

Resources

An increasing global population needs more resources. At a basic level there we need uncontaminated food and water supplies, shelter, clothing and good health. Resources are also required to make all the things that we use in our daily lives.

The demand for resources



A shopper in Greenwich, London

When people use something, it becomes a resource.

People in **MEDCs** need lots of resources to sustain their high levels of consumption. Whereas, people in **LEDCs** sometimes have limited access to basic resources such as food and water. People in LEDCs also often have rich natural resources, such as large forests and deep deposits of valuable metals and minerals. To help them out of poverty, LEDCs can extract and sell resources to MEDCs.

This system creates a dependency that has serious implications for the environment. The more resources that MEDCs buy from LEDCs, the more money there is for LEDCs to improve living standards, but the greater the impact on the environment.



A water pump in Lulimba, DR Congo

There is an increasing demand for goods and services from a growing global population, especially those in MEDCs. The world's resources are being used up more quickly. The consumption of resources is spread unequally between MEDCs, who use more resources, and LEDCs, who use less.

Consequences of resource exploitation

Socio-economic consequences

- Higher energy prices as sources are depleted, eg increase in petrol prices and domestic fuel bills in the UK. This can have the result of leaving the elderly and those on low incomes in fuel poverty.
- The gap between rich and poor becomes more evident.
- Funding needed for research into alternative energy, and increased costs for exploration and extraction of existing energy sources.

Environmental consequences



Cooling towers in York

- ✓ Increased carbon emissions cause global warming with consequences including climate change and sea levels rising due to melting ice caps.
- ✓ Air pollution from factories as countries industrialise and exploit resources. The economic miracle in China is exploiting resources at a rapid rate and making Chinese cities, such as Beijing, some of the most polluted in the world.
- ✓ Ecosystems such as rainforests are under threat from exploitation as countries eg Brazil, exploit their resources for development.

Political consequences

- ✓ Global agreements such as the **Kyoto Protocol** to reduce carbon emissions, and a need for international cooperation.
- ✓ Loss of public support for governments from as domestic fuel bills and petrol prices rise. People are forced to change their lifestyle, which is unpopular.

Case study: consequences of resource exploitation

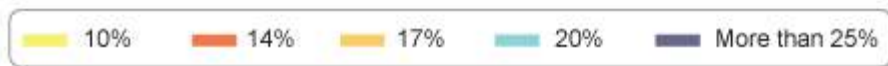
The inequality in the use of resources between MEDCs and LEDCs is shown by their carbon emissions. Countries that use a lot of **fossil fuels** to produce energy to power industry and electricity and heat for homes, also produce a lot of carbon gasses, as an unwanted by-product. Carbon dioxide (CO₂), in particular, is given off when fossil fuels, such as oil and coal, are burnt.

- ✓ Plants and trees need CO₂ and use it up. However, if there is too much CO₂ due to factories and power stations, combined with a reduction in the number of trees, through deforestation, CO₂ builds up in the atmosphere.
- ✓ This build up of CO₂ is believed to contribute to **global warming** through the **greenhouse effect**. This is why CO₂ is called a **greenhouse gas**.
- ✓ The biggest producers of CO₂ in the world are the United States, China, Russia, Japan, India, Germany, United Kingdom, Canada, Italy and Mexico.
- ✓ The largest producers by far are the USA and China.

The diagram below the countries that contribute the biggest percentage of the world's carbon emissions.



Percentage contribution to global carbon emissions



Countries contributing to carbon emissions

Sustainable use of resources



A recycling point in Eastbourne, Sussex

The world's natural resources have conflicting demands upon them and can be difficult to manage:

- ✓ The environment should be preserved.
- ✓ Resources need to be retained for future generations to enjoy.
- ✓ Humans need to continue to make and do the things that allow them to live comfortably.
- ✓ LEDCs need to develop, through exploiting their resources.
- ✓ There should be a better balance between the consumption of those resources between LEDCs and MEDCs.



Wind Turbines on Ovenden Moor, West Yorkshire

To conserve natural resources for future generations, **sustainable** management of the natural environment is necessary. Alternative resources might be developed in order to ease the strain on **finite resources**. However, alternative resources can be expensive and take time to develop. Existing resources could be used more efficiently, to prevent finite resources being used up so quickly.

Ways to limit the damage caused by humans to the environment include:



Tents at a music festival in Gloucestershire

- ✓ **Sustainable** resource management can help ensure that the use of resources does not cause an imbalance in the environment. Increasingly, sustainable practices are being encouraged to preserve animal and plant life for the benefit of future generations. An example of sustainable development is eco-tourism. Tourists are able to enjoy areas of natural beauty without requiring over-development that might harm the environment.
- ✓ **Recycling** resources reduces waste. Used cans, bottles, paper and cardboard can be recycled and reduces the need to use extra resources.
- ✓ Limiting carbon emissions generated from industrial and domestic use of fuels can assist in reducing pollution levels and limit environmental problems such as **global warming** and **acid rain**. Some governments, including the UK, signed the **Kyoto Protocol** to say they will try to reduce carbon emissions.
- ✓ Resource **substitution** is another sustainable way in which resources can be managed. **Renewable** resources can be used instead of finite resources. Electric power can be produced with a renewable energy resource such as tidal, wind or solar power instead of **fossil fuels**.

All life on earth is sustained by energy from the sun. Plants and animals can store energy and some of this energy remains with them when they die. It is the remains of these ancient animals and plants that make up fossil fuels.

Energy sources

Fossil fuels are **non-renewable** energy sources and will one day run-out. Burning fossil fuels generates greenhouse gases and relying on them for energy generation is **unsustainable**. Hence the need to find more **renewable, sustainable** ways of generating energy. **Renewable** or infinite

energy resources are sources of power that quickly replenish themselves and can be used again and again.

Some resources can be thought of as both renewable and non-renewable.

- ✓ **Wood** can be used for fuel and is renewable if trees are replanted.
- ✓ **Biomass**, which is material from living things, can be renewable if plants are replanted.
- ✓ Over the last 200 years an ever-increasing proportion of our energy has come from non-renewable sources such as oil and coal.

Non-renewable energy resources

Type of fuel	Where it is from	Advantages	Disadvantages
Coal (fossil fuel)	<p>Formed from fossilised plants and consisting of carbon with various organic and some inorganic compounds.</p> <p>Mined from seams of coal, found sandwiched between layers of rock in the earth.</p> <p>Burnt to provide heat or electricity.</p>	<p>Ready-made fuel.</p> <p>It is relatively cheap to mine and to convert into energy.</p> <p>Coal supplies will last longer than oil or gas.</p>	<p>When burnt coal gives off atmospheric pollutants, including greenhouse gases.</p>
Oil (fossil fuel)	<p>A carbon-based liquid formed from fossilised animals.</p> <p>Lakes of oil are sandwiched between seams of rock in the earth.</p> <p>Pipes are sunk down to the reservoirs to pump the oil out.</p> <p>Widely used in industry and transport.</p>	<p>Oil is a ready-made fuel.</p> <p>Relatively cheap to extract and to convert into energy.</p>	<p>When burnt, it gives off atmospheric pollutants, including greenhouse gases.</p> <p>Only a limited supply.</p>
Natural gas (fossil fuel)	<p>Methane and some other gases trapped between seams of rock under the earth's surface.</p> <p>Pipes are sunk into the ground to release the gas.</p> <p>Often used in houses for heating and cooking.</p>	<p>Gas is a ready-made fuel.</p> <p>It is a relatively cheap form of energy.</p> <p>It's a slightly cleaner fuel than coal and oil.</p>	<p>When burnt, it gives off atmospheric pollutants, including greenhouse gases.</p> <p>Only limited supply of gas.</p>
Nuclear	<p>Radioactive minerals such as uranium are mined.</p> <p>Electricity is generated from the energy that is released when the atoms of these minerals are split (fission) or joined</p>	<p>A small amount of radioactive material produces a lot of energy.</p> <p>Raw materials are</p>	<p>Nuclear reactors are expensive to run.</p> <p>Nuclear waste is highly toxic, and needs to be safely stored for hundreds or thousands of years (storage is extremely expensive).</p>

Type of fuel	Where it is from	Advantages	Disadvantages
	together (fusion) in nuclear reactors.	relatively cheap and can last quite a long time. It doesn't give off atmospheric pollutants.	Leakage of nuclear materials can have a devastating impact on people and the environment. The worst nuclear reactor accident was at Chernobyl , Ukraine in 1986.
Biomass	Biomass energy is generated from decaying plant or animal waste. It can also be an organic material which is burnt to provide energy, eg heat, or electricity. An example of biomass energy is oilseed rape (yellow flowers you see in the UK in summer), which produces oil. After treatment with chemicals it can be used as a fuel in diesel engines.	It is a cheap and readily available source of energy. If the crops are replaced, biomass can be a long-term, sustainable energy source.	When burnt, it gives off atmospheric pollutants, including greenhouse gases. If crops are not replanted , biomass is a non-renewable resource.
Wood	Obtained from felling trees, burnt to generate heat and light.	A cheap and readily available source of energy. If the trees are replaced, wood burning can be a long-term, sustainable energy source.	When burnt it gives off atmospheric pollutants, including greenhouse gases. If trees are not replanted wood is a non-renewable resource.

How long will fossil fuels last?

Estimates from international organisations suggest that if the world's demand for energy from fossil fuels continues at the present rate that oil and gas reserves may run out within some of our lifetimes. Coal is expected to last longer.

Estimated length of time left for fossil fuels

Fossil fuel	Time left
Oil	50 years
Natural gas	70 years
Coal	250 years

Renewable energy sources

Renewable energy sources quickly replenish themselves and can be used again and again. For this reason they are sometimes called **infinite energy resources**.

The advantages and disadvantages of renewable energy sources.

Type of energy	Where it is from	Advantages	Disadvantages
Solar	Energy from sunlight is captured in solar panels and converted into electricity.	Potentially infinite energy supply. Single dwellings can have own electricity supply.	Manufacture and implementation of solar panels can be costly.
Wind	Wind turbines (modern windmills) turn wind energy into electricity.	Can be found singularly, but usually many together in wind farms. Potentially infinite energy supply.	Manufacture and implementation of wind farms can be costly. Some local people object to on-shore wind farms, arguing that it spoils the countryside.
Tidal	The movement of tides drives turbines. A tidal barrage (a kind of dam) is built across estuaries, forcing water through gaps. In future underwater turbines may be possible out at sea and without dams.	Ideal for an island such as the UK. Potential to generate a lot of energy. Tidal barrage can double as a bridge, and help prevent flooding.	Construction of barrage is very costly. Only a few estuaries are suitable. Opposed by some environmental groups as having a negative impact on wildlife. May reduce tidal flow and impede flow of sewage out to sea.
Wave	The movement of seawater in and out of a cavity on the shore compresses trapped air, driving a turbine.	Ideal for an island country. More likely to be small local operations, rather than done on a national scale.	Construction can be costly. May be opposed by local or environmental groups.
Geothermal	In volcanic regions it is possible to use the natural heat of the earth. Cold water is pumped under ground and comes out as steam. Steam can be used for heating or to power turbines creating electricity.	Potentially infinite energy supply. Used successfully in some countries, such as New Zealand and Iceland.	Can be expensive to set up and only works in areas of volcanic activity. Geothermal and volcanic activity might calm down, leaving power stations redundant. Dangerous elements found underground must be disposed of carefully.
Hydrological or Hydroelectric Power (HEP)	Energy harnessed from the movement of water through rivers, lakes and dams.	Creates water reserves as well as energy supplies.	Costly to build. Can cause the flooding of surrounding communities and landscapes.

Type of energy	Where it is from	Advantages	Disadvantages
			Dams have major ecological impacts on local hydrology.
Biomass	<p>Decaying plant or animal waste.</p> <p>An organic material, which can be burnt to provide energy, eg heat, or electricity.</p> <p>An example of biomass energy is oilseed rape (the fields of yellow flowers you see in the UK in summer), which produces oil.</p> <p>After treatment with chemicals it can be used as a fuel in diesel engines.</p>	<p>It is a cheap and readily available source of energy.</p> <p>If replaced, biomass can be a long-term, sustainable energy source.</p>	<p>When burnt, it gives off atmospheric pollutants, including greenhouse gases.</p> <p>Biomass is only a renewable resource if crops are replanted.</p>
Wood	<p>Obtained from felling trees, burnt to generate heat and light.</p>	<p>A cheap and readily available source of energy.</p> <p>If the trees are replaced, wood burning can be a long-term, sustainable energy source</p>	<p>When burnt it gives off atmospheric pollutants, including greenhouse gases.</p> <p>If trees are not replanted then wood is a non-renewable resource.</p>

Exam tip

Make sure you know what types of energy are **renewable** and **non-renewable**. It is important to remember that biomass and wood are only renewable if the trees and crops are replanted. Many people fall into the trap of thinking that bio means renewable - it doesn't!

Case study: wind power

Wind power is a controversial commodity. Although it is renewable, and goes some way towards solving the problem of scarce fossil fuels for energy, not everyone is in favour of windfarms. Those who live close to wind farms claim that they are unsightly and noisy.

Burbo Bank Wind Farm – Liverpool Bay



A wind farm off Crosby beach

The wind farm has been fully operational by summer 2007, and consists of 25 turbines, which will produce enough energy to supply 80000 homes. The wind conditions in this part of the Mersey estuary are perfect for harnessing wind energy.

During the installation noise could be heard from nearby residents as the turbines were fixed into the seabed.

Some people living along the Sefton Coast have since had their view of Snowdonia blighted by the windmills.

Case study: changing energy use in UK

The UK government wants to reduce its carbon dioxide emissions, get more of its energy from renewable sources. It has committed itself to a number of targets:

UK energy targets

- ✓ The UK has set itself a goal of deriving 10% of UK electricity from renewable sources by 2010.
- ✓ The UK government has committed itself to reducing **greenhouse gases** by 12.5% relative to 1990 levels by 2012. This promise was made when Britain signed the **Kyoto Protocol** in 1997.
- ✓ The UK government has also set a target of reducing carbon dioxide emissions by 20% of 1990 levels by 2010. CO₂ accounts for the greatest proportion of greenhouse gas emissions in the UK.

Rising energy demand

Rising energy demand and changes in energy generation are making it very hard to meet these targets. For example:

- ✓ Switching power generation from coal to gas and nuclear, has helped reduce CO₂ emissions. However Britain is using more and more electricity, and is reducing the number of nuclear power plants it builds. So unless we use alternative sources for making electricity, such as wind power, CO₂ emissions will start to rise again.
- ✓ Regulations have forced vehicles to become more energy-efficient and give off less atmospheric pollution. The government has also continued to increase fuel and road taxes. Even so, the use of transport is rising so fast that the amount of CO₂ given off by transport vehicles continues to rise.

Meeting the targets



Wind turbines in Thurstone, Yorkshire

There are some hopeful signs. UK power companies are now investing £100s of millions in renewable power:

- ✓ Many **wind farms** have been set up, particularly in Scotland and Wales. Some plans for large wind farms have been blocked by planners.
- ✓ **Wave power** provides electricity to about 400 houses on the Island of Islay in Scotland, and could be used much more widely.

- ✓ Proposals are being considered to put a huge **tidal barrage** across the Severn Estuary.
- ✓ UK energy companies are making a very small amount of electricity from **biomass**. This could be expanded.

Energy generation from fossil fuels produces a build-up of gases - principally carbon dioxide and methane - which is thought to be a major cause of global warming.

Impacts of energy demand: global warming

The greenhouse effect

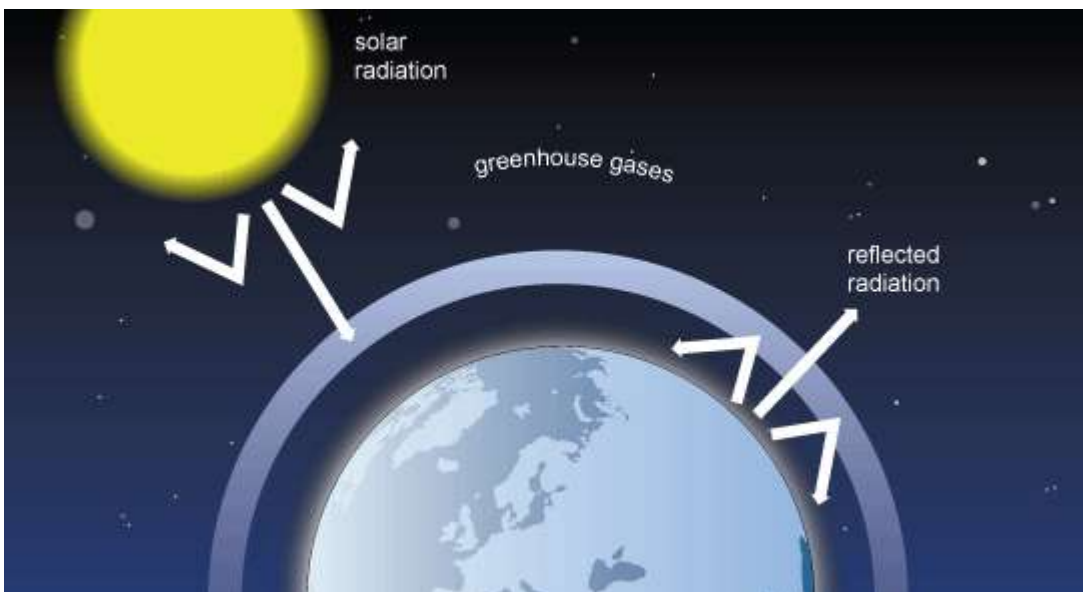
When fossil fuels are burnt - by industry, in power stations and in vehicles and planes - the gases enter the **atmosphere**. Although these gases have always been present in the world's atmosphere, their concentration is gradually increasing as more and more fossil fuels are burnt.

Scientists believe that the build-up of these so-called **greenhouse gases** in the atmosphere acts like a blanket or greenhouse around the planet; heat is trapped inside the Earth's atmosphere. This is the **greenhouse effect**, and the resulting increase in global temperatures is called **global warming**.

How the greenhouse effect works

It's thought that the build-up of greenhouse gases impacts on global temperature in two ways:

1. The gases allow more of the sun's rays to enter the atmosphere. Some **solar radiation** is still reflected back into space by the outer parts of the atmosphere, but it's believed the amount reflected back is gradually reducing.
2. At the same time, the greenhouse gases absorb more of the solar radiation that is reflected back from the Earth's surface - trapping heat and keeping it in the atmosphere. The ability of the atmosphere to capture the sun's warmth is essential for life on earth. But if significantly MORE warmth is being captured, this is bad news for the planet.



The greenhouse effect

Another group of greenhouse gases includes the **chlorofluorocarbons (CFCs for short)**. CFCs have been responsible for depleting the **ozone layer as they attack and destroy ozone molecules**.

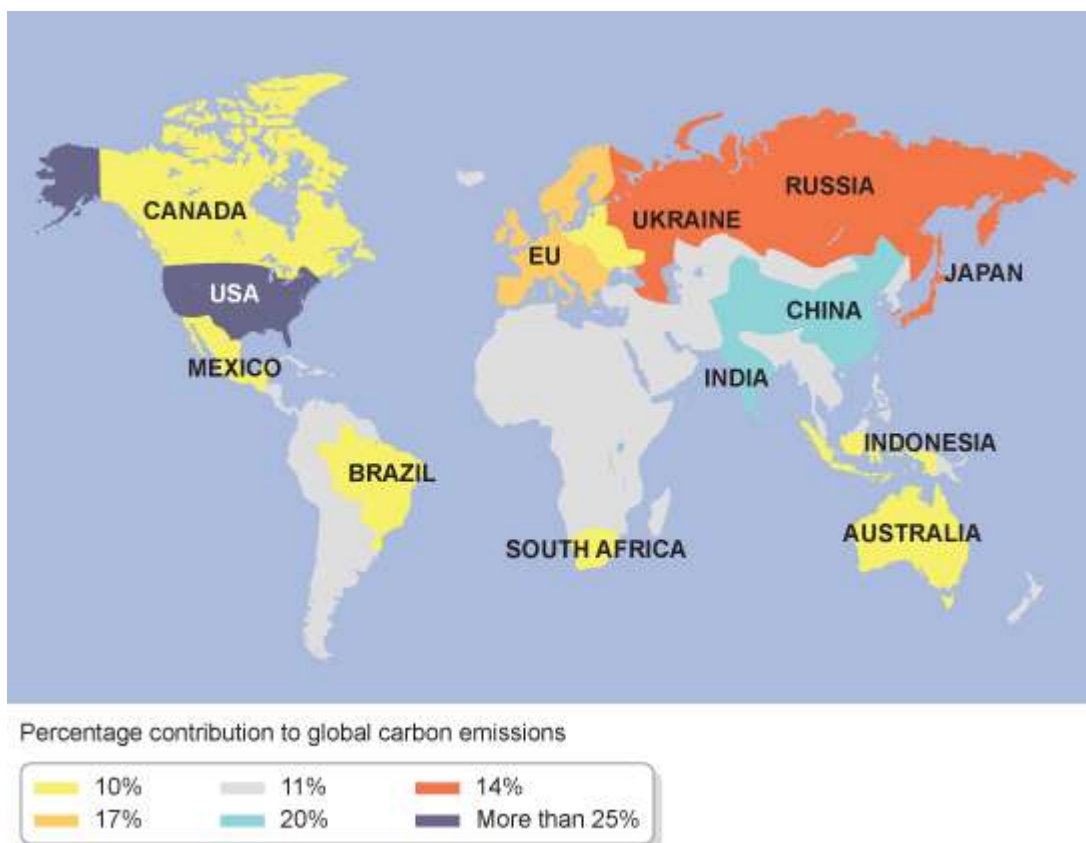
- ✓ The ozone layer is a high level layer of gas in the stratosphere. The ozone helps to keep out harmful ultra-violet rays, which cause sunburn on human skin and damage plants.
- ✓ The resulting ozone holes let harmful ultra-violet radiation in and add to the greenhouse effect.

- ✓ CFCs can be used in aerosols, such as hairspray cans, fridges and in making foam plastics.
- ✓ CFCs were banned in many countries in the mid-1990s after it was found that they were breaking up the Earth's ozone.
- ✓ Scientists say the hole in the ozone layer over Antarctica could disappear within 50 years

Implications of global warming

Scientists, politicians and industrialists continue to debate the causes of global warming, with some arguing that it is a natural process that's been going on for centuries. However, the **Intergovernmental Panel on Climate Change (IPCC)** - established by the United Nations in 1988 - has stated the evidence suggests that human activity **does** affect global warming, in particular through the release of greenhouse gases and the use of **aerosols**.

There is also debate over how quickly the earth is warming up. Some scientists estimate that atmospheric temperatures could rise by 1.4° - 5.8°C in the next 100 years. Others believe that they will rise more slowly.



Global carbon emissions

Whatever the causes and timescale, the **implications** of global warming are very serious.

- ✓ The map above shows which countries are responsible for the most emissions. LEDCs want to develop and to catch up with MEDCs and this normally means using more energy and burning more fuel. So global warming could threaten development.
- ✓ Global warming could melt the world's ice caps and glaciers, leading to an increase in sea levels. Some scientists estimate that over the next hundred years sea levels could rise by between 10cm and 90cm - making many coastal areas around the world uninhabitable.
- ✓ Global warming could also affect the weather patterns, leading to more droughts, flooding and extreme weather, such as **hurricanes**.

- ✓ In Britain we are largely unaffected by the dangerous weather of the **tropics**, such as hurricanes or severe droughts. But some climatologists argue that the UK climate is changing as a result of global warming - with the possibility of more frequent floods, water shortages, and extreme weather conditions

Carbon credits

The carbon credits scheme is aimed at reducing greenhouse gas emissions. It is based on the “polluter pays principle” according to how much pollution they generate. The idea is that people are encouraged to pollute less, as it will cost them less in carbon taxes.

Case study: London Congestion Charge

Drivers are charged for driving in the congestion charge zone in central London. The aim is to discourage drivers from using the zone during peak hours and use public transport instead, thereby reducing congestion, the time spent in queues, the pollution generated and the cost to the economy. The money generated is used to improve public transport, eg older London buses which generate more pollution have been removed from service.

The results

- ✓ Traffic congestion, accidents, and pollution levels have all been reduced.
- ✓ There has been increased investment in public transport.
- ✓ Bus services are more reliable.
- ✓ Retail sales inside the congestion charging zone have increased.

Sustainable energy resources

To meet the increasing global demand for energy, while reducing the risk of damage to the environment or contributing to **global warming**, it is important that:



Traffic jam on the A2 in London

- ✓ Countries find new types of energy, whilst developing and expanding existing sources that are more **sustainable** than **fossil fuels**.
- ✓ Industry and domestic users of energy use it more efficiently (ie stop wasting it).
- ✓ **MEDCs** start to switch from fossil fuels to alternative sources.
- ✓ As **LEDCs** start to use more energy they are encouraged to develop more sustainable sources of energy.

The purpose of **sustainability** is to manage resources or run projects or industries, so future generations can use the resources too.

International concern has led many countries to try to reduce their use and consumption of carbon-based fossil fuels. Many governments signed the **Kyoto Protocol**, committing them to reducing **greenhouse gas** emissions.

Energy efficiency



Energy efficient bus

With energy consumption rising, it is important that industry, transportation and consumers in their homes use energy more efficiently, so that less is wasted. This will also save money on fuel bills. We can all help by making changes to our lifestyles and our houses - for example by:

- ✓ Walking, cycling, or using public transport rather than fossil-fuel powered cars.
- ✓ Using smaller more energy-efficient cars.
- ✓ Reducing the number of aircraft journeys taken (especially short-haul flights).
- ✓ Switching off lights, power sockets, phone chargers and TVs when not in use.

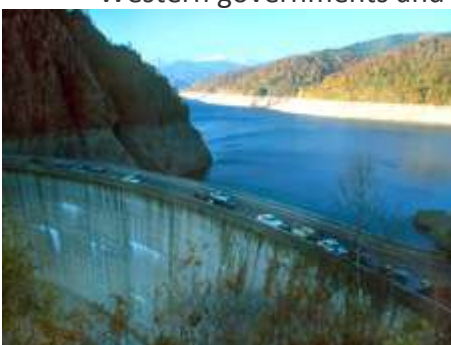
- ✓ Using energy-efficient light-bulbs and rechargeable batteries.
- ✓ Recycling and reusing plastics and oil-based products.
- ✓ Insulating house roofs, blocking drafts, using double-glazing and more efficient heating systems.
- ✓ Considering introducing solar panels, or switching to an electricity supplier that supplies **green electricity**.

The energy debate

The energy question affects us all deeply, but there is no 'right' view on it. You need to consider the different solutions proposed, and ask yourself what is at stake for the different interest groups (for example consumers, politicians, **LEDCs** and **MEDCs**).

Here are some of the arguments:

- ✓ Many scientists, governments and international bodies (but not all) accept the greenhouse effect and global warming theories. Some argue that the greenhouse effect, and the extent to which greenhouse gases contribute to it, have both been exaggerated. Some argue that the predicted rises in atmospheric temperatures and sea levels are overestimated.
- ✓ Environmental campaigners argue that oil companies have contributed to environmental problems. Some activists even claim that wars in the Middle East were influenced by Western governments and oil companies' plans to get access to oil reserves.



Vidraru Dam, Vidra, Romania

On the other hand, many representatives of oil companies and industries that use a lot of energy argue that environmentalists have exaggerated the extent to which fossil fuels pollute the atmosphere, and the impact this will have on the environment.

- ✓ Most governments have promised to reduce greenhouse gasses by signing up to the **Kyoto Protocol**. But the United States - the world's biggest greenhouse gas emitter - refuses to ratify the treaty.
- ✓ Some groups - environmentalists included - campaign against certain types of alternative energy generation. For example, dams built to produce hydroelectric power flood large areas - impacting on local people, wildlife, vegetation and hydrology. Tidal barrages could alter the look, behaviour and ecology of estuaries, such as the Severn, and might cause pollution problems. Some people oppose wind farms on the grounds that they are ugly and noisy and a hazard to wild birds.

Exam tips

1. Make sure you know about the renewable energy sources and what people can do in order to become more energy-efficient.
2. Be aware that different interest groups see the advantages and disadvantages of energy types very differently. If you are asked to weigh up the advantages and disadvantages of different energy sources, make sure you explore everyone's point of view.

3. Make sure you know what the term **sustainable** means - it comes up a lot in the exam. Think about examples of sustainability in the context of energy production, economic activity, and development.