TEACHER'S GUIDE
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Follow-up Activities

- Have students investigate the concept of energy transfer by dropping a marble onto soft clay. What effect does the marble's position above the clay have on the energy transferred?
- Create an "Energy Transfer Museum." Ask students to bring in toys, tools, devices or cut-out pictures of things that demonstrate some form of transfer of energy. Ask them to be ready to explain the transfer of energy that takes place.
- Have students work in groups to develop their own energy-transfer machines using common supplies.
- Assign each student a specific type of energy to research (chemical, electrical, wind, water, light, sound, etc.) and have them discover how it is transformed into other forms of energy.
- Have students investigate a pendulum, deducing how and why the pendulum (a swinging object on the end of a string) swings longer and farther the higher it starts its fall. Have students drop the pendulum from at least four different heights, measuring how high it swings to the other side and counting the number of times it swings before stopping.

Suggested Internet Resources

Periodically, Internet Resources are updated on our Web site at www.LibraryVideo.com

- **www.energyed.ecw.org/acrobat/evidence.pdf**
  These printable energy lessons are geared to K–2 students and are designed to illustrate how energy is used in daily life.
- **www.energy.ca.gov/education/projects/projects-html/projects.html**
  This page from the "Energy Quest" Web site of the California Energy Commission lists a number of projects that will assist students in creating energy-transfer machines.
- **www.eecs.umich.edu/mathscience/funexperiments/agesubject/lessons/whelmer/energytrans.html**
  This hands-on science activity about energy transfer from the McREL Web site is based on Steve Jacobs' Whelmers. Lessons on this site have been aligned with the National Science Education Standards.

Suggested Print Resources

- Energy Center of Wisconsin. *K–12 Energy Education Activity Guide.* Madison, WI; 1997.
- Gutnik, Martin. *Projects That Explore Energy.* Millbrook Press, Brookfield, CT; 1994.
- Harlow, Rosie. *Energy and Power.* Kingfisher Books, New York, NY; 1995.
- Hewitt, Sally. *Full of Energy.* Watts Publishing, Danbury, CT; 1998.
- Oxlade, Chris. *Energy and Movement.* Children's Press, New York, NY; 1999.
- Stringer, John. *The Science of a Spring.* Raintree-Steck Vaughn, Austin, TX; 2000.

TEACHER'S GUIDE CONSULTANT

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TITLES

- **ALL ABOUT HEAT**
- **ALL ABOUT THE CONSERVATION OF ENERGY**
- **ALL ABOUT THE TRANSFER OF ENERGY**
- **ALL ABOUT THE USES OF ENERGY**
- **WHAT IS ENERGY?**

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Energy for Children™

All About the Transfer of Energy

Grades K–4

This guide is a supplement, designed for educators to use when presenting this program in an instructional setting.

Before Viewing: Research in learning suggests that it is important for the teacher to discover what the students know — or think they know — about a topic, at the start of a new unit, so that their accurate conceptions can be validated and reinforced, and their misconceptions identified and corrected. Therefore, after reviewing the pre-viewing discussion questions provided for your class, create an "Everything We Know About…" list. Preview key vocabulary words and have students raise additional questions they hope will be answered by this program. Most importantly, students should be told that as "science detectives" they must listen closely, so that after viewing the program, they will be able to tell whether or not the facts/beliefs they put on their list were scientifically accurate.

After Viewing: After a brief discussion about the program, challenge your "science detectives" to prove or disprove the accuracy of the facts they put on their "Everything We Know About…" list. Discuss what else they learned and use the follow-up questions and activities to inspire further discussion. Encourage students to research the topic further with the Internet and reading resources provided.

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Program Summary

You are doing work whenever you move something or change it in some way. It takes energy to do work! Energy comes in many forms and is either moving or stored. You see energy in action in working machines, falling water, blowing wind, flying birds and playing children. Energy in motion is called kinetic energy. Examples of stored or potential energy are gasoline for cars, wood for fires, batteries for toys and food waiting to be eaten. The stored energy these things contain can be used to do work. Some things have potential energy because of their position. A diver standing on a high diving board has greater potential energy than a diver on a low board.

Energy can change forms from potential energy to kinetic energy. When a diver actually leaves her high diving board—where she has potential energy, just waiting to be used—she descends to the water, changing the potential energy to kinetic or moving energy. This change in form of energy is called a transfer of energy. The diver's potential energy was changed or transferred to kinetic energy when she moved off the board. When a skateboarder skates up a wall to the top, he stops a moment before sliding downhill and up the other side once again. The skateboarder is transferring energy over and over again, from kinetic (skating up the hill) to potential (resting at the top) and back to kinetic energy. Energy can also be transferred from one object to another. When you hold a bowling ball before you release it down the alley, it has potential energy. When you release it, letting it roll toward the pins, it has kinetic energy. When the ball hits the pins, the kinetic energy from the ball is transferred to the pins. As a result, the ball slows down and the pins start moving with their new supply of kinetic energy.

Machines do work by transferring energy. In steam engines, stored energy from fuel like wood or coal is burned, heating water into steam. The steam turns gears and the wheels to make the engine move forward. In this case, the potential energy of the fuel is transferred to moving steam, and the kinetic energy of the moving steam is then transferred to the gears and wheels. In the same way, the food you eat has lots of potential energy from the sun that has been transferred to energy stored in plants. When you eat and digest the food, the stored energy is released and transferred to kinetic energy so that you have the energy to move around and keep your body warm. Just like a steam engine, your body is actually an energy-transfer machine!

Vocabulary

The following words are included for teacher reference or for use with students. They are listed in the order in which they appear in the video.

(Continued)

energy — The ability to make things happen or to do work. Energy occurs in many different forms, and can change from one form to another.

work — Any change or movement of an object. Work is done when energy is transferred from one object to another.

fuel — A material that contains stored energy and is available to make things happen.

kinetic energy — Energy that is active or moving.

potential energy — Energy that is stored or waiting to be used. A stretched rubber band or a battery has potential energy.

transfer of energy — The flow of energy from one thing to another or the change of energy from one form to another.

steam engine — A device that changes the stored energy in fuel into active steam energy that moves parts and does work.

James Watt — (1736–1819 C.E.) A Scottish inventor famous for building a powerful steam engine.

Pre-viewing Discussion

Before students generate their list of "Everything We Know About..." this topic, stimulate and focus their thinking by raising these questions so that their list will better reflect the key ideas in this show:

- How do things move or change?
- What is energy?
- How do we get energy from the sun?

After the class has completed their "Everything We Know About..." list, and before watching the show, ask them what other questions they have that they hope will be answered during this program. Have students listen closely to learn if everything on their class list is accurate and to hear if any of their own questions are answered.

Focus Questions

You may wish to ask your class the following questions to assess their comprehension of key points presented in the program.

1. What is energy?
2. Where do people get energy?
3. Why does a car need gasoline to run?
4. What is work? Give some examples of work being done.
5. What kinds of things have moving energy?
6. What are some examples of stored energy?
7. How are potential and kinetic energy different?

(Continued)

8. How can stored energy change into active, moving energy?
9. What is fuel used for?
10. How do we know that wood, coal, gasoline and food all have potential energy?
11. If a huge boulder was at the top of a cliff ready to fall downhill, what kind of energy would it have? How would this change if the boulder started to roll?
12. Which kind of energy do speeding cars have? What about slow snails?
13. What kind of energy do parked cars have? How about stretched rubber bands?
14. What happens to the stored energy of a skateboard as it rolls down a hill?
15. What happens to the moving energy of a skateboard as it goes up a hill?
16. How does a roller coaster use energy transfers?
17. Can kinetic energy be transferred to another object? Explain.
18. Explain how machines transfer energy from one form to another.
19. How is energy from the sun used by plants?
20. How does energy from the sun get transferred to energy that can be used by humans and other animals?
21. Explain why our bodies are called "energy-transfer machines"?

Follow-up Discussion

The most important part of this segment is to examine both the facts and beliefs generated by the class in their "Everything We Know About..." list. Research indicates that students will retain their previous misconceptions–in preference to the new information–until they actively recognize and correct their own errors. Because of this, it is important to lead students to the correct ideas while identifying and correcting any misconceptions from the class list. After reviewing the list, encourage students to share the answers they got to the questions raised before viewing the program.

Thought-provoking discussions provide a good way to assess the overall depth of student understanding. The following are some suggested discussion topics.

- Ask students to explain how they could use the moving bodies of two students in the classroom to demonstrate the transfer of energy.
- Have children explain how we know energy is present even though it cannot be seen.
- Discuss how machines help people do work by transferring energy from one place to another.