

Zero-Energy House Competition

Teams are required to purchase their own materials prior to arrival at the competition.

Objective

The objective of this competition is to build a one-bedroom model home that uses passive solar energy to heat up the house as much as possible and can hold the heat over a specified time. The goal is to design a home that can increase to the highest temperature during the day simulation and lose the least amount of heat during the night simulation.

Testing

We will place a thermometer in your model house and then blast your model with a large light bulb (representing the sun) for 4-8 minutes. The light will be placed directly above the house. During this time, we will record the temperature inside your model to see how much it warms up. Then, we will simulate nighttime and record the temperature change over 2-6 minutes with the light off and the wind blowing (a fan). The fan will be aimed at the house from the side. This part of the test will show how well your model home retains heat.

The thermometer will be placed through the door during testing as it is attached to a digital screen so make sure there is space for the thermometer.

Judging Criteria

- Your total score will be calculated as the gains in the temperature during the day minus the loss of temperature during the night.

$$\text{Total Score} = \Delta T_{\text{day}} - \Delta T_{\text{night}}$$

- Change in Temperature during the day simulation (ΔT_{day})
- Change in temperature during the night simulation (ΔT_{night})
- In the case of a tie, winner will go to the most aesthetic home.

Rules

The following rules are based on the constraints listed above as well as the objective. However, the following rules do not exhaust every possibility and the judges have final discretion of what is not allowed within the design principles.

- The thermometer block must be removable.
- The device must not catch on fire or put off fumes when heated.

- The device must not include any electrical components.
- Judges will place the thermometer inside the house.
- Each team will have the same amount of time to heat up the house and cool it down.

Design Constraints

The following constrain the design and materials used.

- 1) The house must have three windows and a door. The bedroom must have at least one of the windows.
- 2) The house will not exceed 1'x1'x1' and must be portable.
- 3) The floor size of the home must be AT LEAST 64 square inches.
- 4) The roof height must be at least 2 inches tall.
- 5) The house must accommodate a 3 in tall figure (meaning the height from floor to ceiling must be at least 3 inches)
- 6) Door size must be able to accommodate a thermometer that can be placed entirely inside the middle of the model with the door closed and be able to be read through a window.

Material Allowances:

Must not contain:

- liquid or gel
- Adhesives (e.g. glue) that melt at high temperatures
- Food Products
- Many small pieces (such as shredded paper)
- A large quantity of metal (such as a steel frame), however aluminum foil is fine.