What Do We Get From Solar Energy?

Student Objectives
The student:
- can list the benefits that we get from solar energy
- will 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*. After leaving the surface of the Sun, 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 in plants 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 is the use of harnessed ocean tides 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 their 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 also complete their 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.

Key Words and Definitions

- **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 energy
- **radiant energy** – energy that transmits away from its source in all directions. For example, solar energy created by the sun is a form of radiant energy.
- **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

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 can 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.
- ***Catch the Wind, Harness the Sun: 22 Super-Charged Projects for Kids*** by Michael Caduto (Storey Publishing, 2011)
  Twenty-two projects plus stories, background information, cartoons and photos covering solar thermal, photovoltaics, solar cooking, climate change, energy production and energy conservation–plus wind energy!
- ***Energy From The Sun*** by Allan Fowler (Children's Press, 1998)
  This Read About Science book gives an overview of how energy from the Sun provides things that are necessary for life on Earth. This book is particularly suited for the young or remedial reader.
- ***The Shocking Truth about Energy*** by Loreen Leedy (Holiday House, 2011)
  Comical characters explain the basics of energy, including the many forms it can take. Readers learn how energy changes from one form to another so that the Sun's energy can end up in a lunch box and eventually in people's muscles.
- ***The Sun (Eye on the Universe)*** by Niki Walker (Crabtree Publishing, 2000)
  This book explains what type of star the Sun is, and what fuels its enormous energy. Students will learn about eclipses, solar activity, space weather, but more importantly about the relationship between the Sun and Earth.

Internet Sites

http://solar-center.Stanford.edu

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

https://www.youtube.com/watch?v=NDZzAIcCQLQ

Energy 101: Solar Power, an animated video that discusses photosynthesis, photovoltaics and solar thermal technology.

What Do We Get From Solar Energy?

Florida NGSS Standards & Related Subject Common Core

			.1	.2	.3	.4	.5	.6	.7	.8
Grade 3										
Earth in Space and Time	**Big Idea 5**	**SC.3.E.5**		**X**						
Earth Structures	**Big Idea 6**	**SC.3.E.6**	**X**							
Forms of Energy	**Big Idea 10**	**SC.3.P.10**	**X**			**X**				
Interdependence	**Big Idea 17**	**SC.3.L.17**		**X**						
Grade 4										
Forms of Energy	**Big Idea 10**	**SC.4.P.10**	**X**							
Interdependence	**Big Idea 17**	**SC.4.L.17**			**X**					
Grade 5										
Forms of Energy	**Big Idea 10**	**SC.5.P.10**	**X**							
Visual Arts	**Third Grade:** VA.3.F.3.1 **Fourth Grade:** VA.4.C.1.1, VA.4.C.2.3, VA.4.F.3.1 **Fifth Grade:** VA.5.S.1.3, VA.5.F.3.1									

Third Grade Benchmarks

Science--Big Idea 5: Earth in Space and Time

- SC.3.E.5.2 - Identify the Sun as a star that emits energy; some of it in the form of light.

Science–Big Idea 6: Earth Structures

- SC.3.E.6.1 - Demonstrate that radiant energy from the Sun can heat objects and when the Sun is not present, heat may be lost.

Science–Big Idea 10: Forms of Energy

- SC.3.P.10.1 - Identify some basic forms of energy such as light, heat, sound, electrical, and mechanical.
- SC.3.P.10.4 - Demonstrate that light can be reflected, refracted, and absorbed.

Science–Big Idea 17: Interdependence

- SC.3.L.17.2 - Recognize that plants use energy from the Sun, air, and water to make their own food.

Visual Arts–Innovation, Technology, and the Future

- VA.3.F.3.1 - Create artwork that communicates an awareness of events within the community.

Fourth Grade Benchmarks

Science–Big Idea 10: Forms of Energy

- SC.4.P.10.1 - Observe and describe some basic forms of energy, including light, heat, sound, electrical, and the energy of motion.

Science–Big Idea 17: Interdependence

- SC.4.L.17.3 - Trace the flow of energy from the Sun as it is transferred along the food chain through the producers to the consumers.

Visual Arts–Critical Thinking and Reflection

- VA.4.C.1.1 - Integrate ideas during the art-making process to convey meaning in personal works of art.
- VA.4.C.2.3 - Develop and support ideas from various resources to create unique art.

Visual Arts–Innovation, Technology, and the Future

- VA.4.G.3.1 - Create art to promote awareness of school and/or community concerns.

Fifth Grade Benchmarks

Science–Big Idea 10: Forms of Energy

- SC.5.P.10.1 - Investigate and describe some basic forms of energy, including light, heat, sound, electrical, chemical, and mechanical.

Visual Arts–Skills, Techniques, and Processes

- VA.5.S.1.3 - Create artworks to depict personal, cultural, and/or historical themes.

Visual Arts–Innovation, Technology, and the Future

- VA.5.F.3.1 - Create art to promote public awareness of community or global concerns.

National Next Generation Science & Common Core Visual Arts Standards

Third Grade Standards

Visual Arts–Connecting

- Cn.10.1.3a - Develop a work of art based on observations of surroundings.

Fourth Grade Standards

Science--Earth and Human Activity

- 4-ESS3-1- Obtain and combine information to describe that energy and fuels are derived from natural resources and their use can affect the environment.
- 4-ESS3-2 - Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans.

Science--Energy

- 4-PS3-1 - Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.

Visual Arts–Creating

- Cr.1.1.4a - Brainstorm multiple approaches to a creative art or design problem.

Fifth Grade Standards

Science--Earth's Place in the Universe

- 5-ESS1-2 - Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of stars.

Science--Energy

- 5-PS3-1 - Use models to describe that energy in animals' food was once energy from the sun.

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?