

Solar Energy



How much energy comes from the Sun?

The Sun is a huge sphere of very hot gas and has been producing energy for millions of years.



Even though it is about 150 million kilometers away, the Sun is our closest star and sustains all life.

Solar energy is the radiation from the Sun that reaches Earth. The amount of solar energy that strikes the Earth each day is 10,000 to 15,000 times greater than our daily energy needs.

In fact, the Sun is so powerful, that every minute, enough solar energy reaches Earth to meet our needs for one year!



How do we use solar energy?

The Greeks and the Romans designed and built houses to maximize use of the Sun.

The Romans also made glass and knew that it could trap solar energy. Sunlight was so important that the Roman legal system actually included the right to have access to the Sun!



In modern times, there are three main ways of using solar energy:

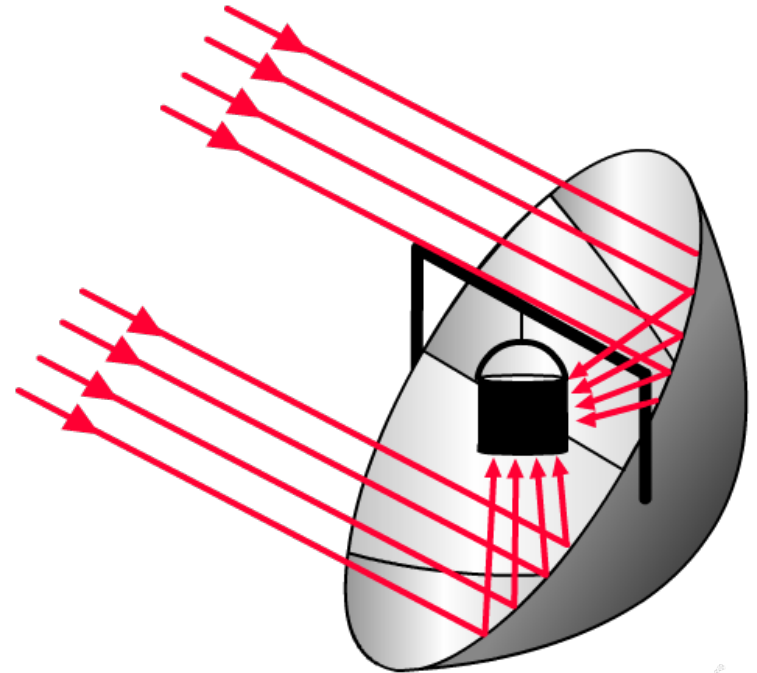
- passive solar heating
- solar power stations
- solar cells.

What is passive solar heating?

Passive solar heating involves any system that can capture the Sun's energy directly. This can be done using a simple solar collector or by the design of a building.

For example, the heat of the Sun can be focused on one spot using a curved mirror.

Solar cookers work on this principle and so require no fuel. Other examples of passive solar heating include a greenhouse or a south-facing window.



What do you think are the advantages and disadvantages of passive solar heating?



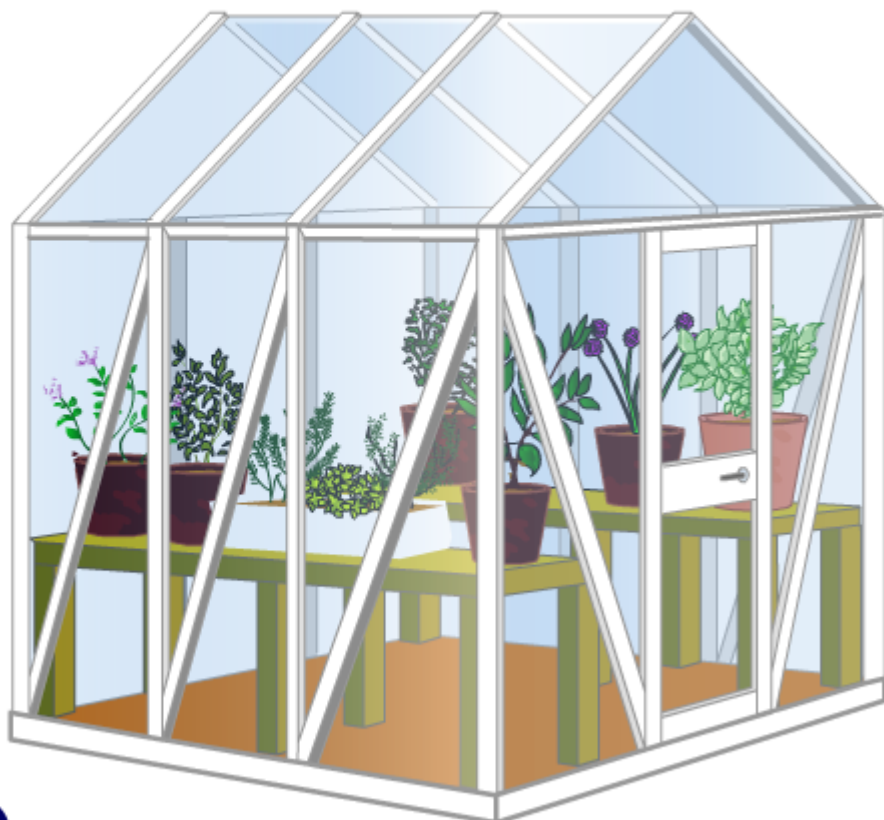
How can the Sun heat buildings?

Buildings can be designed to allow in as much light as possible by incorporating glass walls instead of solid walls. The building is then heated by utilizing the greenhouse effect, which reduces additional energy needs and costs.

This low energy house has a photovoltaic roof and has been designed so that it requires only a minimum amount of energy for heating and lighting.



Why is a greenhouse warm inside?



Plants grow better in a greenhouse because the air inside is always warmer than the air outside, even in winter.

Click "**play**" to find out how the glass in a greenhouse traps solar energy.





What is the order of events that explains how a greenhouse stays warm on a cold day?

- 1** The longer-wavelength infrared waves cannot pass through the glass and are reflected.
- 2** Light and heat (infrared waves) from the Sun pass through the glass into the greenhouse.
- 3** The longer-wavelength infrared waves are trapped in the greenhouse, raising its temperature.
- 4** Some of this light and heat is absorbed by the plants and soil warming them up.
- 5** The warm plants and soil produce heat as infrared waves with longer wavelengths.

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What is a solar power station?

Solar power stations use the Sun's energy to heat water and make steam, which then drives a turbine to produce electricity.



Some solar power stations use a series of mirrors, called heliostats, to reflect light onto a boiler.

This solar power station in California consists of about 1,800 heliostats, with an electrical output of 10 megawatts.



More solar power stations

Some solar power stations use curved mirrors, which focus solar energy onto pipes containing water. This heats the water and forms the steam needed to drive a turbine.



Making solar power stations effective

Solar power stations are most effectively located in areas with high light intensity.

This test design is located in Arizona where the sunlight is intense and the air temperature is high.

The mirrors must track the Sun as it moves across the sky to be as efficient as possible.

