Poster Contest

**Student Objectives**
The student:
- will identify major events in the history of solar energy
- will work cooperatively to create a poster that communicates information.

**Materials:**
- posterboard or large sheets of paper
- various art materials (e.g. paints, markers, crayons and computer graphics)
- time line information

**Key Words:**
- passive solar
- photovoltaic
- solar collector
- solar furnace
- solar still
- time line

**Time:**
1 – 2 class periods

**Procedure**
1. Divide the class into groups of three or four students.
2. Explain to the class that they will be creating a poster to depict a part of the time line of solar history, and then sharing them with the class.
3. Assign a period of history to each group. Group divisions could be:
   - prior to 1600
   - 1600 - 1800
   - 1800s
   - 1900 - 1953
   - 1954 - 2000
   - 2000 - present
4. Tell the class they don’t have to illustrate everything in their part of the time line, rather they should pick a few things for their poster that interest them or that they think are particularly important.
5. Assist the groups as necessary while they are working on their posters.
6. When the posters are completed, have each group present their poster to the class and explain what information they are depicting.
7. Have the class vote on which time period in solar energy history they think is the most interesting and important.
8. Hang the posters in the class for the duration of your work on Solar Matters.
Key Words & Definitions
- **passive solar** – construction technique of using structural elements to bring in heat when needed and deflect or vent heat when it is not desired
- **photovoltaic** – the effect of producing electric current using light from the sun
- **solar collector** – a device that collects solar energy
- **solar furnace** – a device that uses solar energy to heat, burn or melt
- **solar still** – a device that uses solar energy to distill a liquid
- **time line** – a chronological list of historical events that all relate to a specific subject

Related Research
1. What are the future trends in solar energy? Research what the experts think will be the trends in solar energy in the future.
2. Research important scientists in the history of solar energy.
   - The mean daily solar radiation is measured in Langleys, named for Samuel Langley. What did he do to earn this honor?
   - The reign of Louis XIV of France (1643-1715) was an era of solar experiments. Louis gained the title of Sun-King. Why?
   - Tales tell us that Archimedes saved the Greek city of Syracuse from Marcellus and his Roman fleet by using reflectors to concentrate solar energy on invading ships, which caused them to catch fire and burn. Is there any credibility to these stories? Watch the *Mythbusters* episode that explored this story.
   - Georges Buffon proved the potential of concentrating solar energy in 1695. What did he do?
   - Antoine Lavoisier built a solar furnace with curved glass sections filled with wine. What did he do with this solar furnace? How are solar furnaces used today?
3. Have the students produce skits about their time period.
4. Prepare a presentation to give to parents, a partner class, or the school in general for Earth Day on the history and current applications of solar energy.

Internet Sites
  U.S. Department of Energy solar timeline
  U.S. Energy Information Administration, Solar Thermal Energy Time Line for students
  U.S. Energy Information Administration, Photovoltaic Time Line for students
Solar Matters III
Florida and National Standards
Next Generation Science & Common Core

Poster Contest

Florida NGSS Standards & Related Subject Common Core

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Sixth Grade Benchmarks

Science–Big Idea 1: The Practice of Science
• SC.6.N.1.5 - Recognize that science involves creativity, not just in designing experiments, but also in creating explanations that fit evidence.

Science–Big Idea 2: The Characteristics of Scientific Knowledge
• SC.6.N.2.2 - Explain that scientific knowledge is durable because it is open to change as new evidence or interpretations are encountered.
• SC.6.N.2.3 - Recognize that scientists who make contributions to scientific knowledge come from all kinds of backgrounds and possess varied talents, interests, and goals.

Social Studies–World History
• SS.6.W.1.1 - Use timelines to identify chronological order of historical events.

Language Arts–Standards for Speaking and Listening
• LAFS.6.SL.2.4 - Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.
• LAFS.6.SL.2.5 - Include multimedia components and visual displays in presentations to clarify information.
Visual Arts—Innovation, Technology, and the Future
- VA.68.F.3.1 - Use technology applications through the art-making process to express community or global concerns.
- VA.68.F.3.3 - Collaborate with peers to complete an art task and develop leadership skills.

Seventh Grade Benchmarks

Language Arts—Standards for Speaking and Listening
- LAFS.7.SL.2.4 - Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.
- LAFS.7.SL.2.5 - Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points.

Visual Arts—Innovation, Technology, and the Future
- VA.68.F.3.1 - Use technology applications through the art-making process to express community or global concerns.
- VA.68.F.3.3 - Collaborate with peers to complete an art task and develop leadership skills.

Eighth Grade Benchmarks

Science—Big Idea 4: Science and Society
- SC.8.N.4.1 - Explain that science is one of the processes that can be used to inform decision making at the community, state, national, and international levels.
- SC.8.N.4.2 - Explain how political, social, and economic concerns can affect science, and vice versa.

Social Studies—American History
- SS.8.A.1.2 - Analyze charts, graphs, maps, photographs and timelines; analyze political cartoons; determine cause and effect.

Language Arts—Standards for Speaking and Listening
- LAFS.8.SL.2.4 - Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.
- LAFS.8.SL.2.5 - Integrate multimedia and visual displays into presentation to clarify information, strengthen claims and evidence, and add interest.

Visual Arts—Innovation, Technology, and the Future
- VA.68.F.3.1 - Use technology applications through the art-making process to express community or global concerns.
- VA.68.F.3.3 - Collaborate with peers to complete an art task and develop leadership skills.

National Next Generation Visual Arts Standards

Sixth Grade Standards
- Cr.1.1.6a - Combine concepts collaboratively to generate innovative ideas for creating art.
Note: Related Common Core Language Arts Standards are listed in the Florida section above.

Seventh Grade Standards
- Cr.2.3.7a - Apply visual organizational strategies to design and produce a work of art,
design, or media that clearly communicates information or ideas.

Note: Related Common Core Language Arts Standards are listed in the Florida section above.

**Eighth Grade Standards**

- Cr2.3.8a - Select, organize, and design images and words to make visually clear and compelling presentations.

Note: Related Common Core Language Arts Standards are listed in the Florida section above.
<table>
<thead>
<tr>
<th></th>
<th>B.C.E.</th>
<th>Year 1 - 500 A.D.</th>
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<tbody>
<tr>
<td>4.5 billion years ago</td>
<td>Solar energy reaches the Earth.</td>
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<tr>
<td>7th Century B.C.E.</td>
<td>Magnifying glass used to concentrate sun's rays to make fire.</td>
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<td>3rd Century B.C.E.</td>
<td>Greeks and Romans use &quot;burning mirrors&quot; to focus sunlight as weapons of war to ignite fires and burn sails of enemy war ships.</td>
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<td>20 A.D.</td>
<td>Chinese document use of burning mirrors to light torches for religious purposes.</td>
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<td>100 A.D.</td>
<td>Italian historian Pliny the Younger builds passive solar home using glass for the first time to keep heat in and cold out. Roman baths built with large windows facing south to let sunlight in for heat.</td>
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<tr>
<td>600s</td>
<td>Justinian Code enacted to protect sunrooms on houses and public buildings so that shadows will not interfere with the sun used for heat and light.</td>
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<td>1300s</td>
<td>Ancestors of Pueblo people called Anasazi, in North America live in south-facing cliff dwellings that capture the winter sun.</td>
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<td>1600s</td>
<td>Educated people accept the idea that the sun and stars are the same.</td>
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<td>1643-1715</td>
<td>Reign of French King Louis XIV, (&quot;Sun King&quot;), is an era of solar experiments.</td>
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<td>1695</td>
<td>French Georges Buffon concentrates sunlight using mirrors to ignite wood and melt lead.</td>
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<td>1700s</td>
<td>European aristocracy use walls to store solar heat for ripening fruit (fruit walls). England and Holland lead development of greenhouses with sloping glass walls facing South. Frenchman Antoine Lavoisier builds solar furnace to melt platinum.</td>
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<td>1767</td>
<td>Swiss scientist Horace de Saussure invents first solar collector (solar hot box).</td>
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<td>1800s</td>
<td>Wealthy Europeans build and use solar-heated greenhouses and conservatories. French scientist uses heat from solar collector to make steam to power a steam engine.</td>
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<td>1830s</td>
<td>Astronomer Sir John Herschel uses solar cooker to cook food for his expedition to South Africa.</td>
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<td>1839</td>
<td>French scientist Edmund Becquerel observes photovoltaic effect.</td>
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<td>1860s</td>
<td>Post Civil War U.S. development of solar energy; pioneers find that water left in black pans in the sunlight gets hot.</td>
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<td>1861</td>
<td>French scientist Augustin Mouchot patents solar engine.</td>
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<td>1870s</td>
<td>Augustin Mouchot uses solar cookers, solar water pumps for irrigation, and solar</td>
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stills for wine and water distillation (most widespread use of solar energy).

Solar-powered printing press working in France.

1891 Baltimore inventor Clarence Kemp, ("real father of solar energy in the U.S.") patents first commercial Climax Solar Water Heater.

1892 Inventor Aubrey Eneas founds Solar Motor Company of Boston to build solar-powered motors to replace steam engines powered by coal or wood.

1897 Kemp's water heaters used in 30% of homes in Pasadena, CA.

1900s

1905 Albert Einstein publishes a paper explaining the photoelectric effect on a quantum basis.

1908 Los Angeles: Carnegie Steel Company invents modern type of roof solar collector.

1920s Solar Industry focus moves from California to Florida.

1936 American astrophysicist Charles Greeley Abbott invents solar boiler.

1940s Great demand for solar homes, both active and passive, creates Your Solar House, a book of house plans by 49 great solar architects.

1941 Approximately 60,000 solar water heaters in use in Florida.

1950s Architect Frank Bridgers designs world's first solar-heated office building.

Late 1950s Extensive use of solar cells in space industry for satellites.

1960s Some U.S. solar companies manufacturing solar cells or solar hot water heaters; U.S. oil imports surpass 50 percent.

1967 Soyuz 1 is the first manned spacecraft to be powered by photovoltaics.

1970s Department of Energy established; national solar research labs established.

1973 Energy shortages/oil embargo; indifference about solar energy begins to decline.

1974 Florida Solar Energy Center (FSEC), largest state solar center, is established.

The world’s first (modern day) building (in New Mexico), heated and powered only by solar and wind power.

1977 President Jimmy Carter installs solar panels on the White House and promotes incentives for solar energy systems.

1978 First solar powered calculators.

1979 Second U.S. oil embargo; Solar trade association (Solar Energy Industries Association) established in Washington, DC.

1980 Energy Security Act virtually shuts down national solar research programs; states begin establishing solar research facilities.

Thin film photovoltaic cells exceed 10% efficiency and become a usable form of photovoltaics.

1980s U.S. government and private industry assist several thousand Navajo and Hopi Indians in Arizona and New Mexico supplement their passive solar homes with photovoltaic power.

1983 Wisconsin enacts solar access law to protect the "right to light" for urban gardens,
soon enacted in Arizona and Michigan.

1986 President Reagan removes the solar panels from the White House.
1989 Reflective solar concentrators are first used with solar cells.
1990s Tokyo has approximately 1.5 million buildings with solar water heaters (more than in the entire U.S.); Israel uses solar water heating for approximately 30 percent of their buildings and all new homes are required to install solar water heating systems; Greece, Australia, and several additional countries are ahead of the U.S. in solar energy usage.

2000s

2000 Astronauts begin installing solar panels at the International Space Station. Each wing of the array consists of 32,800 solar cells.
2001 NASA's solar-powered airplane, Helios, sets a world altitude record for non-rocket powered craft at 96,863 feet.
2003 9kW photovoltaic system and a solar thermal system were installed to heat the swimming pool at the White House.
2008 Photovoltaic cells exceed 40% efficiency in the laboratory.
2013 President Obama installs photovoltaic panels and solar thermal collector on White House roof.
2014 Ivanpah, a 392 megawatt concentrated solar powered generation plant goes online in California.