Geothermal Power

The following 34 captioned photos are from the background pages of the LEARNZ Geothermal Power Field Trip web site for Term 1, 2006.

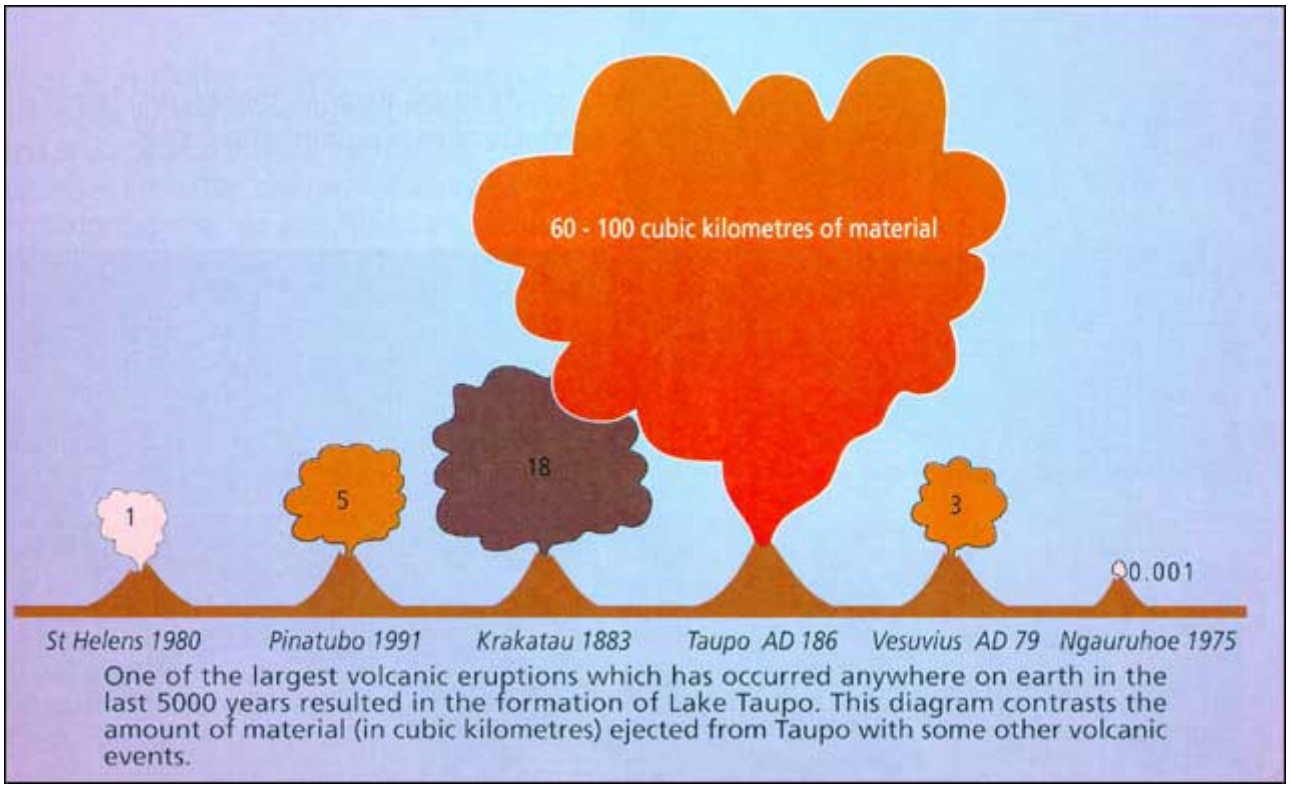
Get much more about geothermal power, and the full range of LEARNZ virtual field trips at www.learnz.org.nz

Next

The west field of Wairakei Geothermal Power Station.

New pipelines carrying steam from a well head. The fencing prevents sheep from warming themselves in cold weather and ruining their wool.

New uses for waste hot water from Wairakei have been found, such as farming these prawns in 38°C water.



The 186AD eruption of Taupo is compared with other recent eruptions. However the Taupo eruption 26 000 years ago was eight times larger than this, but is not shown on the diagram - Image: Contact Energy Ltd.

A common warning in the Taupo volcanic zone.

The Taupo volcanic zone extends across much of the central North Island. This is the famous Pohutu geyser 80km away from Wairakei.

Not steam (which is an invisible gas) but rather clouds of white water vapour from a silencer at Wairakei.

It is water vapour rather than steam (which is invisible) that is the real problem for motorists.

The sign illustrates one problem in a geothermal area.

A natural hot spring with silicates depositing on its edge as the the water cools.

A warning sign on the stairway into a well head cellar.

What was once a bubbling geothermal pool has become an acid sulfate crater due to a drop in water and pressure levels within the reservoir. This change is reversible however. Note the yellow sulfur deposits.

Looking east along the western borefield. The line of bores follows an fault plane that currently provides 50% of Wairakei steam.

A modern well head amongst farmland near Wairakei.

A single flash plant that services several bores.

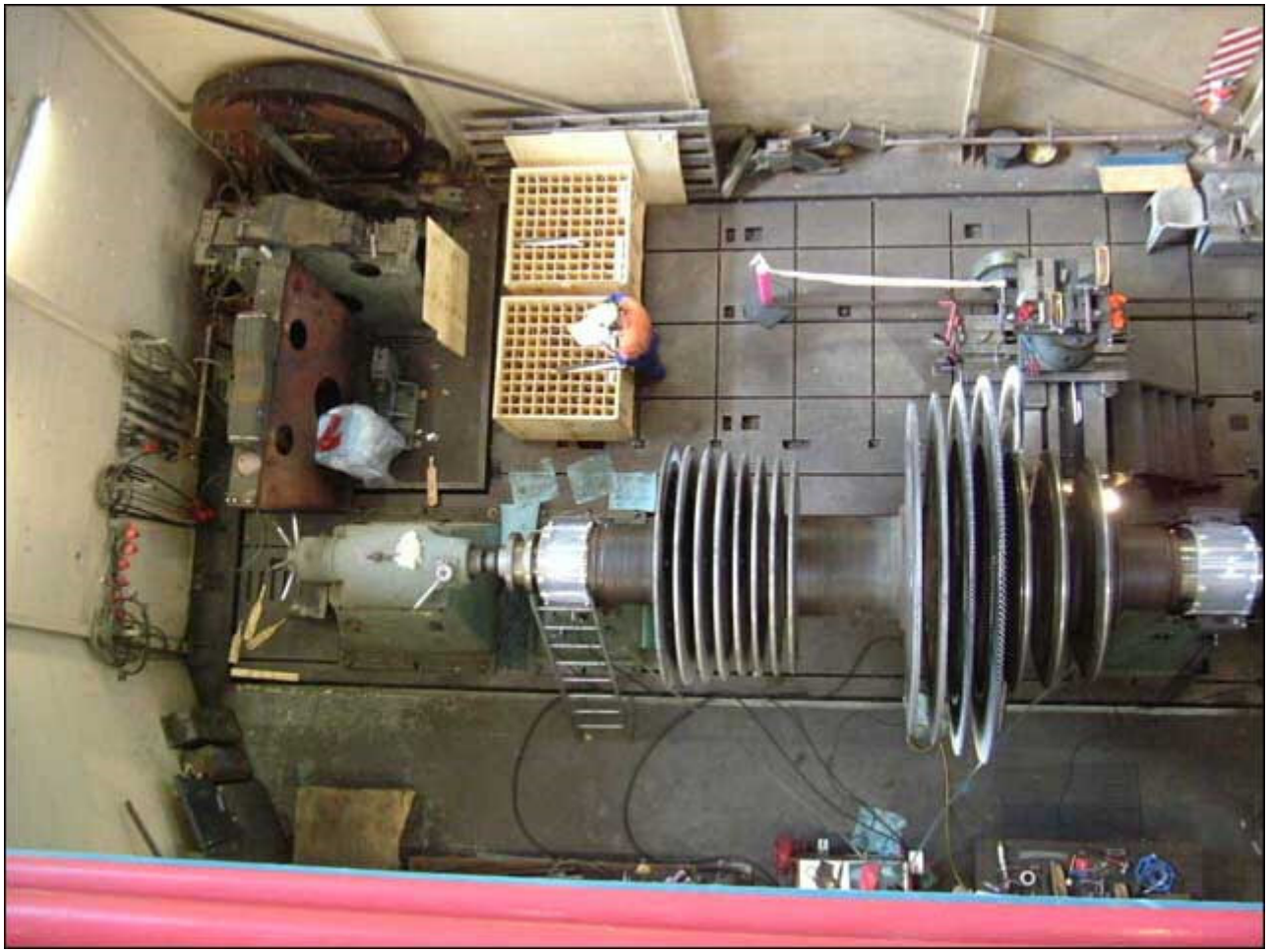
A single silencer for a single bore in the eastern borefield of Wairakei.

Pipeline leading from the western borefield to the Wairakei Power Station.

Water being discharged to the Waikato River has physically eroded the cement, exposing the larger stones. This process has been accelerated by acids that are formed when hydrogen sulfide gas dissolves in the condenser water.

The pipeline in the foreground carries hot water that will be used to recharge underground water at the edges of the geothermal field. The ponds behind are part of a prawn industry made possible by the use of waste heat energy.

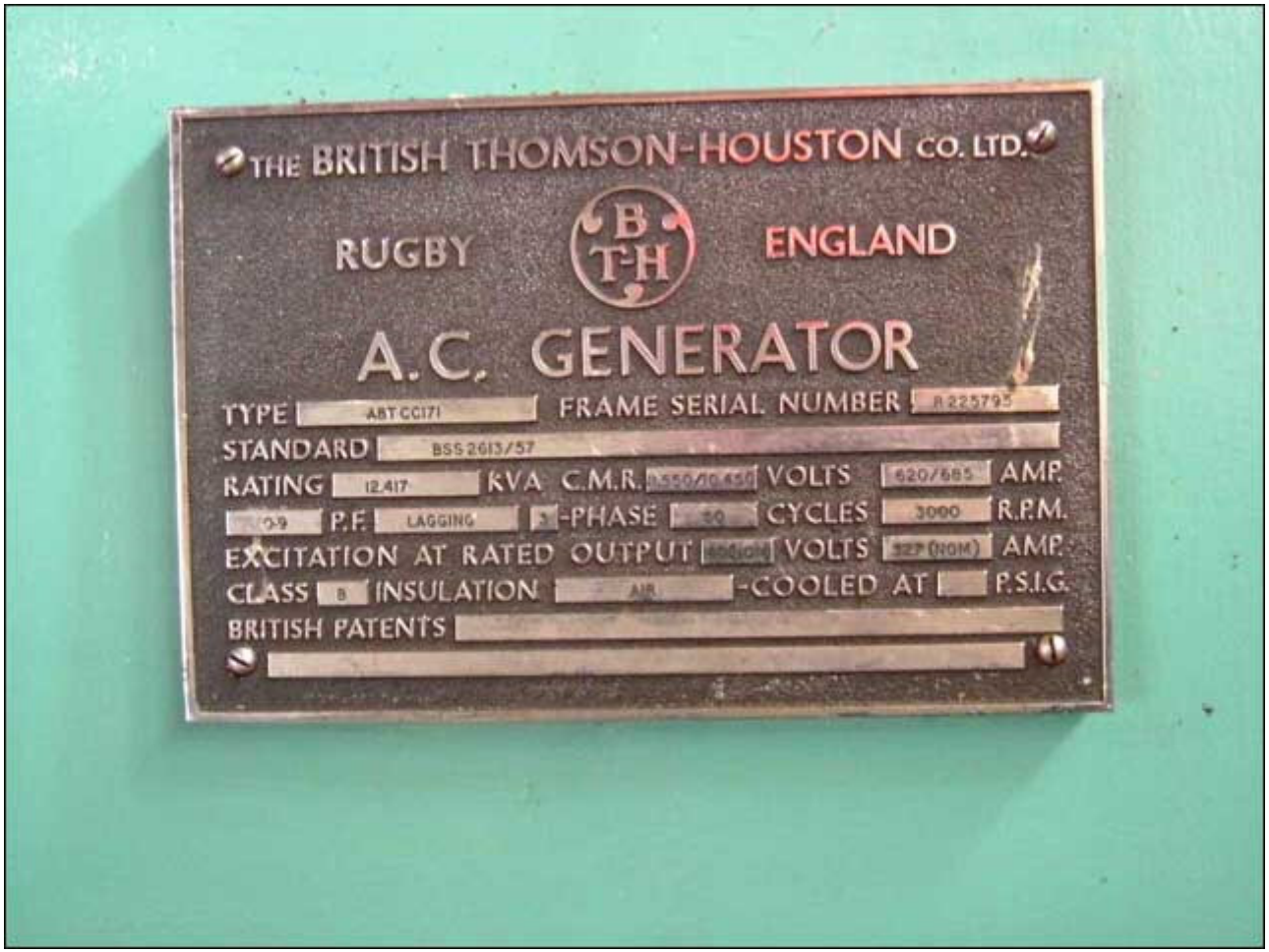
Fitting new blades to the central shaft of low pressure turbine 9. Note the 5 stages of blading.



An aerial view of the shaft of low-pressure Steam Turbine 9 which is being rebladed. Notice how the man in orange gives scale and that the lathe occupies the whole floor space.

A single blade from the low-pressure steam turbine that drives Generator 9. Others are stacked below.

This sign on Generator 4 warns of the intense magnetic field produced by the stator.



A manufacturer's plaque on Generator 4
showing the design specifications.

Generator 4 is painted green and the intermediate pressure steam turbine that drives it is painted red. The exciter that produces the magnetic field in the stator of the generator is on the right and is blue.

A single condenser in a mixed pressure turbine is painted green to show it contains cool river water. The water enters through the two pipes and is sprayed into the round chamber.

Generators 7, 8 and 9 with their low pressure steam turbines (painted grey and red) to drive them. Notice the maintenance in the foreground being done on the exciter for the stator's magnetic field.

For most of us, pylons are the symbols of the national grid.

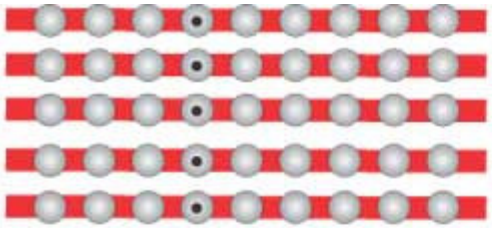
Three of the transformers in the switchyard of the Wairakei Power Station that link it to the national grid.

A single oil cooled transformer. Notice its ability to transform 3 phases to 220KV.

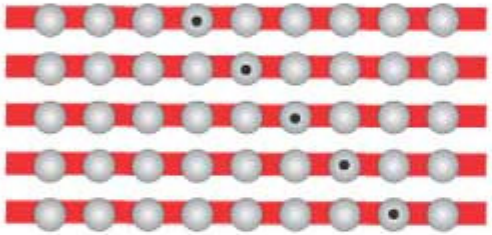
Isolating transformers were commonly used for protecting workers but are being replaced by RCD or Residual Current Devices such as this.

This modern switchgear is housed within the powerhouse of the Clyde Dam. The small space it occupies and absence of visible wires is possible because all circuits are insulated with sulfur hexafluoride in the pipe work. Notice also the three phases colour coded red, yellow and blue.

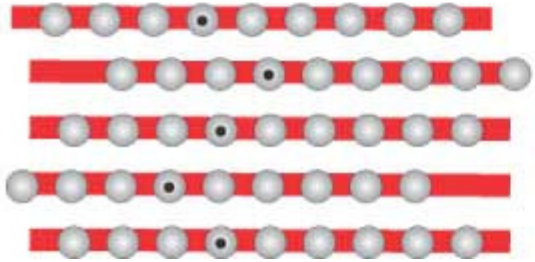
DC-AC diagram.



No current.
The circles represent electrons.
One electron is marked with a dot to make it easier to follow the diagram.
The line represents a wire.
Electrons do not move along the wire in this diagram

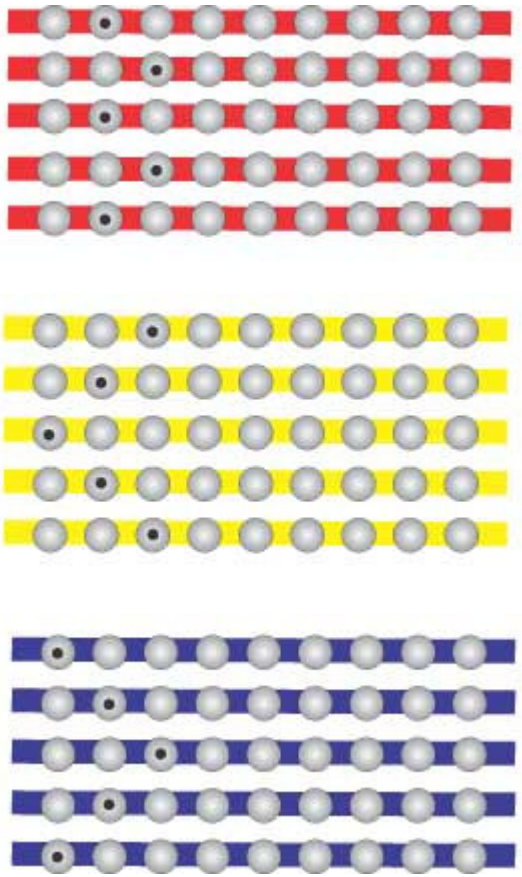


Direct current or D.C.
Electrons travel along the wire in one direction.



Alternating current or A.C.
Electrons travel to the right then left, but overall they do not travel along the wire.

The international colour code for each phase of red, yellow and blue is used in this diagram. Notice how within each phase (colour) the electrons are moving back and forth but not in unison with the other phase (colour).



As well as the preceding images, by the end of the Wairakei Geothermal virtual field trip, the web site has over 100 photos and about 30 video clips.

There are also recordings of 3-6 audioconferences where students from New Zealand schools have their questions answered by electrical engineers and other specialists. A Web Board records further questions about geothermal power at Waiarakei with answers provided by the experts. A diary is automatically sent from the field to enrolled classes, who also receive 5 newsletters.

There is much, much more . . .

http://www.learnz.org.nz/trips06/geothermal61.php