What Do We Get From Solar Energy?

Student Objective
The student will:
- be able to list benefits that we get from solar energy
- create a visual project of what solar energy means to us on earth.

Materials:
- paper (construction or white)
- glue
- tape
- scissors
- magazines
- crayons or colored pencils
- Science Journal

Key Words:
hydroelectric
passive solar
photosynthesis
radiant energy
solar energy
Sun
thermal energy

Time:
1 hour

Background Information

The Sun is the ultimate source of all energy on earth. Even our fossil fuels were created by solar energy thousands of years ago. In general, solar energy can be grouped into eight types: photosynthesis, wind energy, hydroelectric power, ocean energy, passive solar heating, active solar heating and photovoltaics.

Solar energy is the energy radiated by the chemical reactions of our Sun. During the nuclear fusion process in our Sun, four hydrogen atoms combine to form one helium atom with a release of matter that is emitted and travels outward from the sun as radiant energy. The unit of measure for this energy is the *photon*. It takes these photons of energy a little over eight minutes to travel to earth. There is so much energy radiating from our Sun that it produces more energy in one second than the earth has used since time began.

Of the total energy from the Sun that reaches the Earth, about 30% is immediately bounced back into space by the atmosphere. The atmosphere, land masses and oceans absorb 45% in the form of heat. Almost 23% operates the water cycle, about 1% is used in air and ocean circulation, and less than 1% is used by plants.

Sunlight provides energy through **photosynthesis**. This energy is recoverable through burning of wood and fossil fuels such as coal, petroleum, and natural gas which are created through the process of photosynthesis. Photosynthesis is also the basis of all food energy; our food chain on Earth begins with the Sun.

Sunlight heating the ground and the lower atmosphere produces wind which powers wind turbines. **Wind power** has the potential to become a very significant alternative fuel in many areas of the world.

Sunlight stored as the gravitational energy of water through the water cycle can be extracted with dams and electric generators. **Hydroelectric power** is renewable and considered a "clean" energy since no burning is required, but it is limited in quantity.

Ocean Energy - The use of the ocean tides has been harnessed to make electricity along with a variety of other methods which make use of the motions and thermal gradients in the ocean. A heat engine can derive useful energy through the use of the temperature difference between the sun-warmed surface layers of the ocean and the colder depths, in a process called ocean thermal energy conversion (OTEC). This technology is complex, therefore limiting the use of the tremendous amount of stored energy in the ocean thermal gradients.

Solar thermal uses the energy of the Sun to make heat; solar thermal is mainly used to heat water for domestic and industrial use or for heating a building interior; however, it has also been used experimentally to create steam from a liquid that can then be turned into electricity with a turbine. **Photovoltaic** refers to the process of turning the energy of the Sun directly into electricity. Photovoltaic cells (commonly called solar cells) are made from silicon that undergoes a chemical process to add electrons and increase its instability, then the silicon mixture is allowed to form crystals from which the photovoltaic cells are made. Electricity is produced when a photon of light energy strikes the solar cell, causing the electrons to flow. The action of the electrons starts an electric current. This conversion of sunlight to electricity happens silently and instantly with no moving parts to wear out and no depletion of resources.

Documented use of solar thermal dates back at least to ancient Greek and Roman times. Recent research indicates that they used glass as a passive solar thermal collector. However, photovoltaic technology is relatively new; as a viable energy source, it is only 50 years old.

Solar energy has great potential for the future. As a source of energy, sunlight is free, its supplies are unlimited and it is available in the majority of areas of the world. However, at this time the relatively high cost of photovoltaic cells and systems is limiting its use. This is expected to change as our supplies of fossil fuels diminish, new methods of producing photovoltaic cells are discovered, and the increase in demand for the technology brings the price down.

Procedure

1. Give each student a piece of paper. Have each student put his or her name on the back of the sheet of paper.
2. Put all of the needed supplies in a central location.
3. Write on the board, "What do we get from Solar Energy?"
4. Explain that they are to make a collage of what they believe solar energy is. If resources are in short supply, you may want to limit the number of things that they put on the paper to a specific number. Students may draw items in their collage as well as cut and paste.
5. Students should complete Science Journal.
6. Once the students are finished with their collage, have them explain to the class what they included in their collage. Use their responses as a springboard to a discussion of new uses or concepts.

Further Research

1. Make a school display on the uses of solar energy. Have students collect items that use solar energy. They should determine which solar energy uses are not represented by their items; then pictures be drawn or collected for the rest of the solar energy uses.

Related Reading

- ***Arrow to the Sun: A Pueblo Indian Tale***, Gerald McDermott, Illustrator (Penguin USA, 1977)
  This adaptation of the Pueblo Indian myth explains how the spirit of the Lord of the Sun is brought to the world of men. In this tale, a boy searching for his father is made into an arrow and shot to the sun. When he meets the Lord of the Sun, he is asked to prove himself. The boy uses his bravery to pass the tests and bring the Sun's spirit to the world of man. As a result, the people celebrate his return with the Dance of Life.
- ***Solar Power (Energy Forever Series)*** by Ian Graham (Raintree, 1999)
  This book examines solar energy, its history, uses, advantages and disadvantages, and new developments in the field.
- ***Solar Power (True Books)*** by Christine Petersen (Children's Press, 2004)
  This book provides readers with a lucid picture of the sun and wind as natural forces before introducing some of the technology (windmills, turbines, solar panels) used to harness energy on a large scale. The captioned photos are well chosen, and the science and the explanations of the technology are eminently clear. Peterson ends the book with a forecast of the future that informs kids about the advantages and disadvantages of such renewable resources and speculates on their use in years to come.
- ***Solar Power of the Future: New Ways of Turning Sunlight into Energy*** by Susan Jones (Rosen Publishing Group, 2003)
  Discusses various kinds of solar energy, the history and development of their use, economic aspects of solar energy, and future possibilities.
- ***The Sun (Eye on the Universe, 5)*** by Niki Walker and Bonna Rouse (Crabtree Publishing Company, 2000)
  This book explains what type of star the Sun is, what fuels its enormous energy, and what the Sun's position is in our galaxy. Kids will be intrigued to learn about eclipses, solar activity, and space weather but, more importantly, they'll gain an insight into the crucial relationship between the Sun and Earth
- ***The Sun (Starting with Space)*** by Paulette Bourgeois and Bill Slavin (Kids Can Press, 1999)
  This book includes not only basic scientific observations, but also briefly told myths and legends and instructions for easy, homespun demonstrations all illustrated with a combination of color photos and lively cartoons. After a look at the past and future of The Sun, she discusses its visible and invisible emissions, seasons, the ozone layer, and the northern lights, the last accompanied by a particularly spectacular photo taken from space.

Internet Sites
http://library.thinkquest.org/15215/

Extensive site about the Sun. Contains links to activities, books, and other information.

http://planetarium.org/

Allentown School District Planetarium. Extensive site includes articles and links to various astronomical subjects, including sun astronomy, archaeoastronomy, and astronomical misconceptions.

http://solar-center.Stanford.edu

Stanford University Solar Center. FAQs about the Sun, physics, solar energy, and astronomy.

EnergyWhiz

Submit your solar poetry the EnergyWhiz web site at **http://energywhiz.com/**. If we publish your poetry, we will send you an EnergyWhiz t-shirt.

What Do We Get From Solar Energy?

			.1	.2	.3	.4	.5	.6
Energy	**Standard 1**	**SC.B.1.2-**	**X**	**X**	**X**	**X**		
	Standard 2	**SC.B.2.2-**	**X**	**X**				
Earth and Space	**Standard 1**	**SC.E.1.2-**			**X**			
	Standard 2	**SC.E.2.2-**						
Language Arts Standards:	**VA.1.2**							

Benchmark SC.B.1.2.1 - The student knows how to trace the flow of energy in a system.
Grade Level Expectations
The student:
Fourth
- knows that most living things use energy from the Sun to live and grow.

Benchmark SC.B.1.2.2 - The student recognizes various forms of energy.
Grade Level Expectations
The student:
Third
- knows different forms of energy

Fourth
- knows that there are a variety of sources for electricity.

Benchmark SC.B.1.2.3 - The student knows that most things that emit light also emit heat.
Grade Level Expectations
The student:
Third
- knows that the Sun provides energy for the Earth in the form of heat and light

Fourth
- knows that most objects that emit light also emit heat.

Benchmark SC.B.1.2.4 - The student knows the many ways in which energy can be transformed from one type to another.
Grade Level Expectations
The student:
Fourth

- knows ways that energy can be transformed.

Benchmark SC.B.2.2.1 - The student knows that some source of energy is needed for organisms to stay alive and grow.
Grade Level Expectations
The student:
Third
- knows that some source of energy is needed for organisms to stay alive and grow.

Benchmark SC.B.2.2.2 - The student recognizes the costs and risks to society and the environment posed by the use of nonrenewable energy.
Grade Level Expectations
The student:
Third
- classifies resources as renewable or nonrenewable.

Benchmark SC.E.1.2.3 - The student knows that the Sun is a star and that its energy can be captured or concentrated to generate heat and light for work on Earth.
Grade Level Expectations
The student:
Fourth
- knows how the energy of the Sun can be captured as a source of heat and light on Earth.

Benchmark VA.1.2 - The student understands and applies media techniques and processes.
Grade Level Expectations
The student:
Grades 3-5
- uses and organizes two-dimensional and three-dimensional media, techniques, tools, and processes to produce works of art that are derived from personal experience, observation, or imagination
- uses control in handling tools and materials in a safe and responsible manner
- uses good craftsmanship in a variety of two-dimensional and three-dimensional media.

What Do We Get From Solar Energy?

hydroelectric - the production of electricity by using the energy in the movement of water

passive solar - to utilize solar energy without using any mechanical systems**.** For example the basic natural processes of radiation, conduction, and natural convection.

photosynthesis - the process in green plants and certain other organisms by which carbohydrates are synthesized from carbon dioxide and water using light as an energy source

radiant energy - energy transferred by radiation, especially by an electromagnetic wave.

solar energy - energy derived from the sun

sun - the star at the center of our solar system

thermal energy - the transfer of energy form one body to another as a result of a difference in temperature or a change in phase

What Do We Get From Solar Energy?

1. Write an explanation of the collage that you created. What made you choose your specific pictures?

_____

_____

_____

_____

_____

_____

_____

2. What have you learned in this project? What would you still like to learn about solar energy?

_____

_____

_____

_____

_____

_____

_____