

Net Zero Wales | Module 1 | Net Zero and Climate Change



This module is about the climate emergency - "a code red for humanity" according to the United Nations (UN) Secretary-General - and why this is the defining crisis of our time. In February 2022, the Intergovernmental Panel on Climate Change stated that "any further delay in global action on adaptation and mitigation will miss the closing window of opportunity to secure a liveable and sustainable future for all".

There is no place across the world that can escape from the devastating consequences of climate change, but there are actions that are being taken and further actions that can be taken right now to adapt to and mitigate the worst effects. This module will help you navigate the basic science of climate change, explaining some of the major causes of rising global temperatures and the impacts that this has. It will also help you understand what net zero emissions is and why net zero is so critically important. We will then look at some of the responses at the global level, from the UK Government, from Welsh Government and from industry. Finally, you will have the opportunity to reflect on what you've learnt so that you can take action too.

Learning Outcomes:

By the end of this module you will be able to:

1. Understand the basic science of climate change

2. Explain some of the major causes and effects of climate change
3. Understand and discuss the meaning of net zero carbon and why this is so important
4. Outline some of the responses from industry and/or the Welsh government to the climate emergency
5. Describe and propose personal action that you can take to help tackle the climate emergency

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What is climate change and why is this an emergency?

The causes of climate change

The effects of climate change

Key responses

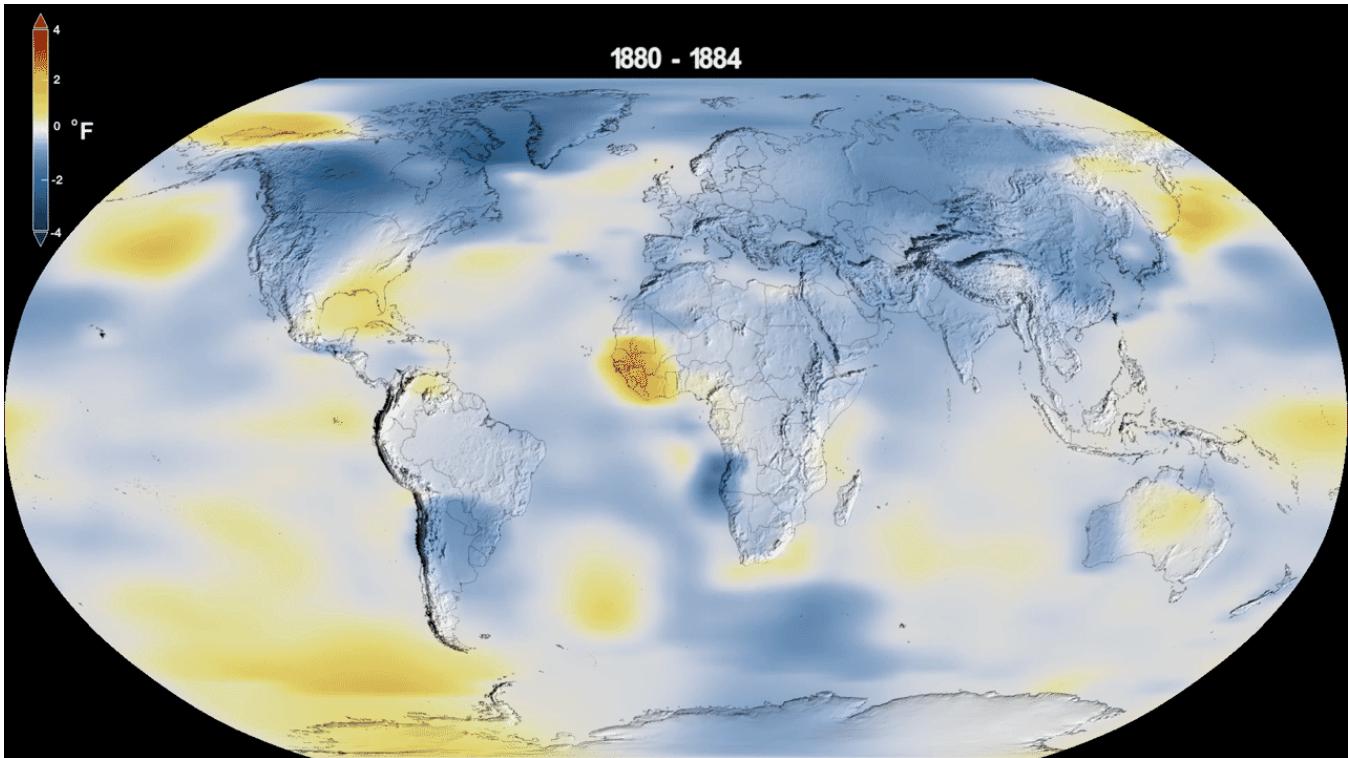
From learning to action

What is climate change and why is this an emergency?

Learning Objectives

- To recognise the climate emergency
- To understand net zero

Climate change refers to large-scale, long-term shifts in our planet's atmospheric conditions as a result of a warming planet. We are already witnessing the impacts of climate change as floods, extreme weather and wildfires are seen worldwide with devastating effects on people and nature.



Credit Source : NASA's Scientific Visualization Studio. Data provided by Robert B. Schmunk (NASA/GSFC GISS).

This is caused by increasing amounts of greenhouse gases (GHGs) - mainly carbon dioxide, methane and nitrous oxide - in the atmosphere. The most abundant greenhouse gas carbon dioxide (CO_2), which accounts for about two-thirds of greenhouse gases, is largely the product of burning fossil fuels. These gases trap the sun's heat and cause the planet's temperature to rise.

More than 99% of climate scientists agree that climate change is caused by human activities. However, there is an important and significant difference between 'weather' and 'climate'.



Weather

Weather refers to



atmospheric conditions over a short period of time in a particular region, which can change within hours or



Climate

Climate refers to how the atmosphere behaves over a long period of time over a very large area, such as a country, a continent, or the whole world.

Without global and local action, humans and nature will experience catastrophic warming.

In line with the advice from the Climate Change Committee (CCC), this must be a decade of action globally.

Getting the terminology right

Global-warming potential (GWP) —

Global-warming potential (GWP), is the term used to describe the potency of a greenhouse gas, taking account of how long it remains active in the atmosphere. The global-warming potentials (GWPs) currently used are those calculated over 100 years. Carbon dioxide is taken as the gas of reference and given a 100-year GWP of 1.

Carbon dioxide equivalent (CO₂eq) —

A carbon dioxide equivalent (CO₂eq) is used to compare the emissions from various greenhouse gases on the basis of their global warming potential (GWP), by converting amounts of other gases to the equivalent amount of carbon dioxide with the same global warming potential.

For example, the GWP for methane is 25 and for nitrous oxide 298. This means that emissions of 1 million metric tonnes of methane and nitrous oxide respectively are equivalent to emissions of 25 and 298 million metric tonnes of carbon dioxide.

In order to prevent the worst effects of climate change, global greenhouse gas emissions need to fall rapidly, reaching net zero before 2050 ([World Resources Institute](#)). The warming of the earth is proportional to cumulative CO₂eq emissions, which means that the planet will keep heating for as long as global emissions remain higher than net zero. This implies that climate damage, caused by global warming, will continue escalating for as long as emissions continue.

- i Net zero refers to the balance between the amount of greenhouse gases produced and the amount of greenhouse gases removed from the atmosphere. If the amounts are the same net zero has been achieved.

Decisions and Actions

In order to make the best decisions and take the best actions we can use science-based targets.

- Science-based targets provide a clearly-defined pathway to reduce GHG emissions, helping prevent the worst impacts of climate change.
- Targets are considered 'science-based' if they are in line with what the latest climate science deems necessary to meet the goals of the Paris Agreement – limiting global warming to well-below 2°C above pre-industrial levels and pursuing efforts to limit warming to 1.5°C.
- It is important to note that limiting will only prevent the worst case scenarios of climate change even if we achieve net zero emissions, globally, by 2050.



Complete the content above before moving on.

The causes of climate change

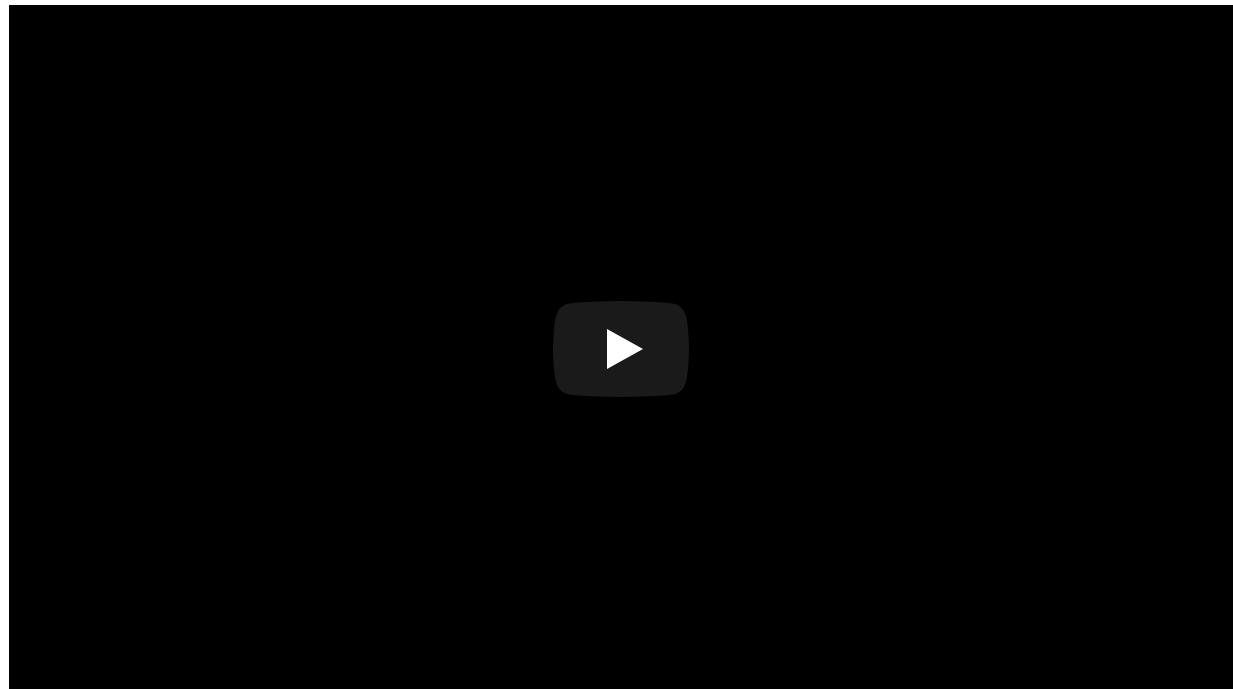
Learning Objectives

- To understand the basic science of climate change
- To recognise the greenhouse gas effect and sources of greenhouse gases

Billions of tons of greenhouse gases are released into the atmosphere every year as a result of human activities.



Since the beginning of the industrial era (1850), human activities have raised atmospheric concentrations of CO₂eq by nearly 49%. This is more than what has happened naturally over a 20,000 year period. The warming of the earth occurs due to the greenhouse effect.



[The Greenhouse Effect](#) by simpleshow foundation is licensed under [CC BY](#)

The Greenhouse Effect

The greenhouse effect is a natural phenomenon whereby greenhouse gases trap heat in the atmosphere. These gases are principally water vapour, methane and nitrous oxide but most importantly, carbon dioxide (CO₂).

CO₂ stays in the atmosphere for centuries and therefore we are already 'locked' into the impacts of climate change from all the CO₂ that has already been emitted. This is why it is so important to prevent even more CO₂ being released alongside methane and nitrous oxide.

Human Activities

Human activity is the primary driver of climate change. Some of the key drivers are:

Energy



The burning of fossil fuels is the single largest source of energy in the world.

In 2020, around 80% of the world's energy needs were generated by the fossil fuels, coal, oil and natural gas. Although coal consumption is falling in many parts of the world, oil and gas are still growing.

This releases tremendous quantities of carbon into the atmosphere, disrupting the natural carbon cycle.

Credit source: [What is the carbon cycle?](#) by National Ocean Service is licensed under [CC BY](#).



Transport



Transport accounts for a quarter of global carbon emissions. In the UK transport contributes more greenhouse gases than any other sector, because of the use of fossil fuels in transport. Cars, trucks and motorbikes make up about 75% of the greenhouse gas emissions from transport. The aviation industry emits around 2.1% of all global emissions.



Consumer lifestyle —

Over its lifecycle, the average consumer 'good or product' will be responsible for carbon emissions more than six times its own weight. But emissions are also produced through the use, packaging, transport and distribution of goods and services and ultimately their disposal.



Destruction of carbon sinks

Deforestation, degradation of the soil, destruction of peatlands, loss of ecosystems, loss of hedges and the fragmentation of ecosystems all lead to increase of CO₂eq as these natural resources are natural 'sinks' for CO₂. For example methane produced from the digestive processes in cattle, methane produced by bacteria in rice paddies, carbon dioxide produced from burning fossil fuels in farm machinery.



Agriculture

Agriculture is responsible for about 25% of human greenhouse emissions.



Waste

Humans create huge amounts of waste, because of the amount of packaging used and the short life cycle of products. Waste which cannot be recycled may end up in landfills where it decomposes and releases greenhouse gases.



Knowledge Check

Climate change refers to small-scale and short-term shifts in our planet's atmospheric conditions.

True

False

SUBMIT

Tick the correct answer.



Net zero means that greenhouse gases released into the atmosphere are balanced out by the removal of greenhouse gases out of the atmosphere.



Net zero means that no greenhouse gases are released into the atmosphere .

SUBMIT

Tick the correct answer.



Limiting warming to no more than 1.5 degrees Celsius above pre-industrial levels will prevent global climate change from happening.



Limiting warming to no more than 1.5 degrees Celsius above pre-industrial levels will only prevent the worst case scenarios of climate change.

SUBMIT

Tick the correct (2) answers.



Fossil fuels have the greatest global impact in terms of release of carbon emissions.



Deforestation is a key contributor to climate change as carbon is released when land is cleared.



Consumer lifestyle has little effect on climate change.

SUBMIT





Complete the content above before moving on.

The effects of climate change

Learning Objectives

- To understand some of the major impacts and consequences of rising global temperatures

Climate change is far more complicated than simply “hotter summers and wetter winters”.

The climate is a very complicated system that touches every part of the environment and every aspect of human life on earth. The race to achieving net zero carbon emissions is crucial. In a warming planet we will witness:



Glaciers, ice sheets and ocean levels

Glaciers and ice sheets in polar and mountain regions are already melting faster than predicted.

With billions of people living in areas at risk of flooding from rising sea levels (almost 40 per cent of the world's population live within 100 km of a coast), action is needed to prevent cities from being completely submerged; thereby displacing millions of people inland and increasing pressure on available space.

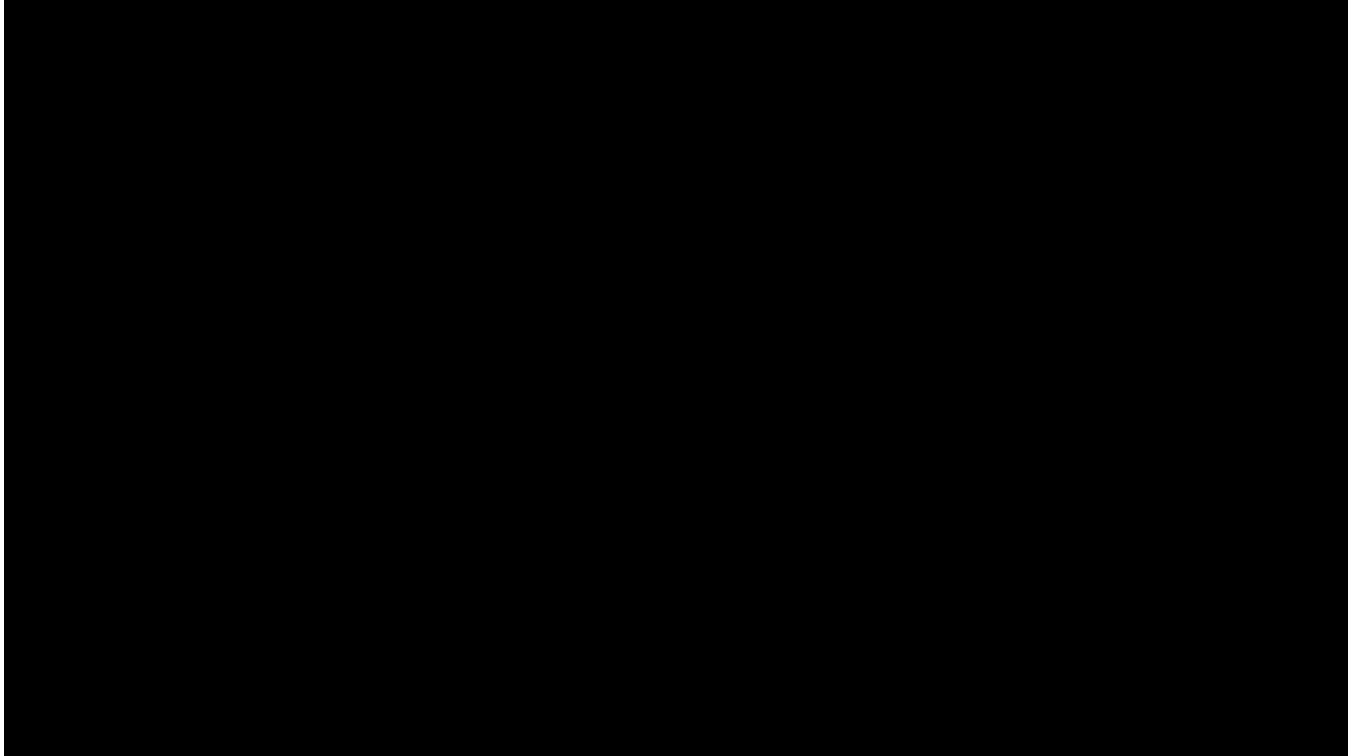
Food shortages

Although the effect around the world varies depending on region, globally climate change is going to have a negative impact on food production due to changes in weather, such as longer dry spells and heavier rainy spells, and an increase in pests. Heavy rain coupled with intensive farming can literally wash fertile soils away and in very dry places, soil is lost to the wind. Climate change is a direct cause of soil degradation, which limits the amount of carbon the earth is able to contain.

Water shortages

Climate change is already increasing droughts globally due to changes in weather patterns. Higher temperatures and more extreme, less predictable, weather conditions are projected to affect availability and distribution of rainfall, snowmelt, river flows and groundwater, and further deteriorate water quality. This in turn impacts upon health and food security. In 2050, the number of people expected to be living in severely water-scarce areas will increase to 2.7 - 3.2 billion people.





Credit Source: NASA's Scientific Visualization Studio.

Human movement and conflict

Climate change will drive human migration away from areas worst affected by climate change. As resources like food and drinkable water become scarcer, the chance of conflict becomes more likely.

Extreme weather events

Not every extreme weather event is caused by climate change. However, the evidence shows that an increase in global surface temperatures also increases the likelihood of droughts and intensity of storms. This is because warmer air evaporates more water into the atmosphere where it becomes fuel for more powerful storms and weather events.



This is [Earth in the next 100 years if we don't act on climate change](#) by World Economic Forum is licensed under [CC BY](#).

Knowledge Check

Which of the following are key impacts of climate change?

Melting glaciers and ice sheets

Displacement of people

Droughts



Floods



Food shortages



Human conflict



All of the above

SUBMIT



Complete the content above before moving on.

Key responses

Learning Objectives

- To understand the global and Welsh Government's response to the climate emergency
- To understand mitigation and adaptation to climate change

Global agreements

The 2015 Paris Agreement on climate change called for holding warming to "well below" 2°C above pre-industrial levels, but great effort must be taken to limit the increase even further, to no more than 1.5°C.

This was further discussed at the [COP26](#) summit in Glasgow in 2021 where a Pact was agreed to accelerate action towards the goals of the Paris Agreement and the UN Framework Convention on Climate Change; however, the world is already at 1.1°C above pre-industrial levels and current emissions are still rising.

Wales:

[The Environment \(Wales\) Act 2016](#) provides a framework to manage Wales' natural resources and reduce greenhouse gas emissions in Wales, while the Well-being of Future Generations (Wales) Act 2015 aims to improve the social, economic, environmental and cultural well-being of Wales. Both Acts include parts which are important to climate change adaptation.

The following are key future impacts of climate change on the UK:

- Extreme heat will become more likely in summer with exceptionally warm summers 10-20% more likely
- There could be up to 40% more rain on the wettest winter days
- Risks to ecosystems and habitats due to inability to adapt to a rapidly changing climate
- Risks to agriculture, forestry and land-management practices
- Risks to soils from drought and flood
- Risks to habitats, homes, businesses and infrastructure from coastal erosion, wind, in-land flooding and subsidence
- Risks to health and wellbeing from high temperatures, changes in air quality, poor water quality and new diseases.

In April 2019 the Senedd declared a climate emergency. It recognises the clear threat climate change presents to our health, economy, infrastructure and natural environment.

The Senedd has passed a law to achieve net zero greenhouse gas emissions by 2050.

Getting to net zero means we must decarbonise our lives and the economy and build climate resilience. Resilience means that we must do two things (1) mitigate the impacts of climate change and (2) adapt to climate change.

Getting the terminology right...

Decarbonisation

Decarbonisation, also known as climate mitigation, is about reducing CO₂eq emissions resulting from human activity, with the eventual goal of eliminating them.

Climate resilience

Climate resilience is the ability to anticipate, prepare for, and respond to events, trends, or disturbances related to climate change. Resilience includes adaptation and mitigation.

Climate adaptation

The process of adjusting to both the current and expected impacts of climate change in order to reduce harm to people and the environment, including biodiversity. This also includes changing people's behaviour towards a greener way of living and working.

The following are ways the Welsh Government is working towards achieving a Net Zero Wales:

- 1 Planting forests and trees to act as a carbon sink
- 2 Installing charging points for electric vehicles
- 3 Banning fracking for gas and not issuing new licenses for coal extraction

- 4 Changing building regulations to increase energy efficiency in new houses
- 5 Building homes outside of known flood plains
- 6 Growing crop varieties suited to warmer, drier summer conditions
- 7 Requiring Public Service Boards to pay regard to the latest climate change risk assessment when developing their wellbeing assessments
- 8 Supporting low carbon farming practices
- 9 Releasing land from agriculture
- 10 Decarbonising electricity production from fossil fuels
- 11 Increasing electricity production from low carbon and renewable sources
- 12 Safeguarding and increasing carbon stores in soils and biomass

There is an urgent need for system change, personal and collective action to meet net zero.



Complete the content above before moving on.

From learning to action

Learning Objectives

- To recognise the power of personal and collective action on reaching net zero
- To appreciate your personal potential in shaping a positive future for all
- To calculate your own carbon footprint and plan actions that you can take now to reduce your carbon footprint

So, it's over to you.

You have the opportunity to make an extraordinary contribution to tackling the climate and ecological emergencies. You have the power to make a difference through your career path. You have the power to be a changemaker who touches the lives of people all around you and makes the world a much better place for all.

You could calculate your own [carbon footprint](#)

If you are looking for some inspiration on the impact that one person can make click on the link below to find out more about Boyan Slat and The Ocean Cleanup. <https://theoceancleanup.com/about/>

Click below to download your pledge card...



netzero_pledge.pdf

682 KB



Take a few minutes to reflect on what you have learned and how it made you feel - write down a few brief notes.

Now write your personal pledge/statementwhat action(s) will you take? Try and be specific.

Here are a few pointers:

- Identify personal purchasing decisions and the impacts (positive and/or negative) that this may have on the environment and people
- Identify and take actions that help halt and reverse the loss of nature
- Help inform others of what you have learned and encourage them to take action
- Gain a deeper understanding of the opportunities available through a greener career

I'm sure that you have your own ideas.



Carbon Capture Technician

FIND OUT MORE

Meteorologist

FIND OUT MORE

Environmental Engineer

FIND OUT MORE

Useful links and resources:

- [BBC - Greenhouse Effect](#)
- [Climate Change Committee](#)
- [Climate change 2022](#)
- [Climate Change Committee progress report](#)
- [COP26](#)
- [Net Zero Wales summary](#)
- [Net Zero Wales Carbon Budget](#)
- [Our world in data](#)
- [Well-being of Future Generations Act](#)
- [Welsh Government declaration of climate emergency](#)
- [UK Climate Projections](#)
- [Climate Change](#)



Complete the content above before moving on.