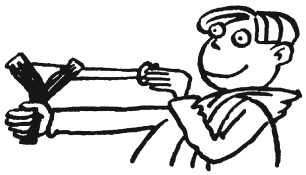
Useful and wasted energy

Name _____ Class _____ Date _____

What are the useful and wasted energy transfers in these activities?

Activity	Useful energy transfers	Wasted energy transfers
A 		
B 		
C 		
D 		
E 		
F 		

I CAN... • identify useful and wasted energy transfers.

Transferring energy 1

Name _____ Class _____ Date _____

1 Look at this picture of Bonfire Night.

a Label with a C the things that are stores of chemical energy. One has been done for you.

b Label with an L the things that are transferring energy by light.

c Label with an S the things that are transferring energy by sound.

d Label with an H the things that are transferring energy by heat.

e Label with a K the things that have kinetic energy.

2

a What kind of stored energy are this group using? _____

b Name two ways in which this energy is being transferred.

_____ _____

c Which of these energy transfers is useful? _____

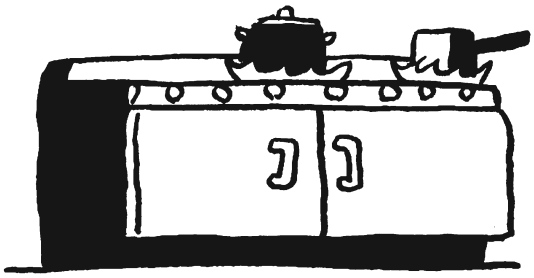
Transferring energy 1 (continued)

3

This rollercoaster has stored gravitational potential energy at the top of the track. What will this be transferred to as it goes down?

_____

4



a What kind of stored energy is being transferred by this gas cooker? _____

b All the stored energy ends up as thermal energy. Where is the useful thermal energy stored?

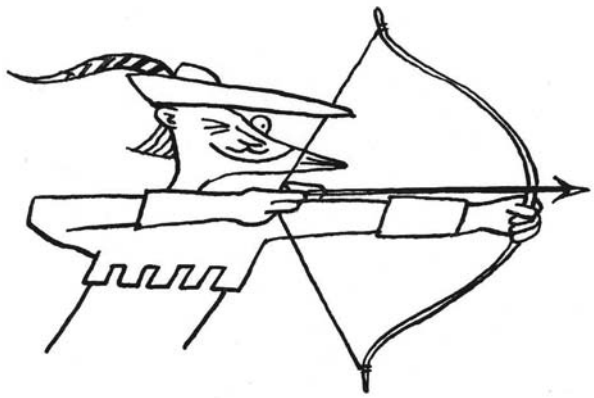
_____

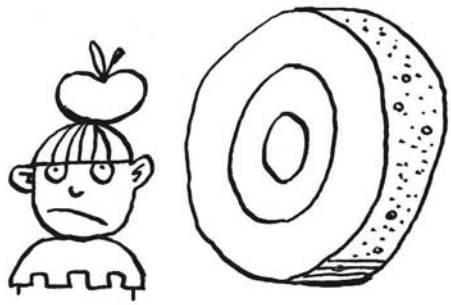
c Where is the wasted thermal energy stored?

_____

_____

5





a What kind of energy is stored in the bow when it is bent? _____

b What kind of energy will be stored in the arrow when it is fired? _____

I CAN...
- identify energy stores and transfers
- identify useful and wasted energy transfers.

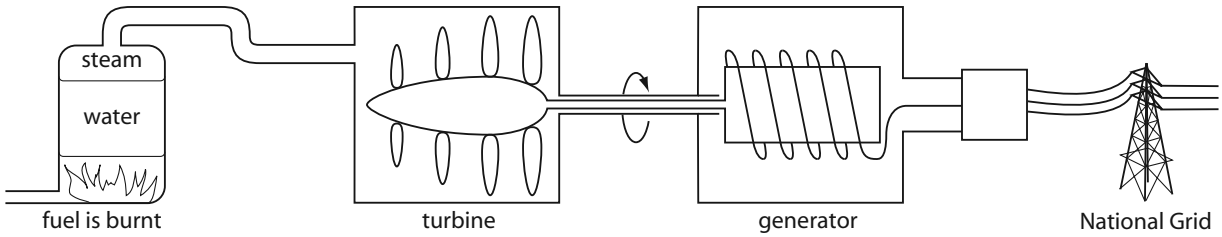
The generation game

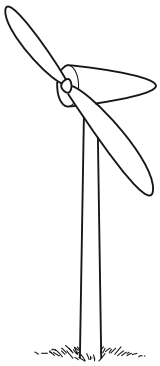
1 Cut out the diagrams and the labels.

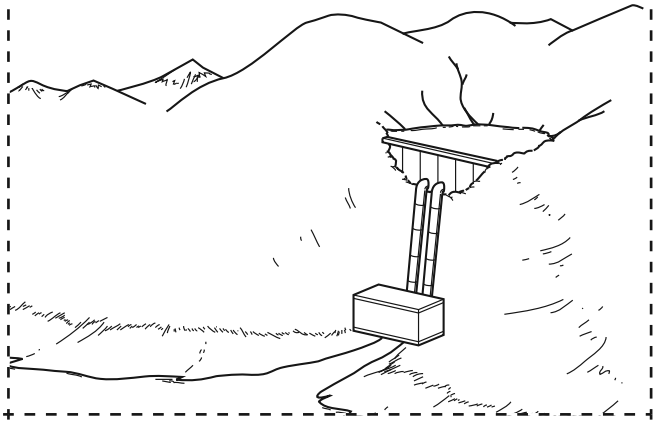
2 Arrange them so that the labels explain what happens in the diagrams.

3 Ask your teacher to check what you have done, then stick the diagrams and labels into your book.

I CAN...
- describe how a power station works
- recall some renewable resources that can be used to generate electricity.







Steam is produced from the chemical energy stored in fossil fuels.

The electricity is transferred around the country by the National Grid.

Water flowing downhill can be used in hydroelectric power stations to make electricity.

The steam makes turbines spin.

The turbines make generators spin. The generators make electricity.

Wind is a renewable energy resource that can be used to make electricity.

9Ib(7) Generating electricity

Name _____ Class _____ Date _____

The answers to questions **1** to **6** are shown jumbled up in brackets at the end of the question.

1 Electricity is made by _____ it in a _____ _____. (ageing tern, watt poisoner)

2 Most fuels in a power station are used to heat water and turn it to _____. (mates)

3 What are the enormous fans in a power station called? _____ (sun tribe)

4 The generators contain large magnets inside coils of wire. This is because a moving magnet inside a coil of wire creates _____. (tricycle tie)

5 How is the electricity from the power station sent around the country? _____ _____ (gladiator inn)

6 What do we call the electricity which comes to our homes? _____ _____ (climate sincerity)

7 Name two different fossil fuels that can be used in a power station. _____ _____

8 What gas is produced when fossil fuels burn? _____

9 What problem is this gas causing for the world? _____

10 Give three examples of renewable energy resources that can be used to generate electricity. _____ _____ _____

I CAN...
- describe parts of a power station
- recall some fuels used and the problems these can cause
- recall some examples of renewable energy resources.

9Ic(1) Voltage and energy

Name _____ Class _____ Date _____

Tick one box to answer questions **1** to **3**.

1 What does a cell push around a circuit?

☐ atoms ☐ electrons ☐ components

2 What do light bulbs do in a circuit?

☐ transfer energy as light

☐ transfer energy as sound

☐ use up the current

3 The voltage of a cell is a way of measuring:

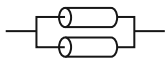
☐ how much current the cell gives to the circuit

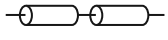
☐ the size of the cell

☐ how much energy the cell gives to the current.

Tick two boxes to answer questions **4** and **5**.

4 You can increase the size of the current by:

☐ using more cells, like this 

☐ using more cells, like this 

☐ using cells with a higher voltage

☐ using smaller cells.

5 If you increase the voltage of the cells in a circuit:

☐ the current gets bigger

☐ the current gets smaller

☐ more energy is transferred by the circuit

☐ more current is used up by the circuit.

6 Look at the drawing of the central heating model.

a Draw lines to match up the parts.

This part of the model…	…represents this part of a circuit.
boiler and pump	wires
pipes	light bulb
radiator	cell

b You turn up the boiler so the water is hotter. This represents putting a cell with a higher voltage in the circuit because:

☐ the hotter water transfers more energy to the radiator

☐ the hotter water flows more slowly

☐ the hotter water flows faster.

I CAN... • recall what the different parts of a circuit are for • describe how to increase the voltage in a circuit • recall what happens when you increase the voltage • use a model to help to explain circuits.

Revising electricity

Cut out the following question and answer cards. Some questions have more than one answer. Find the correct answer cards for each question. Write down the question number and the letter(s) of the answer card (or cards) in your book. You do not need all the answer cards.

I CAN... • recall key facts about electricity and circuits.

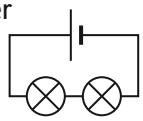
1 Choose a parallel circuit.

2 Choose a series circuit.

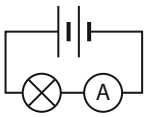
3 Choose two circuits that have two bulbs controlled by one switch.

4 Choose a circuit with an ammeter in the correct place.

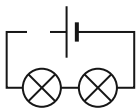
5 Choose two series circuits that have brighter bulbs than this circuit.



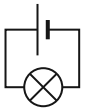
6 Choose a circuit that has a dimmer bulb than this one.



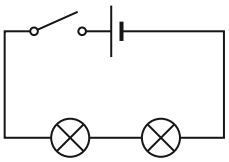
7 Why doesn't the bulb light in this circuit?



8 Choose a circuit which has a brighter bulb than this one.



A



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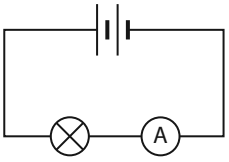

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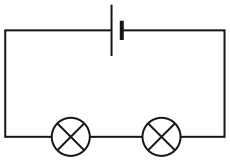

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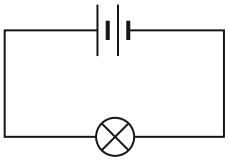

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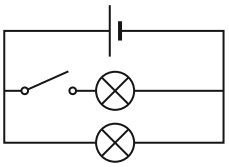

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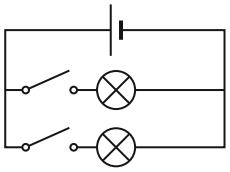

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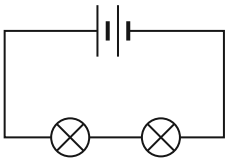

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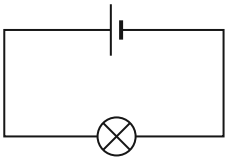
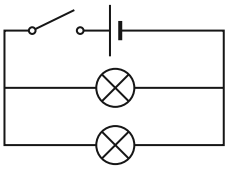
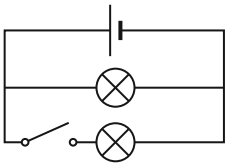


I



J



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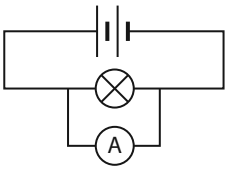

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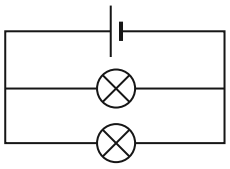


M

It needs another cell.

N

There is a gap in the circuit.

Electricity true/false

Name _____ Class _____ Date _____

1 Decide whether each of the statements below is true or false and put a T or an F in the circles on the right. If a statement is false, change some of the words to make it correct.

2 Now look at your pairs of corrected statements and decide if the second statement is an explanation for the first one.

	True	False
A A circuit needs wires for the voltage to flow through.	◯	◯
B A current is a flow of electrons.	◯	◯

Does **B** explain **A**? Yes or no? _____

C A voltmeter measures the energy converted by a component.	◯	◯
D A voltmeter is always connected in series.	◯	◯

Does **D** explain **C**? Yes or no? _____

E A cell contains electrical energy.	◯	◯
F A cell is needed to provide energy for a circuit.	◯	◯

Does **F** explain **E**? Yes or no? _____

G There can be a different voltage across each component in a circuit.	◯	◯
H Components always use up the same amount of energy.	◯	◯

Does **H** explain **G**? Yes or no? _____

I CAN... • recall some key facts about electricity.

9Ic(7) Power

In a circuit, energy is transferred from a cell or a power station to appliances like lights, cookers and TVs. The amount of energy transferred depends on the current and the voltage.

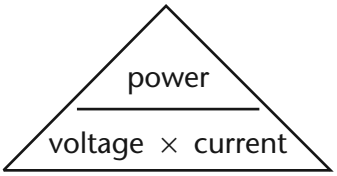
Electrons carry energy around a circuit. If more electrons flow then more energy can be transferred. High currents carry more energy.

The voltage is a way of saying *how much* energy the electrons are transferring. If there is a high voltage, the electrons are transferring a lot of energy.

A machine transfers electrical energy into other forms of energy. The power of a machine is the amount of energy it transfers every second. A powerful machine transfers a lot of energy each second.

You can work out the power of an electrical appliance using this formula:

power = current × voltage
(W) (A) (V)



You do not need to remember this formula.

The units for power are watts (W) – 1 watt is 1 joule of energy transferred per second.

1 What does power mean?

2 a What are the units for power?

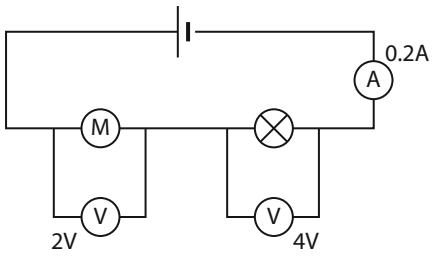
b What does the unit mean?

3 Explain why the power depends on the voltage and the current.

4 Sometimes you might know the voltage and power and need to calculate the current. Rewrite the equation with current on the left-hand side:

current =

5 a Calculate the power of the components in this circuit:



b Why do you only need one ammeter in the circuit?

6 This table shows some facts about various electrical components used in a house. Copy the table and fill in the spaces.

Appliance	Power (W)	Voltage (V)	Current (A)
radio	12		0.052
fan heater		230	8.70
kettle	2400	230	
toaster	770	230	
light bulb	40		0.175
light bulb	100	230	
outside light		230	2.17
fridge		230	0.11
TV	500		2.17
electric oven	2800	230	
electric hob (4 rings)		230	30.43

7 **a** What do you notice about the voltages?

b Why do you think this is?

8 Write the items in the table in two lists; one for appliances that are mainly used for heating and one for those that do other things. Write the power of the appliance next to each one. What do you notice about the power ratings in your two lists?

9 How much energy is transferred by the following items? (*Hint:* Multiply the power by the time in seconds to find the number of joules of energy transferred.)

a A 40 W light bulb left on for 2 hours.

b A 100 W light bulb left on for 2 hours.

c A fan heater left on for an hour.

d An oven left on for an hour.

10 Use your answers to question **9** to explain how the following actions can help the environment:

a using lower powered light bulbs

b switching an oven off 5 or 10 minutes before an item has finished cooking.

I CAN... • calculate the power of an appliance from the current and voltage.

Energy and power

Name _____ Class _____ Date _____

1 These are the labels for a fan heater and an electric fire.

Fan heater – Model 35412
230 Volts 50–60 Hz
3000 Watts

Electric fire – one bar
50–60 Hz 230 Volts 1000 Watts

a Draw a circle around the parts that show you how much energy each appliance transfers each second.

b Which appliance transfers the most energy each second? _____

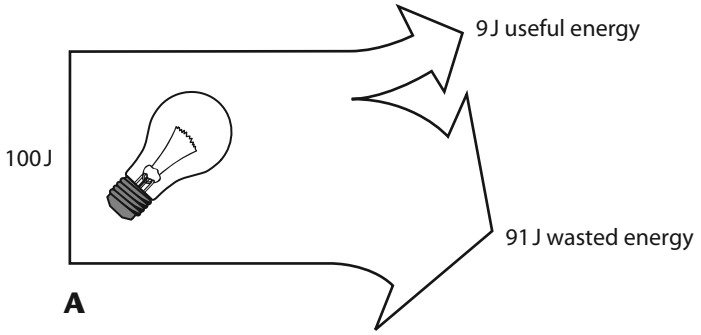
c How did you work out your answer to part **b**?

_____

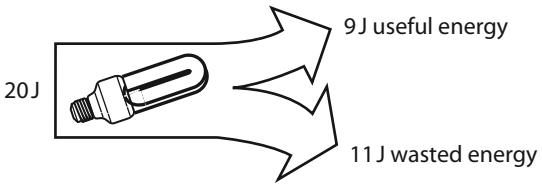
2 Draw lines to match each piece of equipment with the energy it transfers each second.

Equipment	Energy transferred per second
electric fires and kettles	5000 J
electric ovens	1000 J
light bulb	400 J
televisions and computers	100 J

These diagrams show how much useful and wasted energy two different light bulbs transfer.



A



B

3 a Which light bulb transfers the most energy?

b Which one wastes the most energy?

c Which one is the most efficient?

4 a How is the useful energy transferred from the light bulbs? Tick the correct box.

☐ heating ☐ sound ☐ light

b How is the wasted energy transferred? Tick the correct box.

☐ heating ☐ sound ☐ light

I CAN...
- recall which kinds of appliance use the most energy
- recall the units for power
- explain how energy is wasted by light bulbs.

Energy survey

Name _____ Class _____ Date _____

You may need to ask an adult to help you to collect the information you need.

1 Write down an estimate of how long each type of electrical equipment is used for in your home each day. If your home has any pieces of equipment not in the table, write them in the rows at the bottom of the table.

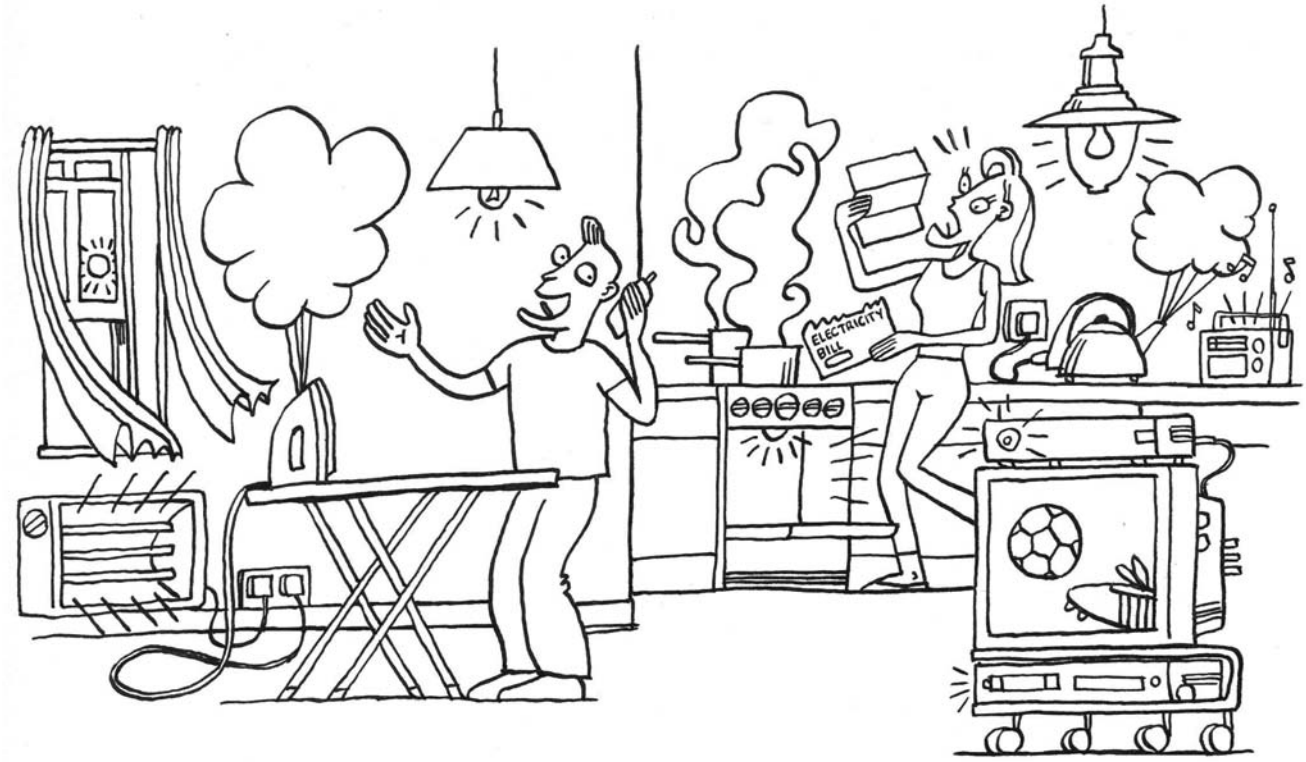
2 Try to find the power rating of each piece of equipment. For small items such as kettles or toasters, this is usually on a label on the bottom. For larger appliances, the power rating is usually given in the instruction booklet.

Always unplug electrical items before looking for the power label. Ask an adult to help you. ⚠

Equipment	Time used per day (minutes)	Power rating (watts)	Equipment	Time used per day (minutes)	Power rating (watts)
kettle			TV		
toaster			radio/CD player		
electric oven			computer		
fridge			video/DVD		
microwave oven			hairdryer		
dishwasher			lights		
washing machine			immersion heater		
tumble dryer			vacuum cleaner		
iron			games consoles		

I CAN... • gather relevant information to carry out an energy survey.

Using less



1 Write down the ways in which energy is being transferred *usefully* in the picture.

2 List the things in the picture that use mains electricity.

3 **a** How is most mains electricity generated in this country?

b How does generating mains electricity in this way contribute to global warming?

c How can electricity be generated without contributing to global warming?

4 This family pay a lot for electricity. Write down some ways in which they could reduce the size of their electricity bill.

5 How could reducing their electricity bill also help the environment?

I CAN...
- identify energy transfers
- recall how electricity is generated
- make suggestions for reducing energy use
- explain how reducing energy use can help the environment.

9I Quick Quiz answer sheet

Name _____ Class _____ Date _____

The Quick Quiz is to see how much you already know about a subject. It also gives you some idea of the things you will soon be learning about. Record your answers in the answers column. Shade in or tick the ones you get right.

Topic		Answers		I can already...
9Ia	1			Recall the different ways in which energy can be stored.
	2			Recall the different ways in which energy can be transferred.
	3			Recall which forms of energy are usually produced as waste energy.
	4			Use a Sankey diagram to help me to explain what efficiency means.
9Ib	1			Describe how electricity is generated.
	2			Describe how electricity gets to our homes.
	3			Recall which energy resources are used to make most of the electricity in the UK.
	4			Explain some of the advantages and disadvantages of different energy resources used to generate electricity.
9Ic	1			Recall the units for measuring voltage.
	2			Explain how to measure voltage.
	3			Explain what voltage is.
	4			Describe how the voltage in a series circuit is divided between the components.
9Id	1			Recall the units for measuring power.
	2			Explain how to find the power of an appliance.
	3			Recall which kinds of appliances transfer the most energy.
	4			Explain why it is better to use more efficient appliances.

Quick Quiz:	/16	At the start: 0–4 = I didn't know much; 5–9 = I knew something 10–12 = I knew a fair bit; 13–16 = I already knew a lot

Energy

Energy can be **transferred** in different ways:

- electricity
- heating
- forces
- light
- sound.

Energy can also be stored.

- **Thermal energy** is stored in hot things.
- **Chemical energy** is stored in food, fuels and cells.
- **Kinetic energy** is stored in moving things.
- **Gravitational potential energy** is stored in high up things.
- **Strain energy** is stored in stretched or squashed things.
- **Nuclear energy** is stored inside atoms.

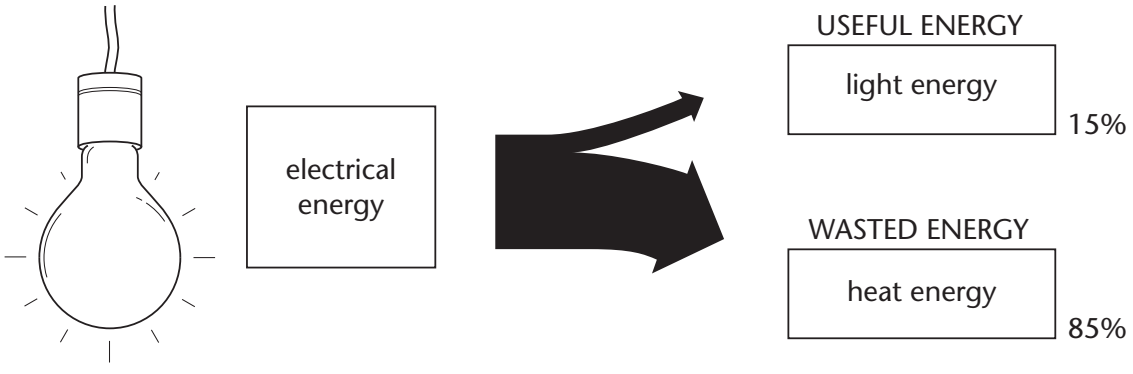
Energy is measured in **joules** (**J**) or **kilojoules** (**kJ**). A kilojoule is 1000 joules.

Energy cannot be made or destroyed, but can only be transferred from one place to another. This is the **law of conservation of energy**.

Efficiency

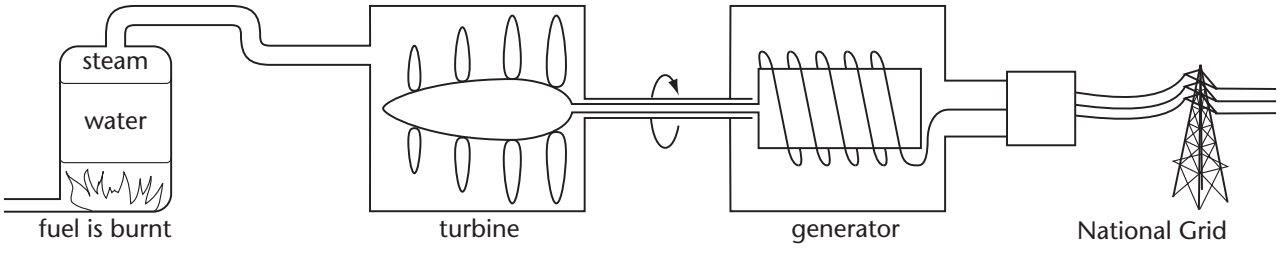
Not all energy is transferred usefully. Often it is turned into heat that we cannot use. This is **wasted energy**. Light bulbs transfer most energy to heat, which is wasted energy.

The percentage of useful energy produced by something is known as its **efficiency**. The light bulb in the diagram is 15% efficient.



Generating electricity

Fossil fuels are transported to **power stations** where they are burnt to transfer heat energy. This heats water, turning it to steam. The steam drives **turbines** which turn **generators**. The electricity generated flows along cables into the **National Grid**.



Some power stations use **nuclear fuel**. Electricity also can be generated from **renewable resources** such as wind and moving water. These will become more important as fossil fuels run out.

Burning fossil fuels produces carbon dioxide, which is causing global warming. We need to reduce the amount of fossil fuels we burn.

Voltage

A circuit must have a **cell** or power supply to provide a **voltage**. The voltage pushes **electrons** around the circuit and gives them energy. This electrical energy is transferred to other **components** in the circuit, which then transfer it to other forms of energy. For instance, a buzzer transfers electrical energy to sound.

The voltage of a cell can be measured using a **voltmeter**. The units for voltage are **volts** (**V**). The voltage across a component is a way of measuring how much energy the component is transferring.