DEVELOPING A GEOHEAT STRATEGY TO INCREASE GEOTHERMAL DIRECT USE IN NEW ZEALAND: STAKEHOLDER CONSULTATION

M. Climo[1], B. Carey[1], S. Bendall[2], A. Seward[1]

[1] GNS Science, Wairakei Research Centre, Private Bag 2000, Taupō 3352, New Zealand.
m.climo@gns.cri.nz ; b.carey@gns.cri.nz , a.seward@gns.cri.nz

[2] Environmental Management Services, PO Box 245, Taupō 3351, New Zealand
simon.bendall@emslimited.co.nz

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ABSTRACT

The Geoheat Strategy is being developed to coordinate a cross sector drive to increase the use of direct geothermal energy. A consultative process undertaken in 2015 formulated the draft strategy ahead of public review. A robust strategy will enable growth, with the ensuing economic, social and environmental benefits. Feedback, ideas and questions from stakeholders were collated through facilitated workshops, an online survey, comment received on the draft document through the NZGA website whilst available for public review and meetings with some parties. The New Zealand Geothermal Association is the host organisation for the strategy. Stakeholders represented include heat suppliers, heat users, service industries, government agencies, Iwi/Māori, industry associations, and researchers. The paper discusses geothermal direct use in New Zealand and the strategic approach proposed to drive growth.

1. INTRODUCTION

New Zealand's domestic direct geothermal energy use, diversification and growth has to date occurred without an overarching strategy. While development has occurred, it has done so in an uncoordinated and ad-hoc manner, independently by individual users, companies and organisations in response to business opportunities and market drivers.

There have been successes from this approach; New Zealand was a pioneer in establishing large direct use industrial geothermal heat use at Kawerau for timber drying, and pulp and paper processing in the 1950's. In 2013 the Kawerau industrial use contributed around 4,200 TJ/year, almost half of New Zealand's total direct geothermal energy use of 8,600 TJ/year (Carey et al., 2015). Other successful direct use applications include milk processing, horticulture, aquaculture, space heating and cooling and bathing.

But the lack of strategic direction and coordination has seen the energy use history of New Zealand's geothermal direct use and development go through periods of growth, decline and little or no change with time (Figure 1), primarily influenced by market economics, product positioning, company strategies and government intervention in Rotorua direct geothermal use in the 1980's. The period between 1960 – 1980 saw steady growth from the increasing development of bathing and industrial use (reaching ca. 6,500 TJ/y from ca. 100 TJ/y) whilst 1980 to 2000 was a period of low growth with some limited development, but also the closing of some facilities, as well as the Rotorua bore closure. (Figure 1; Climo et al, 2016). The trends in the TVZ are also variable depending on location and district.

The Geoheat Strategy approach seeks to develop sustained (and sustainable) growth, realising untapped potential. It is estimated that some 7,500 TJ/year of primary geothermal energy could be accessed for industrial / commercial use from consented and producing geothermal fields in the TVZ, which if business can be connected up would grow New Zealand's direct use by about 40%.

Direct geothermal has an important part to play in our energy future. The New Zealand Government is updating the National Energy Strategy (MBIE, 2011) over the next twelve months, with renewable energy targets being sought in three main categories: electricity, transport and process heat use.

Geothermal is already a significant contributor to renewable electricity and geothermal can play an important role in the other two categories:

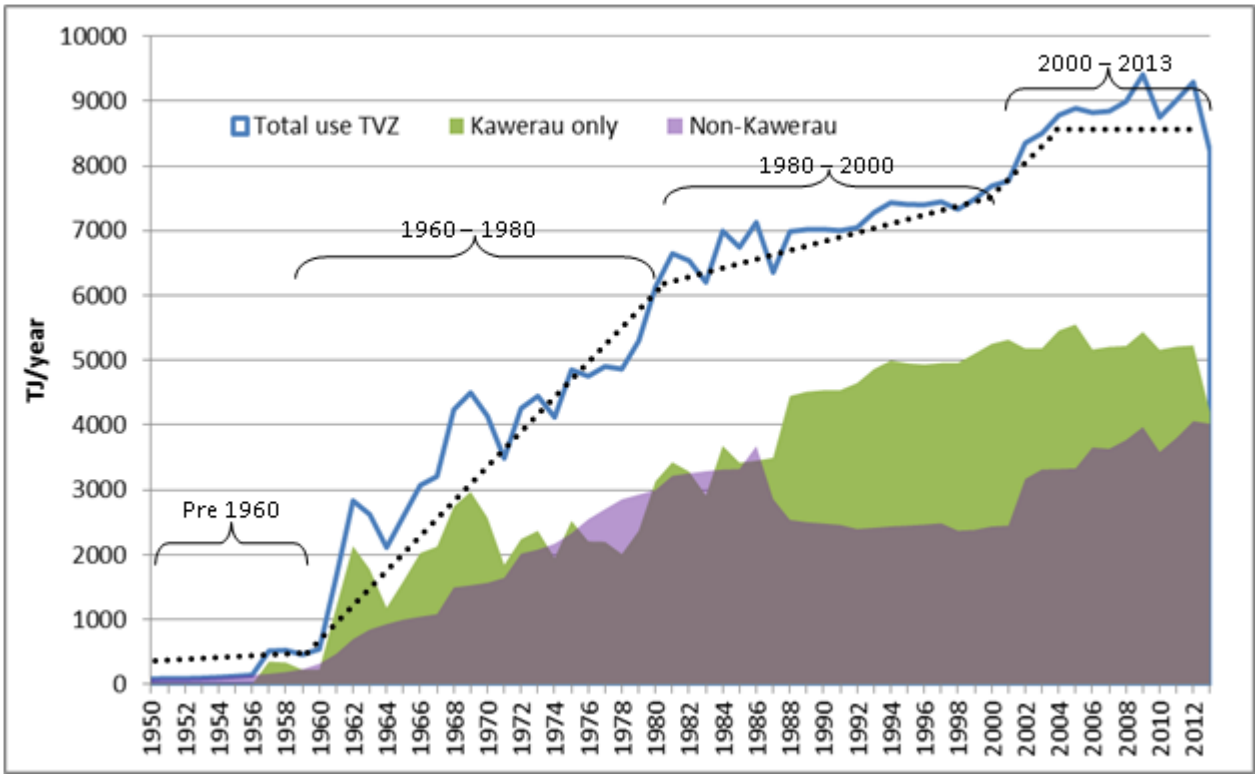

Figure 1: Estimated annual energy use (TJ) since the 1950s in the Taupo Volcanic Zone (blue line), Kawerau (green shading), and in other TVZ areas (purple/grey shading). Adapted from Climo et al, 2016.

- Transport: geothermal energy can assist in achieving renewable energy transport targets by supporting the production of biofuels, and / or renewable electrical energy for electric vehicles. This is a longer term prospect as New Zealand begins to adopt electric vehicles.

- Process heat use: Direct geothermal energy is an ideal energy source for process heat and can make a significant contribution in the short to medium term. The Geoheat strategy is a vehicle to assist with these aspirations.

1.1 The Geoheat Strategy

The Geoheat Strategy establishes a coordinated cross-sector approach to drive the uptake of direct geothermal heat use.

A Geoheat Strategy was first proposed in 2012 (Carey and Climo, 2012) as a means to coordinate an increase in direct geothermal resource use. A strategy development process commenced in 2015 and involved stakeholders participating in consultation workshops. In 2016, a draft document was publically available for feedback through the New Zealand Geothermal Association website (NZGA, 2016). One on one meetings have also been held with several parties. The material gleaned from these processes has, after review, been used to develop the strategy.

1.2 Why Geothermal Direct Use?

Geothermal direct use is a potential enabler for economic development. It is a renewable energy fuel, it can assist with New Zealand's CO_2 emission aspirations, and it opens the opportunity for Green Branding products. Some businesses might convert from fossil fuels to geothermal energy as Asaleo's predecessor, Svenska Cellulosa Aktiebolaget (SCA) did. There are opportunities to create new business enterprises encouraging businesses to locate to geothermally-rich districts.

1.3 Scale of Geothermal Direct Use Applications

In developing the strategy, all opportunities for direct use were to be considered and supported across the range from small domestic use to large industrial scale use.

Table 1 (next page) summarises three tiers of geothermal direct use development in New Zealand:

- Industrial,
- Commercial, and

- Domestic/Small Scales.

Each tier has different technical requirements, such as energy demand, process temperature, likely well depth and financial requirements to access geothermal energy. The typical entity (i.e. individual, business, or organisation) operating in each tier has different characteristics, for example, technical expertise, funding capacity and decision making processes. Infrastructure and locational constraints increase as the scale of use increases. The complexity of Resource Management Act (RMA) consenting processes increases with scale, but arguably, consenting difficulty is not linear with increasing scale. For example, while the Industrial scale users have the most complex consenting, they are also better resourced to deal with it. Additionally there are heat suppliers who already have consents for production from some geothermal fields.

1.4 Alignment with Regional Growth Strategies

The Geoheat Strategy aligns with regional development aspirations and will support central government renewable energy targets.

Three regions; Waikato, Bay of Plenty and Northland are endowed with high temperature geothermal resources. These valuable assets provide these regions with a significant renewable energy advantage that if appropriately harnessed will contribute to regional economic development through tourism, jobs and energy use.

Regional strategies and actions (e.g. Bay of Connections, 2013, 2015, 2016) generally target shorter term outcomes compared to the Geoheat Strategy which is targeting out to 2030. There are areas of overlap and potential to gain for mutual benefit, so integration and alignment are both important and appropriate.

2. STRATEGY DEVELOPMENT & CONSULTATION

The authors started driving the development of the Geoheat Strategy in early 2015. The process began with a systems mapping exercise identifying key influences for increasing the direct use of geothermal resources. These preliminary draft success factors were then taken to stakeholders for feedback/validation using facilitated focus group workshops and comment via a web based online survey. Input was also sought during the 2015 NZGW at Wairakei. Ideas on barriers to uptake and possible actions to reduce these barriers were explored and collated. There was opportunity for new success factors to be contributed.

Table 1: Broad categorisation of geothermal direct use developments and characteristics.

Scale	Requirements	Characteristic
Industrial	Temperature: >160ºC Capacity: 1-100MW Well depth: >1000m Finance: $1M-$10M++	• Corporates, large enterprises, private industry. Includes NZ exporters. • Largely self-funded. Able to pay experts or have in-house technical skills. • Company based criteria for decision making. • Green image and ethos might be important. • Growth in this tier leads to economic development. • Need for coordination and information sharing.
Commercial	Temperature: 100-200ºC Capacity: 50kw-1MW Well depth: 100m-1000m Finance: $100k - $1M	• Small to medium enterprises, private business. • None to limited internal capability for geothermal projects. • Decision making is financially-driven, but increasingly ethos driven. • Importance of marketing – need to sell the idea to this group. • Growth of this tier leads to economic development. • Need financial and technical support, as well as access to information.
Domestic and Small Scale	Temperature: 30-100ºC Capacity: <50kw Well depth: 10m – 100m Finance: 10k-100k	• Individuals. • Information deficient. Want proven solutions. • None to limited internal capability for geothermal projects. • Decision making is emotive and financially driven. • Interested in ethos and green/renewable options. • Development in this tier has links to wellness, community and health outcomes.

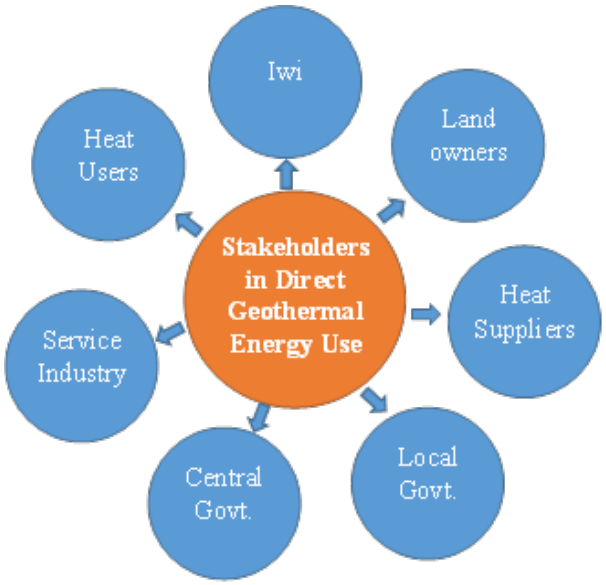

Figure 2: Key stakeholder groups identified (in blue) as benefitting from increased geothermal direct use

2.1 Key Players

Participants in the consultation identified a diverse range of stakeholders with an interest in increasing the direct use of geothermal energy in New Zealand. These are grouped in Figure 2.

The central, essential relationship is between the heat supplier (often a landowner) and the heat user. Heat users span diverse sectors, such as manufacturing, tourism, horticulture, wood processing, etc. Increased direct use of geothermal energy will benefit service industries, government agencies, Iwi/Māori, industry associations, researchers and the regions.

The strategy consultation process included contributions from representatives of all of these groups. Input was received from 45 participants across three workshops and an online survey (available for those who could not attend a workshop).

3. SUCCESS FACTORS & PRIORITY ACTION AREAS

Participants were asked to identify the top three priorities from a preliminary list of key success factor/action areas (Table 2). Each participant was then asked to select their three highest priority areas for action.

The priority action areas identified by each workshop group were explored in more detail with that group. Participants were asked for each priority action area:

1. How does this priority area contribute to increased use of geothermal resources?
2. What are our current strengths?
3. What is holding us back?

The highest identified priority action areas were to improve Awareness and understanding of Demand for geothermal energy.

Medium priority action areas were seen as simplifying Policy, greater information on Resources & Technology, coordination of Champions, and access to appropriate Funding. Expertise was seen as the lowest priority action area.

Table 2: Action area voting by participants and what would constitute success.

Action Area	What would success look like?	Total Votes
Demand	Geothermal energy is integrated in business structures as a clear value proposition generating advantage.	29
Awareness	Everyone thinks geothermal first; it is intrinsically linked to our national identity.	28
Policy	National, regional and district level policy are aligned to enable sustainable geothermal utilization.	19
Champions	Coordinated cross-sector network of geothermal champions drive geothermal growth.	18

Action Area	What would success look like?	Total Votes
Resources & Technology	Data is accessible on resources and uses. Best practice application of technologies, generation of innovative ideas.	17
Funding	Government, industry and other sectors invest in developing geothermal energy projects.	15
Expertise	We have readily accessible, world-leading capability.	4

4. IDENTIFYING STRENGTHS AND BARRIERS

This section summarises the identified gaps, questions and recommended action arising from the feedback gained through the stakeholder workshops. These were summarised into themes to guide development of the Geoheat Strategy.

4.1 Demand

Demand refers to the market demand for geothermal energy and the economic assessment and feasibility of incorporating geothermal energy into business structures and developments. Geothermal energy must show a clear value proposition, generating a competitive advantage for the user.

Stakeholders saw Demand as a fundamental factor for attracting heat users to consider geothermal as a viable energy option. Increased demand will drive development.

Strengths include:

- Abundant known high temperature resources
- Green, renewable branding
- Enthusiastic and willing heat suppliers
- Proven technologies and applications – reference sites (on all scales) showing what is possible

Barriers include:

- Location specific energy; users must come to the energy source
- A lack of knowledge of, for example: who needs energy; specifications of the demand; cost structures and business cases for different markets and sectors; conversion costs to change fuel types to geothermal
- Ineffective monetisation - absence of effective carbon price and emission trading scheme
- Lack of coordination for multi-user projects
- Lack of knowledge of competitive energy sources, while alternate suppliers capture markets (e.g. solar)

4.2 Awareness

Increased awareness will support increased use of geothermal energy. We need to overcome the dominant perception that geothermal is only for electricity and tourism, and increase the profile of direct use. The goal is that everyone thinks geothermal first; so it is included as a viable option whenever energy options are under consideration. Strong and positive awareness of geothermal opportunities provides a social licence to operate, which is essential for decision making.

Strengths include:

- Mātauranga – connection with Māori
- Science – strong expertise and understanding
- Long history of geothermal use, and a diverse range of uses
- Great examples of geothermal uses; accessible
- Technical reports and case studies are available
- National focus on renewable energy and high percentage of clean energy options in New Zealand

Barriers include:

- No coherent communications and marketing strategy
- No common understanding on resources and opportunities (mixed messages)
- Technically complex information requires audience-appropriate translation
- Lack of clarity on who to contact and how to connect heat users to the available expertise
- Resistance to sharing information
- Limited mechanisms for reaching outside the geothermal industry
- Perceptions – on geothermal's cost, value and importance to NZ
- Not in my back yard – want to use heat but not be too close to infrastructure

4.3 Policy

Policy is essential to get 'right' as this will encourage or discourage investment in geothermal development. Policy determines the size of the development opportunity by providing access to geothermal resources.

Policy refers to the various interconnected national, regional and district level policy frameworks, and their effectiveness at enabling sustainable geothermal use. The policy environment is always in a state of change. For example, regional plans are on a ten year review cycle, and implementation of Statutory Acknowledgement's and Treaty Settlements are ongoing. Also, the Te Ture Whenua reform bill is underway, seeking to make it easier for Māori landowners to make decisions about how they wish to use their land.

Strengths include:

- Policy decisions are science/evidence based
- Classification of systems provides certainty
- Established framework (RMA) and transparent rules
- Increasing alignment of regional policies and plans
- Implementation of Statutory Acknowledgements to recognise treaty settlement legislation

Barriers include:

- No preapproval for consenting creates uncertainty and risk for applicants. This can deter investors.
- High costs for consenting and compliance
- Regulatory complexity, especially at a smaller scale
- Some overlapping and inconsistent rules
- Focus on science/data driven policy
- Insufficient involvement of Māori in processes
- Preservation mentality. Is the policy framework primed for economic development or is it too focused on sustainable management?

4.4 Champions

Champions represent a coordinated cross-sector network to drive geothermal growth. There is a need to "match make" between relevant groups, and to share knowledge and lessons learnt from previous experience.

Strengths include:

- Expertise available in the region to call upon
- Industry and Government support, at all levels
- Communication between stakeholders

Barriers include:

- Competition for prospective opportunities
- Disconnect between stakeholders
- No identified central point of contact, nor funding to support a coordinator
- Lack of independent advice on direct use
- Lack of role clarity between stakeholder groups and individual organisations/ agencies

4.5 Resources & Technology

Information is required to ensure that geothermal energy solutions are the preferred choice when making decisions. This requires a depth and breadth of data and information to be available and accessible on the geothermal resources, uses and best practice application of technology.

Strengths include:

- Abundant resources
- Good track record of appropriate resource utilisation
- Diverse technologies applied and proven
- Strong science base and data

Barriers include:

- Wider access to detailed information, particularly resource information for operating geothermal fields and technology/economic information for existing direct use operations
- Solutions are often technically bespoke, so can't be a straight duplication
- Confusion / perception about what resource is actually available
- Future resource sustainability is not understood
- Land-locked lands
- Some examples of poor resource management

4.6 Funding

Funding is essential to incentivise, enable and de-risk projects. Investment in developing geothermal energy projects includes support from Government, industry and other sectors.

Strengths include:

- Geothermal has low on-going costs (after capital is spent)
- Asset rich; groups have funds to spend locally; capital is available for the right projects
- Green brands attract investment
- Geothermal fluids are often already above ground (if heat supply is existing)
- Government is willing to spend; looking for direction

Barriers include:

- Up front capital costs for geothermal projects
- Cash strapped entities
- Financial literacy/transparency and how to access funding
- Poor communication about funding opportunities
- Not a lot of examples of accessible (re data)
- Fragmented development
- Lack of funding for centralised research information for everyone to access
- Disconnect between goal, values and policies of funders/investors and recipients
- Funding criteria - how do we value our resources and opportunities, other than economically?

5. UNDERLYING PRINCIPLES

It became apparent through the stakeholder engagement and consultation process that there are underlying principles that must be considered in developing and implementing a Geoheat Strategy for New Zealand. This includes, for example, consideration of the balance between economic, cultural, social and environmental benefits. Strong relationships were also seen as vital; including knowing and understanding the different views and approaches applicable to geothermal resources (e.g. cultural values and protocols).

In response to this, the strategy proposes, together with seven success factors, four underlying principles, to provide enabling strategic direction for activities undertaken under the Strategy (Figure 4).



Figure 4: Seven success factors and four underlying principles (outer circle) providing enabling strategic direction for the Geoheat Strategy.

The underlying principles proposed were:

1. Principle of Kaitiakitanga: Geothermal development is founded on sustainable business and resource use models, recognises kaitiaki, and supports the guardianship and protection by current and future generations.

2. Shared: Responsibility is shared, ownership will be joint, and benefits will be mutual

3. Integrated: Sectors, organisations and disciplines support and complement each other in the pursuit of a common goal

4. Focused: Our focus is direct use growth, building on strengths and current successes, to deliver maximum benefit to New Zealand

The Strategy is a shared responsibility for mutual benefit that integrates sectors, organisations and disciplines. Future growth is underpinned by the principle of kaitiakitanga, with a long-term, sustainable vision. The Strategy is focused on commercial and industrial scale direct use of the higher temperature Central North Island and Northland geothermal resources, but doesn't discount lower temperature resources in other regions or domestic scale use.

6. SUMMARY & NEXT STEPS

A draft Geoheat Strategy document was made available for feedback through the New Zealand Geothermal Association in early 2016 (NZGA, 2016). This document is being finalised

following public feedback. The ultimate goal of this Geoheat Strategy is to enable an increase in the annual direct geothermal primary energy use of 7.5PJ by 2030. It also targets 500 new jobs in geothermal related business over the same period. Seven key action areas and key underlying principles were identified and defined during a series of workshops with stakeholders. These were:

- Demand
- Awareness
- Policy
- Champions
- Resources & Technology
- Funding
- Expertise

Recommended actions for beyond 2017 were suggested, building on the input received through stakeholder consultation. While not exhaustive, these future actions seek to address the key barriers and success factors identified for increasing New Zealand's geothermal direct use.

The next step is to build a foundation for successful strategy implementation. Key establishment steps suggested were:

- Establish a Strategy Coordination Role and appoint a Strategy Coordinator
- Establish a Geoheat Strategy Governance Group (Steering group)
- Identify funding pathways
- Identify a host as the centre for geothermal direct use advocacy and activity – This will initially be virtual being web hosted
- Identify and prioritise a work plan for implementation of strategy actions

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