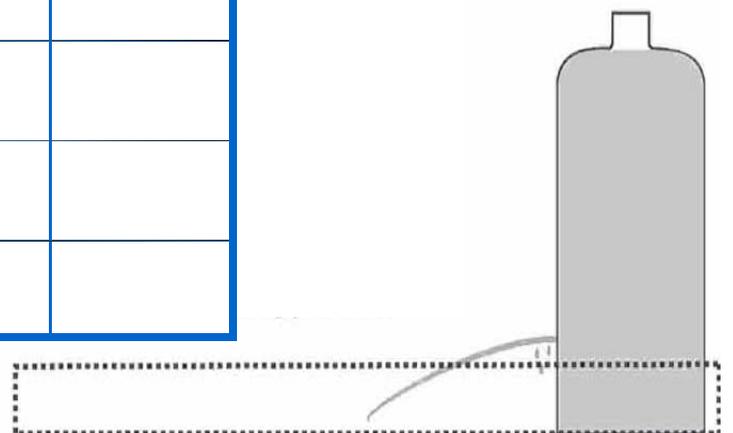
- Fill the bottle with water to the top line.
- Place the bottle at one end of the wallpaper pan with the holes pointing into the pan. Use the ruler and marker to mark one inch marks from the bottle to the end of the pan.
- Remove the duct tape from Hole 1 and immediately measure the distance the water projects out from the hole. Record your data in the chart.
- Cover the hole with your finger, refill the bottle with water, uncover the hole and measure again. Repeat once more for a total of three trials.
- Empty the bottle, dry the outside well, and cover the hole with duct tape.
- Repeat Steps 3-5 for Holes 2-4.
- Calculate the average distance the water projected for each hole.

## Assessment

Answer the following in your science notebook: How does the height of the water affect its force? Explain using your data.



Height	Trial 1	Trial 2	Trial 3	Average
Hole 1				
Hole 2				
Hole 3				
Hole 4				



# Intermediate Activity: Choose Your Own Hydropower Adventure

## Concepts

- Water circulates through the crust, oceans, and atmosphere in what is known as the water cycle. Water evaporates from the earth's surface, rises and cools as it moves to higher elevations, condenses as rain or snow, and falls to the surface where it collects in lakes, oceans, soil, and in rocks underground. (NSECS 5-8 Earth and Space Science 1f)
- There are many ways to generate electricity using hydropower. Hydropower is the energy of moving water.
- All energy can be considered to be either kinetic energy, which is the energy of motion; potential energy, which depends on relative position; or energy contained by a field, such as electromagnetic waves. (NSECS 9-12 Physical Science 5b)
- The sun is the major source of energy for phenomena on the earth's surface, such as growth of plants, winds, ocean currents, and the water cycle. (NSECS 5-8 Earth and Space Science 3d)

## Time

About 45 minutes

## Materials

Station posters, 8 dice, colored pencils

## Preparation

1. Print copies of the station posters (download from [www.need.org/newsletters.php](http://www.need.org/newsletters.php)) and hang them around the room. Place one die at each station.
2. Classroom management: since every student needs to start at the RIVER station and end at the HOME station, it is suggested you have students start the game a few at a time.

## Activity

1. Give students the following directions:

*How many steps will it take to generate electricity using hydropower? You are going to create your own adventure to find out. There are eight different stations set up around the room. You might visit them all, or you might not. Only one person can be using a station at a time, so you will need to form a line at each station and wait your turn. Write down each step (station) of your adventure in your science notebook as you visit each station.*

*Each of you will begin as a water molecule floating down a river. You will start at the RIVER station. Roll the die once. Follow the instructions on the poster for the number you roll. For example, if you roll a three, you will read number three on the poster. The capitalized word tells you which station to go to next.*

*Walk to your next station and get in line. If a roll instructs you to stay at the same station, go to the end of the line and wait for your next turn. Keep playing until you reach the HOME station. After rolling the dice and recording this step of the adventure in your science notebook, you will return to your seat. I'll send a few students at a time to get started.*

2. Allow time for all students to complete one hydropower adventure.
3. When everyone has returned to their seat, give students the following directions:

*Now you are going to sketch your journey in your science notebook using a pencil. Everyone started as a molecule of water floating on a river. So draw a river (you may want to demonstrate on the board—two parallel squiggly lines would work well). Label this "river."*

*Where did you go next? For example, if you went to the cloud station, you'll draw a cloud above the river and label it "cloud." If you went to the reservoir, you'll need to draw a circle at the end of the river and label it "reservoir." As you are drawing, keep in mind all the steps you took on your adventure so you have enough space on your paper.*

4. Allow a few minutes for students to draw their adventures. Then give the following directions:

*Now take a colored pencil and lightly draw in arrows to show how you moved from step to step. Everyone's first arrow will go down the river. If your second step was the cloud, draw an arrow from the river to the cloud. Draw an arrow for each step of your adventure.*

## Discussion

1. Let a few students share their adventures using their drawings.
2. Discuss the water cycle. Label parts of the water cycle, such as evaporation and condensation, on student drawings. Point out that the water cycle is not necessarily a full circle. Does anyone's drawing demonstrate this? (e.g., water molecule cycles from ocean to cloud, back to ocean, back to cloud, etc.) Also discuss the source of energy that drives the water cycle (the sun's radiant energy).
3. Discuss and label the forms of energy found on students' drawings. Discuss and label energy transformations found on students' drawings. Give students time to share their adventure with a partner, explaining the forms of energy and energy transformations taking place as their water molecule moved through the water cycle and generated electricity using hydropower.

## Assessment

Instruct students to write a descriptive paragraph under their sketch describing their adventure, including forms of energy and energy transformations occurring along the way.

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# Secondary Activity: Hot Topics in Hydropower

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## Concepts

- Hydropower as an energy resource has both advantages and disadvantages.
- Humans populations use resources in the environment in order to maintain and improve their existence. Natural resources have been and will continue to be used to maintain human populations. (NSECS 9-12 Science in Personal and Social Perspectives 3a)

## Introduction

1. Introduce the concept of using water to generate electricity to the students using Secondary Infobooks (available at [www.need.org/curriculum.php](http://www.need.org/curriculum.php)).
2. Discuss as a class some of the advantages and disadvantages to using hydropower.

## Activity

1. Choose a scenario for your class. Assign each student or team of students roles or viewpoints to represent.
2. Allow students time to research their roles and points of view. Have students write persuasive essays supporting their positions.
3. Have students debate and determine how they would proceed in their scenario. Consider inviting guests to pose questions or give additional viewpoints.

Scenario 1: You reside in a coastal town on the ocean. Your power is supplied by a hydropower plant, but people are also interested in harnessing the energy from the ocean. Based on your assigned role, research the effects of a tidal or wave plant, and how the energy from the hydroplant might be increased to determine which is the better option to meet your town's energy needs. Give at least three reasons for your position, and support each reason with three facts.

- Local Energy Company Representative - Trying to provide the most cost effective energy.
- Residential Consumer - Wants cheap electricity, but doesn't want to pay taxes to get it.
- Ocean View Homeowners Association Representative - Concerned about how tidal energy facilities will affect property values.
- Local Indian Tribe Representative - Has fishing rights in the ocean.
- Sports Fisherman - Wants fish population to remain high.
- Mayor - Priority is to improve business options and way of life.
- Hydropower Plant Manager - Wants money to go toward improving the current dam facility, upgrading it to produce more energy.
- Hydro Scientist - Enthusiastic for advancing hydropower technology.
- Marine Biologist - Concerned about the effects on the local marine environment.
- Marine Mammal Activist - Wants to make sure marine life will not be affected.
- Renewable Energy Enthusiast - Wants any sort of renewable energy improvements.
- Hydro Developer - Wants to bring future of hydropower to locale.
- City Council Member - Priority is keeping the best interest of the city in mind.
- Plant Manufacturer - Is interested in building a plant next to the dam.

Scenario 2: You live in an area where historically there was a large salmon population in the local stream. But it was dammed 50 years ago to produce electricity. Now people want to decommission the dam to allow more spawning salmon to return to their breeding grounds. Based on your assigned role, research the impact of removing the dam as well as the impact of the dam on local economy, fish populations, environment and energy needs. Determine if in your role you support or are against decommissioning the dam. Give at least three reasons for your position, and support each reason with three facts.

- Local Energy Company Representative - Trying to provide the most cost effective energy.
- Residential Consumer - Wants cheap electricity, but doesn't want to pay taxes to get it.
- Local Indian Tribe Representative - Has fishing rights in the river.
- Sports Fisherman - Wants fish population to remain high.
- Mayor - Priority is to improve business options and way of life.
- Hydro Scientist - Wants to keep using river for electricity production.
- Environmental Biologist - Wants to protect the environment.
- City Engineer - Oversees engineering of projects.
- Environmental Activist - Wants environment returned to natural state.
- Renewable Energy Enthusiast - Wants to keep using renewable energy.
- City Council Member - Priority is keeping the best interest of the city in mind.
- River Property Owner - Concerned about flood control.
- Reservoir Property Owner - Concerned about property values.
- Recreational Boater - Likes to sail on the lake.
- Water District Supervisor - Concerned that the reservoir is used to supply local drinking water.

## Short Circuits



### Turning Plastic into Fuel

An alternative to recycling plastic is changing it into a carbon-based fuel, similar to the petroleum from which it was originally made. Polymer Energy™, LLC. has a system that converts plastics into crude oil. This technology was awarded the Gold European Environmental Press Award in 2006. The Polymer Energy™ system uses catalytic pyrolysis to convert unsorted, unclean plastics into crude oil. While only certain kinds of plastics work in this system—mostly high and low density polyethylenes (HDPE and LDPE), and polypropylene (PP)—they are common plastics like those found in shopping bags, computers, and packaging for cleansers or cosmetics. The product that comes from the Polymer Energy™ system can be further processed at a refinery into liquid fuel, such as gasoline.

For more information, visit [www.polymerenergy.com](http://www.polymerenergy.com).

### Generating Electricity by Bobbing the Waves

The island nation of Ireland is looking to the ocean for energy. Ideally situated for using ocean wave energy, Ireland has been researching the possibility of commercial-scale electricity generation using the waves that crash against its shores. Wavebob Ltd., an Irish wave-energy development company, and Vattenfall AB, a Swedish European electric provider, announced that a collaboration between the companies would result in a commercial wave farm off the west coast of Ireland. First off, though, is making the first full-scale Wavebob by 2010. Tests so far have used 1:50, 1:20 and 1:4 scale versions of the Wavebob.



The United States is also catching the wave. Earlier this year Wavebob announced the opening of U.S.-based operations in Annapolis, Maryland.

For more information, visit [www.wavebob.com](http://www.wavebob.com).

