

## Geothermal Well Drilling and Testing

Geothermal energy is clean, green and renewable and the process of geothermal energy generation is fascinating. In this fact sheet, you can find out more about geothermal drilling and testing at the Te Ahi o Maui geothermal project in Kawerau.

The entire Te Ahi o Maui project could not operate without first creating holes in the ground from which geothermal fluid is extracted. The holes, also known as wells, are created using drilling rigs.

Over the predicted 35 year life of the power plant, five or six wells may be drilled. Each well will take approximately 35 to 45 days to drill.

### Establishing the wells

To begin the well drilling process, large flat areas called 'well pads' are prepared so that the drilling rig can operate on a stable platform. The earth around the well pad is levelled, compacted and stabilised before the drilling rig is brought to site in a number of pieces and assembled.

Initially, the Te Ahi o Maui project will construct two or three well pads for both the production wells and the reinjection wells. Several wells can be drilled from a single pad. Future wells may also require the construction of additional well pads.

Each well pad will have a 'sump', which is a kind of pond that acts as a collection point for water and mud used during drilling, as well as any geothermal water from the wells. Water and mud is required by the drilling process for clearing soil and rock as the hole gets deeper and to prevent the geothermal fluid flowing up the well. The sump may also hold fluids produced from the well during well testing, which is in the first few days after the well is drilled.

Long term, the area around the wellhead - and any piping into the wells - is a lot smaller than the full well pad needed at the time of drilling. The unused part of the well pad can be replanted, and the sump is usually filled in or fenced when it is no longer needed.

### Well drilling

The drilling rig uses a drill 'bit' to dig into the ground to reach the geothermal reservoir – for the Te Ahi o Maui project this might be up to 2.5km below the earth's

surface. The well is drilled in sections using different-sized drill bits, each section narrower than the one before. The depths and the sizes of each section are determined by the final size and depth required for the production hole, and the expected geological conditions in the reservoir.

Modern well drilling techniques also allow for the drill bit to change direction underground to target specific areas with a high degree of accuracy. This is done to improve the success rate and productivity of the wells.

As each section is drilled, it is cased with a protective metal pipe that stabilises the hole and contains the pressure from the fluid. The metal pipe is cemented in place. The final section that is drilled is called the 'production hole' and inside this section is a perforated pipe called the 'liner'. The liner prevents the walls from caving in while allowing the geothermal fluid to travel up the well to the surface.

### Well types

There are two different types of wells:

- A production well, which is where the steam and water come out from deep below the earth's surface
- A reinjection well, which is where the cooled geothermal fluid is put back into the ground after it has been used.

### Well testing

During the well drilling process, the drilled material is brought to the surface and geologists can use this material to gather information about geothermal activity and the layers of rock and minerals from the drill hole.





When the production well is completed, and while the drilling rig is still in place, tests are carried out on the new well. The tests show what the temperatures and pressures are down the hole. With the drilling rig removed, flow testing is undertaken to understand the natural variations and flow rates that can be expected from the well.

The reinjection well is also tested by pumping water into the well. Water is injected into the reinjection well, and the pressures are monitored. Pressures and temperatures are monitored at a variety of depths and flow rates to establish the injection performance of the wells.

After all the testing is completed, the geothermal reservoir is left untouched while drilling equipment is removed and pipelines constructed. Pressure and temperature are still monitored during this time.

The wellhead is the section at the surface of both the production and reinjection wells. It holds the equipment needed to control the operation of the well and pipes. A 'wellhead flow control valve' controls what is let out of the production well; it can be closed completely in emergencies. As the wellheads can be very hot, they are security fenced for safety and to protect them from vandalism.



### Te Ahi o Maui production wells

The production wells will be located on land owned by the Kawerau A8D Ahu Whenua Trust in the vicinity of the existing KA22 Well. It is expected that three or four production wells may be required over the life of the plant.

Determining the precise location and depth of the production wells is done through careful planning and analysis work. This takes into account the locations and depths of the existing wells on the Kawerau field, as well as the known geological and geophysical features of the field.

A pipeline carries the steam and water from the production well to the power station, and then later to the reinjection wells.

### Te Ahi o Maui reinjection wells

The reinjection area is located on A8D land over 1km northwest of the production well area, at the outer edge of the known reservoir boundary. The reinjection wells will either be deeper or shallower than the extraction point.

A typical reinjection well will have a 'check' valve to prevent return water flow and an isolation valve, to completely cut off flow.

### Questions? Please contact us

The Te Ahi o Maui Geothermal Project is a partnership between Eastland Group Limited and Kawerau A8D Ahu Whenua Trust.

For more information:

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