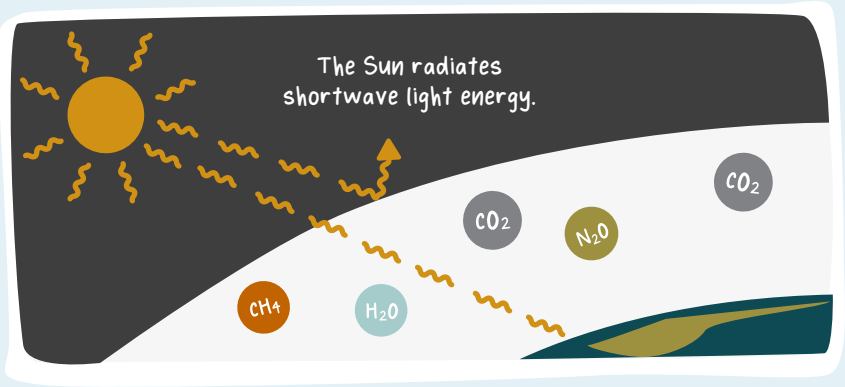
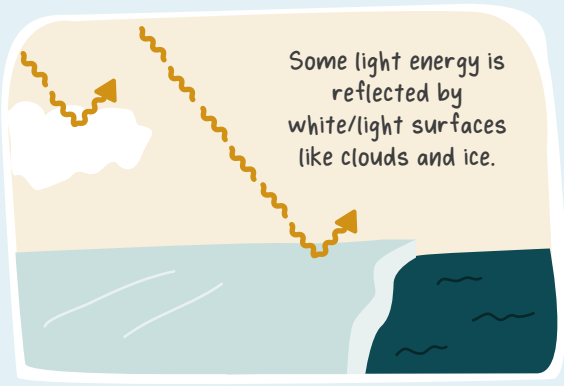
The GREENHOUSE EFFECT

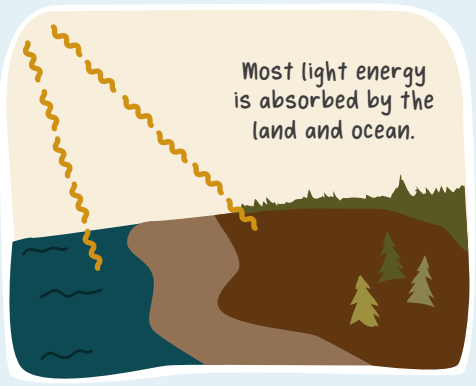
Earth's natural greenhouse effect keeps us comfortable, but adding more greenhouse gases heats things up.

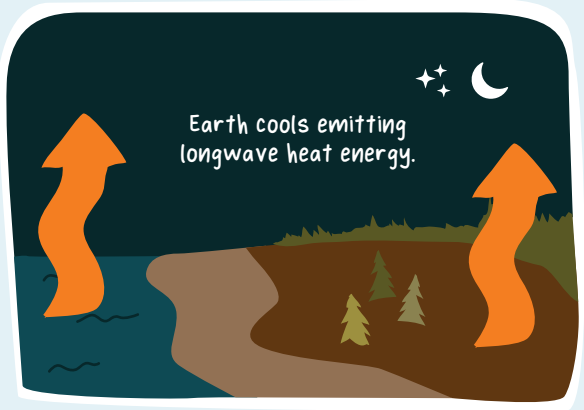
UP NORTH ON CLIMATE
Climate Change Impact and Adaptation Study for the North of Ontario

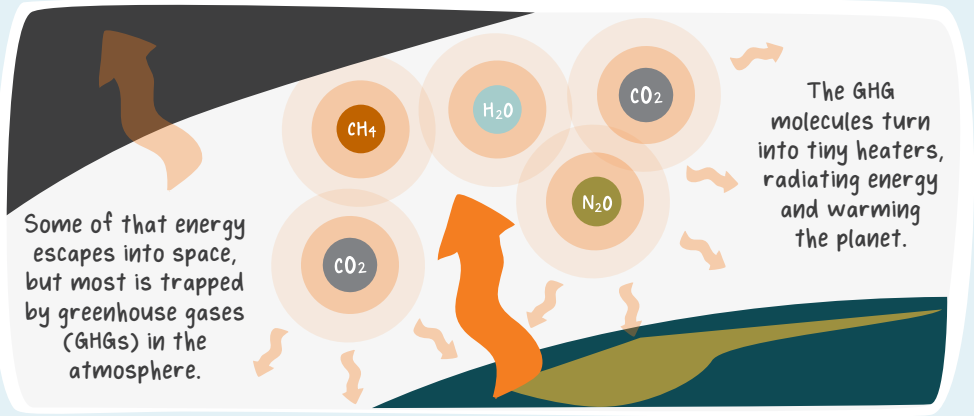
The Natural Greenhouse Effect







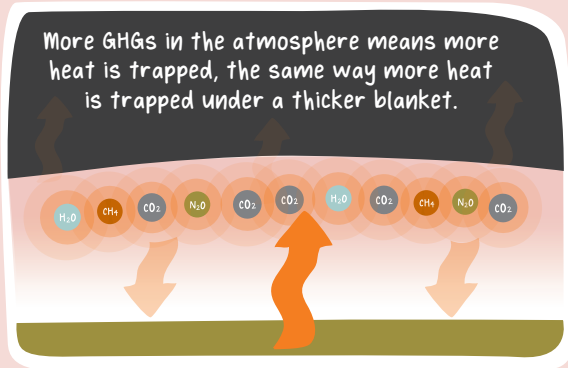


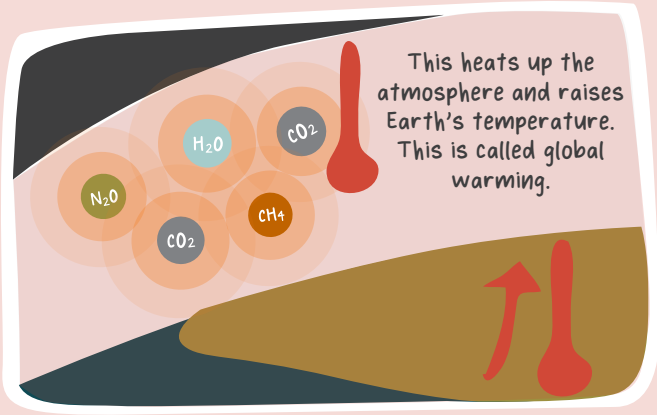


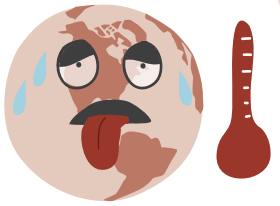
Because of the greenhouse effect the average temperature of the Earth is +15°C allowing life as we know it.

Amplified Greenhouse Effect

Burning fossil fuels (like coal & gas) and other human activities release GHGs.



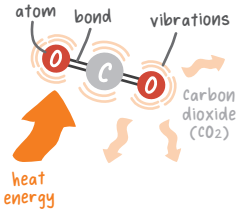




The Earth's average temperature has increased by 1°C in 100 years, 30X faster than in the past.

Q&A THE GREENHOUSE EFFECT

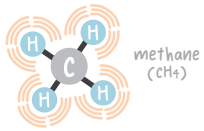
How do GHGs create the greenhouse effect?



Earth's atmosphere is made of invisible gases. Some gases like oxygen (O_2) and nitrogen (N_2) don't trap much heat energy, but others, like carbon dioxide (CO_2) and methane (CH_4), do. Gases that are good at trapping heat are called greenhouse gases (GHGs).

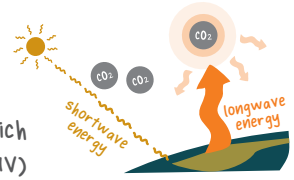
GHGs trap heat because of the way their molecules are put together – they are made of more parts (called atoms) and have more bonds (the force that holds atoms together) than gas molecules that don't trap heat. When heat energy radiated from the Earth hits a GHG molecule it begins to vibrate, as if the bond are little springs. As vibrations slow, the molecules gradually release heat in all directions like tiny heaters. Heat energy moves around the atmosphere, from one GHG molecule to another, or even back down to the surface, like a ball in a pinball machine.

Do some GHGs trap more heat than others?



The number and strength of a molecule's bonds determines how much it vibrates and how much heat energy it can hold. Some greenhouse gases (GHGs) hold more heat than others. But scientists also consider how long a GHG stays in the atmosphere and how much of it there is when looking at its effect on warming.

Why do GHGs only trap outbound energy?



Sunlight enters our atmosphere as shortwave energy, which includes visible light (that we can see) and ultraviolet (UV) light that causes sunburns. This type of energy is not trapped by gas molecules in the atmosphere. When sunlight hits the Earth's surface, that energy is absorbed and re-emitted as longwave energy (called infrared energy) that we can't see but can feel as heat. Longwave energy is a type of energy that can be trapped by greenhouse gases.

Why is the greenhouse effect important?

Earth's atmosphere acts like a blanket holding warmth from the Sun. Without it, the Earth's average temperature would be -18°C. By trapping the heat energy released by the Earth, the natural greenhouse effect warms Earth to an average of 15°C, allowing life as we know it.

How are humans amplifying the greenhouse effect?

Humans are affecting the natural greenhouse effect by adding greenhouse gases (GHGs) to the atmosphere. Carbon dioxide (CO_2), the most abundant GHG, comes from burning fossil fuels like coal and gas. Methane (CH_4) is released by cattle and landfills and is the main component of natural gas. Nitrous oxide (N_2O) comes mainly from fertilizers and agriculture. All these added GHGs have caused Earth's average temperature to rise nearly 1°C in the last 100 years, a rate much faster than the natural warming that has happened in the past.

Is water vapour a GHG?

Water vapour (H_2O) is water in its gas form, like the steam that rises from a pot of boiling water. It's an important part of the atmosphere, forming clouds and falling as rain and snow. It's also a greenhouse gas (GHG), trapping longwave heat energy emitted by the warmed Earth.

Water vapour isn't a human pollutant like other GHGs. Instead, the amount of water in the atmosphere depends on the temperature, with warmer air holding more water than colder air. As the Earth warms, the atmosphere can hold more water vapour, which causes more warming, which leads to more water vapour, and so on.

Which surfaces absorb/reflect the Sun's energy?

White surfaces, like clouds, snow, and ice, reflect the Sun's energy; dark surfaces, like water, rocks, and soil absorb it. When warming temperatures melt reflective ice and snow in the Arctic, more energy is absorbed by the open ocean. This warms the water, impacting weather in the north and even affecting the polar front (an air pattern important to global climate). Less ice also means more dark ocean to absorb energy, leading to more warming and even less ice.

Grand Council Treaty #3 · Keewaytinook Okimakanak · Matawa First Nations Management · Mushkegowuk Council · Nokiiwin Tribal Council · Shibogama First Nations Council · Laurentian University / Université Laurentienne

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