

# The Greenhouse Effect

A greenhouse is a building used to grow plants in a controlled environment. Greenhouses are often used to protect sensitive plants from too much cold or too much heat. Most modern greenhouses are covered with glass, plastic, or some other material that is transparent to sunlight, but does not allow heat to enter or exit easily. This allows the plants inside to receive natural sunlight, and also allows the greenhouse to be heated by the sunlight. Materials such as soil and plants inside the greenhouse absorb some of the energy from the sunlight. A portion of the energy from the sunlight is then reradiated back into the atmosphere of the greenhouse. However, the transparent material of the greenhouse does not allow all of this heat energy to pass back to the outside. As a result, some heat is trapped inside the greenhouse. The temperatures inside the greenhouse are higher than they would be without the transparent covering. A similar phenomenon occurs in Earth's **atmosphere** and is one of the reasons life has been able to flourish on Earth. Our atmosphere helps warm Earth in what is known as the **greenhouse effect**.

Most of the energy on Earth comes from the sun as solar radiation. Sunlight is the visible portion of solar radiation. Most sunlight is able to pass through the atmosphere. The sunlight that passes through the atmosphere heats Earth's surface. Some of this heat is reradiated back into the atmosphere. Different types of **gases** in the atmosphere then absorb some of this heat and reradiate it back toward Earth's surface. These gases are known as greenhouse gases. Absorption of heat by greenhouse gases results in higher temperatures in Earth's lower atmosphere than would be possible without the presence of greenhouse gases. This effect is also known as the "blanket effect." The gases absorb heat and reradiate the heat back toward Earth like a blanket absorbs and reradiates heat to keep us warm.



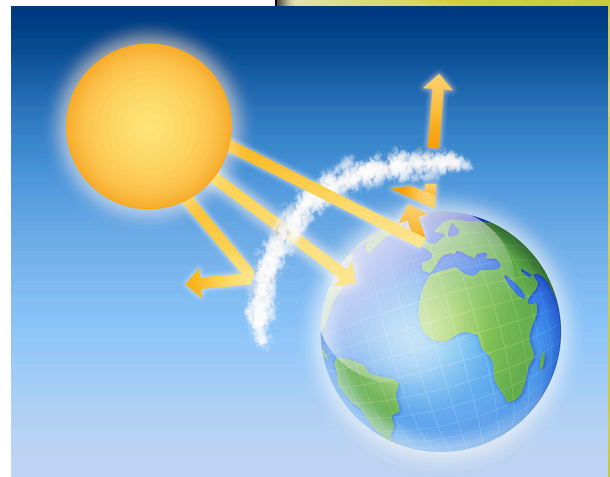
Greenhouses are used to provide plants with a controlled environment. This usually involves protecting plants from extreme cold.

# The Greenhouse Effect

The greenhouse effect is the main reason Earth's surface has moderate temperatures. Earth also resides in a portion of the solar system known as the "Goldilocks Zone." This is in reference to the idea that Earth is not too close and not too far from the sun. Earth is situated at a distance where it does not become too hot or too cold. However, Earth's proximity to the sun is only one factor that determines the surface temperatures on Earth. For example, the moon is the same distance from the sun, but the moon's surface is much colder than Earth's surface. This is because the moon has no atmosphere to trap heat energy from the sun. Earth's atmosphere and the greenhouse gases within Earth's atmosphere are the most important factors in determining the temperature on Earth's surface.

The most important greenhouse gases include **carbon dioxide**, methane, and water vapor. Greenhouse gases in the atmosphere can be compared to the glass or other transparent material in a greenhouse. Both the glass and the greenhouse gases allow sunlight to pass through and both also absorb and reradiate heat. This results in increased temperatures in a greenhouse and on Earth, respectively.

When people talk about the greenhouse effect, they often discuss the negative consequences. However, the greenhouse effect is very important to life on Earth. Without the greenhouse effect, the average temperature on Earth would be around  $\square 18^{\circ}\text{C}$ , or about  $0^{\circ}\text{F}$ . Most of the organisms that live on Earth could not exist in such a cold environment. With the greenhouse effect, the average temperature on Earth is around  $14^{\circ}\text{C}$ , or  $57^{\circ}\text{F}$ . This moderate temperature, which is not too cold and not too hot, has proven to be essential to the establishment of life on Earth.



Greenhouse gases within Earth's atmosphere absorb and reradiate energy back to Earth's surface. This is known as the "greenhouse effect."

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There is a point though, where too high a concentration of greenhouse gases in the atmosphere can lead to an accelerated global warming trend. Eventually, having an elevated amount of greenhouse gases can lead to a phenomenon known as a runaway greenhouse effect. A runaway greenhouse effect occurs when a planet begins to absorb more energy than it can radiate back into space. Scientists are able to identify planets experiencing a runaway greenhouse effect when surface temperatures are increasing, while heat loss to outer space is decreasing.

Venus is an example of a planet that is experiencing a runaway greenhouse effect. Venus has a massive atmosphere that is 96% carbon dioxide. The atmosphere on Venus is so dense that the atmospheric pressure is about 90 times that of Earth. The density of Venus' atmosphere and the abundance of carbon dioxide, a greenhouse gas, have created a runaway greenhouse effect on Venus' surface. The average surface temperature on Venus is 464°C, or 867°F. The runaway greenhouse effect on Venus has been caused by natural processes.

Earth is experiencing an increased greenhouse effect due to an increase in greenhouse gases in the atmosphere. The increase of greenhouse gases on Earth is due to natural causes, such as gases being emitted from volcanoes, as well as human causes, such as pollution emitted during the burning of fossil fuels. Pollution and the emission of greenhouse gases have the ability to increase the greenhouse effect on Earth and cause global climate change.