RENEWABLE ENERGY IN TASMANIA

PRIMARY SCHOOL RESOURCE

YEARS P-2

Department for Education, Children and Young People

Tasmanian Government

Introduction to the resource

This resource is for years P-2 and is about understanding Tasmania's renewable energy capability and explores different types of renewable energy. For local context, the resource includes information about the Tasmanian Renewable Energy Action Plan (TREAP), which details actions and projects being taken to grow the state's renewable energy industry. It links to the Australian Curriculum: Science and Sustainability as a cross curricular priority. It introduces the concept of energy, its relevance to daily life and the difference between renewable and non-renewable energy. It includes background information for teachers, plus lessons and activities for students.

HOW TO USE THE RESOURCE

This resource uses the 'Five Es' instructional model designed by Biological Sciences Curriculum Study, an educational research group in Colorado. It has been found to be extremely effective in engaging students in learning science and technology. It follows a constructivist or inquiry-based approach to learning, in which students build new ideas on top of the information they have gained from previous experience.

The resource is designed to provide a variety of resources, notes and activities to give you flexibility in the classroom. You and your students can choose to use all or any of the sections, adjust them for your classroom or choose one for a deep dive into a certain topic. It includes:

- A curriculum overview mapping the years P-2 Australian Science Curriculum
- Teacher notes
- Student activities, including a matrix of curriculum-linked activities that allows teachers to provide a range of short and longer classroom activities for flexible delivery of the program
- The **What is energy?** video
- Further reading and resources.

THE COMPONENTS OF THE FIVE ES ARE:

ENGAGE
Students are asked to make connections between past and present learning experiences and become fully engaged in the topic to be learned.

EXPLORE
Students actively explore the concept or topic being taught. It is an informal process where the students should have fun manipulating ideas or equipment and discovering things about the topic.

EXPLAIN
This is a more formal phase where the theory behind the concept is taught. Terms are defined and explanations are given about the models and theories.

ELABORATE
Students have the opportunity to develop a deeper understanding of sections of the topic.

EVALUATE
Both the teacher and the students evaluate what they have learned in each section.

Australian Curriculum: K-2 Science 9.0

Area	K (adapt activities as needed for Prep)	1	2
SU - Science Understanding: **PS** - Physical Sciences	Describe how objects move and how factors including their size, shape or material influence their motion (AC9SFU02)	Describe pushes and pulls in terms of strength and direction and predict the effect of these forces on objects' motion and shape (AC9S1U03)	
SU - Science Understanding: **CS** - Chemical Sciences	Recognise that objects can be composed of different materials and describe the observable properties of those materials (AC9SFU03)		Recognise that materials can be changed physically without changing their material composition and explore the effect of different actions on materials including bending, twisting, stretching and breaking into smaller pieces (AC9S2U03)
SU - **ESS** - Earth & Space Science		Describe daily and seasonal changes in the environment and explore how these changes affect everyday life (AC9S1U02)	
SHE - Science as a Human Endeavour	Explore the ways people make and use observations and questions to learn about the natural world (AC9SFH01)	Describe how people use science in their daily lives, including using patterns to make scientific predictions (AC9S1H02)	

Renewables in Tasmania: Science & Sustainability

RENEWABLE ENERGY IN TASMANIA

Tasmania is known for being Australia's leading renewable energy state. Moving away from fossil fuels helps us take action on climate change by reducing our greenhouse gas emissions. Tasmania was the first Australian jurisdiction to achieve net zero emissions. Once we reached the target of 100% self-sufficiency in 2020, we then legislated a Tasmanian Renewable Energy Target to double that production. This means our target is to produce 21,000 gigawatt hours of electricity in one year, by 2040. This is 200% of our 2020 demand. Growing our state's renewable energy resource industry can attract investment, create jobs and support Australia to transition away from fossil fuels (coal-fired power stations and gas).

In 2020, the Tasmanian Government released the Tasmanian Renewable Energy Action Plan (TREAP) which details the key projects, actions and policies to grow and expand the renewable energy sector. Tasmanian educators and students have an important role to research, design, create, build, problem-solve, communicate, educate and support Tasmania's renewable energy future and our action on climate change. Table 1 outlines the three priority areas of the TREAP.

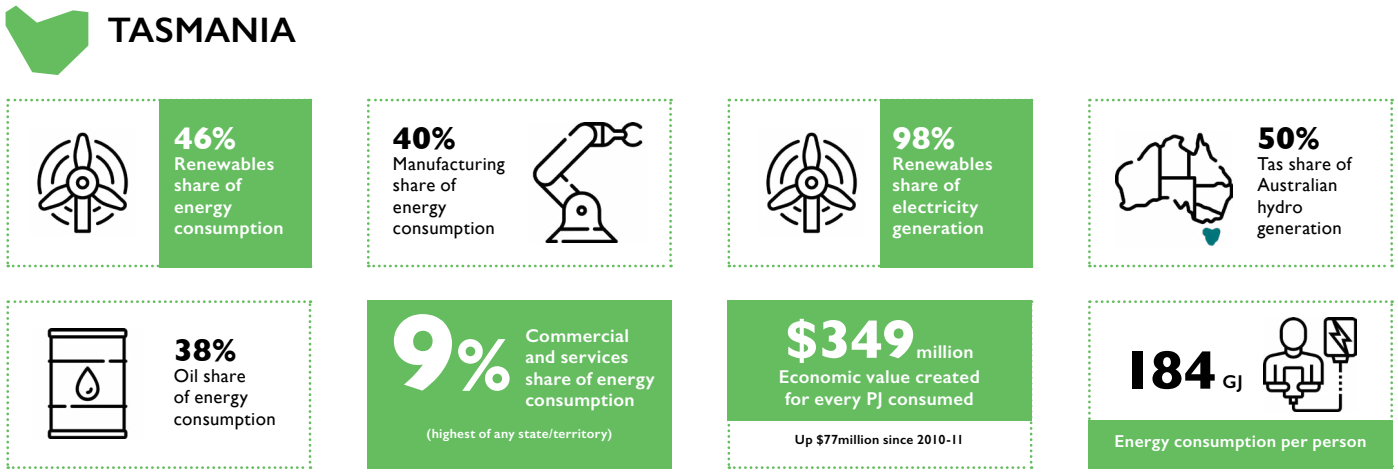
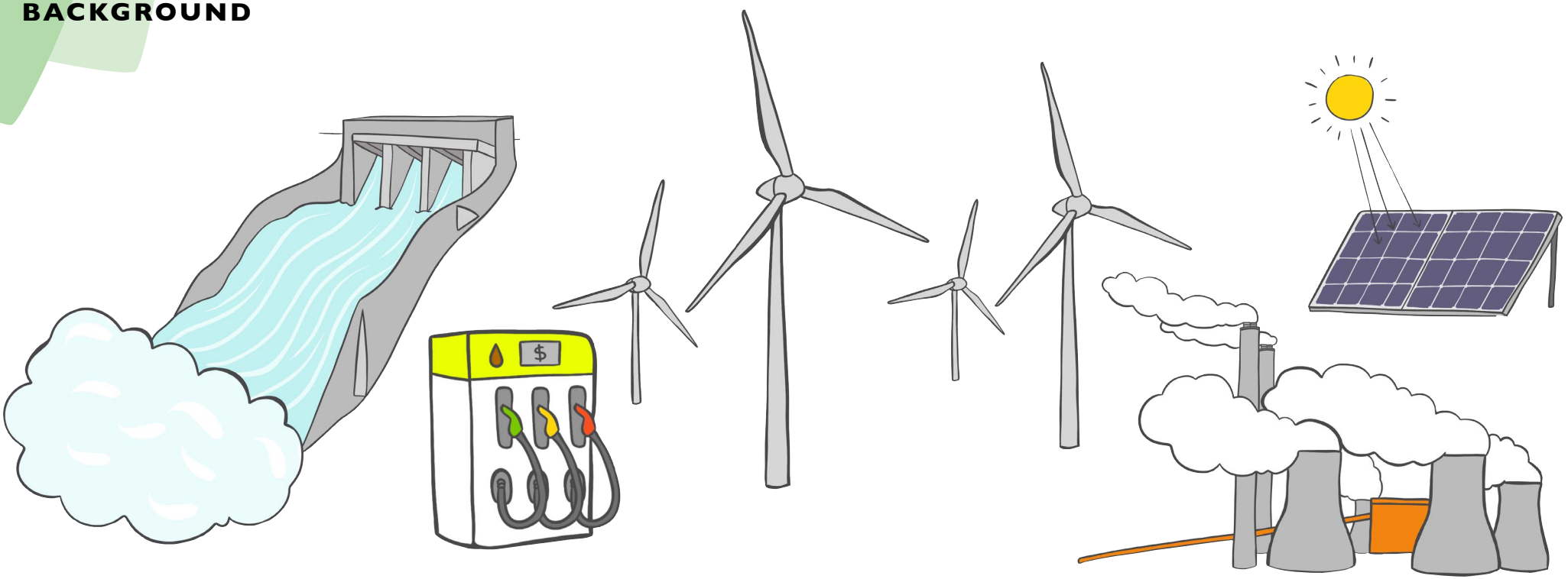


Figure 1: Tasmania's Energy Statistics. Source: https://www.energy.gov.au/ publications/australian-energy-statistics-state-and-territory

Table 1: TREAP priority areas and main projects

Priority	Main ideas / projects
1. Transforming Tasmania into a *global* renewable energy powerhouse	• Tasmanian Renewable Energy Target (200%) • Battery of the Nation • Project Marinus • Renewable Hydrogen Action Plan
2. Making energy work for the Tasmanian community	• Access to reliable, secure and affordable energy • Advocacy for use of renewable energy tools like smart meters, products and services • Continued support for energy efficiency programs
3. Growing the economy and providing jobs	• Maximise local business and employment opportunities for renewable energy projects • Continue to promote Tasmania as a premier investment destination for businesses wanting competitive, clean, reliable energy



RENEWABLE ENERGY AND CLIMATE CHANGE

Investment in renewable energy isn't just good for the economy. Renewable energy is clean, sustainable and can help us take action on climate change by reducing our greenhouse gas emissions. Because renewable sources of energy do not rely on burning fossil fuels, they can help to reduce emissions, and mitigate climate change.

Less reliance on fossil fuels like coal, natural gas (methane) and crude oil (for petrol) — all non-renewable resources — to power our lifestyles means reducing the carbon-based emissions (carbon dioxide, CO_2, and methane, CH_4) entering the atmosphere. That's a great reason to move to more renewable sources of energy for our power generation.
In Tasmania, our energy generation is predominantly from renewable sources: hydro power and wind. On the mainland, the use of renewables for electricity is on the rise, but the rest of Australia relies mostly on coal-fired power generation. In 2022, 32% of Australia's total electricity generation was from renewable energy sources, including solar (14%), wind (11%) and hydro (6%) (source: energy.gov.au). Other sources of renewable energy include geothermal (heat from the Earth), bioenergy (or biomass) and, more recently, green hydrogen, which is produced using renewable energy.

Batteries can store the electricity generated by renewables, so the energy can be used later. They can be 'recharged' and have a long life. They help store energy for electric vehicles, can be used in houses, apartments and commercial buildings.
Large-scale energy storage can be achieved using batteries, or pumped hydro. Large batteries are typically used for solar power and consist of an inverter to help charge and discharge the battery, and a transformer to step up to high voltage suitable for transmission around the electricity network. You can read more about pumped hydro on page 7.

Australia has huge potential for renewable energy, with great science research on energy storage and generation. University of Tasmania scientist Dr Stuart Corney says more diverse power generation, and more integration of energy systems means renewables are the future of the energy grid.).

SCIENCE UNDERSTANDING, SCIENCE AS A HUMAN ENDEAVOUR AND SCIENCE INQUIRY SKILLS

This guide introduces students to the science behind energy, its capture/conversion and use. It provides information about the most common forms of renewable energy and how they work, as well as their role in addressing climate change. Using this guide, you can encourage your students to think about energy, how we use it and careers in renewable energy – how interesting, diverse and important they can be.

HYDROELECTRIC POWER

Hydroelectric power is widely used to make electricity in many countries.
Here's how it works:

1. Water is stored in a dam or reservoir up high.
2. When the water is released, gravity makes it rush downhill through a pipe.
3. This fast-moving water hits turbines, which are connected to a generator.
4. The water's force makes the turbines spin, and this spinning generates electricity.

In the generator, there are rotating parts surrounded by a big magnet and copper wire. As the magnet turns, it releases a flow of electrons, which is electricity.

So, the process starts with the energy of the water up on the hill (potential energy), turns it into the movement of the turbines (kinetic energy), and finally changes that into electricity (electrical energy). This electricity goes through a transformer, then to a substation, and from there, it's sent to homes and businesses all over Tasmania.

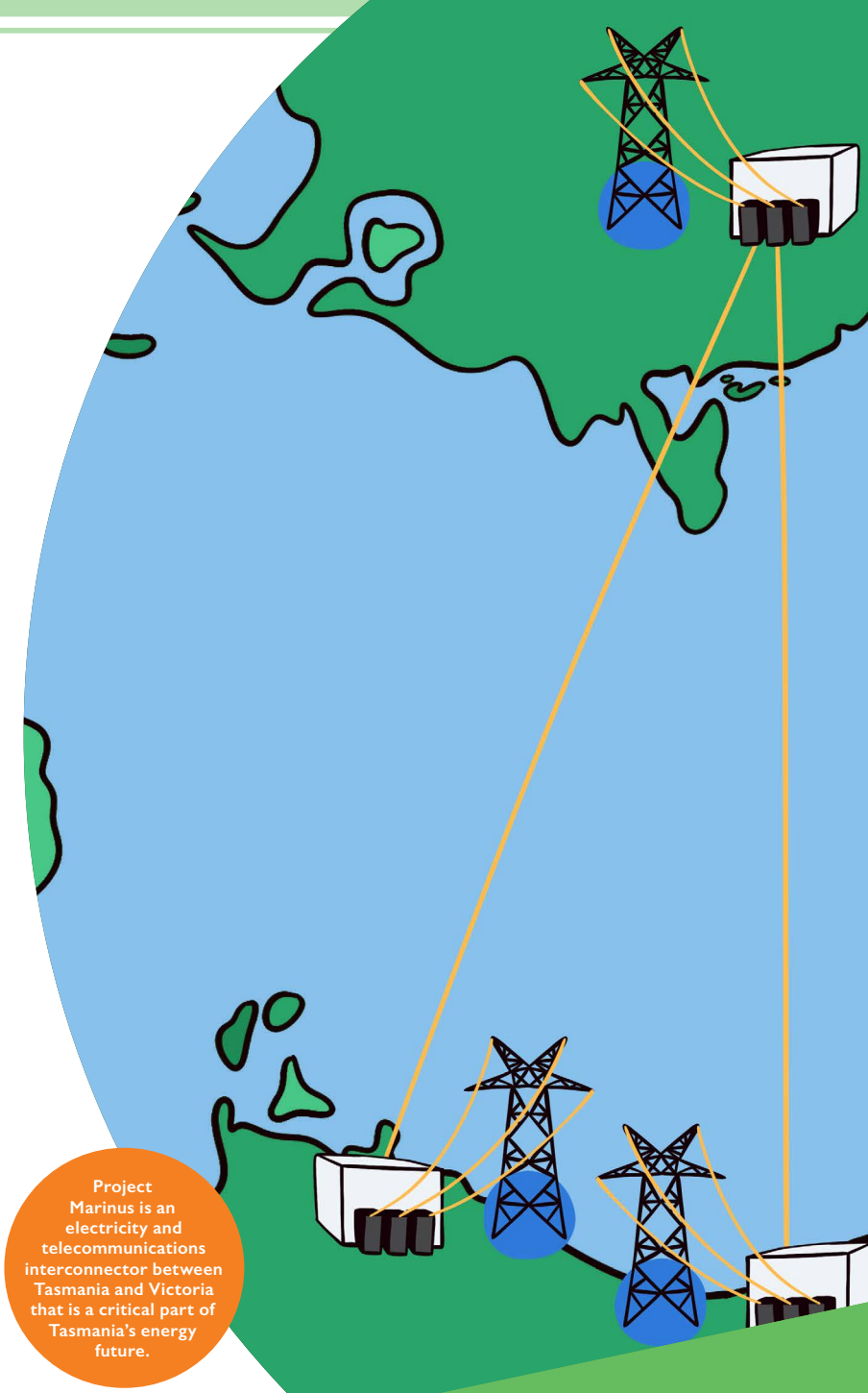
NATIONAL ELECTRICITY MARKET

The National Electricity Market (NEM) is a wholesale electricity market that connects the Australian electricity network from Queensland to South Australia and Tasmania via the Basslink interconnector — currently the sole electricity interconnector between Tasmania and Victoria.

The NEM allows generators of electricity, transmitters and electricity retailers to work together to get electricity exactly where it's needed at the best possible price.

PROJECT MARINUS

Project Marinus (also referred to as MarinusLink) is a proposed 750 MW capacity undersea and underground electricity and telecommunications interconnector between Tasmania and Victoria (with plans for a second 750MW still being considered).



Project Marinus is an electricity and telecommunications interconnector between Tasmania and Victoria that is a critical part of Tasmania's energy future.

Interconnectors are a key feature of the future energy grid. They allow power to flow between different regions (Tasmania to Victoria), and enable the efficient transfer of electricity from renewable energy generation zones to where the electricity is needed.

Project Marinus will add an additional interconnector between Tasmania and Victoria — allowing Tasmania to export more renewable energy to the mainland, and also ensuring there's always electricity exactly when we need it.

PUMPED HYDRO AND BATTERY OF THE NATION

Hydropower is a way to make electricity from moving water. It uses different methods like hydroelectricity and Pumped Hydro Energy Storage (PHES). Usually, electricity is used straightaway. PHES lets us store this extra energy for later use, or for export. We do this by moving water from a lower place to a higher one, kind of like making a big battery with the upper reservoir. Tasmania's 'Battery of the Nation' project is doing this to provide more clean and affordable energy to the NEM, starting with the Lake Cethana project and upgrading the Tarraleah hydropower scheme. You can read more at www.hydro.com.au/clean-energy/battery-of-the-nation

GREEN HYDROGEN

Green hydrogen is a fuel that can be made from clean energy sources. It's important for making our world cleaner and reducing pollution. Tasmania is in a good position to create a major green hydrogen industry because it has a lot of wind and hydropower. This hydrogen can be used here and sold to other places, helping our economy and making the mainland and other countries less relient on fossil fuels. It's good for our wallets, our energy supply, and the environment!

SKILLS AND CAREERS IN RENEWABLE ENERGY

While much of Australia still relies on fossil fuels, Australia's coal-fired power plants are being retired faster than expected, which will require more renewable energy generation and storage to replace them. The renewable energy industry has a huge range of STEM jobs in research, trades, office and field-based roles, and other roles such as communications and marketing, business managers, educators and tour guides.

Project Marinus and Battery of the Nation will generate many jobs in Tasmania and Victoria throughout their development, construction, and operation phases, as a skilled workforce will be needed to design, develop and maintain an affordable, reliable and secure energy grid. This will require engineers, builders, electricians, business managers, programmers, analysts, project managers, energy assessors, technicians, and many more careers and is a big opportunity for young people in Tasmania.

The MarinusLink and Battery of the Nation projects have the potential to generate hundreds of jobs in Tasmania.

Flick a switch

WHERE DOES THE LIGHT COME FROM?

1. Teacher switches classroom lights off and back on.

2. Ask the question – how do you think flicking the switch turns the lights off and on?

3. Pair & share: Students talk for 2-3 minutes (teacher to monitor engagement) about the question and their ideas.

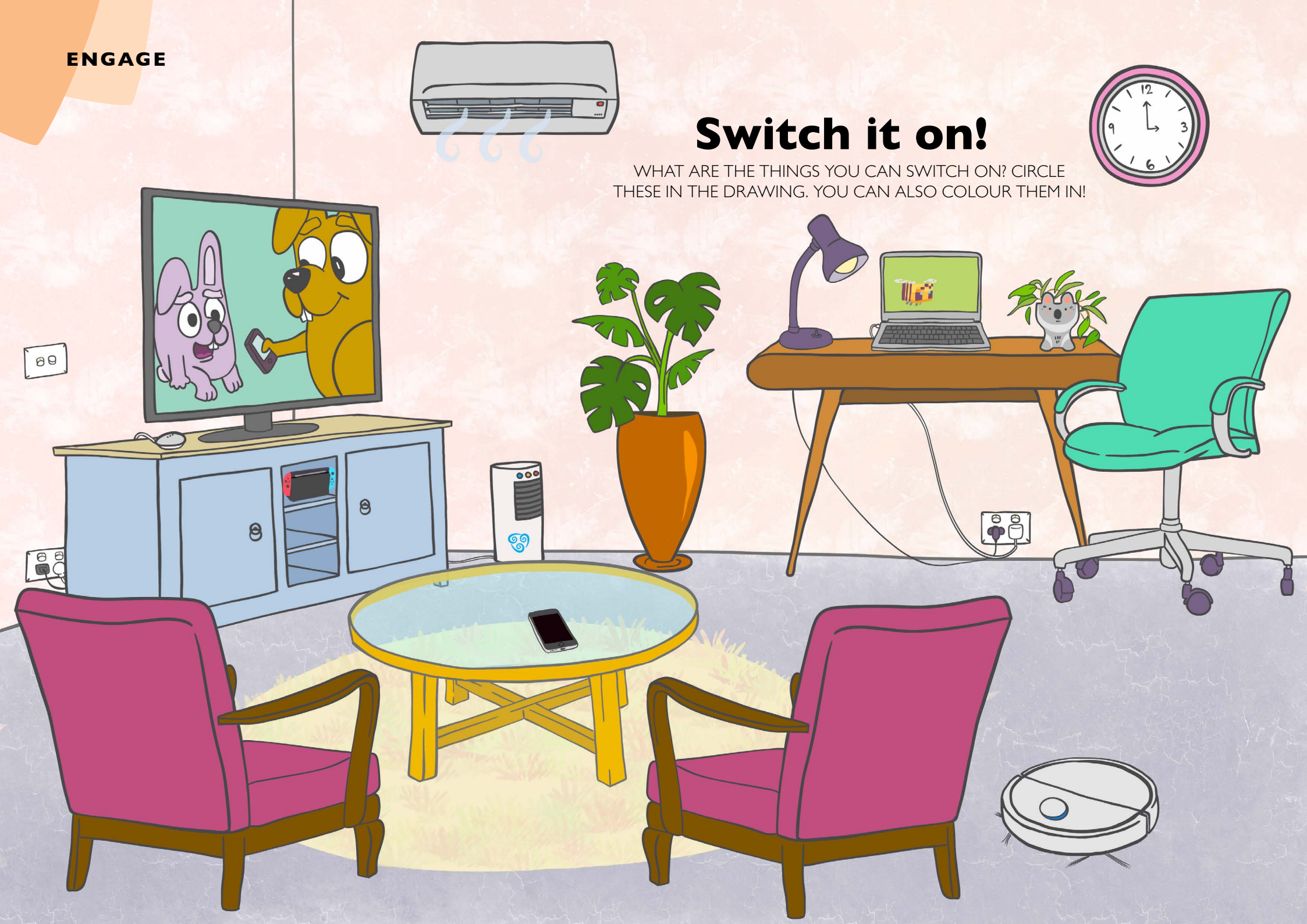
4. Whole class: Teacher to ask some of the students to share their thoughts – scribe ideas on whiteboard.

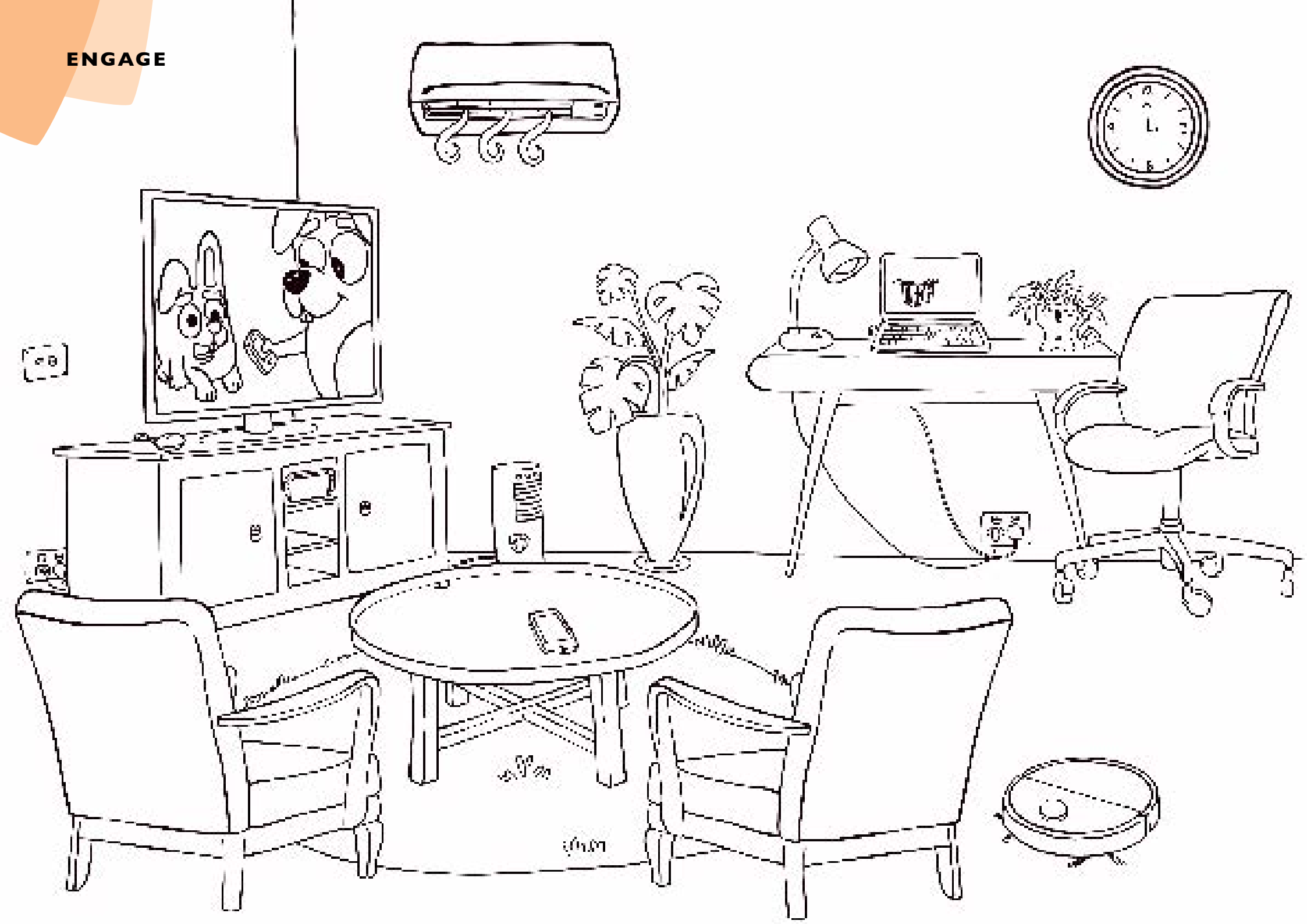
Watch video: P-2 What is energy?

Creative thinking: What do you think happens to the electricity when we turn the switch to 'off'?

Switch it on!

WHAT ARE THE THINGS YOU CAN SWITCH ON? CIRCLE THESE IN THE DRAWING. YOU CAN ALSO COLOUR THEM IN!





What is energy?

WHERE DOES THE ENERGY WE USE EVERY DAY COME FROM?

Teachers: Use the following text as discussion points for your class

POWERING AUSTRALIA

Just like we can eat all different sorts of foods to give our bodies energy, we can get energy for electricity from many different sources.

Some of these sources, like coal, we can't quickly get more of when they run out. And they make a lot of mess when we dig them up from the ground, and even more mess – which we call pollution – when we burn them to make electricity.

But there are other things, like water, sunlight and wind, that we won't run out of, and which we can use to make electricity in a cleaner way.

Here in Tasmania, we already get all our electricity from clean energy.

POWER FROM WATER

People have been using water for power for a very long time.

Long before people worked out how to make electricity, moving water in streams or rivers was used to turn wheels, which turned other wheels to do things like grind wheat to make flour, or saw wood.

Now, we can use water to make electricity. We still use the water to turn a sort of wheel called a turbine.

We call the electricity we make from water hydroelectricity. This is where most of our energy in Tasmania comes from. Tasmania has been making hydroelectricity for more than a hundred years now, and we are so good at making it that we are working on making enough to send some to the rest of Australia as well.

POWER FROM THE SUN

We can also get energy from the heat and light of the Sun. We call this solar energy. There are different ways of making solar energy, but the one you have probably seen is solar panels. You might have these on your roof at home or at school. These panels change sunlight into electricity that we can use for all sorts of things.

There is another sort of solar energy that changes sunlight into heat instead of directly to electricity, and this is called solar thermal.

POWER FROM THE WIND

Wind turbines are enormous, with the most recently built in Tasmania standing at nearly 200m from the ground to the top of the blade tip. The tallest building in Tasmania is only 73m tall!

To make the most of the best wind currents, turbines are built in places that get a lot of wind, and Tasmania is located in the Roaring 40s, an area of latitude on the Earth known for strong winds.

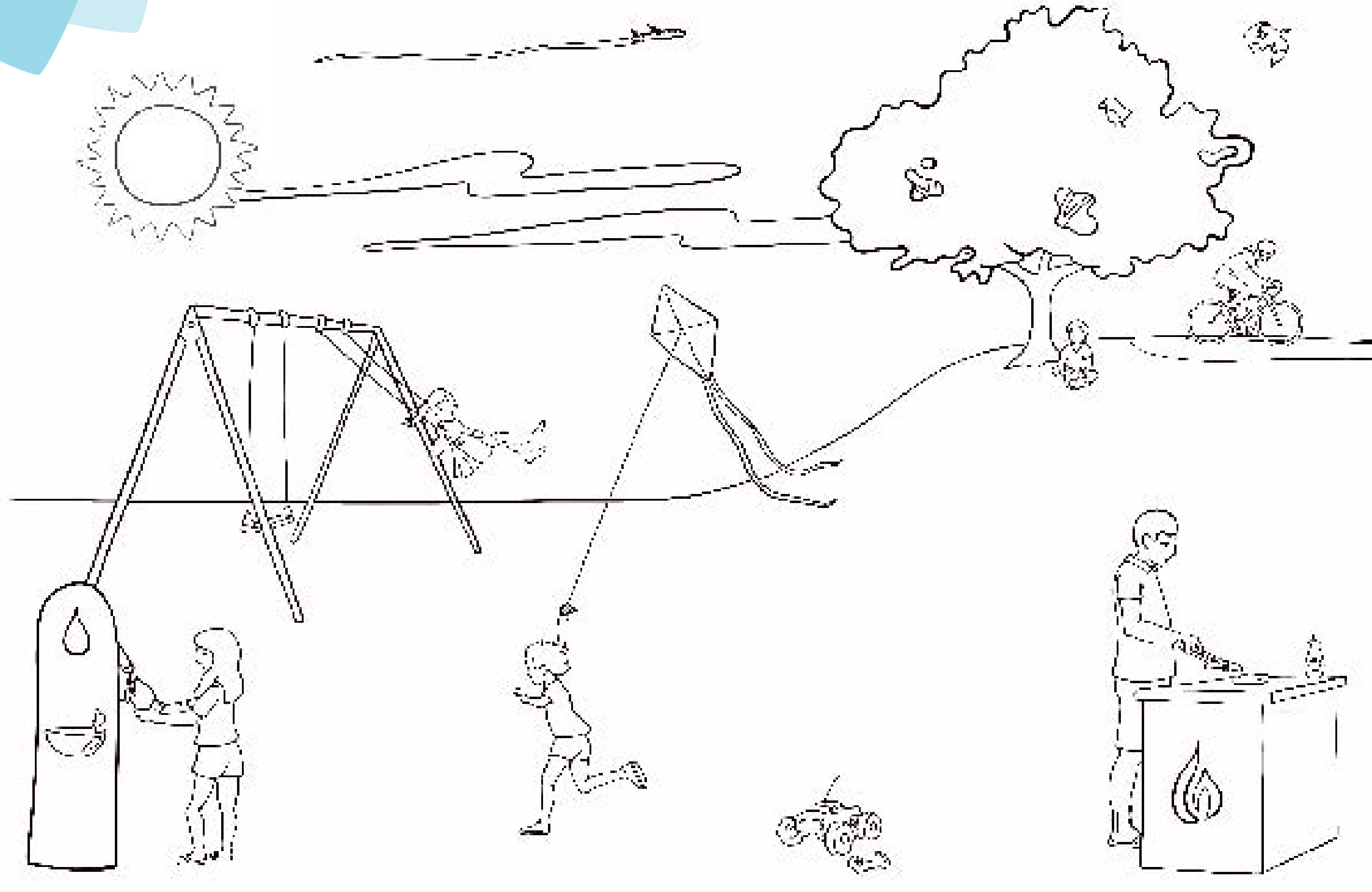
Wind 'farms' are where large numbers of wind turbines are set up in one place, feeding power into the electricity grid.

DID YOU KNOW?
Energy doesn't disappear. There is the same amount of energy in the world today as there was when it began. When we use energy, we don't actually use it up; we change it into other types of energy. When we burn wood, we change its energy into heat and light. When we drive a car, we change the energy in the petrol into heat and movement.

Find it

WHAT HAS ENERGY? CIRCLE THESE IN THE DRAWING. YOU CAN ALSO COLOUR IT IN!

EXPLAIN - ARTICLE I - ACTIVITY



How can we save energy?

Teachers: Use the following text as discussion points for your class.

First of all, let's have a think about why we might want to save energy:

- Some things – like most of our cars – use petrol for energy. Petrol is a type of energy that costs a lot and is bad for the environment.
- Energy costs money, even good, clean energy. If we save energy, we can use our money for other things.

TRANSPORT

Transport is how we get from one place to another. Walking or riding a bike uses our energy and is a great way to travel to somewhere quite close. If you need to go further or carry more things, you might go in a car or bus.

Have you heard of electric cars? Instead of using petrol, they use electricity – so you charge them a bit like you would charge a phone, by plugging them into a power outlet. There aren't many electric cars in Australia yet, but one day there will be. By the time you're old enough to start driving, you'll probably be driving an electric car!

Taking a bus – if there are buses near where you live – saves energy, because lots more people are travelling at once compared to a car.

HEATING AND COOLING

What do you do when you're too hot or too cold at home? In winter, when it's cold, instead of using a lot of energy to make your house really warm using a heat pump, you can put on a jumper and something warm on your feet.

Keeping our houses and buildings cool in summer is important too. Growing trees can help with shade, and when people design new houses to build, they can make sure that breezes can come through when we need them.

HAVING FUN

Even watching television or playing on a device uses energy. Every time you read a book or go and play outside, you're saving electricity.

FOOD

We can save energy on our energy too! If we buy food that comes from a long way away, lots of energy gets used bringing the food to us in big trucks, or even aeroplanes. If we buy food that comes from close by, or even grow our own, we save a lot of energy (and it tastes better too, because it's fresh).

We can save energy in lots of ways!

In these pictures, how much electricity is used? The images on top show ways we can use less electricity!

The Matrix

	P-K	1	2
Science	Set up two tracks for toy cars: one flat on the ground, and one on a ramp. • How can you make the car move along the flat track? • What do you have to do to make it move down the ramp? • What do you have to do to make it move up the ramp?	Give students a rubber band, a pipe cleaner and a lump of playdough. Get them to stretch and bend each of them. • What happens when you stretch it? • What happens when you bend it? • Can you break it into smaller pieces using your hands? • Can you put it back together if you break it into smaller pieces?	Bring a tray of ice cubes into the classroom and ask the students: • What is this? • Is it solid or liquid? • What will happen to it if we leave it in a container in our classroom? • [if they say it will melt] What does it turn into when it melts? • Water can be liquid and solid – can it be anything else? • Boil an electric jug – what is happening here?
Science as a Human Endeavour	Spend 2 minutes trying to find everything in your classroom that uses energy. Discuss them as a group. Did anyone find things that you missed?	Building on previous activity – what would each of these materials be useful for? Think of one thing you could make with each of them, that the other ones wouldn't be good for. Why?	Building on previous activity – how do you think water works in nature? Where/how do we see water in nature? How do you think it gets from one of these places to another? Where can you find water in your house or property? How do you think it gets there?
Cross Curricular Priority	Using old magazines, cut out and make a collage with pictures of things you have in your house that use energy.	Make a drawing or painting of yourself at home or at school doing 3 different things that are helping to save energy.	Play a drama game. One person uses their body to pretend to be a machine that uses energy to run – everyone else has to guess what they are. When someone gets it right, they take the next turn.
General Capabilities	Take turns to tell the class your favourite: • way to get energy for your body (food) OR • thing to play with that DOESN'T need any energy.	Make a poster for the classroom that has reminders – in words and/or drawings — about ways we can save energy at school. You could make it a chart where you can put a tick or a star every day you remember to do the right thing.	Make a simple game like snakes & ladders, where you go up when you save energy and down when you waste it. Play it with a classmate.
STEM	Make a simple catapult with paddle pop sticks and rubber bands. Use it to launch different things and see how far they go.	Think about the energy we use for different things like cars, lights and keeping warm. In a group, talk about what sorts of jobs people might have that help bring that energy to us. [Teacher to provide prompts as appropriate.]	We've been learning about energy and how we use and save energy. How do you think we store it? [Provide some examples of items that use batteries.]

This activity is suitable for years P-2 and links to the Sustainability Cross Curriculum Priority, General Capabilities and Science as a Human Endeavour.

Cool colours

Background

Light can turn into heat when it hits something solid and it can also be reflected so it doesn't turn into heat.
Do different colours reflect heat differently?

What do we think?

○ Yes ○ No

Materials

- Coloured paper, including white and black
- Ice cubes (all same size)
- Timer

Procedure

1. Choose a warm, sunny day. Go outside and put the pieces of coloured paper on the ground, making sure they are all getting sunlight.
2. Put one ice cube on each sheet of paper.
3. Start timing and record the time it takes for each ice cube to melt.

Analysis and conclusion

Did the ice cubes all take the same amount of time to melt?

Was the time shorter or longer for the light coloured/dark coloured paper?

Real world connection

If you wanted to stay cool on a sunny day, what colour would be good to wear?

This activity is suitable for years P-2 and links to the Sustainability Cross Curriculum Priority, General Capabilities and Science as a Human Endeavour.

I can see sound!

Background

Sound is a type of energy – it moves!

Can we see that movement?

What do we think?

○ Yes ○ No

Materials

- Medium-sized bowl
- Plastic wrap
- Big rubber band
- Uncooked beans
- Uncooked rice
- Pepper
- Big saucepan
- Big spoon

Procedure

1. Cut a piece of wrap that's a bit bigger than your bowl.
2. Stretch it over the bowl and hold it on with a rubber band. It will look a little bit like a drum.
3. Sprinkle a few beans on the top of the plastic. Hit the bowl with the spoon to create a sound. Hold it close to the plastic. What happens?
4. Does anything happen if you get right up close to the bowl and hum (without letting your face touch the bowl).
5. Try the rice and the pepper. Is there any difference? What about using a saucepan instead of a bowl?

Analysis and conclusion

What did you see?

What was the difference between the beans, rice, and pepper?

Were the sounds different with different instruments?

This activity is suitable for years P-2 and links to the Sustainability Cross Curriculum Priority, General Capabilities and Science as a Human Endeavour.

Energy from sunshine: the plant version

Background

We can use the sun to make electricity.

Do plants use the sun for energy?

What do we think?

○ Yes ○ No

Materials

- Seed trays
- Seed raising mix
- Fast-growing seeds like peas, beans or fenugreek
- Brown paper bags
- Small watering can

Procedure

1. Fill 3 trays with seed-raising mix and plant 2 or 3 seeds into each. Water gently.
2. Put all the trays in a position where there will be sunlight for as much of the day as possible.
3. Leave one tray uncovered. Cover another with a brown paper bag, but take the bag off for one hour every day. Cover the third with a brown paper bag, but only take it off when watering the seeds.
4. Water the trays every couple of days – just make sure the soil stays damp.
5. How did the 3 trays go?

Analysis and conclusion

What happened to the seeds?

What does that tell you about plants and sunshine?

Real world connection

If you wanted to grow vegetables to eat, what would you need to think about when choosing a spot to plant them?

This activity is suitable for years P-2 and links to the Sustainability Cross Curriculum Priority, General Capabilities and Science as a Human Endeavour.

Build a Lego dam

Background

Sometimes – like when we are using water to make electricity – we want to be able to store water, and control how and when it moves. Dams are one of the ways we can do this.

Can you build your own dam to make the water move how you want it to?

What do we think?

○ Yes ○ No

Materials

- Lego base plates and assorted blocks
- Tubs to set up a dam
- Bottles for pouring water

Procedure

1. Talk about dams, show pictures/videos of how they work.
2. Ask students to work in pairs to build their own Lego dam using a base plate as a slope and the bricks as walls.
3. Let students pour water into their dam and make modifications if required/ desired.

Analysis and conclusion

What were you trying to do with your dam?

Did it work? Why/Why not

This activity is suitable for years P-2 and links to the Sustainability Cross Curriculum Priority, General Capabilities and Science as a Human Endeavour.

Water works

Background

We use water for lots of things, including transport (boats).
It's important for boats and ships to float.
Do we think some things float better than others?

What do we think?

○ Yes ○ No

Materials

- Tubs
- Water
- A range of objects, such as balls, blocks, pencils, rubbers and other common classroom objects

Procedure

1. Ask students to choose 3 or 4 different objects each.
2. Ask them to draw or write these objects as a list and next to it write 'Yes' or 'No' for whether they think it will float.
3. Students test each of their objects and record whether or not it floated.

Analysis and conclusion

Which things floated?

Were you right in your guess about which things would or wouldn't float?

If you were building a boat, what might you use to build it?

This activity is suitable for years P-2 and links to the Sustainability Cross Curriculum Priority, General Capabilities and Science as a Human Endeavour.

Float your boat

Background

We've already looked at things that float and don't float. We use water for energy and for transport – boats – and they need to be able to carry things.

Materials

- Tubs
- Water
- Small pieces of aluminium foil
- 5 and 10c coins
- Cottonwool balls

Procedure

1. Show students how to make a boat shape from foil.
2. Let students test that their boat floats (help fix them if they don't).
3. Ask them to guess how many coins or cottonwool balls their boat will hold before it sinks.
4. Experiment.

Additional activities: This carbon unit is worth a look, as is this online Scootle activity.

Analysis and conclusion

Could your boat hold more coins or more cottonwool balls?

Why?

How do you think big ships carry heavy things?

What did you learn?

Think about what you have learned about energy.

- Write or draw 3 things you learned that you didn't know before OR
- Work in groups of 3 to create a short presentation or performance about saving energy.