An Energy Source In New Zealand

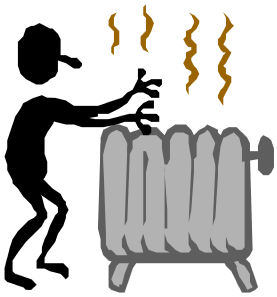
Geothermal Power

Name: _____ Class: _____

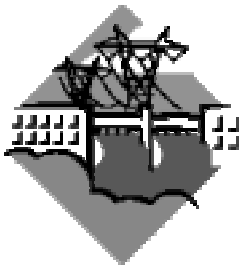
An Energy Source in New Zealand

In our everyday lives we use a lot of electrical energy.

We wake up because of our alarm on our clock, we make toast using a toaster (and Milo by boiling the kettle). Our shower is warm because of electricity and we turn on the lights in our house to see better (and heaters to get warm) on early, frosty winter mornings.



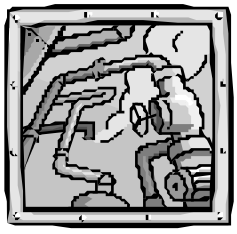
This electricity has to come from somewhere, other types of energy have to be changed into the electrical energy we can use at home.



Many types of energy sources can be used to produce electricity.

For example;

- Water can be dammed (Hydro power)
- Wind turbines (windmills) turn wind into electricity (Wind power)



- Hot steam/water underground can be captured (Geothermal power)

The energy source that we are going to study is **GEOTHERMAL**

We will explore where this energy comes from and follow the steps required to harness this energy to turn it into electricity we can use at home.

Introduction

The **Wairakei Power Station** is owned and operated by Contact Energy Limited, who produce 25% of NZ's electricity. The Station is an important national generator of electricity. The Crown owns the geothermal resource itself. The power station is situated 7km North of Taupo township, and is of particular interest because it -

- was the first geothermal plant in the world to use very hot water as the source of steam used to drive the turbines
- produces 1550 GWH of electricity per year, which is enough to supply Taupo, Rotorua, Napier and Hamilton
- produces 4.3% of NZ's electricity production
- has run at better than 90% of maximum output since the 1960's
- is efficient at changing heat energy (hot steam/water) into electrical energy

The Western Borefield

Image: Heurisko Ltd.

Resource Sheet 1: History of the Wairakei Borefield

1. The New Zealand Government started searching for steam to generate electricity in the Wairakei area in the 1950s. Give 3 reasons why they needed to start this development.

_____

_____

_____

_____

_____

_____

2. What type of changes occurred at the Wairakei Borefield due to the removal of steam and hot water?

_____

_____

_____

_____

3. Why were these changes a problem?

_____

_____

_____

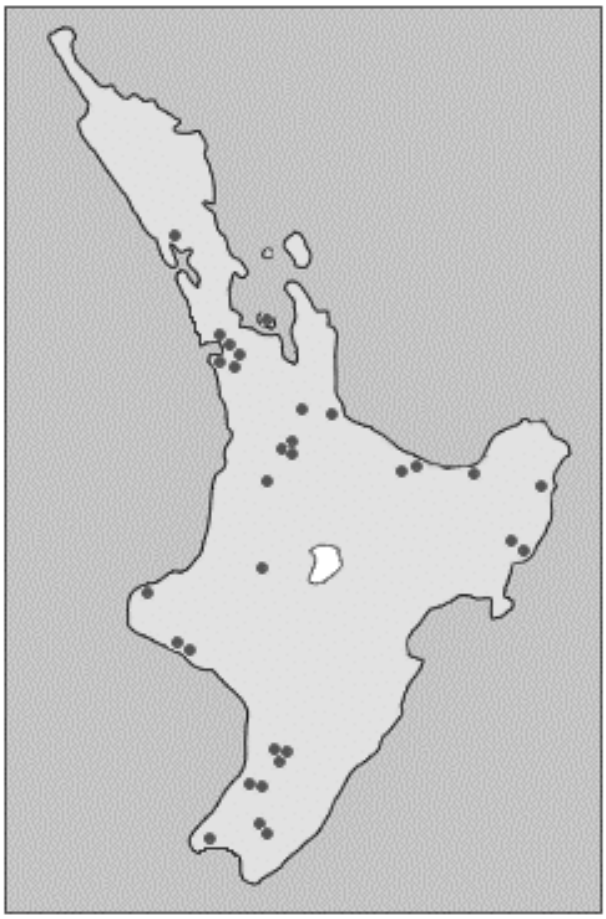
_____

_____

Resource Sheet 2: Geology

Geology is the study of our Earth, its rocks and structure.

1. On the map below, locate the Wairakei Geothermal field (draw an X); colour the Taupo volcanic zone RED.
   Hint: Find Taupo township first!



2. Each of the following rock layers is part of the reason for the above area having so many geysers, hot mud pools and lots of hot steam. Describe the job that each rock layer does -
   Mudstone rock = _____
   Volcanic rocks = _____
   Magma (molten rock) pools = _____
   Fault planes (cracks between layers of rock) =
   _____

Resource Sheet 3:

Match the names for “water” with the correct state.

steam	liquid
water	solid
ice	gas

When we boil the kettle at home to make a hot drink we know the water is ready when “steam” appears out of the spout.
Is this steam? _____
Give a more accurate term for what we see
_____

Resource Sheet 4:

Complete the following table that summarises how chemicals in the hot water and steam are both helpful and harmful.

Helpful	Harmful
Allow _____ and temperatures underground to be worked out	The water and steam is so hot that it can cause _____ burns
Allow _____ to flow through the hot _____	The chemicals can be _____ themselves. For example hydrogen sulfide _____ is _____

Read about the problems caused by removing the hot water.
What sort of effect on the environment do you think this will continue to have?
_____
_____
Will these problems have any effect on the people that live in this area? (Explain your answer)
_____

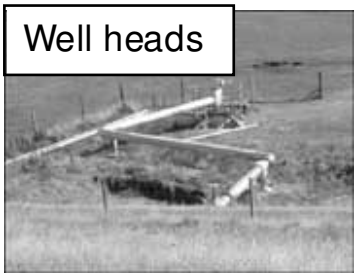
Resource Sheet 5: Bore Field Equipment

Match each piece of equipment with its correct function (job)

Bores

Produce extra steam from hot water

Well heads



Carry both hot water and steam between the Bore fields, Power station and the river

Flash Plants

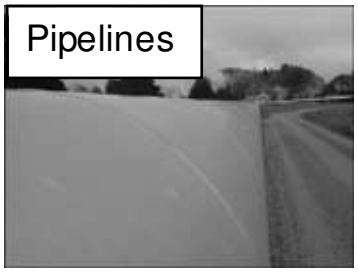
These are the holes drilled in the ground to remove the hot water and steam

Flash Plants

Silencers

These hold the drill rig while drilling the well

Pipelines



These reduce the noise of steam escaping into the air

Resource Sheet 6: Water Discharge and Rejection

Describe what is meant by –

a) Discharge

_____

_____

b) Reinjection

_____

_____

The waste hot water is also being used (recycled) in other ways, for example in the prawn farms. Think of another possible use for the waste hot water. Describe some of the advantages and disadvantages that your use might have.

_____

_____

_____

_____

_____

Resource Sheet 7: Steam Turbines / The Electrical Generator

Write an energy chain that shows what happens to the energy in the hot water and steam when it is used by the power station

_____ → _____ → _____

Energy Energy Energy

There are many factors that affect the electricity supply. Choose TWO, write down each factor and explain WHY it affects the supply

Factor 1 =

_____

_____

Factor 2 =

_____

_____

Resource Sheet 8: Wairakei Turbines and Generators

Write down THREE advantages of using a Binary Plant

1. _____
   _____
2. _____
   _____
3. _____
   _____

Resource Sheet 9: The National Grid

1. What is the "National Grid"?

_____
_____

2. What TWO ways is electricity carried on the National Grid?
   _____
   _____
3. Why can't people use an ordinary switch (like the type we use to turn on the lights) to change the voltage carried by wires from the Power Station?
   _____
   _____
   _____
   _____
   _____

The Volt is a measure of electrical energy.
WHY do you think the electricity needs to be transformed as it moves from the Power Station to towns then to our homes? -

_____
_____
_____
_____
_____
_____
_____

Daily Diary

Read the Daily Diary each day and summarise each in your own words below:

Day _____

_____
_____
_____
_____
_____
_____

Day _____

_____
_____
_____
_____
_____
_____

Day _____

_____
_____
_____
_____
_____
_____

Day _____

_____
_____
_____
_____
_____

Glossary

Use this page to note any words that you don't know the meaning of.

Use the online LEARNZ glossary page and "Language of Science" to find out the definitions.

My Questions

Use the space below to jot down any questions you have during the audioconferences:

_____

_____

_____

_____

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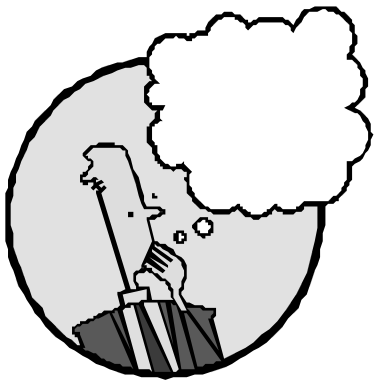
Competition Answers

My answers to the competition are:



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Note – All Photographic Images: Heurisko Ltd.