

# The basics

## We need to talk about Climate Part 1

### Understanding Energy

To better understand what is happening with our changing climate, we need to start with an understanding energy. Some key energy understandings include:

- Energy is all around us. We use energy to warm and cool our homes, to drive our vehicles, operate our machines, to make things, and to light up our world.
- Energy comes in different forms – heat energy, light energy, potential energy, kinetic energy, chemical energy, nuclear energy, chemical energy, sound energy, elastic energy, and gravitational energy.
- Energy can be transferred from one object to another, as when you warm your hands by holding them under a hot water tap.
- Energy can also be transformed from one form to another. An everyday example of transformation is when you boil water in a kettle. Electrical energy is used to heat an element (the energy is transformed from electrical energy into heat energy), which then transfers the heat energy to the water in the kettle.

An excellent introduction to energy is “A Guide to the Energy of the Earth” [here](#)

### What is the Greenhouse Gas Effect?

We live on a planet in space that is very cold. Without two factors, we could not live on Earth. The first factor is the heat and light that comes from the sun, many millions of kilometres away. The second factor is that our planet is surrounded by an atmosphere made up of many gases, the most common being nitrogen, with smaller amounts of oxygen, methane, carbon dioxide, water vapour, nitrous oxide, and others.

We have all experienced sitting in a closed vehicle in the sun. The vehicle absorbs the radiation energy from the sun through the metal and plastic panels, and the glass windows. This solar radiation then starts to heat up the fittings and the air inside the vehicle. Some of this heat will be radiated back to the outside air through the body of the vehicle, but most of it will be retained inside the vehicle, as the windows are closed and there are no crosscurrents of air to carry some of the heat to the outside. If left for too long in the sun, temperatures may become quite unbearable inside the vehicle.

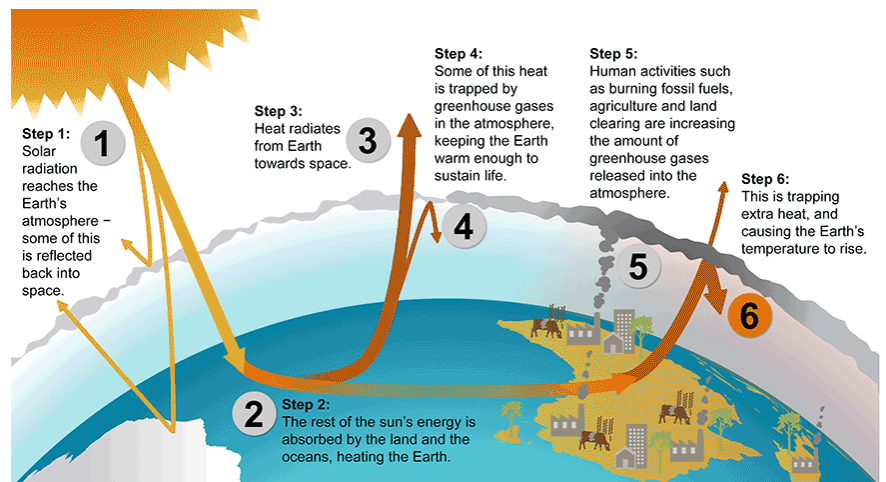
This effect is known as the “greenhouse gas effect”, which was named by Joseph Fourier in 1820. It had long been observed that people could grow flowers, vegetables, and fruit during cold weather inside a small structure, called a greenhouse, which was constructed of clear plastic or glass. Radiation from the sun would pass through the glass or plastic and warm up the soil and plants inside the greenhouse. These objects would then heat the air inside the greenhouse so that the temperature inside the greenhouse became much warmer than the outside air. Some of the heat inside the greenhouse would radiate back to the outside air, but most is trapped inside the greenhouse.



## Enhanced Greenhouse Gas Effect

As shown in the diagram, the principle of the greenhouse effect can help explain how the Earth stays warm. When solar radiation enters the Earth's atmosphere, some of it is reflected back into space (1), but most is absorbed by the land, oceans and lakes (2).

Some of this heat radiates back into space (3), while some is trapped by the greenhouse gases in the atmosphere, heating the atmosphere and sustaining life (4).



*This Photo by Unknown Author is licensed under CC BY*

The “Enhanced Greenhouse Gas Effect” describes the observations over the past few hundred years, that activities of human populations (burning carbon rich fossil fuels e.g. coal, natural gas and petroleum, agricultural practices and land clearing, and landfilling organic materials) has increased the amount of greenhouse gas in the Earth’s atmosphere. These extra greenhouse gases, in particular carbon dioxide, methane, and nitrous oxide, which are good at retaining heat (5), trap more heat. As the amount of greenhouse gas in the atmosphere increases, the temperature of the atmosphere also increases (6). **Renewable energy sources** (such as solar, wind, hydro and biomass) do not emit as much CO<sub>2</sub> as burning fossil fuels, reducing the total amount of GHGs emitted to the atmosphere each year. Read more about the greenhouse effect and how the enhanced greenhouse gas effect is leading to climate change [here](#).

## About Climate Change

### 1. What is Climate Change?

According to the United Nations, “ Climate change refers to long-term shifts in temperatures and weather patterns. Such shifts can be natural, due to changes in the sun’s activity or large volcanic eruptions. But since the 1800s, [human activities have been the main driver of climate change](#), primarily due to the burning of fossil fuels like coal, oil and gas”. [UN](#) and the Climate Fact Sheet [here](#) and [MIT Climate Portal](#).

### 2. What is causing Climate Change today?

As shown in the above diagram, human activities are causing an unprecedented and marked increase in the amount of greenhouse gases in the atmosphere, resulting in increased air and surface sea temperatures across the globe, with an average increase of 1.45°C since preindustrial times.

### 3. How is Climate Change affecting the Planet?

Temperature increases across the globe are increasing the amount of energy in the atmosphere. This increased energy has increased the frequency and intensity of extreme weather events, such as heatwaves, wildfires, storms, hurricanes, floods, and conversely droughts.

### 4. What can we do to slow down Climate Change?

Climate change is already happening. Scientists are urging world leaders to take steps to mitigate the causes of climate change (e.g. switch to renewables, and to develop community resilience and adaptation strategies).

To learn more, watch these videos:

- “Climate Change: It’s Real. It’s Serious. And it’s up to us to Solve it.” National Geographic [here](#)
- Project Drawdown: “Climate Solutions 101” [here](#)
- The state of the climate - and what we might do about it (Sir Nicholas Stern) [here](#)