



the CEED

THE CENTER FOR ENERGY EFFICIENT DESIGN

Title <i>LEGO® My House</i>	
Grade Level	Fourth Grade
Subject	<i>Solar Energy/Green Building Techniques</i>
Objective(s): The student will understand natural resources including the sun. The student will investigate solar energy by measuring the effect of the sun’s heat on various materials. The student will use appropriate instruments to measure the temperature, develop a hypothesis, and collect and display data.	SOL Addressed: 4.1c appropriate instruments are selected and used to measure length, mass, volume, and temperature in metric units; h)hypotheses are developed as cause and effect relationships; i) data are collected, recorded, analyzed, and displayed using bar and basic line graphs 4.9 The student will investigate and understand important Virginia natural resources. Key concepts include c) minerals, rocks, ores, and energy sources; 4.8 The student will investigate and understand the relationships among Earth, the moon, and the sun. Key concepts include a) the motions of Earth, the moon, and the sun;
	Next Generation Science Standards: 3-ESS3-1. Make a claim about the merit of a design solution that reduces the impacts of weather 4-ESS3-1. Obtain and combine information to describe that energy, and fuels are derived from natural resources and their uses affect the environment.
Materials Needed Per Class of 30 and Prior Knowledge	Materials Needed: One thermometer for each group One bag of the following: potting soil, sand, small light colored and small dark colored rocks Small plants One small shoe box lid for each group Large supply of <i>LEGO®</i> Large box lid Prior Knowledge: Students will need to have a basic understanding of the sun as a source of energy as it provides the earth with light and heat. The student will need to have a basic understanding of basic green building techniques. The student will need to know how to read a thermometer accurately.

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<p style="text-align: center;">Ways to differentiate this lesson plan</p>	<p>1. EXTENSION for Higher Level Learner –Students could use the knowledge gained from the activity to answer the following questions.</p> <p>2. Imagine three cities in the desert.</p> <p style="padding-left: 40px;">One city (A) is surrounded by a dark-colored rocky surface.</p> <p style="padding-left: 40px;">Another city (B) is surrounded by a light-colored sandy surface.</p> <p style="padding-left: 40px;">The third city (C) is built on the edge of a large man-made desert lake.</p> <p style="padding-left: 40px;">1. Which city would likely have the highest average summer air temperature and why?</p> <p style="padding-left: 40px;">2. Which of the above cities would have the warmest average winter temperature? Why?</p> <p>MODIFICATIONS –Students may have data tables provided by the teacher and simply fill in the data.</p>	
<p style="text-align: center;">Introduction/ Anticipatory Set</p>	<p>Anticipatory Set: The teacher will ask students the following questions and supervise a class discussion.</p> <p>Questions to ask students:</p> <ul style="list-style-type: none"> • Where does all of our energy come from? • What is renewable energy? What are some sources of renewable energy? • How does the sun affect the earth? • How does the sun affect the way we design our homes? • How can we make our homes more energy efficient? 	<p>Introduction:</p> <p>Imagine that you want to build a new home. You would like to build your home to be energy efficient. You will learn about the green building techniques used in the CEED building and then have an opportunity to try to create your own green building.</p>

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Guided Practice	<p>The teacher will use the “how it works” portion of the CEED website to introduce the students to the ways buildings can be designed to take advantage of the sun’s energy. The students will view the videos and information about earth berming, green roofs, and orientation of buildings.</p>
Independent Practice	<p>Students will be presented with their challenge: Your challenge is to use what you have learned about green building to design a <i>LEGO</i>® house. You will be allowed to use any of the materials available for landscaping around your house and to make a roof for the top of your house. You may decide with your team about your goal. Will you try to design your house to retain the sun’s energy and stay warm or will you design your house to repel the sun’s heat and stay cool?</p> <ol style="list-style-type: none">1. Students will be introduced to the various materials available for the experiment.2. Students will work with their team to design their <i>LEGO</i>® house (This house will be designed with a flat roof made from a small box lid). This will allow students to choose a material for their roof which can be placed in the box lid. They will be provided with a larger box lid to use as the area around their house where they may place their chosen materials for “landscaping”.3. Students will discuss with the class how often they might measure their home’s temperature. What would be reasonable for time increments?4. Students will design a data table to record information from their experiment.5. Students will develop a hypothesis with their team for their experiment.6. Students will place the thermometer inside the <i>LEGO</i>® house and measure the temperature at various intervals decided by the class earlier. Students will record the temperature at each interval on their data table.7. Students will answer the following questions:<ol style="list-style-type: none">A. Did your home gain or lose heat?B. What was the difference in your base temperature and your ending temperature?C. What conclusions can you draw about your home’s ability to heat up or stay cool as it is affected by the sun’s energy?D. What strategies and materials worked best for your home?8. Write a conclusion explaining what you learned about the sun’s energy and its effect on your materials and your <i>LEGO</i>® home.

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Closure (Summary of Lesson)	Students will share their information with the class. Students will discuss the following questions: A. Which materials were used in the homes that stayed the coolest? B. Which materials were used in the homes that warmed up the most? C. Which material would you want to use if you wanted your house to stay cool? D. Were there any other strategies used by the teams that helped the homes stay cool or warm?
CEED Building Application/ Sensor Data	Access the Ceed Sensor Data. Look at the solar panel information. How much energy are they collecting today? At what time today were the solar panels collecting the most solar energy? Does that time correspond to when your homes temperature was the highest? What properties of the CEED building are helping it to be energy efficient?
Assessment	The teacher can assess the following: data tables, student's conclusions, and student's hypothesis.

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.

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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

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