



# Climate Change

## Earth's Atmosphere

Our Earth is surrounded by a blanket of gases called the **atmosphere**. Without this blanket, our Earth would be so cold that almost nothing could live. It would be a frozen planet. Our atmosphere keeps us alive and warm.

The atmosphere is made up of many different gases. Most of the atmosphere (99 percent) is oxygen and nitrogen. The other one percent is a mixture of greenhouse gases. These greenhouse gases are mostly water vapor, carbon dioxide (CO<sub>2</sub>), methane, CFCs, ozone, and nitrous oxide.

Carbon dioxide is the gas we produce when we breathe and when we burn wood and fossil fuels. Methane is the main gas in natural gas. It is also produced when plants and animals decay. The other greenhouse gases are produced by burning fuels and in other ways.

## Sunlight and the Atmosphere

Rays of sunlight (**radiant energy**) shine down on the Earth every day. Some of these rays bounce off clouds and are reflected back into space. Some rays are absorbed by molecules in the atmosphere. About half of the sunlight passes through the atmosphere and reaches the Earth.

When the sunlight hits the Earth, most of it turns into heat (thermal

energy). The Earth absorbs some of this heat. The rest flows back out toward the atmosphere. This keeps the Earth from getting too warm.

When this thermal energy reaches the atmosphere, it stops. It can't pass through the atmosphere like sunlight. Most of the heat becomes trapped and flows back to the Earth. We usually think it's sunlight that warms the Earth, but actually it's this contained thermal energy that gives us most of our warmth.

## The Greenhouse Effect

We call this trapping of heat the **greenhouse effect**. A greenhouse is a building made of clear glass or plastic. In cold weather, we can grow plants in a greenhouse. The glass allows the sunlight into the greenhouse. The sunlight turns into heat when it hits objects inside. The heat becomes trapped. The radiant energy can pass through the glass; the thermal energy cannot.

## Greenhouse Gases

What is in the atmosphere that lets light through, but traps heat? It's the greenhouse gases, mostly carbon dioxide and methane. These gases are very good at absorbing thermal energy and sending it back to Earth.

## The Greenhouse Effect

Radiant energy (light rays and arrows) shines on the Earth. Some radiant energy reaches the atmosphere and is reflected back into space. Some radiant energy is absorbed by the atmosphere and is transformed into heat (dark arrows).

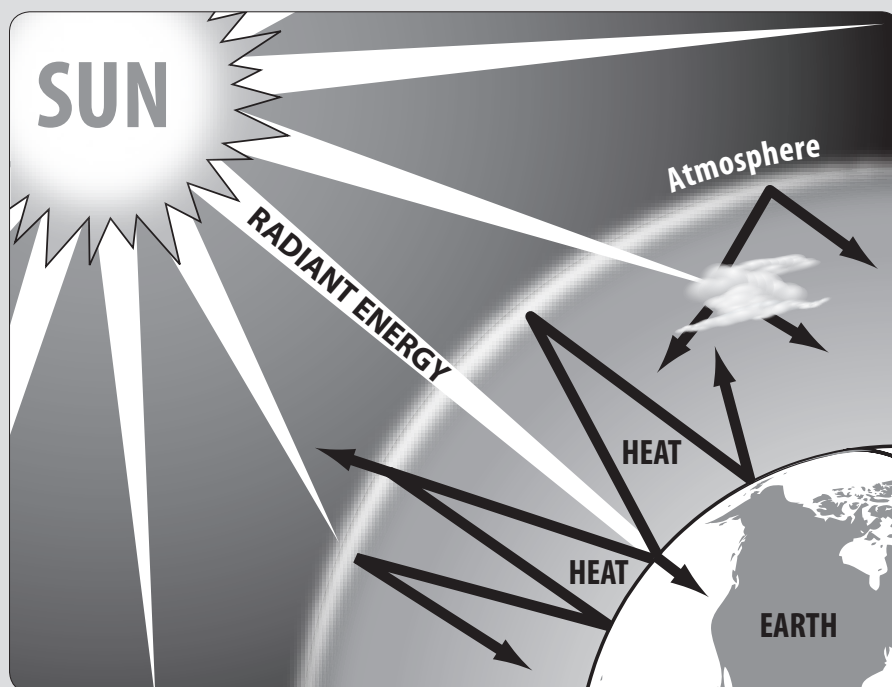
Half of the radiant energy that is directed at Earth passes through the atmosphere and reaches the Earth, where it is transformed into heat.

The Earth absorbs some of this heat.

Most of the heat flows back into the air. The atmosphere traps the heat.

Very little of the heat escapes back into space.

The trapped heat flows back to Earth.



In the last 50 years, the amount of some greenhouse gases in the atmosphere has increased dramatically. We produce carbon dioxide when we breathe and when we burn wood and fossil fuels such as coal, oil, natural gas, and propane. Since the Industrial Revolution, CO<sub>2</sub> levels have risen by approximately 39 percent.

Some methane escapes from coal mines and oil wells. Some is produced when plants and garbage decay. Some animals also produce methane gas. One cow can give off enough methane in a year to fill a hot air balloon!

## Global Climate Change

Scientists all over the world are studying the effects of increased levels of greenhouse gases in the Earth's atmosphere. They believe the greenhouse gases are trapping more heat in the atmosphere as levels increase. They believe the average temperature of the Earth is beginning to rise. They call this phenomenon **global warming**.

Scientists at NASA, the National Air and Space Agency, have found that the average temperature of the Earth has risen about 0.74°C in

the last 100 years. They believe this increase in global temperature is the major cause of a 12 to 22 centimeter rise in the sea level over the same period of time.

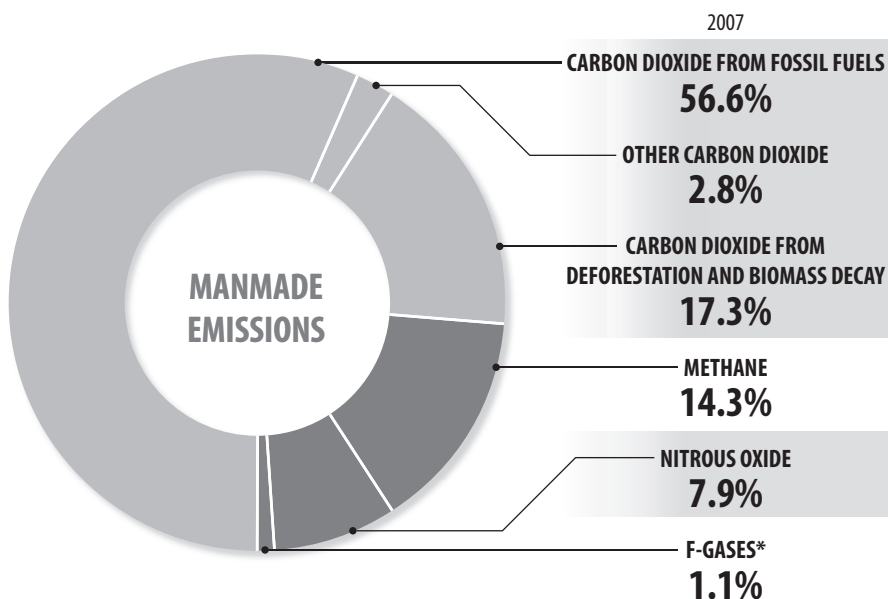
Climate change experts predict that if the temperature of the Earth rises just a few degrees Fahrenheit, it will cause major changes in the world's climate. They predict there will be more floods in some places and more droughts in others. They believe the level of the oceans will rise as the ice at the North and South Poles melts. They think there might be stronger storms and hurricanes.

These scientists believe that countries all over the world need to act now to lower the amount of carbon dioxide that is emitted into the atmosphere. They believe we should reduce the amount of fossil fuels that we burn. The solutions being implemented include reducing CO<sub>2</sub> emissions from transportation and electricity by switching to less carbon intensive fuels. Experts around the world are trying to find ways to lower greenhouse gas emissions without causing major impacts on the economy.

## Greenhouse Gases

Carbon dioxide accounts for more than 75 percent of all global greenhouse gas emissions, mainly due to the increased use of fossil fuels. Since the Industrial Revolution, the concentration of all greenhouse gasses has increased.

### GLOBAL GREENHOUSE GAS EMISSIONS



### ATMOSPHERIC CONCENTRATIONS

	2007	PRE-INDUSTRIAL (1750)	2009
CARBON DIOXIDE FROM FOSSIL FUELS	56.6%	278 parts per million	384.8 parts per million
OTHER CARBON DIOXIDE	2.8%		
CARBON DIOXIDE FROM DEFORESTATION AND BIOMASS DECAY	17.3%	ALL CARBON DIOXIDE	
METHANE	14.3%	0.72 parts per million	1.8 parts per million
NITROUS OXIDE	7.9%	0.27 parts per million	0.32 parts per million
F-GASES*	1.1%	0 parts per trillion	84.5 parts per trillion

\* F-gases include HFCs, PFCs, and SF<sub>6</sub> which are used in many different industrial applications including as refrigerants, propellants, and tracer chemicals.  
Data: U.S. Environmental Protection Agency, Intergovernmental Panel on Climate Change, Oak Ridge National Laboratory