Paper 1 - Section A – The challenges of natural hazards – *Natural and Tectonic hazards*

What is a natural hazard –

A natural event or process which causes loss of life and/or damage to property which creates disruption to human activities.

What are some different natural hazards?

- Volcanic eruption (tectonic hazard)
- Earthquakes (tectonic hazard)
- Storms / topical revolving cyclones
- Floods

What is Hazard risk?

This is the chance or likelihood of being affected by a natural event.

What factors effect hazard risk?

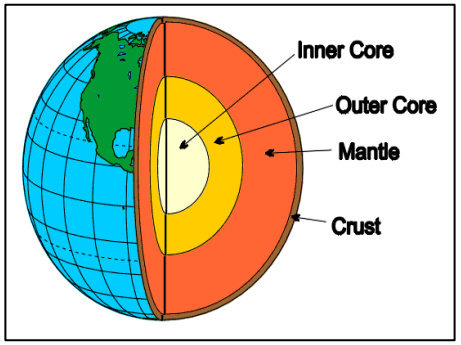
Urbanisation – 50% of the world now lives in cities. Urban areas are at greater risk of earthquakes and tropical storms.

Poverty – Poverty forces people to live in areas more at risk from hazards as the land is cheaper.

The structure of the earth

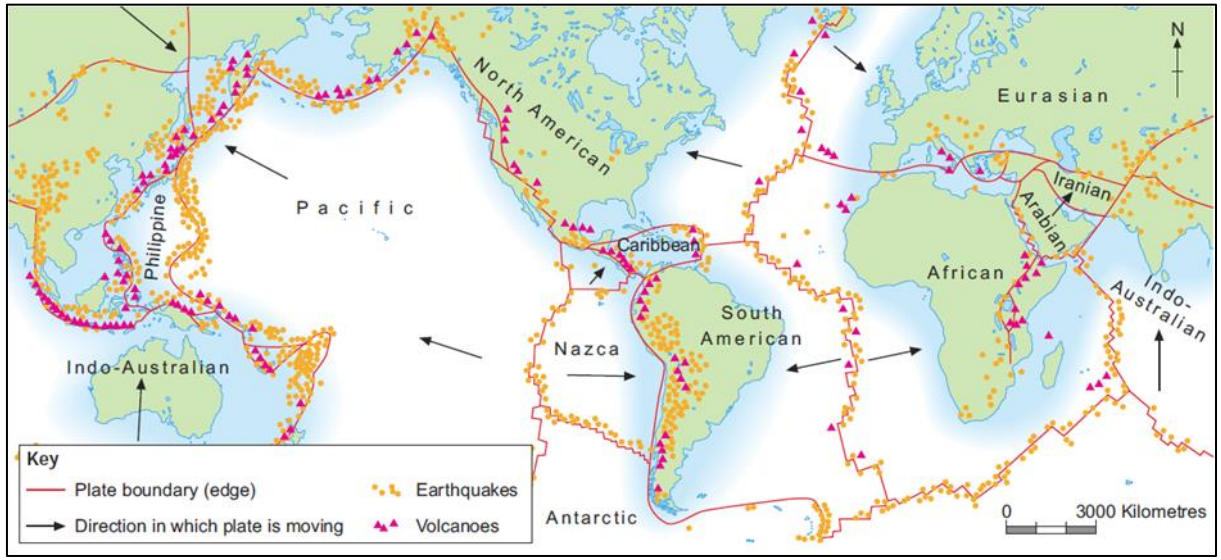
The earth has 4 layers

The core (divided into inner and outer), mantle and crust.



Tectonic plate theory

- The earth crust is split up into a number of different plates about 100km thick.
- They sit on top of the earth's mantle
- These can be divided into two different plates –
  - ***Oceanic crust***
    - Younger, denser and thinner
  - ***Continental crust***
    - Older, lighter and thicker
- Plate move around due to convention currents within the earth's mantle.
  - This is when the Hot mantle rises and pulls the crust apart on the surface. As it cools, it sinks and drags the crust back down with it. This is a constant cycle.
- This movement leads to tectonic hazards such as *earthquakes and volcanoes* which is why we find these along tectonic plate boundaries.
- A good example of this is the Pacific ring of fire, which is where we find a high number of earthquakes and volcanoes (75% of the world's active volcanoes and 90% of the world's earthquakes).

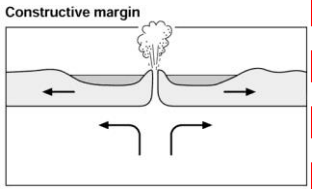


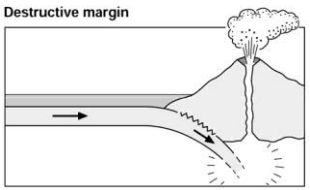
Big Ideas				
Place - what makes a location	**Interconnections** - how and why things are linked	**Processes** - how things work	**Environment**- what's around us	**Sustainability** - now and the future

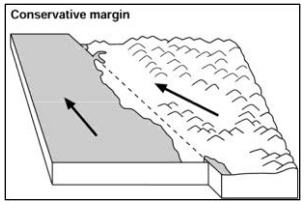
Paper 1 - Section A – The challenges of natural hazards – *Tectonic hazards*

Plate margins

- Where two plates meet is called a plate margin or plate boundary
- The line between these plates is called a fault line.
- ***Constructive plate margin***
  - These plates are pulling apart. As they do magma rises up through the crack. This is known as seafloor spreading. This magma is very runny and can travel many miles and forms a volcano on the surface. This volcano is flat and wide and is called a ***Shield Volcano***. This leads to new land being formed.
  - An example is the mid-Atlantic ridge which is causing Iceland to grow.
  - It causes earthquakes and volcanoes.
- ***Destructive margin***
  - These plates are moving towards each other. The denser, Oceanic plate, subducts under the lighter, continental plate. As the two plates scrape past each other, friction builds up and causes earthquakes. As the denser oceanic crust subducts further into the earth, it warms and melts. This creates magma which forces its way upwards and causes an explosive volcanic eruption. This is known as a ***composite volcano.***
- ***Conservative margin***
  - These two plates are moving past each other and cause friction to build up which is released in the form of an earthquake.
  - An example is the San Andreas Fault on the west coast of the USA
  - There are no volcanoes found here.







Nepal Earthquake (LIC)	Chile Earthquake (HIC)
This occurred on – April 2015 7.9 on the Richter scale – Destructive plate	This occurred on – February 2010 8.8 on the Richter scale - Destructive plate
Primary effects – 9000 killed - 7000 Schools destroyed - 20,000 injured - Total cost - $5billion	Primary effects – 500 killed - 4500 Schools destroyed - 12,000 injured - Total cost - $30billion
Secondary effects - • An avalanche on Mt Everest killed 19 people • A further avalanche in Langtang left 250 people missing.	Secondary effects – • 1500km of roads damaged. • A fire occurred at a chemical plant which lead to an evacuation.
Immediate response - • Search and rescue teams provided food and water from countries like the UK • 300 000 people migrated from the capital Kathmandu	Immediate response - • Power and water restored to 90% of homes within 10 days • A national appeal raised $60million dollars
Long-term response – • They enforced stricter codes on new buildings. • In June 2015 they hosted an international conference to seek help for reconstruction.	Long-term response – • The president said it would take 4 years to fully recover • Chile's strong economy based on copper exports meant they didn't need foreign aid.

Reasons why people live in tectonic areas

Time scales – Earthquakes and volcanic eruptions do not happen very often so people are not threatening by them

Protection – Better building design can withstand earthquakes so people feel less at risk.

Poverty – People are unable to afford anywhere else to live so end up in areas at higher risk

Natural resources - Volcanoes can bring benefits such as fertile soils (good for farming).

Reducing the risk of tectonic hazards

Monitoring - Remote sensing – Satellites detect changes in the volcanos shape which suggest magma is building up

Predication – volcanoes are based on scientific monitoring. You cannot predict earthquakes.

Protection – The Transamerica pyramid in San Francisco has deep foundations and a pendulum at the top of it that allow it to sway in earthquakes.

Planning – Hazard maps can show you at risk areas which may restrict what can be built / how it should be built.

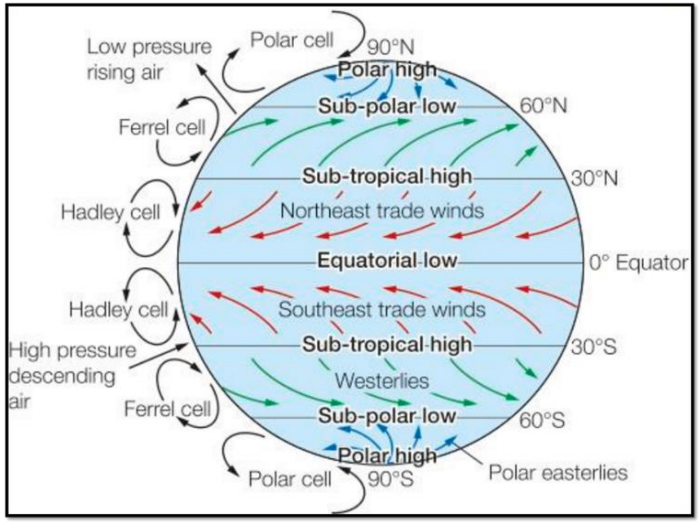
Paper 1 - Section A – The challenges of natural hazards – *Weather Hazards*

What is global atmospheric circulation?

The movement of air around earth to try and balance the temperature

Global circulation model –

- At the equator, the sun's rays are most concentrated. This means it is hotter. This one fact causes global atmospheric circulation at different latitudes**.**
- Air that is sinking causes high pressure. Winds on the ground move outwards from these areas
- Air that is rising from the ground cause low pressure. Winds on the ground moves towards these areas of low pressure.
- Winds on the earths surface transfer heat and moisture
- Due to the earths tilt and rotation, the earth moves in relation to the sun. This causes pressure belts and winds to move north in the summer and south during our winter.

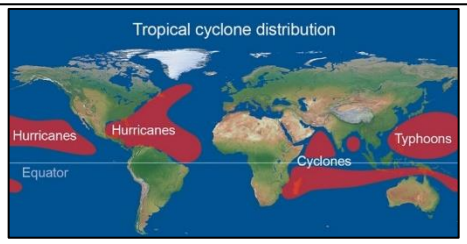


What is a tropical cyclone?

A tropical cyclone is a huge storm are powerful storms that develop in the tropics.

Global distribution of tropical cyclones -

Depending on where you are, you will know a tropical cyclone via a different term. They are mainly called, Hurricanes, Cyclones or Typhoons.



Typhon Haiyan

This occurred on – November 2013
Location – The Philippines – Southeast Asia
Power – A category 5 storm with winds of up to 170MPH

Primary effects
- 6300 killed – mostly drowned from a storm surge
- 40,000 homes destroyed or damaged
- 90% of Tacloban city destroyed.

Secondary effects
- Many jobs lost which left 6 million people without income
- Power supplies in some areas cut off for a month
- Looting and violence broke out in Tacloban city.

Immediate responses
- US aircraft carrier George Washington sent to help by providing helicopter for hard to reach areas
- Over 1200 evacuation centres set up for the homeless

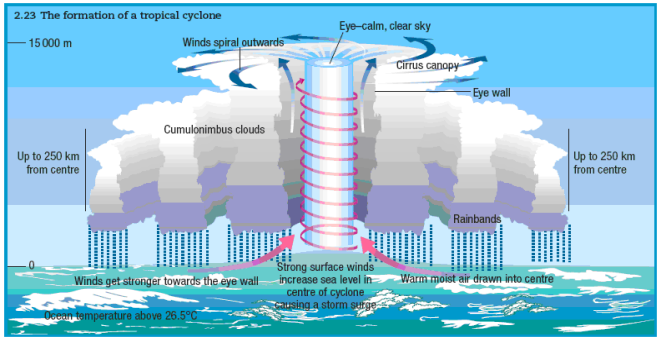
Long-term responses
- Aid agencies such as Oxfam provided fishing boats as this allowed an income.
- 'Cash for work programmes' paid people to help clear and rebuild city.

Formation of tropical cyclones -

- Occur in low latitudes between 5° and 30° north and south of the equator (in the tropics).
- Ocean temperature needs to be above 26° C.
- Happen between summer and autumn.

Sequence of tropical cyclone formation -

1. Air is heated above warm topical oceans
2. Air rises under low pressure conditions
3. Strong winds form as rising air draws in more air and moisture causing torrential rain.
4. Air spins to the Coriolis effect around a clam eye of the storm
5. Cold air sinks in the eye so it is clear and dry
6. Head is given off as it cools powering the storm.
7. On meeting land, it loses souse of heat and moisture. This and more friction with the land cause it to lose power.



Paper 1 - Section A – The challenges of natural hazards – *Weather Hazards*

Impacts of climate change on Tropical cyclones –

With the increasing world temperature due to climate change, we can expect to see the Distribution, Frequency and intensity of tropical cyclones change.

Distribution (location)

- We can expect to see them further north and south as water temperature rises outside of tropical waters.

Frequency (how often)

- No evidence that they will increase with some models suggesting they might decrease.

Intensity (how powerful)

- With an increase in sea surface temperature we can expect to see more powerful tropical cyclones occur as time progresses.

Reducing the risk of tectonic hazards

Monitoring - Satellites can track the movement of a formed tropical cyclone

Predication – By tracking a tropical cyclone we can predict where it will strike and evacuate and prepare that area.

Protection – Windows and doors can be reinforced to withstand strong winds. Houses close to the sea can be built on stilts to reduce risk from storm surges. Bangladesh built 2000 communal storm shelters

Planning – events like the national hurricane preparedness week (USA) educate people of the dangers of hurricane and why it is important to evacuate when told. .

UK Weather hazards

- Weather is the day to day conditions of the atmosphere.

Examples of UK weather hazards are –

- Thunderstorms
- Prolonged rainfall
- Drought and extreme heat
- Heavy snow and extreme cold
- Strong winds.

Extreme weather in the UK

Evidence suggest that Extreme weather in the UK is becoming more common.

- ***2013/2014*** – UK's wettest winter in 2050 years. Somerset level floods occurred.
- ***2015/2016*** – December 2015 was the UK's wettest and warmest month ever recorded.
- ***2019*** – UK's highest ever recorded temperature of 38.7°C in Cambridge
- The 10 hottest years on record have occurred during the last 20 years.

UK Extreme Weather Event – Somerset Level flood.

When – December 2013 until February 2014
Location – Somerset, South-west England.

Causes of flood

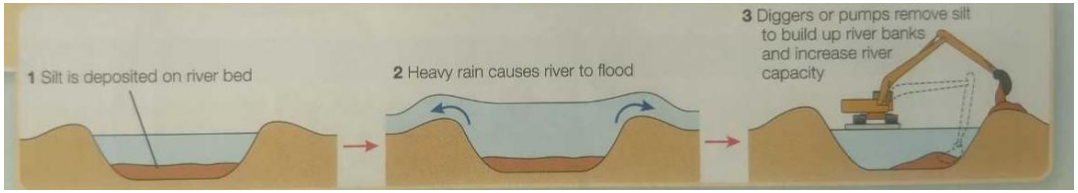
- Wettest January in over 100 years which brought 350mm of rain compared to the average of 100mm
- A storm surge swept water up the Rivers and causing it to flood onto land
- The rivers had not been dredged in 20 years.

Impacts of flood

- *Social (people)*
  - 600 homes flooded
  - 16 farms evacuated
  - Villages such as Moorland cut off. This impacted people's daily lives
- *Economic (money)*
  - £10 million total damage
  - Over 1000 livestock (cows etc) evacuated
  - Over 14,000ha of agricultural land (farming) under water for 3-4 weeks
- *Environmental (plants and animals)*
  - Floodwaters contaminated with sewage and chemicals
  - A huge amount of left behind debris had to be cleared.

Management of flood

- Immediate responses
  - Villages got around using boats
  - People used sandbags to try and prevent flooding
  - People moved items upstairs to prevent them getting damaged.
- Longer term responses
  - A £20million flood action plan put in place by Somerset council to reduce flooding. This included:
    - Road levels raised so people go still travel in future flood events
    - At risk villages will have flood defences
    - 8km of the river Tone were dredged to increase how much water it could hold and reduce food risk.



Dredging – *This is the taking out of material from the bottom of the river to allow it to hold more water and reduce the risk of flooding.*

Paper 1 - Section A – The challenges of natural hazards – *Climate change*

What is climate change?

A change in the earth's climate over a period of time. In particular, the change from the 1950s onwards, due to the increase in carbon dioxide.

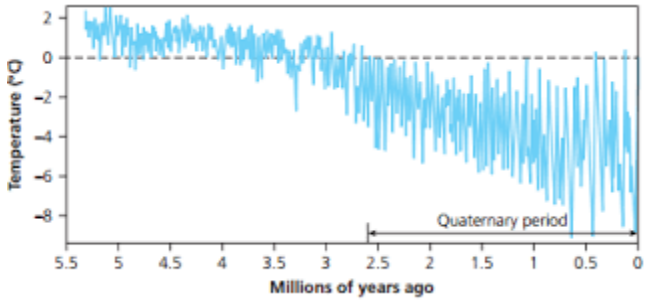
The earths changing climate

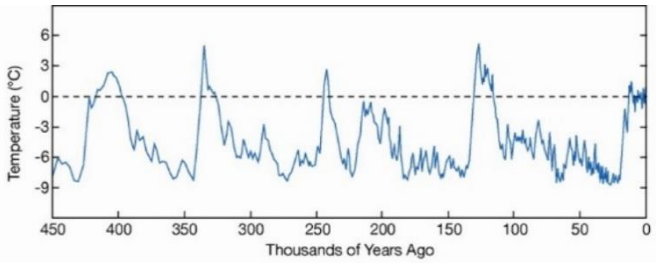
The first graph shows the earths changing temperature over 5.5 million years when compared to today's average (the 0°C dotted line). The last 2.6 million years is known as the ***Quaternary period*** and during this time the temperature has fluctuated a great deal.

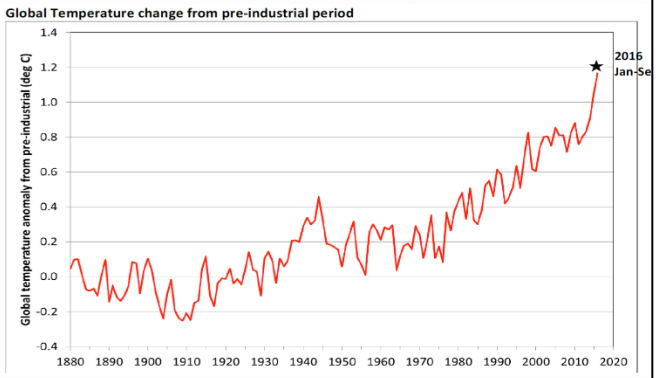
The second graph shows that the earth has been cooling. These cold spikes are known as glacial periods (when ice covers Parts of Europe and North America).

The final graph shows how the temperature for the last 100 years has begun to increase. This is known as global warming and is an example of climate change.

Since the 1880 the average global temperature has risen by 0.85°C. Most of this has occurred since the 1970s.







Evidence of climate change

Melting ice – Artic sea ice has thinned by 65% since 1975. A warming earth melts the ice

Rising sea levels – the sea level has risen by 10-20cm in the last 100 years. This is due to -

- Thermal expansion – water takes up more volume when warmer.
- Melting ice adds water to the seas and oceans

Natural causes of climate change

Orbital changes (Milankovitch cycles) – Around every 100,000 years, the earth's orbit around the sun changes from circular to mildly elliptical. This is known as Eccentricity. When closer to the sun the planet warms and when further away it cools.

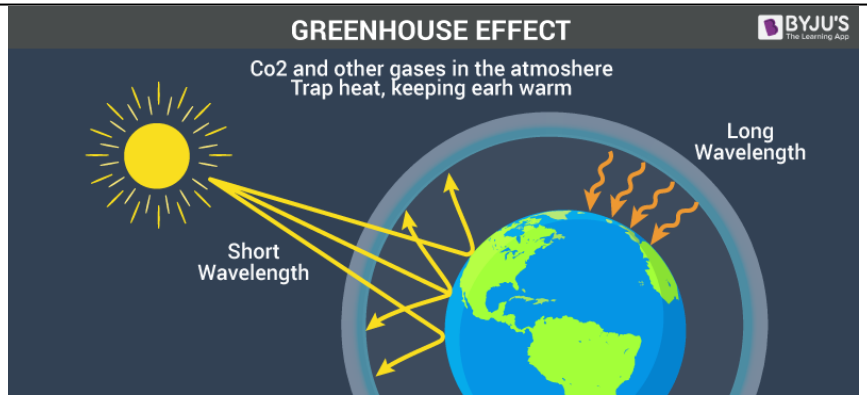
Solar activity – The sun emits different amounts of solar activity over a period of 11 years. A sunspot (a dark spot on the sun) increases the amount of heat the earth receives and heats our climate.

Volcanic activity – When volcanoes erupt, they produce huge amounts of ash which goes into the atmosphere. This ash can black out the sun reducing the temperature on the earth.

The greenhouse effect

The majority of scientist believe that human activity is causing the earth to warm up. To understand how this is possible we need to understand what the greenhouse effect is.

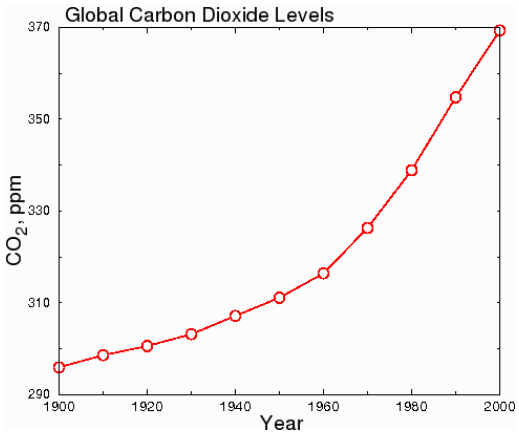
- The earth's atmosphere allows heat from the sun (short wave radiation) to pass through to warm up the earths surface.
- This heat energy is then converted into longwave radiation which can be absorbed by green houses gases such as Carbon dioxide (C02) and Methane.
- This heat is then trapped which causes the earth to warm up.
- The more greenhouses gases that are realised the more heat that is trapped. This is known as the **enhanced greenhouse effect.**



Paper 1 - Section A – The challenges of natural hazards – *Climate change*

Human causes of climate change

Burning fossil fuels – Since the start of the industrial revolution in the 1750's, we have been using coal, gas and oil for producing electricity and transport (cars and planes). CO2 accounts for 60% of all greenhouse's gases and has increased by 30% since 1850. See the below graph.



Deforestation – Trees both remove and then store carbon dioxide from the atmosphere. Once they are cut down, the stored carbon is released back into the atmosphere and less is taken out of the atmosphere.

Agriculture - *Trees* are often cut down to make space for land to farm upon (see problems in the point above). An increase in cattle and rice leads to a greater realise of Methane which is a greenhouse gas and traps the heat in the atmosphere.

Effects of climate change

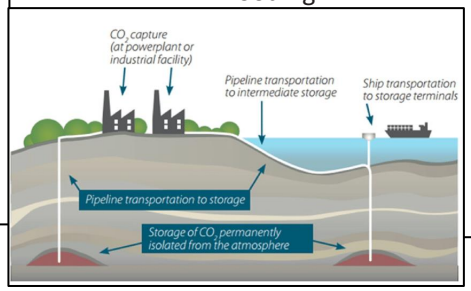
Climate change will have impacts all over the world and will affect rich and poor countries. Some of the impacts are –

- ***Sea levels will continue to rise by up to 120cm by 2100.***
  - This will cause flooding in countries like Bangladesh, India and China.
  - Low lying islands such as Tuvalu and the Maldives could disappear entirely.
- ***More droughts and heatwaves***
  - This will cause many more deaths as people run out of water or are unable to grow crops to feed themselves.
- ***Species and ecosystems will be impacted***
  - A temperature increase of 1.5°C will put 20-30% of all species at risk of extinction.
- ***Changes in the UK***
  - The growing season appears to have lengthened due to spring starting earlier and the delayed onset of autumn/winter. This will allow us the grow different crops.

How to manage climate change – Adaptation

Adaptation strategies do not aim to reduce or stop global warming. Instead they aim to respond to climate change by limiting its negative effects

- ***Changes in agriculture***
  - Introducing drought resistance crops (GM crops) to deal with a lack of water.
- ***Managing water supply***
  - Irrigation scheme like IBIS could be used to transfer water. Water can also be recycled so that it is not wasted.
- ***Reducing risk from sea level rise***
  - The islands of Maldives, which is at risk from sea level rise. They are building a 3m high wall around the capital (Male) to help prevent it flooding.



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How to manage climate change – Mitigation

Alternative energy sources - To help reduce carbon emissions, we can use different source of energy. These include, Solar power, wind power and nuclear energy. The UK aims to produce 15% of all our energy by 2020.

Carbon capture and storage (CCS) - Coal is the worst fossil fuel but is one of the most widely used to produce electricity. CCS uses technology to capture the CO2 produced in electricity generation. It is able to capture up to 90% of CO2 that is produced and stores it underground or in the ocean which prevents it getting into the atmosphere. See the above picture.

Planting trees (afforestation) - Trees remove and store CO2 from the atmosphere. By planting more trees, more CO2 is taken out of the atmosphere.

International agreements - Due to the global scale of climate change, it requires an international effort to mitigate. Agreements such as the Paris Agreement in 2015, saw 195 countries agree reduce emission levels. They agreed to keep global temperature increase below 2°C by investing $100 billion per year in developing countries to reduce emissions.