

Putting Science and Imagination to Work

Show your students how to energize their future

Dear Educator:

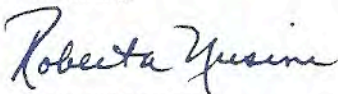
The award-winning curriculum specialists at Young Minds Inspired (YMI), along with the scientists at GE, are pleased to present you with the enclosed teaching guide designed to accompany the special magazine, **ecomagination for KIDS!**

The **ecomagination for KIDS!** magazine is part of a GE commitment to use technology to help solve some of the world's toughest problems. **Ecomagination** is a GE initiative designed to help customers improve environmental and operational performance. Along with engaging material that you can use with your students, there also is information in the magazine about a special section of the GE Web site (www.ge.com/geoterra) where students can have fun as they learn about the things they can do to help protect the environment.

The materials in this program are designed to help your students develop an even deeper understanding of important issues that relate to energy and the environment and, ultimately, to our very quality of life. The four activities, **designed to help you meet National Science Standards**, focus on the wind and the sun as sources of energy and power, on conserving and protecting our water supply, and on the effect of greenhouse gases.

Although the materials in this program are copyrighted, you may make as many copies as necessary to meet your students' needs. As former teachers, we are sure that you will find this guide to be a valuable instructional tool that you will want to share with colleagues.

Sincerely,



Roberta Nusim
Publisher and former teacher



Joel Ehrlich
President and former teacher



Dr. I.M. Brainy



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imagination at work

Program Components

1. This teacher's guide
2. Four reproducible student activity masters
3. Sixty **ecomagination for KIDS!** magazines
4. A response card for comments

Program Objectives

1. To help students understand the importance of respecting and protecting the environment.
2. To motivate students to understand the role of technology in finding solutions to environmental issues.
3. To encourage students to focus on renewable sources of energy.
4. To engage students in hands-on learning activities designed to strengthen their commitment to being good environmental stewards.

Target Audience

This program has been designed for upper elementary school students in grades 4-6. The activities focus on conserving water, wind power, solar energy, and greenhouse gases.

How To Use This Guide

Photocopy and distribute one copy of each activity master, along with one copy of **ecomagination for KIDS!**, to each student. Use the activities to build upon the information in the magazine, and share additional copies of both with colleagues.

Resources

Ecomagination: <http://ge.com/ecomagination>

GE Energy: <http://geenergy.com>

U.S. Environmental Protection Agency: www.epa.gov

Florida Solar Energy Center: www.fsec.ucf.edu/ed

4empowerment: Science Resources:

www.4empowerment.com/en/science/

Young Minds Inspired: www.ymiteacher.com

NATIONAL SCIENCE EDUCATION STANDARDS

Activity 1 The Power of the Wind

- Understand about scientific inquiry.
- Measure and graph the motion and speed of an object.

Activity 2 Water, Water Everywhere...

- Understand the water cycle.
- Understand evaporation.

Activity 3 Our Amazing Sun

- Understand that the sun is a major source of energy.
- Understand that heat can be produced in many ways.

Activity 4 The Great Big Greenhouse

- Understand that humans depend on their natural and constructed environments and that humans change environments in ways that can be either beneficial or detrimental.

Activity 1

The Power of the Wind



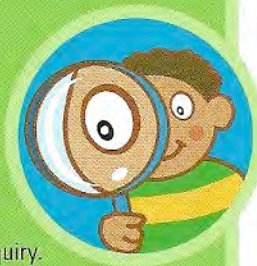
Part A. This activity is designed to be completed at home. Encourage students to complete it with a parent. It is intended to help students begin thinking about the wind and the power it has to move things. As you distribute the activity master, lead a discussion about the wind: Does the wind always blow from the same direction? Do structures (the house, garage, etc.) affect the way the wind blows? The bubbles students will use as they map the wind are light and move easily. What other things move easily in the wind (leaves, dandelion seeds, etc.)? Note: Make sure that students understand the materials they will need—a bigger version of the wind-mapping grid (consider doing this as a class activity), a tape measure or yardstick, soapy water, and a small loop to spread the bubbles. (A loop can be made from several grocery store twist ties.)

Part B. You'll need several small electric fans, plastic grocery bags, and a supply of the objects listed on the activity sheet for this activity. To begin, have students work in small groups to make their predictions. To test their predictions, they will place one object at a time in their plastic bag and hold it in front of the fan. You might also have students experiment with other objects, making predictions about how strong the fan (wind) would have to be to move heavier objects.

Part C. A good place for students to begin their research is Windmill World, www.windmillworld.com

Extended Activities

- If your students have ever witnessed it firsthand or seen pictures of the damage that can be done by a tornado, they know just how powerful the wind can be. To simulate this phenomenon, have students work in groups to create a tornado in a bottle. Each group will need two clean, empty 2-liter soda bottles. They should fill one bottle half full with water and then tape the two bottles together securely, end to end, at the opening. (Duct tape works best for this.) Next, they should pick the bottles up carefully, swirl them around so the water begins to spin, and quickly flip them over. You also might ask students to find photographs that depict the damage



that can be done by the powerful winds in tornadoes.

- The Dust Bowl of the 1930s was caused by poor agricultural practices coupled with a lengthy, extreme drought. The wind was so fierce that it left the furniture in even well-sealed homes covered with dust. Ask students to interview parents and other family members about wind storms or other experiences involving wind, such as hurricanes, that they may have witnessed. Provide time during class for students to share what they learned.

Activity 2

Water, Water Everywhere...

Part A. To help students get started with the first part of this activity, suggest that they walk through an average day mentally, noting each time they use water—including flushing the toilet, brushing their teeth, taking a shower, etc. Responses to the second part might include: turn off the tap while brushing your teeth; water house plants, etc., with the water saved in clean, empty milk bottles when running the faucet to get hot water. To complete the activity, compile a class list of water conservation ideas and share it with students in other classes.



Part B. Begin by talking to your students about the water cycle: The sun heats the water in lakes, streams, etc., and the warm water evaporates and rises into the atmosphere. The evaporated water is returned to the earth in the form of precipitation (rain, snow, sleet, or ice).

To complete the activity, you will need the following materials for each group of students: 2 quarts of water, 4 cups of sand, several small stones, a clear glass mixing bowl, a short drinking glass, and clear plastic wrap.

Instruct your students to:

1. Mix the sand and water in the mixing bowl.
2. Stand the glass in the middle (the glass should be tall enough that the water in the bowl cannot flow

into it, but shorter than the top of the bowl).

3. Cover the bowl with the plastic wrap and weight the edges down with rocks.
4. Place one rock in the center of the plastic wrap, directly above the glass.
5. Place the bowl in direct sunlight and leave it there for several hours. The bowl should contain dried or damp sand and the glass should contain relatively clean water. Your students will discover that they have demonstrated the processes of evaporation and condensation—just like when the sun heats water causing it to evaporate, leaving dirt and debris on the ground. The sun also heats the air, causing it to rise. The evaporated water in the air condenses, or turns back to liquid.

Part C. A good place for students to begin their research is the EPA's Web site, www.epa.gov/safewater/kids/other.html

Extended Activity

Lots of people today use grey water—water that is saved after washing dishes, bathing, etc.—to water lawns and gardens and to conserve fresh water. Have your students do some research to learn more about how grey water is being used and about some of the new products that have been designed to facilitate the process. Then, have them talk with their parents to decide if there are ways their family might be able to use grey water. Ask them to bring suggestions back to class for discussion.

Activity 3

Our Amazing Sun

Part A. Student responses to the question in this section of the activity sheet might include: to heat our homes or our water, to power traffic signs seen along highways, and on satellites. Explain that solar electric panels are made up of silicon—the same thing that makes up sand. The silicon is heated to extremely high temperatures and formed into thin wafers. When sunlight hits a solar panel, it makes the electrons in the silicon move around. The electrons flow through wires in the solar panel, generating electricity.

Part B. You will need two clean, empty soda bottles and two small balloons for



The Amazing Rayz

each group of students. Half the bottles should be painted white and half should be painted black. You can prepare the bottles in advance yourself or you can ask your students to do it. Each balloon should be secured tightly on the mouth of a bottle. Students should take their bottles to a bright, sunny location and observe what happens for about 15 minutes. (The balloon on the black bottle will begin to inflate.) As students observe, discuss the sun as a source of energy and explain that what they are doing is collecting the sun's energy in the form of heat.

Part C. Encourage students to brainstorm ideas with their parents or other family members. Provide time for students to share their ideas during a class discussion.

Extended Activity

Make a solar cooker with your students for another good demonstration of how the sun's energy can be harnessed. Directions can be found at many different online sites, including www.solarcooking.org

Activity 4

The Great Big Greenhouse

Part A. Divide your students into small groups. Each group will need two small thermometers and a glass jar or other clear container large enough to hold one of the thermometers. Have students take

their baseline reading by putting both thermometers in direct sunlight. After three minutes, have them record the temperatures on the chart. Next, they should invert the jar over one thermometer, being careful not to cast a shadow on the other thermometer. Keep time, with students recording the temperature of each thermometer at one-minute intervals (up to four minutes) on the chart. (Note: This experiment

can be done on a sunny day, or you can use high-wattage light bulbs.) After students have completed the experiment and written their responses, lead a class discussion. Students should understand that, because the air over the exposed thermometer could circulate, it stayed cooler than the thermometer in the jar—where the air was trapped and heated, just like the greenhouse gases trapped in the earth's atmosphere heat the air we breathe.

Part B. Begin by talking about greenhouse gases. Explain that some greenhouse gases occur naturally in the atmosphere, while others result from human activities.

Naturally occurring greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide, and ozone.

Tell your students that certain human activities add to the levels of most of these gases. For example, carbon dioxide is released to the atmosphere when solid waste, fossil fuels (oil, natural gas, and coal), and wood and wood products are burned. Student responses in this section of the activity master might include: turning off the TV, lights, and computer when they aren't using them; setting the thermostat lower in winter and higher in summer; carpooling or riding a bike instead of making individual trips in the car. To extend the discussion, talk to your students about how making a point to recycle and to buy recycled products also helps to save energy and reduces the emissions of greenhouse gases.

Part C. Students can develop individual energy conservation checklists or combine the best ideas into a master list that they can take home to share.

Extended Activity

Challenge your students to use what they have learned as they completed the activities in this program to design their own energy-efficient house of the future. What current technologies would they use to save energy? What technologies do they think might be available in the future to use?



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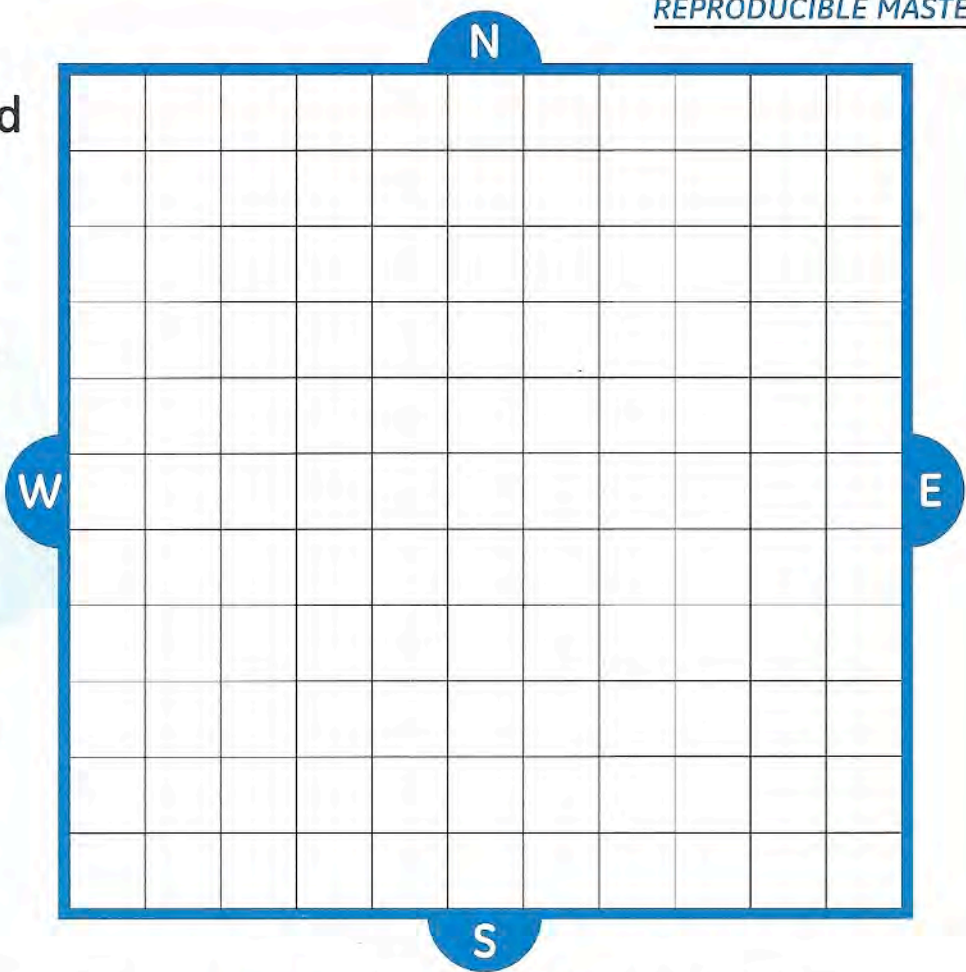
imagination at work

Activity 1

The Power of the Wind

Have you ever watched a sailboat glide across the water? If so, you've seen wind energy in action! The power of the wind is also harnessed and turned into electric energy by giant wind turbines. (You can learn more about wind turbines on page 5 of the **ecomagination for KIDS!** magazine.)

Part A. You probably notice when it's really windy. You might even notice when there's no wind at all. But if you're like most kids, you probably don't think much about the direction the wind blows, or how hard it's blowing on normal days. Well, that might change after you finish your own personal wind map! You'll need a bigger drawing of the wind-mapping grid shown on this sheet, some soapy water, and a small loop with which to spread the bubbles.



Here's what to do:

1. Draw your house and the other things around it that don't move (trees, fences, etc.) on the wind-mapping grid above.
2. Go outside your house and pick a place to stand. Mark your location with a (1) on your map. Blow some bubbles, and draw a line that shows the direction they go. Measure how far they went, and estimate how fast they traveled. Write your observations in the space below. Then, repeat the process at different spots in the yard. If you don't have a yard, you can do this activity at a local park or playground.

DISTANCE THE BUBBLES TRAVELED	SPEED AT WHICH THE BUBBLES MOVED <small>(slow, medium, fast, not at all, etc.)</small>
1. _____	
2. _____	
3. _____	
4. _____	
5. _____	

Part B. How does the wind affect other things? Which of the following items do you think will be affected by the wind generated from a small electric fan? Write your predictions in the first column. Then, note what actually happens.

WILL THE WIND MOVE IT?

	MY PREDICTION	WHAT ACTUALLY HAPPENED
Ping-Pong ball	_____	_____
Foam packing "peanut"	_____	_____
Rubber band	_____	_____
Paper clip	_____	_____
Playing card	_____	_____
Cotton ball	_____	_____

Part C. People have been using windmills to harness the power of the wind for centuries. The Netherlands is the country that most people associate with windmills, but they exist all over the world. Do some research to learn about the different kinds of windmills that are in use today in The Netherlands and other places. You can make your notes on the back of this sheet.

Activity 2

Water, Water Everywhere...

Although most of the earth's surface is covered with water, in some parts of the world people don't have enough water to drink. That's because most of the water on Earth (97%) is in the oceans, and it's full of salt. Desalination—the process of taking the salt out of water—is one important solution to the water shortage problem. (You can find out more about desalination on pages 6-8 of **ecomagination for KIDS!**)

Part A. It's clear. It's tasteless. You can't smell it. So, what's the big deal about water, anyway? It's this simple: Water is the most important resource we have. We can't live without it. Did you know, for example, that a person can live about a month without food, but only about a week without water? Depending on where you live, you may have experienced the effects of a water shortage. Your family may have been asked not to water the lawn, or to make sure the dishwasher was full before running it, for example.

Because it's such a valuable resource, it's important not to waste clean water, even when there isn't a water shortage. First, in the space below, list all the ways you use water every day.

Now, list as many things as you can that your family could do to help conserve water.

Part B. Evaporation. Condensation. Precipitation. These are the three most important processes of the water cycle. One of the most important results of the water cycle is clean water. Follow your teacher's instructions to see how it works. Write your observations and conclusions in the space below.

What did you find when you checked the bowl?

What parts of the water cycle were responsible for what you saw?

How does the process you have observed work in the real environment?

Part C. Have you ever stopped to think about where the water that comes out of the faucet comes from? Unless your water comes from a well, it originates in local lakes, rivers, and streams. When it rains, more water falls into these water sources. But some rain falls on other areas—lawns, parking lots, streets, etc.—and it travels back to our drinking water sources through storm drains, along with all the pollutants that also are on the ground. That's why it's important to keep things like pesticides, fertilizer and motor oil from places where they can be carried into storm drains.

With your group, do some research to learn more about protecting the water supply. You can use the back of this sheet to make your notes. Then, combine your information and plan a brochure or poster that will teach other kids about the importance of keeping our streams and rivers clean.



Activity 3

Our Amazing Sun

There's something about a sunny day that just makes you feel energized. The power of the sun can be used to produce other kinds of energy, too. And the best part is that the sun is a source of renewable energy. As much solar energy as we use, we just can't use it up! (You can find out more about renewable energy sources on pages 4 and 5 of **ecomagination for KIDS!**)

Part A. There are lots of ways to use solar energy—the light or heat that comes from the sun—and those different uses fall into two basic categories. First, we can use solar energy to heat things. This is called **thermal energy**. In the space below, list three things that solar energy can be used to heat.

1. _____
2. _____
3. _____

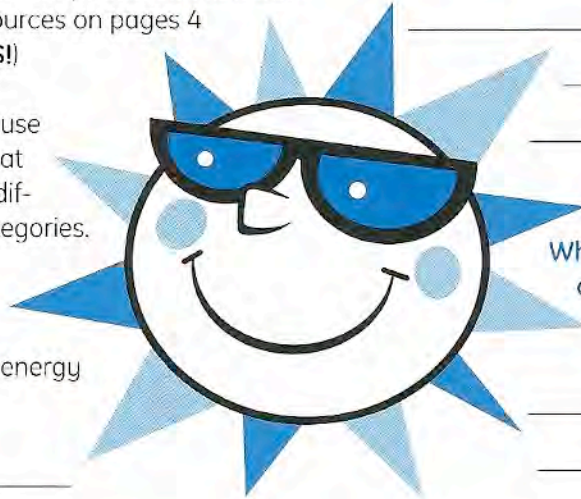
We also can use special solar panels to turn the sun's light into electricity. This is called **photovoltaics** (**photo** means light and **voltaic** means electricity). Do some reading to learn more about solar panels and how they are used. You can use the back of this sheet to make notes for a class discussion.

Part B. You know that the sun is a source of heat, because you can feel it when you stand in a sunny spot. Now, let's take a look at what that heat, or thermal energy, can do. Follow your teacher's instructions as you work in your group. Write your observations in the spaces below.

What did you notice about the bottles when you touched them?

What happened to the balloons?

Why do you think that happened?



Why do you think people in hot climates wear light clothing?

Part C. Now that you know a little about the ways solar energy can be used today, what do you think the next big use for it will be? Write your idea in the space below.

Activity 4

The Great Big Greenhouse

Have you ever heard of the greenhouse effect? That's what happens when certain gases in the earth's atmosphere trap the heat from the sun. And, while you may have heard about global warming (that's when too many greenhouse gases and heat are trapped in the earth's atmosphere, causing our climate to slowly become warmer), the greenhouse effect is a good thing. It keeps our atmosphere warm enough for us to live comfortably.

You'll learn more about greenhouse gases and the greenhouse effect as you complete the activities on this page. But first, find out how much you already know about the environment. Try the environmental challenges on pages 12 and 13 of **ecomagination for KIDS!** to find out.

Part A. Follow your teacher's instructions as you work with the members of your group to see for yourself just how the greenhouse effect works. Use the temperature chart below to record your observations.

	Thermometer 1	Thermometer 2
Sunlight only - baseline		
Sunlight/jar - reading 1		
Sunlight only - reading 1		
Sunlight/jar - reading 2		
Sunlight only - reading 2		
Sunlight/jar - reading 3		
Sunlight only - reading 3		
Sunlight/jar - reading 4		
Sunlight only - reading 4		

Now, write your responses to the following two questions:

What happened?

Why do you think it happened?

Part B. We do lots of things every day that increase the amount of greenhouse gases we emit. That's because much of the energy we use comes from fossil fuels such as coal and oil, and when we burn them they release these gases. And, since so many people are using fossil fuels, the atmosphere is collecting too many greenhouse gases. (Too much of a good thing can be a bad thing!)

Any time you use electricity, you put more greenhouse gases into the air. The same thing happens when you ride in a car. In the space below, list some basic things you can do that will help to reduce the emissions of greenhouse gases. Use the back of this sheet if you need more space.

Part C. Did you know that you generate approximately 6.6 tons of greenhouse gases every year? Each person living in the United States does—and that's way too much. Do some reading and learn about more ways you can help save energy and reduce the amount of greenhouse gases that **you** emit. Then, turn what you learn into a checklist that each member of your family can use to do his or her part to help save energy and protect the earth's atmosphere.



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