

Knowledge Organiser

World Studies

KS4 Geography

Topic 9: Consuming Energy Resources

Name:

Class Teacher:

Big Question	Task	Due Date
BQ4	Knowledge quiz on page 9	
BQ8	Knowledge quiz on page 13	
	Revise for end of topic test	



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BQ 6 – Why do oil prices change?

BQ 7 & 8 –What are the impacts of continuing to rely on dwindling fossil fuel supplies?

BQ 9 - How can energy efficiency and conservation help in making energy resources last longer?

BQ 10 – What other alternate energy sources are available and how can they help?

BQ 11 – What views do different stakeholders have about future energy generation methods and why are attitudes changing?

Exam structure & Case Studies

Paper 1: Global Geographical Issues (37.5%)

- ❑ Topic 1: Hazardous Earth
- ❑ Topic 2: Development dynamics
- ❑ Topic 3: Challenges of an urbanising world

Written examination: 1 hour and 30 minutes, 94 marks.

Answer all questions

Paper 2: UK Geographical Issues (37.5%)

- ❑ Topic 4: The UK's evolving physical landscape
- ❑ Topic 5: The UK's evolving human landscape
- ❑ Topic 6: Geographical investigations

Written examination: 1 hour and 30 minutes, 94 marks.

Answer all questions in Topic 4 and 5

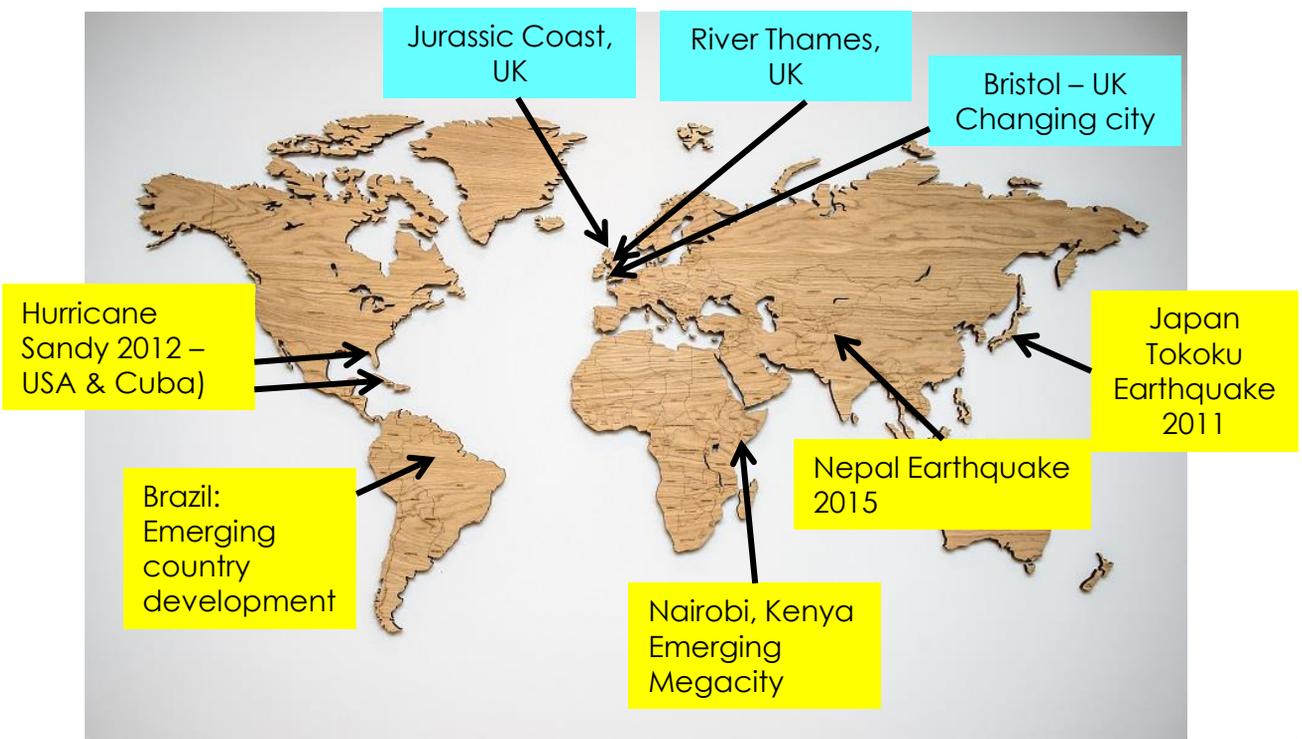
Topic 6: Answer Q 8 & Q10

Paper 3: People and Environment Issues – Making Geographical Decisions (25%)

- ❑ Topic 7: People and the biosphere
- ❑ Topic 8: Forests under threat
- ❑ Topic 9: Consuming energy resources

Written examination, 1 hour and 30 minutes, 64 marks.

Answer all questions





Glossary

Key term	Icon	Definition
Renewable		A non-finite resource that is replenished at the rate that it is used.
Non-renewable		A finite resource that is not replenished at the rate that it is consumed.
Recyclable energy		Recovering energy and products from waste energy resources e.g., nuclear waste
Fossil fuels		Non-renewable energy sources that come from the remains of plants and animals that died millions of years ago.
Energy Mix		The combination of energy sources used by a country or region. Varies based on availability, affordability and climate change governance.
HEP		Hydroelectric power – the use of a dam on a river to contain discharge, releasing it through turbines when needed to generate energy.
Biofuel		A fuel derived from living matter e.g. sugar cane biodiesel or heating from burning farm waste.
Energy Security		Having safe, affordable and reliable access to fuel/energy sources to support a high quality of life.
Traditional biomass		The use of low technology versions of biofuels e.g. burning dung or wood for heating and cooking.
Fracking		Hydraulic fracturing – using high pressure water/steam and chemicals to extract natural gas by shattering rocks deep underground that contain it.
Tar sand extraction		Extracting petroleum products from sands that are rich in bitumen using chemicals and high temperatures.
Unconventional fossil fuel		Using new methods or technology to extract fossil fuels e.g. fracking, not using traditional methods like pumped oil wells
Energy Efficiency		Using modern version of technology that do the same job but consumes less energy
Energy conservation		Changing habits/behaviours to reduce the amount of energy consumed e.g. walking instead of driving

BQ1 &2 How can we classify energy resources and how do they differ?

Renewable vs Non-renewable

Renewable resources are those that can be replenished naturally over time. Note, that this replenishment needs to be at a sustainable rate for it to be considered renewable. Renewable resources are considered to be non-finite, they should not run out.

Non-renewable resources are those that are not naturally replenished at the rate they are consumed. Non-renewable resources are considered to be finite, that they have a limited supply and we can run out of them.

Recyclable Fuels

Are fuels, that once spent can be recycled and much of the remaining potential energy recovered. This includes nuclear fuel rods, up to 90% of the energy of a uranium fuel rod can be recovered and recycled once it has been used.

Advantages & Disadvantages of Fossil Fuels

Advantages	Disadvantages
Readily available (at the moment)	Non-renewable source – will eventually run out
Relatively easy to produce energy from them	Increasing fuel costs
	Release carbon dioxide (CO ₂) when burnt – greenhouse gas
	Release sulphur dioxide (SO ₂) when burnt – acid rain

BQ1 &2 How can we classify energy resources and how do they differ?

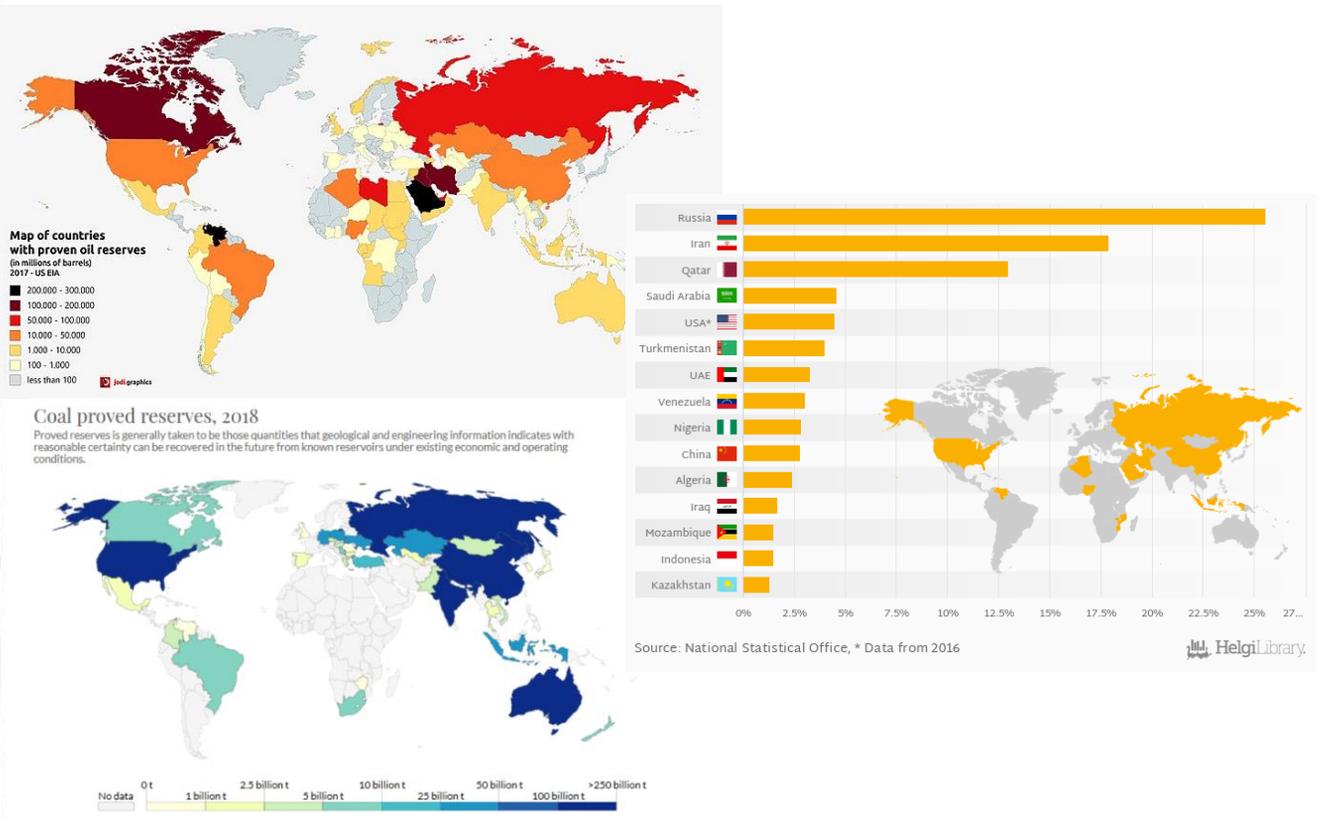
	Advantages	Disadvantages
Solar	<ul style="list-style-type: none"> • No running costs. Once constructed they are cheap to maintain. • Provides a lot of energy in areas with stable day lengths and clear skies. • Can be fitted to rooves of homes, reducing the land space required for energy generation. • Renewable and does not emit CO2 whilst generating energy. 	<ul style="list-style-type: none"> • Relatively expensive to purchase compared to fossil fuels. • Solar panels not fitted to rooves take up valuable land for farming other land uses. • Requires large amounts of energy to produce which may require burning fossil fuels. • Visually intrusive • Less effective in cloudy environments or in seasonal winters. • Requires energy storage capability to store excess for high demand times
Wind	<ul style="list-style-type: none"> • Ideal for high wind areas such as mountains and out at sea • Can be built out at sea reducing demand of land space • Newer turbines are quiet and efficient • Renewable and does not emit CO2 when generating energy 	<ul style="list-style-type: none"> • Relatively expensive to purchase compared to fossil fuels. • Requires large amounts of energy to produce which may require burning fossil fuels. • Visually intrusive • Less effective in areas with minimal winds • Requires energy storage capability to store excess for high demand times
Hydroelectric	<ul style="list-style-type: none"> • Provides a large reservoir for water supply management. • Reservoirs can attract leisure/tourism industries for water activities. • Renewable and does not emit CO2 whilst generating energy. • Can help to limit flood risk downstream 	<ul style="list-style-type: none"> • Floods large areas of land reducing land availability for wildlife and human use • Limits movements of wildlife up/downstream, potentially causing extinctions • Water quality can be affected by pollutants entering the reservoir • Dams may break and trigger devastating floods across wide areas.
Biofuels	<ul style="list-style-type: none"> • Considered renewable, if grown at a fast enough rate. • Reduces reliance on fossil fuels • Can be made into a biodiesel that cars, lorries, planes and ships can be modified to run on. • Close to carbon neutral – CO2 emitted during burning is captured by plants growing again. 	<ul style="list-style-type: none"> • Uses land that could be grown for food, pushing up food prices. • Labour intensive • Not fully carbon neutral, as fossil fuels may be used in transport, harvesting and processing • Heavy agriculture environmental issues e.g. herbicides, pesticides, eutrophication of waterways and deforestation.

BQ 3 - How is access to energy affected by access to technology and physical geography?

Physical Factors Affecting Energy Distribution

Geology

- Fossil fuels formed in specific geological regions. Not all countries have equal access.



- Geothermal energy is concentrated along plate boundaries. Countries far from plate boundaries generally have much more limited access to geothermal energy generation

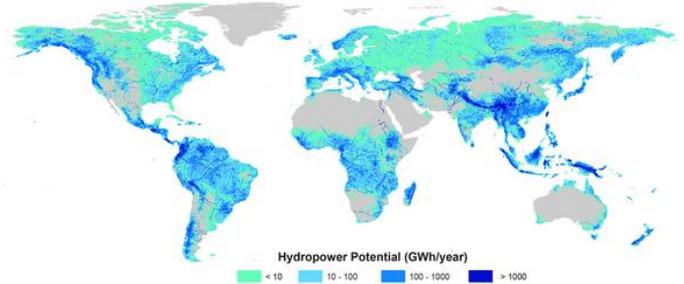


BQ 3 - How is access to energy affected by access to technology and physical geography?

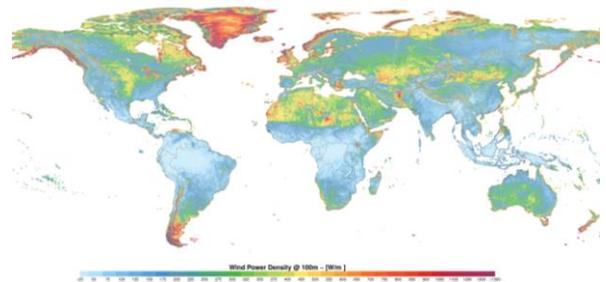
Physical Factors Affecting Energy Distribution

Climate Type

- Hydroelectric power potential is generally limited by access to rainfall and valleys that can be effectively dammed



- Wind power is generally more available in regions that are close to coasts with long fetches and in more mountainous regions

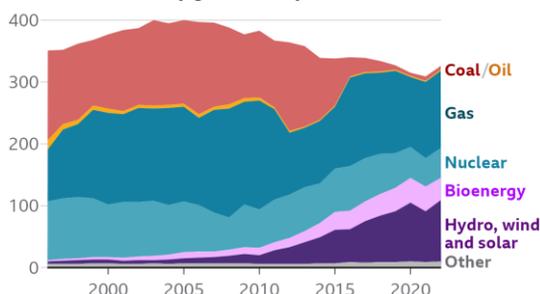


Accessibility & Development

As a country develops it is better equipped to have the finances and skilled workforce to be able to construct and extract energy infrastructure e.g. oil wells/refineries and solar power plants.

The UK's Energy Mix Over Time

How the UK's electricity mix has changed
Amount of electricity generated by fuel source (terawatt hours)



Source: Department for Energy Security and Net Zero



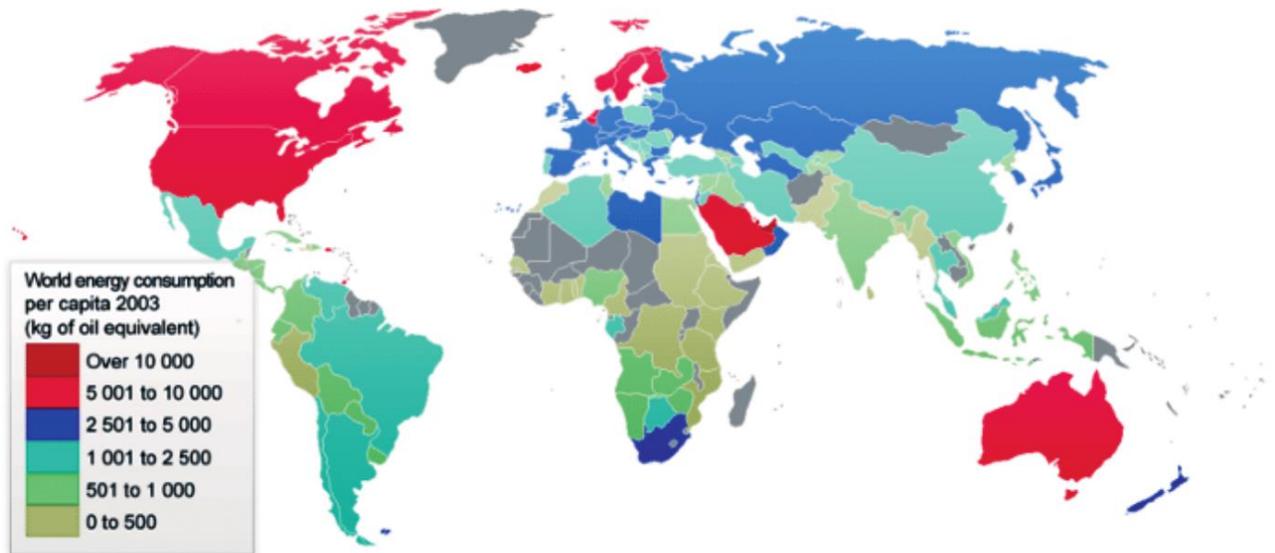
The UK has had to shift its energy mix over time to meet the needs of the population, changing climate and availability. It is important to keep a diverse energy mix so we do not risk energy security by relying on few sources that may become expensive or unavailable e.g. gas during the start of the Russo-Ukrainian Conflict.

Homework 1

Try to answer all of these key knowledge questions. Then check your answers using the answer page. These are some of the questions that will be in the knowledge quizzes and the mid and end of unit tests.

Key knowledge question	Your answer
Define non-renewable (1)	
<i>Define renewable (1)</i>	
<i>Define recyclable fuel (1)</i>	
Give an example of each fuel type: (3)	Renewable Non-renewable Recyclable
Define energy mix (1)	
What are the three main energy sources of the UK's energy mix (3)	
State two physical factors that affect energy accessibility (2)	
Give one advantage and one disadvantage of fossil fuels (2)	

BQ 4 & 5 – How and why does energy consumption vary across the world?

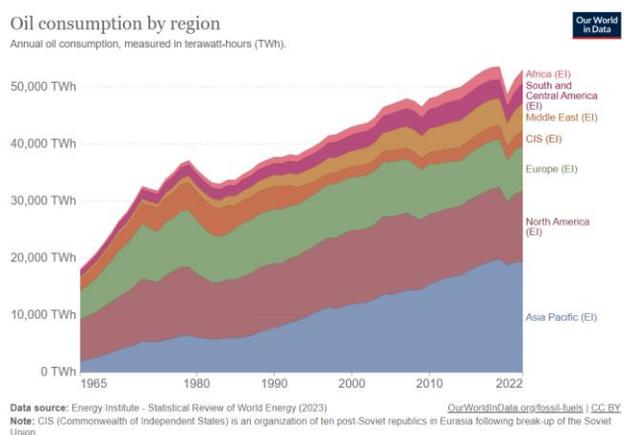


Energy consumption per capita is generally controlled by three primary factors:

- Level of economic development
- Economic sectors (type/level of industry in a country)
- Dependence on traditional fuel sources

Oil consumption increases for two key reasons; firstly, as GDP per capita increases the population has more wealth to buy and utilise energy consuming devices e.g. personal cars, and secondly, GDP per capita increases indicate development through industrialisation where more energy is consumed to generate goods/services which consume energy too.

However, oil consumption in some regions will remain low or stagnant despite development due to a lack of secure access to oil or reliance on other sources such as natural gas e.g. the UK and Europe. This is be effect will be more prominent as we switch transports systems to more efficient, electric or hydrogen ones.



BQ6 6 – Why do oil prices change?

The cost of most goods and services are tied to **supply and demand**. If a good or service is highly sought after but there is not much available, the price will be high e.g. tickets to a popular concert. When one of these two factors changes it will likely affect the price of a good or service. If supply decreases or demand increases then the cost will increase.

There are several key factors that affect supply/demand and energy security for a country:

- Conflicts (war such as Russo-Ukrainian conflict)
- Diplomatic relations (how friendly countries are with one another)
- Recessions (economic downturns that result in fewer goods being made)
- Booms (the opposite of a recession)
- Over or under supply – either intentional changes to production or accidents

1 - 1990 oil price shock was triggered by Iraq invading Kuwait,

2- China joined the World Trade Organisation in 2001

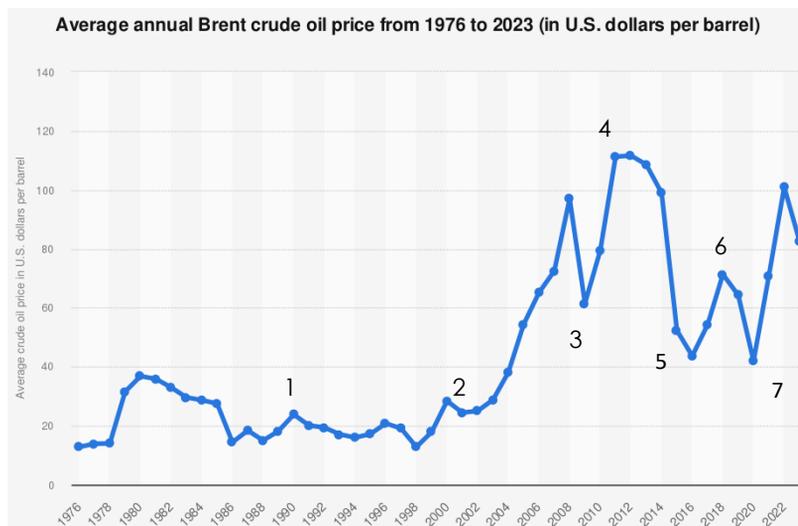
3 - A global recession hit in 2008

4- In 2010 a large oil spill in the Gulf of Mexico reduced supply

5- After 2013 the USA invested heavily into fracking and shale oil extraction (we will cover these later), increasing oil supply. Oil producing countries responded by lowering oil prices

6 - At the end of 2019 a global pandemic hit. Demand for goods and travel dropped significantly whilst factories also struggled to stay open

7 - Russia invaded Ukraine in 2022. Russia is a major gas and oil producer. Many countries, particularly in Europe, refused to purchase Russian products

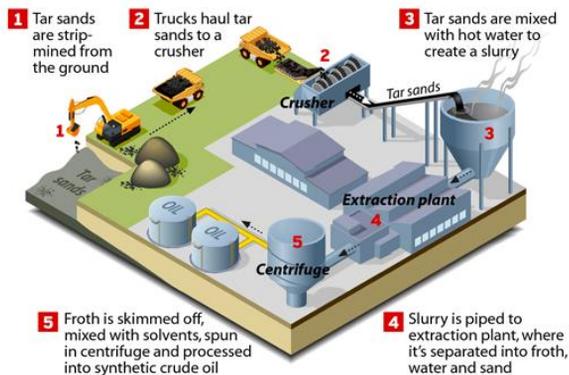


BQ 7 & 8 –What are the impacts of continuing to rely on dwindling fossil fuel supplies?

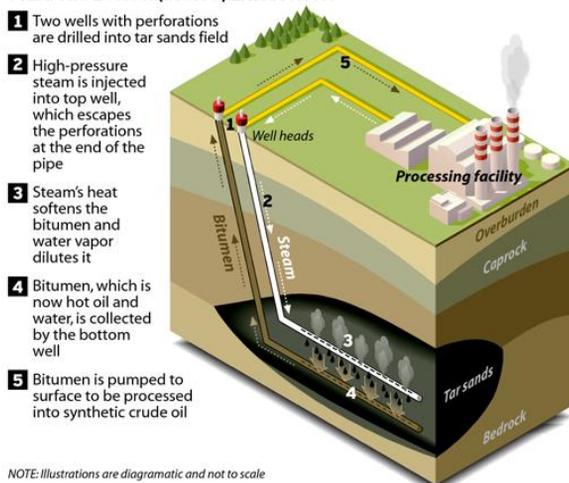
Extracting Oil From Tar Sands

There are two main processes in extracting oil from the bitumen in Canada's tar sands.

OPEN-PIT EXTRACTION

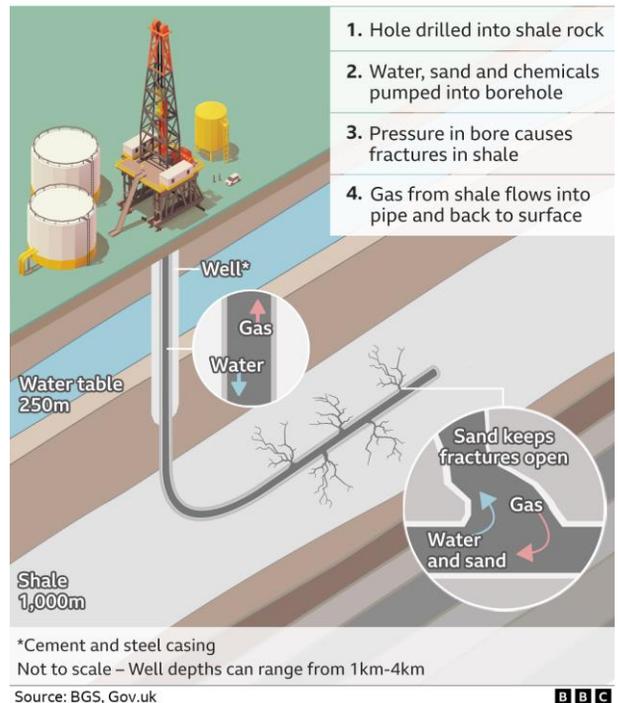


STEAM INJECTION (IN SITU) EXTRACTION



NOTE: Illustrations are diagrammatic and not to scale

How gas is extracted by shale fracking



As supplies of oil and gas dwindle and energy insecurity increases, we are turning to unconventional fossil fuel supplies. We are extracting oil/gas from areas of the world that traditionally were too expensive to reach or too valuable, ecologically, to allow for drilling.

In addition to this we are exploiting oil sands and fracking to extract fossil fuels that were previously not cost efficient to extract.

Advantages

- Provides jobs. In Canada alone over 70,000 people are directly employed in this area.
- Provide energy security for countries and their allies.
- Reduces reliance on foreign oil producing nations e.g. Russia and Saudi Arabia
Extends the life cycle of fossil fuels and technology/systems that rely on them.

Disadvantages

- Massive deforestation to clear land for extraction.
- Transportation of oil via pipelines may cause tundra melting and risks spillage.
- Discourages energy conservation and switching to green energy, increasing global warming threat.
- Consumes vast amounts of energy – producing 2.9 units of energy per unit consumed.
- High water consumption 3 barrels of water per barrel of oil.

Homework 2

Try to answer all of these key knowledge questions. Then check your answers using the answer page. These are some of the questions that will be in the knowledge quizzes and the mid and end of unit tests.

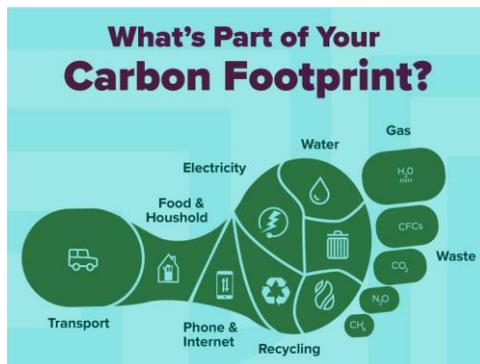
Key knowledge question	Your answer
State one way unconventional fossil fuel supplies benefit us. (1)	
State two negative impacts of fracking (2)	
<i>Explain why we are resorting to unconventional fossil fuel extraction (2)</i>	
Define supply and demand (1)	
Explain one for increasing energy consumption (2)	
<i>Give two examples of non-renewable energy (2)</i>	
<i>Give two examples of renewable energy (2)</i>	
What type of energy is nuclear energy categorised as? (1)	
State one reason why the UK does not use much oil as part of its energy mix (1)	
Explain how plate boundary locations affect energy accessibility (2)	

BQ9 - How can energy efficiency and conservation help in making energy resources last longer?

Carbon Footprint

A carbon footprint is a measure of how much carbon dioxide would be released because of the activities of a particular individual, organisation, or community.

In depth calculations can be made to work carbon footprints out with some precision. There are simpler, far less accurate questionnaire methods that can be completed quickly. These methods are useful to educate people about what impact they are having and what might be done to minimise our impact on global warming potential.



Scan this QR code to calculate your own carbon footprint!

Energy conservation – conserving energy by changing behaviours e.g. walking/cycling more, turning heating down or buying local produce instead of imported food.

Energy efficiency – the use of technology that consumes less energy than the standard version e.g. driving electrical vehicles, building insulated homes and fitting efficient light bulbs and boilers.

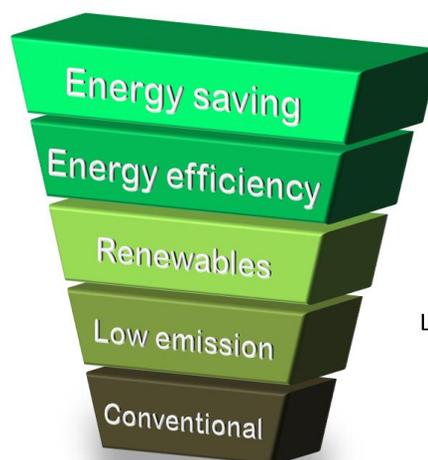
Leaner

Keener

Greener

Cleaner

Meaner



Switch off
Eliminate waste

Better appliances
Lower energy losses

Sustainable energy
production

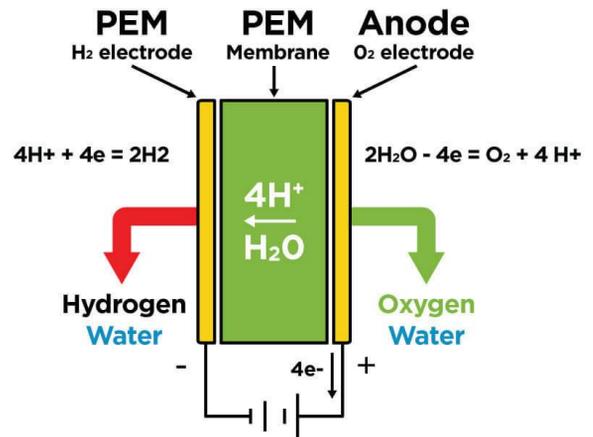
Low carbon generation
Carbon capture

Sources of last resort
Offset to compensate

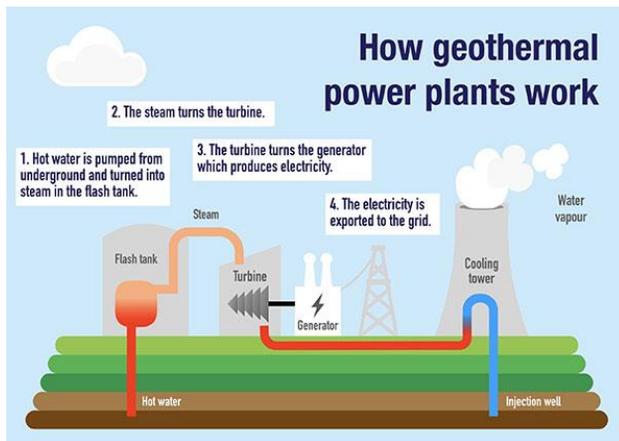
BQ10 - What other alternate energy sources are available and how can they help?

Two additional methods of generating energy without the direct use of fossil fuels include hydrogen generation and geothermal power.

Hydrogen power usually utilises excess power from the grid (e.g. when demand is low during the night and wind turbines are still generating excess energy) to run electricity through water. This process splits water into hydrogen and oxygen.



- Abundant- will never deplete.
- Will be a viable replacement for fossil fuel.
- Used widely in industry with much experience.
- Can be generated by renewable energy.
- It's only emission is pure, drinkable water.
- One gallon of hydrogen produces an equal amount of energy as 1/4 gallon of gasoline.
- Difficult to extract
- Expensive, renewables more so
- Flammable, leak-prone
- Strict standards



PROS		CONS	
1.	Environmental Friendly.	1.	Convinient to Only a Particular Area.
2.	Renewable Source of Energy.	2.	Environmental Issues.
3.	No Fuel Required.	3.	Surface Instability.
4.	Plentyful Supply.	4.	High Investment.
5.	Huge Potential.	5.	May Run out of Steam.
6.	Incredible for Heating and Cooling.	6.	Sustainability Issue.
7.	Source of Employment.		
8.	Energy Security.		
9.	Low Impact.		

Geothermal power utilises hot rocks from deep within the ground. Water is pumped down to the hot rocks and the resulting steam is used to spin turbines and generate electricity.

Diversifying our energy mix with alternative energy sources is important to ensure energy security. International relations or major global events such as a volcanic winter could severely impact a nation's ability to run effectively.

BQ11 - What views do different stakeholders have about future energy generation methods and why are attitudes changing?

Our energy future

There are two possibilities for our energy future:

- **Business as usual** – we continue as we are, generating most of our energy from non-renewable energy sources that are finite
- **Move to a sustainable future** – we reduce our reliance on fossil fuels, reduce our energy consumption and switch to renewable options for generating energy.

Everyone has different views on whether we should be moving towards a sustainable future and how rapidly this should be achieved.

<p>Consumers (UK population)</p> <ul style="list-style-type: none"> - Wants the lowest cost energy per unit, most care more for this than renewable vs non-renewable but this is changing - Concerned about rising costs of energy if we continue to use depleting fossil fuels. - Relying on other countries is unpopular - Wind turbines unpopular, others are widely protested e.g. nuclear (NIMBY) 	<p>TNCs (transnational corporations)</p> <ul style="list-style-type: none"> - Wants the lowest cost energy option. - Fossil fuel industry provides millions of jobs and provides profit for many companies - Many companies are investing in renewable, sustainable option - Will follow tax incentives from government - Businesses want to avoid high upfront costs of sustainable methods
<p>Governments</p> <ul style="list-style-type: none"> - Energy security and cost is highest priority to keep voters happy -Diverse energy mix and avoiding reliance on other countries - Different parts of the government may prioritise different things e.g. environmental ministers may be more concerned with pollution and CO2 released from fossil fuel consumption whilst industry ministers may focus on employment and protecting businesses 	<p>Climate Scientists</p> <ul style="list-style-type: none"> - Need to reduce CO2 emissions at all costs. Sustainable energy options through wind/solar/nuclear etc to avoid 2.5C temperature rise
<p>Environmental Groups</p> <ul style="list-style-type: none"> - Conservation and efficiency are most important points. Even renewable options have an environmental impact that damages the environment. 	

Key knowledge questions

Homework 3 Answers

Key knowledge question	Your answer
State two groups in favor of fossil fuel extraction and unconventional fossil fuels (2)	
<i>State two groups strongly in favor of focusing on a more sustainable future (2)</i>	
<i>Give two reasons for changing attitudes towards energy futures (2)</i>	
Describe how geothermal power works (2)	
Which regions of the world generally have the best access to geothermal power (2)	
Define energy efficiency (1)	
Define energy conservation (1)	
Give two examples of energy efficiency (2)	
Give two examples of energy conservation (2)	
Give an example of an event that has dramatically affected gas prices	

Key knowledge questions

Homework 1 Answers

Key knowledge question	Your answer
Define non-renewable	Fuels that are finite and can run out
Define renewable	Fuels that are non-finite and cannot be used up
Define recyclable	Fuels that we can recover most of the energy from, if processed and recycled
Give an example of each fuel type:	Renewable – solar, wind, HEP, biofuel Non-renewable – coal, oil, gas Recyclable - nuclear
Define energy mix	The breakdown of energy sources used to generate electricity.
What are the three main energy sources of the UK's energy mix	Gas, wind and nuclear
State two physical factors that affect energy accessibility	Geology, access to the coast, access to mountains, access to plate boundaries, number of daylight hours
Give one advantage and one disadvantage of fossil fuels	See below

Advantages	Disadvantages
Readily available (at the moment)	Non-renewable source – will eventually run out
Relatively easy to produce energy from them	Increasing fuel costs
	Release carbon dioxide (CO ₂) when burnt – greenhouse gas
	Release sulphur dioxide (SO ₂) when burnt – acid rain

Key knowledge questions

Homework 2 Answers

Key knowledge question	Your answer
State one way unconventional fossil fuel supplies benefit us. (1)	Extends use of fossil fuels, provides jobs, reduces reliance on other countries, provides energy security, keeps costs of gas/oil from escalating
State two negative impacts of fracking (2)	Consumes large quantities of water, contaminates ground water supplies, consumes large amounts of energy to extract gas, deforestation to clear land, health impacts from water contamination
Explain why we are resorting to unconventional fossil fuel extraction (2)	Oil/gas prices are rising (1) due to declining supplies (1) increased demand (1) political instability (1)
Define supply and demand (1)	The way prices are affected by the availability and demand of a product
Explain one for increasing energy consumption (2)	Development – as a country becomes wealthier people have more money for energy consuming device OR as a country develops, they may industrialise, secondary industry consumes more energy
Give two examples of non-renewable energy (2)	Coal, oil or gas
Give two examples of renewable energy (2)	Biomass, solar, hydrogen, wind, HEP, tidal, geothermal
What type of energy is nuclear energy categorised as? (1)	Recyclable
State one reason why the UK does not use much oil as part of its energy mix (1)	The UK does not have large local oil supplies. There are plentiful gas and coal supplies that are more local.
Explain how plate boundary locations affect energy accessibility (2)	Countries that are on plate boundaries may be able to access geothermal energy, a renewable source.

Key knowledge questions

Homework 3 Answers

Key knowledge question	Your answer
State two groups in favor of fossil fuel extraction and unconventional fossil fuels (2)	TNCs (although not all), consumers (if cost is lower) and government
State two groups strongly in favor of focusing on a more sustainable future (2)	Climate scientists, environmental groups
Give two reasons for changing attitudes towards energy futures (2)	Wealthier – as a country gets wealthier people can afford upfront costs (1), governments have more money for upfront costs of sustainable options (1), Education – school and media is educating people on the impacts of climate change (1) also educating about how to reduce emissions (1) Environmental concerns – impacts of climate change becoming more obvious causing awareness/worry (1)
Describe how geothermal power works (2)	Hot volcanic rocks heat water (1) generating steam which can spin a turbine to generate electricity (1)
Which regions of the world generally have the best access to geothermal power (2)	Those close to plate boundaries
Define energy efficiency (1)	Using technology that does the same job but using less power
Define energy conservation (1)	Using less energy by changing behaviour/habits e.g. walking instead of driving
Give two examples of energy efficiency (2)	Insulating homes, double glazed windows, low energy appliances/bulbs, electric vehicles, heat pumps,
Give two examples of energy conservation (2)	Walking/cycling, switching off lights, turning heating down, warm clothes instead of heating, switching off appliances, eating local food
Give an example of an event that has dramatically affected gas prices	Gulf war, Russo-Ukrainian Conflict, development of fracking, Covid, 2008 financial crash