



# Design an Energy-Efficient House

Science, Technology, English  
Curriculum Levels 3-4

---

## Activity Description

Students work in small groups to research energy-efficient house design and passive solar energy. They share their research findings, develop a design for an energy-efficient house and construct a model energy-efficient house from materials supplied, then explain their model to the class.



## Teaching rationale

The students work in groups to conduct web-based inquiry to research factors that need to be considered when designing an energy-efficient house. They share their research findings, develop a design for an energy-efficient house and construct a model energy-efficient house from materials supplied, then explain their model to the class.

The students will be able to:

- describe the factors that need to be considered in designing an energy-efficient house
- describe or model a range of approaches to the design and construction of energy-efficient houses

## Curriculum Links

Area	Achievement Objectives
Science (Level 3-4)	<p><b>Physical World</b> <i>Physical inquiry and physics concepts</i></p> <ul style="list-style-type: none"><li>• Students will explore, describe and represent passive solar energy and other features of energy-efficient house design and construction to create a model of an energy-efficient home.</li></ul> <p><b>Nature of Science</b> <i>Participating and contributing</i></p> <ul style="list-style-type: none"><li>• Students will use their growing knowledge of passive solar energy and work together to process knowledge and explore various options before making decisions and building a model of an energy-efficient house.</li></ul> <p><i>Investigating in science</i></p> <ul style="list-style-type: none"><li>• Students will ask questions, undertake internet research, find evidence and explanations and process available information before building a model of an energy-efficient house and presenting an explanation of its energy-efficient features.</li></ul>
Technology (Level 3)	<p><b>Technological Knowledge</b> <i>Technological products</i></p> <ul style="list-style-type: none"><li>• Students will understand the relationship between the material used and their performance properties in technological products.</li></ul>

**English  
(Level 4)**

**Listening, Reading, and Viewing**

Processes and strategies

Students will integrate sources of information, processes and strategies with growing confidence to identify, form and express ideas as they work in groups to design a model of an energy-efficient house.

Ideas

- Students will show an understanding of ideas contained in complex text that explain the scientific concepts of passive solar design and construction.
- Students will show an increasing understanding of how to shape texts for different purposes when they present their energy-efficient house model to the class.
- Students will understand the relationship between the material used and their performance properties.

**Speaking, Writing, and Presenting**

Students will show an increasing understanding of how to shape texts for different purposes and audiences.

**Running the activity**

- Students form into small groups to conduct their inquiry.
- Need device to undertake internet research.
- Give a copy of the student inquiry worksheet (below)
- Give a copy of the Energy Efficient House Design checklist (below)
- Option to get groups presenting to class as final activity.

# Design an Energy-Efficient House

## Student Inquiry – Small Group

### Overview

You need to work in groups to design an energy efficient house.

The house you will design should aim to be a family home built to an average budget. The design will need to consider the use of passive solar energy.

Each group will:

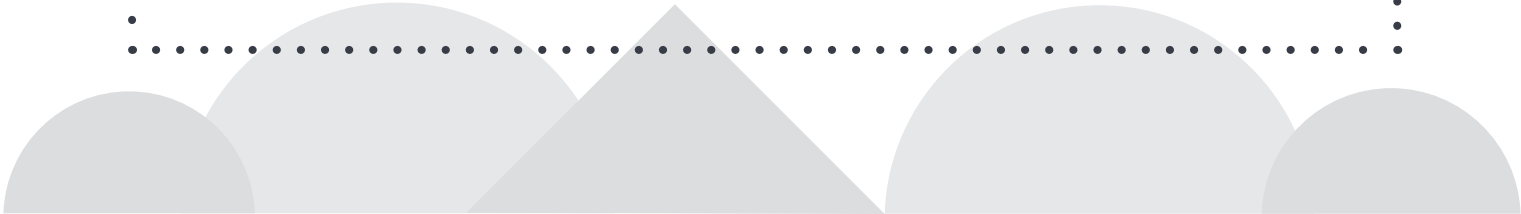
- Complete research using the [School-gen Useful Websites](#) (Ecohouse Design) links to identify what factors and design features need to be considered when designing an energy efficient house.
- Discuss their research findings and work together to agree on a design for an energy efficient house
- Present their design to the class describing its features.



## Key Question

Before you try to answer this question, have a go at answering supporting questions A and B on the next two pages. You can research information on these questions by using the resources listed below

**What is your group's design for an energy efficient house?  
List and then sketch your ideas in the space below.**



## Supporting question A



What passive solar energy factors need to be considered when designing an energy efficient house?

Factors	What design features can be used to increase energy efficiency?	How will this increase energy efficiency?
<i>Example - The sun's path is higher and there are more sunlight hours during summer.</i>	<i>Plant deciduous trees on the North and West to allow sunlight in during winter, and to shelter the house from the sun in summer.</i>	<i>Save energy on air-conditioning.</i>

## Supporting question B



What other energy efficiency factors need to be considered when designing an energy efficient house?

Factors	What design features can be used to increase energy efficiency?	How will this increase energy efficiency?
<i>Example - Heat can be lost through walls</i>	<i>Put insulation in the walls.</i>	<i>This will trap warm air and slow down heat loss during winter. The insulation will also help keep the house cool in summer.</i>

## Energy Efficient House Checklist

Using the sun's energy to warm buildings is described as using passive solar energy.

When architects are designing a building, to make maximum use of passive solar energy and create a building that is naturally warm in winter and cool in summer, they need to consider:

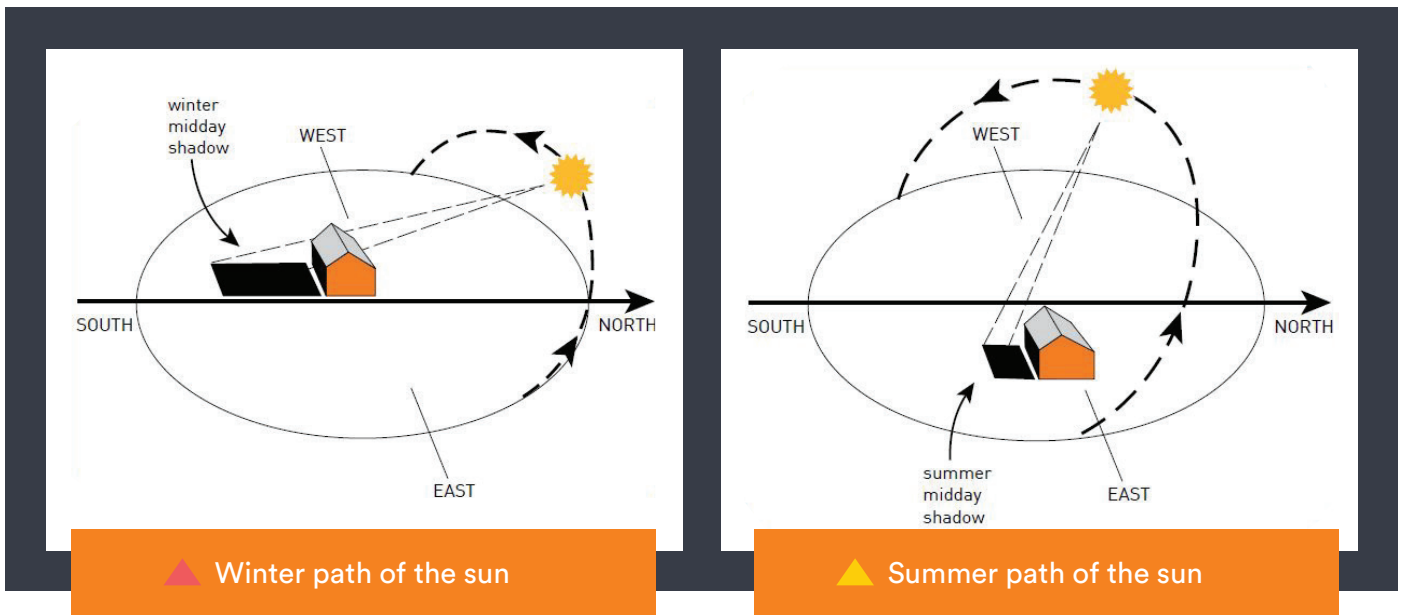
- the building's orientation
- particulars of the site, like the prevailing wind
- the placement, size, construction and treatment of windows
- the use of insulation.

In winter passive solar design and construction means that we:


- use a window design that lets as much solar heat into the building as is practical
- use building materials that absorb the winter sun and release the heat after sunset
- use insulating material that helps retain the heat of the sun (and the heat from other heat energy sources such as a heater).

In summer, passive solar design and construction may mean that we:

- use trees, shade structures, the positioning or windows or window treatments to reduce the amount of summer solar energy that enters buildings or parts of buildings.
- The sun has a different trajectory or path across the sky in the summer than in the winter.







Buildings should be designed and constructed to make sure they receive maximum winter sun. A building that is built on an east-west axis and has windows facing the north will collect maximum summer and winter solar energy. This means that:

- ▲ main living rooms should face north
- rooms that require early morning sun or later afternoon coolness should be on the east
- heat loss will be greatest from south-facing windows, so most homes are built with few windows on the south side (in the Southern hemisphere)
- ▲ rooms that do not need to be warm like bathrooms, laundries and garages should face the cooler south.

Windows facing north will absorb maximum heat energy. Some windows that face north may need to be shaded by deciduous trees or shade structures to help stop some rooms from overheating in summer.

- Special glass or window tints can be used that to reduce absorption of UV radiation and heat in these rooms.

West-facing windows can cause overheating in the late afternoon and may need to be shaded.

- east-facing windows help to warm a room up in the morning.

Curtains can be used to retain heat in a room in winter and to prevent overheating in summer.

