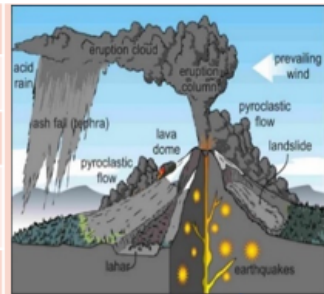


| The structure of the Earth | |
|---------------------------------|---|
| The Crust | Varies in thickness (5-10km) beneath the ocean. Made up of several large plates. |
| The Mantle | Widest layer (2900km thick). The heat and pressure means the rock is in a liquid state that is in a state of convection. |
| The Inner and outer Core | Hottest section (5000 degrees). Mostly made of iron and nickel and is 4x denser than the crust. Inner section is solid whereas outer layer is liquid. |

| Volcanic Hazards | |
|-------------------------|--|
| Ash cloud | Small pieces of pulverised rock and glass which are thrown into the atmosphere. |
| Gas | Sulphur dioxide, water vapour and carbon dioxide come out of the volcano. |
| Lahar | A volcanic mudflow which usually runs down a valley side on the volcano. |
| Pyroclastic flow | A fast moving current of super-heated gas and ash (1000°C). They travel at 450mph. |
| Volcanic bomb | A thick (viscous) lava fragment that is ejected from the volcano. |



| Managing Volcanic Eruptions | |
|---|--|
| Warning signs | Monitoring techniques |
| Small earthquakes are caused as magma rises up. | Seismometers are used to detect earthquakes. |
| Temperatures around the volcano rise as activity increases. | Thermal imaging and satellite cameras can be used to detect heat around a volcano. |
| When a volcano is close to erupting it starts to release gases. | Gas samples may be taken and chemical sensors used to measure sulphur levels. |
| Preparation | |
| Creating an exclusion zone around the volcano. | Being ready and able to evacuate residents. |
| Having an emergency supply of basic provisions, such as food | Trained emergency services and a good communication system. |

| Convection Currents | |
|--|---|
| The crust is divided into tectonic plates which are moving due to convection currents in the mantle. | |
| 1 | Radioactive decay of some of the elements in the core and mantle generate a lot of heat. |
| 2 | When lower parts of the mantle molten rock (Magma) heat up they become less dense and slowly rise. |
| 3 | As they move towards the top they cool down, become more dense and slowly sink. |
| 4 | These circular movements of semi-molten rock are convection currents |
| 5 | Convection currents create drag on the base of the tectonic plates and this causes them to move. |

| LIC-CS: Haiti Earthquake 2010 | |
|--|---|
| <p>Causes On a conservative plate margin, involving the Caribbean & North American plates. The magnitude 7.0 earthquake was only 15 miles from the capital Port au Prince. With a very shallow focus of 13km deep.</p> | |
| <p>Effects 230,000 people died and 3 million affected. Many emotionally affected. 250,000 homes collapsed or were damaged. Millions homeless. Rubble blocked roads and shut down ports.</p> | <p>Management Individuals tried to recover people. Many countries responded with appeals or rescue teams. Heavily relied on international aid, e.g. \$330 million from the EU. 98% of rubble remained after 6 months.</p> |

| Earthquake Management | |
|--|--|
| PREDICTING | |
| <p>Methods include:</p> <ul style="list-style-type: none"> Satellite surveying (tracks changes in the earth's surface) Laser reflector (surveys movement across fault lines) Radon gas sensor (radon gas is released when plates move so this finds that) Seismometer Water table level (water levels fluctuate before an earthquake). Scientists also use seismic records to predict when the next event will occur. | |
| PROTECTION | |
| <p>You can't stop earthquakes, so earthquake-prone regions follow these three methods to reduce potential damage:</p> <ul style="list-style-type: none"> Building earthquake-resistant buildings Raising public awareness Improving earthquake prediction | |

| Types of Plate Margins | |
|---|--|
| Destructive Plate Margin | |
| When the denser plate subducts beneath the other, friction causes it to melt and become molten magma . The magma forces its way up to the surface to form a volcano. This margin is also responsible for devastating earthquakes . | |
| Constructive Plate Margin | |
| Here two plates are moving apart causing new magma to reach the surface through the gap. Volcanoes formed along this crack cause a submarine mountain range such as those in the Mid Atlantic Ridge . | |
| Conservative Plate Margin | |
| A conservative plate boundary occurs where plates slide past each other in opposite directions, or in the same direction but at different speeds. This is responsible for earthquakes such as the ones happening along the San Andreas Fault, USA. | |

| Unit 1a | |
|---|--|
| The Challenges of Natural Hazards | |
| What is a Natural Hazard | |
| A natural hazard is a natural process which could cause death, injury or disruption to humans, property and possessions. | |
| Geological Hazard | Meteorological Hazard |
| These are hazards caused by land and tectonic processes. | These are hazards caused by weather and climate. |
| Causes of Earthquakes | |
| Earthquakes are caused when two plates become locked causing friction to build up. From this stress , the pressure will eventually be released, triggering the plates to move into a new position. This movement causes energy in the form of seismic waves , to travel from the focus towards the epicentre . As a result, the crust vibrates triggering an earthquake. | |
| The point directly above the focus, where the seismic waves reach first, is called the EPICENTRE . | |
| SEISMIC WAVES (energy waves) travel out from the focus. | |
| The point at which pressure is released is called the FOCUS . | |

| HIC - CS: Eyjafjallajökull (E15) Eruption, Iceland 2010 | |
|---|---|
| <p>Causes The North-American and Eurasian plates move apart on a constructive plates. The disruption caused by Eyjafjallajökull was the result of a series of small volcanic eruptions from March to October.</p> | |
| <p>Effects The thick ice cap melted which caused major flooding. No reported deaths. Airspace closed across Europe, with at least 17,000 flights cancelled. Costed insurers £65m to cancelled flights.</p> | <p>Management Iceland had a good warning system with texts being sent to residents within 30 minutes. Large sections of European airspace were closed down due ash spread over the continent. Airlines developed ash monitoring equipment.</p> |

Global pattern of air circulation

Atmospheric circulation is the large-scale movement of air by which heat is distributed on the surface of the Earth.

| | |
|--------------------|--|
| Hadley cell | Largest cell which extends from the Equator to between 30° to 40° north & south. |
| Ferrel cell | Middle cell where air flows poleward between 60° & 70° latitude. |
| Polar cell | Smallest & weakest cell that occurs from the poles to the Ferrel cell. |



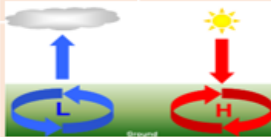
Distribution of Tropical Storms.

They are known by many names, including hurricanes (North America), cyclones (India) and typhoons (Japan and East Asia). They all occur in a band that lies roughly 5-15° either side of the Equator.



High and Low Pressure

| Low Pressure | High Pressure |
|--|--|
| Caused by hot air rising. Causes stormy, cloudy weather. | Caused by cold air sinking. Causes clear and calm weather. |



Formation of Tropical Storms

- The sun's rays heats large areas of ocean in the summer and autumn. This causes **warm, moist air** to rise over the particular spots
- Once the **temperature is 27°**, the rising warm moist air leads to a **low pressure**. This eventually turns into a thunderstorm. This causes air to be sucked in from the **trade winds**.
- With trade winds blowing in the opposite direction and the rotation of earth involved (Coriolis effect), the thunderstorm will eventually start to **spin**.
- When the storm begins to **spin faster than 74mph**, a tropical storm (such as a hurricane) is officially born.
- With the tropical storm growing in power, **more cool air sinks** in the centre of the storm, creating calm, clear condition called the **eye of the storm**.
- When the tropical storm hits land, it **loses its energy source** (the warm ocean) and it begins to lose strength. Eventually it will 'blow itself out'.

Changing pattern of Tropical Storms

Scientists believe that global warming is having an impact on the frequency and strength of tropical storms. This may be due to an increase in ocean temperatures.

Management of Tropical Storms

| | |
|--|---|
| Protection Preparing for a tropical storm may involve construction projects that will improve protection. | Aid Aid involves assisting after the storm, commonly in LIDs. |
| Development The scale of the impacts depends on the whether the country has the resources cope with the storm. | Planning Involves getting people and the emergency services ready to deal with the impacts. |
| Prediction Constant monitoring can help to give advanced warning of a tropical storm | Education Teaching people about what to do in a tropical storm. |



Primary Effects of Tropical Storms

- The intense winds of tropical storms can destroy whole communities, buildings and communication networks.
- As well as their own destructive energy, the winds can generate abnormally high waves called **storm surges**.
- Sometimes the most destructive elements of a storm are these subsequent **high seas and flooding** they cause to coastal areas.



Secondary Effects of Tropical Storms

- People are **left homeless**, which can cause distress, poverty and ill health due to lack of shelter.
- Shortage of clean water and lack of proper sanitation** makes it easier for diseases to spread.
- Businesses are damaged** or destroyed causing employment.
- Shortage of food as **crops are damaged**.

Case Study: Typhoon Haiyan 2013



| | | |
|--|--|--|
| Causes Started as a tropical depression on 2 nd November 2013 and gained strength. Became a Category 5 "super typhoon" and made landfall on the Pacific islands of the Philippines. | Effects <ul style="list-style-type: none"> Almost 6,500 deaths. 130,000 homes destroyed. Water and sewage systems destroyed had caused diseases. Emotional grief for dead. | Management <ul style="list-style-type: none"> The UN raised £190m in aid. USA & UK sent helicopter carrier ships deliver aid remote areas. Education on typhoon preparedness. |
|--|--|--|

Case Study: UK Heat Wave 2003



Causes
The heat wave was caused by an anticyclone (areas of high pressure) that stayed in the area for most of August. This blocked any low pressure systems that normally brings cooler and rainier conditions.

| | |
|---|---|
| Effect <ul style="list-style-type: none"> People suffered from heat strokes and dehydration. 2000 people died from causes linked to heatwave. Rail network disrupted and crop yields were low. | Management <ul style="list-style-type: none"> The NHS and media gave guidance to the public. Limitations placed on water use (hose pipe ban). Speed limits imposed on trains and government created 'heatwave plan'. |
|---|---|



What is Climate Change?

Climate change is a large-scale, long-term shift in the planet's weather patterns or average temperatures. Earth has had tropical climates and ice ages many times in its 4.5 billion years.

Recent Evidence for climate change.

| | |
|----------------------------------|---|
| Global temperature | Average global temperatures have increased by more than 0.6°C since 1950. |
| Ice sheets & glaciers | Many of the world's glaciers and ice sheets are melting. E.g. the Arctic sea ice has declined by 10% in 30 years. |
| Sea Level Change | Average global sea level has risen by 10-20cms in the past 100 years. This is due to the additional water from ice and thermal expansion. |

Enhanced Greenhouse Effect

Recently there has been an increase in **humans burning fossil fuels** for energy. These fuels (gas, coal and oil) emit **greenhouse gases**. This is making the Earth's atmosphere thicker, therefore trapping more solar radiation and causing **less to be reflected**. As a result, the Earth is becoming warmer.



Evidence of natural change

| | |
|---------------------------|---|
| Orbital Changes | Some argue that climate change is linked to how the Earth orbits the Sun, and the way it wobbles and tilts as it does it. |
| Sun Spots | Dark spots on the Sun are called Sun spots. They increase the amount of energy Earth receives from the Sun. |
| Volcanic Eruptions | Volcanoes release large amounts of dust containing gases . These can block sunlight and results in cooler temperatures. |

Managing Climate Change

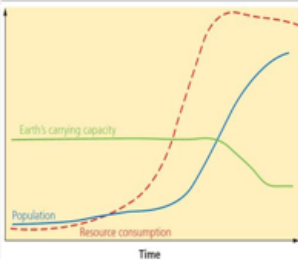
| | |
|--|--|
| Carbon Capture This involves new technology designed to reduce climate change. | Planting Trees Planting trees increase the amount of carbon is absorbed from atmosphere. |
| International Agreements Countries aim to cut emissions by signing international deals and by setting targets. | Renewable Energy Replacing fossil fuels based energy with clean/natural sources of energy. |



| Resource Challenges | | |
|---|---|--|
| Resources are things that humans require for life or to make our lives easier. Humans are becoming increasingly dependent on exploiting these resources, and as a result they are in high demand. | | |
| Significance of Water | | |
| Resources such as food, energy and water are what is needed for basic human development. | | |
| FOOD | WATER | ENERGY |
| Without enough nutritious food, people can become malnourished . This can make them ill. This can prevent people working or receiving education. | People need a supply of clean and safe water for drinking, cooking and washing. Water is also needed for food, clothes and other products. | A good supply of energy is needed for a basic standard of living. People need light and heat for cooking or to stay warm. It is also needed for industry. |

Demand outstripping supply
The demand for resources like food, water and energy is rising so quickly that supply cannot always keep up. Importantly, access to these resources vary dramatically in different locations

| 1. Population Growth | 2. Economic Development |
|--|---|
| <ul style="list-style-type: none"> Currently the global population is 7.3 billion. Global population has risen exponentially this century. Global population is expected to reach 9 billion by 2050. With more people, the demand for food, water, energy, jobs and space will increase. | <ul style="list-style-type: none"> As LICs and NEEs develop further, they require more energy for industry. LICs and NEEs want similar lifestyles to HICs, therefore they will need to consume more resources. Development means more water is required for food production as diets improve. |



Resource Reliance Graph

Consumption – The act of using up resources or purchasing goods and produce.
Carry Capacity – A maximum number of species that can be supported.

Resource consumption exceeds Earth's ability to provide!

3. Changing Technology and Employment

- The demand for resources has driven the need for **new technology** to reach or gain more resources.
- More people in the **secondary and tertiary industry** has increased the **demand for resources** required for electronics and robotics.

| Food in the UK | |
|--|--|
| Growing Demand | Impact of Demand |
| <ul style="list-style-type: none"> The UK imports about 40% of its food. This increases people's carbon footprint. There is growing demand for greater choice of exotic foods needed all year round. Foods from abroad are more affordable. Many food types are unsuitable to be grown in the UK. | <p>Foods can travel long distances (food miles). Importing food adds to our carbon footprint.</p> <ul style="list-style-type: none"> + Supports workers with an income + Supports families in LICs. + Taxes from farmers' incomes contribute to local services. - Less land for locals to grow their own food. - Farmers exposed to chemicals. |
| Agribusiness | Sustainable Foods |
| <p>Farming is being treated like a large industrial business. This is increasing food production.</p> <ul style="list-style-type: none"> + Intensive farming maximises the amount of food produced. + Using machinery which increases the farms efficiency. - Only employs a small number of workers. - Chemicals used on farms damages the habitats and wildlife. | <p>Organic foods that have little impact on the environment and are healthier have been rising. Local food sourcing is also rising in popularity.</p> <ul style="list-style-type: none"> Reduces emissions by only eating food from the UK. Buying locally sourced food supports local shops and farms. A third of people grow their own food. |

| Water in the UK | |
|---|--|
| Growing Demand | Deficit and Surplus |
| <p>The average water used per household has risen by 70%. This growing demand is predicted to increase by 5% by 2020. This is due to:</p> <ul style="list-style-type: none"> A growing UK population. Water-intensive appliances. Showers and baths taken. Industrial and leisure use. Watering greenhouses. | <p>The north and west have a water surplus (more water than is actually available). The south and east have a water deficit (more water needed than is actually available). More than half of England is experiencing water stress (where demand exceeds supply).</p> |
| Pollution and Quality | Water stress in the UK |
| <p>Cause and effects include:</p> <ul style="list-style-type: none"> Chemical run-off from farmland can destroy habitats and kills animals. Oil from boats and ships poisons wildlife. Untreated waste from industries creates unsafe drinking water. Sewage containing bacteria spreads infectious diseases. | |
| Management | Water Transfer |
| <p>UK has strict laws that limits the amount of discharge from factories and farms. Education campaigns to inform what can be disposed of safely. Waste water treatment plants remove dangerous elements to then be used for safe drinking. Pollution traps catch and filter pollutants.</p> | <p>Water transfer involves moving water through pipes from areas of surplus (Wales) to areas of deficit (London). Opposition includes:</p> <ul style="list-style-type: none"> Effects on land and wildlife. High maintenance costs. The amount of energy required to move water over long distances. |

Unit 2c

The Challenge of Resource Management

| Energy in the UK | |
|--|---|
| Growing Demand | Energy Mix |
| <p>The UK consumes less energy than compared to the 1970s despite a smaller population. This is due to the decline of industry.</p> | <p>The majority of UK's energy mix comes from fossil fuels. By 2020, the UK aims for 15% of its energy to come from renewable sources. These renewable sources do not contribute to climate change.</p> |
| Changes in Energy Mix | |
| <ul style="list-style-type: none"> 75% of the UK's oil and gas has been used up. Coal consumption has declined. UK has become too dependent on imported energy. | |

| Energy in the UK (continued) | | | | | |
|---|---|---------|--|-----------|--|
| Significance of Renewables | Exploitation | | | | |
| <ul style="list-style-type: none"> + The UK government is investing more into low carbon alternatives. + UK government aims to meet targets for reducing emissions. + Renewable sources include wind, solar and tidal energy. - Although infinite, renewables are still expensive to install. - Shale gas deposits may be exploited in the near future | <table border="1"> <tr> <th>Nuclear</th> <td> <p>New plants provide job opportunities.</p> <p>Problems with safety and possible harm to wildlife.</p> <p>Nuclear plants are expensive.</p> </td> </tr> <tr> <th>Wind Farm</th> <td> <p>Locals have low energy bills.</p> <p>Reduces carbon footprint.</p> <p>Construction cost is high.</p> <p>Visual impacts on landscape.</p> <p>Noise from wind turbines.</p> </td> </tr> </table> | Nuclear | <p>New plants provide job opportunities.</p> <p>Problems with safety and possible harm to wildlife.</p> <p>Nuclear plants are expensive.</p> | Wind Farm | <p>Locals have low energy bills.</p> <p>Reduces carbon footprint.</p> <p>Construction cost is high.</p> <p>Visual impacts on landscape.</p> <p>Noise from wind turbines.</p> |
| Nuclear | <p>New plants provide job opportunities.</p> <p>Problems with safety and possible harm to wildlife.</p> <p>Nuclear plants are expensive.</p> | | | | |
| Wind Farm | <p>Locals have low energy bills.</p> <p>Reduces carbon footprint.</p> <p>Construction cost is high.</p> <p>Visual impacts on landscape.</p> <p>Noise from wind turbines.</p> | | | | |

Option 1: FOOD



Food Security is when people at all times need to have physical & economic access to food to meet their dietary needs for an active & healthy life. This is the opposite to Food Insecurity which is when someone is unsure when they might next eat.

Human



- **Poverty** prevents people affording food and buying equipment.
- **Conflict** disrupts farming and prevents supplies.
- **Food waste** due to poor transport and storage.
- **Climate Change** is affecting rainfall patterns making food production difficult.

Physical



- The **quality of soil** is important to ensure crops have key nutrients.
- **Water supply** needs to be reliable to allow food to grow.
- **Pest, diseases and parasites** can destroy vast amounts of crops that are necessary to populations.
- **Extreme weather** events can damage crops (i.e. floods).

Daily Calorie Intake

Food Supply



This map shows how many **calories per person** that are consumed on average for each country. This can indicate the global distribution of **available food and food inequality**.

This map shows the amount of **food produced** in different countries. Whilst **Asia and North America** have **high** production outputs, **Africa and Central America** have **low** production outputs.

Increasing Food Supply



C.S. Thanet Earth



- Hydroponics** - A method of growing plants without soil. Instead they use nutrient solution.
- New Green Revolution** - Aims to improve yields in a more sustainable way. Involves using both GM varieties and traditional and organic farming.
- Biotechnology** - Genetically modified (GM) crops changes the DNA of foods to enhance productivity and properties.
- Irrigation** - Artificially watering the land so crops can grow. Useful in dry areas to make crops more productive.

Located in Kent, the site involves four huge greenhouses using hydroponics.

Advantages

- Supports more than 500 jobs.
- Produces food all year round.
- Provides UK with food security.

Disadvantages

- Money generated mostly goes to large companies not community.
- Requires a lot of energy.
- Causes visual & light pollution.

Sustainable Food Supply



C.S. NEE - Indus Basin Irrigation System



This ensures that fertile soil, water and environmental resources are available for future generations.

Largest irrigation scheme in the world. Involves large and small dams. Thousands of channels provides water to supports Pakistan's rich farmlands.

Advantages

- Improves food security by adding 40% more land for farming.
- Increased yield & range of foods.

Disadvantages

- Few take an unfair share of water
- Water is wasted and demand is rising due to population growth.
- High cost to maintain reservoirs.

Option 2: WATER



Water security is when people have good access to enough clean water to sustain well-being and good health. Water insecurity is when areas are without sufficient water supplies. Water Stress is when less than 1700m³ is available per person.

Human



- **Pollution** caused from human and industrial waste being dumped into peoples water sources.
- **Poverty** prevents low income families affording water.
- **Limited infrastructure** such as a lack of water pipes and sewers.
- **Over-abstraction** is when more water is taken than is replaced.

Physical



- **Climate** needs to provide enough rainfall to feed lakes and rivers. Droughts affect supply if water.
- **Geology** can affect accessibility to water. Permeable rock means sourcing water from difficult aquifers, whereas impermeable allows water to run-off into easily collected basins.

Impact of Water Insecurity



Food production

The less water available for irrigating crops the less food that will be produced. This could lead to starvation.

Industrial output

Manufacturing industries depend heavily on water. A severe lack of water can impact economic output.

Disease and Water Pollution

Inadequate sanitation systems pollutes drinking water causing diseases such as cholera and typhoid.

Water conflict

Water sources that cross national borders can create tensions and even war between countries.

Increasing Water Supply



C.S. Lesotho Highland Water Project



Water diversion - Involves diverting water to be stored for longer periods. Often water is pumped underground to prevent evaporation.
Dams and Reservoirs - Dams control flow and storage of water. Water is released during times of water deficit.
Water transfer - Includes schemes to move water from areas of surplus to areas of deficit.
Desalination - Involves the extraction of salt from sea water to produce fresh drinking water.

Lesotho is a highland country dependent on South Africa. Lesotho has water surplus due to high rainfall.

Advantages

- Provides 75% of Lesotho's GDP.
- Provides water to areas of drought in South Africa.

Disadvantages

- Dams displaced 30,000 people.
- Destruction to key ecosystems.
- 40% lost through pipe leakages.

Sustainable Water Supply



C.S. NEE - The Wakel River Basin



Ensures water supplies don't cause damage to the environment whilst also supporting the local economy.

A project in India that aims to improve water use by encouraging greater use of rainwater harvesting techniques.

Water conservation - Aims to reduce the amount of water wasted.
Groundwater Management - Involves the monitoring of extracting groundwater. Laws can be introduced.
Recycling and 'Grey' Water - Means taking water that has already been used and using it again rather than returning it to a river or the sea. This includes water taken from bathrooms and washing machines.

How does the project work?

- Provides 'taankas' that store water underground.
- Small dams called 'johed' interrupt water flow and encourages infiltration.
- Villages take turns to irrigate their fields so water is not overused.
- Maintained by farmers so it is entirely sustainable.
- Greater education for awareness.

Option 3: ENERGY



Energy security means having a reliable, uninterrupted and affordable supply of energy available. Energy insecurity can be experienced by countries with both a high and low energy consumption. Technology is increasing energy consumption.

Physical



- **Geology** determines the availability of fossil fuels.
- **Climate variations** will affect the potential use of renewable energy.
- **Natural disasters** can damage energy infrastructure.

Economic



- **Cost of extracting fossil fuels** is becoming costly and difficult.
- **Price of fossil fuels** are volatile to potential political changes.
- **Infrastructure for energy** is costly, especially for LICs.

Technology



- **New technology** is making once difficult energy sources now reachable/exploitable.

Political



- **Conflict and turmoil** in energy rich countries can affect exports.
- **Stricter regulations** over Nuclear.

Impact of Energy Insecurity

Sensitive environments

Exploration of energy resources threatens to harm sensitive areas such as the oil drilling in Alaska, USA.

Food production

Food production depends on the energy needed to power machinery and transport goods to different markets.

Energy conflict

Shortages of energy resources can lead to tensions and violence. Conflict can be caused by fear of energy insecurity.

Industry

Countries can suffer from shortfalls in energy leading to a decline in manufacturing and services.

Increasing Energy Supply

Non-renewables
Fossil Fuels - Conventional power stations can be made more efficient with carbon capture overcoming the environmental impacts.
Nuclear - Once a nuclear plant is built it can provide a cheap and long-term dependable source of energy.

C.S. UK Fracking



Fracking is used to extract natural gas trapped in underground shale rock. It is a method considered by the UK.

Advantages

- Estimated to create 64,000 jobs.
- UK has large shale gas reserves.
- Is far cheaper than natural gas.

Disadvantages

- May cause groundwater pollution
- Is a non-renewable resource.
- May trigger minor earthquakes.

Renewables
Wind, Solar, Biomass - These are examples of environmentally friendly renewable sources that can't run out but cost a lot to install.

Sustainable Energy Supply

This involves balancing supply & demand. It also includes reducing waste & supporting the environment.

C.S. NEE - Chambamontera



Chambamontera is an isolated community in the Andes of Peru. It introduced a micro-hydro to exploit water power as an energy source.

Benefits to the community

- Provides renewable energy.
- Low maintenance & running costs
- Has little environmental impacts.
- Using local labour and materials.
- Businesses are developing.
- Less wood is needed to be burnt.

Home design - Building homes to conserve energy. i.e. roof insulation.
Reduce demand - Changing attitudes towards energy used to save energy.
Efficient technology - Making cars more efficient by improving engine design and weight. i.e. Hybrid engines.
Transport - Using public buses & bikes.

Climate Change

WHAT IS CLIMATE?

- Climate is the average weather in a place. It tells us what the weather is usually like.
- Climate is worked out by taking weather measurements over a long period of time (usually 30 years) and then calculating the average i.e. of temperature and rainfall.
- Weather is what you get on a day-to-day basis!

WHAT IS CLIMATE CHANGE?

A change in global or regional climate patterns, in particular a change apparent from the mid to late 20th century onwards and attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels!

EVIDENCE FOR CLIMATE CHANGE

ANALYSIS OF POLLEN AND TREES

Allows us to see if more or less pollination has taken place. More pollen would suggest a warmer climate as there would be more pollen and less pollen would indicate the opposite.

WEATHER RECORDINGS

Thermometers are more accurate now and digital readings can be recorded remotely. This means you can easily tell if the climate has changed as you can compare different dates at different times.

ICE CORES

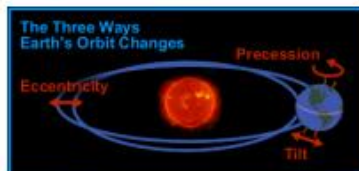
Locked inside ice are molecules and trapped air, which are preserved year on year with more snowfall. Subtle changes in temperature can be measured from ice cores extracted in Antarctica. These can be used to tell the climate from millions of years ago.

ROCKS AND FOSSILS

These can be studied for information covering longer time periods. Eg limestone would have been formed on the bottom of a warm seabed millions of years ago. Telling us what climate was like when first created.

ORBITAL THEORY

- The Earth's orbit is sometimes circular, and sometimes more of an ellipse (oval).
- The Earth's axis tilts. Sometimes it is more upright, and sometimes more on its side.
- The Earth's axis wobbles, like a spinning top about to fall over.



NATURAL CAUSES OF CLIMATE CHANGE

SUNSPOT THEORY

- The Sun's output is not constant. Cycles have been detected that reduce or increase the amount of solar energy.
- Temperatures are greatest when there are plenty of sunspots - because it means other areas of the Sun are working even harder!



THE ERUPTION THEORY

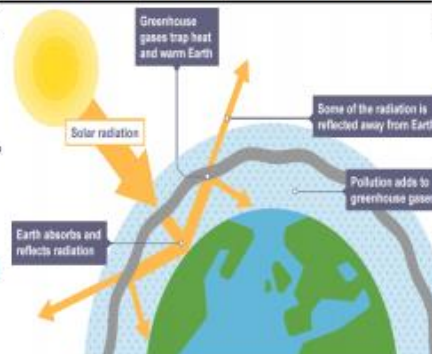
- Volcanic eruptions produce ash and sulphur dioxide gas. This is circulated globally by high level winds.
- The blanket of ash and gas will stop some sunlight reaching the Earth!
- Instead, the sunlight is reflected off the ash/gas, back into space.
- This cools the planet and lowers the average temperature.



HUMAN CAUSES OF CLIMATE CHANGE

THE GREENHOUSE EFFECT

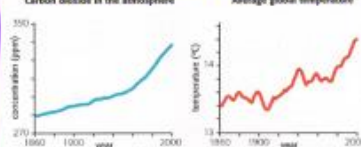
- A natural function of the Earth's atmosphere is to keep in some of the heat that is lost from the Earth.
- The atmosphere allows the heat from the Sun (short-wave radiation) to pass through to heat the Earth's surface.
- The Earth's surface then gives off heat (long-wave radiation).
- This heat is trapped by **greenhouse gases** (eg methane, carbon dioxide and nitrous oxide), which radiate the heat back towards Earth.
- This process heats up the Earth.



HUMAN FACTORS INCREASING WARMING

- Burning fossil fuels, eg coal, gas and oil - these release carbon dioxide into the atmosphere.
- Deforestation - trees absorb carbon dioxide during photosynthesis. If they are cut down, there will be higher amounts of carbon dioxide in the atmosphere.
- Dumping waste in landfill - when the waste decomposes it produces methane.
- Agriculture - agricultural practices lead to the release of nitrogen oxides into the atmosphere.

Carbon dioxide in the atmosphere Average global temperature



- Carbon dioxide (CO₂) is a greenhouse gas.
- As technology has developed and the population on earth has increased, the amount of CO₂ has increased since 1860.
- Data clearly shows that although temperatures have fluctuated since 1960, the general pattern is that global temperatures have increased as CO₂ levels rise.

IMPACTS OF CLIMATE CHANGE

UK

- Crops such as oranges, grapes and peaches can be grown in the UK
- Winter heating costs will be reduced as winters will be milder
- Accidents on the roads in winter will be less likely to occur
- Sea levels could rise, covering low lying areas, in particular east England
- Scottish ski resorts may have to close due to lack of snow
- Droughts and floods become more likely as extreme weather increases
- Increased demand for water in hotter summers puts pressure on water supplies

WORLDWIDE

- Energy consumption may decrease due to a warmer climate
- Longer growing season for agriculture
- Frozen regions such as Canada may be able to grow crops
- Sea level rise will affect 80 million people
- tropical storms will increase in magnitude (strength)
- Species in affected areas (eg Arctic) may become extinct
- Diseases such as malaria increase, an additional 280 million people may be affected

But the negative impacts of climate change will significantly outweigh the positives.

ADAPTING TO CLIMATE CHANGE

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



- **AGRICULTURE** - farmers will have to adapt as some crops may not be able to grow in a warmer climate. However, other crops (eg oranges and grapes) will be able to be planted.
- **WATER SUPPLY** - water transfer schemes could be used. This is where water is transferred from an area of water surplus to an area of water shortage.
- **REDUCING RISK FROM SEA LEVEL RISE** - areas at risk from sea level rise may use sea defences to protect the land from being eroded away.

CLIMATE CHANGE ACTIVISM

Climate change activism and protests have increased in recent years. Below are some examples of action that is being taken to combat climate change.



- **Raising awareness:** sharing learning about the human impact of climate change with others.
- **Campaigning:** asking decision makers to do what they can to reduce greenhouse gas emissions and support communities to adapt to climate change.
- **Going green:** individuals, schools and communities taking action to reduce their own emissions.
- **Fundraising:** raising money for charities working against climate change.

ADAPTATION VS MITIGATION

MITIGATION

This involves reducing greenhouse gas emissions and increasing the sinks for these gases. This can be done by setting targets to reduce emissions, switching to renewable energy sources and carbon capture and storage.

ADAPTATION

This involves changing lifestyles to cope with the consequences of climate change. This includes managed retreat from eroding coastlines, the development of drought-resistant crops and the extension of conservation zones to enable the migration of species.

MITIGATING TO CLIMATE CHANGE

Mitigation means to reduce or prevent the effects of something from happening.

Mitigation strategies include:



- **ALTERNATIVE ENERGY** - using alternative energy such as solar, wind or tidal can reduce the use of fossil fuels. This will reduce the amount of carbon dioxide released into the atmosphere.



- **CARBON CAPTURE** - this is the removal of carbon dioxide from waste gases from power stations and then storing it in old oil and gas fields or coal mines underground. This reduces the amount of emissions into the atmosphere.



- **PLANTING TREES** - encouraging **afforestation**, means that there will be more trees to absorb the carbon dioxide in the atmosphere during the process of photosynthesis.



- **INTERNATIONAL AGREEMENTS** - in 2005 the Kyoto Protocol became international law. The countries that signed up to the treaty pledged to reduce their carbon emissions by 5 per cent. However, this ran out in 2012 and its overall impact has been small. The US refused to join and major developing countries like China and India were not required to make any reductions.

AN INCONVENIENT TRUTH

An Inconvenient Truth is a 2006 American concert/documentary film directed by Davis Guggenheim about former United States Vice President Al Gore's campaign to educate people about global warming. The film features a slide show that, by Gore's own estimate, he has presented over a thousand times to audiences worldwide.



BEFORE THE FLOOD



Before The Flood is the product of an incredible three-year journey that took place with my co-creator and director Fisher Stevens. We went to every corner of the globe to document the devastating impacts of climate change and questioned humanity's ability to reverse what may be the most catastrophic problem mankind has ever faced.