Resource Management

read

Global inequalities in the supply and consumption of resources

quiz

Overview

- The consumption of resources across the world varies significantly.
- High-income countries (HICs) typically consume more than low-income countries (LICs).
- There are enough resources on the planet but the challenge is they are unevenly distributed. As a LIC develops its demand for resources also grows.
- This growth in demand in LICs, along with population growth, can lead to a shortage of resources in some countries.

Food Inequalities

- In many regions of Europe, Asia, and both North and South America, favourable climate, fertile soil, and advanced technology contribute to a surplus of food production, allowing the majority of the population to fulfil their daily dietary needs.
- On the other hand, in Africa, the harsh physical environment, coupled with low technology and political turmoil, result in a less dependable food production system. This leads to widespread undernourishment, as many individuals do not have access to sufficient food, and undernutrition, meaning a lack of a balanced diet and essential nutrients.

Water

- The unequal distribution of freshwater around the world is largely due to varying climates. Areas such as Africa and some parts of the Middle East are particularly susceptible to water scarcity and droughts, leading to a disproportionate amount of time and effort spent on collecting water.
- This can have a substantial impact on both economic growth and overall social well-being.

Energy

- The distribution of energy resources, particularly fossil fuel reserves, is highly unequal.
- The presence of coal in Europe played a major role in supporting early economic growth and enhancing social well-being.
- While renewable energy sources such as wind, solar, and water are more evenly distributed in theory, the high cost of development has made it difficult for many low-income nations to take advantage of these resources.

Summary

- The global trade of food, water, and energy helps to balance supply and demand.
- However, this mainly involves HICs that are able to afford imports.
- In contrast, many LICs particularly those in Africa, have not seen significant benefits from the redistribution of resources.

UK Resources

The UK is privileged to possess a resource surplus, which has been a major contributor to its early and sustained economic development and relatively high standard of living for its citizens.

Changing Energy Demand in the UK

read

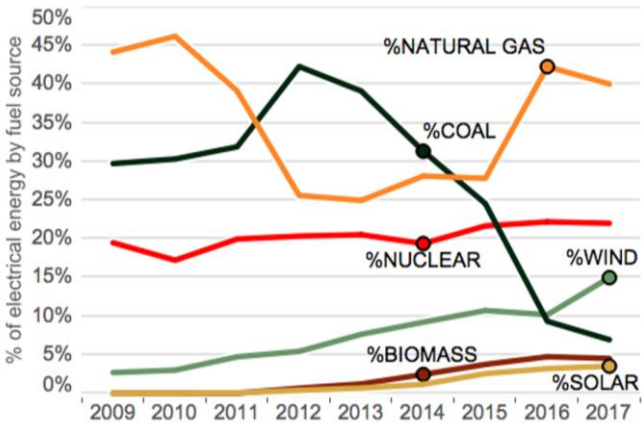
quiz

Energy: The UK possesses substantial reserves of fossil fuels (previously coal and now oil and gas), operates several nuclear power plants (utilising imported uranium), and holds potential for various forms of renewable energy including wind, solar, and hydroelectric power.

Changing Energy Demand

The UK consumes less energy than it did in 1970, despite the population being 9.1 million higher. 12 per cent less energy is used by the average household. Heavy industry uses 60 per cent less energy due to its decline. Demand for energy by transport has increased.

UK's Energy Mix



Key facts:

- 2015 – majority of UK's energy mix = fossil fuels
- Overtime a decline in fossil fuels and growth in alternative energy supplies.
- Nuclear power provides just over one-fifth of the UK's energy mix
- Renewables provide just over 20% of the UK's energy mix
- In 2011 coal use increased as older power stations worked to capacity as they were soon to be closed due to EU regulations on emissions
- Oil and gas reserves have declined.
- Renewable energies such as wind are growing in significance, but are still only a small percentage of energy produced
- Renewables are encouraged so the government can meet targets on reducing emissions

Energy Exploitation Issues

Fossil fuels

- Unsustainable, they will eventually become too expensive or run out.
- Costs increase to deal with the effects of climate change and adaption to it.
- CO_2 is released which contributes to acid rain and climate change.
- Fracking for shale gas can cause earthquakes and groundwater pollution.

Nuclear

- Nuclear plants are expensive to build and decommission.
- Transporting and storing nuclear waste is expensive.
- Waste is radioactive for 100 years+ and has to be stored safely to avoid contamination.
- Nuclear accidents have long-term impacts on people and wildlife.

Renewable energy resources

- High set-up costs. Costs increase in remote areas.
- Biomass can reduce land available for food production increasing food prices.
- Low profitability is a concern.
- Biomass reduces biodiversity as only one crop is grown e.g. sugar cane.
- HEP schemes flood land upstream, changing the landscape and wildlife.
- Wind turbines can affect bird migration.

Changing Water Demand in the UK

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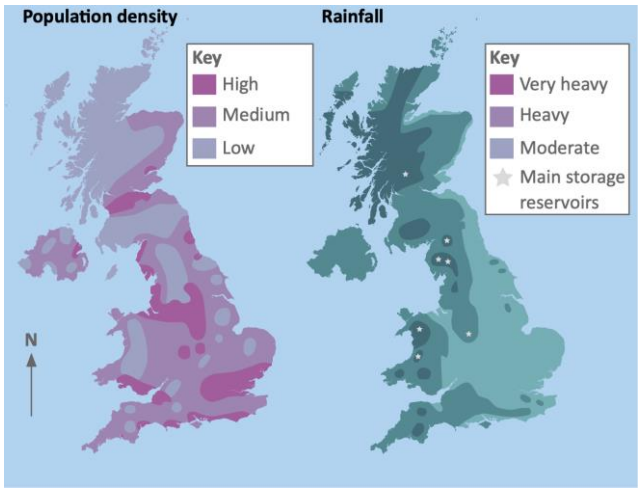
Water: Although there is an imbalance of supply and demand within the UK (with a surplus in the north and west and a deficit in the south and east), water availability is rarely a concern.

Changing Water Demand

Average household water use in the UK has increased by 75% since 1985. The average person uses 150 litres each day, compared with 47 litres in Africa. The growing demand is due to the increase in:

population | wealth | baths/showers | industry | leisure e.g. golf courses

Water Deficit and Surplus



The UK receives enough rainfall to meet its demand for water. However, rainfall is uneven. Annual rainfall is highest in the west, whereas the east of the UK has a lower than average rainfall. 1/3 of the UK's population lives in the southeast, the driest part of the UK. Therefore, the west has a water surplus, whereas the east has a deficit, leading to water stress.

Need for Water Transfer

The UK has considered a national water transfer scheme to match supply and demand. However, due to the expense, community displacement and CO2 emissions it has not been put in place. Small scale water transfer occurs between Kielder reservoir, pumping water into the North Tyne River.

UK Water Quality

The Environment Agency manages water quality in the UK. Despite improvements since the Industrial Revolution only 27 per cent of water is classified as good.

Causes of Water Pollution

- Agricultural chemicals e.g. fertiliser
- Warm water from industrial cooling
- Oil from ships and boats
- Untreated waste from industry
- Sewage release

Effects of Water Pollution

- Aquatic life killed by pesticides
- Fertilisers cause algae growth, leading to eutrophication (insufficient oxygen in river)
- Wildlife poisoned by toxic waste
- Microbacteria from sewerage spreads disease affecting humans and wildlife

Managing Water Quality

- Strict legislation limits
- Waste water treatment plants remove solids, bacteria, algae and chemicals
- Pollution traps such as reed beds filter pollutants
- Sewers and water mains reduces overflow of current sewers, spills and accidents

Changing Food Demand in the UK

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Food: The UK enjoys a temperate climate, with ample rainfall and moderate temperatures. Thanks to fertile soil, mild topography, and advanced technologies, the UK is one of the most efficient food producers in the world.

Changing demand for food

The population of the UK is growing, which increases demand for food.
Forty-five per cent of the UK's food was imported in 2019.
Additionally, there is a growing demand for:

- exotic, high value food from abroad
- out of season food being available all year
- more organic alternatives

Increase in Imported Food

Despite the increasing food miles, it can be cheaper to import food from low income countries to the UK.

- A growing proportion of imported food consists of high-value products. Even if the food is produced cheaply in LICs, transport, storage and refrigeration costs can result in high prices.
- ✘ LICs benefit from jobs created in agriculture, packing and transport raising tax revenues that can be invested in services to benefit the population.
- ✓ However, less land is available for locals to grow their own food, there is greater pressure on water supplies and farmers are exposed to chemicals such as pesticides.

Carbon Footprint

In the UK, food travels over 30 billion kilometres annually.
Food contributes 17 per cent of the UK's carbon emissions (11 per cent is due to the transport of imported food).
Some UK grown produce have a higher carbon footprint compared to if it had been imported e.g. tomatoes grown in heated greenhouses.

- **To combat food miles and carbon emissions people could source more local food or try to buy seasonal food.**

Growth of agribusiness.

- Agribusiness is a growing trend in food production in the UK, where food is farmed on a large scale.
- Treating a farm like an industrial business increases food production and profits.
- But by removing hedgerows, combing small farms and increasing mechanism and chemical use there are negative impacts on local economies and the environment.
- **Economic negatives:** Employment declines and small scale farmers can't compete
- **Environmental negatives**: loss of biodiversity and habitats for wildlife and increase in water pollution from fertilisers.

Increase in organic produce

- Organic produce is grown without the use of artificial chemicals such as pesticides, herbicides and fertilisers.
- Demand for organic produce has increased since the 1990s.
- Organic produce is more expensive because yields tend to be lower and labour costs are higher.
- However it is less damaging to the environment and often supports small scale, local farmers.

Seasonal Food

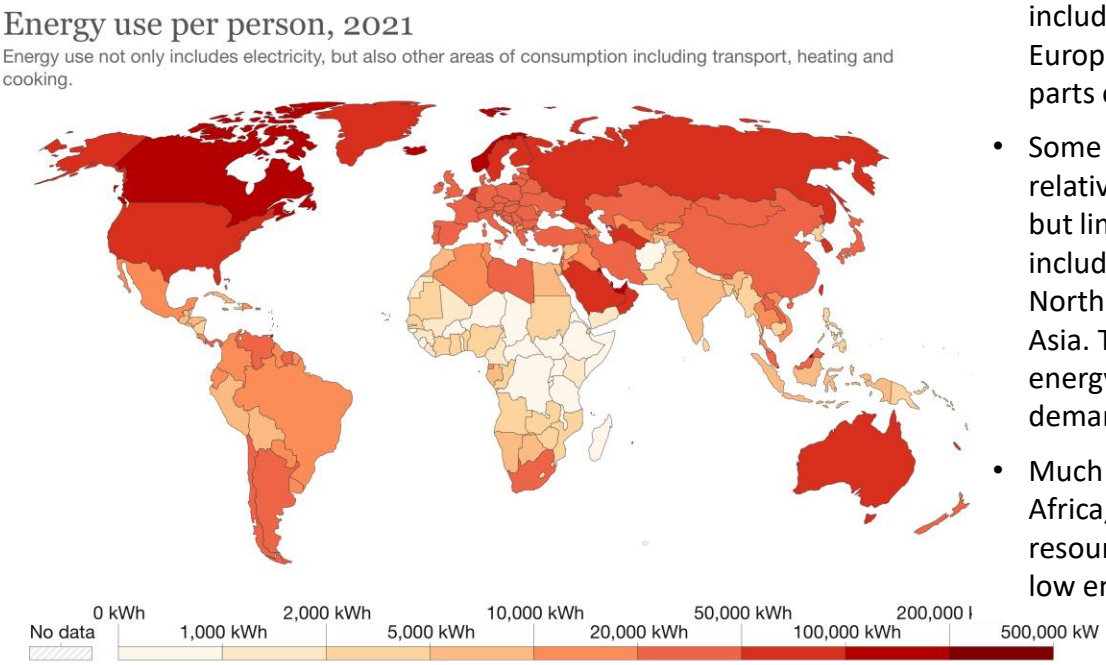
- One way to reduce food miles is to eat seasonal food.
- This means to eat food that grows naturally in the UK during each season. For example to only eat strawberries in summer.

Local Sourcing

Local sourcing reduces carbon emissions by importing only foods that cannot be grown in the UK, eating seasonal UK produce, purchasing food from farmers' markets and consuming home-grown food.
This helps to support local farmers and businesses too.

Energy in Depth

Pattern of global energy use



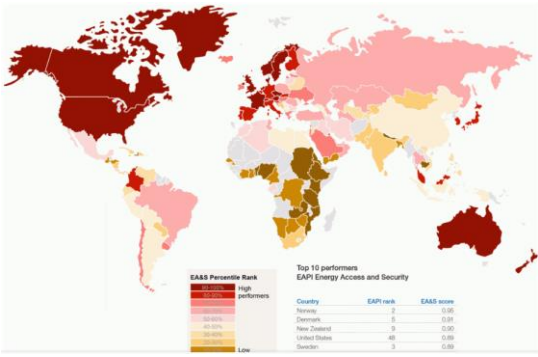
- Countries rich with energy resources also have high energy consumption, including North America, Europe, Australasia and parts of the Middle East.
- Some regions have a relatively high energy use, but limited energy resources including South America, North Africa and parts of Asia. These countries rely on energy imports to meet demand.
- Much of central and eastern Africa, where energy resources are scarce, has low energy consumption

Why is energy use increasing?

Economic development	• As a country becomes more developed, there is a higher demand for food, leading to more intensive farming techniques. This requires additional energy to power machinery, provide lighting and heating, process and transport food. • Rapid industrialisation means more manufacturing which requires large amounts of energy. • More wealth means more demand for consumer goods which need energy to manufacture and when they are used.
Population growth	• Since 1950 the world's population has increased, leading to the growth in demand for energy. • The majority of this growth has been in LICs/NEEs, where there are already energy deficits. • Energy provision will be a significant challenge for Africa in the future as there is rapid population growth and an energy deficit
Technology	• Developments in technology have led to an increase in consumer demand for electrical devices that are energy-intensive to produce. • This has been reduced slightly with advances in energy efficient technology however.

Energy security?

The map below shows energy security – dark red is energy secure and yellowy/green is an energy deficit.



- Energy security is largely determined by energy supply and demand.
- Despite having a high reliance on imports North America and Europe are largely energy secure.
- However, large areas of central and southern Africa, Asia and South America experience energy insecurity.

Factors affecting energy availability

Physical factors	• Geology affects the availability of fossil fuels such as oil, natural gas and coal. The formation of fossil fuels are found in sedimentary rocks. • Climate and relief can also affect the extraction of fossil fuels. Mountainous areas and regions with extreme climates present challenges for the extraction of fossil fuels and their transportation. EG Alaska and Siberia. • Large reserves of fossil fuels are found beneath deep oceans and seas. This presents significant challenges in extracting fossil fuels. • Physical factors can present opportunities for renewable energy. For example, upland regions are ideally suited for the construction of dams and reservoirs for HEP; areas with reliable sunshine can be used to generate solar energy; coastal of windy locations can be used to create electricity using turbines.
Coast of exploitation and production	• As non-renewable energy resources become depleted, they become increasingly expensive to extract. The cost of exploitation often demands on supply and demand. As demand increases, prices rise, and extraction becomes more viable. • Where the costs of energy production are low, energy is cheap, and demand can grow.
Technology	• Developments in technology have enabled new energy resources to be exploited, for example, fracking for shale gas. • There has also been a considerable growth in renewable energy as technology has made it more economically viable and productive
Political factors	• Conflicts have occurred as the result of energy insecurity, EG the Middle East. • Flows of energy can be interrupted as the result of disputes. An example of this is Libya where oil exports reduced due to conflict.

Impacts of energy insecurity

More sensitive environments are damaged.
•Drilling for oil in Alaska threatens polar & tundra ecosystems.
• TRF cleared to make way for biofuels/HEP.
•HEP floods valleys, displacing people, farmland & ecosystems.
• Renewable energy such as wind and solar farms in popular upland areas such as the Scottish Highlands and the Lake District creates visual pollution & disrupts bird migration routes

In countries where there is energy insecurity, there are conflicts between different sectors including industry, domestic users and agriculture. Energy insecurity can lead to international political conflicts, such as the disputes along the gas pipeline from Russia to the West.

It is expensive to extract energy resources from remote and environmentally sensitive locations, leading to an increase in the price of energy, which will be met by consumers.

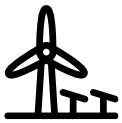
Increased energy demands to improve agricultural output will continue to grow. In areas of energy insecurity this will lead to an increase in the food prices.

Industrial output can be affected by energy insecurity and fluctuating prices. Companies in energy insecure countries will experience challenges in competing with those in countries with energy security, reducing economic output in NEEs.

What strategies can be used to increase energy supply?

1. Increase production of non-renewables (fossil fuels & nuclear)

- In the future, traditional non-renewable energy resources like coal will become too expensive, both economically and environmentally, to extract. However, despite their environmental impact, fossil fuels are and in the short term will continue to be important for some time.
- The development of new technology such as fracking has allowed increased extraction of shale gas that can be used in energy production.
- Nuclear power is a non-renewable energy resource that uses the uranium as the raw material. Water is heated by nuclear fission to create steam to drive turbines.



2. Increase use of renewable energy

As renewable energy becomes more efficient and better value its role in global energy production will become more important.

Energy Source	Advantages	Disadvantages
Hydro-electric (HEP)	✓ Suited to remote, upland environments ✓ Isolated communities can be supplied with energy using micro-hydro schemes ✓ Reservoirs can control flooding downstream ✓ Very efficient & multipurpose.	✗ Dams and reservoirs lead to the displacement of people, loss of farmland and natural environments ✗ Dams and reservoirs are very expensive to construct
Wind	✓ Potential for wind energy in the UK with 10% of electric production. ✓ Jobs are created in the local area in manufacturing and maintenance.	✗ Only generate electricity when there is wind ✗ Expensive to construct and maintain ✗ Some consider them unsightly and land-based wind farms often face strong objections
Solar	✓ Very effective in areas with high sunshine. ✓ Could be very effective in some LICs with several hours of sunshine a day. ✓ Very effective in converting sunlight to electricity	✗ Energy generation depends on sunlight amount ✗ Expensive ✗ Can involve using fields that were previously used in food production
Tidal	✓ Effective in areas that experience a high tidal range ✓ Tidal barrages can protect coastal settlements from sea level rise and storm surges	✗ Tidal barrages are very expensive ✗ Tidal barrages can have a negative impact on marine ecosystems and fish migration
Biomass	✓ Low-tech organic matter, such as wood and manure can be used ✓ Relatively cheap	✗ Agricultural land is sometimes used to grow plants for biomass ✗ Burning biomass contributes to carbon emissions ✗ Deforestation occurs in tropical rainforests to make way for commercial biofuels
Geothermal	✓ Very effective in areas of volcanic activity ✓ Produces vast quantities of cheap energy ✓ Naturally produced hot water can be used for heating homes, industrial processes and swimming pools	✗ Warm water released into rivers and the sea can have a negative impact on marine ecosystems ✗ Electric generation requires the construction of reservoirs
Wave	✓ Can provide isolated coastal settlements with energy	✗ Very expensive to construct ✗ Wave energy is inconsistent

Sustainable energy supply strategies

A sustainable energy supply balances supply and demand by:

- developing renewable energy supplies
- conserving energy by reducing waste
- improving fuel efficiency
- the efficient use of fossil fuels

A sustainable energy supply has the following characteristics:

does not damage the natural environment
involves and benefits local communities
can be applied to both HICs and LICs.
supports the local economy

Through increasing our use of renewable energy; reducing our use of fossil fuels; increasing fossil fuel efficiency and conservation we can reduce our carbon footprint.

Designing energy efficient or zero carbon homes and workplaces

- Insulating roofs and walls.
- Double or triple glazing to stop heat escaping through windows.
- Solar panels on roofs and heat pumps for heating and hot water.
- closing doors when the heating is on
- turning off electrical equipment, such as computers, when they are not being used
- using low-energy lighting, such as LEDs
- regulating thermostats

Transport

Transport uses a significant amount of energy, through burning oil-based products. There are a number of ways to use energy more efficiently, including:

•using public transport, such as buses and trains, instead of the car
•using a bike
•buying hybrid/electric cars
•encouraging people to car share, including the introduction of car-sharing lanes on major roads
•reducing the use of air transport, particularly for short-haul flights

Reducing energy demand

There are a range of strategies that can be used to reduce energy demand. These include:

- Financial incentives so people switch from petrol/diesel cars to electric/hybrid cars.
- Government grants or tax relief for insulating homes, installing renewable energy devices such as solar panels and fitting double glazing
- Educating & promoting the benefits of reducing energy demand
- Installation of smart-metres so people can track and adjust their energy

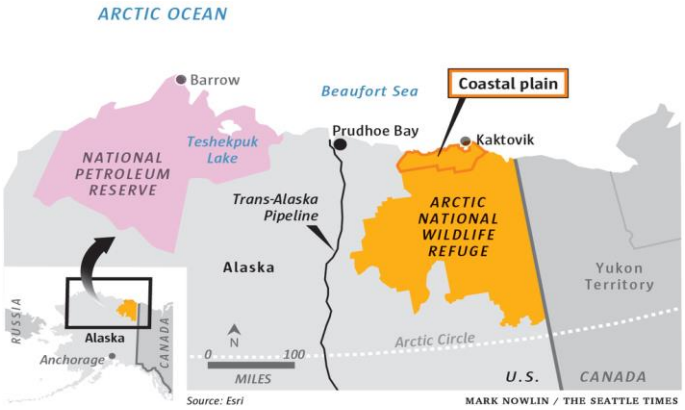
Using technology to improve the efficiency of using fossil fuels

Technology is increasingly being used to reduce carbon emissions and improve efficiency. These include:

•the introduction of more efficient car designs
•the introduction of hybrid or electric cars
•carbon capture and storage
•combined heating and power being used to generate electricity and using the hot water by-product to heat homes

CASE STUDY: An **example** to show how the extraction of a fossil fuel has advantages and disadvantages.

What?	**Oil**
Where?	**ANWR (Arctic National Wildlife Refuge) – Alaska, USA**
Background:	• Alaska is a US state. • They already drill for oil in Alaska. • ANWR = conservation area since 1950s (where wildlife and plants are protected from development). • Since 1970s some politicians have wanted to allow oil drilling = highly controversial. • Jan 2021, Trump finally sold off parts of ANWR to oil companies.



	Advantages		Disadvantages
Economic	ANWR ground holds billions of barrels of oil, creating profit for the USA.	**Environmental**	Home to migrating caribou reindeer, disrupts their natural environment + cuts off their calving site = may lead to decline
Economic	Oil drilling west of ANWR in Prudhoe Bay = fuelled economic development state has depended on	**Social**	Indigenous communities depend on caribou for food source, culture and consider them sacred
Economic	Could ensure future energy security as reduces reliance on energy insecure Middle East however, currently secure due to fracking boom	**Environmental**	Huge risk to nature – extraction in Prudhoe Bay caused the most damaging oil spill in history (80s) – millions of barrels spilt into sea, wildlife devastated.
Political	Reduces reliance on sources of energy from abroad, which may be politically unstable (e.g. the Middle East), increasing energy security.	**Environmental**	Habitat is critical to polar bear population, in dire situation from dev & increased temperature, numbers declined 40% from 2001 – 2010.

CASE STUDY: An **example** of a local renewable energy scheme in an LIC or NEE to provide sustainable supplies of energy.

What?	**Solar mini grids** – Built by Rubitec, composed of more than 300 large solar panels on a compact plot of land. A small powerhouse is lined with batteries that can store enough energy for electricity, even during the rainy season. Wires on wooden poles run from the mini-grid to homes and businesses
Where?	Gbamu-Gbamu, around 150km east of Lagos
Why was it needed?	• Rising population in Nigeria leading to increased energy demands. • Currently very little use of renewable energy potential • Large rural-urban divide regarding energy access. • About 47% of Nigerians do not have access to grid. electricity and those who do have access, face regular power cuts. • Large swathes of land lay barren because of oil leakage from illegal refineries.

In what ways is the scheme sustainable?	• Over 2,500 people no longer rely on expensive, polluting generators to light homes & small businesses. • Steady solar electricity is now available 24 hours a day. • Provides low-cost reliable electricity to rural areas. • Quick to build – mini grid construction can take less than one month. • Mini-grid power is still cheaper than fuel for generators and more convenient and reliable. As equipment costs come down and companies add customers, electricity prices could come down. • Nigeria has the potential to give 26 million residents access to electricity by using solar mini grids. • Reduces carbon emissions.