



Heating up with Soda Cans – Solar Energy Heaters

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Target Grade: 4th grade

Time Required: 97 minutes

Standards:

- **4.ESS3:** (Earth and Human Activity) 1) Obtain and combine information to describe that energy and fuels are derived from natural resources and that some energy and fuel sources are renewable (sunlight, wind, water) and some are not (fossil fuels, minerals).
- **4.W.TP.2** Write informative/explanatory texts to examine a topic, convey ideas, and information.

Lesson Objectives:

Students will:

- Know what solar energy is and how we use it.
- Understand that there are advantages and disadvantages that come with using solar energy.
- Be able to research the different ways to use solar energy and create a model structure to demonstrate the practical use of solar energy by building a soda-can bottle heater.
- Be able to present their design to the class.

Central Focus:

This lesson integrates two content areas: Earth and human activity and English/language arts. In this lesson, students will discuss within their table groups, what solar energy is and how it is used. They will be taught about the advantages and disadvantages that accompany the use of solar energy. By the midpoint of this lesson, students will be asked to research the different ways to use solar energy, specifically focusing on residential uses. When they determine the different uses of solar energy, they will create a model by building a soda-can solar heater to demonstrate the practical use of solar energy. This lesson integrates ELA because students will then be asked to write informatively about solar heaters and how they can benefit our everyday lives.



Background Information:

Students should be aware of how to write informative/explanatory texts prior to this lesson. The teacher can refer back to famous inventors learned in social studies, focusing on Benjamin Franklin. The teacher will discuss his discovery and how electricity works and could be used by experimenting during a thunderstorm. In the days leading up to this activity, the teacher needs to introduce the definition of solar energy and how the population uses it. To be sure students fully understand solar energy, they should write an informative/explanatory one-page paper describing what solar energy is and we use it.

Materials

Teacher

- Smartboard (Video will be played as lesson introduction)

Students

- Each group of students will have a set of supplies given to them.
 - Cardboard boxes
 - Black paint
 - Scissors
 - Glue
 - Aluminum foil
 - Duct tape
 - Plastic tubing
 - Empty soda cans
- Poems assigned to each student
- Chromebook, iPad, etc. (for research purposes only)

Instruction

Introduction (Around 15 minutes)

- Motivator: Today we will begin our unit on solar energy! This video is a quick Bill Nye introduction of how solar energy works. <https://www.youtube.com/watch?v=av24fEMhDoU>
- The teacher will show visual aids to help students better understand how solar energy works. The teacher will also show images of DIY solar soda-can projects, so the students have a clear picture of what to create. See page 5.
- Hook: The teacher will display a Venn-Diagram on the whiteboard. The teacher will lead a class discussion and have the students compare the pros and cons of solar energy.

Guided Practice (10 to 15 minutes)



- Split students into their assigned groups: You will now brainstorm with your group the different ways that solar energy can be used. Focus on how solar energy is used in residential areas. After you brainstorm with your group, get out a Chromebook and research the different uses of solar energy. You also need to research designs for building solar energy heaters. Remember, take notes and gather as much information as possible. You will be presenting at the end of this lesson, as well as turning in an informative essay.
- Ask questions: Throughout the lesson, the teacher will give students opportunities to answer questions regarding solar energy as it is used today. The questions will get the students to think about how they can use solar energy more frequently in their daily lives.
 - What is solar energy? What are the benefits of solar energy?
 - How is solar energy used now, and how could it be used more?
 - Where would you use your soda can solar heater? How would it improve your life?

Activity part 1 (30 to 45 minutes):

- Call a team representative from each group to collect their needed materials: Take some time to collaborate your group's ideas for making your solar heater. When you have a plan, you may begin building.
- Students will begin the design process.
- During independent work: The teacher will move around the classroom and monitor the group's discussions. The goal is to see the groups work together and solve issues they may encounter with their designs.

Activity Part 2 (10 to 15 minutes):

- As groups begin to finish their models, the teacher will instruct the students to begin organizing and writing their essay: You will all gather the notes you took from your research at the beginning of this lesson and use it to write your essays. In your writing, include information about solar heaters and how they can benefit our everyday lives.

Conclusion/Presentations (3 to 5 minutes):

- Groups will present their final project: Each group will get a chance to present their model. Be sure to tell the class what it's purpose is, how you chose to build it, and how it is beneficial residentially.



Differentiation

Grouping: Will be based on high-low performance. The teacher will place students who struggle and progress at slower rates with students who are high-performing. This way, the high-performance students can help re-explain instructions to their group members when the teacher isn't present.

Assessment

Formative:

- The final project will be graded using a standard project grading rubric.
- Students will also complete a peer review assessment of each member in their group that will be added to their final project grade.
- Students will turn in their essays that they wrote after building their solar heater model. This essay will inform the teacher if the students were able to grasp the information about solar energy correctly.
- Questions: Throughout the lesson, the teacher will give the students opportunities to answer questions regarding solar energy. The questions are aimed to get the students to think about how we could use solar energy more often in our lives.
 - Knowledge/comprehension: What is solar energy? What are the benefits of solar energy?
 - Application and Analysis: How is solar energy used now, and how could it be used more?
 - Creation and Evaluation: Where would you use your soda can solar heater? How would it improve your life?

Image Examples:



Obtained from:

<https://goo.gl/images/NnXBbg>

Presentation Rubric

CATEGORIES	Mastered (4)	Developing (3)	Emerging (2)	Not observed (1)
CATEGORIZATION	Student was able to categorize the importance of solar energy in residential areas	Student was able to categorize only a portion of the importance of solar energy	Student understood solar energy but was unable to categorize the importance in a residential area.	There is no evidence of categorization.
DRAWING CONCLUSIONS/ JUSTIFYING SOLUTIONS	Student was able to justify their solar heater model. Was able to redesign problems as they arose.	Student was able to justify the use of a solar heater but unable to justify their solar heater. Was able to fix some problems as they arose.	Displayed knowledge of what the outcome should be, but unable to justify the solution.	There is no evidence of drawing conclusions/ justifying solutions.
GENERATING IDEAS	Student was able to share and make ideas about how to build their solar heater for their residential design model.	Displayed ability to generate ideas about how to build solar heater but was unable to share thoughts with class.	Displayed little to no ability to generate ideas about how to build a solar heater for their residential model.	There is no evidence of generating ideas.
PREDICTING OUTCOMES	Displayed ability to predict the outcome of solar heater seen through designs. Solar heater worked as predicted.	Displayed ability to predict the outcome of solar heater seen through designs, Solar heater worked 75%.	Displayed ability to predict the outcome of solar heater seen through designs, Solar heater did not work.	There is no evidence of predicting outcomes.
OBSERVING AND EXPERIMENTING	Able to explain how they built their solar heater through experimentation	Explained how they built their solar heater but did not include how they experimented.	Displayed ability to observe, little to no experiments conducted	There is no evidence of observing/experimenting.
IMPROVING SOLUTIONS	Displayed ability to improve upon their first design.			There is no evidence of improving solutions.
IDENTIFYING RELEVANT INFORMATION	Students shared relevant information about their solar heater when presenting.	Students shared some relevant information about their solar heater when presenting.	Students went off topic when presenting their solar heater. Did share little relevant information.	There is no evidence of identifying relevant information.
CREATIVITY	Mini residential model and soda can heater were well thought out, neat, and creative.	Mini residential model and soda can heater were well thought out and creative.	Mini residential model or the soda can heater was well thought out and creative.	There was no evidence of creativity in either model.

Essay Rubric

ESSAY RUBRIC	BASED ON THE STUDENT'S ABILITY TO MEET THE CRITERIA GIVE A SCORE OF 3,2, OR 1.
PROVIDED INFORMATION ABOUT SOLAR HEATERS PROVIDED REASONS AS TO WHY SOLAR ENERGY IS IMPORTANT.	
PROVIDED REASONS/EXAMPLES AS TO WHY SOLAR HEATERS AND SOLAR ENERGY ARE IMPORTANT IN RESIDENTIAL AREAS.	

Peer evaluation:

Students will fill out a peer evaluation for their group. The teacher will inform the class that 3 points indicate the student participated 100%, 2 points indicate that the student participated 50% in the activity, and 1 point indicate the student did not participate in the activity.

Peer evaluation

Group member names:	3	2	1