DISGUSTING & DREADFUL SCIENCE

Electric Shocks

and other energy evils

Lasers • Light

Circuits • Batteries

Lightning and much more...

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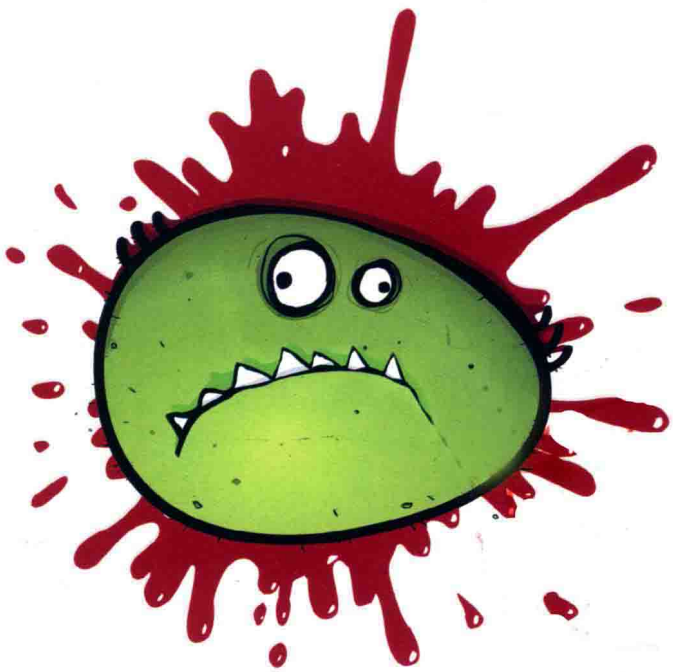

by Anna Claybourne

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Teaching and literacy notes

These notes and activities will help you to make the most of this book with your child or class.

READING

- Challenge the reader to find out information fast by using the index. For instance, where can they find out about Luigi Galvani?
- Read about Mary Shelley's book *Frankenstein*, published in 1818, on page 26. Encourage the child to read one of the many retellings that are available.
- Words in bold are in the glossary. Encourage the reader to use the glossary.

WRITING

- Wind power – what's not to like? Once they have been built, wind turbines use the wind to generate electricity. BUT not everyone likes them. Find out more about the case for, and against, wind turbines and write a newspaper article setting out both sides of the argument.
- Keep a record of the times that you use electricity in one day. That means everything, from turning on a light to charging your phone. Now imagine a day when you can't do any of those things – high winds have caused a power cut. What would you do instead? Write it down.
- This book is packed with quirky information about electricity, perfect material to create a quiz. Write your own electricity quiz to test out your friends' knowledge of the subject

SPEAKING AND LISTENING

- Discuss the case for and against pylons. They march across much of the countryside, carrying electricity from power stations to our homes and businesses. Electricity cables could be buried underground but it costs more to do so. Is that a good enough reason not to bury them out of sight? Is there more to the story?
- Should we all carry on using electricity as much as we like, relying on the hope that someone is gong to invent a new way of making electricity that doesn't involve burning coal or creating nuclear waste? Or should we all change the way we live now in order to consume much less electricity and therefore reduce the use of fossil fuels and the output of greenhouse gases?

ACROSS THE CURRICULUM

ART

- Design a poster highlighting the dangers of electricity. Some useful information is presented on page 14.

HISTORY

- Who invented the electric light bulb? Was it British inventor, Joseph Swan, or American inventor Thomas Edison? Or was it both? Find out and write a non-fiction report about the inventors of the light bulb.

SCIENCE

- Read about turbines on page 10. If you have a wind-up torch, give it to the child. Encourage the child to link their effort to what they have learnt about how electricity is generated.

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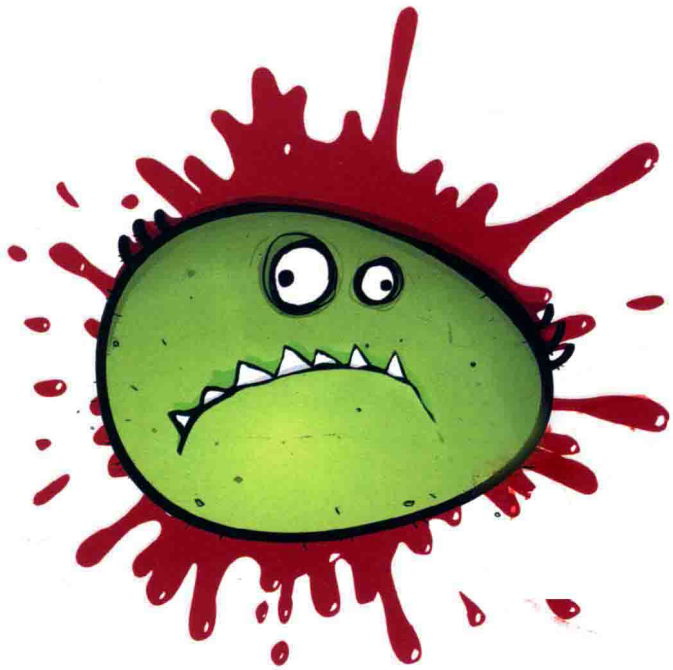

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Contents

ZZAPP!

CRACKLE! Yeeeouch! As you know, it's an incredibly bad idea to touch electric sockets, wiring or the insides of electric gadgets or machines. That's because electricity can give you a painful shock. It can even be deadly.

Ouch!

Electricity can flow through the human body, and this is why it can give us a shock. The stronger the current, and the longer it flows for, the more dangerous it is. Serious electric shocks can cause nasty burns, injuries and worse!

Living dangerously

So why on EARTH do we have something as powerful and dangerous as electricity flowing around inside our houses? It's because electricity is so useful, it has become almost essential. We're so used to it, we'd be lost without it!

Electricity is power

Electricity is a type of energy, and that means it can do things for us. All sorts of things! Since we discovered how to use it, we've come up with millions of very useful inventions that run on its power – cookers, fridges, lightbulbs, computers, traffic lights, microwaves, subway trains, radios... what else can you think of?

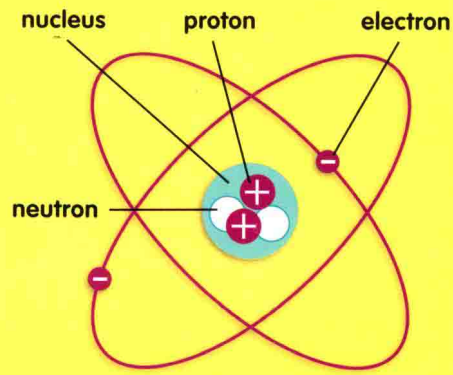
See for Yourself

Life without electricity

Make a chart listing all the electrical appliances you use on a particular day – such as electric lights, digital alarm, electric toothbrush, electric shower, fridge, kettle, TV, laptop and so on. Then work out how you would do these jobs without electricity. Is there anything you really couldn't live without?

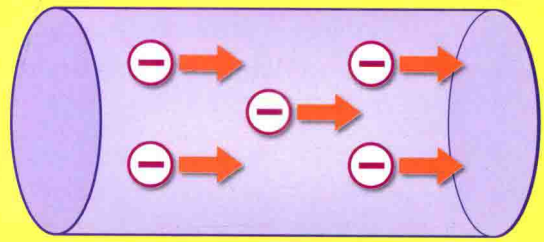
What is electricity made of?

Electricity comes in several forms and it can be hard to understand. Basically, it is a flow of particles, usually very small ones called **electrons**. Normally, electrons are not found on their own. They are tiny parts inside **atoms**, the building blocks that make up all the stuff around us.



Every atom is made up of a nucleus (packed with protons and neutrons) and electrons.

But in some substances, especially metals, electrons can break free, move around and flow through a substance – a bit like water flowing in a river. A flow of electricity is called an **electric current**, and something that has electricity flowing through it, such as a wire, is described as **live**.

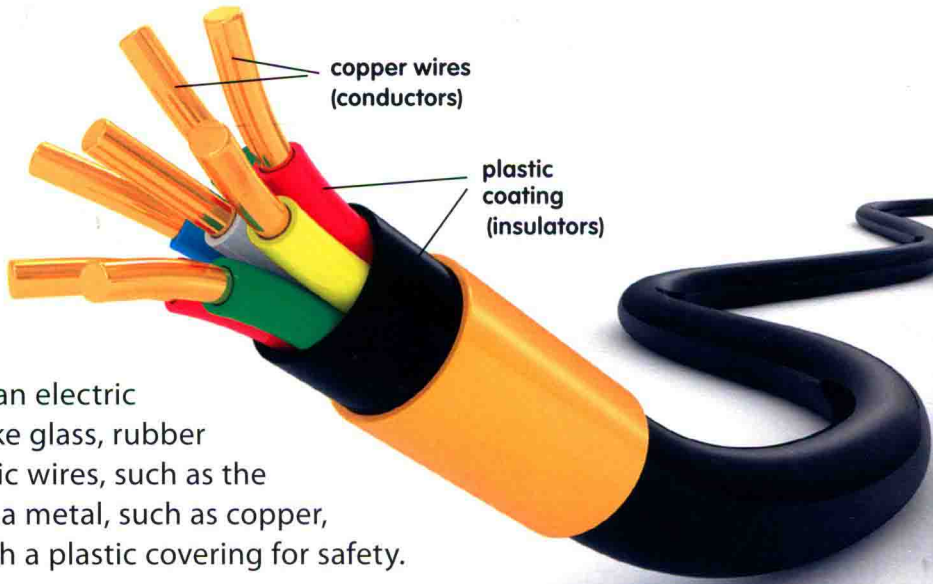


A live cable with electrons flowing through it.

World of wires

Electricity is (almost) everywhere. It's in our homes, it powers streetlights, signs, trains, schools and factories. All these places have to be connected by electrical wires, so that a supply of electricity can reach them.

Flow or no flow?



Only some materials, mainly metals, let electricity flow through them easily. They are called electrical **conductors**. Things that don't carry an electric current well are called **insulators** – like glass, rubber and plastic. That's why many electric wires, such as the one right, are made of a metal, such as copper, with a plastic covering for safety.

Pylon power

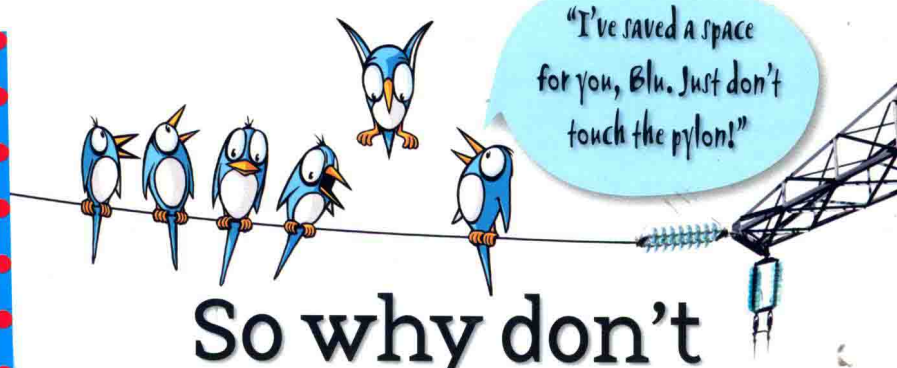
In most countries, there's a network or grid of big electrical cables criss-crossing the land. They carry electricity at a very high **voltage**, or energy level. Coming from these cables are wires that carry lower voltage electricity into the underground mains and into our buildings. Inside our houses, wires carry it around inside the walls to the power sockets.

Pylons are very hard to climb – for a good reason. If you did manage to get to the top of one, and touch a wire, the high voltage would frazzle you to a crisp!

Pylons are tall towers that carry electricity cables high above the ground.

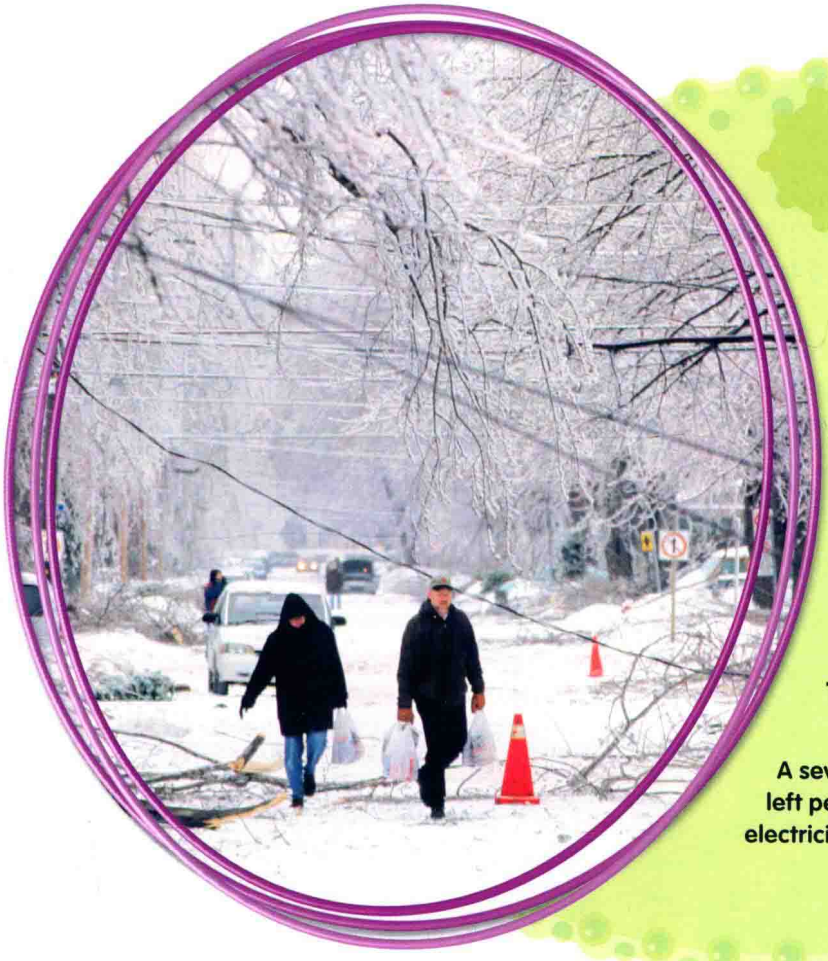
Yuck!

In the USA in 1889, electricity worker John Feeks met a horrible death working on power lines on a busy street in New York. As he was electrocuted, it is reported that his body sizzled and burned while horrified people below could only watch. His body dangled there for a long while before the power was switched off and it was safe to get him down.



So why don't birds fry!?

Birds sit on pylons and power cables and come to no harm. That's because a bird doesn't give the electricity in the wire anywhere else to go. The electricity keeps going along the easiest path – the wire itself. However, if part of the bird also touched the pylon, it would create an attractive path for the electricity, so it would flow through the bird and electrocute it.

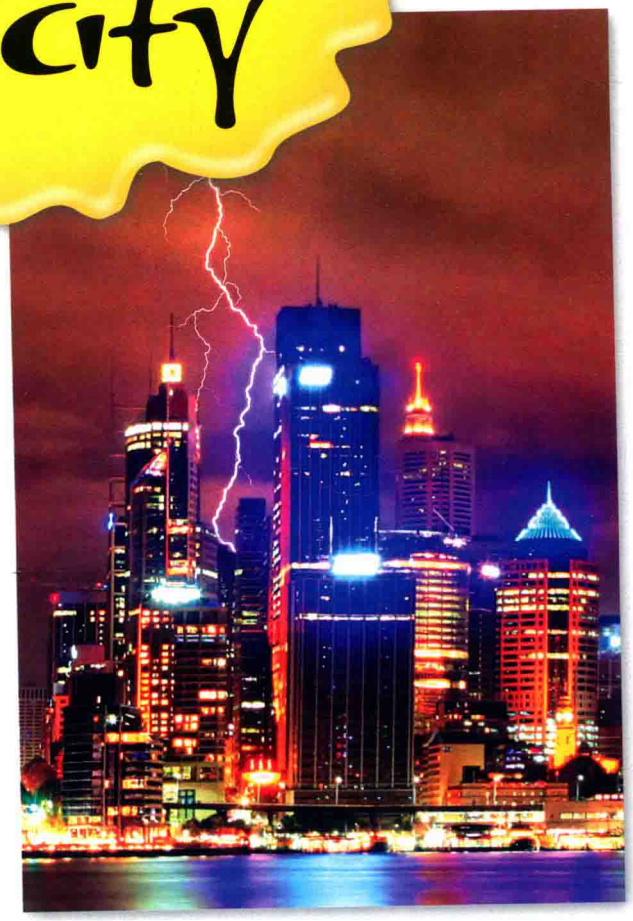


Do not touch!

Pylons and their cables can stand up to most rain, wind and snow storms – but there's one type of weather that can bring them down. In an ice storm, very cold rain falls and freezes onto every surface. Ice can build up on electricity cables, making them so heavy they snap. If you ever see one lying on the ground **DO NOT TOUCH IT!** Call for help instead.

A severe ice storm in Canada in 1998 left people across Quebec without electricity for weeks.

Electricity city



Over the past 300 years, we've gone from having no electric machines to being surrounded by them almost constantly. Setting up electricity supplies and cables is called electrification. It began in the UK and USA in the 1880s, and spread around the world. Today, every country has some kind of electricity supply, and in most places modern life depends on it.

We use electricity to heat water, cook, wash clothes, manage our money, learn, get around, light our homes, send messages and have fun. Of course, all this means that if the electricity was suddenly switched off, we'd be a bit stuck. In fact, it does happen, and it's called a **blackout** or power outage.

Yuck!

One yucky effect of a blackout is fridges and freezers losing their power. All that fresh food turns into stinky, rotten gloop. **Bleugh!**

DID YOU KNOW?

There are actually over a billion people in poorer parts of the world who do not have an electricity supply in their homes. But many of them still use electricity – at work or school, from batteries, or in wind-up electrical gadgets such as radios.

Blackout!

In 2003, a huge blackout hit the eastern USA and Canada when the electricity supply went wrong. It only lasted one night, but affected over 50 million people. Cities went dark, bank machines and tills closed down, trains stopped, and water cleaning systems failed, so people had to boil water to make it safe to drink.

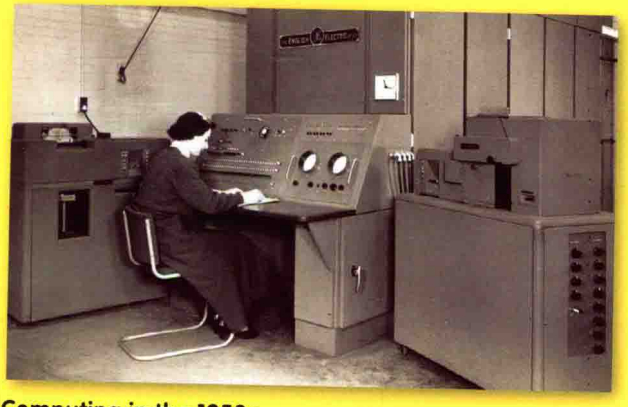
Rats have been the cause of some blackouts.

On the plus side, everyone got a great view of the Milky Way, usually only seen from unpopulated places such as Antarctica (as below)! Light from streets and buildings usually makes it very hard to see the stars clearly.

The computer age

Computers are one of the greatest electrical inventions of all. They contain tiny, very complicated electronic **circuits**. Electrical signals flowing around the circuits make the computer do all its calculations. This is how computers store facts, keep track of air traffic, access the Internet, and do all the other amazing jobs they do. Can you imagine life without them?

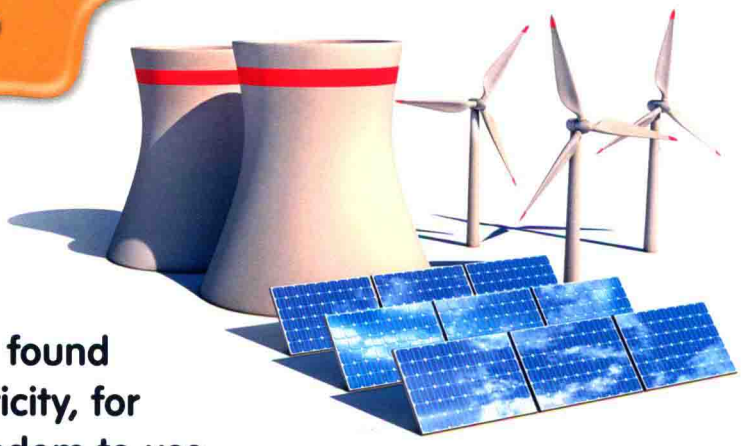
Over the years, we have invented smaller and smaller computer parts, and computers have shrunk and shrunk!



Computing in the 1950s.

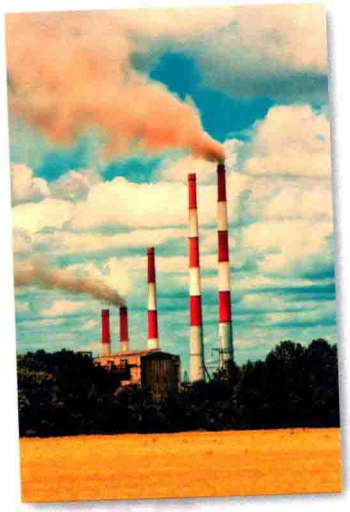
Computing as we know it today.

Power up!



We know electricity comes along wires. But where do we get it from? Electricity is found in nature – lightning is a type of electricity, for example. However, lightning is too random to use as an energy supply. Instead, we have to generate electricity. For that, we can use all sorts of things – fuels like coal, gas and oil, underground heat, wind, water, and even poo!

Wind farms and solar panels harness natural energy from the wind and the Sun. Nuclear power stations make natural substances react in a way that produces huge amounts of energy.



Spinning wheels

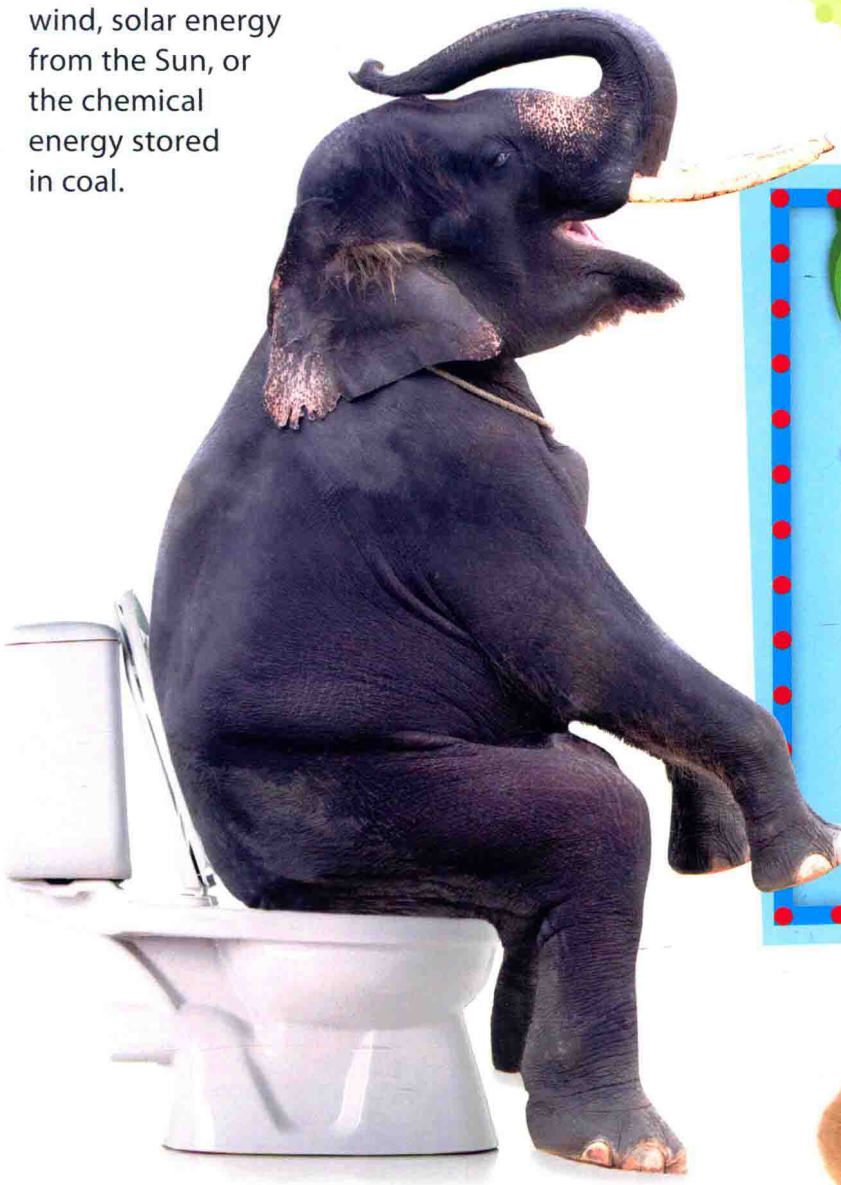
To make electricity, energy is used to generate a spinning movement – for example, a river makes a waterwheel turn and wind makes a windmill spin round. Or with a fuel such as coal, power stations (such as the one left) use it to heat water and make steam, which spins a machine called a **turbine**. Another machine, called a **generator**, then turns the spinning motion into an electrical current. It does this by making a magnet spin around inside a coiled-up piece of wire, which creates an electrical charge.

Turn it off!

At the moment, we get a lot of our electricity by burning fossil fuels like coal and gas. There are two big problems with that! **One**: fossil fuels are eventually going to run out. **Two**: burning fuels makes air pollution, which leads to global warming. So it's important to save electricity and only use what you need.

Energy swap

Electricity is a type of energy. You can't make energy out of nothing – you can only turn one form of energy into another. To get electricity, you have to use another form of energy – such as the flow of wind, solar energy from the Sun, or the chemical energy stored in coal.

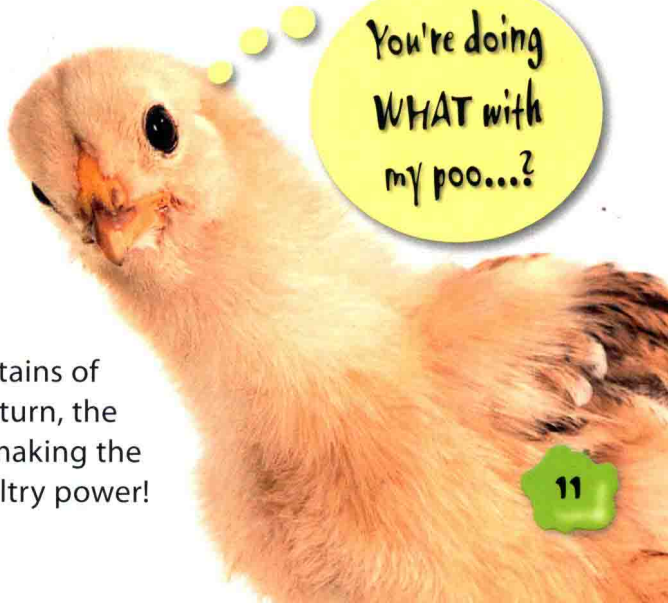


DID YOU KNOW?

It's hard to store large amounts of electricity – it just goes straight into the grid and gets used. We actually use most of our electricity less than one second after it is generated.

Yuck!

Some electricity really does come from poo. Zoos sometimes collect poo from elephants and other animals, then store it in big tanks. It rots and gives off a type of smelly gas, called methane. The gas is collected and used as a fuel to generate electricity. This system can be used for people's homes, too – but it does need a LOT of poo!

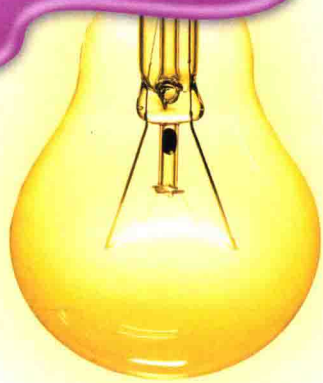


Chicken power!

Clever chicken farmers are turning the mountains of poo their chickens produce into electricity. In turn, the electricity is used to power the buildings, making the farms self-sufficient. Now that's poultry power!

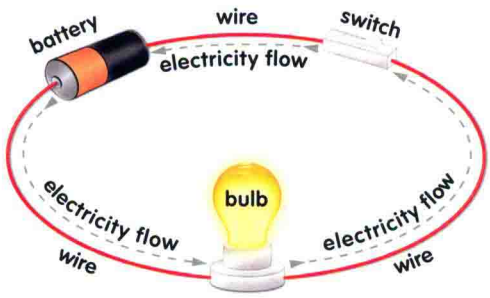
Looping the loop

To keep working, electricity has to flow around in a loop, called a circuit. Its power comes from the flow of electrons pushing along a wire or cable – just as a river makes a waterwheel work, or wind blows a windmill.



A simple circuit

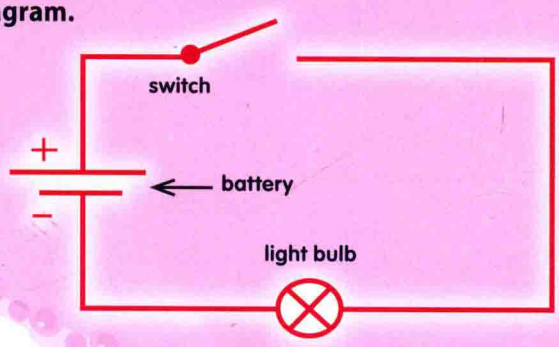
All a circuit needs is a power source, such as a battery, and wires to carry the electricity around the circuit. You can add a bulb and a switch to really see what's going on!



If the switch is on, the bulb will glow because the electricity is flowing from one end of the battery, round the loop, to the other end. If the switch is off, the circuit is broken and the electricity doesn't flow.

Circuit diagrams

A circuit diagram shows the parts of a circuit clearly and simply. Lines show the wires and symbols are used to represent the other components (bits and bobs). Here's the simple circuit above drawn as a diagram.



⊗	**Light bulb** A light bulb glows when electricity flows through it.
—/—	**Switch** The switch is a break in the circuit. When you close it, the circuit joins together and electricity can flow.
⊣⊢	**Battery** A battery or another type of energy cell provides the electrical charge.
Ⓜ	**Motor** A **motor** uses a flow of electricity to make a rotating motion. Motors are used in fans, CD drives, toys and any gadget that makes something spin or turn.

This is a key to some of the most common components used in circuit diagrams.