

greenhouse effect

Natural greenhouse effect

Without the Greenhouse Effect, life on Earth would probably not exist. It would mean an average temperature of -18°C, instead of the current 15°C. That's a difference of 33°C.

Sunlight passes through the Earth's atmosphere and is converted to IR (infra-red) radiation, which is then radiated back from the Earth's surface. However, this process changes the wavelength of the sunlight (infra-red waves) and, as a result, most does not pass through the stratosphere, but is reflected back towards the Earth from the area where stratosphere and troposphere meet.

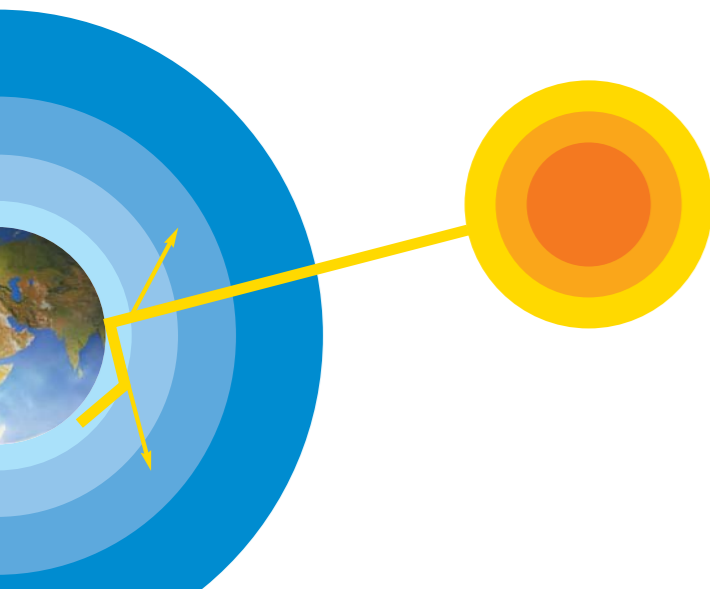
The energy of the IR radiation is absorbed by carbon dioxide (CO₂), methane (CH₄) and nitrous oxides (NO_x) molecules and water vapour. This increases the temperature of the lower part of the atmosphere, so the atmosphere acts just like a normal greenhouse: a lot of the Sun's energy can enter, little can leave.

Natural processes such as plant photosynthesis keep the process in balance.

Enhanced greenhouse effect

There is evidence that since the industrial revolution the concentration of greenhouse gases in our atmosphere, in particular CO₂ and CH₄ have increased dramatically. This increase leads to the atmosphere trapping increased levels of IR radiation reflected back from the Earth and is called the **Enhanced Greenhouse Effect**. Many scientists believe this to be the reason for a rapid increase in the Earth's temperature, particularly over the last 50 years.

There is some debate as to the relative contributions of human activity, and the natural activity of the Earth to this Enhanced Greenhouse Effect. Nevertheless, the fact remains that the Earth's temperature is changing, as is the concentration of CO₂ and other greenhouse gases.



timeline

1988	Public becomes aware of changes in climate and the proposed connection to the burning of fossil fuels.
1992	Rio de Janeiro Earth Summit launches World Sustainable Development programme. BP published their first global environmental emissions and discharges targets.
1997	Kyoto Protocol - worldwide measures agreed by many governments to curb greenhouse gas emissions. BP is first energy company to advocate precautionary action on climate change.
2000	BP introduces first global greenhouse gas emissions trading system. The UK Government imposes a climate change levy on UK businesses.
2001	Governments continue to negotiate terms for the Kyoto Protocol.
2002	All 15 European Union states ratify the Kyoto Protocol on global warming, paving the way for a new international attempt to curb greenhouse gas emissions. BP meets its 10 year target to reduce emissions by 10% and sets new target to sustain the 2002 emissions. The eighth conference of the United Nations Framework Convention on Climate Change (UNFCCC), makes the need to avoid dangerous climate change its ultimate objective. It requests a global stabilisation of greenhouse gas concentrations at a level that would prevent dangerous climate changes.
2003	UK Government in the Energy White Paper set aspirational targets for 20% improved efficiency in domestic sector by 2010 with further 20% by 2020; a 20% increase in the generation of electricity by renewable energy resources by 2020 and a 60% cut in CO ₂ emissions by 2050.
2004	Launch of Sustainable Mobility Project Report by World Business Council for Sustainable Development (12 global automotive and energy companies within WBCSD). British Prime Minister Tony Blair describes climate change as the world's "greatest environmental challenge" and says that "the time to act is now". Russia signs up to the Kyoto Protocol on global warming.

The future **Can we make a difference?**

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climate change

The world's climate

Natural and enhanced greenhouse effect

Evidence and causes

Human activity or natural cause?

Implications and effects

What does it mean for us?

Action

What can we do?



Can we make a difference?

This leaflet will give you the basic facts you need to know to make up your own mind.

the world's climate

Climate

Climate is the name we use for the typical weather patterns of a particular region over a long period of time.

We can divide the Earth's climate into five main groups: tropical (equatorial and monsoon), dry (all types of desert), warm moderate, cold moderate and cold (polar).

Areas close to the equator have the most regular hours of sunshine and are therefore the hottest. Areas near the poles have great variations in the number of sunshine hours and the angle of sunlight entering the Earth's atmosphere; these areas are the coldest.

Climate is affected by changing weather patterns; by atmosphere, by surface (rocks, oceans, ice sheets) but also by living organisms – including us humans!

In turn, climate affects us all, from the clothes we wear, to the houses we build – **it influences every part of our lives!**

What affects weather

Our weather is affected by a variety of factors:

- the ocean - its currents carry warmth around the world
- changes in activity in the atmosphere - air can be dry or water laden and is constantly moving, heating up, cooling down
- changes in the orbit of the Earth affect the distance between the Earth and the Sun, as well as the angle at which sunlight enters the Earth's atmosphere
- volcanic activity produces ash and gases which reduce the sunlight reaching the Earth's surface.

Long term changes in weather patterns are called climate change.

Atmosphere

We divide the Earth's atmosphere into different layers:

thermosphere (includes ionosphere)

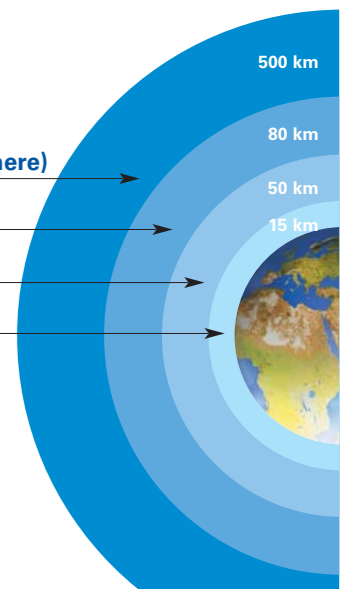
mesosphere

stratosphere

troposphere

Without the atmosphere, there would be no water on Earth and temperatures would vary between extreme hot and extreme cold.

There would be no life on Earth!



causes

Human activity

Throughout human history, population has increased slowly. It was roughly 1830 before world population reached 1 billion. By the next 100 years the population doubled. By the next 100 years, in 2030, it is expected that the world's population will have reached a staggering 9 billion!

This increase in population has led to a huge increase in the demand on our Earth's resources.

Power generation

We constantly need energy to generate electricity: to light our homes, factories, streets and to provide heat for cooking and warmth. Most power stations generate electricity by burning fossil fuels. Today, the electricity sector produces about 30% of global carbon dioxide (CO₂) emissions – and it's estimated our electricity demands in 2050 will be double those of today.

Industry

Energy is needed to manufacture the increasing range of products we use: for their production, packaging, storage and transportation. Energy is used but also wasted at every stage, from extracting and refining raw materials, to assembly and distribution to the customer.

Buildings and waste

Poor building design, such as ineffective insulation, as well as inefficient lighting and appliances all waste energy. People themselves are wasteful, leaving lights on and machines running.

The disposal and treatment of rubbish and other waste also produces methane (CH₄) and CO₂ emissions.

Transportation

Our ever growing demand for mobility has led to huge increases in vehicles on the road, not only for personal use but also for transportation of goods. These vehicles produce around 20% of global CO₂ as well as other emissions which contribute to pollution.

Deforestation and farming

The demand for wood products and land for houses and farming has led to large scale deforestation, meaning less CO₂ can be recycled by nature.

Animal farming releases carbon dioxide and methane as the animals breathe and digest plants. Rice production in paddy fields also produces significant amounts of CH₄.

Natural activity

Throughout history the Earth has gone through periods of alternating warming and cooling.

Volcanic activity releases large amounts of CO₂ and particles. These particles cool and reflect rays back into the atmosphere, causing a natural cooling effect.

Changes in the Earth's orbit around the Sun can also affect climate change.

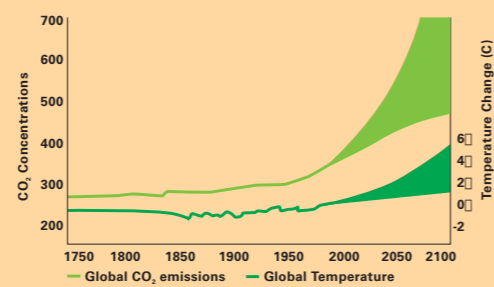


effects



Climate change is affecting or may affect regions of our Earth in the following ways:

- increase in the number of extreme weather events such as hurricanes, storms and flooding
- decrease in agricultural productivity, caused by extreme weather affecting the supply of food
- droughts and water shortages will become widespread in some areas – 30% of the world's population is currently facing water scarcity – this number is predicted to double in the next 30 years; desert areas will also expand
- decrease in biodiversity – a loss in the variety of the world's habitats and the plants and animals that give us fertile soils, clean air and water as well as natural resources
- rise in sea levels and extreme weather events could affect 85% of the world's population who live in coastal regions – large areas of land could disappear under water.

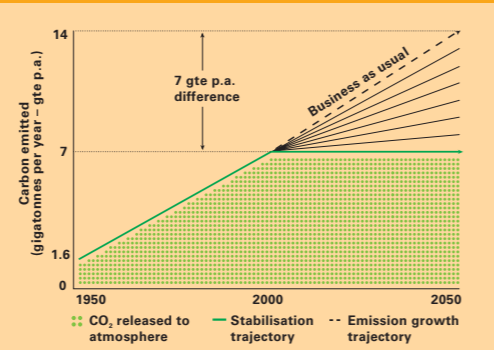


Changes in global CO₂ emissions and temperature projected to 2100

In the next 50 years, global CO₂ emissions will double unless concerted action is taken.

The challenge is how to stabilise atmospheric levels of greenhouse gases to limit world temperature rise, while still providing society with the energy it needs.

This graph illustrates the range of projections for CO₂ and temperature change up to 2100.

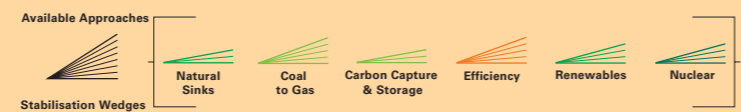


Stabilising global emissions

This model illustrates a series of actions ('wedges') that could each reduce annual emissions by 1 billion tonnes of carbon by 2050.

Examples of a 'wedge' include:
 - gas replacing coal in 1,400 large new power stations
 - doubling the fuel efficiency of 2 billion cars
 - major increases in renewable energy.

Many of these actions align to BP's business strategy and current activities.



what can we do?

Meeting the challenge

We have tended to take our atmosphere and climate for granted. However, as we have seen, they are highly susceptible to change, with local changes easily becoming regional. Now it is a global issue known as global climate change. Our atmosphere is deeply linked with other components of the Earth's system – changing or harming one usually changes or harms them all – so it affects every one of our lives.

Globally

Although there seems to be a broad consent that human activity is contributing to climate change, there is no universal agreement on how to prevent it. Immediate action, such as keeping future emissions close to today's levels, could prevent worst case scenarios in the future. However, the world is growing and developing, particularly in China and India. There needs to be an international consensus on measures that take into consideration the needs of those 'developing' countries as well as 'developed' countries.

- In 1997 there was a first step forward. The Kyoto Protocol was part of the United Nation's Framework Convention on Climate Change (UNFCCC), in which governments signed an agreement to limit or reduce the amounts of greenhouse gases they produced, on average by 5.2% below 1990 levels. There are now 141 countries signed up since Russia ratified last year.

- Every minute 2,000 trees are cut down around the world. Although they release carbon dioxide through respiration and decomposition, our forests take carbon dioxide from the atmosphere and use it to grow. It is thought that if reforestation took place on a massive scale, 60-90 billion tonnes of CO₂ could be absorbed and stored.

- Individual businesses can also play an important role. BP has already achieved a target of reducing emissions by 10% and are now committed to sustaining these lower emissions levels, achieved in 2002, despite growth.

- In October 2004, BP Group Chief Executive, John Browne, set out BP's latest thinking. "It would be too great a risk to stand by, do nothing and to wait so long that when the impact on the climate really does begin to be felt, you have to take action which is so disruptive as to cause serious damage to the world's economy."

- Businesses working together collaboratively. The World Business Council for Sustainable Development (WBCSD "Sustainable mobility project") has developed mobility goals directed to society at large which would substantially reduce emissions, whilst reducing transport-related deaths and injuries, helping to reduce congestion and improving mobility in developing countries.

Nationally

- Many governments are now working with researchers, environmental groups and businesses to provide solutions and develop new technology to reduce emissions.
- By using less carbon intensive fossil fuels (e.g. natural gas instead of coal) we can drastically reduce emissions of carbon dioxide.
- An important way forward for many governments is to further develop the use of renewable energy sources, such as solar and wind power. However, there is much development in the fields of other sustainable sources such as tidal, wave, biomass, hydrogen and nuclear.
- Other national projects, such as the Sleipner Project in Norway, aim to store, or 'hide' CO₂ and stop it getting into the atmosphere. CO₂ is pumped into tiny holes in a layer of rock 1,000 metres under the sea. Although it won't stay there forever, it is hoped that in centuries to come, should it begin to 'leak', then we, as a world community, would have substantially reduced the levels of CO₂.

Locally

- With over 400 million motor vehicles on the road worldwide, governments are increasingly aware of the need to reduce the use of cars locally. Many local schemes are developed to promote the use of public transport or car sharing.
- Locally managed recycling schemes save energy and resources and often limit the need for landfill sites (which in turn limits the release of methane gases).
- Schools and public buildings can also make a difference in their waste management and use of goods.

Personally

Reduce, reuse and recycle. We can all make a difference by cutting down on our energy consumption.

Reduce:

- consume and throw away less
- use the car less; walk or cycle on short journeys (it's much healthier!) or use public transport
- buy loose food, or products in largest size you can use to avoid excessive packaging
- turn off non-essential lights and appliances
- turn down heat thermostats
- close curtains and blinds at night, to reduce energy lost through windows
- insulate homes well
- shower rather than bath
- clean and service your tools, computers, appliances, etc. regularly so they last longer.

Reuse:

- repair before you think of replacing
- donate products such as clothing or furnishings to charities or community groups
- use refillable pens and pencils
- reuse carrier bags
- reuse scrap paper for notes, old envelopes again with labels over addresses
- buy rechargeable items rather than disposable
- use washable plates, cups, silverware for parties instead of disposable ones.

Recycle:

- purchase items made from recycled materials
- find out where your nearest recycling facility is and use it for paper, glass and cans
- computers, cellular phones, TVs, radios, clocks, etc. can all be recycled or donated to charities
- lots of kitchen waste can be recycled as compost and used in vegetable and flower gardens.

