



TEACHER NOTES



ENERGY PICK 'N' MIX ACTIVITY

KS2



SAVE INK - don't print this first page!



Lesson overview

In this activity, students learn about the energy mix, the sources that we use in the UK to generate electricity, and how the UK's energy mix has evolved over time.

Learning objectives

- ▶ Learn about the important role electricity plays in our lives
- ▶ Understand the distinction between renewable and non-renewable energy sources
- ▶ Consider the UK's mix of energy sources over time
- ▶ Learn about the variety of jobs in the energy industry

Subjects

Science
Geography

WARM-UP (15 mins)

Part 1: It's electric!



Do you know what electricity is? Ask students to have a go at describing what it is. Electricity is created when tiny invisible things called electrons move. This flow is called an electric current.

HPC Inspire

We're Hinkley Point C's Education Programme in Somerset and the wider South West region. And we're here to help young people take advantage of the huge opportunities that the construction and

operation of HPC has to offer. We do this through a range of fun and innovative activities: including hands-on STEM workshops, careers assemblies and online learning resources.

Can you see electricity? Or hear it?



You'll probably have seen these around the country. They are called **pylons** and they carry electricity above ground from where it's generated to businesses and homes, like yours. Electricity can also be carried underground through pipes.

Do you use electricity at home?

Ask students: How do you know it's in your home, if you can't see it?



Electricity comes into our homes through power cables. We can't see it. But we are able to use it by plugging in things like our PlayStation, TVs and kettles to power sockets in the walls. Electricity is also used to power our lights.

Some people also use electricity to heat their homes and charge their cars.



Did you know?

By the time you're able to drive, most people will be driving some form of electric car. You won't ever need to go to a petrol station again to fill up! But will be able to charge your car from home, in a car park or even on the street.

Part 2: 3-minute challenge!



Ask students to write down in their Worksheet as many things they can think of in the home that need electricity to operate. It might be something they use (e.g. a games console or phone charger). Or it could be something other people in their family use (e.g. cooking, water heating etc).

Have a brief discussion about what they've included on their list – did everything they include use electricity? Are there any unusual things they've included? Make clear the distinction between battery-operated or gas-powered devices, and those that use electricity.

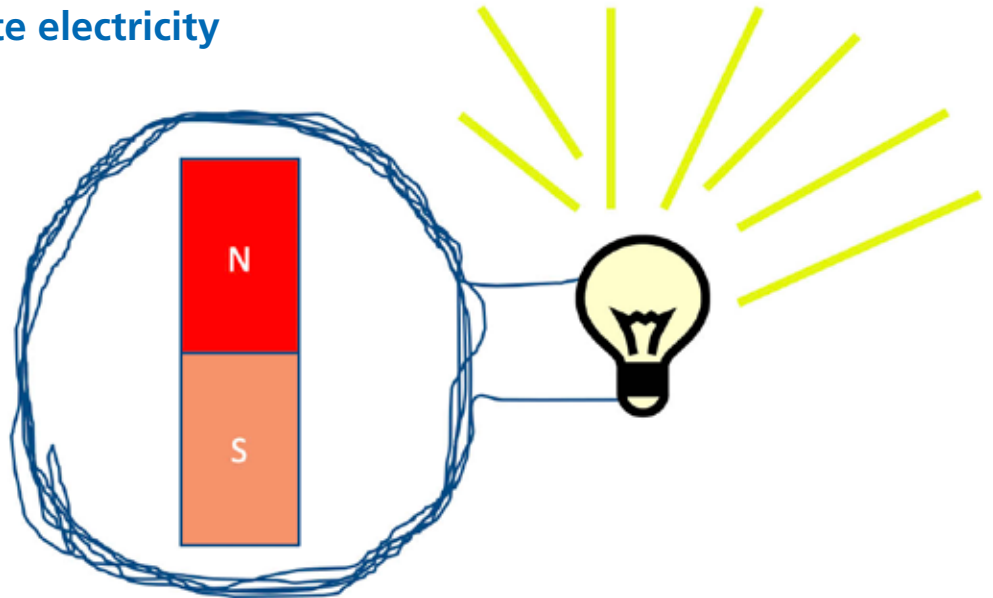
Part 2: How we generate electricity

Electricity doesn't magically appear out of thin air!

It has to be generated first. Does anybody know how this is done in power stations? *Invite students to put up their hands.*

Electricity is created by spinning a magnet inside a coil of copper wire. We call this a **generator**. The magnet moves the tiny electrons and that makes an electrical current.

The magnets need to move really fast to generate electricity. How do you think this is done?



The generator is connected to what's called a **turbine**. This picture shows the turbines inside a nuclear power station (*point to the circular discs*). They are made up of lots of blades and they spin 3,000 times a minute!

Ask everyone to click their fingers.

Did you know... In the time it's taken you to click your fingers, they will have spun 50 times!

THE MAIN ACTIVITY

(60 mins)

Part 1: Where do we get our power from?



All generators need an energy source to create electricity.

Can you name what some of these energy sources might be, using the images above?

From (top, left-right): solar, wind, hydro (water), nuclear, wave, coal, gas, oil.

There are lots of differences between these energy sources. One of the main differences is that some are **renewable**. And some are **non-renewable**.

Renewable energy sources will never run out. They are a natural source of energy.

Non-renewable energy sources won't last forever, as they're based on materials we get from the Earth. So they will run out at some point.

Ask students to fill in the table on their Worksheet based on whether they think the energy sources on the previous page are renewable or non-renewable.

RENEWABLE ENERGY SOURCE	NON-RENEWABLE ENERGY SOURCE
Solar	Coal
Wind	Oil
Wave	Gas
Hydro	Nuclear



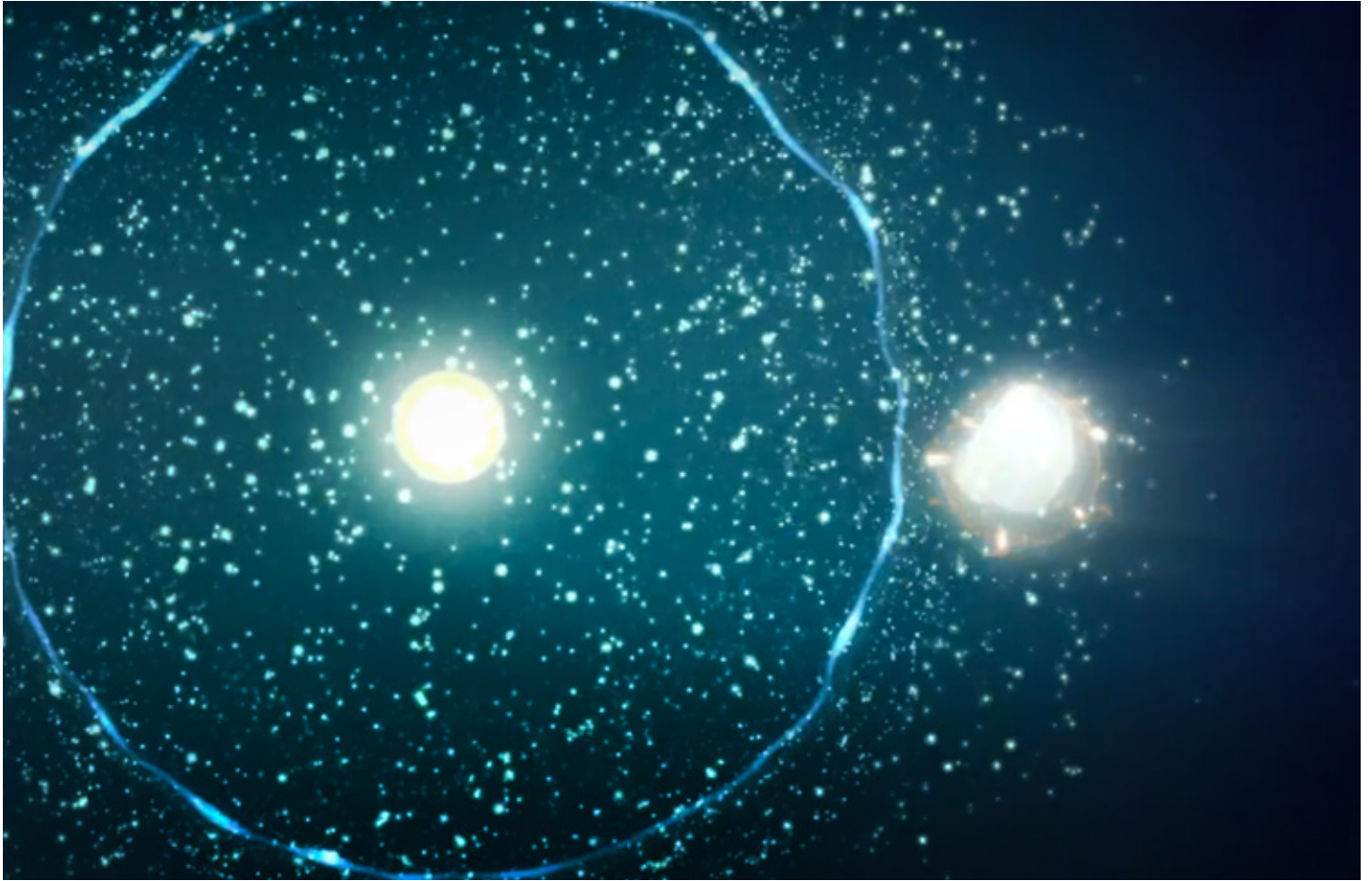
What are non-renewable energy sources?

Although there are fewer of them, most of the electricity we get in the world comes from **non-renewable sources**. And has done for many, many years.

Coal, oil and gas are non-renewable energy sources and are collectively known as **fossil fuels**. This is because they're formed from fossils – the remains of plants and animals that died millions of years ago.

But burning fossil fuels creates **carbon dioxide gas**. This produces pollution and is making the Earth warmer. It's causing a process called **climate change**. You could ask students if they can think of any examples of climate change (e.g. more rain/flooding, hotter weather, ice caps melting etc.)

Burning fossil fuels is one of the negative ways in which humans have affected the environment over the years.



Nuclear is a different type of non-renewable energy source.

Nuclear is also a non-renewable energy source. This is because it uses a metal mined from the ground called uranium. But it's different to fossil fuels because it doesn't release any carbon dioxide to generate electricity.

The big difference is that in a nuclear power station, heat is produced to spin the turbines using a **nuclear reaction** (see the image above) rather than burning any fuel. So it's known as a **low-carbon energy source**. You could show [this film](#) exploring how nuclear power is generated if you want to explore this topic in more detail.



Renewable energy sources don't cause pollution.

Unlike fossil fuels, **renewable energy sources** don't create carbon dioxide or pollution. So they don't contribute to climate change.

They're also important because they don't run out (like fossil fuels). So as our demand for electricity increases – as we switch to driving electric cars and heating our homes this way – we'll need to rely more on other energy sources to meet demand. These are some of the reasons why many countries – like the UK – are switching to generate more electricity from renewable energy sources. It's an example of how humans can have a positive impact on their environment.

Non-renewable energy sources (except nuclear) generate electricity by burning fossil fuels to create heat. What's interesting about renewable energy sources, however, is that they create electricity in different ways:

- ▶ **Wind power** converts the energy from the movement of the wind to turn a turbine and generate electricity.
- ▶ **Wave power** converts the energy from the movement of waves to turn a turbine and generate electricity.
- ▶ **Tidal power** converts the energy from the pull of the tides to turn a turbine and generate electricity.
- ▶ **Hydro power** converts the energy from moving water to turn a turbine and generate electricity.
- ▶ **Solar power** converts the Sun's energy directly into electricity.

Part 2: Quiz time!

Test how much students know about renewable and non-renewable energy resources with the quiz in their Worksheet.



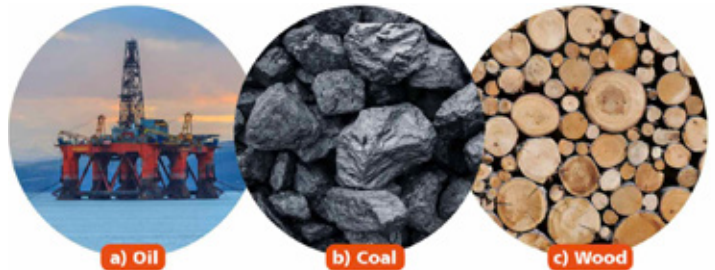
1. Q. Which of these is a renewable energy source?

A. c) Tidal power. Renewable energy sources will never run out. Both coal and gas are fossil fuels that come from underground or beneath the sea. They will run out over time. But the tides will never run out – they will be there forever.



2. Q. Non-renewable energy sources – like coal, gas and oil – are limitless: true or false?

A. False. Non-renewable energy sources will run out. Coal, gas and oil come from underground or beneath the sea, and will run out eventually.



3. Q. Which one of these is NOT a fossil fuel?

A. c) Wood. This was a slightly tricky question! Since wood is a fuel we burn for heat, but it's not a fossil fuel. Fossil fuels will run out eventually. But wood won't, if we plant more trees to replace those cut down.



4. Q. Which produces the most reliable long-term supply of energy?

A. c) Nuclear. Nuclear power uses a fuel source that is dug out of the ground (uranium) but it isn't going to run out any time soon. So it provides a more reliable long-term supply of energy than coal and gas. That's because coal and gas are fossil fuels, so once they're gone, they're gone forever.

5. Q. Name FOUR low-carbon energy sources.

A. Possible answers include nuclear, solar, wind, hydro, tidal and wave. A low-carbon energy source is one that doesn't produce many – or any – gases that harm our environment and contribute to climate change.

Part 3: Pick 'n' mix



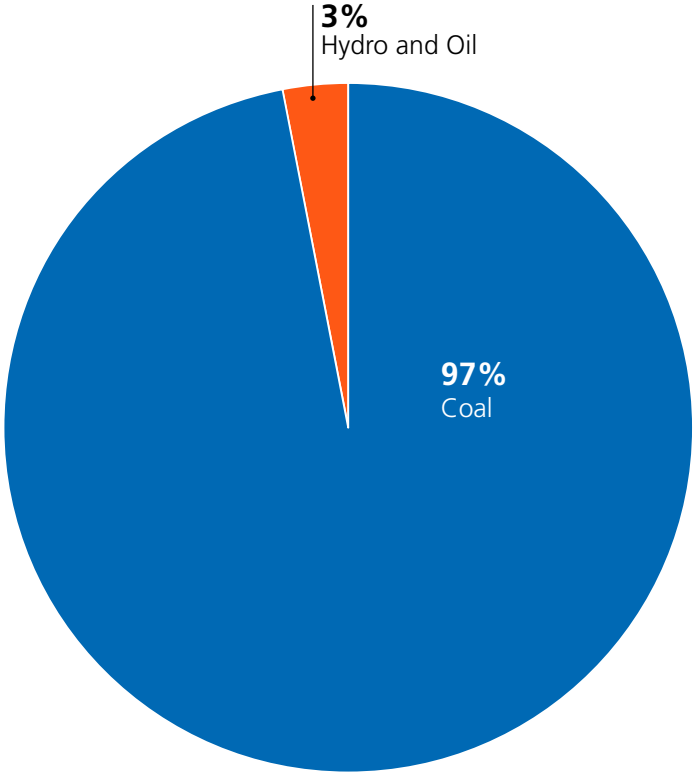
We don't rely on just one power source though for electricity. Since we began using electricity more than a hundred years ago, we've used a combination of different energy sources. We call this combination the **energy mix**.

We need a 'mix' because:

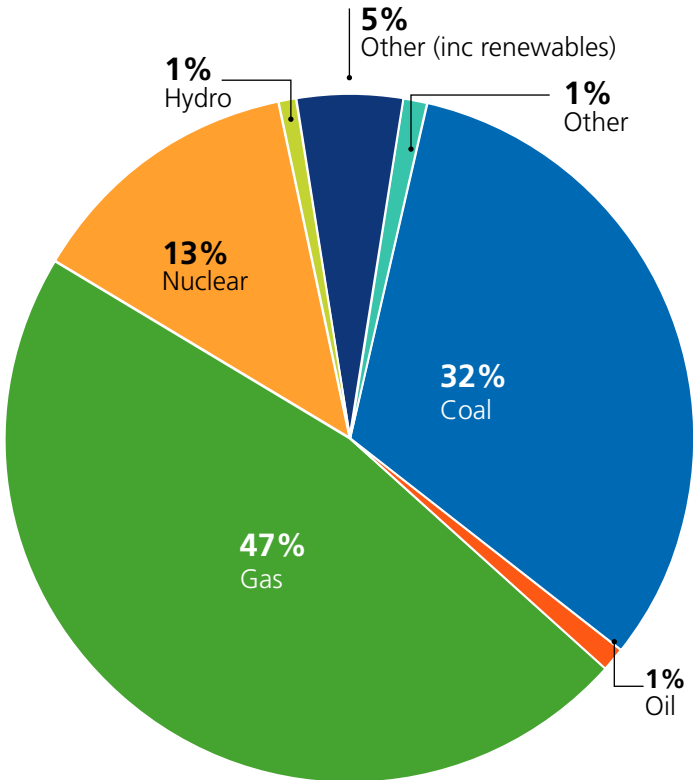
- ▶ No single energy source will power all our lights (or gadgets)
- ▶ They all have strengths and weaknesses

The two pie charts opposite show how much the UK's energy mix has changed! We're no longer reliant on mainly one fuel – as we were in the 1950s – to produce electricity.

The UK's energy mix in 1950



The UK's energy mix in 2008



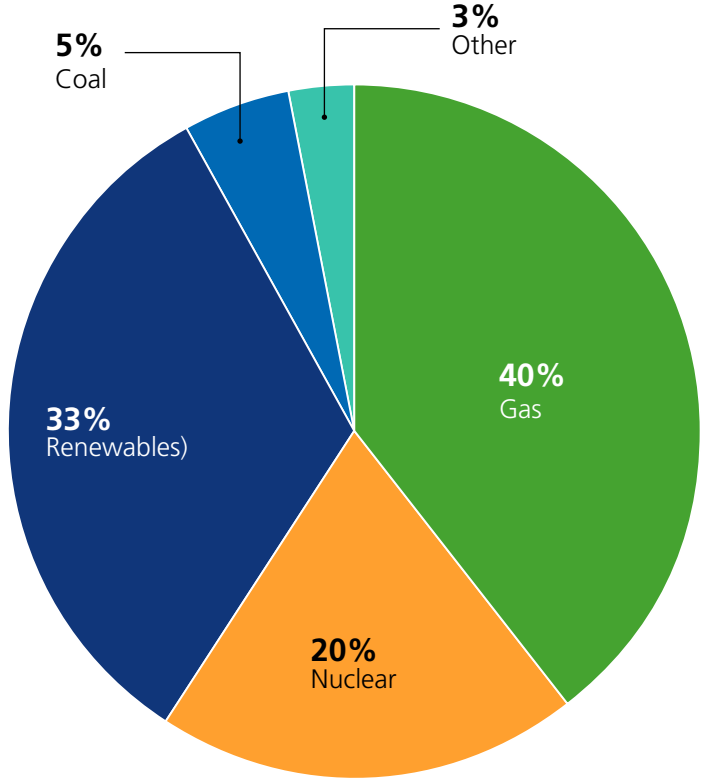
Our energy mix has changed over the years for a number of reasons:

- ▶ **Government rules:** In recent years, the Government has said it wants to use more renewable energy sources
- ▶ **Price:** The price of fossil fuels has gone up and down over time. For example, in the early 1970s, oil became really cheap so the UK switched to using more oil at the start of that decade
- ▶ **New technologies:** The UK started to use more nuclear from the 1960s onwards; while in the 1990s, gas became a significant source as the first gas-fired generation plant was built at the start of the decade.
- ▶ **Geography and climate:** You need hills and windy areas for wind power to work, for instance. And sunny weather for solar!

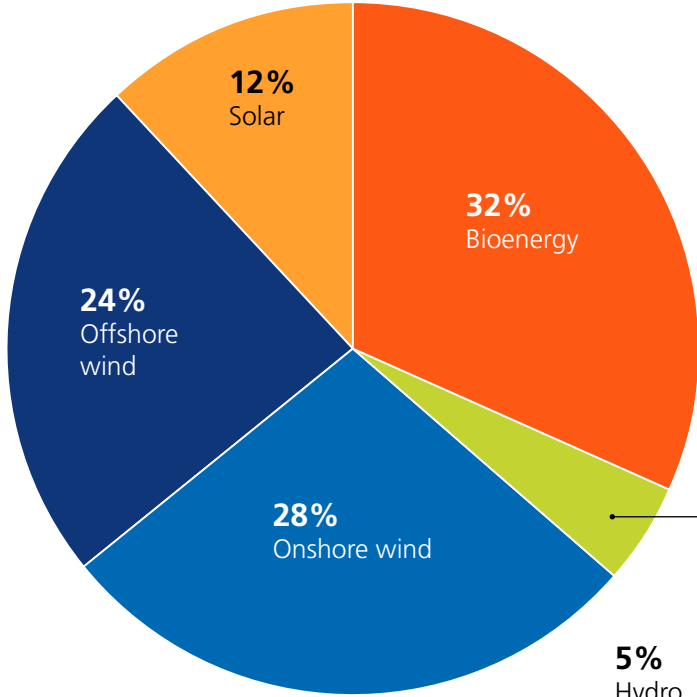
Now it's your turn... Look at each of the pie charts in your Worksheet. These represent the energy mix in different years. Using the clues and what you've just learnt about the factors that have affected the UK's energy mix, can you label each of them with the correct energy source?

Please note: The Government groups 'renewables' together as one energy source. So flag this up with students for pie chart 3 onwards.

1. The UK's energy mix in 2018



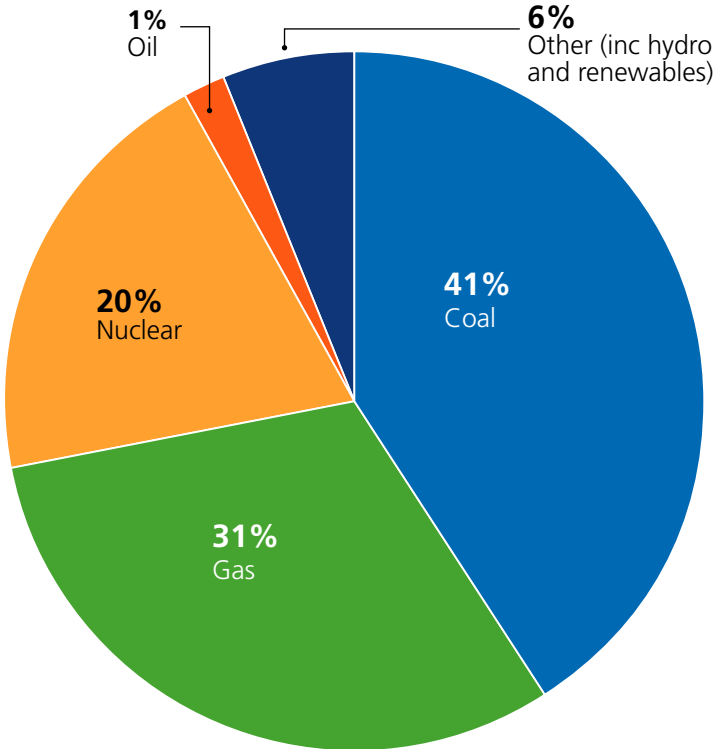
2. How did renewables contribute to the UK's energy mix in 2018?



NB: We have rounded up the stats, so it doesn't quite represent 100%. Also, the Government stats for the UK's energy mix are released every July. You can find the most recent [here](#). Click into each year you want to review, and then scroll down to the report labelled 'Digest of UK Energy Statistics (DUKES): Electricity'.

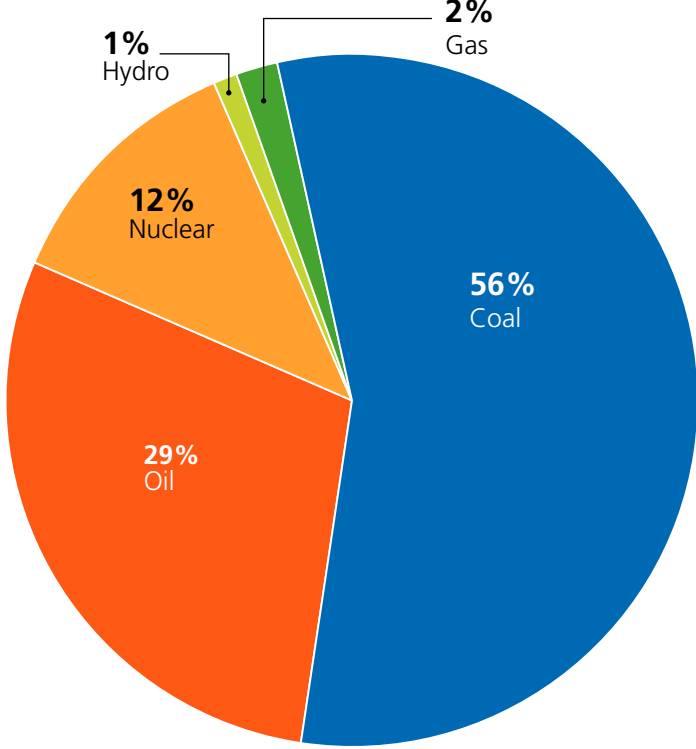
Did you know... Renewables generated a record share of electricity generation in 2018 – up 4% from the previous year. Ask students if they were aware that wind was the biggest provider of renewable electricity? Have they seen any wind turbines? What about solar farms?

3. The UK's energy mix in 2006



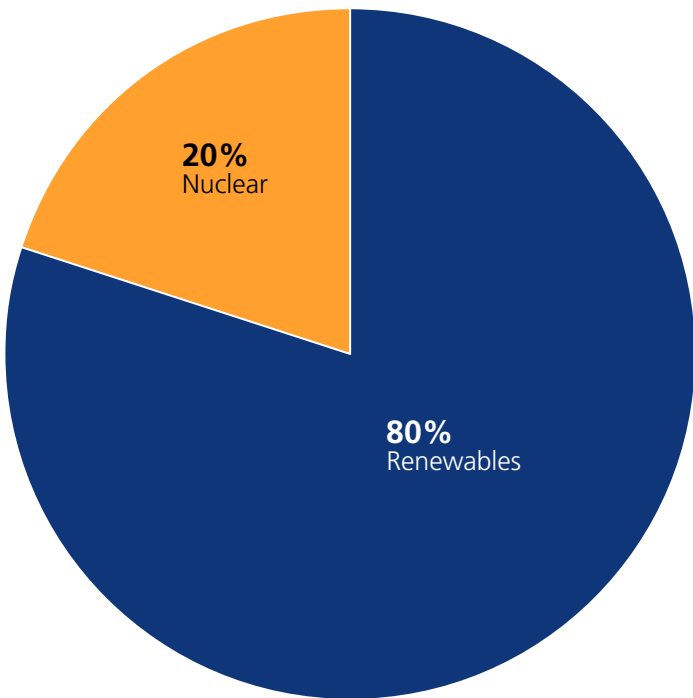
Clue: In the early 2000s, we were still heavily reliant on fossil fuels.
Clue: Nuclear power generated a fifth of our electricity.

4. The UK's energy mix in 1972



Clue: Until the 1970s, the UK had been reliant on coal – so this was still an important part of the energy mix at the start of the 1970s.
Clue: Another fossil fuel became a major source of electricity generation in the early part of the 1970s... Can you name it?

5. The UK's energy mix in 2050



Clue: If the UK is to achieve 'net-zero' emissions by 2050, we need to be 100% reliant on low-carbon energy sources... Can you think what each will contribute to the energy mix?

This is a trick question, as we're asking you to estimate what our energy mix might be in the future! 2050 is an important date though, as it's the date by which the Government has committed to achieving 'net-zero' carbon emissions. This means our energy mix needs to be entirely reliant on low-carbon energy sources, like renewables and nuclear, by this date.

What do you think the phrase 'net-zero' means? It means that the amount of carbon dioxide emissions released in the UK – from activities like generating electricity, transport and heating – is balanced by how much carbon we can 'remove', using all sorts of new technologies.

What's so important about the year 2050? The net-zero target for 2050 was recommended by the Committee on Climate Change, an organisation that advises the Government. They believe that it could help prevent the world from warming up by more than 1.5°C – as long as other countries also reduce their own carbon emissions. Although 1.5°C doesn't sound like much of a temperature increase, it's widely acknowledged by scientists that global warming any higher than this could be catastrophic.

CAREERS IN NUCLEAR

10 mins



Hinkley Point C (HPC) is the first new nuclear power station to be built in 25 years. And it's really important because it will help the UK generate more power from low-carbon energy sources in the future.

HPC is also providing lots of new jobs. It's a massive infrastructure project, which is creating about 25,000 job opportunities in total! And when it starts to generate electricity, there will be jobs for about 900 people to keep the power station running.

There will be all sorts of future careers in the energy sector. And because we need more low-carbon sources in our future energy mix, it's a growing and exciting area to work in that could give you a skillset for life and take you all over the world!
Take a look at the photos on the next page to see the variety of roles in the low-carbon energy industry...

There are so many job opportunities in the low-carbon energy sector:



Imagine developing new wind farms



Helping to ensure the safe generation of nuclear power



Looking after wind or solar sites



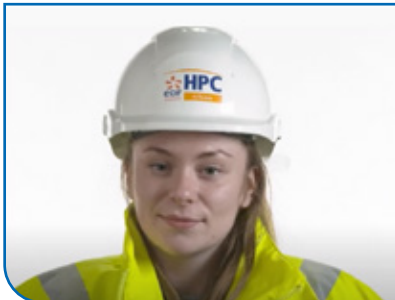
Using virtual reality technology as part of your daily job!



Working with new technologies and devices



Building robotic tools to repair or maintain equipment



What's it like to start your career in the nuclear industry? Watch **this film** featuring apprentices Megan, Callum and Sam to find out what it's like to work on the Hinkley Point C project.

Homework activities

Choose from one of the following:

1. Investigate what power sources are near to you and why (e.g. a nuclear power station needs to be near water).
2. Look on Gridwatch on 3 different days over a week. Write down which power sources contribute to the UK's electricity on each day and their percentage contribution.
3. Complete the table in your Worksheet, giving at least one pro and one con for each of the energy sources:

ENERGY SOURCE	PROS	CONS
Nuclear	<ul style="list-style-type: none"> ▶ Low carbon ▶ Not likely to run out any time soon ▶ Reliable: provides baseload electricity ▶ Higher output and less land space required than for renewables 	<ul style="list-style-type: none"> ▶ Uses a non-renewable fuel (uranium) ▶ Building a nuclear power station is a big investment project, involving government and other organisations ▶ Nuclear waste remains radioactive, so the waste products require long-term management in special facilities
Gas	<ul style="list-style-type: none"> ▶ Reliable ▶ Flexible ▶ Fairly low-cost way to generate power 	<ul style="list-style-type: none"> ▶ Gas is a non-renewable resource, so it will run out ▶ Not low carbon ▶ It produces pollution and contributes to climate change
Wind	<ul style="list-style-type: none"> ▶ Low carbon; no pollution. The UK is also the windiest country in Europe ▶ Offshore wind turbines can generate more electricity than onshore wind ▶ Relatively low cost to run and no fuel costs 	<ul style="list-style-type: none"> ▶ Variable power source (no wind = no electricity) ▶ Limited development onshore due to available land space ▶ Offshore wind farms are trickier and more expensive to build
Solar	<ul style="list-style-type: none"> ▶ Low carbon; no pollution ▶ We get enough sunlight in the UK to make it a viable energy source ▶ No fuel costs 	<ul style="list-style-type: none"> ▶ Variable (it doesn't work well in cloud or at all at night) ▶ Restricted by the amount of land space required ▶ Solar power can't be stored very easily or cheaply over a long period

Curriculum links

Science: Electricity

Geography: Human and physical geography – describe and understand key aspects of: human geography, including types of settlement and land use, economic activity including trade links, and the distribution of natural resources including energy, food, minerals and water.

PSHE: Living in the wider world: L5. ways of carrying out shared responsibilities for protecting the environment in school and at home; how everyday choices can affect the environment (e.g. reducing, reusing, recycling; food choices).

Find out more about **Hinkley Point C** and **careers in the nuclear industry**

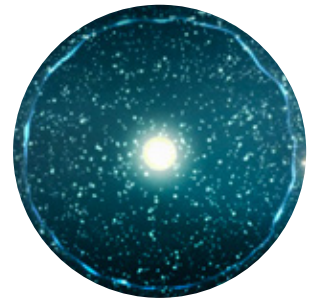
WARM-UP

3-minute challenge!

Write down in three minutes as many things as you can think of in your home that need electricity to operate.

THE MAIN ACTIVITY

Part 1: Where do we get our power from?



Which of the energy sources above are renewable or non-renewable?
Fill in the table below with your answers.

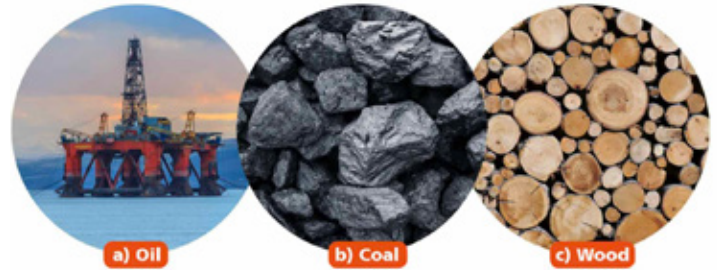
RENEWABLE ENERGY RESOURCE:	NON-RENEWABLE ENERGY RESOURCE:
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Part 2: Quiz time!



1. Q. Which of these is a renewable energy source?

A. _____



3. Q. Which one of these is NOT a fossil fuel?

A. _____



2. Q. Non-renewable energy sources – like coal, gas and oil – are limitless: true or false?

A. _____



4. Q. Which of these produces the most reliable long-term supply of energy?

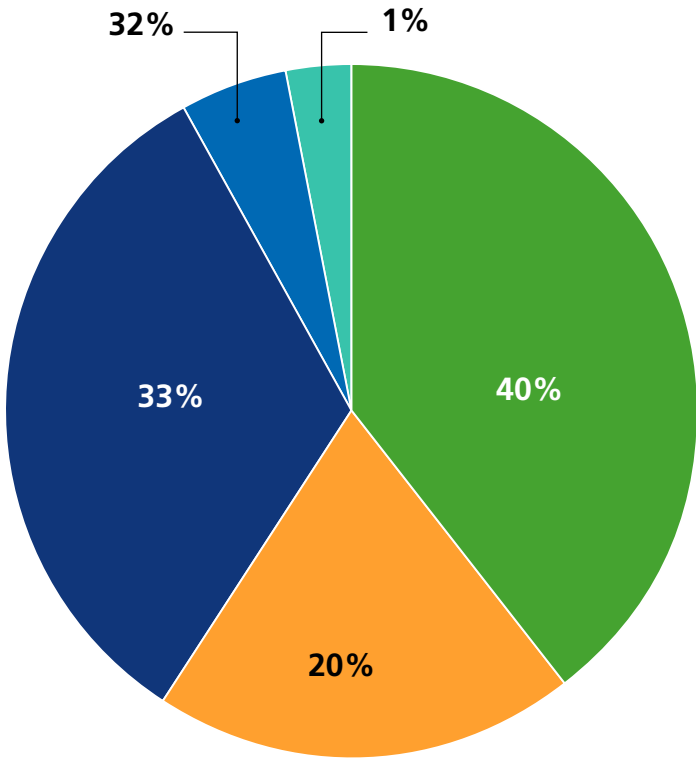
A. _____

5. Q. Name FOUR low-carbon energy sources.

A. _____

Part 3: Pick 'n' mix

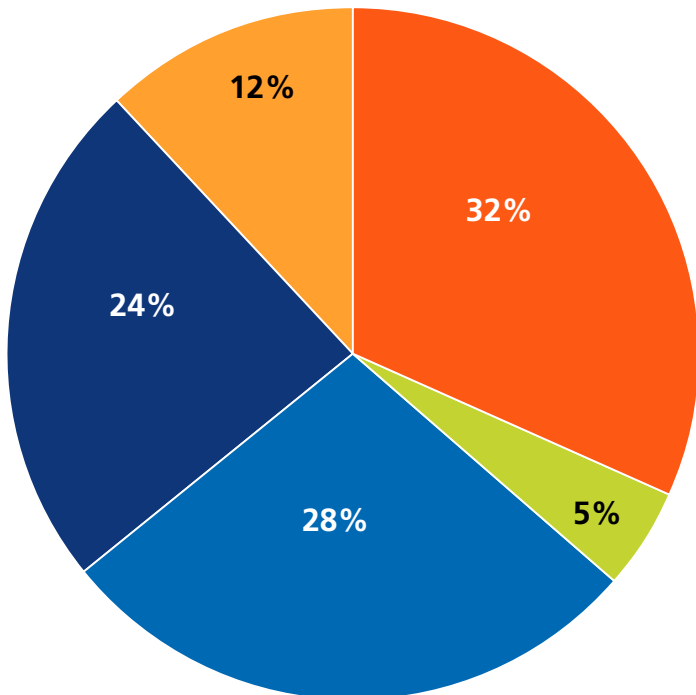
Look at each the pie charts below for the UK's energy mix. Using the clues and what you've just learnt, can you work out which percentage matches each energy source?



1. The UK's energy mix in 2018

- Gas: _____
- Coal: _____
- Renewables: _____
- Nuclear: _____
- Other fuels: _____

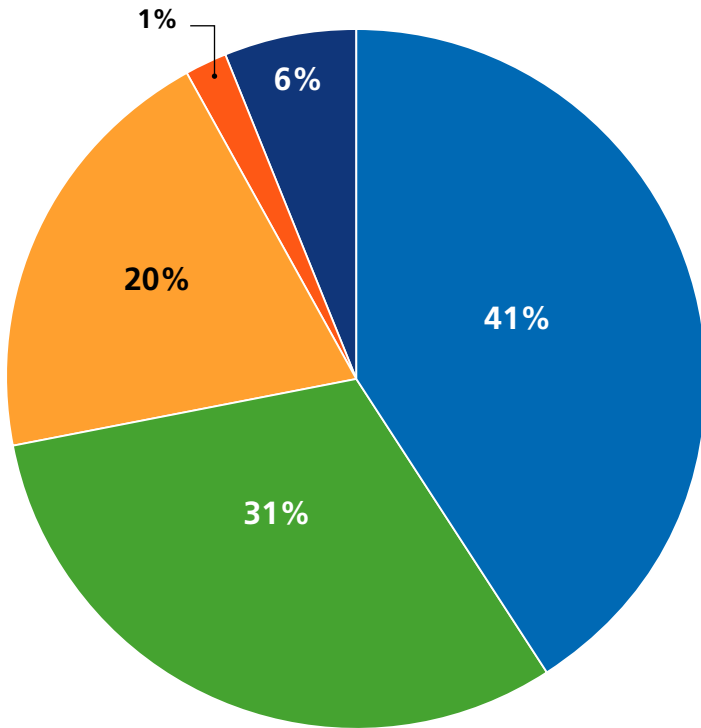
Clue: The UK's main energy source is still a fossil fuel.
Clue: Renewables contributed a record amount to electricity generation in 2018.



2. What was our renewables energy mix in 2018?

- Onshore wind: _____
- Offshore wind: _____
- Hydro: _____
- Solar: _____
- Bioenergy: _____

Clue: We have more onshore than offshore wind farms
Clue: Bioenergy has replaced coal in some old power stations (and there were a lot of old coal power stations!)



3. The UK's energy mix in 2006

Nuclear: _____

Gas: _____

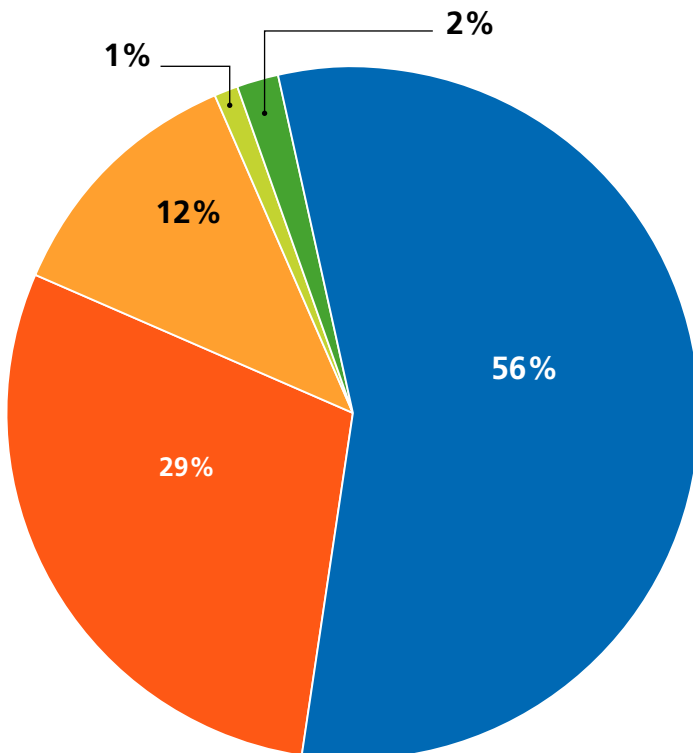
Coal: _____

Oil: _____

Other:
(includes hydro and renewables)

Clue: In the early 2000s, we were still heavily reliant on fossil fuels.

Clue: Nuclear power generated a fifth of electricity in this year...



4. The UK's energy mix in 1972

Hydro: _____

Gas: _____

Oil: _____

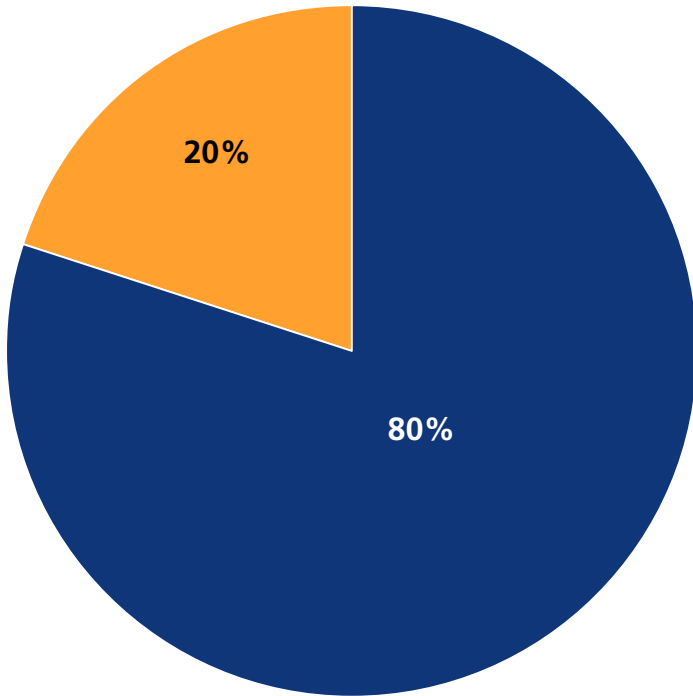
Nuclear: _____

Coal: _____

Clue: Until the 1970s, the UK had been reliant on coal, so this was still an important part of the energy mix at the start of the 1970s.

Clue: Another fossil fuel became a major source of electricity generation in the early part of the 1970s... Can you name it?

Clue: Gas wasn't a big contributor to our energy mix in the 1970s.



5. The UK's energy mix in 2050

Nuclear: _____

Renewables: _____

Clue: The UK wants to achieve 'net-zero' emissions by 2050. This means we need to be 100% reliant on low-carbon energy sources by this date... How much do you think each low-carbon energy source will contribute to the energy mix?

HOMESCHOOL ACTIVITY

Choose from one of the following:

1. What power sources are near you? Can you think of why they might be located near you? (E.g. a nuclear power station needs to be near water.)

2. Look on Gridwatch on 3 different days over a week. Fill in the table below with the three main energy sources that contributed to the UK's electricity on each date, and their percentage contribution. We've included an example for you:

DAYS OF THE WEEK	THE THREE MAIN POWER SOURCES
Friday 1 May 2020	CCGT (type of gas) – 29% Nuclear – 20% Wind – 13%
_____	_____
_____	_____
_____	_____

3. Complete the table below, giving at least one pro and one con for each energy source:

ENERGY SOURCE	PROS	CONS
Nuclear		
Gas		
Wind		
Solar		

Find out more about **Hinkley Point C** and **careers in the nuclear industry**