4 What can you learn?

e - Using energy wisely

Purpose

To explore key concepts in greater depth and relate them to your school situation

Key concepts

Making sure that we conserve energy and use it wisely

After exploring the many forms and uses of energy and the impacts they can have on the environment, consider all the possible ways to reduce your energy use, or use energy forms that won't harm the environment. Refer to your Pool of Knowledge and Map for ideas which came up as you investigated energy in your school environment.

Consider

- How can you use less energy?
- How can you use more environmentally-friendly energy forms?
- What are all the alternatives?
- Can you produce energy in your school?

Evaluate / Reflect

- How easy was it to think of some ways to reduce your energy use?
- Can you still have the things you want but use less energy?
- Are there some things you might have to stop doing?
- What are the alternative ways of generating energy?

Activities

Background text - Using energy wisely

4e.1 Various Values
4e.2 Energy Alternatives
4e.3 Try this out
4e.4 See the light
4e.5 The lighthouse
4e.6 Energy Efficient Kitchen
4e.7 Electricity use at home
4e.8 What a Waste of Energy
4e.9 B.E.S.T - Brilliant energy saving trail
4e.10 Energy efficiency at home
4e.11 Keep it or lose it
4e.12 Safe and Smart
4e.13 Stay safe
4e.14 Safety sleuth search

Background text

Using Precious Energy Wisely

Bicycles, skateboards and walking are ways of getting around without burning fuel.

Transport is a very big user of fossil fuels, releasing carbon into our atmosphere and exhausting the world's reserves of oil. Using public transport and carpooling make motorised transport more efficient.

There are many ways to cut down on electricity and gas use at home and at school.

At home, insulating hot water cylinders and using less hot water are important steps, because water heating is the biggest single energy use in a typical household. At school, we also need to be careful with hot water use. At home and at school, there can be gains made in turning off lights that are not in use, and in closing doors, stopping drafts and not overheating rooms in winter. If there is a chance of installing extra insulation in walls, floors and ceilings, this reduces our need to heat rooms in winter or cool them in summer. Other ways of using less energy are to look out for energy-efficient appliances when we are shopping for something new and to install energy-efficient light bulbs in existing light sockets.

Little things we do everyday can help, like only boiling as much water as we need in the jug at any one time, using the clothesline to dry our clothes, or only running the clothes drier for the shortest time necessary in wet weather. Turn the television off at the TV, not with the remote, and remember to turn off computer printers and monitors when you have finished.

You may not have considered it, but recycling materials is a way of saving energy. This is because it takes less energy to recycle products like bottles and cans than to create new products from raw materials. This is especially true of aluminium, which is an energy intensive product to manufacture.

Recycling aluminium uses about one quarter of the energy of making new aluminium.

The closer we can generate power to where we want to use it, the better. Power can be generated locally from clean, renewable sources.

Whenever electricity is moved around, some of it gets dissipated and is no longer available for use. Most of our power is currently generated at power stations and then transferred to homes. Energy is lost along the way in the form of heat (the wires get hot). In New Zealand, we also convert natural gas to petrol (at the synthetic fuel plant in Taranaki) and this results in half the original energy in the gas being lost. These problems will be minimised if we use less energy, and if we use local power generation from appropriate sources such as solar power, wind turbines and micro-hydro (mini-turbines that can supply a few homes with power from a small amount of water).

You can tap into your own local energy inexpensively, for example by making solar water heaters using recycled materials. Solar panels for electricity, wind turbines and micro-hydro generators are more costly, but can end up saving money in the long run and provide significant environmental benefits.

You can create carbon sinks to soak up carbon from the burning of fossil fuels by planting trees or improving the growth of existing forests.

As trees grow, they absorb carbon out of the atmosphere and 'fix' it as wood. To make a difference, large areas of trees are needed. Major pest control in existing forests can also help the bush to grow vigorously again and absorb more carbon. Using less energy is likely to have a greater positive impact than creating carbon sinks, but every tree planted still makes a difference.

4e.1 Various values - 'Energy-wise'

You will need

- Scenario card
- Role cards
- Values cards

Scenario – energy rationing in New Zealand

Role cards

- Elected councillor – this is your third term on council. You also own a market garden on the outskirts of town and grow much produce under lights in large greenhouses
- Resident 1 - you live in the area but commute to Auckland every day to work and your kids go to school in Auckland
- Hospital administrator – you are responsible for the day to day management of the hospital
- Resident 2 – you grew up in the area, work on a farm further south and your children attend a local school
- Representatives of shops and factories from the local area
- School principal – the local school has 135 pupils and is an Enviroschool

Values cards

Set of small cards for each group. Each card has one word written on it describing a value or way of acting. Use the following values or make up your own

- fairness
- greed
- conflict
- co-operation
- openness
- secrecy
- listening to others
- selfishness
- respect for nature
- trust
- respect for others
- concern

1 To begin this activity, break the class into small groups of five or six and have them sit in a circle.

2 Introduce the problem situation using the scenario presented here.

Scenario

It is the year 2020 and the population of New Zealand is now 4.5 million with 2 million people living in the Auckland region (extending from Pukekohe/Bombay in the south to Warkworth in the North). New Zealand maintains its nuclear free stance and only two hydro generation plants have been approved since 2003. The country does not have enough electricity generation capacity and now faces a chronic shortage and "energy rationing". The Government has ruled that energy is allocated per population distribution, consequently Auckland received all of the power generated in the North Island and one third of that generated in the South Island.

Each district/city council administers its "allocation of power" and has to make decisions on how to distribute the power among the community. It has been a very dry summer and officials have signalled that there will not be enough power to meet needs this winter. You live in a small town 50km south of Auckland, 10km outside the Auckland Region boundary. Your community has numerous lifestyle blocks and many people commute into Auckland to work, shop, attend school and access services. The council has let you know that you face prolonged and regular power cuts.

The district council has called a public meeting to discuss how it will allocate the electricity it has available.

3 Assign a role to each person in the group.

4 As a group, discuss the problem and decide what to do. Change the way you act according to the values cards. Turn over the first card and start your meeting acting the way the card suggests. After a minute or two, turn over another card and change the way you are acting. Continue until you have tried several cards.

Consider

- How did you feel when you adopted each of the different values?
- How did each value affect the way you talked with each other?
- How did each value affect the decisions you made about the use of energy?

Evaluation/Reflection

Are there some values that are more helpful than others for working together and protecting the environment?

Variation

The group discussing the problem acts as themselves, but one person is tapped on the shoulder and receives a values card. They then take up that value and act it out in the group meeting. Observe how this can change the dynamics of the discussion.

Fairness	Greed
Conflict	Cooperation
Openness	Secrecy
Listening to others	Respect for nature
Selfishness	Resident 1 - you live in the area but commute to Auckland every day to work and your kids go to school in Auckland
Representatives of shops and factories from the local area	School principal – the local school has 135 pupils and is an Enviroschool
Resident 2 – you grew up in the area, work on a farm further south and your children attend a local school	Hospital administrator – you are responsible for the day to day management of the hospital
Elected councillor – this is your third term on council. You also own a market garden on the outskirts of town and grow much produce under lights in large greenhouses	

4e.2 Energy Alternatives

You will need

- Scrap paper and pencils
- Cardboard dial as per 4

Use all that you have learned so far about energy to create a game about wise energy use. Then you can decide which of your good ideas can be practised in your school or home.

1 Introduce this activity by asking everyone to draw a form of transport.

How many people drew motorised transport? What other forms of transport can you think of that are non-motorised?

2 Make a class list of Good Energy Ideas - ways to

a. reduce our use of motor transport

b. reduce our use of electricity and gas

c. generate energy from clean, renewable sources

d. create carbon sinks

3 Generate another list of Bad Energy Ideas - energy wasting actions.

4 Make an "energometer". Cut out a large arrow and attach to a big piece of cardboard marked with a dial, in such a way that the arrow can be turned around to different points on the dial. Mark one end of the dial "Super Energy Saver" and the other end "Super Energy Loser".

5 Make up a class story about someone going about their daily activities, some of which waste energy and some of which save energy. Use ideas from your lists of energy saving and energy wasting actions. You could go around the class and each person can make up the next sentence of the story. After their sentence, they can go to the "energometer" and move the dial up or down depending on whether their sentence showed energy saving or energy wasting.

6 You can introduce other characters like "Super Energy Hero" or "Energy Baddie" who do unbelievable things to save or waste energy.

Evaluate / Reflect

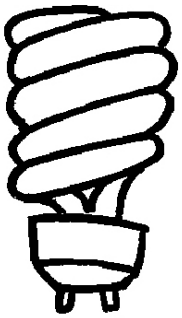
- How easy is it to save energy?
- If we were all super energy losers, what would happen to our world?
- How would your school be different?

4e.3 Try this out

You will need

- Hand powered lighting display from GreenGauge or Bay of Plenty Regional Council, Tauranga or Rotorua Education officers

Experience the difference between powering an incandescent light bulb and a compact fluorescent light bulb CFL. Discover the difference in electricity needed to power each type.



Compact fluorescent **Incandescent**

Which type of bulbs do you have around your school or at home?

NOTE: DO NOT TURN THE HANDLE UNLESS ONE OF THE LIGHTS IS SWITCHED ON AS THIS DAMAGES THE UNIT

1 Turn the handle to generate electricity by spinning magnets passed coils of copper wire. This electricity is used to power the light bulbs.

Almost all large scale electricity production involves spinning a magnet in a coil of wire. This technique, which works because of electromagnetic induction, is the basis of almost all commercial power plants. Nuclear power plants, gas power plants, coal power plants, wind turbines, hydroelectric plants, and geothermal plants are just different kinds of engines used to spin the magnets.

- Switch the light to the right on. Turn the handle to make the light shine
  This light is an incandescent bulb. Notice the amount of effort needed to light it up
- Switch off the light to the right then switch on the light to the left. Turn the handle to make the light shine
  This light is a compact fluorescent bulb

2 What did you notice about how difficult it was to turn the handle and generate enough electricity to make the incandescent light work well compared to the amount of electricity needed to make the compact fluorescent light work well?

An incandescent bulb uses about five times the amount of electricity as the equivalent compact fluorescent. You could run five energy efficient light bulbs for the same cost as running one incandescent bulb.

Evaluate/Reflect

- If you had to turn this handle to power all the lights in your house which bulb would you prefer?
- What different actions might you take?

This lighting display and other resources can be booked for use with students through GreenGauge 07 3154623 or the Education Officers at Bay of Plenty Regional Council 0800 884 880.

Why do incandescent light bulbs use more electricity than compact fluorescent bulbs?

Incandescent lights

These light bulbs give us light but they also get hot. About 95% of the energy used by an incandescent bulb is used to give heat and only about 5% is used to give light. An electric current passes through the thin filament which you can see in the bulb. The filament gets white hot and releases photons which produce the light we see.

Compact fluorescent bulbs

These bulbs do not get very hot when they are on. Energy is not "lost" in this way. They also convert ultraviolet light to visible light so they are more efficient.

The bulbs or tubes have two main parts:

i. ballast which is either magnetic or electronic

ii. a white phosphor coating on the inside of the bulb or tube

An electrical current from the ballast flows through the gas, causing it to emit ultraviolet light. The ultraviolet light then excites the phosphor coating which emits visible light.

Older fluorescent tubes flicker when they are switched on. This is because they have magnetic ballast. The newer ones have electronic ballast and they come on much more quickly without flickering.

For more information look at websites such as:

http://en.wikipedia.org/wiki/Compact_fluorescent_lamp

http://www.howstuffworks.com/fluorescent-lamp2.htm

Safe Disposal of Fluorescent Tubes and Bulbs

Mercury is toxic and it accumulates in our bodies. Tiny traces of mercury exist in nature, so we're all exposed to it.

All fluorescent tubes contain small amounts of mercury. An energy saving bulb typically contains about 4/1000 of a gram. This mercury is safely contained unless the lamp is broken. If the lamp breaks the quantity of mercury is not enough to pose a hazard to users.

Mercury is also released into the environment from coal-fired and geothermal electricity generation, so widespread adoption of energy saving bulbs - because of the reduced demand for coal-fired energy generation - will possibly reduce the overall release of mercury to the environment.

Safe disposal of energy saving bulbs

To ensure the mercury is safely contained. Ask your local council about safe disposal and recycling options.

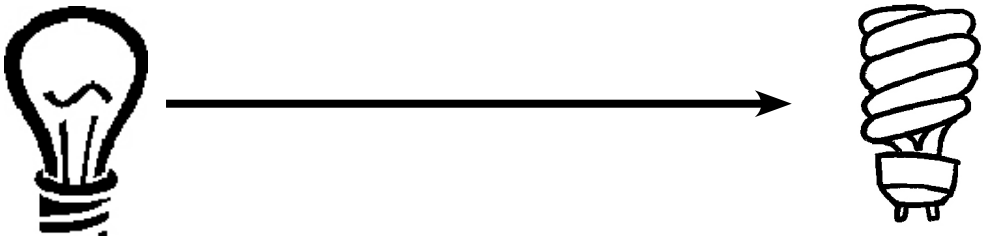
The ministry has also produced a factsheet on disposal of household lamps, which is available from www.energywise.org.nz

Source: www.consumer.org.nz

4e.4 See The Light

1 As a class work through the following sheets to learn how much energy one family could save.

Changing to CFL light bulbs



2 What difference does it make, is it worth it?

An average New Zealand family uses 1,100 kWh of electricity per household on lighting each year.

The highest unit price for electricity in the Eastern Bay at the moment (2009) is about 25 cents or $0.25.

3 How much would it cost a family a year for their lighting at this price?

1,100kWh x $0.25 = $_____(a)

If the family changed all their lights to compact fluorescents, they would only use 20% or 1/5th of the electricity on their lighting.

4 How much would it cost the family per year if they used energy efficient lights?

1100kWh ÷ 5 = _____kWh (b)

(b)_____kWh x $0.25 = $_____(c)

5 How much would the family save on their lighting?

(a)_____ - (c)_____ = $_____.

Savings per compact fluorescent bulb installed

- Savings for 100W Ecobulb - $175 worth of electricity over the lifetime of the bulb
- Savings for 75W Ecobulb - $130 worth of electricity over the lifetime of the bulb

If the five most used 100W light bulbs in the house were changed from incandescent bulbs to compact fluorescent Ecobulbs the savings over the lifetime of the bulbs (approximately 10,000 hours) would be $875.

- Save on your own power bill

Evaluate/Reflect

- How many light bulbs do you have at home?
- Could your family change them to compact fluorescent bulbs to save energy?

4e.5 The Light House

You will need

- A copy of both tables per student or group

The Itson family live in Watt Street. Their house has three bedrooms, a lounge, dining room and kitchen. The house also has one bathroom, a separate toilet, and a laundry.

All the lights in their house are incandescent lights.

Each bedroom and the lounge has a 100 Watt ceiling light and two 40 Watt lamps.

The dining room, kitchen and laundry have one ceiling light each with a 100 watt bulb in each fitting.

The bathroom and the toilet each have a 75 Watt bulb in the ceiling light and a 40 Watt light over the basin.

1 How many rooms do they have in their house? (Count all the rooms even if they are small.)

2 If the Itson family left every light on in the house, how many Watts would the lights be using?

3 Use the table below to record the number of lights of different wattages in the Itson house. Multiply the number of Watts by the number of lights of that wattage.

   If there are two 40 watt lamps they will use 80 Watts of power together.

   2 x 40 Watts = 80 Watts

   Remember 1000 Watts = 1 kilowatt

   By changing from incandescent lights to compact fluorescent lights the Itson family will save power and money.

   In the Eastern Bay of Plenty electricity costs around 25 cents (in 2009) per kilowatt/hour (25 kWh). The Itson family would save 25 cents for every hour the lights were on. This does not sound very much but they are actually saving 80% of the power used for lighting in their house.

4 How much would it they save per month or per year if the lights were on for 2 hours every day?

Table of Watts using incandescent lights

Room	Number of 100 Watt incandescent lights	Total Watts	Number of 75 Watt incandescent lights	Total Watts	Number of 40 Watt incandescent lights	Total Watts	Total Wattage of all lights in the room
Bedroom 1	1	100w	0	0	2	80w	180w
Bedroom 2							
Bedroom 3							
Lounge							
Dining room							
Kitchen							
Bathroom							
Laundry							
Toilet							
Total wattage for all lights in the house							

How much power would the lights use if they were all changed to compact fluorescent lights?

Table of Watts using compact fluorescent lights

Room	Number of 20 Watt compact fluorescent	Total Watts	Number of 15 Watt compact fluorescent lights	Total Watts	Number of 8 Watt compact fluorescent	Total Watts	Total Wattage of all lights in the room
Bedroom 1	1	20W	0	0	2	16W	36W
Bedroom 2							
Bedroom 3							
Lounge							
Dining room							
Kitchen							
Bathroom							
Laundry							
Toilet							
Total watts for all lights in the house							

Work out how much power the Itson family could save if they changed all the bulbs in their house from incandescent ones to compact fluorescent ones.

Total Watts for incandescent lights	Total watts for compact fluorescent lights	Difference in total number of Watts

Answers

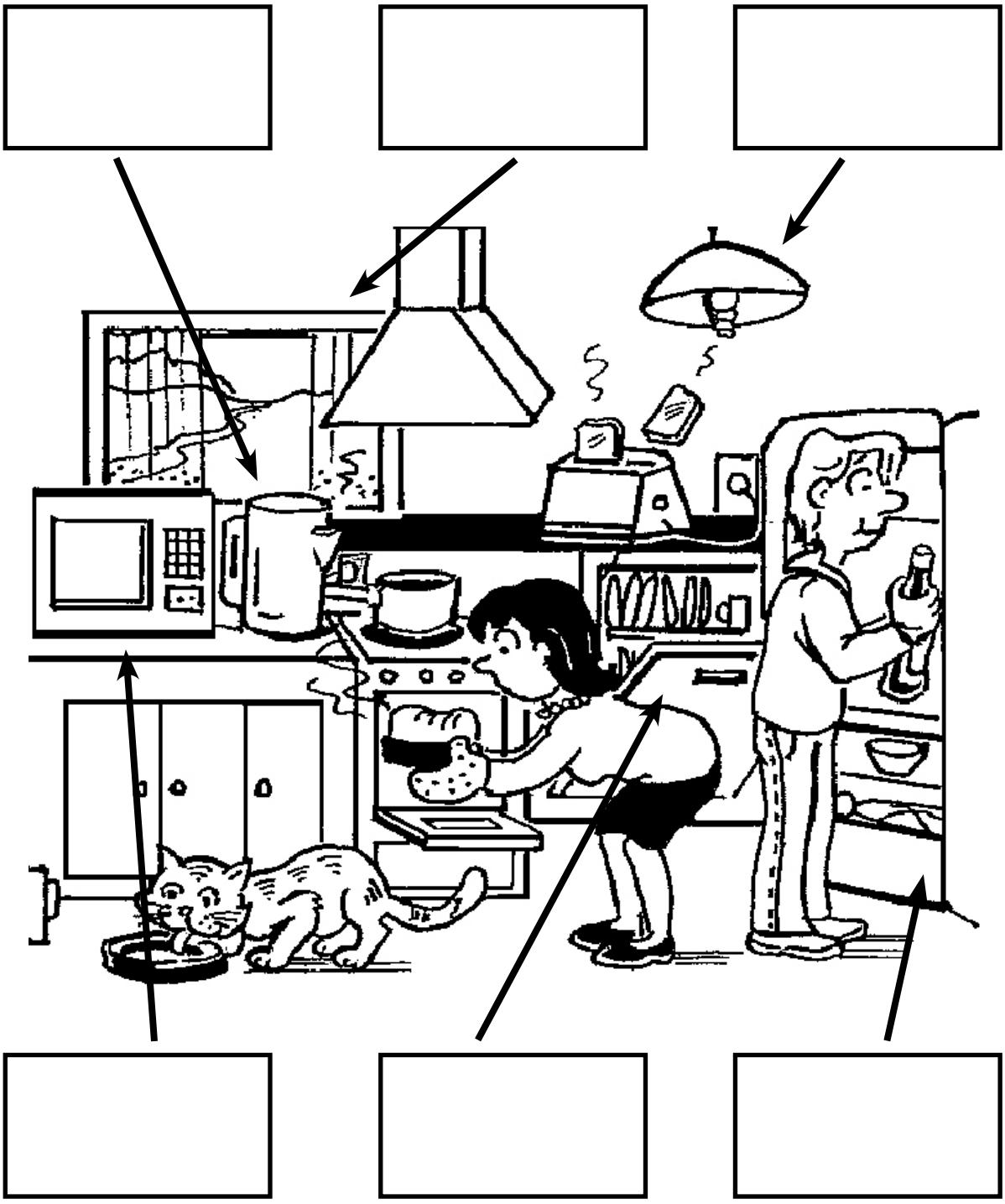
- 2kWh x 30 days = 60kWh 60kWh x 25 = 1500 cents = $15.00
- 2kWh x 31 days =62kWh 62kWh x 25 = 1550 cents = $15.50
- 2kWh x 365 days = 730kWh 730kWh x 25 = 18250 cents = $182.50

Room	**Number of 100 Watt incandescent lights**	**Total Watts**	**Number of 75 Watt incandescent lights**	**Total Watts**	**Number of 40 Watt incandescent lights**	**Total Watts**	**Total Wattage of all lights in the room**
Bedroom 1	1	100W	0	0	2	80W	180W
Bedroom 2	1	100W	0	0	2	80W	180W
Bedroom 3	1	100W	0	0	2	80W	180W
Lounge	1	100W	0	0	2	80W	180W
Dining room	1	100W	0	0	0	0	100W
Kitchen	1	100W	0	0	0	0	100W
Bathroom	0	0	1	75	1	40	115W
Laundry	1	100W	0	0	0	0	100W
Toilet	0	0	1	75	1	40	115W
Total wattage for all lights in the house							1250W

Room	Number of 20 Watt compact fluorescent	Total Watts	Number of 15 Watt compact fluorescent lights	Total Watts	Number of 8 Watt compact fluorescent	Total Watts	Total Wattage of all lights in the room
Bedroom 1	1	20W	0	0	2	16W	36W
Bedroom 2	1	20W	0	0	2	16W	36W
Bedroom 3	1	20W	0	0	2	16W	36W
Lounge	1	20W	0	0	2	16W	36W
Dining room	1	20W	0	0	0	0	20W
Kitchen	1	20W	0	0	0	0	20W
Bathroom	0	0	1	15W	1	8W	23W
Laundry	1	20W	0	0	0	0	20W
Toilet	0	0	1	15W	1	8W	23W
Total watts for all lights in the house							250W

4e.6 Energy Efficient Kitchen

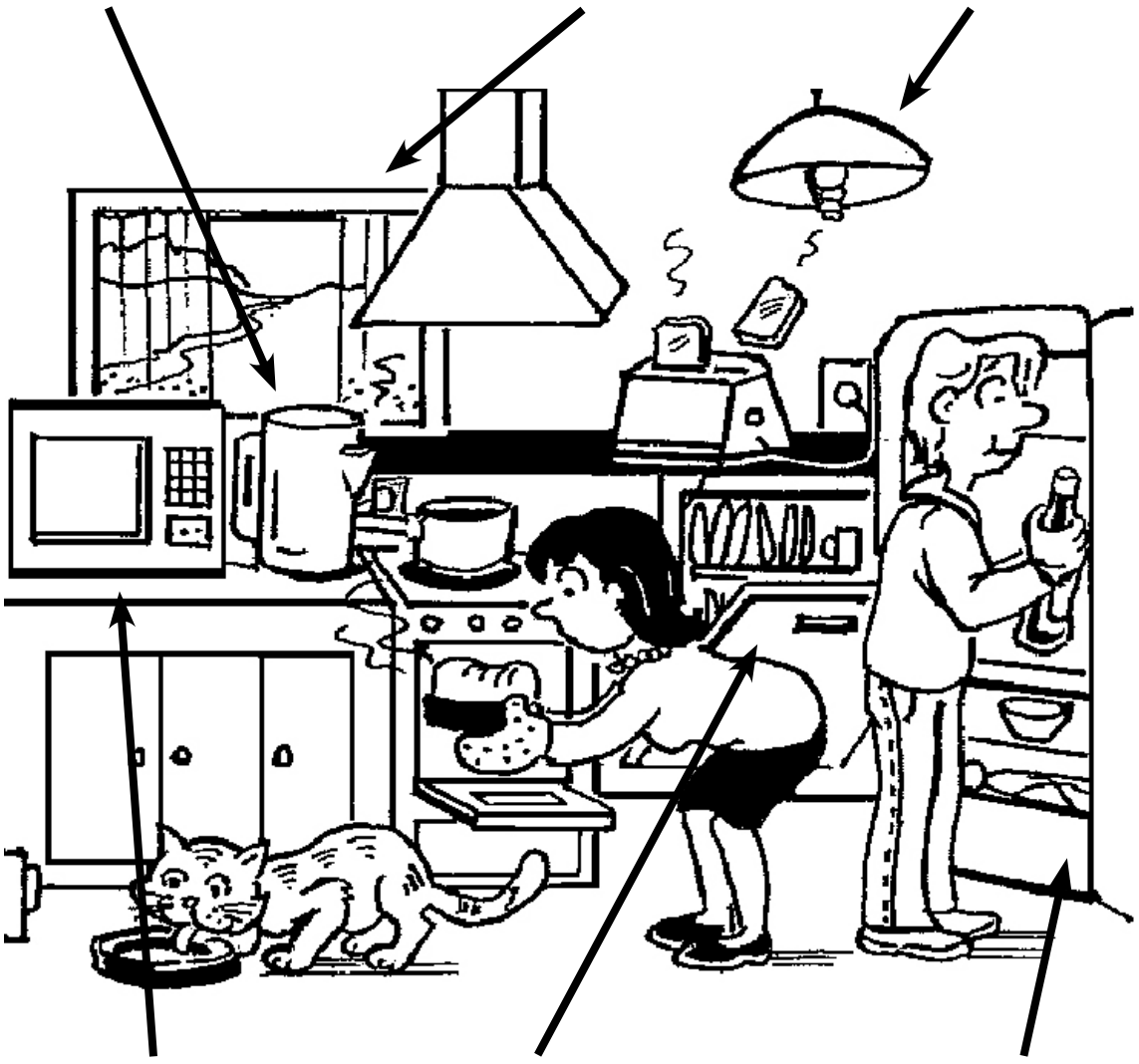
Can you write an energy efficient tip in each box?



Only fill the electric jug with the amount of water you need.

Close curtains at sunset to keep the warmth in.

Use compact fluorescent light bulbs and turn lights off when leaving a room.



Use the microwave instead of oven when possible.

Only run the dishwasher when you have a full load.

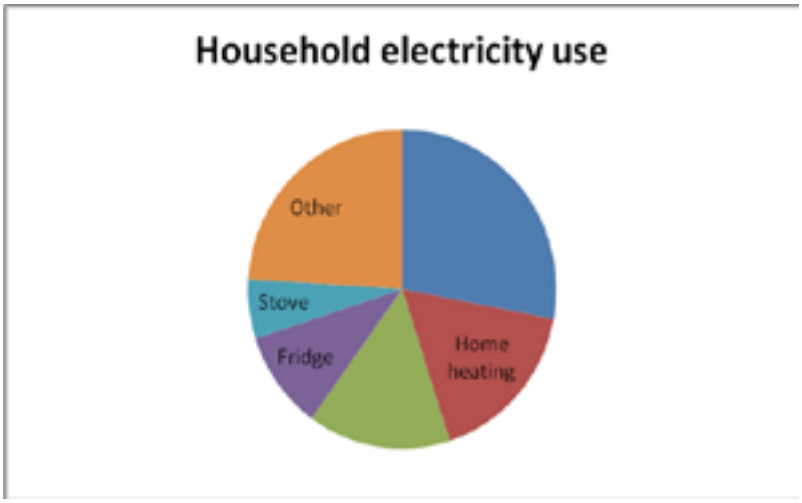
Clean the seals on the fridge doors regularly to keep them soft.

4e.7 Electricity Use at Home

How do we use electricity at home?

Make a list of twelve things your family has at home that use electricity.

Now look at the pie chart and the table below which shows how the electricity is used in a typical New Zealand home.



Use	Percentage
Water heating	28%
Home heating	17%
Lighting	15%
Fridge	10%
Stove	6%
Other	24%
Total	100%

Write the missing labels onto the pie chart.
Does anything surprise you?

Answer these questions:

1 What uses the most electricity in a home? _____

1a What sort of things do you use hot water for at home? _____

_____

2 What percentage of electricity is used for lighting?_____%

2a Do you have energy saving lights at home? All/Some/None

3 Is more electricity used for lighting than for home heating? Yes / No

3a What sort of home heating does your house use? _____

_____

4 What is the total percentage used for home and water heating?.....%

5 What sort of things which use electricity might be included in the "other" category?

_____

_____

Energy saving at home

Can you think of 5 energy saving tips you could give to a family who want to reduce the amount of electricity they use at home.

1 _____

2 _____

3 _____

4 _____

5 _____

4e.8 What A Waste Of Energy

Think about what energy you have used at home and at school since this time yesterday.

Think about

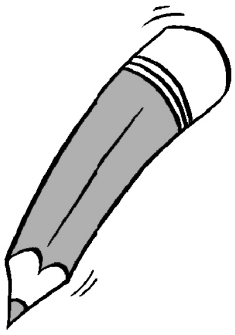
Washing, eating, cooking, travelling, playing games, watching the TV, reading, and other things you did that used energy.

Now imagine a family that uses energy without thinking about how much they are using. They waste energy all the time.

When they get up they turn the hot water on in the shower then go back into the bedroom to decide what to wear. They leave the shower running when they are not using it (about 40% of all electricity used in an average home is used to heat water).

At breakfast time they switch the TV on, but nobody is watching it.

They rush out of the house leaving the lights on...



Think of the ways that this family might waste electricity during the day

- Draw, use pictures and words to make a storyboard showing the ways they wasted energy during the day
- Write up a story or act out a story about an energy wasting or an energy saving family

In Watt Alley lived the Itson family who wasted a lot of energy. Next door lived the Itsoff family who wasted very little energy. Every morning, whether the sun was up or not, Mr Itson woke up and switched on the bedside light. He didn't seem to notice he had left the light on when he went to the kitchen to make his breakfast; in fact it was still on when he left for work an hour later……

Extensions

- Act out the story you have just written about an energy wasting family or an energy saving family
- Act out the story of the energy wasting family. When the audience spots that the family is wasting energy they say, "STOP". Someone from the audience suggests an energy saving alternative
- Use unfortunately/fortunately to describe what happens during the day.
  "Unfortunately Jason walked out of the room and left the light on".
  "Fortunately Joseph walked past the room a few minutes later and turned it off".
- Write a short advertisement to encourage people to save energy
- Make a video of the advert or record it on tape. Play the advert to other people
- Write a poem or a song... With a chorus, such as "And it wasted a lot of energy!" or "What a waste!"

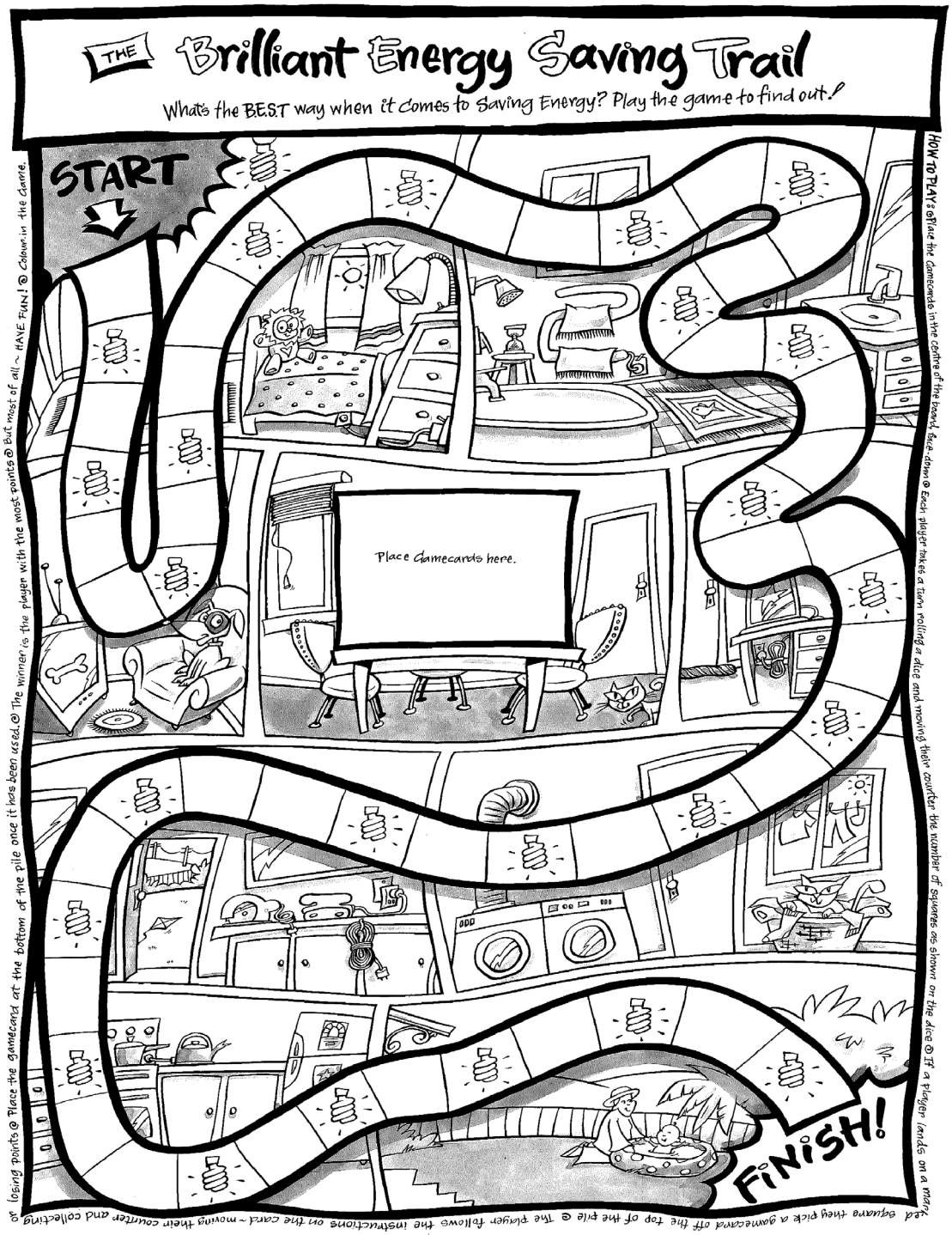
Evaluate/Reflect

- What good energy habits are you currently using?
- Think of two other actions you could take at home
- How could your class save energy in the classroom?

4e.9 The Brilliant Energy Saving Trail

You will need

- An A3 version of this sheet per group
- Cut out cards (next page) per group
- 1 dice per group
- 1 counter each
- A copy of the Brilliant Energy Saving Score Card per group



THE Brilliant Energy Saving Trail Scorecard

Player Name:	Points collected or lost:	Total Points:

You turn the TV off at the wall. Great! Move forward 2 spaces. Collect 10 points.	You turn the TV off with the remote control; not at the wall. Oops! Move back 2 spaces. Lose 5 points.	Your family replaces 5 incandescent light bulbs with 5 energy efficient bulbs. Great! Move forward 3 squares. Collect 5 points.
A light bulb needs replacing and you put in the same sort of incandescent bulb as you took out: not an energy efficient bulb. Oops! Move back 2 squares. Lose 5 points.	It's a sunny day and you hang your clothes to dry outside. Great! Move on 2 squares. Collect 10 points.	It's a sunny day and you put the clothes in the clothes dryer to dry them. Oops! Move back 2 squares. Lose 5 points.
Your family collects a full load of washing for a full load before doing a wash. Great! Move on 3 squares. Collect 5 points	You do a full wash in the washing machine even though there are only a few things to wash. Oops! Move back 2 squares. Lose 5 points.	You have a short shower. Great! Move on 4 squares. Collect 10 points.
You have a long shower. Oops! Move back 4 squares. Lose 10 points.	You notice that a hot tap is dripping but it never gets fixed. Oops! Move back 4 squares. Lose 10 points.	You notice that a hot tap is dripping and it is fixed straight away. Great! Move on 4 squares. Collect 10 points.
You are the last person to leave the room and you turn off the lights. Great! Move on 3 squares. Collect 10 points.	You are the last person to leave the room and you leave the light on. Oops! Miss a go. Lose 5 points.	Your old fridge needs replacing. Your family buys a new fridge with a 5 star energy rating. Great! Move on 3 squares. Collect 15 points.

EASTERN BAY ENERGY TRUST	EASTERN BAY ENERGY TRUST	EASTERN BAY ENERGY TRUST
EASTERN BAY ENERGY TRUST	EASTERN BAY ENERGY TRUST	EASTERN BAY ENERGY TRUST
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Your old fridge needs replacing. Your family buys a fridge with a 2 star energy rating. Oops! Move back 3 squares. Lose 10 points.	You turn your computer off at the wall when you have finished using it for the day. Great! Move on 2 squares. Collect 5 points	You switch the TV off using the remote control & leave it on 'standby'. Oops! Move back 3 squares. Lose 10 points.
You pull the curtains as soon as the sun starts to go down to keep the house warm. Great! Move on 1 square. Collect 5 points.	In winter you don't pull the curtains until late at night so the house cools down quickly. Oops! Miss a go. Lose 5 points.	You only fill the electric jug with the water you need. Great! Move on 3 squares. Collect 5 points.
You always fill the electric jug full however much water you need. Oops! Move back 2 squares. Lose 5 points.	You make a snake to stop the draught under the front door. Great! Move on 4 squares. Collect 10 points.	There is a draught under your front door. You do nothing to stop the cold air coming in to the house. Oops! Miss a go. Lose 5 points.
Your house is warm and dry because it has insulation in the ceiling and underfloor areas. Great. Move on 5 squares. Collect 20 points	You leave the heated towel rail on all the time. Oops! Move back 3 squares. Lose 10 points.	You leave the fridge door open. Oops! Move back 2 squares. Lose 10 points.
The hot water cylinder in your house is old but it has a cylinder wrap on it and the outlet pipe is lagged. Great! Move on 3 squares. Collect 5 points.	The hot water cylinder in your house is old, it has no cylinder wrap on it and the outlet pipe is not lagged. Oops! Move back 3 squares. Lose 10 points.	You only switch the dishwasher on when it is full of dishes. Great! Move on 2 squares. Collect 5 points.

EASTERN BAY ENERGY TRUST	EASTERN BAY ENERGY TRUST	EASTERN BAY ENERGY TRUST
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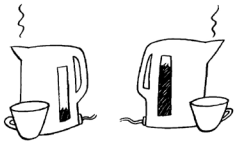
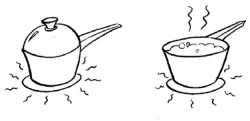
4e.10 Energy Efficiency at Home

You will need

- A copy of this sheet per student or group

1 Look at the pairs of pictures. One is more energy efficient than the other. Decide which picture shows us saving energy, and tick it.

2 Can you explain why one is more energy efficient?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	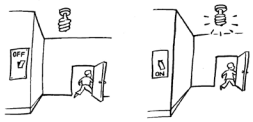	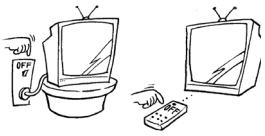
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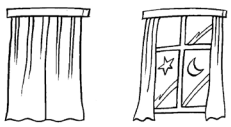
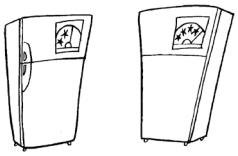
		
Why	Why	

4e.11 Keep It Or Lose It

Testing different materials and learn which ones make good insulators

You will need

- A copy of the recording sheet per student or group
- A large tray or board
- A good thermometer
- Watch or clock
- Small glass jars with good fitting lids – all the same size
- A jug of hot water (from the hot tap – do not use boiling water – be careful!)
- Different types of materials such as:
  Aluminium foil
  Woollen sock or scarf
  Cotton sock
  Polyester insulating material
  Raw wool
  Plastic bubble packaging
  Earth or mud
- You can also try using different thicknesses of the same material

Discuss

1 On the record sheet list the different materials you have chosen to test for insulation.

2 Of all the different materials you are going to test, which ones do you think will do a good job at insulating the jar and keeping the heat in? Which ones do you predict will be the poor insulators where the water will lose heat quickly?

3 Wrap each jar with a different material. Leave one jar unwrapped as a control.

4 Fill each jar with the water from the jug. Do this as quickly as possible so that the water doesn't lose heat.

5 As soon as the water is in the jar, take the temperature of the water and record it on the sheet. Screw or clip the lid on the jar. All the jars of water should start at the same temperature if possible.

6 Carefully carry the tray outside. Find a cold place.

7 Wait a certain period of time (10 – 15 minutes). Take each jar in turn, remove the lid and take the temperature of the water. Record the temperature on the sheet. Work quickly so that the temperatures are taken as close together as possible.

Material	**Start temperature °c**	**Temperature °c after _____ mins**	**Difference in temperature °c**	**Is it a good insulator? 1= very good, 2= good, 3= average, 4= poor, 5= very poor**
Control jar				No insulation around jar
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5

The best insulation material was _____

The water only lost _____ °C in _____ minutes.

The worst insulation material was _____

The water lost _____ °C in _____ minutes.

The control jar with no insulation _____

Consider

- What do you notice about the temperature of the water in the jars?
- Are any the same temperature as they were at the beginning of the experiment?
- Which of the wrapped jars has the lowest water temperature?
- Which has the highest?
- What is the temperature of the control jar?
- How does that compare with the jars wrapped in materials?

8 Now do the experiment again but leave the jars outside much longer. Try 30 minutes or an hour. Does it make a difference? Which materials work best at keeping the heat in? How does this compare with what you thought before you tested them? Were you predictions correct?

Extension 1

Hot Water

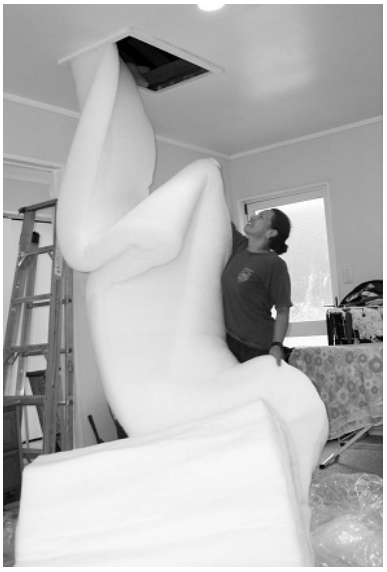
- What does your school use to heat it's water? (Electricity, coal, solar….)
- What do you use at home to heat your water? (Electricity, coal, solar….)
- Most homes use about 30% of their household energy in heating water. What do we use hot water for at home? Could we use less hot water?
- Time how long you stay in the shower? Do you have the water running all the time you are in the shower? When you use hot water for your shower the cylinder fills up again with cold water. In the cylinder there is an electric element which switches on and heats up the water ready for the next time you need hot water. The more hot water you use, the more often the heater switches on and uses electricity to heat the water.

Insulation

- Why do you think it would be good to wrap insulation around an old hot water cylinder that has no built-in insulation?
- Look at the picture "Insulation = Comfort"
- Talk about the differences between the 'before' and 'after' pictures
- Why do you think there is a difference? How do you think this family will benefit from the insulation?

Extension 2

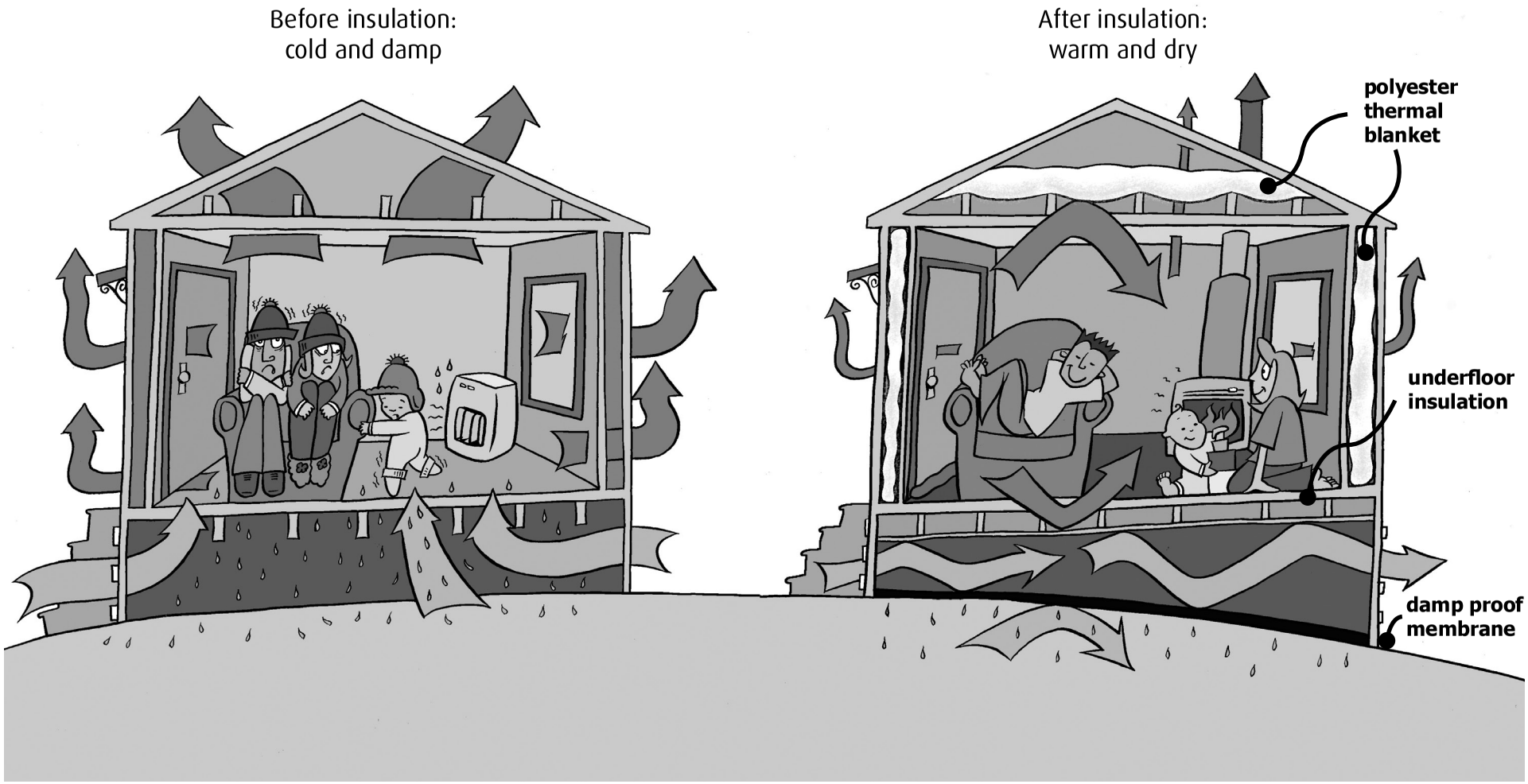
- Some materials are better insulators than other. We use materials to make clothes to keep our bodies warm in winter. Think about the clothes that keep you warmest in winter. Would a woollen jumper or a cotton one keep you warmest in winter? Why? What about the materials we use on our beds in summer or winter? Which keep us warmest and coolest?
- Air is a very good insulator of heat. Air which is trapped between layers of material or within the material acts as an insulator keeping the heat in. Think about a warm ski jacket or a fluffy duvet. If you squash the material between your fingers it is quite thin but if you let if fluff up there is a lot of air trapped between the fibres. It is this trapped air rather than the material itself which keeps you warm.
  Good insulating materials are what we should use to keep houses warm in winter and cool in summer. Good insulation keeps the heat from the sun or from our heaters, in the house longer. This keeps the house warmer and saves money on heating fuel. Keeping ourselves and our houses warm in winter helps us keep well too.
- Look at the photo. This insulation is going up into the ceiling to stop the warm air escaping out of the roof. See how much 'loft' or fluffiness it has. This material will trap a lot of air in it and keep the house much warmer.



Evaluate/Reflect

- Are the classrooms at your school insulated? What difference do you think this would make?
- What can you do at home or school to save hot water?

Insulation = Comfort



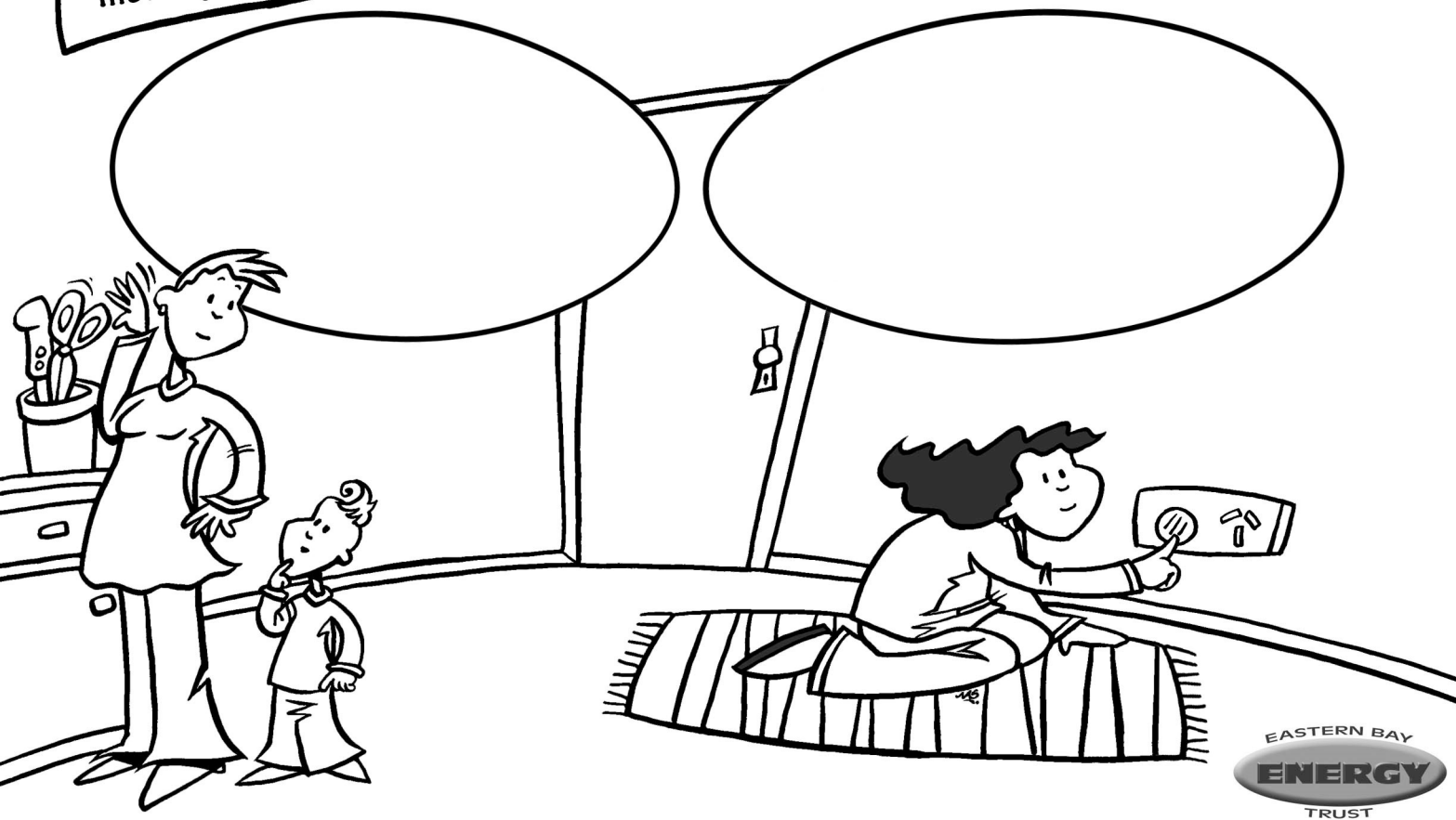
Safe and Smart

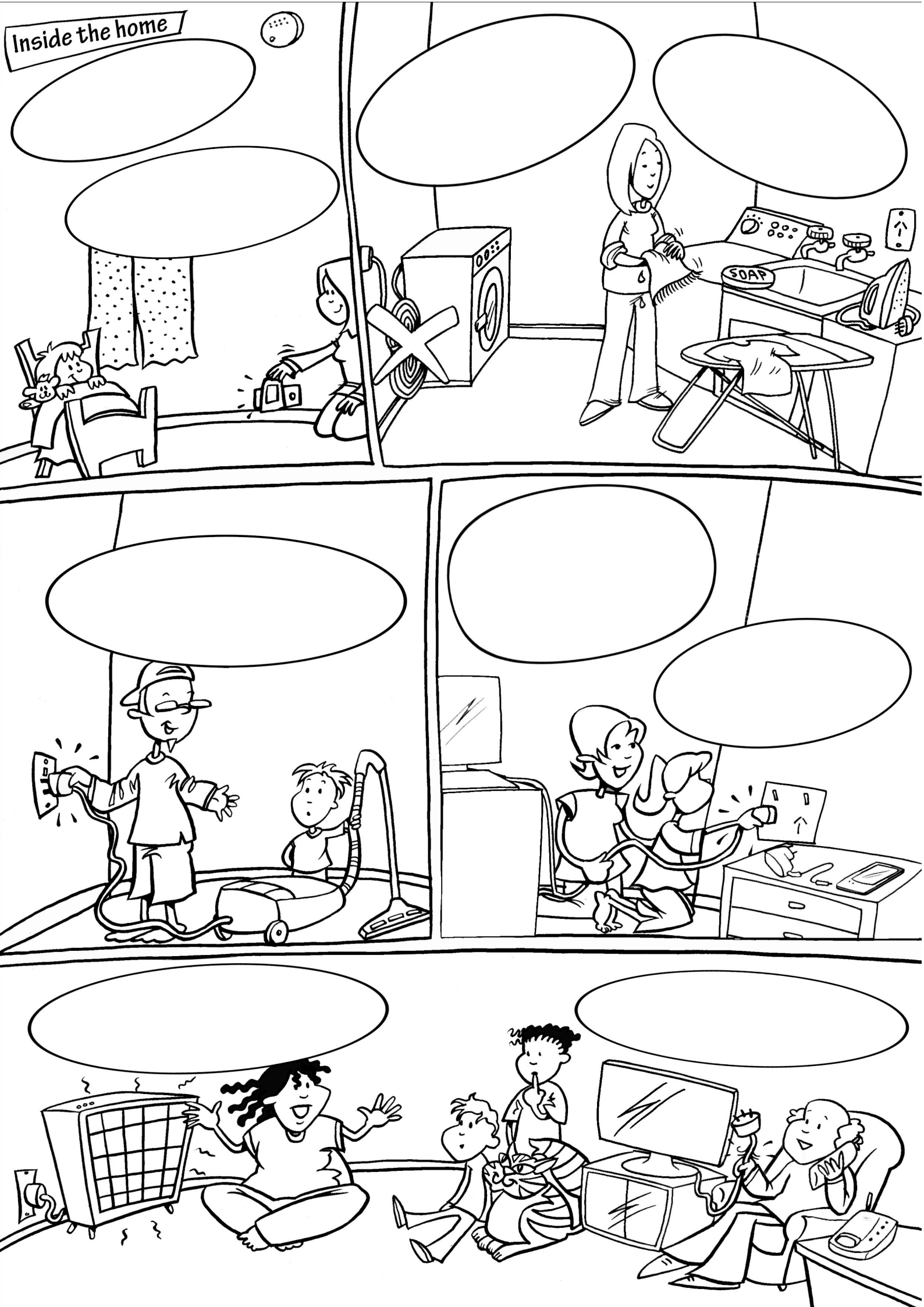
Children can be fascinated by power points, switches and electrical applicances. Many children have been hurt by biting power cords, by pushing objects into power points or heaters, or by getting live appliances wet.

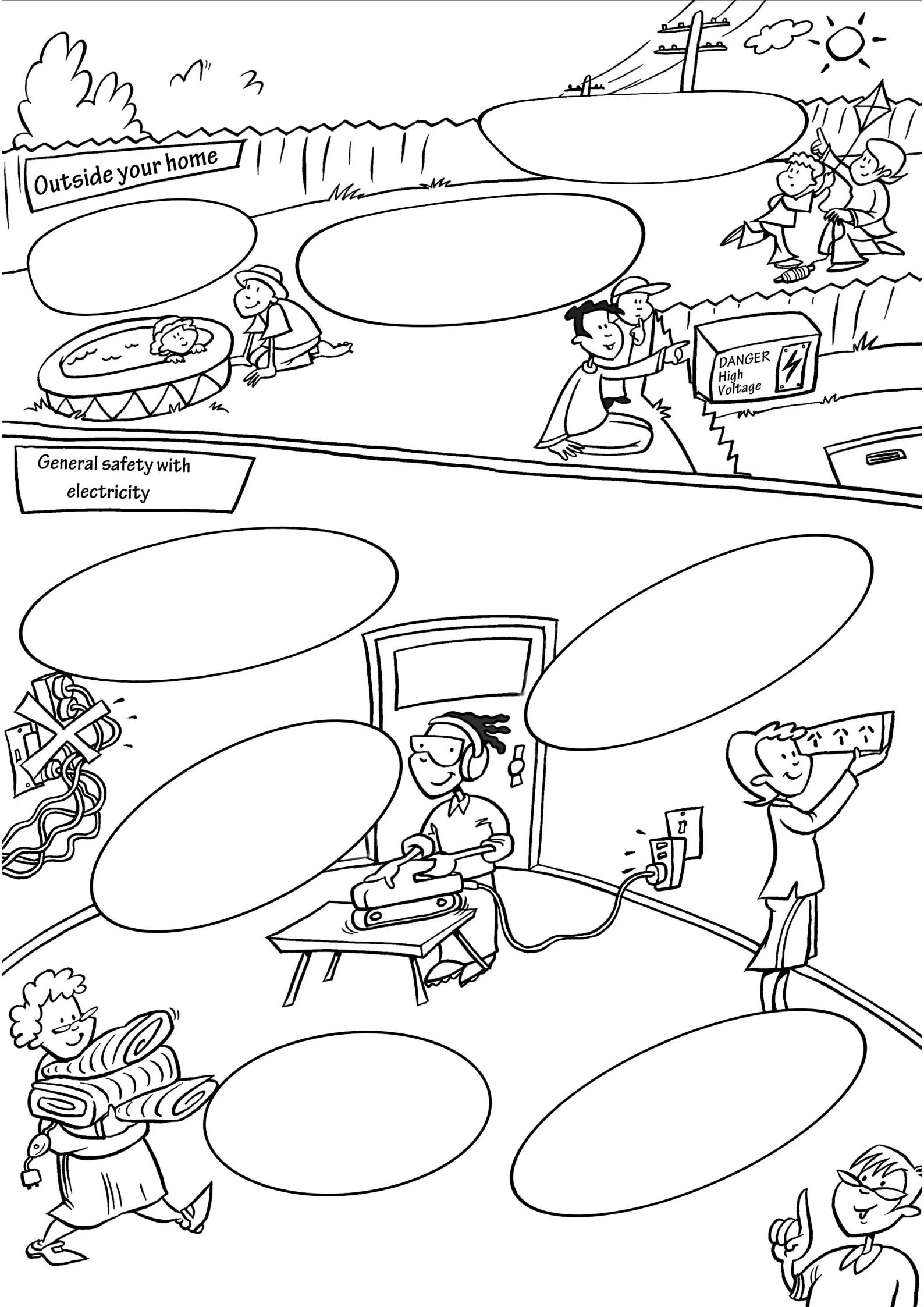
Remember – overloaded electrical circuits, faulty electrical equipment and misuse of electrical equipment are all common causes of fires.

So be sure! Take a few minutes to check around your home. A few simple changes will help you keep your family and young visitors safe.

Inside your home




Inside the home
SOAP


Outside your home
DANGER
High
Voltage
General safety with
electricity

Does everyone dry their hands before using electrical switches?

Are double adaptors used carefully so that no power socket gets overloaded?

Is an RCD (Residual Current Device) always used with portable electric tools?

Does everyone turn off appliances when not in use?

Are electric blankets checked each year?

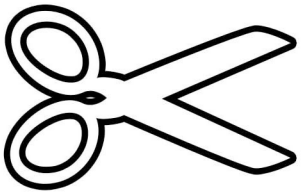
Are any multi-outlet power point boxes mounted well out of reach of children?

Are smoke alarms tested regularly?

Do all the unused powerpoints have safety plugs in them?
You can buy them from many shops selling electrical appliances and fittings.
Are all the unused power points switched off?

Are curtains and bedding well away from any night lights?

Are all appliance power cords checked regularly for damage?



Cut these shapes out and paste them in the correct positions on your Safe and Smart sheet!

Have you made sure that any sharp objects like scissors, keys or screwdrivers have been put away? Sharp objects can be pushed into power points - that's dangerous!

Are all appliances kept away from any source of water?

Do plugs get pulled out safely by holding the plug not the cord?
Are young children stopped from unplugging anything?

Does everyone uncoil extension leads before using them, and put them out of the way when not in use?

Does everyone keep long objects or items like kites well away from power lines?

Are mobile phone chargers switched off and unplugged after use?

Is a registered electrician always used for any electrical repairs?

Are children taught to stay away from power lines/poles/boxes/transformers? Do they know to keep out of trees by power lines?

Are children taught to never drop anything into bar or fan heaters?

4e.13 Stay Safe

Read the following excerpt from a newspaper. This report appeared in the Whakatane Beacon on Tuesday 27 November 2007. Unfortunately a man was electrocuted while he was whitebaiting.

Brainstorm

Why did this accident happen and how could it have been avoided?

Whitebaiter badly burned as net hits lines

A WHITEBAITER had his arm and hands badly burned after he was electrocuted when his net accidentally touched an overhead power line in Poroporo.

The 47-year-old man suffered "moderate to severe" burns to his right arm and left hand when the accident happened on Friday at 6.30am, St John Ambulance acting area manager Michelle Sattler said.

The man was taken by ambulance to Whakatane Hospital but was later transferred to Waikato Hospital's burns unit.

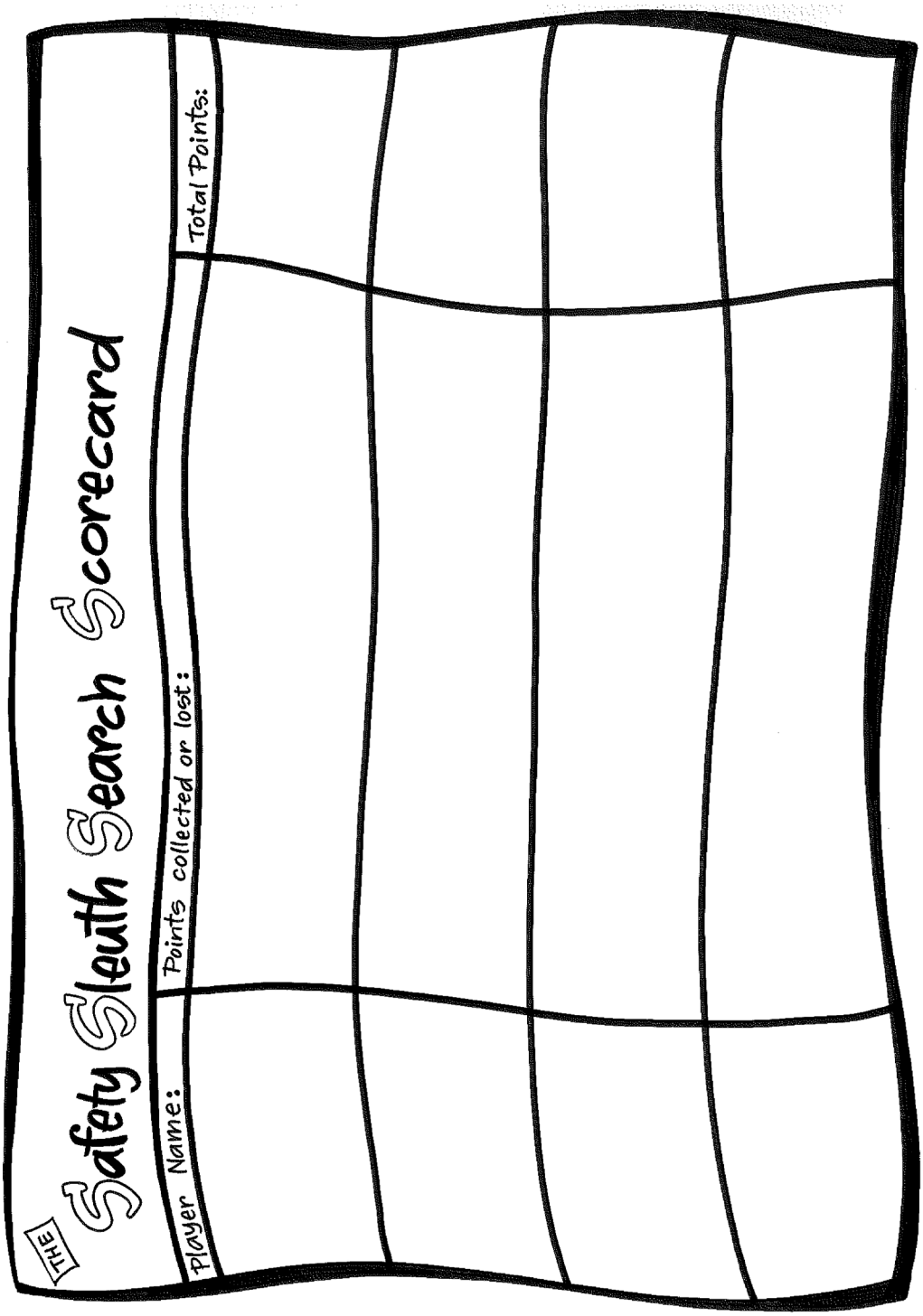
Evaluate/Reflect

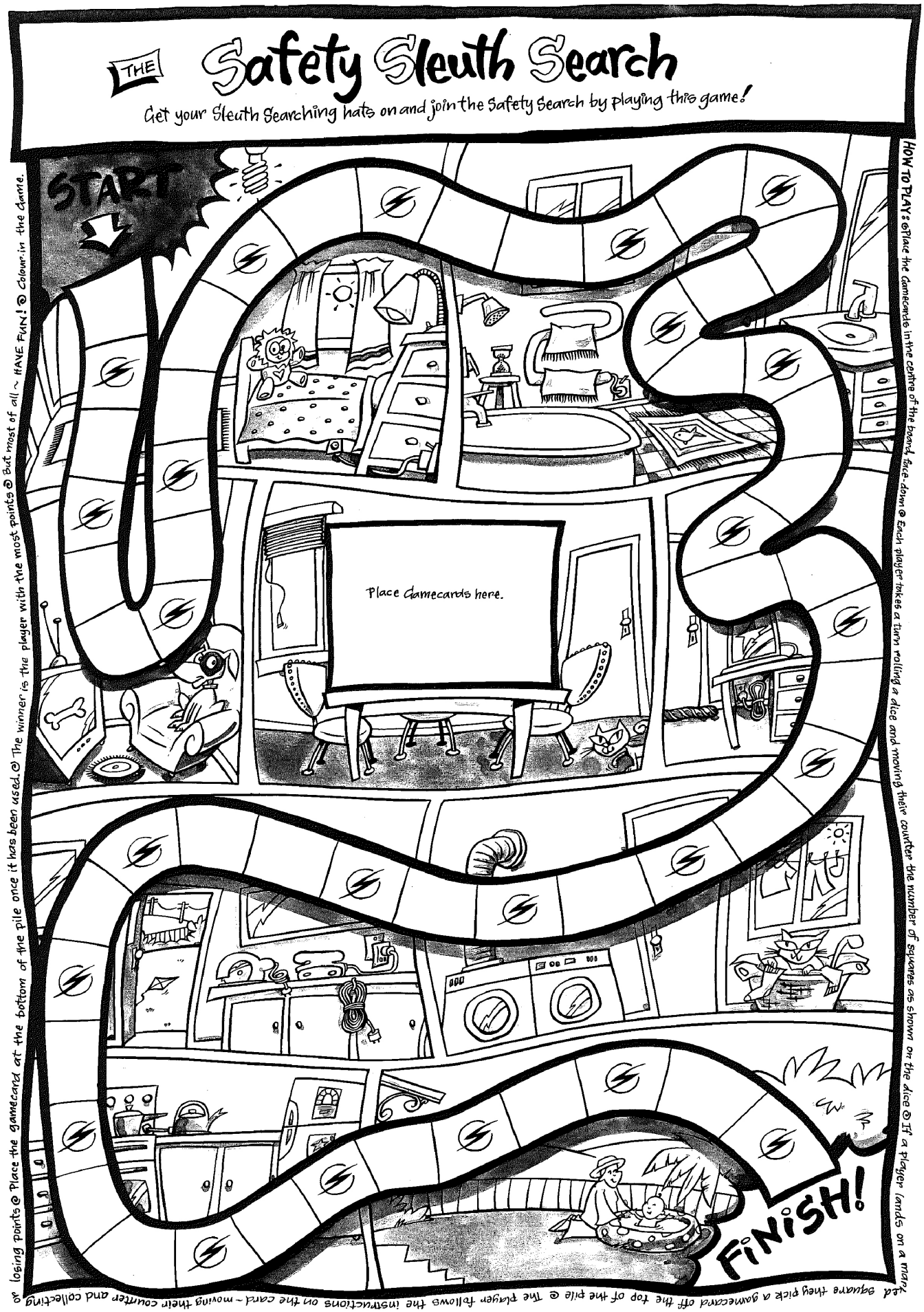
- Why do you think accidents happen around electricity?
- What can you do in the classroom to avoid accidents?

4e.14 Safety Sleuth Search

You will need

- An A3 version of the Game Sheet per group
- Cut out cards (next page) per group
- 1 dice per group
- 1 counter each
- A copy of the Safety Sleuth Score Card per group




THE Safety Sleuth Search
Get your Sleuth Searching hats on and join the Safety Search by playing this game!
START
Place Gamecards here.
FINISH!
HOW TO PLAY: Place the Gamecards in the centre of the board, face-down. Each player takes a turn rolling a dice and moving their counter the number of squares as shown on the dice. If a player lands on a marked square they pick a gamecard off the top of the pile. The player follows the instructions on the card - moving their counter and collecting or losing points. Place the gamecard at the bottom of the pile once it has been used. The winner is the player with the most points. But most of all ~ HAVE FUN! Colour in the game.

You put a safety plug in an unused socket. Good thinking. Move on 3 squares. Collect 10 points.	You wind up a long extension lead. Good thinking. Move on 2 squares. Collect 5 points	You unplug the radio by holding the plug firmly and pulling. Good thinking. Have another go. Collect 10 points.
You take your kite to a big, open area to fly it. Good thinking. Move on 2 squares. Collect 5 points.	You take your electric blanket to be tested before you use it in winter. Good decision Move on 3 squares. Collect 10 points.	You go to a park where there are some power poles, power boxes and overhead power lines. You play well away from them. Good decision. Have another go. Collect 10 points.
You notice the lead on the iron is frayed. You tell an adult who can get it fixed or replace it. Good thinking. Move on 2 squares. Collect 5 points.	You notice the lead on the iron is frayed and you ignore it and use the iron anyway. STOP! Think about safety. Move back 3 squares. Lose 10 points.	You use an electric lawn mower to cut the grass but you don't use a safety switch with it. STOP! Think about safety. Move back Lose 10 points
You dry your hands before you switch on the electric jug. Good thinking. Have another go. Collect 10 points.	You wear rubber soled shoes in the wet laundry. Good thinking. Move on 2 squares. Collect 10 points.	You get out of the shower, all wet, and go to switch on the hair dryer. STOP! Think about safety. Miss a go. Lose 10 points.
You haven't got enough sockets in your bedroom for all your things so you 'piggyback' double adapters into the socket. STOP! Think about safety. Miss a go. Lose 5 points.	There are young children in your house but there are no safety plugs in the sockets. STOP! Think about safety. Move back 2 squares. Lose 5 points.	There is a long extension lead lying on the floor across a doorway. STOP! Think about safety. Miss a go. Lose 5 points.

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EASTERN BAY ENERGY TRUST	EASTERN BAY ENERGY TRUST	EASTERN BAY ENERGY TRUST

You haven't got enough sockets in your bedroom for all your things so you unplug one appliance and plug in another. Good Thinking. Have another go. Collect 10 points.	You pull a plug out of a socket by holding the cord and pulling. STOP! Think about safety. Move back 1 square. Lose 5 points.	You take your kite to a place where there are overhead power lines. STOP! Think about safety. Move back 4 squares. Lose 15 points.
You plug another appliance into an already overloaded socket. STOP! Think about safety. Miss a go.	You unwind a long electric cord before you use it. Good thinking. Have another go. Collect 10 points.	You are throwing away an old, damaged iron. You cut off the plug so it can't be used again by mistake. Good thinking. Move on 1 square. Collect 5 points.
You take the radio outside to listen to it in the garden. The plug is lying on wet grass. STOP! Think about safety. Move back 2 squares. Lose 10 points.	You are walking along with a very long fishing rod. You are near power lines. You dismantle the fishing rod. Good thinking. Move on 3 squares. Collect 10 points.	You see a sign that says, "DANGER HIGH VOLTAGE" You stay well away. Good decision. Move on 4 squares. Collect 15 points.
You are going to dig a deep hole in the garden. You check where the underground electric cables are before you start. Good thinking. Move on 3 squares. Collect 10 points.	You put a safety plug in an unused socket. Good thinking. Move on 3 squares. Collect 10 points.	You unwind a long electric cord before you use it. Good thinking. Have another go. Collect 10 points.
You unplug the electric fire by holding the plug firmly and pulling. Good thinking. Have another go. Collect 10 points.	You pull a plug out of a socket by holding the cord and pulling. STOP! Think about safety. Move back 1 square. Lose 5 points.	You dry your hands before you switch on the hair dryer. Good thinking. Have another go. Collect 10 points.

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