



THE 2018 SOUTH CAROLINA
**4-H ENGINEERING
CHALLENGE**

EnlightenSC Energy House Challenge

Challenge Description:

Teams will design and build a cost-effective, energy-efficient home that maximizes the use of natural light and that includes an energy-crop garden. At the event, each team will display their house and garden, show documentation of the building process, and give a presentation to a panel of judges.

Team Requirements:

- 2-4 students per team.
- Age Range: Junior (age 9-13) and Senior (age 14-19)

Materials Needed:

Design and bring a cost-effective, energy-efficient home that maximizes the use of natural light and that includes an energy-crop garden. The house and the garden are to be made from repurposed and recycled materials. Provide at least 4 photographs of the construction of your home in process.

Challenge Instructions:

Teams will display their energy house with an energy-crop garden and pictures of the construction of the house and garden. Each team will make a presentation to explain their design and thinking to the judges.

Preparation Instructions:

1. Create a structure that will serve as your home. You need repurposed and recycled materials to apply to represent additions to the structure.
2. Craft a *home* or three-dimensional space – a cube, series of planes, or an irregular shape. The design must allow enough light to enter the space. Using the flashlight when you are finished, see what shadows are cast in the volume. Move the flashlight to represent the changing of the sun's location during the day.
3. Assume that your home will use natural light for most of the day. Where will you position your home to be most efficient and most comfortable while allowing the most productivity?
4. Consider how you will generate the additional power you need to heat, cool, light, and operate your home. Will you attach to the power grid like most homes do and purchase electricity from a local utility? Will you go "off the grid" and power your home with renewable energy, such as solar panels? If so, what will you do when the sun isn't shining? Whatever you decide, think about the consequences of each choice, including how much it will cost to purchase power or the initial cost of equipment such as solar panels.
5. Use *only* recycled or repurposed pieces to create your additional power to the paper design of your home. For example, use old camera film as a way to represent solar panels.
6. Design your garden. Use only repurposed or recycled materials to represent your garden.



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Judging:

Entries will be judged on three criteria: design, explanation of thinking, and photographs documenting construction. Homes are to be built off-site and brought to the competition for judging.

1. Homes and gardens will be judged on their beauty, creative design, creative use of repurposed objects, energy efficiency, cost effectiveness, and consideration of practical challenges, including costs.
2. Be prepared to explain your thinking to the judges about the choices you made in designing your energy-efficient home and garden.
3. Provide at least 4 photographs of the construction of your home in process.

Judging Rubric:

Design (max 20 points)

Beauty	1	2	3	4
Creative Design	1	2	3	4
Repurposed Objects	1	2	3	4
Energy Efficient	1	2	3	4
Cost Effective	1	2	3	4
Consideration of practical challenges including cost	1	2	3	4

Explanation of thinking (max 12 points)

- Is it possible to design a home that is both aesthetically appealing and energy efficient? ____
- What does it mean for a home to be energy efficient? ____
- How are homes made energy efficient? ____
- What is the impact of an energy-efficient home on the environment? ____
- How does using natural light contribute to energy efficiency? What problems does it create? ____
- What is the connection between natural light, energy efficiency, and productivity? ____
- What kinds of renewable energy systems can be installed in a home to allow the home to be more energy efficient? Which systems are the most cost-effective for consumers? ____
 - How can you harness renewable energy to power a home? ____
 - How does the design of the home contribute to energy use and/or efficiency? ____
 - How does energy efficiency in one home affect a community? ____
- What does the term “Demand Response” mean and how can it impact home energy use? Define a “Smart Home.” How does it incorporate “Demand Response”? How are the two concepts different? ____
 - How have consumers responded to electric utilities’ efforts to manage their use of electricity during periods of peak energy use? ____

Photo Documentation (max 9 points)

Less than 4 photos (but at least 1-3)	____ (1 point)
Four photos	____ (3 points)
More than 4 photos	____ (5 points)

TOTAL _____ (max 41 points)



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Questions to Consider:

- How should you design a home that is both beautiful and energy efficient?
- What is an energy-efficient home? How are homes made energy efficient?
- How do energy-efficient homes impact the environment?
- What crops could be planted in your energy-crop garden? How would those crops contribute to the efficiency of the house?
- How are crops used to make fuels? Fertilizer? Why would that be important to your house?
- Other than crops, what could be included in your garden that would contribute to the energy efficiency of your home?
- How does using natural light contribute to energy efficiency? What problems does it create?
- What kinds of renewable energy systems can be installed in a home to allow the home to make it energy efficient? Which systems are the most cost-effective for consumers?
- How can you harness renewable energy to power a home?
- How does the design of the home contribute to energy use and/or efficiency?
- How does energy efficiency in one home affect a community?
- What does the term “Demand Response” mean and how can it impact home energy use?
- Define a “Smart Home.” How does it incorporate “Demand Response”? How are the two concepts different?
- How have consumers responded to electric utilities’ efforts to manage their use of electricity during periods of peak energy use?

Information to Apply:

- Thoughtful home design that incorporates natural light can significantly reduce a home’s energy use and lower consumers’ monthly electric bills.
- An energy-crop garden is a garden that produces crops that help to grow crops used for energy fuels, to recover energy and nutrients from food waste, to improve fertilizer.
- Storage of energy would be helpful to a homeowner. Design viable ways to harness the energy you produce.