HISTORIC MoW GEOTHERMAL DEVELOPMENT IMAGES

Andy Bloomer[1], Paul Bixley[2]

[1]Geothermal Engineering Limited, 20 Henry Hill Road, Taupo, 3330, New Zealand, andy@geoeng.co.nz
[2]Contact Energy, Wairakei, New Zealand.

Keywords: *Wairakei, Kawerau, Ohaaki, photographs.*

ABSTRACT

Geothermal development began in New Zealand in the 1950s. It was primarily done by the Government Departments of the Department of Scientific and Industrial Research (DSIR), the Ministry of Works (MoW) and the New Zealand Electricity Department (NZED). As Wairakei was the first wet steamfield in the world to be developed, innovative techniques had to be invented to separate the steam from the two-phase fluid and to handle the two-phase fluid. Geothermal well drilling was also developed, adapting oilfield practices for the quite different requirements of geothermal reservoirs. Photographs and some films record this early development and the innovations and some of the failures. The photograph originals are now held by GNS, MB Century and Contact Energy. The NZGA intends to digitise and so preserve the images and to make them more widely available. Some of the images are presented here, with a background on the MoW archive.

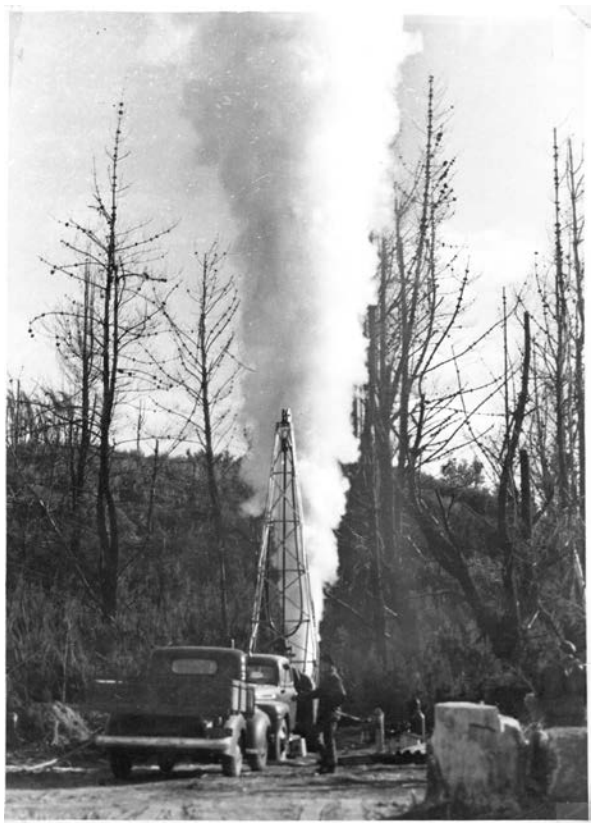

Figure 1: Bore No.1, 3 May 1950

The NZGA also wishes to preserve any historic photos relating to natural and developed geothermal resources held in private collections.

1. BACKGROUND

1.1 History of Development

Geothermal development for energy production commenced in New Zealand at Wairakei in 1950 and Kawerau in 1951. Kawerau started supplying geothermal steam to the pulp and paper mills on 15 March 1957, to timber kilns and log kickers; Wairakei commenced electricity generation in 1958. Further stages of development have continued at Wairakei and Kawerau up to the present time.

It is worthwhile to note that the first electricity generated from geothermal steam in New Zealand was a small 3kW generator at the Spa Hotel (Tauhara Geothermal Field) on 8 February 1952.

1.2 Ministry of Works Images

The Ministry of Works (MoW), later renamed The Ministry of Works and Development (MWD) was the Crown's agent for well drilling, well measurements, and civil and structural construction. Progress was recorded in various reports but also with photographs and some movie film. Many of these records are now held by MB Century at Wairakei; copies of some, and in particular the movie film were held by MWD Head Office in Wellington and those records are now managed by Opus, Wellington.

1.3 Current availability of images and video.

Some of the movie film has been digitised and is now held by The National Film Archive and is available. Examples include, *Wild Power*, the blow out at BR25. There are also many historic geothermal images held by The National Library/Alexander Turnbull Library, which may be available on the Library's website. Some of these are Crown images, while others are private or commercial images from private collections or from newspapers and the like.

2. CHANGES IN WORK PRACTICES AND SPECIFIC EVENTS

The images show how work practices have changed over time. Some of the early images show techniques that would today be considered unsafe and sometimes environmentally irresponsible. But in the 1950's the perspective on safe work practices was relatively undeveloped and it was a time of trying new methods in a completely new field. There was also very strong political pressure to progress geothermal development because the country was experiencing severe power shortages.

2.1 Well Measurements

Techniques for measuring well output and downhole conditions had to be developed. These were jointly developed by the MoW and DSIR. Some have been superseded, such as using a calorimeter for determining well enthalpy. Others are still in use today; sometimes refined, sometimes used very much as first developed in the 1960s.

Figure 2; KA4 Nov. 1955, Test 549. Fitting deflector

2.2 Drilling techniques

Drilling techniques were based on oilfield techniques, using oilfield equipment. However, this had to be adapted to the high temperature, high pressure conditions of geothermal wells. Some video is held of the new drilling rigs (T12s in 1952 and GC350 in 1979), showing mast erection, transport and the like. There are also photographs and movies showing various aspects of drilling operations. As techniques were being learnt, there were failures and these were well documented: lessons learnt were incorporated into the MoW Drilling Manual and later into NZS 2403, Code of Practice for Deep Geothermal Wells.

WK26

WK26 was drilled in 1954 and was one of the first wells drilled with the new T12 rigs. The well had apparently been completed successfully, but later steam appeared from the hillside above the well. This increased until an explosion occurred in 1960. The T12 rig was set up over the bore and a casing break was discovered at about 180m. Cementing of the bore was unsuccessful and a deviated interception well was drilled from some 60m away, which tracked within 1.5m of the WK26 bore enabling it to be quenched and a grout plug placed. The main bore was then re-entered and grouted up to the surface.

WK201

WK201 was drilled to 400m in 1958 with a Failing rig. A natural steam discharge increase, 50m from the well, was observed a few days after the well was completed and had heated and was under pressure. This evolved into a boiling mud crater, which was still active in April 1964. The problem was complicated by the fact that the well was located close to the then route of S.H.1.

WK204

The well blew out in May 1960, while drilling at about 400m. It was known as the "rogue bore". The failure was later attributed to lack of an intermediate casing and poor casing cementing as well as a series of mishaps that resulted in loss of well quench.

Figure 3: WK204 General view of rig equipment, 3.5.60

Figure 4: WK204 Wellhead equipment after removal of rig, 4.5.60

Figure 5: WK204 4.5.60.

The site had been grouted in an attempt to provide safety to the rig and equipment and this may have assisted. Grouting of the well was attempted until, it is reputed, all the cement within a 100km radius had been used up. The rig was then removed from the site, in a precarious operation, but no one was injured and the only equipment lost was the drilling cellar. The ensuing boiling crater became a tourist attraction until the discharge ceased of its own accord thirteen years later, in 1973. An extensive photographic record, including some video, is held; some of which has been well published.

KA9

The first six exploration wells at Kawerau were drilled by MoW. But due to their commitment at Wairakei the following nine wells were drilled by Brown Drilling Company from the USA. The first four of which encountered problems. KA7 blew out, as did KA9 after attempting to set casing at 120m; that resulted in severe damage to the T32 drilling rig.

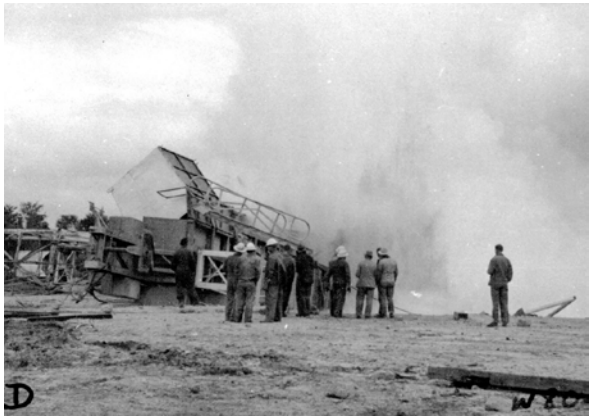

Figure 6: KA9 and T32 rig collapse, 12 June 1956

As the work was not under the control of the MoW there are few photographs of the well drilling, but there are images of the subsequent damaged rig and crater.

2.3 Wairakei Powerhouse Construction

The Wairakei power station was designed by English consultants, but construction was undertaken by the MoW. There is an extensive MoW photographic record of the civil and structural construction. These also show the construction village on the flats beside the powerhouse.

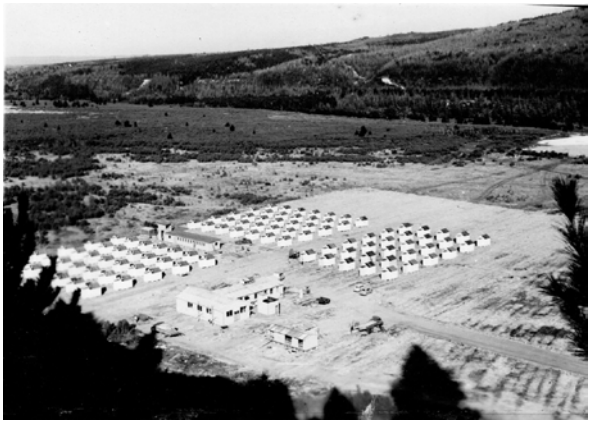

Figure 7: Station 'A' PH, 16.3.56. 100 Man construction camp

Progress photos from various vantage points, such as the top of the top of the Bluff on the steam mains, or from the opposite bank of the Waikato River, can be compared with current views.

Figure 8: 'A' Station views from across the river, 16.1.59

Figure 9: 'A' and 'B' Stations, 14.9.05. Cf Fig. 8

2.4 Kawerau steamfield

Early investigation drilling at Kawerau was carried out by the DSIR; later wells were drilled by MoW or a private contractor. However the steamfield was developed by

Tasman Pulp and Paper Company (TPP), the owner of the mills that the steam was supplied to. The wells that MoW/MWD drilled are recorded.

Figure 10: KA3 before the first discharge, 1967

In 1979 the Crown took over the steamfield from TPP and MWD was the agent responsible for management of the steamfield from then until it was transferred to Ngati Tuwharetoa Geothermal Assets in 2005. After the MWD took over the field a series of photos of the equipment were taken, which gives a good indication of the state of the steamfield at the time. Seven new investigation wells were drilled over the following five years, with three later used for production. (MWD also produced a three-volume report on the state of the steamfield and reservoir and potential for further development).

3. CONCLUSION

Photographs of stages of geothermal development were taken by scientists and engineers working for the Ministry of Works (and Development), the Electricity Division and the Department of Scientific and Industrial Research.

The MoW photos are held and owned by MB Century at Wairakei. The prints are in the process of being scanned to ensure that copies are saved and so that selected images may be disseminated. There are about 15,000 images in the MBC archive.

Digital video has been obtained from 16mm films held by MBC at Wairakei. Most of these films are copies, with the originals being held by Opus Consultants, which manages the material from the original MoW Head Office. Some of these films are already available through the Film Archive website.

GNS and Contact Energy also hold substantial collections of early Wairakei photos, originally owned by DSIR and NZED. There has not yet been discussion on including these in the publically available NZGA archive

OTHER IMAGES OR INFORMATION REQUEST

I expect that as well as the many official photographs taken, many were also taken by people working on the projects. If anyone holds such images or is aware of any, I would be grateful to get copies. Similarly, if anyone knows about the official images – who the people are, what the significance of the images is or any such detail, I would be very pleased to hear.

ACKNOWLEDGEMENTS

My thanks to MB Century for permission to copy and disseminate the images, which remain the property of Century Drilling & Energy Services (NZ) Ltd.

REFERENCES

Kawerau Geothermal Field, Report on Investigations and Development, Ministry of Works and Development, November 1986.

Bolton, RS, *Notes on the Early History of Wairakei*, Proceedings 20th NZ Geothermal Workshop 1998.

Bolton, R, Hunt, T, King, T, Thompson, G, *Dramatic incidents during drilling at Wairakei Geothermal Field, New Zealand*, Geothermics 38, 2009.

Bixley, P, Dench, N, Wilson, D, *Development of Well Testing Methods at Wairakei 1950-1980*, Proceedings 20th NZ Geothermal Workshop 1998.

King, TR, Robson, QJ, *Drilling History at Wairakei*, Proceedings 20th NZ Geothermal Workshop 1998.

Thain, I, Carey, B, *Fifty Years of Geothermal Power Generation at Wairakei*, Geothermics, 38 (2009) 48-63

http://digitalnz.org, Digital NZ

http://archives.govt.nz, Archives New Zealand

http://fletcherarchives.org.nz/, The Fletcher Trust Archives (currently closed)

http://www.linz.govt.nz, Land Information New Zealand

http://natlib.govt.nz, The National Library of New Zealand (including the Alexander Turnbull Library collection)

http://www.ngataonga.org.nz, The National Film Archive, Nga Taonga.

http://www.teara.govt.nz, The Encyclopedia of New Zealand