

Creating a Pop-up Solar Library With Tips from the Ancients

Lesson Overview: After investigating data which projects just how long supplies of natural gas will hold out if current consumption continues at the same pace, students look to the ancients for ideas as they design a pop-up solar library to educate their community about the benefits of fuel conservation and to promote responsible use of alternative power sources.

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Subject(s): Visual Arts, Science, Social Studies, Literature, Technology

Suggested Grade Level(s): 7 - 12

Time Duration: Twelve 40-45 minute class periods

Common Core State Standards Addressed:

National Core Standards for the Visual Arts

Visual Arts/Creating #VA:Cr3.1

Process Component: Section 6

Anchor Standard: Refine and complete artistic work.

Enduring Understanding: Artist and designers develop excellence through practice and constructive critique, reflecting on, revising, and refining work overtime.

Visual Arts/Responding #VA:Re8.1

Process Component: Section 11

Anchor Standard: Interpret intent and meaning in artistic work.

Enduring Understanding: People gain insights into meanings of artworks by engaging in the process of art criticism.

Visual Arts/Connecting #VA:Cn10.1

Process Component: Section 13

Anchor Standard: Synthesize and relate knowledge and personal experiences to make art.

Enduring Understanding: Through art-making, people make meaning by investigating and developing awareness of perceptions, knowledge, and experiences.

Visual Arts/Connecting #VA:Cn11.1

Process Component: Section 14

Anchor Standard: Relate artistic ideas and works with societal, cultural, and historical context to deepen understanding.

Illinois State Standards for the Visual Arts

State Goal 25: Know the Language of the Arts

a. Understand the sensory elements, organizational principles, and expressive qualities of the arts.

b. Understand the similarities, distinctions, and connections in and among the arts.

State Goal 26: Through creating and performing, understand how works of art are produced.

a. Understand processes, traditional tools and modern technologies used in the arts.

b. Apply skills and knowledge necessary to create and perform in one or more of the arts.

State Goal 27: Understand the role of the arts in civilizations past and present.

a. Analyze how the arts function in history, society, and everyday life.

b. Understand how the arts shape and reflect history, society and everyday life.

Objectives:

- Students will analyze public service announcements and other information that focuses on current trends in energy consumption and depleting fuel sources.
- Students will investigate the use of solar energy by ancient civilizations as a source for heat and power.
- Students will examine the basic theory and components related to solar heating and energy efficiency.
- Students will investigate wind and muscle-power as alternative energy sources.
- Students will design, construct, and curate a portable solar library that provides information regarding depleting fuel sources, and the advantages of solar, wind, and muscled-powered energy.

Materials:

- "Artists & Environmental Change: The Elusive Power of Contemporary Art - ARTES MAGAZINE." *ARTES MAGAZINE*. N.p., n.d. Web. 15 Sept. 2014. <http://www.artesmagazine.com/2011/10/artists-environmental-change-the-elusive-power-of-contemporary-art/>. Scroll to Ann T. Rosenthal and Steffi Domike's installation "Watermark: Wood, Coal, Oil, Gas."
- Barber, Scott. "History of Passive Solar Energy." *uncw.edu*. N.p., n.d. Web. 15 Sept. 2014. <<http://uncw.edu/csrf/Explorations/documents/ScottBarber.pdf>>.
- "dan peterman." : *Villa Deponie (House from the Landfill)*. N.p., n.d. Web. 17 Sept. 2014. <<http://www.danpeterman.com/2014/05/villa-deponie-house-from-landfill.html>>.
- "Energy Consumption: The USA vs. Other Countries." *YouTube*. YouTube, n.d. Web. 15 Sept. 2014. <<https://www.youtube.com/watch?v=rWOKLyWz0zo>>.
- "Energy.gov." *How Do Wind Turbines Work?*. N.p., n.d. Web. 17 Sept. 2014. <<http://energy.gov/eere/wind/how-do-wind-turbines-work>>.
- Holloway, Dennis . "A Simple Design Methodology For Passive Solar Houses." *A Simple Design Methodology For Passive Solar Houses*. N.p., n.d. Web. 15 Sept.

2014.
 <<http://www.dennisrhollowayarchitect.com/SimpleDesignMethodology.htm>>.
- "Let It Shine: Solar Architecture in Ancient China." *Mother Earth News*. N.p., n.d. Web. 16 Sept. 2014. <<http://www.motherearthnews.com/renewable-energy/solar-architecture-in-ancient-china-zbcz1311.aspx#axzz3DX1K4ipH>>.
 - Major, J. Kenneth. "The Pre-Industrial Sources of Power: Muscle Power." *Center for International Studies at the University of Chicago*. N.p., n.d. Web. 15 Sept. 2014. <http://cis.uchicago.edu/outreach/summerinstitute/2014/documents/bailleul-lesuer/sti2014_the-pre-industrial-sources-of-power_-muscle-power_-history-today.pdf>.
 - "Paper Dwelling and Collecting System." *Paper Dwelling and Collecting System*. N.p., n.d. Web. 17 Sept. 2014. <<http://www.learningsite.info/CollectedDwellingSmart.htm>>.
 - Poem: A Timbered Choir by Wendell Berry." *Poemhunter.com*. N.p., n.d. Web. 15 Sept. 2014. <<http://www.poemhunter.com/poem/a-timbered-choir/>>.
 - "Popup Libraries!" *Pinterest*. N.p., n.d. Web. 17 Sept. 2014. <<http://www.pinterest.com/simmonsplg/popup-libraries/>>.
 - Ring, James W.. "Windows, Baths, and Solar Energy in the Roman Empire." *Center for International Studies at the University of Chicago*. N.p., n.d. Web. 15 Sept. 2014. <http://cis.uchicago.edu/outreach/summerinstitute/2014/documents/bailleul-lesuer/sti2014_aja-100-%5B1996%5D-roman-bath-and-solar-energy.pdf>.
 - "Some scary statistics on how much energy American's Consume - embodied energy." *YouTube*. YouTube, n.d. Web. 15 Sept. 2014. <<https://www.youtube.com/watch?v=dXzYoKtRqPg>>.
 - "The Center for International Studies." *The University of Chicago Center for International Studies*. N.p., n.d. Web. 17 Sept. 2014. <<http://cis.uchicago.edu/outreach/summerinstitute/2014/schedule.shtml>>.

- Found objects
- Cardboard
- Used shelving & furniture
- Batteries
- Adhesives
- String
- Wire
- Building tools
- Paint
- Brushes
- Paint/water containers
- Pencils/pens/markers
- Internet access
- Journals/sketchbooks

Activities and Procedures:

1) Begin with class reading of Wendell Berry's poem "A Timbered Choir" (provide handout or view online (<http://www.poemhunter.com/poem/a-timbered-choir/>), and viewing of Ann T. Rosenthal and Steffi Domike's installation "Watermark: Wood, Coal, Oil, Gas" (<http://www.artesmagazine.com/2011/10/artists-environmental-change-the-elusive-power-of-contemporary-art/>). Scroll to Ann T. Rosenthal and Steffi Domike's installation). In their journals, ask students to link three images seen in the installation to three phrases or lines from Berry's poem. Then have the students view the public service announcement animation (<https://www.youtube.com/watch?v=dXzYoKtRqPg>), and follow with a brief discussion of how its content links to the poem and installation. Distribute and discuss the project guidelines, and show the students examples of pop-up libraries (<http://www.pinterest.com/simmonsplg/popup-libraries/>), and houses created from found objects (<http://www.danpeterman.com/2014/05/villa-deponie-house-from-landfill.html> & <http://www.learningsite.info/CollectedDwellingSmart.htm>). Homework: Read "History of Passive Solar Energy" (Pages 2 – 5), and sketch an idea for a solar library made out of found materials that can "pop-up" in various indoor and/or outdoor locations in and around the school.

2. Have the students view "The USA vs. Other Countries" (<https://www.youtube.com/watch?v=rWOKLyWz0zo>). As a journal entry, ask the students to describe how they rate their own consumption of energy and have them briefly discuss their responses. Follow with a viewing of Dennis Holloway's brief history of solar energy, including the Native American pueblo stepped "great house" (<http://www.dennisrhollowayarchitect.com/SimpleDesignMethodology.htm>). Then divide the students into small groups (teams) to share their ideas for the pop-up solar library. After the students discuss their individual plans, ask them to synthesize their ideas to create an overall plan for their team's proposal. Homework: In your journal, describe whether or not you think most members of your community are aware of the potential impact of rising fuel consumption on the future. Cite examples.

3. Working in small groups, have students continue to research and brainstorm for ideas for the pop-up solar library. At the end of class, collect (for review) each team's progress statement, and any sketches and notes. Homework: Read "Windows, Baths, and Solar Energy in the Roman Empire." In your journal create an annotated sketch of a room in your home or school that clearly benefits from passive solar energy. Note the size and orientation of the window(s) to sunlight.

4. Return team progress statements, sketches, and notes with comments, and have students continue planning and revising their sketches, written description, and materials list for their library proposal. Homework: Read "Let It Shine: Solar Architecture in Ancient China," and in your journal write a description of one the solar applications described in the article.

5. Show the students the online illustration of how wind turbines work (<http://energy.gov/eere/wind/how-do-wind-turbines-work>), and the video of Meghan Vincent's hands-on energy demonstration (<http://cis.uchicago.edu/outreach/summerinstitute/2014/schedule.shtml>). Have students discuss ideas for both wind muscle-powered devices that could be included in the library. Also, provide a few minutes for finalizing proposals.

Note: Teachers in the Chicago area can contact the Center for Robust Decision Making on Climate and Energy Policy (CDCEP) at rdcep.org to borrow an energy demo kit for their classrooms.

Homework: Read: "The Pre-Industrial Sources of Power: Muscle Power." In your journal, explain how one of the Pre-Industrial Revolution machines worked, and how the same basic process might be used to power something for the pop-up library. Create an annotated sketch of how you envision the device would work.

6. Ask each team to present their pop-up solar library proposals to the entire class. Have the students select the most innovative/practical design and site location(s), and any elements from other proposals that would enhance the overall plan. Then assign students to one of the following teams to build the library: 1) library structure; 2) wind-powered device(s); 3) muscle-powered device(s); 4) seating; 5) display. Tell them that in addition to constructing the component that they are also responsible for writing a didactic and providing reading materials for the library related to the component, conservation of energy, use of alternative power sources, and/or related literary pieces. Also, ask each team to develop a materials list and a timeline. Collect list and timeline at the end of class to review.

Homework: Create an annotated sketch in your journal of how you envision your team's component for the library will look.

7. Pass back timelines and lists with comments. Have students share their annotated sketches with their teammates, and ask them to finalize their design and begin construction.

Homework: Find an image of a Pre-Industrial Revolution artwork from any culture that suggests the use of a power source other than coal, oil, or gas. Sketch the image in your journal, and discuss your assumption by describing how you came to your conclusion.

8. Ask teams to share their progress and provide time for teams to work together to ensure cohesiveness of the overall plan.

Homework: Find an image that suggests the use of wind power in any contemporary culture. Sketch the image in your journal, and discuss your assumption by describing how you came to your conclusion.

9. Have students finish construction of their team components.

Homework: Consult with your teammates to ensure all component requirements have been addressed.

10. Provide time for the students to add finishing touches, and then have teams work together to assemble the library with all components, didactics, and resource materials (in the classroom or other designated space).

11. Peer and self-assessments, and final assessment (tools attached).

12. As a class, have students develop a proposal for installation on pre-determined site to be reviewed by administrators, building engineer, etc. Once permission is granted for the site, oversee students' installation of the pop-up solar library, and have students collect feedback from school/community members.

Assessments:

- Peer, self, and final assessments attached.

Adaptations:

This same format could be used to create a pop-up garden and a rain barrel to collect water for maintaining the garden. A pop-up garden in addition to addressing solar applications could also include wind and muscle-powered features for functional or aesthetic purposes.

Extra Credit/Additional Resources:

Additional reading material on nuclear energy can be found at
<http://cis.uchicago.edu/outreach/summerinstitute/2014/resources.shtml>

CREATING A SOLAR POP-UP LIBRARY WITH TIPS FROM THE ANCIENTS

CONSIDER:

I believe that the average guy in the street will give up a great deal, if he really understands the cost of not giving it up. In fact, we may find that, while we're drastically cutting our energy consumption, we're actually raising our standard of living.

David R. Brower – Environmentalist.

YOUR ASSIGNMENT

In collaboration with your classmates, you will design and build a pop-up solar library to serve as an educational resource for the school and greater community. The library will consist of materials and hands-on learning tools that highlight the benefits of fuel conservation and promote responsible use of alternative power sources. The class will be divided into teams to create design proposals for the library, one of which will be selected as the overall plan for the class installation.

- 1) As a member of a proposal design team, you will work with your teammates to plan and produce a design for the pop-up solar library.
- 2) Once the proposals have been reviewed, the most innovative/practical design will serve as the overall plan for the installation, however, elements from other teams' designs may be incorporated. During this stage, you will serve as a member of a collaborative team to refine and produce one or more components of the library.

YOUR RESPONSIBILITIES

Read all assigned articles, excerpts, and literary works; write responses to journal prompts; actively participate in class/group discussions and studio work; and provide honest and helpful feedback to your peers. You are also expected to come to class prepared, and to stay on task throughout the entire class period; to meet all deadlines, including team deadlines; and to complete all assignments and homework.

PROPOSAL REQUIREMENTS

- Written description, including overall dimensions and site orientation.
- Annotated sketch.
- Materials list.

POP-UP SOLAR LIBRARY REQUIREMENTS

The library can be designed for an interior and/or exterior installation site. All designs must have the following components:

- Passive Solar – Uses sunlight to provide warmth during cold temperatures, and light for reading.
- Cooling – Provides shade during times of intense heat.
- Wind-powered Item(s) – For functional and/or aesthetic purpose.
- Muscle-powered Item(s) – For functional and/or aesthetic purpose.
- Didactics – All components must have a posted description, and suggestions for how the component could be used for other applications (in homes, offices, schools, etc.).
- Reading Materials & Exhibit Space – Books, pamphlets, charts, etc. that relate to conservation issues, and places to display these items.
- Seating – Provides seating for at least four (stools, benches, and/or chairs).
- All components must be safe and soundly constructed.

TIMELINE

Day 1 – Class Activities: Reading of Wendell Berry's poem "A Timbered Choir;" viewing of Ann T. Rosenthal and Steffi Domike's installation "Watermark: Wood, Coal, Oil, Gas;" journal entry; viewing of a public service announcement animation; and distribution of project guidelines along with online viewing of examples of pop-up libraries and houses created from found objects.

Homework: Read "History of Passive Solar Energy" (Pages 2 – 5), and sketch an idea for a solar library made out of found materials that can "pop-up" in various indoor and/or outdoor locations in and around the school.

Day 2 – Class Activities: Viewing of "The USA vs. Other Countries," followed by journal entry; and Dennis Holloway's online brief history of solar energy, including Native American pueblo step houses. Small group activities: Sharing of ideas for a pop-up library, and synthesizing of individual ideas to create an overall plan for the team proposal.

Homework: In your journal, describe whether or not you think most members of your community are aware of the potential impact of rising fuel consumption on the future. Cite examples.

Day 3 – Small group activities: Continue research and brainstorming for ideas for the pop-up library, followed by writing/sketching of the team proposal, including suggested sites for installation (see proposal requirements). Team progress statement, sketches, and notes will be due at end of class.

Homework: Read "Windows, Baths, and Solar Energy in the Roman Empire." In your journal create an annotated sketch of a room in your home or school that clearly benefits from passive solar energy. Note the size and orientation of the window(s) to sunlight.

Day 4 – Small group activities: Review instructor's comments on progress statement, sketches, and notes, and continue planning/sketching/writing pop-up library proposal. Brainstorming for ideas for inclusion in library of wind and muscle-powered devices.

Homework: Read "Let It Shine: Solar Architecture in Ancient China," and in your journal write a description of one the solar applications described in the article.

Day 5 – Class activities: Online viewing of how wind turbines work and hands-on energy demonstration.

Small group activity: Finalizing of solar library proposals.

Homework: Read: "The Pre-Industrial Sources of Power: Muscle Power." In your journal, explain how one of the Pre-Industrial Revolution machines worked, and how the same basic process might be used to power something for the pop-up library. Create an annotated sketch of how you envision the device would work.

Day 6 – Class activities: Team presentations of their pop-up solar library proposals to the entire class. Class votes on most innovative/practical design and site location(s), and other ideas to include in installation. Division of tasks to construct and equip the proposed library, and assignment of students to teams to construct one or more specific components of the library. Small group activities: Listing of supplies and development of a timeline for the completion the team's assigned component(s). Timeline and list due at the end of class.

Note: You will be assigned to a team to construct and assemble one of the following: 1) Library structure with passive solar plan (may take the form of a house, kiosk, canopied space, etc.); 2) wind-powered device(s); 3) muscle-powered device(s); 4) seating for four or more; 5) display furniture (may include repurposed items such as shelves, tables). Each team is responsible for writing a didactic to contextualize its component, and for providing reading materials for the library related to the component, conservation of energy, use of alternative power sources, and/or related literary pieces.

Homework: Create an annotated sketch in your journal of how you envision your team's component for the library will look.

Day 7 – Small group activity: Compare annotated sketches (homework from previous day) and review instructor's comments regarding timeline and materials list. Studio: Continue construction of component(s).

Homework: Find an image of a Pre-Industrial Revolution artwork from any culture that suggests the use of a power source other than coal, oil, or gas. Sketch the image in your journal, and discuss your assumption by describing how you came to your conclusion.

Day 8 – Class activities: Project updates – Each team shares progress and teams work together to ensure cohesiveness of overall plan. Studio: Continue construction.

Homework: Find an image that suggests the use of wind power in any contemporary culture. Sketch the image in your journal, and discuss your assumption by describing how you came to your conclusion.

Day 9 – Continuation of construction.

Homework: Consult with your teammates to ensure all component requirements have been addressed.

Day 10 – Assemblage of the library with all components, didactics, and resource materials in the classroom.

Day 11 – Peer and self-assessments, and final assessment.

Day 12 – Class activity: Development of proposal for installation to be reviewed by administrators, building engineer, etc.

Note: Once the proposal has been approved the library can “pop-up” at the installation site. At that time be prepared to collect feedback from school/community members.

GRADING CRITERIA

- ❖ Evidence of individual contributions that enhanced your team’s proposal.
- ❖ Completeness, innovativeness, and practicality of your team’s proposal.
- ❖ Evidence of individual contributions that enhance the component that your team contributed to the overall library.
- ❖ Your team’s component is soundly crafted out of found materials, is safe and aesthetically pleasing, serves its function, and adds to the overall appeal of the library.
- ❖ Your team’s component included a didactic without spelling/grammar errors, and your team provided additional resource materials for the library.
- ❖ Completeness of all homework and in-class journal entries.

ADDITIONAL GRADING CRITERIA

- ❖ Meeting all deadlines.
- ❖ Attendance and prompt arrival to class.
- ❖ Active and productive participation in all class activities.
- ❖ Thoughtful participation in small group/class discussions and peer reviews.
- ❖ Responsible care/cleanup of tools, materials, equipment, and workspace.

NOTES:

Name _____ Per. _____ Date _____ Self-Assessment Score _____

Circle your team's task (library component):

library structure wind-powered device(s) muscle-powered device(s) seating display furniture

CREATING A SOLAR POP-UP LIBRARY WITH TIPS FROM THE ANCIENTS

Score your participation in your team's proposal and your team's component for the library according to the following scale: 0 – 5 pts. (This section is worth up to 50 pts.)

_____ My team's proposal included: 1) a well-thought out written description, without spelling/grammar errors; 2) estimated dimensions for the library; and 3) a specific site for installation.

_____ Our proposal sketch was neatly drawn and annotated, and our materials list was comprehensive.

_____ My team's component is soundly crafted out of found materials, is safe and aesthetically pleasing, serves its function, and adds to the overall appeal of the library.

_____ Our component includes a didactic without spelling/grammar errors, and we provided additional resource materials for the library.

Circle any items or add what your team provided:

pamphlets charts illustrations other _____

_____ My team met all deadlines.

_____ I completed all reading assignments and journal entries.

_____ I did not have any unexcused absences or unexcused tardies.

_____ I actively participated in all class activities, and I was productive throughout.

_____ I enthusiastically participated and readily shared my ideas in all class and group discussions, and I provided meaningful feedback to my peers, and used their feedback along with my instructor's to improve my individual work and my collaborative work.

_____ I took excellent care of all tools, materials, equipment, and workspace, and I actively participated in all cleanup activities.

In the space below, describe your individual contributions to each team:

Proposal Team

Component Team

Name _____ Per. _____ Date _____ Peer-Assessment Score _____

Circle the team component to be assessed:

library structure wind-powered device(s) muscle-powered device(s) seating display furniture

Peer Reviewer's Name (must be from another team) _____

Score your peer's team component according to the following scale: 0 – 10 pts. (This section is worth up to 30 pts.)

_____ The component is soundly crafted out of found materials, is safe and aesthetically pleasing, serves its function, and adds to the overall appeal of the library.

_____ The component includes a didactic, without spelling/grammar errors, that encourages conservation of energy and/or the use of alternate power sources, along with suggestions for additional applications; and the team provided additional resources for the library.

Circle any items or add what you know this team provided:

pamphlets charts illustrations other _____

_____ The team that constructed this component readily worked in collaboration with other teams to ensure the overall design concept was successful.

Proposal Teammate's Name _____

Score your peer's participation in planning and developing your team's proposal for the pop-up solar library according to the following scale: 0 – 10 pts. (This section is worth up to 10 pts.) Circle the best description of his/her participation and overall contributions:

- 0 – Did not participate or contribute.
- 2 – Very little in participation/contributions.
- 4 – Occasional participation/contributions.
- 6 – Adequate participation/contributions.
- 8 – Almost always participated and contributed.
- 10 – Outstanding participation and contributions.

Component Teammate's Name _____

Score your peer's participation in planning and developing your team's component for the pop-up solar library according to the following scale: 0 – 10 pts. (This section is worth up to 10 pts.) Circle the best description of his/her participation and overall contributions:

- 0 – Did not participate or contribute.
- 2 – Very little in participation/contributions.
- 4 – Occasional participation/contributions.
- 6 – Adequate participation/contributions.
- 8 – Almost always participated and contributed.
- 10 – Outstanding participation and contributions.

Instructor's adjustments _____

Total Score _____

Comments:

Name _____ Per. _____ Date _____ Total Score _____

CREATING A SOLAR POP-UP LIBRARY WITH TIPS FROM THE ANCIENTS: FINAL ASSESSMENT

1) In an annotated sketch illustrate how the Romans were able to provide a comfortable, heated space for public bathing. Your score will be based on the number of correct elements included in your sketch. (0 – 20 pts.)

2) Describe in at least one paragraph the Chinese kang (heated bed) as an example of an efficient use of energy. (0 – 20 pts.)

3) Draw an annotated sketch that illustrates how Native Americans designed pueblo step houses to take advantage of solar energy. Your score will be based on the number of correct elements included in your sketch. (0 – 20 pts.)

4) Describe in at least one paragraph how a wind turbine creates electricity.

5) Wendell Berry has often spoken and written about his concerns for the environment. Much of contemporary artist Dan Peterman's work focuses on the same topic. In one or more paragraphs make three specific points to link the Peterman installation entitled Villa Deponie (House from the Landfill) to the Berry quote listed below. (0 – 20 pts.)



Dan Peterman, Villa Deponie, 2002

With its array of gadgets and machines, all powered by energies that are destructive of land or air or water, and connected to work, market, school, recreation, etc., by gasoline engines, the modern home is a veritable factory of waste and destruction. It is the mainstay of the economy of money. But within the economies of energy and nature, it is a catastrophe. It takes in the world's goods and converts them into garbage, sewage, and noxious fumes—for none of which have we found a use.

Wendell Berry