

What is global warming?

Global warming is the observed increase of the Earth's average air and ocean temperatures since the Industrial Revolution, around the turn of the 18th century. The total temperature increase from 1850 to 2005 is 0.76°C (IPCC, 2007). Although projections vary, it is estimated that atmospheric temperatures could increase by between 1.4°C and 5.8°C by 2100. But what's causing this warming? Why is it such an important issue? And how should our global society approach it?

The Earth's temperature is controlled by the balance between incoming energy from the sun, and energy escaping back out to space. Of the energy received from the sun, about a third hits the Earth and is reflected back out to space. Clouds or dust and ash in the atmosphere also shield Earth from incoming energy. But two-thirds of inbound energy is absorbed by the atmosphere, land and oceans. This energy is trapped near the Earth's surface by naturally occurring greenhouse gases (GHGs) such as water vapour, carbon dioxide (CO₂), ozone (O₃), methane (CH₄) and nitrous oxide (N₂O). This "greenhouse effect" is crucial for maintaining the Earth's temperature in mostly liveable conditions. Without natural GHGs, Earth would be about 30°C colder.

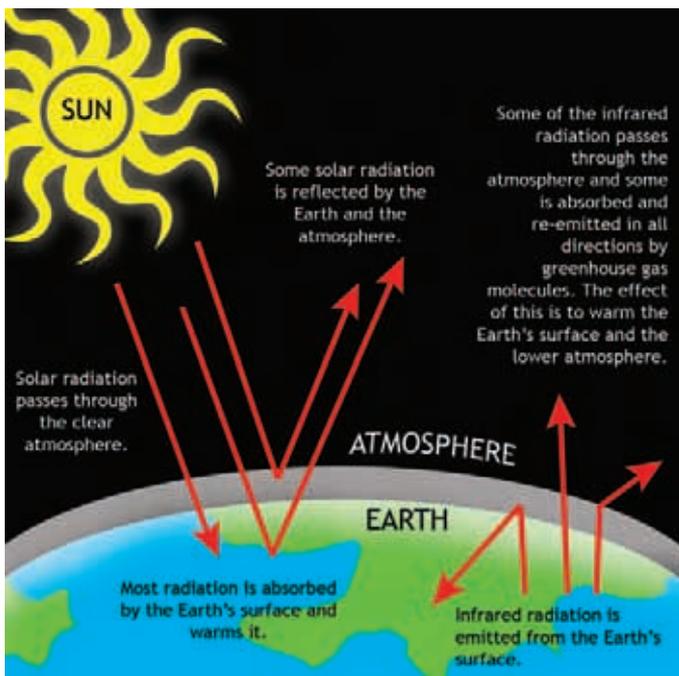
However, economic development and population growth since the beginning of the Industrial Revolution has increased

the burning of fossil fuels, deforestation and agriculture, putting more GHGs into the atmosphere.

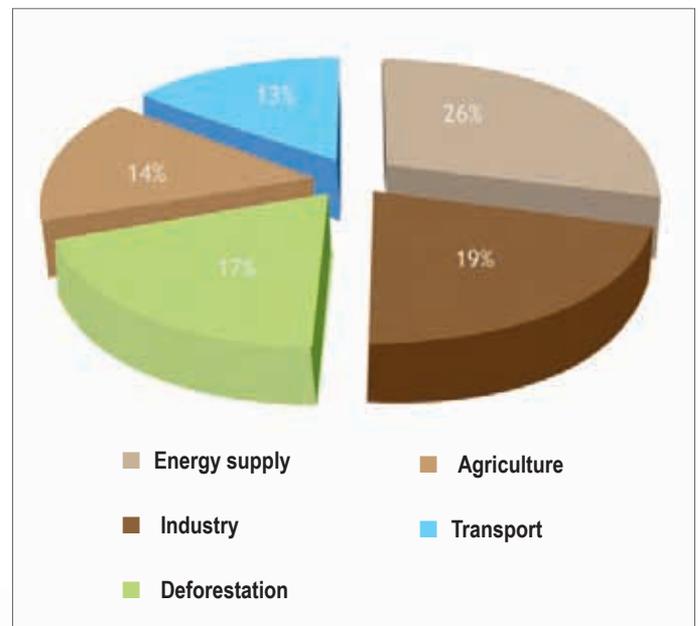
To calibrate the global warming potential (GWP) of GHGs, scientists assign a GWP of "one" to CO₂—how much global warming one ton of carbon dioxide will cause over 100 years. Relative to that, methane has a GWP of 21 and nitrous oxide 310. This means that in 100 years, one ton of methane will have an effect on global warming that is 21 times greater than one ton of CO₂, and so forth.

The role of human-caused emissions

Globally, the primary sources of GHG emissions are the energy supply sector (26%), industry (19%) and forestry through deforestation (17%). Agriculture and transportation account for 14% and 13% of emissions, respectively



The Greenhouse effect



Main sources of greenhouse gas emissions globally: Source: IPCC 2007



Forestry accounts for 17% of GHG emissions through deforestation.

(IPCC, 2007). About half of all emissions are absorbed by oceans, land and forests through natural processes such as photosynthesis in land and ocean plants. The other half stays in the atmosphere, trapping energy that would otherwise have been emitted into space. With less heat leaving the atmosphere, temperatures rise.

Average temperatures have climbed by 0.76 °C since 1850 and as emissions continue, temperatures are expected to rise further. If unchecked by 2030 emissions will result in warming of 1.7 °C to 2.4 °C by the middle to latter part of the 21st century.

Climate change

Increasing heat in the Earth's atmosphere and oceans alters the global climate system. Scientific modelling projects that we should expect changes to regional temperatures, melting glaciers and ice sheets, sea-level rise, seasonal variability, precipitation changes, increase in the frequency and intensity of storms and even changes in ocean circulation. In many parts of the world we are already seeing some of these changes, posing risks to livelihoods and infrastructure.

How society responds

There are two aspects to resolving global warming and associated climate changes. Firstly, mitigation actions are needed if we are to slow or limit temperature increases: emissions must be reduced to stabilise the concentration of atmospheric GHGs, and then reduced over time. Science requires that warming in the next century must be limited to around 2 °C (Allen & Frame et al, 2009), demanding emissions reduction, on 1990 levels, of 20% to 30% by 2020 and 40% to 60% by 2050 (Stern, 2009). This means putting energy efficiency measures in place, reducing reliance on fossil fuels by switching to renewable or low-carbon energy sources, curbing deforestation and emissions from agriculture.

The second aspect to dealing with global warming requires adaptation to the consequences of climate change. Livelihoods, infrastructure and economies, vulnerable to potential climate changes, need to become more resilient. Not only do communities have to adapt physically in their environments, adaptation must increasingly become a prominent characteristic of development planning and decision-making.

By James Cumming

James Cumming is an analyst and environmental economist at OneWorld Sustainable Investments.

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Greenhouse gases (GHGs)

Naturally-occurring gases in the atmosphere that trap heat and keep the planet warm. Human-caused GHGs are dangerously amplifying this warming effect.

