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## **Submission on the MED Paper on Geothermal Energy and Barriers**

Ministry of Economic Development

Attention: Dr Alice Hume

On behalf of the New Zealand Geothermal Association

21 April 2010

### **Introduction**

The New Zealand Geothermal Association (NZGA) would like to thank the Ministry of Economic Development for including NZGA in its consultation process on the barriers to geothermal investment and ways to reduce the impacts of these barriers (report reference <http://www.med.govt.nz/geothermal/barriers>). We recognise that you have already undertaken considerable consultation with geothermal industry members, and this has already informed your view.

The New Zealand Geothermal Association (NZGA) is an independent, non-profit association that provides information on geothermal phenomena and utilisation for industry, government and educational organisations. In addition, the NZGA, as a member of the International Geothermal Association, contributes to the international exchange of information within the geothermal development industry. NZGA membership comprises participants, regulators, and interested parties within the geothermal community. It totals 274 members currently.

### **Overall Comment**

We recognise that it is difficult to bring a discussion of geothermal energy and its barriers into a concise document, and that this is intended to be a high level review rather than a comprehensive view of all the barriers and possible solutions. Your approach of breaking the discussion into a discussion of resources/technologies then phases of development seems particularly useful.

Perhaps the best way to comment would be to list some major barriers to development, and then discuss these. These barriers include:

- Competition from other energy resources
- Consenting regime
- Land/resource access
- Knowledge
- Manpower resources (an aspect that I think has been underplayed in the report and may be underestimated by other submitters)

We do ask that in considering development, you keep in mind the distinction between small and large scale developments, there being greater hurdles to small-scale development in many cases. There is also a need to nurture the skill base within the various consultancies as this experience is based on international projects all of which can bring value to New Zealand developments.

### **Competition from other Energy Resources**

Basically we have a preference for geothermal resource and technologies competing on a level footing with other technologies. Our New Zealand geothermal resources are frequently of a premium nature by world standards and are able to compete in terms of electricity generation or heat supply. We do not support subsidies unless part of a means to overcome a market failure.

There have been market failures for which corrections are required. As an example, it is widely recognised that electricity and heat markets have failed to place a cost on carbon emissions, so we support the introduction of a cost of carbon – hence our general support for the introduction of an Emissions Trading Scheme as a mechanism for this. Because geothermal resources/technologies are associated with low levels of carbon emissions, a market value on carbon will improve their competitiveness relative to fossil fuels.

Other market failures are associated with knowledge. In many cases people are not aware of options e.g. geothermal heat pumps or the possibility of direct geothermal heat use. These knowledge gaps require a correction, which is frequently through education but may require subsidy to build up a small national portfolio of successful projects to be imitated by others. One useful recent example of this is an EECA fund established to help with feasibility studies for new technology applications.

### **Consenting Regime**

NZGA does represent diverse groups and on consenting we have no way of presenting a unified view. Some members have argued for a new Crown Minerals-type mining regime that international investors may more readily understand, and which leaves resource impact management with the Councils without resource allocation requirements. The contra-view is that the Resource Management Act can work well (though can be refined), major investors are familiar with this process, major investment is taking place, and change will be disruptive.

### **Land/Resource Access**

You have recognised land access as a key requirement to a successful development, and for this there is no reasonable alternative to building of relationships, securing of agreements and/or direct purchase of some land.

### **Knowledge**

As outlined above, lack of knowledge can be associated with a market failure in some cases.

Knowledge is also linked to the wider issue of risk management. The process of investigation is partly about the securing of more information to justify investment and to give greater assurance that a project will be viable.

We support the idea of a knowledge stocktake. We do point out that much of the Crown knowledge (through scientific investigations and drilling programmes) was obtained more than 20 years ago. If some sort of forced disclosure of information after a certain period was to be introduced as you suggest, then it would seem more than likely that the Crown information should be disclosed now. A “no cost” disclosure on the same basis as mineral and oil & gas disclosures would be reasonable.

We are aware that the Crown has had in mind to use some of the Crown wells as part of Treaty of Waitangi settlements and so may be concerned at erosion of value due to

disclosure of information. While there may still be some individual wells of particular value at Kawerau and Ngatamariki, the impending development of these will soon reduce the basis for concern around the value of well information. We would support the release of information on Crown assets as soon as there is resolution over ownership of all Kawerau and Ngatamariki wells.

We recognise that companies such as Mighty River and Contact are investing large amounts on science and drilling and support preservation of the confidentiality of this information.

We recently made a submission on the draft Environment Bay of Plenty Regional Policy Statement in which we suggested that Councils could play a role in making information on drilling and wells in some of the lower temperature fields in their area available to improve the ability of other small direct users to assess risk and reward. We continue to support this special case where there will be numerous small developers that need information to assess risk, and see this as a different case to large scale developments where a single player must make many 10s of millions of dollars of investment to seek a development consent at risk of being gazumped.

### **Manpower resources**

We believe that manpower resources has been understated in your report. Many aspects of geothermal development require access to skilled personnel resources. NZGA produced a report in 2009 looking at industry skills in which we concluded for the current and expected rate of development the overall industry was at about the right size or needed to expand slightly. (see [http://www.nzgeothermal.org.nz/Publications/Whats%20New/Skills%20issues%20in%20the%20Geothermal%20Industry\\_2009\\_FINAL.PDF](http://www.nzgeothermal.org.nz/Publications/Whats%20New/Skills%20issues%20in%20the%20Geothermal%20Industry_2009_FINAL.PDF)).

In practice, New Zealand skills are in world-wide demand. There will be increasing calls on our expertise in Australia as their EGS developments move into a development phase, and in places like Indonesia with high demand and opportunities for major geothermal development across multiple projects. This will eat into the availability of our experts.

### **Your Introduction**

New Zealand's geography and infrastructure development makes access to our prime geothermal resources relative easy compared to some countries. We have roads that give access, and a high degree of electricity grid interconnection that means that generated electricity can be readily connected. This contrasts with parts of Australia e.g. the Geodynamics Innamincka geothermal project where 1000km connections may be required, or with some of the islands in Indonesia where there may be isolated small grids.

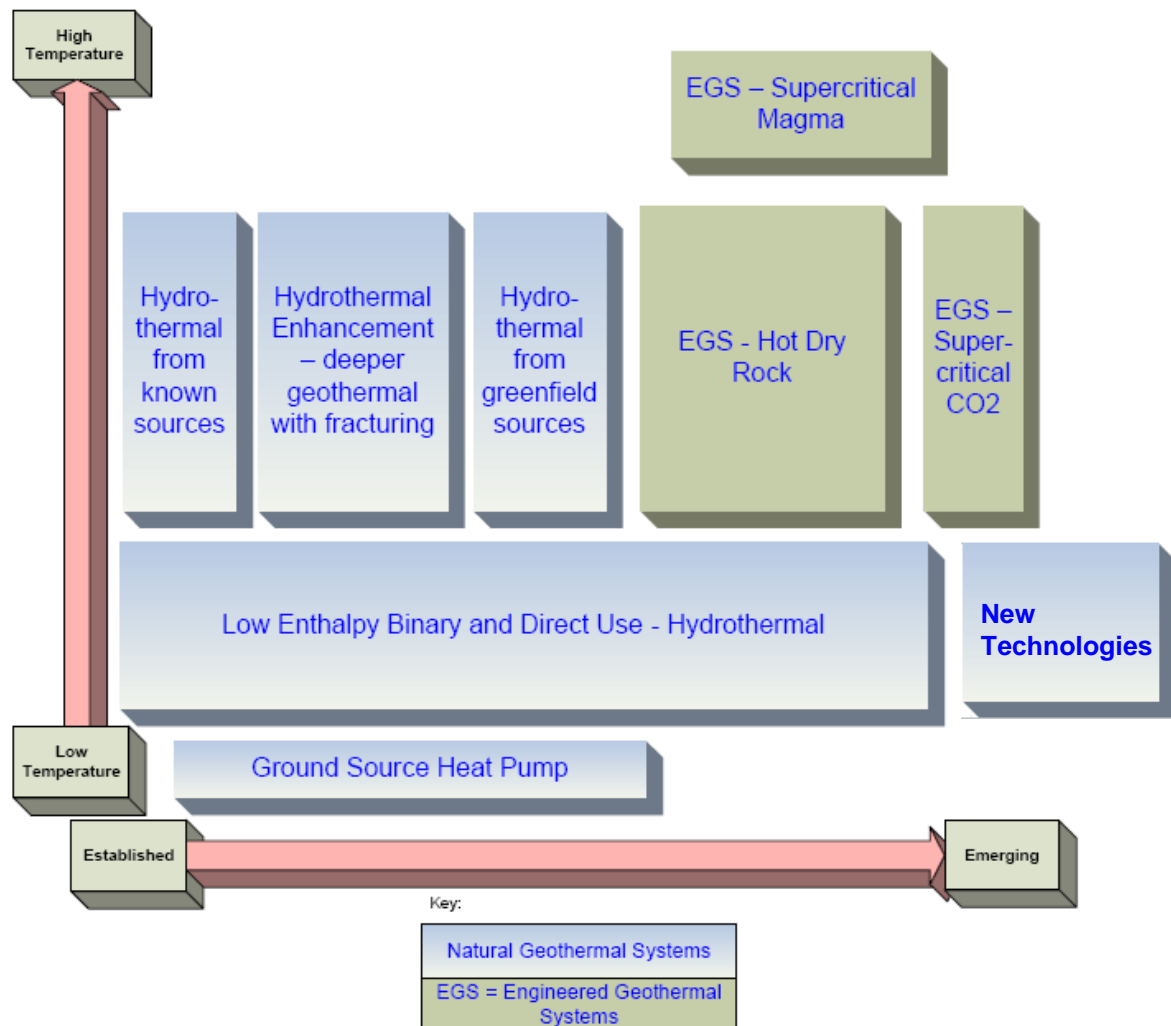
In terms of Maori use of geothermal energy, I think it is more correct to say that the first use "was by Maori as a heat source for cooking and bathing, and for ceremonial purposes". It is not necessary to specify central North Island Maoris as first users, as first use could equally have happened in Northland or near Auckland and even in the South Island.

In the last 150 years Rotorua rather than Taupo or Kawerau has been a greater focus for tourism and direct use. There were also major geothermal spa operations north of Auckland, at Te Aroha and in the South Island at Hanmer Springs and Maruia Springs. 50 years ago both the major industrial development at Kawerau and the Wairakei power station began operation and drilling for domestic purposes started to take off especially in Rotorua, but also in Taupo and other centres.

Your calculation of the value of geothermal energy based on equivalent electricity generation is useful and interesting. Your calculation is effectively a lower bound as it ignores the value of direct use. However the story you tell with the calculation is powerful as it shows that the value of geothermal energy is comparable with that of coal and gas production.

## Your Discussion of Emerging Technologies

Overall we are comfortable with your discussion of these technologies, though the “technologies” you show in Figure 1 are a necessary compromise between technologies and resources.



There may be a category missing to do with new technologies. The Kalina cycle is one such technology, though might be considered a variation on binary cycle. People have also suggested adaption of Stirling cycles, Trilateral Flash cycles and various others that should sit in a category outside the well-established direct use and binary cycle categories, as emerging technologies. Geopressured resources are also missing from your figure and discussion. These are geothermal resources normally found in oil & gas environments producing both hot water and dominantly methane gas, and for which development requires separation and combustion of the gas along with usual geothermal technologies. There may be examples of these systems in our oil and gas environments.

In your discussion of the various EGS options I think that people have underestimated the potential of EGS for direct heat supply. While EGS power station concepts tend to be based around a supply at around 200°C, many direct use applications may only require temperatures less than 100°C and some less than 50°C. When these less ambitious temperature targets are considered coupled with a natural geothermal gradient of around 30°C/km, then spa sites at Murchison or the slopes of Mt Egmont/Taranaki, or in-situ use below existing major heat users become a distinct possibility. It is possible that projects of this sort could precede electricity generation projects, as there is evidence that some such projects could be commercially viable now.

Your Figure 2a suggests that EGS may be more promising around fault lines. In fact a major difficulty with EGS developments is loss of working fluids, and fault lines may provide unwanted conduits for this loss.

Your discussion of emerging technologies finishes with a discussion of other uses of geothermal resources, mentioning mineral extraction and carbon capture and storage. You should also mention commercialisation of thermophiles i.e. the living organisms that can thrive at elevated temperatures.

In terms of barriers, we broadly agree with you, though please refer to our discussion of barriers above. We also refer to a report produced by East Harbour/ GNS Science for EECA in 2007 looking at potential geothermal direct use targets for New Zealand. This listed a range of factors that could influence the thinking of potential investors (some positive and some negative) including:

- General concern over rising fuel prices – this is driving a review of energy options by major energy users which could lead to uptake of geothermal options
- New developments or plant replacement – where developers are considering capital investment in new plant or replacement of energy plant then geothermal options can compete, whereas they may struggle to compete on a capital vs fuel-only basis
- A requirement for a quality fuel supply – this relates to the need to offer quality problem-free energy rather than offer a waste product
- Concern over past bore closures – there may still be residual concerns created by the forced closure of Rotorua bores for some potential domestic investors
- Co-location of resource and user – resource and user must be in the same vicinity
- Concern over CO<sub>2</sub> and other air emissions – local government efforts to improve air quality could help with the uptake of alternative low emissions energy sources such as geothermal energy
- Concern over current levels of domestic heating – New Zealanders are now becoming aware that their houses have been too cold such that it affects health so energy solutions will be sought to improve home conditions
- Aversion to high capital expenditure on energy – it seems that many New Zealanders have a short term view to domestic energy investment, whereas geothermal projects are capital intensive and have longer payback periods. This may require creative solutions such as is now offered by Right House
- Constraining resource consenting policies
- Current knowledge of geothermal resources suitable for direct use – this relates to the knowledge gaps discussed elsewhere in this submission
- Current technology and cost trends for plant and equipment using geothermal energy – generally, geothermal development lifecycle costs are competitive with other develop options

You are in good command of the barriers to geothermal heat pumps.

In terms of hydrothermal enhancement for deep geothermal, we point out that assistance with R & D in this area (i.e. assisting with deep drilling and fracturing on existing fields) will not only assist the developers but will also give the government greater confidence in the proven reserves of geothermal energy accessible by the developers.

In your discussion on low enthalpy binary hydrothermal systems we note a few errors in perception. Wairakei and Kawerau plants use heat in water that was otherwise wasted. Mokai and Rotokawa plants include that function (i.e use of heat in the water) and also have units that substitute for steam condensers while generating electricity.

## Your Discussion of Phases of Development

We support your views around the discussion of the phases of development.

I am not sure that issues around the 12 nautical mile limit are particularly relevant unless we are looking at large scale development out from White Island. Offshore drilling for geothermal while preserving temperature for generation is a whole new area poorly considered by industry currently and would be another area to consider under emerging technologies.

Under your Phase 3 Drilling and Reservoir Modelling, the purpose of drilling is firstly to enable measurement from which modelling can then be undertaken.

Your Phase 4 misses the design and construction phase of development. Much of this is standard engineering and management functions. However, where these include industry firsts e.g. new small scale geothermal power generation there may be room for the government to assist with feasibility studies or asset proving. We note that Government is providing some support for the proving of new wave and tidal powered technologies. There is at least equal room for government support in an industry with a proven world leading capability as for an industry without these credentials. It would seem reasonable for all new generation (or heat use) technology funding to be accessible on a contestable basis rather than being directed at one particular industry segment.

You have a discussion of Phase 5 Decommissioning. In practice the closest we have come to this is Contact's plans for the Te Mihi development, partly as a replacement for the 50 year old Wairakei plant. From this perspective, because geothermal resources are renewable resources they are something like grandfather's axe. There could be endless replacements of this or that e.g. new wells or new power plants on the surface, but ongoing development and use is conceivable on a permanent basis because the resource is essentially renewable. Industry has developed some concepts around the possible resting of fields to help restore original conditions. However Wairakei with now over 50 years of operational history is our longest operating plant and there is no perception of decommissioning and walking away from this resources. Consents are in place for the Te Mihi replacement plant, and that plant is likely to be installed when the old Wairakei plant reliability drops to an unacceptable level.

## Final Comments

We would be happy to discuss details of this submission.

Yours faithfully



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New Zealand Geothermal Association