GROWTH IN THE NEW ZEALAND GEOTHERMAL INDUSTRY

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SUMMARY – This paper looks at New Zealand's geothermal development in various market sectors (e.g. electricity generation, direct heat use, heat pumps and tourism) to confirm that New Zealand geothermal industry is in a growth phase.

International trends are considered with a view to implications for the New Zealand geothermal development.

The response of service industries to this perceived growth is considered.

1. BACKGROUND

There are signs that various market sectors of the New Zealand geothermal industry are in growth mode. This paper quantifies the historic growth and attempts to quantify future growth.

From a New Zealand Geothermal Association (NZGA) perspective, there is an interest in the readiness of New Zealand companies to implement this growth and to respond to the increasing demand for goods and services.

2. GROWTH IN THE GEOTHERMAL ELECTRICITY GENERATION MARKET

New Zealand electricity demand continues to rise. Consumption in 2006 totalled 38,740 GWh and has been growing almost linearly for the last 30 years by about 660 GWh/year (MED 2007). Given that electrical transmission and distribution losses total about 7.5%, this growth equates to the supply from a new 85 MWe baseload geothermal station each year, similar to the Kawerau station currently under construction. In practice, geothermal generation currently supplies about 7.6% of the country's total generation, generated by stations with a capacity of 450 MWe.

The country's high temperature fields are located south and north of the major demand centre (Auckland), represent a renewable energy resource, have low carbon emissions, can produce reliable base load generation, and include premium resources on a world scale in terms of temperature, productivity and relatively benign chemistry.

The Government's New Zealand Energy Strategy (MED 2007) shows that geothermal investment appears competitive with a wide range of generation sources and so presents an investment opportunity. Only considering the apparently competitive geothermal resources, after deleting protected fields from consideration and derating fields that are close to population centres that may draw local opposition, there is the equivalent of around an additional 1000 - 1200 MWe available. These projects can meet more than a decade of demand growth. With a capital cost of around NZ$4million/MWe (NZGA unpublished), this equates to a $4billion development programme.

Figure 1 shows historic generation of electricity from geothermal sources, including station names, capacity and commissioning dates. At least 4 significant phases can be seen:

- 50 years ago – Wairakei (and Kawerau) development
- 20 years ago – Ohaaki (output from this station has dropped significantly such that many of the smaller developments have simply compensated for this decline)
- 10 years ago – a collection of stations (some developed by the old electricity supply authorities prior to Government legislation restricting their involvement in generation and retail, but also including the Mokai station)
- Recent station expansions (including Rotokawa 2, Mokai 2 and 3, and Wairakei binary plant).

Not shown on the graph are ongoing efforts to maintain or increase generation from existing facilities. Very active engineering has been necessary throughout the history of Wairakei's steam supply. Steam winning in the Te Mihi area has recently provided sufficient steam to load Wairakei and Poihipi (with full load at Poihipi expected in 2008). Ohaaki's output dropped dramatically after commissioning, though some of this declined was planned for. In September 2007 the output of the station was down to 25 MWe but an active steam winning project has seen output increase to around 55 MWe net by mid-November. While these steps do not represent increases in installed capacity, they do represent real low cost gains in generation.

There may be some larger efficiency improvement investments possible. The proposed Te Mihi development not only replaces old Wairakei plant but is expected to gain 67 MWe through improved efficiency.

The most recent expansions in geothermal capacity have been partly driven by the rising wholesale electricity price, which has been driven up by rising fossil fuel prices. Until 2003, the low contract price of Maui gas essentially undercut many energy supply options, including geothermal energy. The impending end of the operational supply from the Maui field has already led to a renegotiation of gas supply contracts (such that wholesale gas price has more than doubled for some consumers) and led to considerable repositioning within the gas industry. Major thermal generators are now taking positions on various gas fields to secure options.

Table 1 shows expected new generation, based on recently announced projects or stated company intentions. The generation associated with these stations (assuming a 95% load factor) has been included in Figure 1 which summarises historical and projected generation. This clearly shows unprecedented levels of generation growth at least over a 5 year period and possibly extending over the next 20 years.

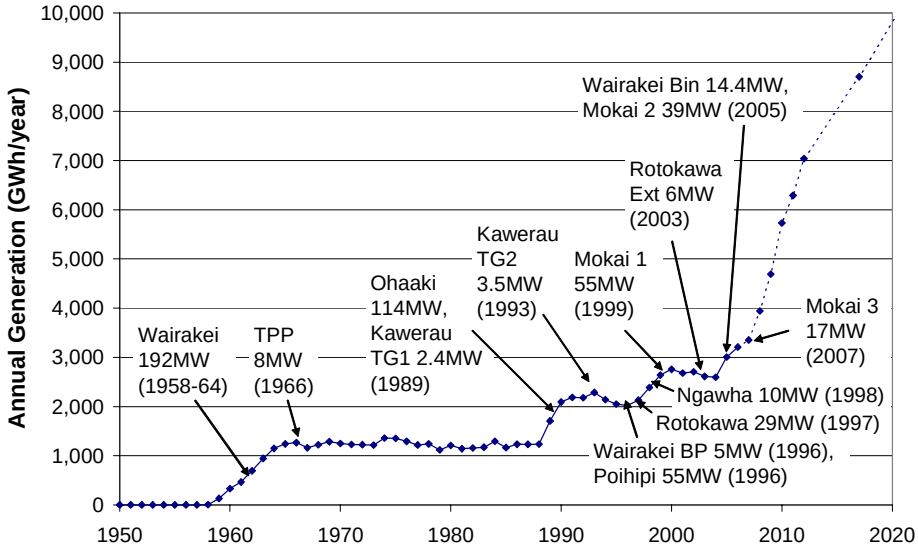

Figure 1: Historical and Projected Growth in Geothermal Electricity Generation in New Zealand. Source: Historical generation – MED 2007; station capacities and commissioning years – NZGA website www.nzgeothermal.org.nz; projections – based on advised capacities and dates for current developments and an assumption that a total 1000 MWe additional capacity will be installed by 2025.

Table 1: Upcoming Geothermal Electricity Generation Projects

Station	Capacity (MW)	Operation	Developer	Comments
Kawerau	90	End 2008	MRP	Construction in progress
Ngawha	15	Mid 2009	Top Energy	Construction in progress (only showing average generation but some load-following could be included in the design)
Rotokawa 2	110	End 2009	MRP	Consenting in progress
Te Mihi	220	End 2010	Contact	Consultation in progress (this replaces part of the aging Wairakei plant – net benefit is 67MW if generation is as good as expected)
Tauhara	<200 (50)	End 2011	Contact	Recent wells very encouraging. Slim hole exploration wells planned for 2007. Initial concept floated to public (50MW used in projections for Figure 1)
Mokai 4	40	End 2011	Contact	Contact has land rights under part of the field and sits on the Mokai steamfield management committee. Concept floated to investors
Misc	200	By end 2016	MRP	Balance of 400MW in MRP's plan (Kawerau, Rotokawa, Ngatamariki, others?)
Misc	400	By 2025	Various	Balance of 1000MW of unspecified projects

Despite a generally positive impression of geothermal development opportunities the only generator companies to actively develop internal resources to progress such projects are Contact

Energy and Mighty River Power. Tuaropaki Power Company is a flexible company that invests in Mokai-specific geothermal generation and other opportunities with minimal staff resources. Bay of Plenty Electricity maintains an active interest in generation projects in their area, along with a team of project leaders and operators who could implement projects if one was selected. Top Energy has actively pursued a further stage of the Ngawha project with operational and project staff. Norske Skog Tasman has invested in a replacement geothermal turbine within its site using its normal process and project management skills and contracted forces.

Contact Energy was formed in the initial break up of the Electricity Corporation of New Zealand. The company inherited a core of New Zealand geothermal development and operations expertise, along with station and steamfield assets on the Wairakei-Tauhara and the Ohaaki geothermal fields, and land interests at Mokai. Recent efforts have been directed at maintaining or maximising the use of current interests at the Wairakei-Tauhara and the Ohaaki resources. These resources are valuable, and based on simple stored heat assessment (NZGA website), could enable over 500 MWe of generation (including current generation) eventually. (Contact has invested in detailed reservoir simulation for these resources that should enable a more specific plan).

Outside of Wairakei-Tauhara and Ohaaki, Contact has an agreement for the purchase of Ngawha electricity for retail purposes, and sits on the Mokai steamfield development committee because of the land interests secured by ECNZ over Pukemoremore. Through these land interests, and in co-operation with the Mokai steamfield committee, Contact may eventually develop a Mokai 4 stage (see table 1).

MRP has established a significant geothermal team, largely based in Hamilton. Rather than "boom and bust", it appears that MRP has a plan to progressively develop projects over time. Their planning includes identification of high and low priority targets. MRP's chair (Carole Durbin) and chief executive (Doug Heffernan) jointly indicated the strategic role of geothermal development to their company in their 2006 Interim Report (MRP 2007), and specifically indicated an intention for MRP to develop 400 MWe of geothermal energy over the next 5 to 10 years.

MRP has been assisted by valuable information from legacy science and drilling undertaken by government agencies over 20 years ago. They have already supplemented this on some fields with their own surveys and additional wells. Land negotiations are known to be an issue for any developer, and MRP has settled in for the long haul of developing relationships.

MRP invested in exploration wells in Mangakino, Kawerau and Rotokawa. The Mangakino wells were a brave step and appear to have helped Mighty River Power on firming up a strategy for field development, largely focused on brownfield development, but also including Ngatamariki based on the 2006 MRP Interim Report.

MRP still appears to be bullish about resource consents. The already secured consents for Kawerau will probably be among the most difficult for them, being for development of a resource underlying major mills and the town of Kawerau. While there were appeals, the total time from consent application lodging to final decision was 7 months. This is in contrast with the 6 years to finalise the reconsenting of the existing Wairakei development by Contact (consents applied for in 2001, and have just come into effect in late 2007). While there are clear differences between the associated projects, it is these two contrasting experiences which help to set the views of MRP and Contact respectively on consenting.

At the time of writing MRP has lodged an application for consents for a major Rotokawa expansion with the expectation that a decision on consents will be in place by December 2007. This is a clearly identified development field under Environment Waikato's planning regime.

A low risk strategy is available to MRP to achieve their 400 MWe target just based on stage developments of Kawerau, Rotokawa, and Ngatamariki. The Mokai field is significantly developed already, though monitoring combined with field reservoir modelling may eventually support further development there. These few fields present an opportunity for possibly more than 500 MWe of electricity generation development.

It is understood that Genesis has an active watching brief on the technology. TrustPower previously was interested in geothermal development and still has some interest in the Rotoma geothermal field, but sees that it will be many years before its interests will be commercially viable so will not be active.

A number of Maori trusts have an active interest in geothermal development for electricity generation (or for heat). It should be borne in mind that these trusts already have operating business ventures, and recognise the potential commercial value of geothermal resources below their land. NZGA wants to find ways to encourage these groups to move to decision points, either for independent development, or development linked to others. There are already successful precedents, such as the diversified Tuaropaki Trust interests.

New investors may enter New Zealand. In Australia, there are currently 27 - 30 geothermal development companies investing in difficult and expensive deep drilling projects. Some of these companies may eventually look to easier targets for investment, such as are found in our high temperature fields.

While the major power developers have outlined certain plans and intentions, what is certain is that circumstances will change and the developers themselves will change. The market in which developers operate requires a greater degree of vertical integration to reduce risks. This will require all parties to maximise involvement in fuels, generation and retail. The other major change will be the carbon economy, with carbon price likely to be volatile. How this translates into restructured organisations is unclear at the moment, though will almost certainly involve greater attention to forestry and timely renewable energy projects, and may see increased interest in our largely renewable companies from overseas investors.

3. GROWTH IN DIRECT HEAT USE

Direct use of geothermal energy in New Zealand is significant. Until now, consumer energy associated with geothermal direct use has exceeded geothermal electricity generation except for brief periods of equality immediately after the commissioning of Wairakei and over the last decade. About half of that direct use is associated with operations at Kawerau (White 2006). In turn the Kawerau industrial supply of geothermal steam is equal to the total amount of geothermal industrial direct use at all other locations in the world (Lund 2005).

This is an area where growth is far more difficult to track. While there have been historical databases, these appear to change their basis such that major steps are apparently unrelated to physical changes. Figure 2 represents a best attempt to track historic use and is based on a wide range of inputs. While many of these are inaccurate, the dominating data for Kawerau renders the final estimates useful.

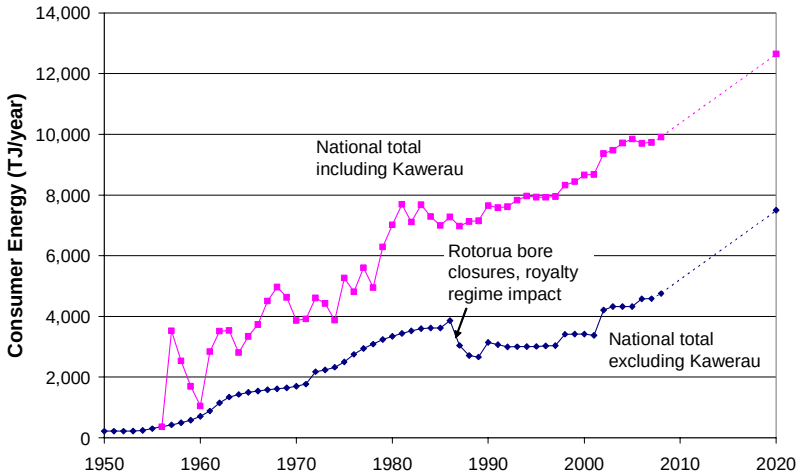

Figure 2: Historical and Projected Growth in Geothermal Direct Use in New Zealand.
Source: Reference point – White 2006; Historical use – personal communications from a wide range of sources; Projected use –East Harbour Management Services and GNS Science 2007.

Major events affecting growth of geothermal direct use in the past have included the initial commissioning of the steam supply to the Kawerau mill in 1957, energy crises in the 1950s and 1970s that drove heavy domestic and commercial investment in geothermal energy, enforced closure of some Rotorua wells coupled with a government royalty regime (now shelved) in the late 1980s with ongoing negative repercussions, but offset at the time by expansion of the Kawerau steam supply.

There is an impression that direct use has been almost totally suppressed over the last 20 years. This has some basis, but has been offset by some recent commercial developments e.g. at Mokai, Wairakei, Tauhara and domestic development at Tauranga.

Supply of heat from a geothermal field can be commercially attractive when of sufficient scale or where development scale is achieved through installation of electricity generation plant (East Harbour/GNS Science 2007). The scale spreads the risk of well failure. For many direct use applications, even a poor electricity production well can be more than sufficient for a single application.

Developers avoided direct heat projects for many years because some early projects were based on peppercorn rates that were clearly sub-commercial. Now a growing number of parties are recognising that geothermal steam supplies can be commercially attractive for all parties. Contact Energy and Tuaropaki Trust are just two parties who have been in active discussions with possible heat users. Meridian Energy, through

Energy For Industry, is working with the New Zealand Clean Energy Centre on a small scale reticulated heating scheme in Taupo involving a school and hospitals. There is an expectation that diversified energy companies will get more involved with wider energy options, including direct use applications.

In terms of future development, domestic and small commercial use is expected to grow in places like Taupo and Tauranga (possibly Rotorua if the moratorium on new wells is lifted). At the larger scale it is logical to expect further development on fields developed for electricity generation (or large scale heat as at Kawerau) of the form seen in the past e.g. greenhouses, timber drying kilns or possibly more diversified options. It is these larger commercial developments that are expected to dominate in terms of future growth. The challenge is to lure developers to relocate operations to a lower energy cost site. In a few cases (such as Kawerau or Tauhara) there may already be potential clients over the field. Mokai has already demonstrated that clients can be attracted with satisfying land and energy arrangements, even where Maori-owned land is involved. These larger scale developments are expected to be the dominant source of future growth. At the moment it cannot be said that there is a clear pipeline of projects coming on stream.

Diversification of energy sources can be encouraged if the lower temperature geothermal resource characteristics are defined. There are many resources around New Zealand with temperatures sufficient to heat homes, offices and green houses. However resource characteristics need to be defined so that all parties including consenting authorities have confidence to commit to certain levels of development.

4. GEOTHERMAL HEAT PUMPS

There are increasing consumer demands for home comfort and an increasing realisation that New Zealand homes have been too cold with negative impacts on population health. Comfort and health aspirations, environmental drivers for cleaner air, and a growing awareness of the efficiency of heat pumps in the face of rising electricity prices is leading to accelerating uptake of heat pumps. New Zealand still appears to be in the early uptake phase of air-source heat pumps (BRANZ 2007), with the number of sales more than trebling between 2001 and 2006, with geothermal heat pumps lagging further behind. While recent geothermal installations still number in their tens, calculations indicate that these are economic for large domestic and a wide range of commercial applications, especially in cold areas nationally. A review of uptake of geothermal heat pumps internationally shows that when markets start adoption, their growth is exponential.

An East Harbour/GNS Science report undertaken for EECA in 2007 developed an estimate for eventual uptake of heat pumps through a comparison of this technology with a wide range of other energy technologies. While projections should be seen as indicative, it appears reasonable that by 2030 about 0.5% of New Zealand homes will have these installed. That equates to 10,000 homes. While growth is expected to be exponential, this will require an average installation rate across the whole period exceeding 400 homes per year. Such a rate is far greater than the current single active company can handle. This is a huge growth area, but requires a reliable and cheap supply source, good home office support, and a network of competent installers. Systems are in place for current low levels of activity but could be stretched shortly.

The BRANZ heat pump study (BRANZ 2007) indicates there are already weaknesses in the general heat pump market in terms of labour shortages, quality of installation and appropriate sizing for New Zealand conditions.

Geothermal heat pump applications will always lag behind other energy investments because their installed capital cost is much more than air-source heat pumps and other heating options. If government or other investors want to encourage uptake with a view to demand-side energy management or “clean energy” options as described in the Energy Efficiency and Conservation Strategy (EECA 2007), then they will have to find ways to reduce the upfront impact of the high capital cost through some spreading mechanism.

5. COMPARISON ACROSS TECHNOLOGIES

There are various economic models for the diffusion and adoption of technologies and it is useful to consider a continuous adoption model in comparing the various technologies already described in this paper. A generic qualitative cumulative adoption path is shown in Figure 3.

Geothermal heat pumps are at the earliest stage of product introduction, though the technology is mature internationally. Cumulative sales nationally still total in the low 10s, but uptake is accelerating as more people become aware of the option and sensitive to the rising cost of energy. The future success of this market segment will depend on reliable suitably-priced supply lines, sound engineering, quality installation by trained personnel and ongoing support services. There are several companies talking about these installations, but only one active installer who is very aware of the issues just mentioned. There may be a need at some stage for NZGA or the NZCEC or a specific heat pump organisation to set up its own quality assurance scheme, say with

a training or accreditation scheme similar to that offered by the Solar Industries Association for solar panel installations.

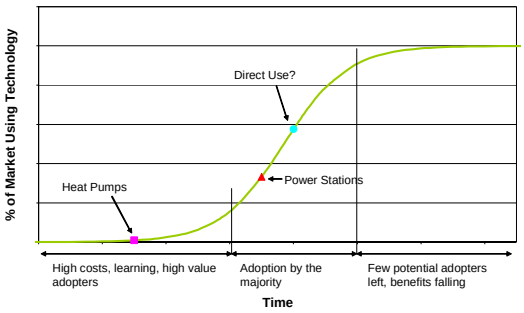

Figure 3: Generic Cumulative Adoption Paths for a Range of Geothermal Technologies.

Power station installations are shown in Figure 3 at an early stage of adoption by the majority. The rough position is governed by the fact that New Zealand currently has about 450 MWe of installed geothermal capacity with another 1000 MWe currently looking competitive (or nearly so) with a range of other technologies, and further generation available beyond that. For many in the industry, the long time between significant steps will have felt like stagnation, but active development programmes now appear to be in place for Mighty River Power and Contact (with other parties expressing interest), along with active commercial and environmental drivers for investment.

Direct use applications are harder to place on the curve. The national direct use is dominated by Kawerau supplies. It is difficult to imagine significant expansion beyond this, although there are ongoing rumours of discussions between parties on the Kawerau field. The hiatus in development after the late 1980s can suggest direct use is in the late part of the curve. However this appearance is due to stability in Kawerau mill energy supply, the Rotorua bore closures and a short-lived royalty regime. The current domestic investment in direct use in Tauranga, and recent model commercial arrangements such as the Gourmet Mokai glasshouse and Tenon kiln supply on the Tauhara field point the way to ongoing investment in this area. Given the nature of our high temperature geothermal fields set in farmland or near large plantation forests, it is readily imaginable that very similar developments could happen on almost any field developed for power generation.

6. GEOTHERMAL TOURISM

The NZGA has been focussed especially on generation in the past. However, geothermal tourism was an early drawcard for foreign currency, and its value was given increased recognition at the time of the Rotorua bore closures. The geysers needed to be protected for a range of reasons including ensuring that tourists would continue to be attracted to Rotorua and the complementary cultural and scenic attractions offered in the area.

Environment Waikato has previously collected visitor numbers on geothermal tourism, but time-series data will not be available until repeat surveys have been undertaken.

Visitor numbers is a carefully protected statistic within the New Zealand tourist industry. The exceptions to this protection are facilities owned or operated by Councils and Government. As an indicator, long term trends have been provided by Hanmer springs (owned by Hurunui District Council) and through the Ministry of Tourism for Te Puia (the Maori Arts and Crafts Centre at Rotorua that includes access to the geysers and geothermal features outside the Whakarewarewa village). It should be noted that the Te Puia operation is in the process of changing. Shortly geysers access will be through Whakarewarewa village which could radically change visitor patterns.

Table 2: Comparison between Hanmer Springs and Waiwera Markets

Hot Pools	**2006 Visitor Numbers**	**Breakdown**	**2006 Population**	**2006 Airport International Arrivals**
Hanmer Springs, Canterbury	507,776	68% local domestic, 7% other domestic, 25% international	348,435 (Christchurch)	762,083
Waiwera Hot Pools, Auckland	>350,000	Unknown	1,125,678 (North Shore, Waitakere, Auckland, Manukau)	3,081,918

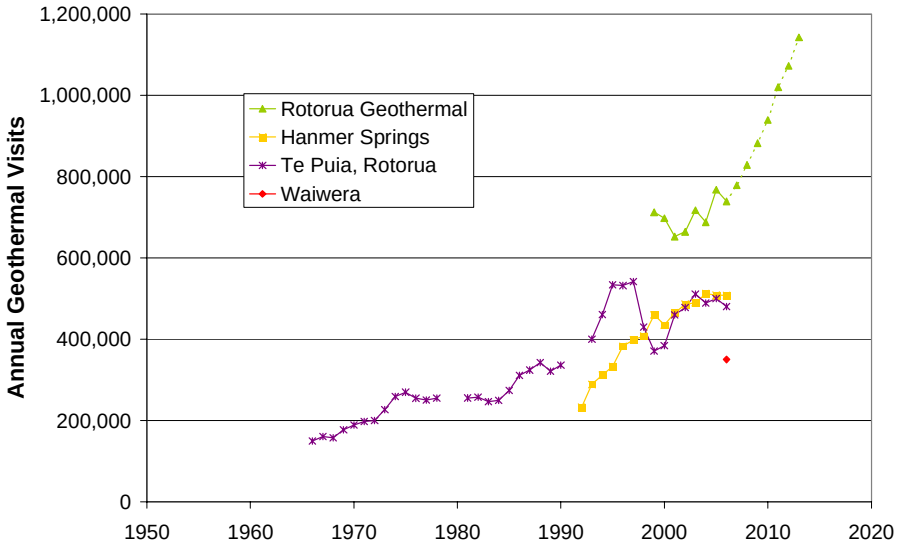

Figure 4: Historical and Projected Growth in Geothermal Tourism Visitors in New Zealand.
Source: Historical use – personal communications from Ministry of Tourism and Hanmer Springs management and from Waiwera pools website; Projected use – based on statistics and forecasts provided by the Ministry of Tourism.

Both the Hanmer and Te Puia visitor numbers show some recent stagnation in terms of growth. However, one of the most striking features of this graph is the fact that Hanmer Springs has been able to rival the prime tourist attraction at Rotorua in terms of visitors. Hanmer Springs is located 1 ¾ hours drive out of Christchurch, whereas Te Puia is within a few minutes of a major regional airport. The management of Hanmer Springs have worked on branding, marketing and active investment in facility improvement resulting in being voted best visitor attraction in 2004, 2005 and 2006 at the New Zealand Tourism Awards and receiving a distinction award in 2006.

Also shown in the graph is a single data point for Waiwera (their website stated they received over 350,000 visitors per year). Given that Waiwera and Parakai are sitting immediately beside the major population base in New Zealand (Table 2), it appears that significant development should be possible.

The Ministry of Tourism collects a wide range of statistics. The projection for Rotorua geothermal visits was based on interrogation of the Ministry database and recent projections (Ministry of Tourism 2007) of tourism numbers. It has been assumed that current trends of tourists visiting geothermal attractions will continue. This means that about 9% of all domestic visitors, and 70% (and increasing) of international visitors to Rotorua will visit a geothermal attraction. Tourist projections show domestic visitors to Rotorua increasing by about 6% while international visitors are expected to increase by nearly 40% between 2006 and 2013. In total, it is the strong growth in international tourism, with interest in geothermal attractions that will lead to a general upturn in geothermal tourism.

The high international interest in Rotorua geothermal attractions could have further commercial value. It allows product developers (say for distributed generation) to show off their products in a high profile location. Many of these visitors are from Asia, with a growing number from China.

7. SOME INTERNATIONAL ISSUES

There are parallels between New Zealand's situation and the international scene. A trigger for stronger interest in geothermal generation (and other forms of generation) in New Zealand was the increase in domestic gas prices following Maui redetermination in early 2003. This reassessment provided the opportunity to renegotiate gas prices up towards the level of LNG (with a suitable margin to discourage companies actually investing in that option). In New Zealand this was also matched by rising coal prices. Obviously there are also altruistic interests such as in climate change which also drive attention in renewable forms of generation, including geothermal energy.

Very similar conditions exists internationally. Fuel price changes and climate change concerns are international. Similarly, organisations are continually being restructured or sold creating a need for resources directed at due diligence.

Figure 5 shows international crude oil price from USDOE sources (US 2006 dollars), modified with current oil price and a projection of future oil prices.

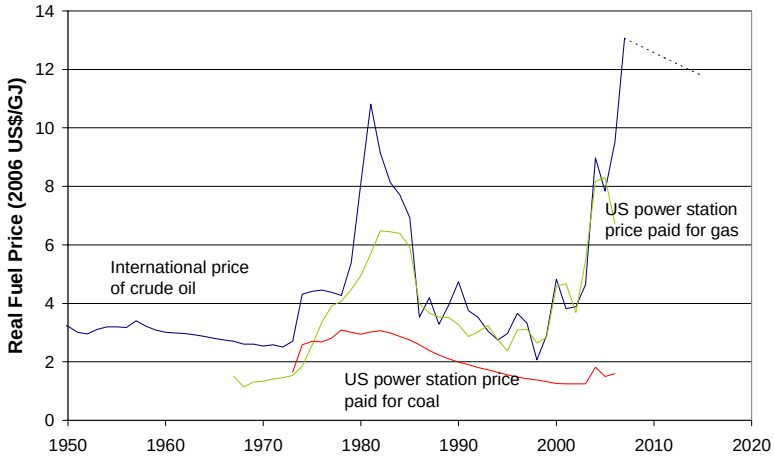

Figure 5: Historical and Projected Comparison between World Oil Prices and US Fossil Fuel Prices Paid by Power Stations.
Source: Historical - developed from USDOE statistics: Projected – unpublished personal communications.

Table 3: Current Status of United States Geothermal Electricity Generation Projects

	Development Phase				
	Not Confirmed	Phase 1 (Identifying site, secured rights to resource, initial exploration drilling)	Phase 2 (Exploratory drilling and confirmation)	Phase 3 (Securing PPA and final permits)	Phase 4 (Production drilling and under construction)
Projects	5	21	19	17	12
Capacity (MW)	350	648-760	578-711	585-725	333-371

Source GEA 2007

There are often linear relationships between oil price and internationally traded commodities such as natural gas (and to a lesser extent coal). The risen oil price should eventually impact the cost of coal and gas in all countries. US price movements and investment trends provide a useful case study.

Surprisingly, over the last 20 years the price per Gigajoule paid for gas by US power stations almost matches that paid for oil internationally. (In the Oceania/South East Asia region internationally traded gas (LNG) price is roughly linked to oil price through a linear relationship known as the Japan Crude Cocktail formula with a lesser cost for gas than in the US). At times of extreme oil price excursions there can be separation of oil and gas prices. Coal prices have undercut gas prices for much of the period graphed and are far less volatile. In fact US coal prices do not appear to have responded to recent oil and gas price increases. This possibly temporarily stable coal price will be undercutting geothermal generation for now, and has the effect of protecting the coal industry and ensuring long term reliance on coal generation for low cost electricity.

Geothermal generation is also picking up after the peak of generation in the early-mid 1990s. According to the US Department of Energy, there is roughly 2,300 MWe of installed geothermal capacity at the end of 2006 (compared with a peak of 3,000 MWe in 1994). Table 3 shows that a series of small projects is moving through the various phases of development, and this could easily see 1000 MWe of new development over the next 5 to 10 years. These projects are largely focused in California, Nevada, Idaho and Oregon. There are a large number of these projects which will stretch global resources. The small size may be due to these projects being driven by regulated targets (through a renewable energy portfolio standards mechanism) rather than strictly commercial drivers currently. In practice, New Zealand companies rarely undertake consultancy work in the United States. This serves as an example of growth, and may mean that US companies currently competing on the international market may soon have to focus closer to home, opening the international markets for New Zealand geothermalists.

In countries where premium geothermal resources exist such as in The Philippines or Indonesia, then these countries will start to head down the same

path. These countries could be further helped in their focus on geothermal development by climate change mechanisms that could see an international price on carbon further swing projects away from traditional use of coal or oil.

The government of the Republic of Indonesia has a "Geothermal Road Map" that includes development of 6,000 MWe of geothermal generation capacity by 2020, if they can overcome current resistance to investment. Philippines interests set a goal of Philippines being the world's leading geothermal energy producer in the next 20 years (GEA 2007). Given Indonesian ambitions, this Philippines goal seems unachievable, but several hundred Megawatts of additional capacity seem reasonable.

Perhaps as significant as any of these opportunities are the opportunities in Australia. Huge investments are now going in to the exploration of hot rock resources, and these will inevitably result in science and engineering contracts. These hot rock resources are extensive, with estimates rising significantly from year to year.

One recent paper (Lawless 2007) suggests that there is likely to be over 1000 MWe of installed generation in the Western Pacific region alone in the next 5 years

Together, this will call on resources from many nations, including New Zealand personnel who have traditionally been active in these markets.

The international price of oil is having a number of other impacts internationally. The potential rewards for oil and gas exploration are leading to huge exploration efforts. This is drawing in drilling rigs, casing materials and scientific and engineering personnel. Drilling materials are in short supply and may require companies to engage in contingency ordering to ensure access. As many geoscience and engineering skills are interchangeable between the geothermal industry and oil and gas industry then this can draw away experienced personnel and bright students from the geothermal option. As a consequence, national generators such as Contact and Mighty River Power are already having some difficulty in attracting appropriate staff. The major consultancies have also had to actively seek skilled resources and give them geothermal training when required.

It is noted that commodity prices have been rising internationally. A number of factors contribute to this, but growing demand in China is a central theme. Consequently, capital costs for a wide range of technologies are increasing, geothermal technologies among them. These commodity price increases could also flow through to fossil fuel prices to the extent that these reflect marginal production costs. The end result may not be a significant displacement of one technology relative to another, though there may be short term impacts on capital intensive technologies like geothermal plant.

Globally, industry continues to restructure with takeovers, mergers and asset sales. This is likely to keep technical staff involved in due diligence relatively busy. Wherever there is a dynamic market then other parties will be assessing entry options and will require the views of experts to support this.

8. INDUSTRY RESPONSE

The preceding paragraphs point to a very active market with diverse calls on equipment and skills. In preparing this report, a survey covering readiness for growth was conducted across 40 organisations representing generation, manufacture, drilling and services, consulting, regional councils, heat pump installation, research and education. 13 companies responded.

Two companies and one council were actively expanding staff numbers to take account of growth. Most other companies had already expanded or were actively recruiting just to compensate for staff turnover.

Most companies provide in-house training for new staff, but a growing number are realising the benefits of specialist courses or of possibly sending staff on the Geothermal Institute Certificate course.

Most of the respondents had already noticed an increase in geothermal workload, some both nationally and internationally. One of the consultants was being faced with increasing diversionary work for skilled geothermal employees but was compensating for this through an active recruiting programme.

In comments one company indicated that consultancy work was difficult in nature and difficult to win, possibly leading to a reduced pool of consultants in the near future.

Expectations were dominantly for an increase in geothermal workload, especially domestically. One or two companies only saw the increase as being for a 3 to 5 year period, but most companies identified this growth as ongoing or indefinite.

With long term growth in the market there is time to commit staff to specialist training, there is a need to support training institutes, and given reported shortages there is an ongoing need to recruit competent people into the geothermal industry at any level.

The NZGA has previously reported on personnel capability within the New Zealand geothermal community (SKM 2005). Concerns were expressed then about the ability to meet expected growth demands and competing calls for service. Those concerns remain.

Despite these concerns, the New Zealand industry has been able to support the recent developments mentioned earlier in this report. Including the Kawerau project this includes the largest single increment in generation over the last 20 years, giving reassurance that the major developers will be able to manage their way through this growth.

9. ACKNOWLEDGEMENTS

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