



the CEED

THE CENTER FOR ENERGY EFFICIENT DESIGN

Solar Power – How Strong is The Sun	
Grade Level	3rd
Subject	Sources of Energy
Objective(s): The student will investigate, understand, compare and contrast the effectiveness of the sun as a renewable source of energy.	<p>SOL Addressed: 3.11 The student will investigate and understand different sources of energy. Key concepts include a) energy from the sun; b) sources of renewable energy; and</p> <p>Common Core Standards: 4ESS3-1 Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.</p>
Materials Needed Per Class of 30 and Prior Knowledge	<p>10 Solar Powered Cars http://sunwindsolar.3dcartstores.com/SunnySide-Up- p 35.html 10 Stopwatches 10 Thermometers Calculators Meter sticks/measuring wheel 30 Copies of Data Table Flat, paved/sidewalk area for test launch outside. (Cars will not work inside)</p> <p>Access to CEED Dashboard http://dashboard.intellergy.us/ceed/index.php</p> <p>Prior Knowledge: Reading a thermometer, operating a stopwatch. The student should be able to define and give examples of renewable and nonrenewable energy sources.</p>
Ways to differentiate this lesson plan	<ul style="list-style-type: none"> • EXTENSION for Higher Level Learner <ul style="list-style-type: none"> - Have students research alternative green energy sources and the cost versus benefit of using these alternate energy sources - Research the effectiveness of electric cars – what is their footprint on the environment when you take production into consideration. • MODIFICATIONS <ul style="list-style-type: none"> - Students should be allowed to work in groups. If a student cannot read the thermometer or stop watch, they should be paired with students who can, or a teacher/teacher’s aide should work in the group with that student.

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Instructional Activities

<p style="text-align: center;">Introduction/ Anticipatory Set</p>	<p>Anticipatory Set: Imagine a world without any fossil fuels. What are some of the ways we could power a vehicle?</p> <p>Questions to ask students:</p> <ul style="list-style-type: none"> • Discuss the least effective sources of energy that would power a car. What makes them the least effective? • What environmental factors affect the amount of energy that can be collected? 	<p>Introduction:</p> <p>Analyze CEED dashboard data for Solar Power collection. Look at the past week. What are peak times of energy collection? What causes these times to be higher? Look at the past Month, then at the past year. What are peak energy collection times? What explains this?</p> <p>Look at the collection for 10:00 pm. Why is it 0?</p>
<p style="text-align: center;">Guided Practice</p>	<p>Students should investigate how effective solar powered vehicles could be in a real world setting by testing their solar powered car at a variety of times throughout the day.</p> <p>Students should choose 3 different times during the school day to collect data on their solar powered vehicles. Note these collection times on the Data sheet. Students should practice reading the thermometer and starting and stopping the stopwatch for accuracy and quickness.</p> <p>**After data collection, the teacher should complete a mini lesson teaching students to find speed by dividing distance by time (meters/second) using a calculator. **</p>	
<p style="text-align: center;">Independent Practice</p>	<p>Students should work together in teams of 3. (If supplies are limited, teams could be larger, however teams ideally should be 5 or less). Each member will take on a role, and should be actively participating. Students will “run” their cars in the designated area in the sun during 3 different portions of the day, recording the time and distance traveled by the car and current temperature. Students will repeat the experiment on Day 2.</p> <p>Students should then work cooperatively in their groups to answer the discussion questions.</p>	
<p style="text-align: center;">Closure (Summary of Lesson)</p>	<p>Students should then work cooperatively in their groups to answer the discussion questions. The teacher should then compare the dashboard data to their data.</p>	

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Instructional Activities

CEED Building Application/ Sensor Data	Students should study the dashboard data for the solar panels at the CEED center as described in the lesson. This data is imperative for student understanding of the direct correlation of the amount of energy given off by the sun, and the distance the car travels.
Assessment	TTW informally assess the student's participation, class discussions, and the students completed discussion questions. TTW formally assess the student using the unit test.

Data Table

<u>Time of Day</u>	<u>Distance of Car (m)</u>	<u>Time Traveled (s)</u>	<u>Speed (m/s)</u>	<u>Temperature</u>
<u>Trial 1:</u>				
<u>Trial 2:</u>				
<u>Trial 3:</u>				
<u>Day 2 Trial 1:</u>				
<u>Day 2 Trial 2:</u>				
<u>Day 2 Trial 3:</u>				

Solar Power Vehicle Questions.

1. What relationship did you observe between the distance the car traveled and the temperature of the air? Explain why you think there is or is not a correlation.

2. What factors do you believe lead to a higher speed?

3. Compare the data from Day 1 and Day 2 at each time. What do you notice about the data? What could explain this?

4. Would a solar powered vehicle work on a large scale for everyday use? Give specific reasons why you believe it would, or why you believe it would not.

5. Compare the distance your car traveled at each time, to the same time on the dashboard data. Explain how the distance traveled directly relates to the amount of energy collected by the solar panels.
