

# ENERGY-EFFICIENT HOME: TEACHER'S GUIDE

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## OVERVIEW

In this hands-on STEM challenge, student teams will design and build a model of the most **energy-efficient home** they can imagine using common classroom materials. The goal is to apply knowledge of energy use, conservation and renewable resources through creative problem solving, collaboration and critical thinking.

## LEARNING OBJECTIVES

**By the end of this activity, students will be able to:**

- Identify common ways energy is used in homes.
- Describe strategies for reducing energy consumption.
- Design and build a model that demonstrates energy-efficient features.
- Explain how materials and design choices impact energy use.
- Collaborate with peers to solve a real-world engineering problem.

## MATERIALS PREP

**Materials can vary by availability. Suggested items include:**

- Cardboard, construction paper, tape, glue, scissors.
- Popsicle sticks, foil, cotton balls, straws, fabric scraps.
- Mirrors, black/white paper, bubble wrap.

**You may also provide:**

- Design planning sheets.
- Sketch paper.

**Prep tip:** Set up a materials table so students can self-select as needed and preview the materials available to them.

## TIMING

- **Intro and scenario:** 10-15 minutes.
- **Planning and sketching:** 15-20 minutes.
- **Building:** 30-45 minutes.
- **Presentation:** 15-20 minutes.
- **Reflection:** 10-15 minutes.
- **Total:** 90-120 minutes (flexible for class periods).

## FACILITATION STEPS

### STEP 1

#### Set the stage:

- Read the challenge scenario aloud or display it on the board.
- Show students the available materials and briefly explain what each one might represent in a real home (e.g., foil for reflective roofing, cotton balls for insulation, clear plastic for windows) to spark ideas and encourage creative thinking.
- **Discuss:** “What makes a home energy efficient?” “Where do homes use the most energy?”

### STEP 2

#### Group work:

- Divide students into small teams (2 to 4 per team).
- Allow time for brainstorming, sketching and selecting materials.

### STEP 3

#### Building:

- Circulate and ask probing questions:
  - » “How will your design reduce energy use?”
  - » “Why did you choose that material for insulation?”

### STEP 4

#### Sharing and reflection:

- Each group presents their house, describing:
  - » Key features.
  - » How it conserves energy.
  - » Challenges and design changes.

## DISCUSSION PROMPTS

- What trade-offs did you have to make in your design?
- How did your home balance comfort and energy use?
- What real-world ideas did your design include?

## DIFFERENTIATION AND EXTENSIONS

### For younger students:

- Use simpler materials and focus on visual design and basic concepts like insulation and sunlight.

### For older or advanced students:

- Add complexity with budget constraints, extreme weather scenarios or requiring specific renewable energy components.

# BUILDING YOUR ENERGY-EFFICIENT HOME

STEP  
1

## UNDERSTAND THE CHALLENGE:

### Read the design scenario carefully:

Your team has been hired by a sustainable architecture firm to design the most energy-efficient home of the future! Your goal is to create a model of a home that uses as little energy as possible while staying comfortable for its imaginary residents. You must make thoughtful decisions about materials, layout and features to reduce the use of electricity, heating and cooling, and maximize the use of renewable energy.

STEP  
2

## PLAN YOUR DESIGN

### With your team:

- Brainstorm ideas. What shape will your house be? Why will it be that shape? What materials will keep it warm or cool? How can you use natural light?
- Sketch your home on paper before you build. Label the key features, like insulation, windows, solar panels and more.
- Preview the materials available to you in advance of sketching.

STEP  
3

## GATHER YOUR MATERIALS

- Choose from the available classroom materials.
- Be creative. Repurpose items when possible.

STEP  
4

## BUILD YOUR MODEL

- Work as a team to build a 3D model of your energy-efficient home.
- Use tape, glue or other tools to connect parts securely.
- You can build walls, roofs, windows and other features based on your plan—but it's okay to change your design as you go.

STEP  
5

## REFLECT AND SHARE

### Prepare a short explanation or presentation that answers:

- What energy-saving features does your house have?
- Why did you choose the materials you used?
- If you could build it again, what would you improve?



# ENERGY-EFFICIENT HOME: RUBRIC

CATEGORY	4 – EXCELLENT	3 – PROFICIENT	2 – DEVELOPING	1 – NEEDS IMPROVEMENT
<b>Energy-efficient design</b>	Model includes multiple, clearly explained energy-efficient features that demonstrate strong understanding of how homes use and save energy.	Model includes some energy-efficient features and shows a general understanding of energy use.	Model includes one or two basic features, with limited explanation or connection to energy use.	Model lacks energy-efficient features or shows minimal understanding of energy use.
<b>Creativity and innovation</b>	Design is highly original, resourceful, and makes excellent use of materials in imaginative ways.	Design shows creativity and uses materials effectively and appropriately.	Design shows some creative thinking, but is basic or conventional.	Design lacks originality or thoughtful use of materials.
<b>Planning and teamwork</b>	Team members collaborated smoothly, used time well and clearly planned their design (evident in sketches or notes).	Team worked well together and demonstrated some planning and time management.	Team had minor collaboration or planning issues that affected progress.	Team struggled to work together or did not plan effectively.
<b>Model construction</b>	Model is sturdy, detailed and carefully built; all parts clearly reflect intended features.	Model is mostly sturdy and clear, with minor construction issues.	Model is somewhat incomplete or fragile, with limited detail.	Model is poorly constructed or unfinished.
<b>Presentation or reflection</b>	Team members gave a clear, confident explanation of their design choices, using energy vocabulary and showing strong reasoning.	Team explained their design and features with some relevant energy terms and reasoning.	Team gave a basic explanation with limited detail or connection to energy use.	Team did not explain their design clearly or skipped reflection.