



## Traditional coal

### How was it formed?

Coal was formed around 300 million years ago when the world was covered with tropical forest.

There was not much oxygen. Bacteria that would normally rot the plants could not do so.

In swampy places, plants died and fell into the water and mud.

The plants and wood physically and chemically changed into coal over millions of years.

### How is it used to generate electricity?

Coal is burned to heat water. This produces steam which pushes against the blades of turbines, causing them to spin. The turbines are connected to generators, which create electricity.

#### FACT

##### Coal

###### Status

Non-renewable

###### Where can you find it?

Wales, Scotland, northern England, China, USA, India, South Africa, Australia, Russia, Poland, Columbia and the Ukraine are the major producers

###### How many power stations in the UK?

17 (100MW and above)

###### The future?

Coal reserves should last until the end of the 22nd century. The existing coal-fired power stations are all quite old and most will need to close or fit new emission control equipment in the next 8-10 years

#### Advantages and disadvantages of using coal to generate electricity

##### Advantages

- Burning coal is one of the cheapest ways to generate power at the moment
- Coal power stations can be built anywhere where there are good transport links and where there is a plentiful supply of cooling water
- The world has many coal reserves

##### Disadvantages

- Burning coal produces carbon dioxide, which contributes to the greenhouse effect. It also produces sulphur dioxide, a gas found in acid rain
- Coal is not renewable. There are limited supplies which will run out one day
- Coal-fired power stations need huge amounts of fuel



## Oil

### How was it formed?

Oil was formed millions of years ago. Dead organic material built up on ocean floors, riverbeds and swamps. It mixed with mud and sand.

More sediment piled on top. The heat and pressure changed this layer into kerogen.

Over time, kerogen breaks up into shorter, lighter molecules and is mostly carbon and hydrogen.

If this mixture is liquid, it will turn into crude oil.

### How is it used to generate electricity?

Oil is burned to heat water. This produces steam which pushes against the blades of turbines, causing them to spin. The turbines are connected to generators, which create electricity.

#### Advantages and disadvantages of using oil to generate electricity

##### Advantages

- Oil is easy to transport by pipeline or ship
- Oil-fired power stations can be built anywhere where there are good transport links and where there is a plentiful supply of cooling water
- A large amount of electricity can be generated from one power station quickly

##### Disadvantages

- Burning oil produces carbon dioxide, which contributes to the greenhouse effect
- It also produces other emissions eg sulphur dioxide
- Oil is not renewable. The world's supply of oil is running out quickly
- Using oil is very expensive compared to coal and gas

#### FACT

##### Oil

##### Status

Non-renewable

##### Where can you find it?

North Sea, but there are also small fields in south England

##### How many power stations in the UK?

2 (100MW and above)

##### The future?

Oil reserves should last until the middle of the 21st century



## Gas

### How was it formed?

Gas was formed millions of years ago. Dead organic material built up on ocean floors, riverbeds and swamps. It mixed with mud and sand.

More sediment piled on top. The heat and pressure changed this layer into kerogen.

Over time, kerogen breaks up into shorter, lighter molecules and is mostly carbon and hydrogen.

If this mixture is gaseous, it will turn into natural gas.

### How is it used to generate electricity?

Gas is burned in a turbine, like a jet engine on a plane, but bigger. This turns a generator, producing electricity.

The hot exhaust gases are then used to make high-pressure steam, which is fed into a steam turbine, which turns another generator, making even more electricity. It is very efficient!

Sometimes, the steam from the back end of a turbine can be used to provide heat to houses or offices. It can also be used for processes such as making paper or chemicals.

### Advantages and disadvantages of using gas to generate electricity

#### Advantages

- Gas is light and easy to transport by pipeline
- Large amounts of electricity can be generated from one gas-fired power station
- Gas-fired power stations are normally built near rivers and the gas pipeline network but they can be built anywhere

#### Disadvantages

- Burning gas produces carbon dioxide, which contributes to the greenhouse effect
- Gas is not renewable. There is a limited supply, which will eventually be used up
- The UK is importing most of its gas. This means that our energy supplies may become quite costly if wholesale prices rise

### FACT

#### Gas

#### Status

Non-renewable

#### Where can you find it?

North Sea and Irish Sea. It is also found in Russia, Eastern Europe, Norway, the Middle East and Africa

#### How many power stations in the UK?

36 (100MW and above)

#### The future?

Gas reserves will last until late in the 21st century

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## Nuclear energy

### What is it?

Nuclear power is generated by splitting uranium atoms into lighter elements.

Neutrons are fired at them to do this. This process is called nuclear fission.

As the atoms split, they release more neutrons and these split more uranium atoms and so on...

This is a chain reaction. It produces lots of heat energy.

### How is it used to generate electricity?

The heat produced by nuclear fission is used to heat water. This produces steam which pushes against the blades of turbines causing them to spin. The turbines are connected to generators, which create electricity. The steam generated in modern nuclear power stations is lower pressure than coal and oil stations.

### Advantages and disadvantages of using nuclear power to generate electricity

#### Advantages

- Uranium is readily and cheaply available, and nuclear fuel is easily stored
- A small amount of nuclear fuel produces a lot of electricity
- Nuclear power stations do not produce any carbon dioxide from nuclear fission

#### Disadvantages

- Nuclear power stations may be unpopular with people who are concerned about how safe they are
- Nuclear energy is not renewable. When uranium runs out it cannot be replaced
- Nuclear energy produces radioactive waste which must be buried in sealed containers for a long time
- Nuclear power stations cannot be switched on and off easily

### FACT

#### Nuclear energy

##### Status

Non-renewable

##### Where can you find uranium?

Several places across the world. Canada is the largest exporter, but Australia has the most uranium

##### How many stations in the UK?

11

##### The future?

All but one of the UK's nuclear power stations will be shut down by 2023



## Hydroelectric energy

### What is it?

Indirect solar power drives the Earth's water cycle. Energy from the Sun evaporates water from seas and lakes.

This water then falls as rain. Some ends up in lakes and reservoirs, high above sea level.

This water has gravitational potential energy.

It is transformed into kinetic energy as it flows down towards the sea.

### How is it used to generate electricity?

The kinetic energy of flowing water spins a turbine which is connected to a generator which creates electricity.

#### Advantages and disadvantages of using hydroelectric energy

##### Advantages

- Once the plant is built, operating costs are very low, so the energy produced is virtually free
- It does not produce any carbon dioxide, which can lead to global warming, making countries hotter and drier
- It is sustainable - the rain that fills the reservoir never runs out
- Dams store water so we can control when electricity is made
- Power output can be increased very quickly to meet sudden demand
- Electricity can be generated constantly as long as there is enough water

##### Disadvantages

- Dams are very expensive to build
- Valuable land is flooded when a reservoir is made: homes and wildlife habitats can be lost
- A good site for a hydroelectric power plant, such as a mountainous region, is not always near towns where energy is needed
- There are not many suitable sites in the UK for new hydroelectric schemes

#### FACT

##### Hydroelectric energy

##### Status

Renewable

##### Where can you find it?

Hydroelectric power stations need to be near large lakes, reservoirs high above sea level or where a lot of water can be dammed

##### How many power schemes in the UK?

7 (50MW schemes)

##### The future?

It is unlikely that there will be a huge increase in hydroelectric power as all large-scale sites are being used, but some small-scale sites are being developed

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## Wind energy

### What is it?

Wind is created by the uneven way the Sun heats the Earth's atmosphere.

Warmer regions in the atmosphere are less dense than surrounding cooler areas.

The air in these warm regions rises.

The cool air that rushes in to replace it is what we know as wind.

### How is it used to generate electricity?

The blades of a wind turbine work in the same way as an aeroplane's wings. When air flows around an aeroplane's wings it creates low pressure above that lifts the aeroplane. Similarly, when air flows around the blades of a wind turbine, it creates low pressure that turns it round. The blades are linked to a generator, and as it rotates it generates electricity.

#### FACT

##### Wind

##### Status

Renewable

##### Where can you find it?

Anywhere it is windy. These tend to be hilly areas or offshore

##### How many wind farms in the UK?

Over 135 wind farms generating over 1900MW, of which over 20 are greater than 25MW

##### The future?

There is huge potential for development of wind power in the UK. The British Wind Energy Association estimates that wind power could supply 3.3 million homes by 2010 which is about 8% of total demand

#### Advantages and disadvantages of using wind to generate electricity

##### Advantages

- Once the wind turbine is built, running costs are very low
- It does not produce any carbon dioxide, which contributes to the greenhouse effect
- The land occupied by a wind farm can still be used for farming
- Wind is a renewable source so it will not run out
- Wind farms are safe and easy to build

##### Disadvantages

- We cannot control when the wind blows. Wind turbines shut down in very strong or very weak winds
- They can only be built in certain areas. These areas need to be windy places, usually hilly areas or coasts
- Not everyone likes the appearance of wind farms



## Solar energy

### What is it?

Solar energy comes from the Sun. It is a star that produces massive amounts of energy.

Nuclear reactions in the Sun's core turn millions of tonnes of hydrogen into energy every second.

The energy radiates into space.

Travelling at the speed of light, a small fraction of this energy reaches Earth about eight minutes after it leaves the Sun.

### How is it used?

Solar photovoltaic (PV) cells convert light energy into electricity. They can be arranged in panels and fitted to roofs and the sides of buildings.

Active solar water heating is an easy source of hot water. Fluid inside a black panel, tilted to face the Sun, heats up and is then circulated to the hot water tank inside the house. There, the heat is transferred to the household water system for use in the home.

### FACT

#### Solar

##### Status

Renewable

##### Where can you find it?

Large-scale solar plants are only cost effective where there is lots of sunshine

##### How many systems in the UK?

There are over 100,000 small solar heating systems in the UK, but very few houses have solar PV panels

##### The future?

The UK climate is not really suitable for it to become a major source, but it could still play a role in water heating systems and electricity generation for the home

### Advantages and disadvantages of using solar energy to generate electricity

#### Advantages

- Solar energy is renewable and the Sun's heat and light are free
- Solar energy can be used to generate electricity in remote places where other electricity supplies are hard to come by
- It does not produce any carbon dioxide, which contributes to the greenhouse effect
- Energy is usually generated at or near to the location it will be used. This keeps transmission and distribution costs to an absolute minimum

#### Disadvantages

- PV cells do not work so well when it is cloudy and do not work at night
- The UK is not a very sunny country! Solar power works better in hot places, so its use is therefore limited

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## Biomass

### What is it?

All the Earth's living material or 'biomass' exists in a thin layer around the surface of the planet.

This is called the biosphere.

It is a huge store of energy.

It is continually replenished by the Sun through photosynthesis.

### How is it used to generate electricity?

Biomass is any plant or animal matter, including plant and animal waste and human sewage. Energy crops are plants grown specifically for fuel. Biomass is burnt directly in boilers to produce steam, which turns a turbine and generator to make electricity.

Human sewage can be broken down to produce methane, which also can be burnt to produce heat and electricity.

### Advantages and disadvantages of using biomass to generate electricity

#### Advantages

- It is renewable - new plants and trees can be grown to replace those used for fuel
- It supports farmers and foresters by providing markets for their crops
- It is a carbon neutral source of energy. This means that the amount of carbon dioxide released when the fuel is burnt is the same as the amount of carbon dioxide absorbed by the plants when they were growing

#### Disadvantages

- It is an expensive method of generating electricity
- Biomass power plants need to be built near a plentiful supply of biomass fuel

### FACT

#### Biomass

#### Status

Renewable

#### Where can you find it?

It is all around us

#### How many power stations in the UK?

Most coal-fired power stations now co-fire a percentage of biomass in the fuel. A number of dedicated biomass power plants up to 44MW are currently generating in the UK

#### The future?

As it becomes easier to collect, process and convert, biomass will become an increasingly popular option

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## Hydrogen fuel cells

### What are they?

Water is a compound of hydrogen and oxygen.

If you pass an electric current through water, its bonds can break, turning it back into hydrogen and oxygen.

Hydrogen and oxygen are released as gases. This is called electrolysis.

BUT a fuel cell is a device that uses this process in reverse.

### How are they used to generate electricity?

They convert hydrogen and oxygen into water, producing electricity and heat.

#### Advantages and disadvantages of using hydrogen fuel cells to generate electricity

##### Advantages

- The only wastes produced are water and some heat, which can be reclaimed
- Operation is entirely silent
- Fuel cells can be built in a huge range of sizes to suit almost any use

##### Disadvantages

- Fuel cells rely on hydrogen fuel, which may be produced using non-renewable energy sources
- It will be some time before hydrogen is as freely available as petrol is at the moment
- Hydrogen is highly flammable

#### FACT

##### Hydrogen fuel cells

##### Status

Renewable if the hydrogen fuel is created from renewable sources

##### Where can you find it?

In theory, it is possible to use the oxygen in the air, and the hydrogen in water

##### How many plants in the UK?

There are a handful of small-scale plants that supply single or small groups of buildings

##### The future?

It has great potential for small-scale use, but it is unlikely the UK will develop large-scale plants in the near future



## Geothermal energy

### What is it?

Heat comes from deep below the surface of the Earth in a layer called the mantle.

Molten rock from the mantle can rise, bringing heat nearer to the surface.

In some places, water deep beneath the Earth's surface is heated up.

This water returns to the surface as natural hot springs and can be used for geothermal energy.

### How is it used to generate electricity?

Man-made holes are drilled down to a hot area beneath the surface so that water can be pumped down. It is heated and then drawn up again. It can be used to heat homes, or if really hot, to drive steam turbines to generate electricity.

### Advantages and disadvantages of using geothermal energy to generate electricity

#### Advantages

- Geothermal energy does not produce any pollution
- Running costs for a geothermal power station are very low

#### Disadvantages

- It is difficult to find suitable sites to put a geothermal power station
- If not carefully managed, a borehole can 'run out of steam' and may not be useable for several decades
- Dangerous gases and minerals can come out of a borehole, which may be difficult to dispose of

### FACT

#### Geothermal energy

##### Status

Renewable, but overuse can damage boreholes for many years

##### Where can you find it?

Volcanic places, like Iceland

##### How many stations in the UK?

There are none that produce electricity, but one in Southampton supplies heat

##### The future?

The potential for electricity generation is limited because the UK is not volcanic, but geothermal energy may be used for heating on a small scale



## Ground source energy

### What is it?

Ground source energy can be extracted from the low-temperature heat found at shallow depths in the Earth's crust.

This temperature stays relatively constant.

The heat can be taken directly from the Earth or a shallow coil system is used just below the surface of the ground.

At this depth it actually uses indirect solar power. It is a great way to heat or cool a house.

### How is it used?

There is a circuit of underground pipes outside the house, and a heat pump inside the house. Anti-freeze circulates in the pipes, absorbing the heat from the soil around it.

This heat is transferred into a liquid where it is boiled, compressed and vaporised, and passed through the system to make heat.

The system can be run in reverse so it takes heat from the house and transfers it to the ground.

### FACT

#### Ground source energy

##### Status

Renewable as it is indirect solar power

##### Where can you find it?

Anywhere you could lay a pipe just below the surface of the ground. Some systems also use boreholes and heat pumps to raise the temperature to 40–50°C for under-floor heating and radiators

##### How many systems in the UK?

About 250 systems are installed every year in the UK

##### The future?

The use of ground source energy for individual homes is likely to increase as installation prices drop

### Advantages and disadvantages of using ground source energy

#### Advantages

- It does not produce any pollution
- Running costs are very low
- It reduces heating bills and consumption of other, non-renewable, energy resources
- All pipe-work is below ground so there is minimal effect on the environment

#### Disadvantages

- The effectiveness of the system will vary with the seasons. However, installing the correct amount of pipe should make up for this variation



## Wave energy

### What is it?

There are oceans, rivers and lakes across the world.

Wind is created by warmer air rising and cooler air replacing it.

The wind blows over these bodies of water.

This makes the water move. These are waves.

### How is it used to generate electricity?

There are several different ways to capture wave energy: from trapping waves to bobbing buoys. Wave energy devices can be fixed to the shoreline or placed out at sea. These are two of the devices:

**Oscillating water columns** contain a turbine. The waves below act like a piston when they move, pushing air up and down making the turbine rotate. It is attached to a generator which produces electricity.

**Point absorbers** capture energy as different parts of them move with the waves. This movement can be used to pump air or liquid through a turbine, which is attached to an electricity generator.

### FACT

#### Wave energy

##### Status

Renewable

##### Where can you find it?

Almost anywhere in the world. The UK has some very good places off north-west Scotland, Wales and south-west England

##### How many stations in the UK?

There are dozens of devices under development

##### The future?

It has great potential. 3% of the UK's energy could be generated from wave power by 2020. That is almost the same as all renewable sources at the moment. It is a promising alternative

### Advantages and disadvantages of using wave energy to generate electricity

#### Advantages

- It is a huge potential resource for the UK
- It is a more predictable energy source than wind
- There are no fuel costs, unlike conventional power generation

#### Disadvantages

- Equipment needs to be designed to survive bad weather conditions such as storms
- There may be high maintenance costs, because the devices can be far out at sea
- There is no leading device at the moment



## Tidal energy

### What is it?

Tides are caused by the gravitational effects of the Sun and Moon on our oceans.

In the UK this creates a rise and fall in sea height, twice a day.

Tidal streams are fast-moving currents caused by the movement of water between high and low tide.

The amount of energy you can get depends on the size and speeds of the streams.

### How is it used to generate electricity?

There are several different ways to capture tidal energy: from trapping tides in lagoons or reservoirs to underwater turbines, like propellers in tidal streams. Here are three types of devices.

Artificial **tidal lagoons** or **reservoirs** trap water through turbines built onto an artificial wall as the tide rises, generating electricity as they fill up. The water is released slowly through the turbines to generate power as the tide falls.

A **tidal barrage** can be built across an estuary. Like a lagoon, it holds water back and creates a difference in tidal height. Water is then released through turbines to generate electricity.

Devices are placed directly into **tidal streams** and extract energy as water flows through and over blades, like a wind turbine.

### FACT

#### Tidal energy

##### Status

Renewable

##### Where can you find it?

Almost anywhere in the world but the best places are where water cannot flow easily, around headlands or between islands. The UK has strong tidal streams and high tidal ranges

##### How many stations in the UK?

There are dozens of devices under development

##### The future?

The UK has some of the best locations for tidal energy - enough to make a significant contribution to the UK's energy needs. The UK is fast developing the industry and hopes to be the world leader in tidal technology

### Advantages and disadvantages of using tidal energy to generate electricity

#### Advantages

- Tides are predictable
- Once the plant is built, operating costs are very low, so the energy produced is very cheap
- It does not produce carbon dioxide or waste
- It needs no fuel

#### Disadvantages

- The plants can only produce power when the tide is flowing in or out - around 20 hours a day
- Barrages can be very expensive to build
- There is no one leading tidal stream device at the moment



## Generating electricity

We can use almost any source of energy to produce electricity and various processes are used to transform the energy into electrical power. Most methods involve using the energy source to create rotational energy which is used to turn an electrical generator. The generator produces the electricity.

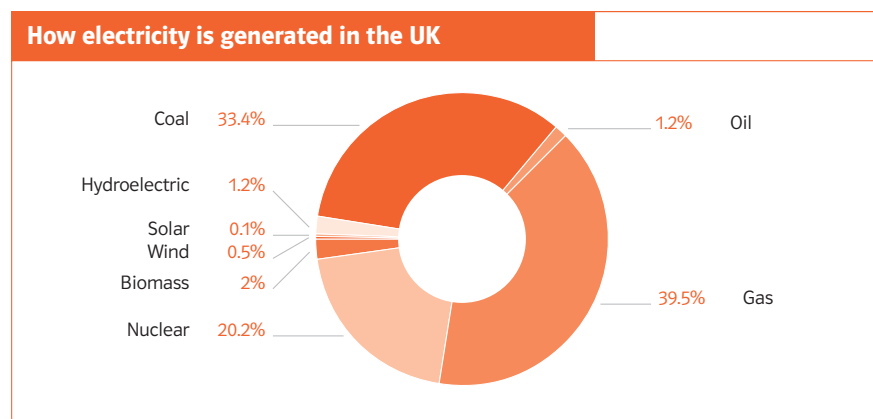
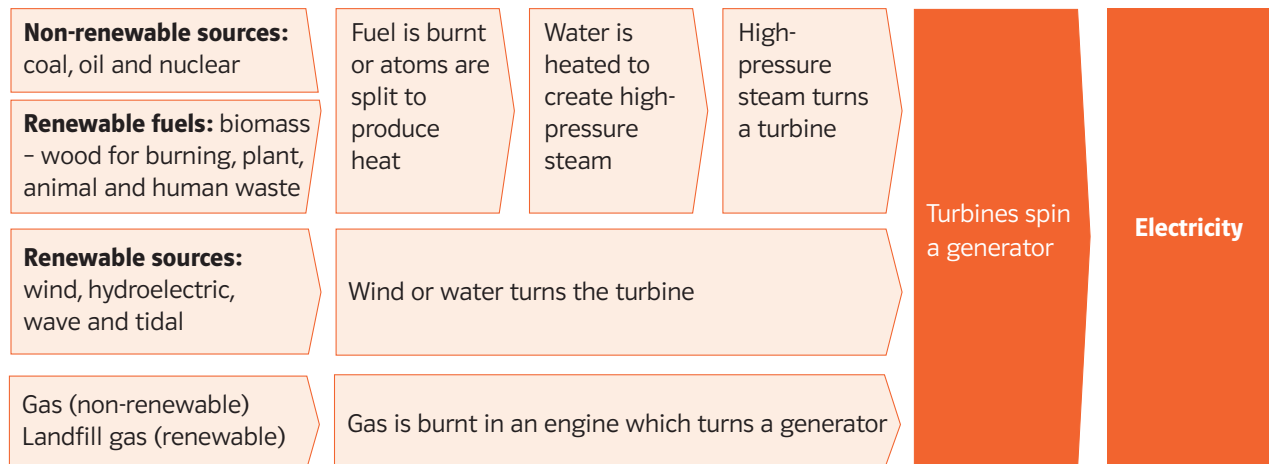
The exceptions are:

- **solar photovoltaic (PV) panels**, which convert the Sun's energy directly into electricity
- **hydrogen fuel cells**, which produce electricity by joining hydrogen and oxygen atoms together to produce water and electricity

These sources are only currently used on a small scale in the UK. They are ideal for 'micro-generation'. This is where individual homes and buildings produce their own electricity.

All large-scale power stations in the UK use generators to produce their electricity. These produce electricity by spinning powerful magnets inside large coils of wire. A large generator generally produces electricity at 22,000 volts.

Turbines used in generating electricity can be spun by different means:



As there are no reliable figures for wave and tidal electricity generation, the figures in the chart do not quite add up to 100%



## Distributing electricity

**You know that the electricity you use at home is generated in a power station, but do you know how it gets to you?**

### The National Grid

The electricity generated in the UK is fed into the National Grid, a giant network of overhead lines and underground cables used to transport all electricity supplies around the country.

Power stations generate electricity which is fed into the National Grid. The National Grid is responsible for forecasting how much electricity will be needed at different times of the day. This is so that the supply of electricity always meets demand. This is very important because electricity cannot be stored.

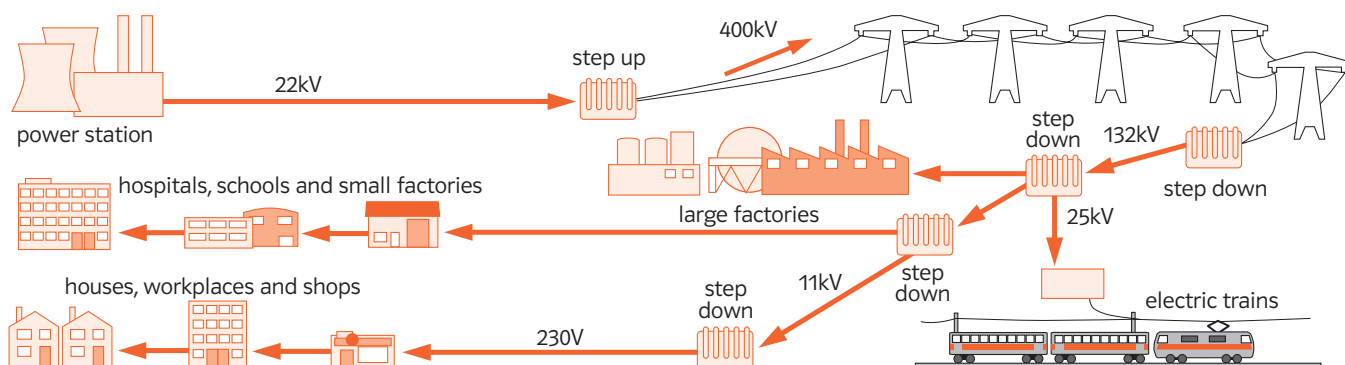
The National Grid has to take all kinds of things into account when predicting demand. It has to look at weather forecasts, a cold night can mean high demand as people switch on electric fires and plug in electric blankets. It also checks TV guides. A film premiere, football match or a Big Brother eviction can mean that several million people all turn their kettles on for tea at the same time when the adverts come on!

The National Grid constantly manages supply and demand on a second by second basis. Local distribution companies manage the distribution of electricity to homes and businesses.

### Importing power

If we cannot produce enough electricity to meet demand, we can import electricity from Europe. This is done through a large cable that runs under the English Channel and links the UK and France. The cable is called the UK-France Interconnector.

The Interconnector can be used the other way around as well. If we have more electricity than we need in the UK, we can sell electricity to France.





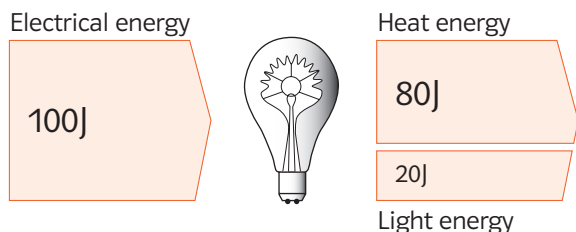
## Electricity in the home

Think of all the things at home that use electricity. There are a lot! In fact, the only things that might not be powered by electricity are your central heating and hot water systems, which could be gas- or oil-powered (although with electrical timers), and your cooker, which may be gas-powered.

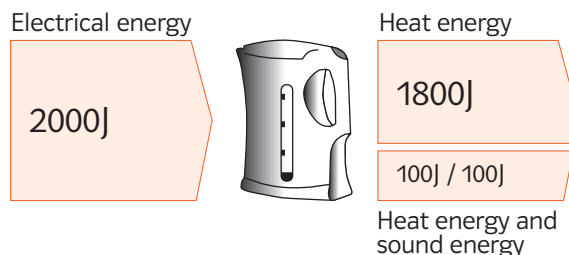
We can use electricity to power our lights, televisions, computers, heaters, fridges and much more because electrical energy is very easy to transform. We can transform it easily into light, heat, chemical, kinetic and sound energy. No other type of energy is quite this flexible.

There is always some wastage, though. Some of the electrical energy we put into a device is transformed into a type of energy that is of no use to us. Here are a few examples.

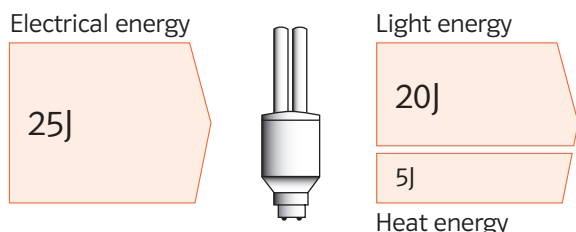
### Tungsten filament light bulb



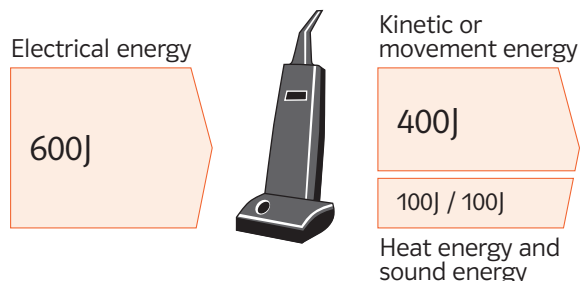
### Kettle



### Low-energy light bulb



### Vacuum cleaner



Did you notice that the total amount of energy coming out of an appliance is exactly the same as the amount of electrical energy that went in? Although some is wasted as heat or sound energy, it is never destroyed. This is called the conservation of energy.

Of course, electricity is not free. The wires in your house are connected to the local electricity network. This electricity is more powerful than the electricity from batteries because it has a higher voltage. A battery is around 1.5 volts, while mains electricity is 230 volts. There is a meter installed somewhere in or around your house. The meter measures how much electrical energy you use. This energy is measured in units and you are charged for every unit you use. The cost varies but is currently around 9p per unit.



## Climate change and the environment

### What is the problem?

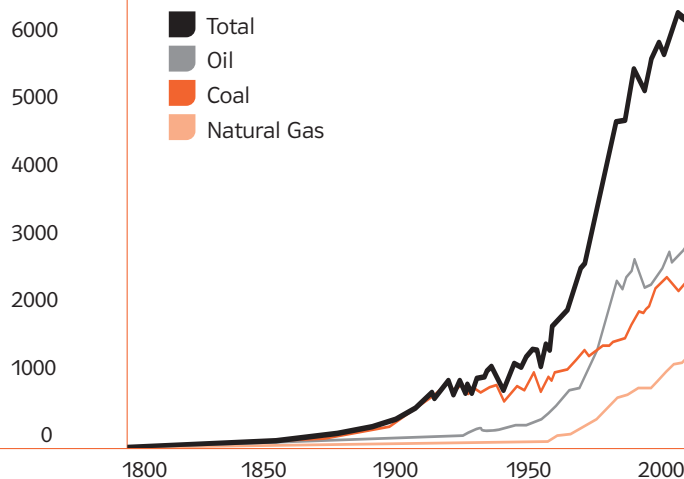
Scientists believe that the huge amount of fossil fuels we burn to produce electricity is damaging the environment.

Burning fossil fuels releases carbon dioxide into the air. It is a 'greenhouse gas' and traps heat in the atmosphere, in the same way as glass windows trap heat inside a greenhouse. The more carbon dioxide in the atmosphere, the more heat is trapped. This is called **the greenhouse effect**.

Scientists believe the greenhouse effect is causing the Earth's climate to change.

### Global fossil carbon emissions\*

Million metric tons of carbon dioxide / year



### What could happen?

If climate change continues at the current rate, it will get much **warmer** and **wetter** in the UK within your lifetime.



#### Warmer

- Annual average temperatures across the UK may rise between 2-3°C
- Warmer summers will be very common
- Very cold winters will be rare and snowfall in the UK will decrease



#### Wetter

- As it gets warmer, it will get wetter. As the polar ice melts, sea levels will continue to rise
- Around the UK sea levels could rise between 26cm and 86cm
- Flooding will be widespread and low-lying coastal areas like the Fens in Cambridgeshire and areas around estuaries like the Thames will be particularly at risk

### What is being done?

Governments around the world are setting targets to reduce carbon dioxide emissions and investing in renewable sources and new technologies that could lead to 'cleaner' electricity. These include hydrogen fuel cells and generating electricity through nuclear fusion - the same process that powers the Sun.

### What can I do?

Small things like...

- turning your television off instead of keeping it on standby
  - only boiling the water you need when using the kettle
  - using energy saving light bulbs and other energy efficient appliances
  - insulating your home
- ...make a big difference if everyone does it!**

\* Original data: Marland, Boden and Andres, 2003

"Global, Regional and National CO<sub>2</sub> Emissions" in *Trends: A compendium of Data on Global Change* Carbon Dioxide Information Analysis Center, US Department of Energy, Oak Ridge, Tenn.



## Safety first!

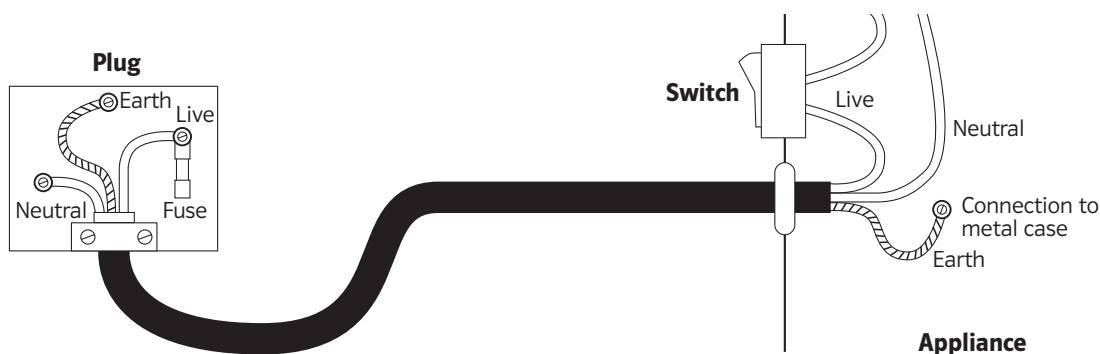
Electricity can kill if handled incorrectly. Every year people are seriously injured or killed when coming into contact with live electricity. We all need to know what the dangers are, and how to avoid them.





## Safe as houses

**We use electricity for many different things in our homes, so it has to be safe. Here are two common safety measures.**



A **fuse** is a thin piece of wire. If a too large current tries to pass through it, it will melt, and then break, and electricity can no longer pass through it.

Fuses are used in two ways in your home. You will find a fuse in every plug. The wire is contained in a small glass or ceramic cylinder with a metal cap on each end. Fuses come in different ratings. These tend to be in amps - 3A, 5A, or 13A. The rating tells you how much electrical current can pass through the fuse before it blows.

Different appliances need different fuses. A table lamp might need a 3A fuse, but an electric fire might need a 13A fuse. You need to check the plug to find out what fuse an appliance needs. If you use a fuse that is too low, your appliance might not work as it will not allow enough current through. If you use a fuse that is too high, the current can overload it and it could cause a fire.

Fuses are also used in the consumer unit or 'fuse box'. This distributes the electricity that comes into your home to different circuits, some for lighting and some for power. Each circuit has its own fuse, which works in the same way as the fuse in a plug.

**Residual Current Devices (RCDs)** can also be found in consumer units. RCDs detect if there is a difference between the current flowing in and out of a circuit. If it is working properly, there should be no difference. If there is a difference, it means that some electricity is escaping or leaking through a fault. The RCD switches the circuit off immediately, even faster than a fuse can melt. This can prevent you getting a shock if there is a fault.

**Remember: the fuse is a safety device. If it breaks, there is a fault!**