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# Natural Environment: Renewable and Low Carbon Energy

## OUTLINE

- Why do we need alternative forms of energy?
- Renewable and non-renewable energy sources
- Conclusions

## WHY DO WE NEED ALTERNATIVE FORMS OF ENERGY?

- Since the industrial revolution, atmospheric CO<sub>2</sub> has increased by 38% (Met Office, 2014).
- This increase in CO<sub>2</sub> is understood to be the cause of climate change which has resulted in a number of environmental issues

## ACTIVITY 1

### IMPLICATIONS OF CLIMATE CHANGE

## ENVIRONMENTAL ISSUES

- Higher temperatures
  - The planet's average surface temperatures has risen by 0.89°C between 1901 and 2012
    - This rate of increase was not seen before the industrial revolution
- Changing rainfall
  - Data suggests changes in precipitation
    - In the UK, winter rainfall is increasing; summer rainfall is decreasing
    - North America – heavy rainfall events have become more intensive
- Changes in nature
  - Altered temperatures has led to changes in the seasons
    - Causes issues for wildlife
      - Spring starting earlier in the UK leads to butterflies appearing earlier and birds changing their migration patterns

## ENVIRONMENTAL ISSUES

- Sea Ice
  - Melting sea ice does not cause sea level rise as it is already on the sea
  - Does have effects on the climate
    - Sea ice helps to keep the polar regions cool and its bright surface reflects 80% of sunlight back into space
    - If this ice melts, the exposed ocean instead absorbs 90% of sunlight and can cause a further rise in sea temperatures (NSIDC, 2015)

## ENVIRONMENTAL ISSUES

If the world fails to act, temperatures could rise by over 4°C. A rise of 2°C would cause severe effects, a higher increase could be catastrophic (Wicks, 2008).

## NON-RENEWABLE ENERGY SOURCES

- Currently, the UK burns fossil fuels to meet its energy demands
  - Coal, petroleum and natural gas
  - Release pollutants and greenhouse gases when burnt and contribute to climate change
- Referred to as “non-renewable energy sources” as they will eventually run out



## ACTIVITY 2

**NUCLEAR POWER AND FRACKING:  
SOLUTIONS TO ENERGY DEFICIT OR DISASTERS  
WAITING TO HAPPEN?**

## NON-RENEWABLE ENERGY SOURCES

- Coal
  - Formed by fossilised plants
  - Mined from seams of coal found between rock layers in the earth
  - Burnt to provide heat or electricity
  - Expected to last 250 years
  - Generates pollutants and greenhouse gases (CO<sub>2</sub>)
- Oil
  - Carbon-based liquid formed from fossilised animals
  - Pumped out from reservoirs between seams of rock in the earth
  - Widely used in industry and transport
  - Expected to last 50 years
  - Generates pollutants and greenhouse gases (CO<sub>2</sub>)

## NON-RENEWABLE ENERGY SOURCES

- Natural Gas
  - A hydrocarbon gas primarily containing methane and other gases
  - Released through pipes sunk into the seams of rock where it is trapped
  - Often used for heating
  - Expected to last 70 years
  - Generates pollutants and greenhouse gases (CO<sub>2</sub>)
- Biomass (can be renewable **or** non-renewable)
  - Generated from decaying plant or animal waste
  - Chemicals can be used for fuel in diesel engines or organic material can be burned for heat and electricity
  - Can be renewable if crops are replanted, but if they are not replaced then biomass is a non-renewable energy source
  - Generates pollutants and greenhouse gases (CO<sub>2</sub>)

# Natural Environment: Renewable and Low Carbon Energy

## NON-RENEWABLE ENERGY SOURCES

- Wood (can be renewable **or** non-renewable)
  - Obtained from felling trees
  - Burnt to provide heat or light
  - Can be renewable if trees are replanted, but if they are not replaced then it is a non-renewable energy sources
  - Generates pollutants and greenhouse gases (CO<sub>2</sub>)
- Nuclear
  - Generated from mined radioactive minerals, such as uranium
  - Used to generate energy by splitting atoms in these minerals in nuclear reactors (nuclear fission)
  - A small amount of radioactive material can produce a lot of energy
  - Does not generate atmospheric pollutants or greenhouse gases
  - Nuclear waste is highly toxic and must be safely stored for hundreds or thousands of years
  - Leakages and accidents can be devastating to people and the environment (e.g. Chernobyl, 1986)

## RENEWABLE ENERGY SOURCES

- By 2020, the UK aims to provide 15% of all energy demand from renewable sources
- Renewable energy sources are naturally replenished and should not run out

## RENEWABLE ENERGY SOURCES

- Solar Energy
  - Photovoltaic/solar cells convert sunlight into electricity
  - Solar power plants capture heat from the sun to produce steam and power electric generators
  - No air or water pollution is produced from solar energy
  - Energy is “free”
  - Can cause damage to the ecosystem if not managed correctly
- Wind Power
  - Located in areas with strong and constant wind (offshore and at high altitude)
  - No air or water pollution is produced, but there may be some pollution produced during manufacturing processes
  - Energy is “free”
  - Large windfarms are needed to produce electricity on a large scale

## RENEWABLE ENERGY SOURCES

- Tidal Power
  - The movement of tides drives turbines to generate energy
  - Water is forced through gaps in a tidal barrage, build across an estuary
  - Barrages can help prevent flooding and double as bridges
  - Not all estuaries are suitable
  - Can have a negative impact on wildlife and may impede flow of sewage out to sea
- Wave power
  - Movement of seawater compresses trapped air in a cavity on the shore and drives a turbine to produce energy
  - Usually undertaken on a local scale

## RENEWABLE ENERGY SOURCES

- **Geothermal**
  - The natural head of the earth can be used to generate steam which can be used to power turbines and generate electricity
  - Only works in areas of volcanic activity
  - Dangerous elements found underground must be disposed of carefully
- **Hydroelectric power (HEP)**
  - The movement of water through rivers, lakes and dams is used to produce energy
  - Can cause flooding of the surrounding areas
  - Damns have major ecological impacts on local hydrology



## ACTIVITY 3

### A LOW CARBON FUTURE

## CONCLUSIONS

- Introduced renewable and non-renewable energy sources
- Assessed how these fit into the climate change debate
- Assessed the advantages and disadvantages of different sources
- Understood the implications of using sources that produce greenhouse gases