Submission from Geoheat Action Group of the New Zealand Geothermal Association

Submission on the Process Heat in New Zealand Document – Opportunities and Barriers to lowering emissions.

Date : 22 February 2019

This submission comes from the Geoheat Action Group, which is the New Zealand Geothermal Association (NZGA) Group that has been driving the Geoheat Strategy for Aotearoa 2017 – 2030.

Thank you for the opportunity to make a submission.

Geothermal Energy is a significant opportunity for New Zealand to grasp in the process / stationary energy area as we as a nation transition to low carbon energy. The NZGA has seen this from a way out and has developed strategy and actions in advance of this PHINZ work.

We would be pleased to come and discuss the contents of the submission and also explore further opportunities for fostering renewable direct heat use in New Zealand if that would be useful to you. We will bring a geothermal flavour to those discussion, out of a position that the renewable energy transition will require using the complete range from the renewables basket. Geothermal is but one component.

This submission does not follow the questions in the document but is more of a general commentary on aspects canvassed. You will find some broad philosophy discussed in several places and there are three aspects we specifically note below:

1) **Broader Emissions Context** - The focus of the activities considered here is that process heat sits within the broader NZ emissions context. The broader context must always be considered as there may be other lower hanging fruit that will see gains that are as good as can be achieved with less investment than by the more narrow focus of the PHINZ work. For instance are there are wins in greenhouse gas absorption or agricultural areas that might provide easier wins than to lowering emissions in the stationary energy area.
2) **Smaller Installations** - In the process heat area there maybe smaller uses / boilers (say less than 1 MW thermal) that are not under direct pressure to reduce emissions and to adjust their processes. Energy management / efficiency advice provided to these smaller installations could be a way of cost effectively lowering emissions and assisting these users (and NZ). The larger installations have consultants that are assisting them and likely don't need advisory support. Small boiler installations raising hot water or steam are unlikely to have such support and coordinated investment in advice is suggested.
3) **Strategic** - The renewable energy label is going to become progressively more important for consumers over time. The appetite for products that are made with renewable energy will rapidly develop and consumer change is swift whilst energy system change is slow. Waiting for consumers to change is really not an option for a business that wishes to maintain and grow a customer base. Business needs to be adopting renewable energy over an orderly time frame now so the box is ticked for tomorrows consumer. Maybe some awareness material for smaller businesses would assist so they can plan for this energy transition that their consumer base will start to demand. The businesses will ask "So what do I do ?" so some advisory material would be useful for them.

The biggest area of potential gain in the direct heat utilisation area is possibly in the industrial use of process heat. There is much more that can be done in the large user and industrial heat use space with geothermal energy. There is energy available at Kawerau and Tauhara on quite short delivery timeframes for businesses now. There is opportunity for geothermal energy supply operations to

grow in New Zealand and some thought as to how this is might be quantified seeking to assist in identifying what the next steps are to releasing **more potential**, whether that be at Kawerau, Tauhara or at other geothermal fields would be useful. Call this the supply pipeline if you like.

Looking beyond the current proven geothermal resources there is, deeper down, much more energy beyond the depths that drilling currently reaches that will in time become accessible. The drivers for this will be the increasing cost of energy, the advances in knowledge around the deeper "beyond todays geothermal resources', the hotter fluids that can reasonably be expected and research that is going on that will more generally release energy from engineered geothermal systems from broader areas than New Zealanders currently consider prospective for geothermal energy.

Temperature of supply is a crucial aspect. Industrial processes have developed around carbon based fuels since the industrial revolution on the basis of energy density and temperatures achievable from carbon fuels underpinning many of the design of processes. It will be beneficial for there to be change in thinking around how processes are engineered focussing on using lower temperature energy sources. This is rather than the other way around which is how can a renewable source provide energy in the same way as the existing carbon source - which appears to be a common approach.

Geothermal is a lower temperature energy source compared to carbon energy. Industrial processes have developed over time around the temperature achievable from carbon fuels. A driver has been that the higher temperatures from carbon fuels push the kinetics and productivity gains that are achievable relative to lower temperature processes. In the geothermal space there is thinking around using mechanical vapour recompression. This is sound because in some circumstances this will enable the temperatures attainable with geothermal sources to be increased. Fundamentally however the approach follows the line seeking to make geothermal match the carbon fuels profile.

A suggestion is to selectively study processes and focus on reengineering the process for use of the temperature profile available from geothermal energy. Then disseminate the results.

Thinking about other sectors there may be approaches and technologies from the geothermal sector that can be applied or adopted in those sectors. One example is the work on low temperature power generation using source temperatures from 60 to 120 C developed in Sweden (Climeon). These systems are being used not only in the geothermal sector (on low temperature geothermal systems in Iceland), but in electricity production through energy recovery in ships (flues and engine cooling systems) and in other industrial energy recovery.

Traditionally processing facilities have adopted a fuel fired boiler plus electricity to supply the process. There is a move to multiple fuels supplying one site. An example of this is the Roquette Freres starch plant in France. The total plant thermal load is some 100 MWth. There is a diversified energy supply from a 40 MWth biomass boiler, production of biogas from industrial sludge and a 24 MWth geothermal supply. For this plant the geothermal energy is transported in a pipe loop that has a 15km length from the geothermal heat supply to the use at the plant.

The message is geothermal can be transported a little way it doesn't have to be used at site. It depends on the size of use and the prevailing energy economics as to how distant. Certainly, energy and temperature losses for a thermal supply of 20 plus MWth over 20km are anticipated to be acceptable. Smaller uses say 5 MW would likely need to be within 5km of the heat supply and small uses say 1 MWth would need to be close to supply.

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New Zealanders view of what geothermal energy is and what it can be used for is an impediment to the adoption of a range of new thermal ground technologies. The past experience limits the thinking on the future. In Europe, for instance, where 50% of the thermal energy is used in facilities heating there is significant activity occurring to develop lower temperature interconnected energy systems, which share energy between facilities along with the interconnected system being connected with a ground energy storage component. Here the ground is being used as a thermal battery. Large reductions in carbon emissions are predicted to be achieved with these systems that are being implemented on a large scale in several European cities. There are two aspects that emerge. New Zealand's approach to energy management is usually on an individual site by site basis. What opportunities are there for energy sharing between adjacent sites - The concept of heat parks ? The other aspect is that of using the ground as a thermal battery to manage fluctuating energy demand.

Conservatism in adoption of new technologies is an impediment. This is noted in the document. Our general view is energy systems in New Zealand are engineered using current known solutions, faster design is achieved, and project delivery shorter with the use of time proven devices engineered to have low consent / permit exposure. Designing for novelty has the potential for time delays to be introduced into the project timeline or additional conditions to be introduced by for instance a permitting authority (if consents are required) which add to the project cost. Engineering is focussed on a low liability, fast solution delivery from the engineering team – this results in the past engineering approach dominating tomorrows installations.

Thinking and work on how to more quickly deploy innovative and new solutions to assist New Zealand in our energy transition would be useful. Energy vision is needed but also processes that facilitate bold engineering enabling engineering and industry to more quickly embrace new solutions. It is how we get to this position that is the challenge. Funding might need to be allocated to push likely winners into the deployment phase. European, EC and country of origin, investment in large deployment projects results in working examples at the industrial scale that then others can emulate. The deployment, scaling up from the research phase, has been de-risked.

There is thinking on the world stage into how geothermal energy might assist in providing more food for the worlds population by reducing food waste. This may be more related to the agri-food sector than the process heat sector but processing will be needed. The document has come out of IRENA in the last month (Accelerating geothermal heat adoption in the agri-food sector: Key lessons and recommendations, January 2019)

There is much going on in the European and US context. This includes smart thermal grids based on energy sharing and Engineered Geothermal Systems. The European Union and the US Department of Energy are spending significant sums on geothermal research. With the large levels of expenditure that are going on over the next five years advances are going to occur, and quite rapidly, and NZ needs to keep abreast of these.

The International Energy Agency Technical Collaboration Programmes (IEA Geothermal for geothermal) could be a way of bringing new information and ideas into New Zealand. There are a number of IEA renewable energy Technical Collaboration Programmes that New Zealand participates in and a workshop with presentations from the New Zealand member from each of the TCP's could be a useful way of sharing some of the knowledge from the world stage.

Please note that the url on page 26 of the PHINZ document no longer works as the New Zealand Geothermal Association has moved to a new web site. The working address is given here - Geoheat

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Strategy url https://nzgeothermal.org.nz/app/uploads/2017/06/Geoheat_Strategy_2017-2030__Web_Res_.pdf

Also there is an Action Plan associated with the Geoheat Strategy that has a shorter operational focus. The url for the current Action Plan for 2018 – 2019 is https://docs.zoho.com/file/0gw4j3499b6a5bd2442d89d715d9614403c03

We wish to reiterate Geothermal Energy is a significant opportunity for New Zealand to grasp in the process / stationary energy area as we as a nation transition to low carbon energy. Lets make the most of what we as a nation have in our renewable basket.

We trust these thoughts and ideas assist you and as indicated earlier we would be happy to come and talk with the team if you think that that would be useful for you.

Thank you

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For Geoheat Action Group

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