

Global Warming

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[Carbon Dioxide - Atmosphere](#)

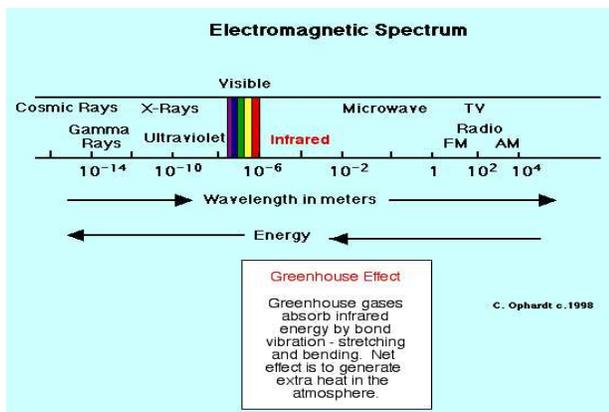
[Carbon Dioxide - Fossil Fuels](#)

[Greenhouse Gases](#)

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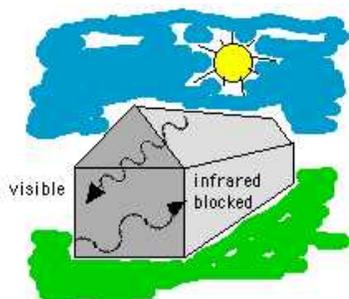


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Greenhouse Gases Absorb Infrared Radiation

Radiation from the sun is absorbed by the earth as radiant visible light. You feel this effect on a sunny day when you stand in the sunshine vs. the shade. Eventually, the heat from the earth is re-emitted into the atmosphere as infrared radiation (IR). As an example, infrared radiation is what you can feel and see (slightly) as the red hot burner of an electric stove. The different types of electromagnetic radiation are shown in the graphic on the left.

Certain gases in the atmosphere have the property of absorbing infrared radiation. Oxygen and nitrogen the major gases in the atmosphere do not have this property. The infrared radiation strikes a molecule such as carbon dioxide and causes the bonds to bend and vibrate - this is called the absorption of IR energy. The molecule gains kinetic energy by this absorption of IR radiation. This extra kinetic energy may then be transmitted to other molecules such as oxygen and nitrogen and causes a general heating of the atmosphere. Analogy: Think of a partially stretched "toy slinky" - if you bump the slinky, the energy of the bump is absorbed by the vibrations in the slinky.



Greenhouse Analogy: Energy from the sun in the form of some ultraviolet and visible light (short wavelength) passes through the glass of the greenhouse. As the light strikes various surfaces in the greenhouse and they are heated. These surfaces in turn re-radiate the heat in the form of infrared radiation (long wavelength). However, the IR radiation is blocked from escaping by the glass. IR is not able to pass through the glass, hence the greenhouse air heats up fairly dramatically.

The greenhouse gases have the same property as the glass towards the IR radiation. Think of the greenhouse gases acting as an invisible glass shield around the earth.

Greenhouse Gas Molecules:

The greenhouse gas molecules are shown in the next series of figures along with the IR spectra and the bending and vibrations caused by absorbing the IR radiation. The arrows on the molecules indicate the direction of the bends and vibrations of the bonds. The IR spectra indicates the specific energies at certain wavelengths which are absorbed. Radiation that is 100% transmittance is not blocked but travels straight through the sample. The dips in the lines are caused by the absorption of energy, hence only 10% of the energy

