

## Didactic Scenario

### 1. Title

The Power of the Sun: Creating a Simple Solar Oven

### 2. Keywords

Solar energy, Heat, Renewable energy sources, Environmental education

### 3. Basic information

**STEAM Subject:** SCIENCE

**Typical interaction time with the learning scenario in for in-school work:** 90 minutes

**General description of the scenario:**

<u>Phases</u>	<u>Stage</u>	<u>Time</u>
Introduction and explanation of concepts (e.g. solar energy, heat)	Preparatory Stage	20 minutes
Construction of the solar oven	Implementation Stage	35 minutes
Observation and evaluation of its operation	Implementation Stage	20 minutes
Discussion and feedback	Evaluation Stage	15 minutes

**Age group:** 10-12 years old

### Estimated difficulty level:

Very Easy	Easy	Moderate	Challenging	Very Challenging
		X		

### Teaching resources

#### Materials:

- Cardboard box (shoe size or larger) – for oven frame.
- Aluminum foil – to reflect the sun's rays and increase heat.
- Black cardboard or black paint – to absorb heat.
- Clear film or plastic wrap (eg clear cellophane) – to keep the heat in.
- Glue or tape – to hold materials together.
- Scissors or cutter – to cut cardboard and other materials.
- Ruler and pencil – for measuring and noting.
- Newspapers or papers (for lining) – to insulate and stabilize the walls.
- Small pan or black plate – to place the food or ingredients you want to heat inside the oven.

#### Optionally:

- Thermometer – to measure the temperature inside the oven and record the results.
- Small pieces of food (eg marshmallows or chocolate) – to demonstrate the effect of heat.

**School infrastructure:** Access to an outdoor area with direct sunlight

### Additional material from external sources/online tools:

- NASA's educational website where you can find detailed instructions and educational materials for building a solar oven. <https://climatekids.nasa.gov/smores/>
- PhET provides interactive simulations of physical phenomena. You can use the "Energy Forms and Changes" simulation to explain the conversion of solar energy to heat. <https://phet.colorado.edu/en/simulations/energy-forms-and-changes>
- Video about introduction to energy <https://www.youtube.com/watch?v=qzvatDIDXwo&t=1s>

**Differentiated instruction for students with different abilities and learning styles in the same class:**

Kinesthetic learning

**Proposal:** Students who learn best through doing and movement can benefit from the construction and practical application of knowledge.

**Activity:** Give these students more active roles in making the oven. You can assign them to handle the tools or take care of placing the materials in the right place.

**Developed by:** Development Center of Thessaly

#### 4. Educational Problem

The scenario solves the problem of abstract understanding of scientific concepts such as energy and heat by providing students with hands-on experience through building a solar oven. In addition, it enhances the active participation and collaboration of students, making them combine theory with application.

#### 5. Learning Objective (-s)

1. Understanding scientific concepts. Students will understand basic concepts such as solar energy, heat and energy conversion.
2. Development of practical skills. They will improve their skills in building and using tools to build the solar oven.
3. Strengthening critical thinking. They will learn to think critically, testing the effectiveness of the oven and looking for ways to improve.
4. Cooperation and teamwork. Students will develop collaborative skills by working in teams to build and test the oven.
5. Awareness of renewable energy sources. They will become aware of renewable energy sources and their importance for the environment.

#### 6. Phases of the Scenario

##### Phase 1

**Title:** Introduction and explanation of concepts (e.g. solar energy, 0 heat)

Indoor	Outdoor	Mixed
		X

**Phase duration in minutes:** 20 minutes

**Detailed description of the scenario phase:** In the first phase of the scenario, students are introduced to the basic concepts of solar energy and heat through a short presentation or discussion. The instructor explains how solar energy can be converted into heat and how this can be harnessed in everyday applications such as solar ovens. Students are then prompted to think of examples of renewable energy sources, and through visual materials (pictures or videos), see how a simple solar oven works. In this phase, the objectives of the activity are also discussed so that students understand the work to come.

### Activity Sheets:

#### Activity Sheet – Phase 1: Introduction to Solar Energy

Name: \_\_\_\_\_

Date: \_\_\_\_\_

#### 1. What is solar energy?

Complete the definition of solar energy based on the class discussion. \_

Solar energy is \_\_\_\_\_.

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#### 2. How can we use solar energy?

Complete the examples below.

- To warm \_\_\_\_\_.
- To produce \_\_\_\_\_.
- To charge \_\_\_\_\_.

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#### 3. Circle the correct answer:

Solar energy is:

- A form of renewable energy.
- A form of non-renewable energy.

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4. Draw what you think a solar oven looks like:

(In this context, ask the students to make a simple design of a solar oven, based on what they have heard so far.)

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5. Discuss with your neighbor:

How do you think solar energy will heat food in an oven? Can you think of other ways we use the sun's heat in our daily lives?

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Additional Questions (optional):

- Why do you think solar energy is important for our environment?
- How can we use it in more applications?

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## Phase 2

**Title:** Construction of the solar oven

Indoor	Outdoor	Mixed
	X	

**Phase duration in minutes:** 35 minutes

**Detailed description of the scenario phase:** In the second phase of the scenario, the students proceed to build the solar oven, using the materials given to them (cardboard, aluminum foil, black paper, transparent film, etc.). The instructor gives step-by-step instructions, explaining the role of each material in the operation of the oven: the aluminum foil to reflect solar radiation, the black paper to absorb heat and the transparent film to retain heat. Students work in groups, cut and assemble the materials, taking care to place each element correctly. During the process, they are encouraged to discuss and think of ways to improve the oven, such as improving the insulation or changing the shape of the box.

**Activity Sheets:** N/A

## Phase 3

**Title:** Observation and evaluation of its operation

Indoor	Outdoor	Mixed
	X	

**Phase duration in minutes:** 20 minutes

**Detailed description of the scenario phase:** In the third phase of the scenario, students observe and evaluate the operation of the solar oven they built. They go outside in direct sunlight and place their ovens with food or an object to see how much heat it can produce. During the observation, students record the time it takes for the food to heat up and compare the temperature inside the oven, using (optionally) a thermometer. Then they discuss the results: How well did the oven work? What factors affected performance? Are there any improvements they could make? This phase encourages critical thinking and relating theory to practice.

**Activity Sheets:** TO

#### Phase 4

**Title:** Discussion and feedback

Inside the classroom	Outdoors	Mixed way
		X

**Phase duration in minutes:** 15 minutes

**Detailed description of the scenario phase:** In the fourth phase of the scenario, students participate in a discussion and feedback about the experience of building and operating the solar oven. During the discussion, students share their observations, analyze the test results, and discuss the strengths and weaknesses of their constructions. The instructor guides the discussion, asking questions to encourage critical thinking and analysis, while providing feedback on the construction and operation of the ovens. Students also consider their peers' suggestions for possible improvements and plan future steps to further improve their designs.

**Activity Sheets:**

Activity Sheet – 4th Phase: Discussion and Feedback

Name: \_\_\_\_\_

Date: \_\_\_\_\_

1. Complete the following statement:

The solar oven we built \_\_\_\_\_ (eg "worked well" or "had problems").

2. Record the following results:

Time taken to heat the food:

Temperature inside the oven (if a thermometer was used):

3. Identify any problems or weaknesses:

The problem we faced was \_\_\_\_\_.

We believe the cause of the problem is \_\_\_\_\_.

4. He mentioned three improvements we could make:

5. Give feedback to your classmates:

Things you liked about building your classmates' oven:

Suggestions for improving your classmates' oven:

6. Conclusion:

What did you learn from this activity and how will you use this knowledge in the future?

## 7. Evaluation Methodology

During the construction of the solar oven, students are assessed through observation of their participation, cooperation and ability to follow instructions. During the observation and evaluation phase, simple measurement tools are used to record oven performance, such as temperature and heating time. In the discussion and feedback phase, students are assessed through activity sheets, which record their observations, suggestions for improvement and feedback to their classmates. The final assessment includes a review of results, participation and ability to apply scientific concepts, with the aim of enhancing learning outcomes and identifying achievements and areas for improvement.

## 8. Additional Resources for the teacher

N/A