5 Energy Sources

c - Energy from water and geothermal

Purpose

To explore sourcing our energy from water

Key concepts

- Water energy is a natural and renewable resource
- Water energy can be converted to electricity

After exploring the many forms and uses of energy (and the impacts they can have on the environment), consider possible ways to reduce your energy use. Also consider how you could increase the amount of energy you could produce in ways that won't harm the environment.

Consider

- How can you produce hydro or steam energy for use in your school?
- What are other alternatives?

Evaluate/Reflect

- To what extent were you able to produce and use water or steam energy in your school?
- What were the alternatives and were they more feasible?

Activities

Background text – Energy from water

Energy Kit

5c.1 Make a turbine (1)

5c.2 Make a turbine (2)

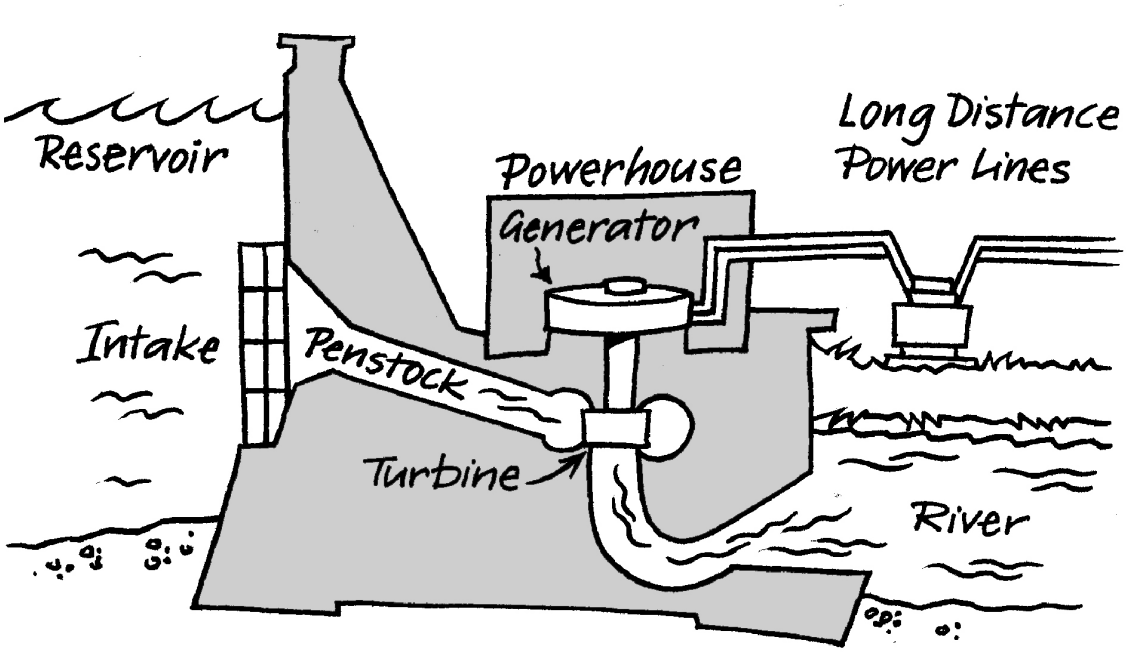
5c.3 Using geothermal energy

Little Green Readers (MAC) in Energy Kit

- Water power
- Making a water wheel

Background text

Energy from water

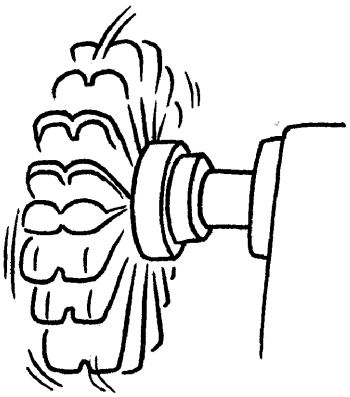


Hydro electric power plants use the power of falling water to turn the turbines that help generate electricity.

Water stored behind the dam is released through the penstock tubes to flow against the blades of the turbines to make them turn.

Hydro electric power provides about 70% of the electricity generated in New Zealand.

Visit local power stations in your area. In the Eastern Bay of Plenty you might visit Matahina dam or Aniwhenua Power Station.

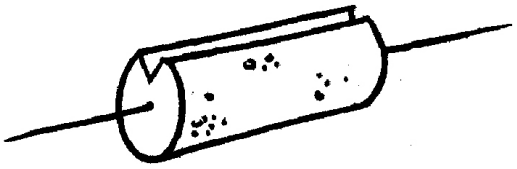


5c.1 Make A Turbine (1)

You will need

- Adult help
- A Stanley knife
- Two margarine containers
- Some wire
- Scissors
- A cork

What to do...



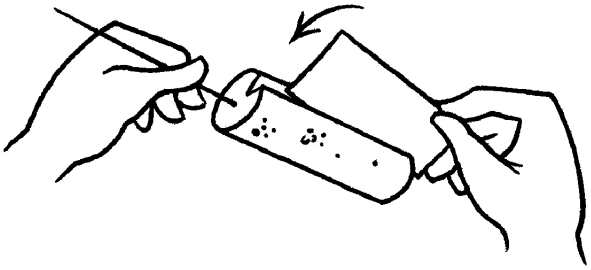
Push the wire carefully through the middle of the cork from end to end.

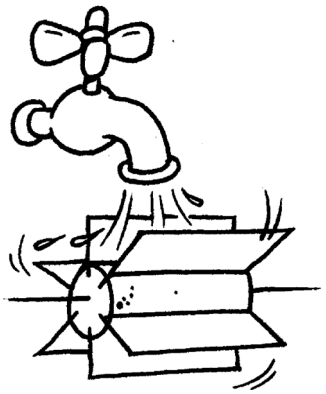
Be sure it moves freely.

Ask an adult to cut 6 slots around the cork, but not too wide or deep. Also have an adult cut 6 rectangles from the margarine containers.

Slide a rectangle into each slot.

This makes the paddle wheel.





Turn on the cold water tap.

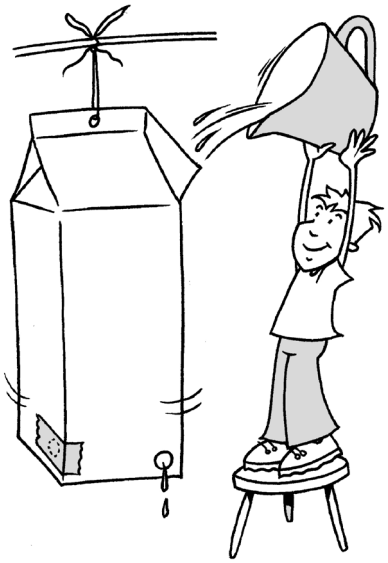
Hold the ends of the wire and put your paddle wheel under the flow of water.

Let it spin between your fingers.

Extension

- Find out how people used water wheels in the past
- Can you find if anyone is using them today?

5c.2 Make a turbine (2)



You will need per group

- A one litre tetra milk or juice carton
- String
- A skewer or nail
- Masking tape or tape that will stick to the carton
- A large jug of water

Method:

1 Using the skewer or nail, carefully punch 4 holes in the tetra carton; one in the bottom right hand corner of each face of the container.

2 Make another hole in the middle of the top of the carton. Thread the string through this hole and tie it firmly so you can hang the carton up by the string. Leave the sides of the top of the carton open so you can fill it.

3 Cover each of the bottom holes with sticky tape.

4 Hang the carton outside on a branch or horizontal pole where it can swing freely.

5 Fill the carton with water.

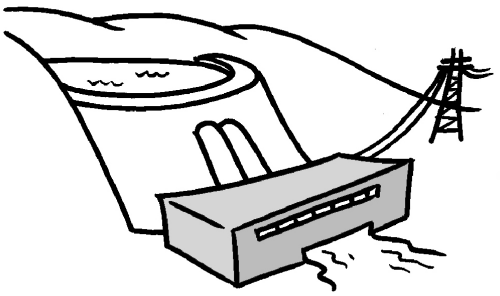
6 Pull the tab off one corner. What do you see happening?

7 Now pull the tab off the opposite corner. What happens now?

8 Pull off the other two remaining tabs. What happens?

9 Discuss
- What happened when the water came out of the first hole?
- Which direction did the carton turn, clockwise or anticlockwise?
- What happens to the speed at which the carton turned when more holes were uncovered?
- When did the carton stop turning? Why?

(As the water pours out of the first hole, the force of the water pushes the carton round in the opposite direction. The more holes there are the faster the carton turns.



Some power stations use this principle to make the huge turbines turn. As the water or steam is forced out through very small holes, the turbines turn. The turbine is connected by a shaft to an electricity generator which makes electricity.)

Reflect/Evaluate

- How could you use a water turbine at home?

Extension

There are different ways of turning turbines in order to generate electricity, for example – wind, water jets, tidal flow, and steam from geothermal sources or by heating water by burning fossil fuels (oil, gas, coal).

Research

Investigate hydro electric power stations in New Zealand. Where are they located? Are most of them in the North Island or the South Island? See maps in Activity 4c.9 Where do we get our power from? Which city in New Zealand do you think uses the most electricity? Is this city close to where most of New Zealand's electricity is generated? How does the electricity get from the power stations to the towns and cities? Where is most of the electricity for your school generated? What happens in very dry years to the electricity supplied by hydroelectric power stations?

Explore how tidal flow and waves are used to generate electricity – There are many examples on www.youtube.com.

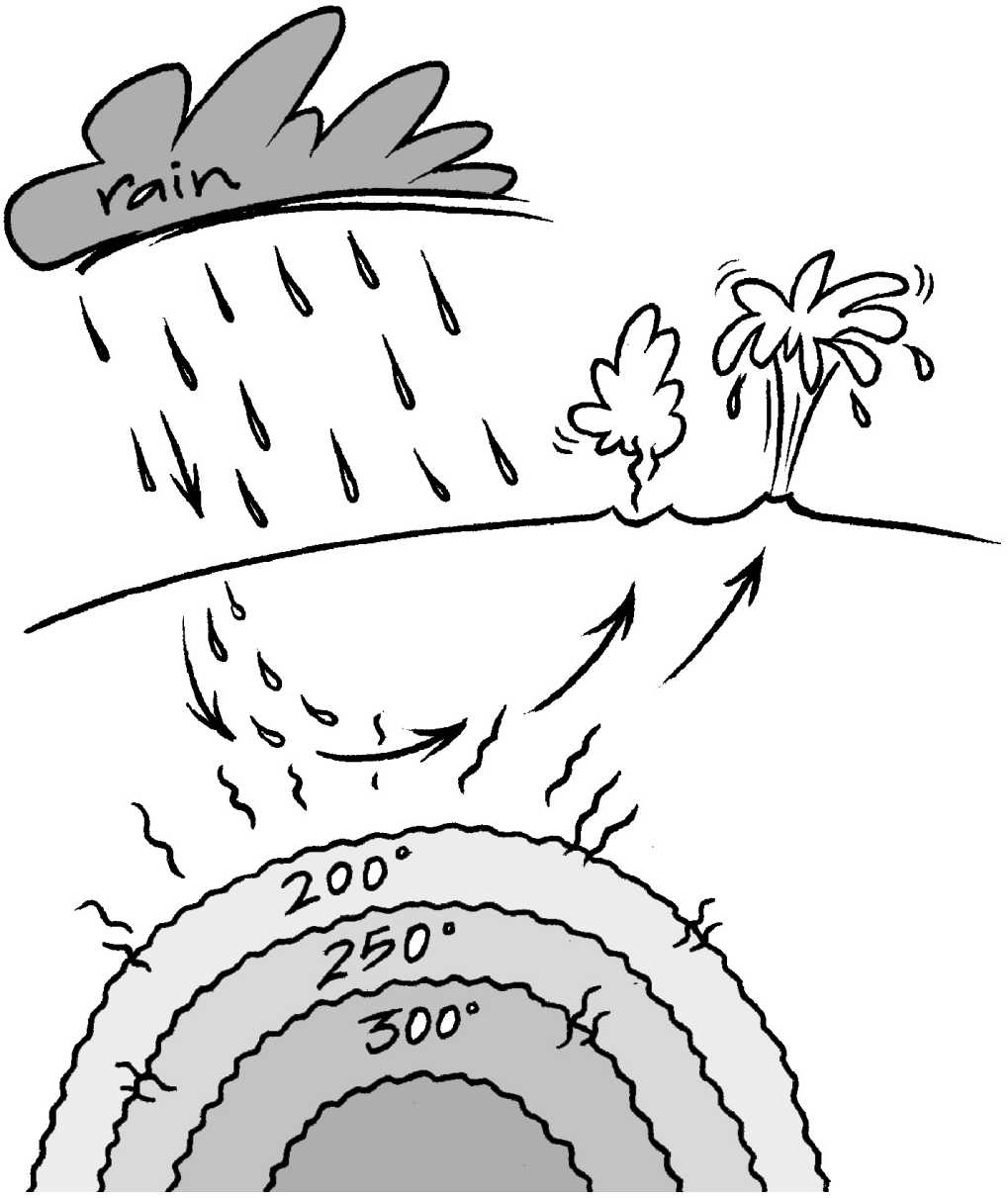
Energy from Geothermal

The word 'geothermal' comes from the Greek and means 'heat from the earth'. Below the surface of the Earth the rocks are very hot. Heat which comes from the Earth itself is called geothermal energy. In some places this hot, molten rock erupts to form volcanoes.

In other places around the world, the hot rocks heat groundwater below the surface. The hot water rises to the surface as a column of water. This forms hot springs, mud pools, geysers, or areas of steaming ground. New Zealand's geothermal features are world famous. The Taupō Volcanic Zone has one of the greatest concentrations of geothermal activity in the world.

In the Eastern Bay of Plenty there are geothermal power plants generating electricity. Currently there are two geothermal power stations in Kawerau.

This diagram shows how groundwater is heated and rises to form hot springs and geysers.



Early uses of Geothermal Energy in New Zealand

Before Europeans arrived, Māori used hot springs for heating, cooking and preserving food, and for their medicinal and therapeutic properties. These traditional uses did not affect or modify geothermal features greatly.

European settlers soon discovered the scenic charms and healing benefits of thermal springs, and spa bathing became the basis of a rapidly growing tourism industry. Bathhouses and treatment centres were set up in Rotorua from about 1870. Between 1891 and 1904 the number of spa baths taken each year by visitors increased from 10,000 to 100,000. At first this demand could be met by the natural springs, but eventually shallow wells had to be drilled to increase the hot-water supply.

A geothermal hotel

Rotorua's Millennium Hotel made full use of its location. Steam from under the ground was used to heat rooms, tap water, and the swimming and spa pools. It was also used for cooling and air conditioning.

Town heating

Geothermal waters have been used for many years in Rotorua, and to a lesser extent in Taupō, to heat homes, businesses and institutions. It would have been efficient to develop municipal heating systems, but this was hindered by a lack of capital and political will. Instead, individuals and organisations drilled their own shallow bores, using small-scale, primitive heating systems that wasted a lot of the heat.

There were severe electricity shortages in the 1950s and restrictions were imposed. This encouraged people in Rotorua to drill wells to heat their homes. By the 1970s it became apparent that drawing off hot water was depleting the Rotorua reservoir and damaging local geysers and springs. Since 1991 geothermal extraction has been managed to protect surface geothermal activity. Recent trends have been towards communal systems, with 10 or more households typically sharing a well.

A major use of geothermal energy in Rotorua is pool heating. Swimming pools can contain clean, fresh water warmed by heat exchangers. Mineral pools use the geothermal waters.

Source: Te Ara Encyclopedia

http://www.sciencekids.co.nz/sciencefacts/energy.html

5c.3 Using Geothermal Energy

You will need per group

- Several large sheets of paper per group
- Felt tip pens/crayons

1 Brainstorm on large sheets
   - How was geothermal energy used in the past?
   - How is geothermal energy used now?
   - Do other countries use it differently?

2 Check out the website below and add any new ideas to your brainstorm.

   www.teara.govt.nz/en/geothermal-energy

   Look at the video clip of the opening of Wairakei Power Station in 1958. This was the first time geothermal steam had been used to generate power in New Zealand.

   In the Eastern Bay of Plenty there are geothermal power plants generating electricity. A geothermal power station has recently been built in Kawerau to use the Earth's energy store. The energy of the moving stream is used to turn turbines to generate electricity.

3 In what other ways is geothermal energy used in New Zealand? Add this to your brainstorm.

Evaluate/Reflect

- How could you use geothermal energy (or steam) in your school?
- Which (if any) of these ideas can you try out?
- Was the idea feasible?