

An Introduction to Climate Change

Climate Change is happening

- The ten warmest years on record have all occurred since 1990. 1998 was the single warmest year in the 142-year global instrumental record and 2001 was the third warmest.
- Global temperature has risen by about 0.6°C since the beginning of the 20th century, with about 0.4°C of this warming occurring since the 1970s.
- When released into the atmosphere, carbon dioxide remains there for about 100 years. So even if we reduce emissions, we are likely to see a global rise in temperature of 2°C by the end of the century owing to greenhouse gases currently in the atmosphere.
- Climate also varies for natural reasons. These include volcanic eruptions and changes in solar output with year-to-year and decade-to-decade variations, as well as natural oscillations within the climate system, such as the North Atlantic Oscillation and the El Niño-Southern Oscillation (ENSO).
- Northern hemisphere sea-ice amounts are decreasing and there has been a substantial thinning of Arctic sea-ice in late summer to early autumn over recent decades. Also, there is a near worldwide decrease in mountain glacier extent and ice mass, consistent with surface temperature increases.
- Global-average sea level rose by about 1.5 mm per year during the 20th century. This is believed to be due to a number of factors including thermal expansion of warming ocean waters and the melting of land glaciers.

People's activities are contributing to Climate Change

- World population today is nearly four times that in the year 1900.
- Carbon dioxide levels are already the highest for almost half a million years and are rising faster than ever before.
- At present, about 6.5 billion tonnes of carbon dioxide are emitted globally each year, mainly through burning coal, oil and gas for energy.
- Since the beginning of the industrial revolution we have used up around 50% of the fossil fuel reserves laid down in the past 500,000 years.
- The domestic sector, at 21% of emissions of carbon dioxide, is the fourth largest source of emissions in Northern Ireland. This represents about 5% of UK domestic sector emissions which is significantly higher than would be consistent with the population. This reflects the heavy consumption of coal, oil and gas.

There are many impacts of gradual climate change

- The loss of ice from glaciers in Greenland has more than doubled over the past decade.
- Rising sea levels can cause some species that cannot adapt to disappear. For example, it may be impossible for salt marsh plant species to migrate onshore.
- Coral reefs are very sensitive to heat. A 1°C rise in sea temperature can cause them to bleach and eventually die. The worst coral bleaching ever recorded occurred in 1998.
- At least 279 species of plants and animals are already responding to global warming and have expanded their ranges towards the poles.
- The Amazon Rainforest, the home of the largest concentration of species anywhere on Earth, could be replaced with desert within 50 years, according to Met Office modelling studies.
- More than a million species worldwide could be driven to extinction by 2050.
- The number of Category 4 and 5 hurricanes has almost doubled in the last 30 years.

- Hurricane Mitch in 1998, made more intense by record sea temperatures, was the worst to hit the Americas in 200 years – until Katrina in 2005 washed away much of New Orleans.
- UKCIP reported that 2005 was the worst year on record with regards to hurricanes with a rise in tropical sea temperature being the suspected reason.
- Not surprisingly, the trend towards hotter and drier summer weather helps to create hotter, more intense fires. The hot weather dehydrates the fuel on the forest floor, creating perfect conditions for fire. The dryness of the weather also prevents fire dampening from rain.
- Higher temperatures and longer dry seasons will soon unleash forest fires on a scale never seen before from the Himalayas to the African Bush, Siberia to southern France.
- Research conducted on behalf of the Department of Health concluded that climate change would mean that by 2050 heat-related summer deaths are likely to increase to around 2,800 per year in the UK.
- The occurrence of high temperatures in a summer of low precipitation exacerbates drought conditions.

There are major social impacts of gradual climate change

- Deaths from the effects of climate change will double in just 25 years - to 300,000 people a year.
- The number of people affected by floods worldwide has already risen from 7 million in the 1960s to 150 million today.
- Sea levels are rising and are forecast to rise another 88cm by 2100 threatening 100 million people globally who currently live below this level. This could eventually lead to loss of whole communities, cities or even low lying islands.
- Warmer, wetter climates will mean more mosquitoes to spread diseases like malaria and dengue fever. This will also be worsened by bad sanitation. Malaria has spread to higher altitudes in places like the Colombian Andes, 7,000 feet above sea level.
- The Intergovernmental Panel on Climate Change (IPCC) concluded in 2001 that crop yields in the middle latitudes, including the UK, may rise. But in the tropics they will decline, sometimes catastrophically, bringing a resurgence of famine in Africa.
- Climate change impacts disproportionately heavily on the poor. Disease, drought, flooding and starvation are all exacerbated and this will lead to increasing number of refugees.
- The modern industrial states are dependent on oil as never before for their prosperity and this has led to war. There is an increased likelihood that similar wars could occur with other resources such as water or land.
- Worldwide, economic losses from weather and flood catastrophes have increased tenfold during the past 30 years of accelerating climate change. If this continues there will be a severe effect on international economies.
- In Europe alone, the severe floods in 2002 had an estimated cost of \$16 billion.

Tipping Points and Positive Feedback

These concepts are relatively new to climate science, but are perhaps the most worrying aspects of climate change. A tipping point is the threshold where a slight rise in the Earth's temperature can cause a dramatic change in the environment that itself triggers a far greater increase in global temperatures. In positive feedback situations present climate change actually accelerates future climate change leading to ever more severe impacts. Unfortunately, there are several examples of how this might happen.

- Shrinking polar ice caps results in an albedo effect. That is, the loss of highly reflective ice results in more energy being captured by Earth's atmosphere and the sea resulting in higher temperatures and faster melting.

- Melting Alaskan, Canadian and Siberian permafrost is releasing huge volumes of the potent greenhouse gas methane into the atmosphere which will result in further climate change.
- Higher ocean temperatures could result in the release of undersea methane hydrates. The methane is currently trapped in ice crystals but warmer waters could result in huge volumes of methane being released.
- Rainforest loss due to climate change could also result in positive feedback as methane will be released as the organic matter decays and the loss of the forests' carbon sequestering potential results in more atmospheric carbon dioxide.

Technology can provide some answers

- It is estimated that nearly two thirds of energy potential is lost during generation, transmission and use. This can be addressed through innovative technologies, particularly localised micro-generation.
- The use of renewable energy would considerably help towards the reduction of carbon emissions. These include: solar energy, wind power, hydropower, biomass and geothermal energy.
- At present over 3% of electricity produced in the UK comes from a renewable source. By the year 2010 the Government's target is to exceed 10%.
- Hydrogen cars are a definite step towards addressing the issue of climate change - it's colourless and odourless. The by-product of burning hydrogen is water vapour, quickly and safely absorbed by the environment and hydrogen supplies three times as much energy as the same quantity of petrol.
- Zero emission buildings are a good example for the future as they can be defined as having no carbon dioxide emissions during their use or construction.
- New and evolving technological solutions may be able to contribute significantly to alleviating climate change – such as solar space mirrors and tidal power – and are under development but need further work.

People can change their behaviour

- People accept major changes when there is an acknowledged crisis; this has occurred many times before, for example in times of war, terrorism and disease outbreaks.
- When the case is made the 'unthinkable change' can happen relatively rapidly, for example health warnings such as smoking or drink driving.
- Government can change priorities and have major influence on the public through regulation and policy.
- Taxes and other financial incentives can bring about rapid changes, for example the oil price increases during the 1970s oil crisis changing driving habits.

A little can help a lot

- Use energy efficient light bulbs! Although they are more expensive to buy initially, after about 900 hours of use the electricity savings have offset the extra purchase cost. Since they will typically last for some 8,000 hours, the savings over its lifetime could reach £35.
- Seek out and support local farmers' markets - They reduce the amount of energy required to grow and transport the food to you by one fifth and keep money in the community.
- Fly less - air travel produces large amounts of emissions so reducing how much you fly by even one or two trips a year can reduce your emissions significantly – a return flight from London to Florida releases as much carbon dioxide as a normal year's driving.
- Check your tyres weekly to make sure they're properly inflated – Proper inflation can increase mileage by more than 3%

- You can use less hot water by installing a low flow showerhead and washing your clothes in cold or warm water instead of hot.
- Unplug electronics from the wall when you're not using them. Even when turned off, things like hairdryers, cell phone chargers and televisions use energy.
- Buy recycled paper products. It takes 70 to 90% less energy to make recycled paper and it prevents the loss of forests worldwide.
- Switch to green power. In many areas, you can switch to energy generated by clean, renewable sources such as wind and solar.
- Buy fresh foods instead of frozen - frozen food uses 10 times more energy to produce.
- Buy organic foods as much as possible - organic soils capture and store carbon dioxide at much higher levels than soils from conventional farms.
- Try telecommuting from home or work - telecommuting can help you drastically reduce the number of miles you drive every week.
- Start a car-share with your co-workers or classmates.

What can you do?

- Individual actions may seem small, but together they can change the world! Write to or phone your MP or MLA and help to raise climate change up the political agenda and support the legislative and financial changes which are needed.
- If everyone in the world lived as most Europeans do, we would need three planets to support us, therefore aim for 'one planet living'. The vision of one planet living is a world where people everywhere can lead happy, healthy lives using their fair share of the Earth's resources.
- Promote awareness of climate issues in your local community and take action! For example, plant more trees in your area - a single tree will absorb one tonne of carbon dioxide over its lifetime.
- Reduce your carbon output to zero through minimising and offsetting.
- Simply be a good global citizen. Be aware of the world as a global community and recognize the rights and responsibilities of all citizens within it.

References

An Inconvenient Truth Website: www.aninconvenienttruth.co.uk; The Intergovernmental Panel on Climate Change (IPCC): www.ipcc.ch; The UK Climate Impacts Programme: www.ukcip.org.uk; www.greenpeace.org.uk; www.green-watch.com; www.firstscientist.com; www.nef.org.uk/greenenergy; www.strath.ac.uk.

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