TEACHER'S GUIDE
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- A largely untapped source of biomass fuel could be right beneath students' noses. Not only can garbage, like municipal waste and sludge, be fermented into fuel, but landfill gas, which consists mainly of methane, can actually be used as a fuel for powering vehicles or for generating electricity. Have students research how methane gas is extracted from a landfill and write a short summary that highlights the advantages and disadvantages of this kind of biomass fuel. Students can also contact the operators of a local landfill to find out if the landfill is currently extracting methane or has future plans to extract methane.
- How do you design an energy-efficient house? In small groups, ask students to design a house that uses as many energy-efficient and green energy sources as possible. Students should think about both the structure of the house as a whole (what kind of building materials to use, where to place the windows, etc.) and the contents of the house itself (types of heating system and appliances and how they will be powered, etc.). Need ideas? Visit **www.solardecathlon.org** to see what college and university teams came up with in a competition to design, build and operate the most attractive and energy-efficient solar-powered house. After the groups present their own house designs, the class can discuss the various energy-efficient techniques and green energy sources used. Extend this activity by challenging students to research the actual cost of building the energy-efficient houses they designed.

Suggested Internet Resources

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

- **www.iptv.org/exploremore/energy/profiles/profiles.cfm**
  This informative website profiles the different types of energy sources people rely upon to live their lives. The uses, benefits and limitations of each energy source are detailed.
- **www.energystar.gov**
  This website describes the origins of the ENERGY STAR program, how products qualify for the ENERGY STAR and ways homes and businesses can improve energy efficiency.
- **www.nrel.gov**
  The National Renewable Energy Laboratory website contains background information on various kinds of renewable energy and describes the laboratory's research and development of renewable fuels and electricity.
- **www.world-nuclear.org/info/chernobyl/inf07.htm**
  The World Nuclear Association provides a detailed description of the 1986 Chernobyl nuclear power plant accident and its aftermath, including discussion of the environmental and health effects and the current status of the facility.

Suggested Print Resources

- Jefferis, David. *Green Power*. Crabtree Publishing Company, New York, NY; 2006.
- McLeish, Ewan. *Sustainable Homes*. Smart Apple Media, Mankato, MN; 2006.
- Stringer, John. *Energy*. Smart Apple Media, Mankato, MN; 2006.
- Wyman, Bruce and L. Harold Stevenson. *The Facts On File Dictionary of Environmental Science (Third Edition)*. Facts On File, Inc., New York, NY; 2007.

TEACHER'S GUIDE

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TITLES IN THIS SERIES

- **AIR QUALITY**
- **GLOBAL CLIMATE CHANGE**
- **GREEN ENERGY**
- **SOIL QUALITY**
- **SUSTAINABILITY IN THE 21ST CENTURY**
- **WATER QUALITY**

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Environmental S·C·I·E·N·C·E for Students™

GREEN ENERGY

Grades 5–12

An understanding of the environment and the relationship that humans, plants and animals have with it is instrumental in developing environmental literacy. Such awareness can help to shape future understandings of the Earth and our actions as informed citizens. For this reason, as students engage in a study of the environment, it is important to present them with accurate explanations, global examples and balanced viewpoints. In addition, the environment's link to human health, the economy and society should also be examined to make clear the interconnected nature of these components. *Environmental Science for Students* will help viewers to understand the science behind their changing world as well as consider multiple perspectives. This six-part series explores the causes and effects of issues facing our environment in the 21st century and explores the short- and long-term potential of possible solutions.

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Program Overview

Because energy is required to fuel the daily activities of all living organisms, it is a valuable resource. Earth's energy resources can be classified as either renewable or nonrenewable. Since the beginning of the Industrial Revolution, coal, oil and natural gas, collectively called fossil fuels, have been the primary energy sources for many humans. In the 20th century, scientists unlocked the nuclear energy contained in atoms of elements like uranium. There is a consensus that these nonrenewable energy sources are running out and that more sustainable and renewable energy sources must be developed and used. Whether renewable or nonrenewable, energy should be conserved and used efficiently.

The development and use of alternative energy sources, sometimes referred to as green energy, is not a recent innovation. However, many have returned to these energy sources to explore and utilize their potential as viable alternatives to fossil fuels. Moving water can be used to generate hydroelectric power, while windmills can harness the power of moving air. Solar panels and photovoltaic cells can capture the large amount of solar energy that bombards Earth every day. In some places, it is possible to tap into the geothermal energy located within the Earth itself. Biomass fuels, already used by humans in some parts of the world, are another promising alternative energy source. Since these different alternative energy sources each have their benefits and limitations, careful evaluation is necessary to ensure that individuals and communities develop and use the alternative energy sources that are most effective for, and best suited to, their needs.

Vocabulary

green energy — Alternative sources of energy that are generally more environmentally friendly than fossil fuels. Examples of green energy include wind power, solar energy and biomass fuels.

nonrenewable energy — Sources of energy that exist in a limited supply and, once used up, are gone for good or will take millions of years to be replenished. Examples of nonrenewable energy sources include uranium, coal, oil and natural gas.

renewable energy — Sources of energy that exist in an unlimited supply or are replenished in a short period of time. Examples of renewable energy sources include wind, water and the Sun.

fossil fuels — Energy resources that are derived from the preserved remains of plants and animals that lived millions of years ago. Examples of fossil fuels include coal, oil and natural gas.

nuclear energy — Energy contained in the nucleus of an atom. Nuclear energy can be released by nuclear fission — the splitting of a large atomic nucleus into two smaller nuclei — or by nuclear fusion — the combining of two smaller atomic nuclei to form a single larger nucleus.

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energy conservation — The practice of reducing the amount of energy used for a particular purpose.

sustainability — The ability to provide for the needs of the world's current population without harming future generations' ability to provide for themselves.

hydropower — Any kind of power produced by moving water.

hydroelectric power — Power produced by converting the energy in moving water into electricity.

wind power — Power produced by moving air.

solar energy — Energy that comes from the Sun.

photovoltaic cell — A silicon-based device that captures solar energy and converts it directly into electricity.

geothermal energy — The heat energy located deep within the Earth.

biomass fuels — Substances that come from plants and animals and are burned as fuels. Examples of biomass fuels include wood, animal dung, ethanol and biodiesel.

ethanol — A biomass fuel produced during the fermentation of crops like sugar cane, corn and sorghum. E85 is an alternative fuel made of 85 percent ethanol and 15 percent gasoline.

biodiesel — A non-toxic, biodegradable biomass fuel derived from vegetable and animal oils. Biodiesel can be made from soybeans, avocados, nuts and even algae.

Pre-viewing Discussion

- How did humans obtain and use energy in the past? Think about the life of a family living in the early 1700s and describe the sources of energy used in their daily activities. Would a modern family use the same sources of energy, and for the same purposes?
- While coal, oil and natural gas are all considered fossil fuels, they have different properties and uses. Have students create a three-column table that compares and contrasts the three fossil fuels. Categories for comparison may include state of matter, chemical names and formulas, common uses, current annual amount used and location and amount of reserves.
- What did you do yesterday that required energy? Ask students to make a list of their daily activities that use some form of energy. Next to each activity, describe the origin of the energy used (for example, energy used to run a computer comes from the power plant, while energy used to walk around comes from food). After watching the video, have students review their lists to determine what activities are powered by fossil fuels and what activities could possibly be powered by an alternative energy source.

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Focus Questions

1. What is "green energy"?
2. What are some examples of renewable and nonrenewable sources of energy?
3. What are fossil fuels? What are some challenges related to the use of fossil fuels?
4. What is nuclear energy? What are some challenges related to the use of nuclear energy?
5. What is energy conservation? What are some ways people can conserve energy?
6. What is sustainability? How does the concept of sustainability relate to green energy?
7. What are some benefits and limitations of hydropower and hydroelectric power?
8. What are some benefits and limitations of wind power?
9. What are some benefits and limitations of solar energy?
10. What are some benefits and limitations of geothermal energy?
11. What are some benefits and limitations of biomass fuels?

Follow-up Discussion & Activities

- What kinds of green energy are used in your community? Students can conduct a "green energy survey" to find out what kinds of green energy are being used in their community, and then make a map detailing where the green energy sources are located. Ask students to think about any types of green energy not shown on their maps and discuss the feasibility of using those types of green energy in the community (for example, their community may or may not have a large enough wide open space for a wind farm).
- How can the wide variety of energy sources available on Earth be used to successfully fuel a city of the future? Students can find out for themselves by going to **www.willyoujoinus.com/energyville** and playing the Energyville game, sponsored by Chevron and developed by The Economist Group. After entering a name for their city, students choose different kinds of renewable and nonrenewable energy sources to power their city, but must be careful to monitor the economic and environmental impacts of their choices. As the years go by, different situations arise that require students to adjust the energy plan for their city. When the simulation ends, students can compare "energy management scores" with their classmates and evaluate the effectiveness of their energy plans. As an extension, have students review the game and assess it from a media literacy standpoint. Consider the sponsors of the game and discuss their possible reasons for presenting a game like this for students.

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