



the CEED

THE CENTER FOR ENERGY EFFICIENT DESIGN

Using Solar Ovens

Grade Level	5 th grade	Subject	Solar Ovens/Energy Sources
Objective(s): TSW identify amounts of solar energy that is collected by the CEED building. TSW read a graph and determine times during the day that the solar panels are producing the most solar energy. TSW investigate solar energy by constructing solar ovens and cooking/heating smores in them. TSW compare/contrast the differences of a homemade solar oven vs. a store bought solar oven.		SOL Addressed: Science 5.1, 5.3, 4.1, 4.3 Math 5.8 a-e	
		Common Core Standards: 4-PS3-2, 4-PS3-4, 4-ESS3-1	
Materials Needed Per Class of 30 and Prior Knowledge	<ul style="list-style-type: none"> • Ice cubes • Graham crackers • Marshmallows • Chocolate bars • Instruction sheet for building solar ovens (various sites to choose from) http://climatekids.nasa.gov/smores/ • or http://www.stevespanglerscience.com/lab/experiments/solar-oven or http://pbskids.org/zoom/activities/sci/solarcookers.html • Store bought solar oven (approx \$60.00) • Thermometers • Small-medium size pizza boxes, shoe boxes, or thin boxes (enough for each group) • Aluminum foil (heavy duty) • Black construction paper • Clear plastic 1 gallon size bags (or clear plastic wrap) • Glue • Masking tape • String • Scissors • Box cutter or sharp knives (for cutting out panel on pizza box) 		
Ways to differentiate this lesson plan	<ul style="list-style-type: none"> • EXTENSION for Higher Level Learner—TSW compare the amount of solar energy to other types of energy(wind) being generated by the CEED building and make a graph of the energy collected on a daily, weekly, monthly, or yearly basis. TSW design/construct solar ovens out of various materials that are provided by the teacher(no set instructions) and compare/contrast with other solar ovens from the group. 		

CEED
Instructional Activities

<p style="text-align: center;">Introduction/ Anticipatory Set</p>	<p>Anticipatory Set: Show “Bill Nye Energy” or similar video to introduce the various types of energy. There are also several short videos on the CEED building dashboard that could be used.</p> <p>Questions to ask students:</p> <ul style="list-style-type: none"> • What are the different forms of energy? • What is the difference between a renewable and nonrenewable energy source? • How can solar energy be harnessed and used here on Earth? • Have you ever seen a solar panel? • How does it harness energy? • What is an insulator? Conductor? • How could solar energy be used in our homes or schools? 	<p>Introduction:</p> <p>The class will discuss solar energy as a very powerful source of energy that all living things use. Discussions of renewable/nonrenewable will follow and how important it is to use sources of energy that are plentiful and free.</p> <p>The class will discuss how to harness solar energy and review how solar panels work. The students can recall relevant information when and if the class has visited the CEED building or a similar building. The students will be asked “Have you ever tried to cook something using solar power?” If so, how did it work out? Did it work? What made it work?</p>
<p style="text-align: center;">Guided Practice</p>	<ul style="list-style-type: none"> • Students will be shown a store bought solar oven. Discuss the important parts that make the oven work. Students will be provided ice cubes to locate the best outside location where their ice cubes will melt the fastest. Encourage them to try different materials—wood, grass, metal, rocks, etc. Discuss the observations being made and have students conclude where the best place to place a solar oven might be. • Students will work in groups of 3-5 to construct their homemade version of a solar oven using the instructions provided. Assist as needed. <p>Predictions should be made by teams:</p> <ul style="list-style-type: none"> • What time of day and kind of day do you think the solar oven will produce the best results? Why? • Which oven do you think will produce the best results for cooking? Why? • How hot do you think the ovens will get on a very sunny day? • How hot do you think the ovens will get on a cloudy day? • How long do you think it will take to cook/melt the smores? 	
<p style="text-align: center;">Independent Practice</p>	<ul style="list-style-type: none"> • Day 1--Allow students to set their solar ovens outside, deciding how best to set them up, where the sun best heats it, and manipulate them through the day. Students will take temperature readings 3 times a day and record their findings. Readings will also be taken from the store bought solar oven. • Day 2—After discussing the time of day that produces the hottest temperatures, students will place smores inside the solar ovens. Students will place thermometer inside oven to obtain temperature. Times and results will differ. 	

CEED

Instructional Activities

	<ul style="list-style-type: none"> • Discuss the successes/challenges with the solar ovens. Brainstorm ways to improve their ovens. • Smores will also be made using the store bought solar oven. Compare/contrast the results with this oven to their homemade one. • Eat them!!!!!!!!!!
Closure (Summary of Lesson)	<p>Students will discuss how the ovens worked and problems they may have had or things they would have done differently. The teacher will ask the students what the advantages of solar power are and how it could improve/benefit our world. Students will understand that solar power is a powerful source of energy that is plentiful and free of charge!!</p>
CEED Building Application/ Sensor Data	<p>TSW use the CEED dashboard to compare times of the day where solar power is producing the most energy and discuss. TSW use the dashboard to view videos under the heading “How it works” to help answer many questions about alternative energy resources.</p>
Assessment	<p>Students will document their experiment by writing about the steps that they took to make the solar oven, cook their smores, and their results. They will answer the following questions:</p> <ul style="list-style-type: none"> • What time of day did the ovens produce the hottest temperature? • How long did it take to cook the smores? • How could you change your oven to produce better results? • When would it be beneficial to use a solar oven? • How could you use solar energy at your home? • What are other ways to use solar energy?

INQUIRY LEARNING RESEARCH PROCESS GUIDELINES

The following table is just one guideline to use for developing your own inquiry materials. The seven steps in the Learning Research Process include not only how people learn but also how research is conducted. The heart of the design, the three-stage learning cycle of exploration, concept invention or formation, and application is embedded in the middle. In addition to these three stages, this design takes into account that learners need to be motivated to spend the time required for understanding complex subjects and that learners need to build this new knowledge onto prior knowledge. These are similar to the 5E and 7E learning models.

The Learning-Research Process

Steps in the Learning-Research Process	7E Equivalent	Component of the Activity
1. Identify a need to learn.	Engage	An issue that excites and interests is presented. An answer to the question <i>Why?</i> is given. Learning objectives and success criteria are defined.
2. Connect to prior understandings.	Elicit	A question or issue is raised, and student explanations or predictions are sought. Prerequisite material and understanding is identified.
3. Explore	Explore	A model or task is provided, and resource material is identified. Students explore the model or task in response to critical-thinking questions.
4. Concept invention, introduction, and formation	Explain	Critical-thinking questions lead to the identification of concepts, and understanding is developed.
5. Practice applying knowledge.		Skill exercises involved straightforward application of the knowledge.
6. Apply knowledge in new contexts.	Elaborate and Extend	Problems and extended problems require synthesis and transference of concepts.
7. Reflect on the process	Evaluate	Problem solutions and answers to questions are validated and integrated with concepts. Learning and performance are assess

CEED
Instructional Activities

Hanson, D. (2006). POGIL Instructor's Guide to Process-Oriented Guided-Inquiry Learning. Lisle, IL: Pacific Crest