Resources and education services
We offer a range of facilitated school programmes and environmental education resources on natural resources and their sustainable management. Environment Canterbury also produce general information and resource material, such as pamphlets, brochures and booklets, many of which are free.

If you would like to receive a 'Key to Canterbury' environmental education pack contact: Environment Canterbury education staff on 03 365 3828 or Customer Services on 0800 600 636 (0800 324 434).

Environment Canterbury: what we do
Environment Canterbury is your regional council. We manage 12 activities for the Canterbury region,
- Air quality
- Civil defence and emergency management
- Coastal environment
- Energy
- Land
- Natural hazards
- Navigation safety
- Pests and biosecurity
- Public passenger transport
- Regional land transport
- Waste, hazardous substances & contaminated sites
- Water quality, quantity and ecosystems

We welcome your comments or suggestions for what you would like to see in future issues.

If you are not on the mailing list for Your Environment, Canterbury, or you would like to receive extra copies of this resource, please contact Environment Canterbury education staff at the Christchurch office, 58 Kilmore St, phone 03 365 3828.

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Power the future

We are used to living with all the mod-cons. As society has developed and changed, so have our lifestyles. Tasks that a hundred years ago took considerable time and effort, like washing clothes, cooking dinner or going to the shop are now accomplished easily and in a fraction of the time. We can do more each day because we have washing machines, electric or gas stoves and cars. These appliances help our everyday efficiency enabling us to accomplish more activities in a day than at anytime in the past. Our time may be more efficiently spent, but are we living more efficiently and at what cost to the environment?

Life is all about trade-offs. In today’s society our time is used more efficiently due to modern appliances but the cost is high ENERGY use. Across all aspects of our lives, at home, at work, we all use a lot of energy each day. We are big consumers of energy that comes from sources which are not guaranteed, like oil and gas. The thought of life without electricity or petrol is almost inconceivable, but it could be a reality.

The gas and oil fields haven’t run dry yet but they do have a life expectancy. We need to start thinking ahead, planning for energy change, preparing to power the future.

In this issue of Your environment, Canterbury we put the bright light on power issues: what types of energy we currently use, where it comes from and some energy alternatives. We need to be thinking ahead, thinking about how will we ‘back enough punch’ to power our future.

In this issue...

1. What is energy?
2. Solar energy
3. Wind energy
4. Hydroelectricity
5. Curriculum links

Produced by Environment Canterbury twice yearly
Your environment

Canterbury

What is energy?

Energy is the strength or power to do something. Ever heard the words, “that person lacks energy, or those kids are full of energy”? To have enough energy to walk, run and think human beings need to eat and drink. Food fuels our bodies. Different fuels like oil, coal or gas are needed to energise machines. There are many different sources of energy. We can get energy from the sun, wind, water, fossil fuels and plants such as trees for wood and crops for oil. There are also many different types of energy for example electricity, mechanical or heat energy that comes from burning fuels.

**Renewable resources**

- Hydro (water)
- Geothermal (steam)
- Solar (sun)
- Wind

**Non-renewable**

- Coal
- Natural gas
- Oil
- Nuclear (not in New Zealand)

Electricity is of vital importance to both our individual lives and the economy. The need for electricity will continue to increase as a result of economic development and population growth. The need for oil-based fossil fuels also continues to increase. This creates a problem as New Zealand is dependent on imported oil to power both vehicles and industry. This means we have little control over either the price or the availability of supply. Many scientists forecast that oil reserves around the world can’t last forever. Some people within the oil industry predict that world oil consumption may exceed commercial production within the next 10 years. Closer to home, similar issues concern the largest of New Zealand’s gas fields. The Maui gas field is predicted to run out by 2037. The fuel from the Maui field currently powers the Huntly power station which is an important national supplier of electricity. Two thirds of all energy used in New Zealand is made up of a combination of fossil fuels. The remaining third (by and large) comprises hydro and geothermal sources of energy.

There seems no doubt that we need to reduce our reliance on non-renewable fossil fuels, like oil, coal and gas to provide the energy needed by power stations to generate electricity. We need to be looking at renewable sources of energy to power our future.

In New Zealand we already commercially use two renewable forms of energy to generate power: hydro and wind. Hydro-power stations have become part of the New Zealand landscape and Canterbury is home to many of them. The McKenzie district is well known for its hydro lakes, stations and canals. Between 70% and 80% of electricity in New Zealand is produced through hydro-power schemes. Wind power is used to generate electricity in New Zealand, but on a small scale. The wind turbines are situated in the Takaroa Ranges north of Wellington. The new wind farm is soon to be built in the Manawatu Gorge in the North Island. This will be the largest wind farm in the southern hemisphere.

**Hey! Look at this...**

Fossil fuels actually come from fossils. A long time after a plant or animal has died it turns into a fossil. Over even more time the fossils turn into oil, coal and natural gas.
Sources of energy use in New Zealand

Nonrenewable
- Oil = 32%
- Gas = 27%
- Coal = 7%

Renewable
- Hydro = 15%
- Geothermal = 14%
- Other = 6%

Other energy sources (solar, wind, etc.)

Activity
Here’s a quick activity. Can you unscramble the words to match them with their meaning?

usssoeffffli
- fuels formed from the remains of plants and animals from a long time ago

nttaasbulies
- maintain or continuously keep going an energy source

gryye
- the strength of power to do something

bneearliw
- source of the energy can be replenished (made again) naturally in a short period of time

nwahnn-erloeey
- source of energy can’t be replenished (made again) in a short period of time

Fact...
Fossil fuels make up 99.9% of energy used in transport

So what’s happening in Canterbury?
The population in Canterbury continues to grow. Between 1991 and 2001, population growth in the region was 1%. The trouble is, domestic energy consumption has exceeded the population growth by 0.5%.
The need for oil to provide fuel for transport continues to grow. Did you know that domestic use of vehicles is responsible for about 38% of all energy consumption in Canterbury? But oil-based products are not the only energy sources starting to feel the squeeze. Electricity is also starting to come under pressure from increased people and activities. One example is the growth of dairy farming across the region. The Canterbury Plains are a dry area but cows need lots of grass in order to produce milk. Electricity is required to power the huge irrigation systems that water the land to keep the grass growing.
Your environment

Canterbury

Solar energy

Solar energy is energy that comes from the sun in the form of sunlight. It is the most abundant form of renewable energy in the world. Sunlight can be converted into energy such as heat and electricity. One way to capture the sunlight and therefore harness the sun's energy is to use solar panels. Solar panels convert the sunlight directly into electricity.

The simple solar-panel - how does it work?

Sunlight is made up of tiny particles of solar energy called photons. Solar panels are made up of lots of parts called solar cells. When the photons in the sunlight shine on a solar cell three things can happen:

1. They may bounce off or be reflected;
2. They may pass right through the solar cell;
3. They may be absorbed by the solar cell.

The absorbed photons can be converted into electricity.

Solar energy is free, clean, sustainable and virtually inexhaustible. It is available almost anywhere in the country and although it is affected by season (more in summer, less in winter) it is more reliable than people think. Using the sun's energy is not a new idea, but modern technology now makes it easier and cheaper to use solar energy than ever before.

Did you know?

• The average New Zealand home receives between 15 and 30 times more energy from the sun than its sun shine on the house than the household will use in electricity or gas.
• On average New Zealand has about 2000 bright sunshine hours per year. If each New Zealand home had its roof area (10m²) half its roof area covered in solar panels, together we would generate 25% of New Zealand’s electricity needs.
• Solar technology is able to produce electricity more reliably, with the least system maintenance and zero fuel costs than many of our established sources commonly in use.

Electricity from solar energy is already used in a variety of ways, both big and small. It is used to power wristwatches, calculators and toys as well as telecommunications, navigation beacons and isolated homes far away from the national electricity grid.
The sun’s warmth

Sitting in the sun on a summer’s day can be hot, sometimes too hot! There is a way to catch this warmth and use it to heat the water in your house. The principle is simple. For example, imagine you are standing between two cars on a sunny day with one hand on the bonnet of a black car and the other hand on the bonnet of a white car. Which car would feel the hottest? The black car will be hotter than the white car because dark colours absorb more heat than lighter colours. Solar water heating uses this principle by ensuring that the place where the sun’s heat is collected is a dark colour.

Solar water heating is already used in some houses around New Zealand. Once you are set up, using solar energy to heat your water can save a household up to 50% of its normal electricity bill! It not only benefits you, but it benefits the environment too!

Solar energy has the power to significantly and positively contribute to energy requirements in a healthy, renewable and therefore sustainable way.

Make a solar water heater

Try this experiment and see just how effective the sun really is at heating water.

**You will need...**
- scissors
- a black plastic rubbish bag
- 3 containers, all the same size (cake tins are good)
- masking tape
- a measuring cup
- plastic wrap (cling wrap)
- a thermometer
- a saucer
- notebook and pencil

**What to do...**
1. Cut a piece of the black plastic rubbish bag big enough to line the inside of one of the 3 containers. Line the container with the plastic, holding the plastic in place using the masking tape on the outside of the container.
2. Fill 3 of the 3 containers with the same amount of water. Use the measuring cup to make sure each container has the same amount of water.
3. Use the thermometer to record the water temperature in each of the three containers. Record the results.
4. Cover the container with black plastic and one of the other containers with plastic wrap. Do not cover the third container.
5. Put the three containers all together outside in a sunny position. Leave them in the sun for 3-4 hours.
6. Check the containers every hour and record the water temperature. Start your recording with the pan that is uncovered. Remember to replace the plastic cover on the two containers after you have taken the measurement.
7. Compare your measurements and see if you can answer these questions.
   - Does the water heat faster in one pan than in the others?
   - Which pan got the hottest and why?
   - Which pan was acting like a solar panel?
Wind Energy

Wind is a naturally occurring phenomenon and is part of weather systems. Wind is created as the sun heats various parts of the earth’s surface to different temperatures. New Zealand has prevailing north-westerly winds due to its location. We don’t really take advantage of this free and clean energy resource, but many places in the world do convert wind energy into electricity.

Winding up the windmills, or wind turbines, we can use, like electricity, to generate mechanical energy. places, on land and sea, are normally consistent and by landforms such

How do wind turbines work?

Most wind turbines have spinning blades. Together the blades are known as the rotor. As the wind blows, the rotor moves. This in turn moves a drive shaft, which turns or drives the generator. The generator produces electricity. The first wind turbines to generate electricity were developed about 100 years ago, but it wasn’t until the 1970s that modern wind turbines started to be developed. Wind turbines do not use fuel like oil or petrol, which can harm the environment.

In more recent times, wind farms have been built to use wind energy to help provide the power needed for industry and our everyday lives. There are a few small wind farms in New Zealand. A trial with a wind turbine in Geilston Park near Christchurch has just started to see if it would be economically viable to generate electricity at this site. However, wind turbines on a commercial scale are large and can be highly visible due to their location. They often need to be positioned on hills, or close to ridge lines as these are the windiest places. Some people find them unattractive and believe they change the look of a landscape in a negative way.
Creating wind power
- make a mini wind turbine

You will need...
- 20 x 20 cm piece of light card
- A pencil
- A ruler
- Coloured pencils, crayons or felt pens
- Scissors
- A large-headed pin (a sewing pin would be good)
- Stick or a pencil

What to do...
1. Using the pencil and ruler divide the card into quarters, using diagonal lines.
2. Divide each diagonal line into thirds making a mark on the line.
3. Cut along each of the lines, starting at the centre and stop when you reach the mark. Mark the corners (see diagram).
4. Colour in the card on both sides if you wish.
5. Pick up the marked corners and push the pin through each corner in turn and then through the centre of the square.
6. Use the pin to attach the wind turbine to the stick.
7. Take the wind turbine outside and let the wind turn the turbine.

Some things to consider with wind generated power
- Clean form of power generation
- Does not affect air or atmosphere quality
- Uses wind, an unlimited free resource as fuel
- Renewable resource (wind)
- Visual and noise impacts, landscapes can be changed by the installation of large wind turbines. The noise of the turbines operating can be loud.
- Cultural significance of the land and archaeological sites (need to choose appropriate sites for wind turbines).

Wind energy has the power to significantly and positively contribute to energy requirements in a healthy, renewable and therefore sustainable way.
Hydropower in action

Hydroelectric power is normally generated from dams, behind which a large lake or reservoir is held. The water is released from behind the dam in controlled amounts. The water flows downhill to a turbine. The principle of this turbine is just like the wind turbine, although the design is different. As the water flows over the turbine it spins, just like an old water wheel. The turbine is connected to a generator and this converts the waters energy into electricity.

Environmental and social impacts of hydroelectricity generation to be considered:

- Clean form of energy,
- Does not affect air or atmosphere quality,
- New Zealand has a lot of water, it is a free and renewable resource,
- Able to produce considerable quantities of electricity and cope with seasonal and daily changes,
- Visual impacts, landscapes can be changed forever due to flooding of areas and dam construction, i.e. Mackenzie district in South Canterbury,
- Can reduce river flow,
- Can affect agricultural activities, loss of land or reduced water for irrigation,
- Cultural significance of the land and archaeological sites (placement of dams needs to take these things into consideration).

Hydroelectricity - using the power of water

Hydro means water and electricity a form of power. Hydroelectricity is generated when energy is released as water travels downhill under the influence of gravity. Therefore, the greater the amount of water and the higher up it is, the more energy it contains. Hydroelectricity provides a large proportion of electricity needed to keep New Zealand running. Of all water that is collected in New Zealand, 98% is used to generate power.

Aerial view of Benmore dam, South Canterbury. Photo courtesy of Meridian Energy.

Activity

You will need...
- Large tin foil pie plate
- Scissors, ruler, pencil
- Sticky tape
- Piece of string about 50cm long
- A small plastic toy such as a plastic animal or toy car

What to do...

1. Cut the bottom out of the pie plate and mark the centre of the plate. Using your ruler, divide the plate into 8 equal parts. Each dividing line must pass through the centre mark.
2. Cut along the lines stopping 2cm from the centre. Fold each of the eight segments, vertically and making the folds in the same direction. Lift the folded piece slightly so it is not lying flat against the other side. These are the blades that will catch the water.
3. Punch a hole through the centre and thread the wheel onto a pencil. Make sure the hole is big enough to allow the wheel to turn.
4. Turn on the tap and let the water run slowly. Hold the pencil at the base of your thumb and first finger. Place the wheel under the flow and observe what happens.
5. Now tie one end of the string to the small plastic toy and the other end to one end of the pencil. Let the water flow over the wheel. What happens to the toy? This water wheel is changing the energy in the moving water into mechanical energy that turns a drive shaft (the pencil) and moves the toy. This principle is the same as the wind turbine.
What's the scenario?

Take a look at the community in the picture below. It is a typical small community in no place in particular. The community used to be much bigger when the coal mine was in use which employed many people. After the coal mine closed it was expensive at the time it closed to get the coal from the settlement into the city, many people moved to the cities. Those that stayed made a living in the seafood industry.

Things are now changing for small isolated communities like this one. Power supply is no longer guaranteed. The government of this country wants the community and others like it to ‘close down’ as they believe they are inefficient and no longer sustainable. If the people want to stay they need to think about how they can create their own power. If their plan is good enough the government may support them to stay. Most of the people who live in the community don’t want to move.

There are some natural resources in the area that could be used to generate power, but how are they going to use them efficiently and sustainably?

Task

In groups, develop and write an efficient and sustainable energy plan for the community.

You can use the picture as part of your report. Mark on the picture where you would place energy generation facilities and what the facility is.

You will need to be able to justify your groups’ decisions to other groups in the class.

Remember: the plan needs to be well thought out if the government is to consider helping to support the community to develop its own power generation.

Things to think about...

(The different forms of power generation. Which forms are suitable for the community? Which are suitable for the environment? Renewable and non-renewable energy sources.)
Your environment

We all use energy everyday, a simple flick of a switch, the push of a button, the turn of a key. These things are so much part of our daily activities, the action of doing them has become a habit. We just don’t think about it. The same goes for our behaviours or actions that waste precious energy, sometimes we don’t even know that we are doing it.

Nobody ever said changing habits was easy, but we all know it can be done. Think about trying to stop biting your fingernails or sucking your thumb!!

Can you identify where power is being wasted in the picture? Do you do any of these things?

Activity

1. Can you find seven things in this picture where energy is being wasted?
2. Write down the things you have noticed and a sentence on what could be done to stop the energy being wasted.
What you can do to save energy at home and at school...

- Turn off the lights when you leave the room.
- Turn the computer off if you are not using it for a while.
- If you have the heater on, make sure the doors, windows, curtains and blinds are drawn.
- Make sure the dishwasher or washing machine is full before turning it on.
- Take a short shower instead of a long bath.
- If you are cold, put on another layer of clothes before putting on the heater.
- Replace a burnt out light bulb with a new energy efficient fluorescent bulb.
  - Think about what you want out of the fridge before opening the door.
  - Make draught stopping door snakes or fit draught excluders to block the cold air getting into your warm room.

**did you know?**

Even if an appliance is turned off, if it is plugged into the power point it still draws a small current. If you are not going to use something for a while you can save power by unplugging it or flicking the switch off.

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**Curriculum Links**

Energy fits particularly well with the Technology and Social Studies curriculum areas.

**Technology**

Technology and Society

Level 2: Identify different views about a specific technological development within the local community.

Level 3: Describe and identify the positive and negative effects of some instances of technologies on people’s lives and environment.

Level 4: Identify and compare the range of factors and attitudes that promote or constrain a current technological development in the wider community.

**Social Studies**

Resources and Economic Activities

Level 2: How and why people work together to obtain resources.

Level 3: How and why people manage resources.

Level 4: How and why people view and use resources differently and the consequences of this.

Place and Environment

Level 2: How people’s activities influence places and the environment and are influenced by them.

Level 3: How different groups view and use places and the environment.

Level 4: How places reflect past interactions of people with the environment.