



NEW ZEALAND
GEOTHERMAL
ASSOCIATION



GEOHEAT STRATEGY FOR AOTEAROA NZ

2017-2030

Ngātoro-i-rangi-Toa-Matarau
Carved by master carver Delani Brown





FOREWORD

WAIARIKI MĀORI GEOTHERMAL ADVISORY GROUP
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TE WHAKATAU O NGĀTOROIRANGI

“E Para E! Tikoko o te au marama
 Tukua au kia puta ki tawhangawhanga nui no Rangi, no Papa
 He aio; tu atu te makariri
 Haramai te werawera
 Hika ra taku ahi ki a Kautete tu
 Hika ra taku ahi ki a Te Pupu
 Hika ra taku ahi ki a Te Hoata
 Ki a Te Moremore-o-te-rangi.”

Most of the traditions from Te Arawa, Tūwharetoa and Mataatua sources ascribe the origin of Geothermal activity in the Taupō Volcanic Zone to the exploits of Ngātoroirangi, and his sisters Kuiwai and Haungaroa, aided by the atua Te Pupu and Te Hoata.

Te Arawa, a confederation of tribes “Mai Maketu ki Tongariro,” have held firm to their oral traditions passing these from generation to generation in perpetuity ensuring the continuation of their culture, their customs and the practice of ancient traditions through which they maintain a strong sense of spiritual connection to their spiritual homeland of Hawaiki. One such narrative recants the indigenous world view of geothermal origins. A journey of exploration by Te Arawa ancestor Ngātoroirangi a Tohunga (high priest) born with a command of both physical and spiritual realms Ngātoroirangi was also navigator of the great voyaging waka Te Arawa, which made its final landfall at Okūrae (Maketu) in the Bay of Plenty where it remains to this day.

There is a clear correlation made in these traditions between the volcanic mountains and areas of surface geothermal activity, the hot springs, geysers, mud pools, sinter terraces and steam vents.

Ngātoroirangi ascended Tongariro, where he almost perished, so intense was the cold on that mountain. Hence Ngātoroirangi called upon his ancestors to send heat and warmth to him, lest he perish. One of his vocations is shared above.

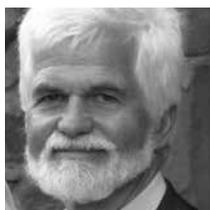
From the time of Ngātoroirangi, geothermal heat and energy have been considered taonga tuku iho (precious gifts provided by the gods) for our use. Te Arawa have since then utilised these for numerous domestic purposes and through trial and error discovered the different healing qualities ngāwhā (hot pools) possess. This vast knowledge and routine of practices have become the traditional fabric which have defined these geothermal communities.

Today, Māori are no longer just resource rich, many are now engaged in Industry partnerships at the forefront of geothermal direct use, and providing power to the national grid. We are resource owners, investors and developers. But we are also active Kaitiaki (Stewards) who shoulder the burden of responsibility to care for and protect those taonga entrusted to us. The expression of which we call Kaitiakitanga (Stewardship) actively working to halt further degradation of natural environments, while seeking to protect resources. We seek to continue to develop and utilise these special resources in a sustainable way, such that they are able to continue to support and provide for the generations to come.

As Chair of the Waiariki Geothermal Māori Advisory Group, I am pleased to introduce and endorse this Geoheat Strategy for Aotearoa, New Zealand. Together, we can expand our understanding of geothermal resources beyond the physical to encompass the special relationship people have with the environment.

Clean, renewable energy must be a significant part of our future, and with it comes benefits for our prosperity, health, and environment. There is clear opportunity for building substantive partnerships which support the significant influence Māori will have in the development of New Zealand’s natural resources in the post-treaty settlement environment. “Let us realise our geothermal potential.”

Alec Wilson • Chair
Waiariki Geothermal Māori Advisory Group



FOREWORD

NEW ZEALAND GEOTHERMAL ASSOCIATION

On behalf of the New Zealand Geothermal Association, it is with great pleasure that I introduce this important guiding document for geothermal use in New Zealand.

The Association is pleased to be taking a lead role in this initiative, and we have been heartened and encouraged by the support and interest expressed by those we have engaged with throughout the development of this Strategy. Thank you to all of those who have given time, opinions, and ideas to this process.

The Strategy lays out early steps and processes to purposefully grow direct geothermal energy use in New Zealand. It seeks to achieve real gains in the short to medium term, looking out to 2030 with primary energy and job targets suggested. The Strategy is designed to be directive, yet flexible, and it will evolve as effort reveals the best next steps.

Geothermal resources are significant to Māori and I would particularly like to thank the Waiariki Māori Geothermal Advisory Group for their involvement in our early workshops, and subsequent guidance, review and support as the Strategy developed.

I would also like to thank GNS Science for their expertise and support in the development of the Strategy. In particular Melissa Climo (GNS Science), Brian Carey (GNS Science), and Simon Bendall (Mitchell Daysh) who have organised the work, developed the approach, run the consultation process, written the Strategy and assisted with reviews and feedback.

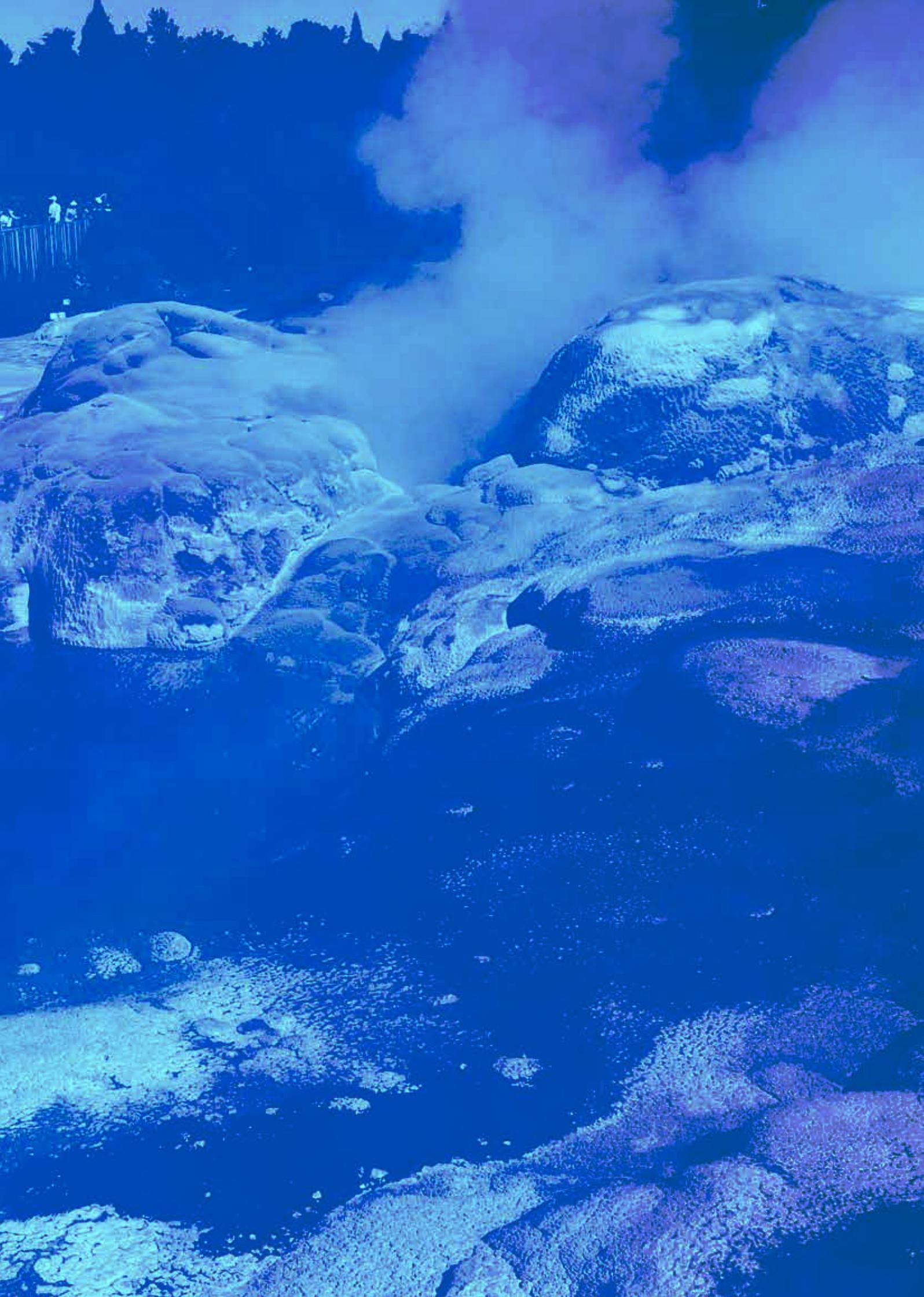
There are a number of regional economic development initiatives underway that the Geoheat Strategy seeks to complement and meaningfully contribute to. Some strategy activity will wrap around work that will be pursued under the Bay of Connections, including: Bay of Plenty Energy Strategy; Toi Moana Bay of Plenty Economic Action Plan; and He Mauri Ohooho – Māori Economic Development Strategy. The Geoheat Strategy can support these work streams to realise their geothermal aspirations, whilst also being broader as a Strategy focused on New Zealand's geothermal potential at a national level.

Ultimately, to be a success, coordination and business leadership are critical in the execution of this Strategy. To do this, resources are needed, as a Strategy without implementation resources will have little or no effect. This will be an ongoing challenge, however I'm confident that, working with our various partners, we will drive this Strategy forward to the benefit of all New Zealanders.

Please join with the New Zealand Geothermal Association, share the vision and become involved in growing direct use geothermal.

A handwritten signature in black ink, appearing to read 'Andy Bloomer'.

Andy Bloomer • President
New Zealand Geothermal Association



EXECUTIVE SUMMARY

Geothermal resources offer a key competitive advantage for New Zealand, providing a local, secure, and renewable energy source. There is substantial opportunity to grow and diversify the direct use of geothermal heat to:

- create new businesses
- convert more industries from fossil fuels to geothermal energy
- support regional economic and social development
- increase the uptake of renewable low carbon energy
- lead the world in direct geothermal energy use

New Zealand has a long history of utilising its high temperature geothermal resources, with approximately six decades of extensive large scale geothermal energy utilisation for industrial direct heat and electricity generation. However, geothermal use goes back much further, to early Māori use of geothermal springs and pools for bathing, healing, cooking, and community life.

Our recent history has seen periods of growth, static, and declining trends in geothermal heat use. The goal of this Strategy is to change this trajectory into one of continuous and sustainable growth in geothermal direct heat use.

This strategy will have been successful if, by 2030:

- 1. Annual direct primary geothermal energy use has increased by 7.5 PJ in new projects in the period 2017–2030; and**
- 2. Geothermal direct use business operations are employing (directly and indirectly) an additional 500 people associated with new projects in the period 2017–2030.**

To put that in perspective, a timber drying facility might use in the order of 1 PJ / annum of direct primary geothermal energy use, where a glasshouse (approx. 12 ha) might use less than 0.3 PJ / annum. So in order to reach the 7.5 PJ / annum target, the Strategy envisages the creation of four or five larger direct use projects (e.g. timber processing, large glasshouses, etc), as well as a range of smaller projects (e.g. bathing, smaller scale glass houses, etc.) over the next 10–12 years.

We propose a coordinated approach to raise awareness, secure investment, streamline policies, retain and develop expertise, adapt technologies, improve access to technical information, and share market intelligence.

Our guiding principles provide a compass for defining actions, decision-making and behaviours. The Strategy is a shared responsibility that integrates sectors, organisations and disciplines for shared benefit. Future growth is underpinned by the principle of kaitiakitanga, with a long-term, sustainable vision.

The Strategy focuses on the higher temperature Central North Island and Northland geothermal resources, but doesn't discount lower temperature resources in other regions. The Strategy excludes fostering the increase in geothermal electricity generation as this sector is already well developed, with strong industry participants and advocates in New Zealand. The Strategy will focus at the commercial and industrial scale to promote economic growth, but does not discount domestic use advancements.

To activate the Strategy, five key steps are necessary to build a foundation for successful implementation. The priority actions for 2017–18 are:

1. Establish a Geoheat Strategy Governance Group
2. Strategy Coordination
3. Establish Geoheat Strategy Action Group
4. Establish a centre for geothermal direct use advocacy and activity
5. Identify and prioritise a work plan for implementation of strategy actions

Recommended actions are also suggested. These have been developed through stakeholder consultation, and are not exhaustive. However, they seek to address the key barriers and success factors identified for increasing New Zealand's geothermal direct use, and will be further developed as the strategy advances.

New Zealand has great potential to grow our direct geothermal use. To realise our potential in this area, this Strategy seeks to coordinate activities and drive growth, to realise benefits at a national, regional and local level.

The image shows a geothermal wellhead in a grassy field. A large, white, conical structure is mounted on a metal base. A thick plume of white steam or vapor rises from the wellhead, partially obscuring the view of the field. In the background, a large, multi-span greenhouse with a metal frame and translucent panels is visible. The entire scene is bathed in a warm, orange-red light, suggesting a sunset or sunrise. The text is overlaid in the lower half of the image.

**NEW ZEALAND
HAS GREAT
POTENTIAL TO
GROW OUR DIRECT
GEOTHERMAL USE**

**CLEAN,
RENEWABLE
ENERGY
IS OUR
FUTURE**

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Bibliographic Reference

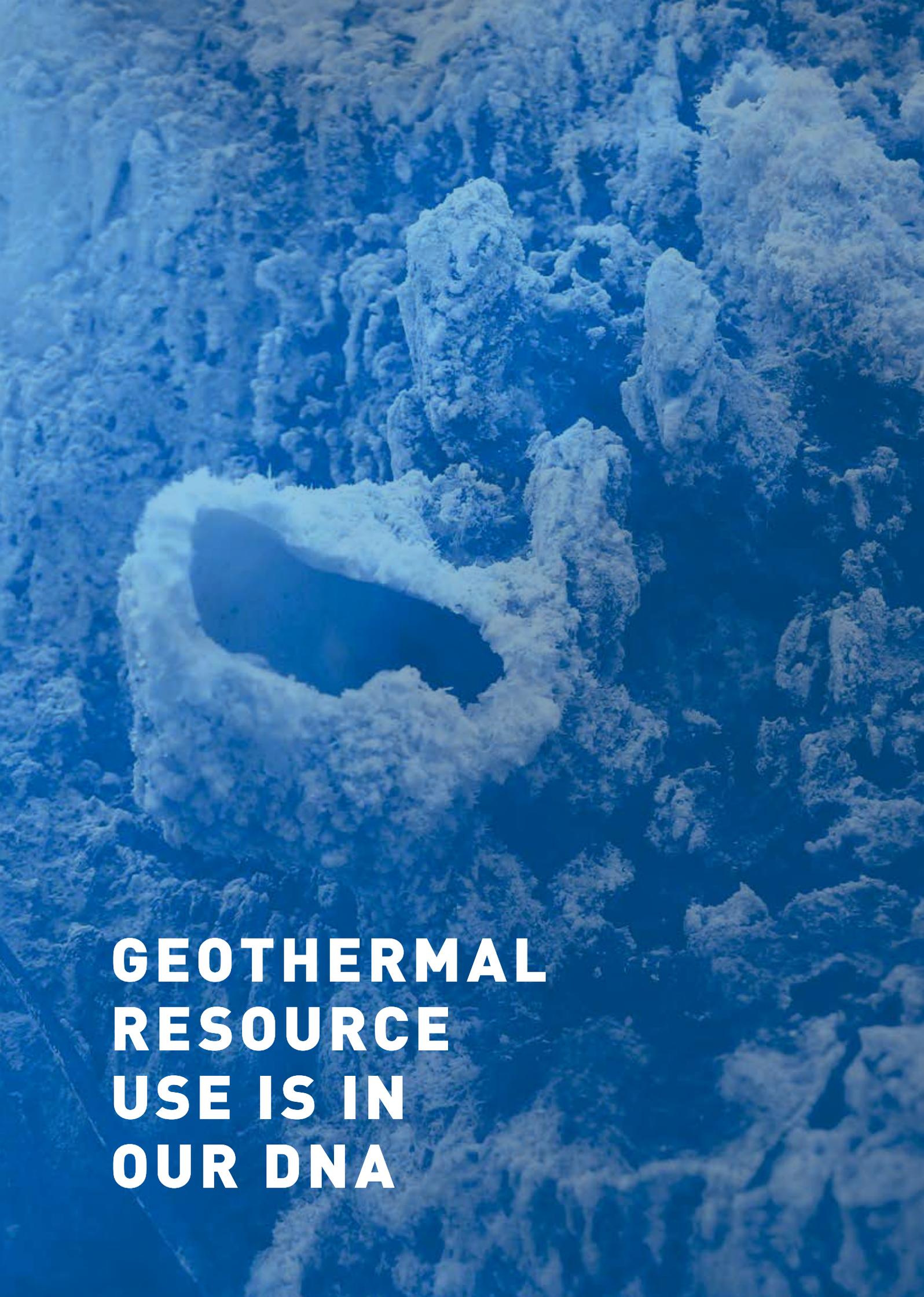
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Acknowledgement to Sarah Milicich, Duncan Graham, Brian Carey and GNS Science for photographs used in the publication.

An aerial photograph of a geothermal field, likely in Iceland, showing a large, dark, circular pool of water in the center, surrounded by a ring of white, mineral-rich earth. The surrounding terrain is rugged and rocky, with various shades of brown and grey. The entire image is overlaid with a semi-transparent blue filter.

**GEOHERMAL
RESOURCE
USE IS IN
OUR DNA**

WHY DIRECT USE FOR NEW ZEALAND?

1.1 NEW ZEALAND'S GEOTHERMAL HISTORY

New Zealand is blessed with extensive geothermal resources. High temperature geothermal energy (>180°C) is available in the Central North Island's volcanic region and at Ngawha, in Northland. Lower temperature geothermal energy (30°C–180°C) can be found in various locations around New Zealand, including as downstream use in association with high temperature geothermal energy production facilities, and lower temperature sources such as along the Alpine Fault in the South Island and at other hot spring locations. Low temperature energy (<30°C) can be found across New Zealand, where solar energy is trapped by the ground, and can be harnessed and utilised with geothermal (ground source) heat pumps.

New Zealand has a long history of utilising high temperature geothermal resources, with approximately six decades of extensive large scale geothermal energy utilisation for industrial direct heat and electricity generation. Industrial geothermal activity derives from developments at Kawerau and Wairakei through the 1950's, while utilisation of smaller scale geothermal energy use, through drilled geothermal wells, began in Rotorua in the 1930's. However, direct heat utilisation goes back much further, to early Māori use of geothermal springs and pools for bathing, healing, cooking, and community life.

From this extensive history we enjoy internationally renowned experience, customs and practices, and expertise in geothermal utilisation.

1.2 BENEFITS OF DEVELOPING DIRECT GEOTHERMAL USE

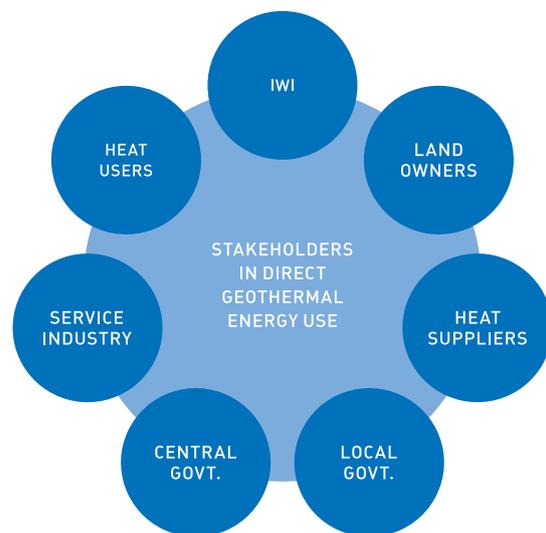
Direct geothermal energy use offers a range of benefits locally, regionally and nationally. These include:

- Sustainable energy from a secure supply
- Employment opportunities — direct geothermal use has greater potential for flow-on social and economic benefits in terms of increased employment than geothermal electricity generation does, as can be seen in existing examples of direct heat use enterprise

- Alignment with regional economic growth agendas
- Renewable energy with carbon friendly credentials useful in product marketing in discerning markets, including international opportunities
- Potential to create competitive advantage
- Fossil fuel displacement

1.3 WHO IS INTERESTED?

A broad range of New Zealanders have an interest in, and have the potential to derive benefits from, the direct use of geothermal energy. These stakeholders are represented in the below graphic.



There are regional development strategies currently being implemented through District Council Economic Development Agencies and Regional Councils including the Bay of Plenty and Northland Regional Councils. Regional development aspirations are well aligned with direct use geothermal businesses, through the potential to grow employment opportunities, upskill employees, and encourage innovative industries. The Geoheat Strategy is designed to complement these existing work streams.



**BLESSED
WITH
EXTENSIVE
GEOHERMAL
RESOURCES**

STRATEGIC APPROACH

The Geoheat Strategy seeks to drive an increase in the utilisation of direct geothermal heat to derive value for New Zealand. Our goal is to develop and implement a Strategy that will establish continuous and sustainable growth in the direct use of geothermal energy.

2.1 GOALS

This Strategy will have been successful if, by 2030:

1. Annual direct primary geothermal energy use has increased by 7.5 PJ in new projects in the period 2017–2030; and
2. Geothermal direct use business operations are employing (directly and indirectly) an additional 500 people associated with new projects in the period 2017–2030

2.2 SCOPE

The Geoheat Strategy is about direct geothermal energy use, focusing on higher temperature primary geothermal energy. Given the breadth of possible activity areas within the geothermal energy sphere, the importance of maintaining clear focus is considered critical to Strategy success. The scope of the Strategy is as follows:

IN SCOPE

PRIMARY FOCUS

- Direct use of geothermal energy
- Industrial and commercial scale developments
- Regional focus on Northland, Waikato and Bay of Plenty geothermal resources

SECONDARY FOCUS

- Residential scale use
- Geothermal resources in other regions of New Zealand

OUT OF SCOPE

- Directly fostering increased geothermal electricity generation
- Geothermal (ground sourced/water sourced) heat pumps

While geothermal heat pumps are excluded from the scope of this Strategy, the Geothermal Heat Pump Association of New Zealand (GHANZ) is understood to be developing its own strategy that responds to the unique characteristics of that sector.

It is also expected that there will be a strong association with the geothermal electricity sector where electricity and direct heat installations share a geothermal resource. In some cases direct geothermal use will occur in conjunction with a geothermal electricity operation where the direct use might not stand alone, and there are opportunities to explore this further.

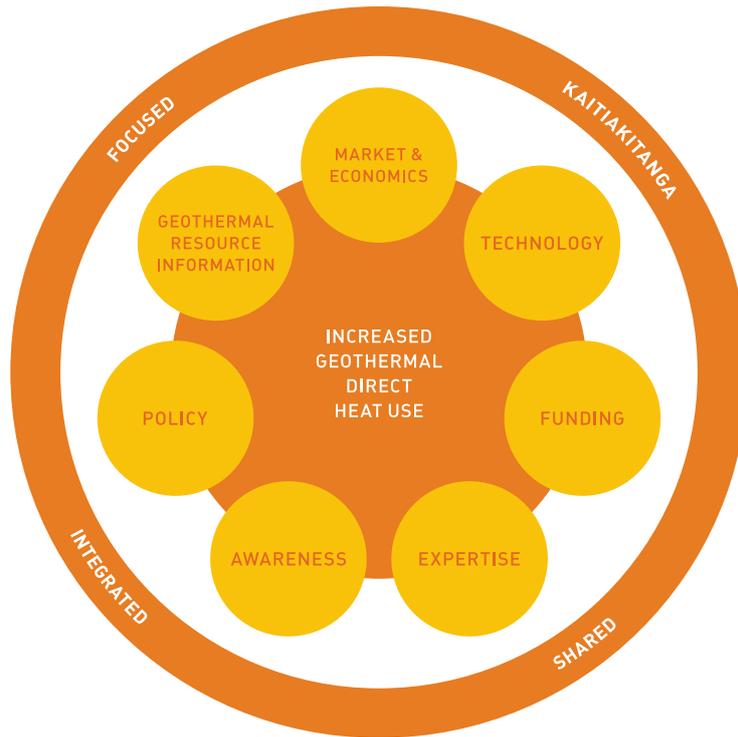
2.3 PRINCIPLES & SUCCESS FACTORS

Our four guiding principles provide a compass for defining actions, decision-making and behaviours: Kaitiakitanga; Shared; Integrated; and Focused.

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.

The following graphic presents these principles, together with seven success factors identified through stakeholder engagement and consultation. These success factors, underpinned by the four principles, together provide the strategic direction for activities undertaken under this Strategy.



UNDERLYING PRINCIPLES

Kaitiakitanga: Geothermal development is founded on sustainable business and resource use models, recognises kaitiaki, and supports current and future generations

Shared: Strategy responsibility is shared, information will be open and benefits will be mutual

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

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

SUCCESS FACTORS

Funding: Government, industry and other sectors invest in developing geothermal energy projects

Awareness: Everyone thinks geothermal first; it is intrinsically linked to our national identity

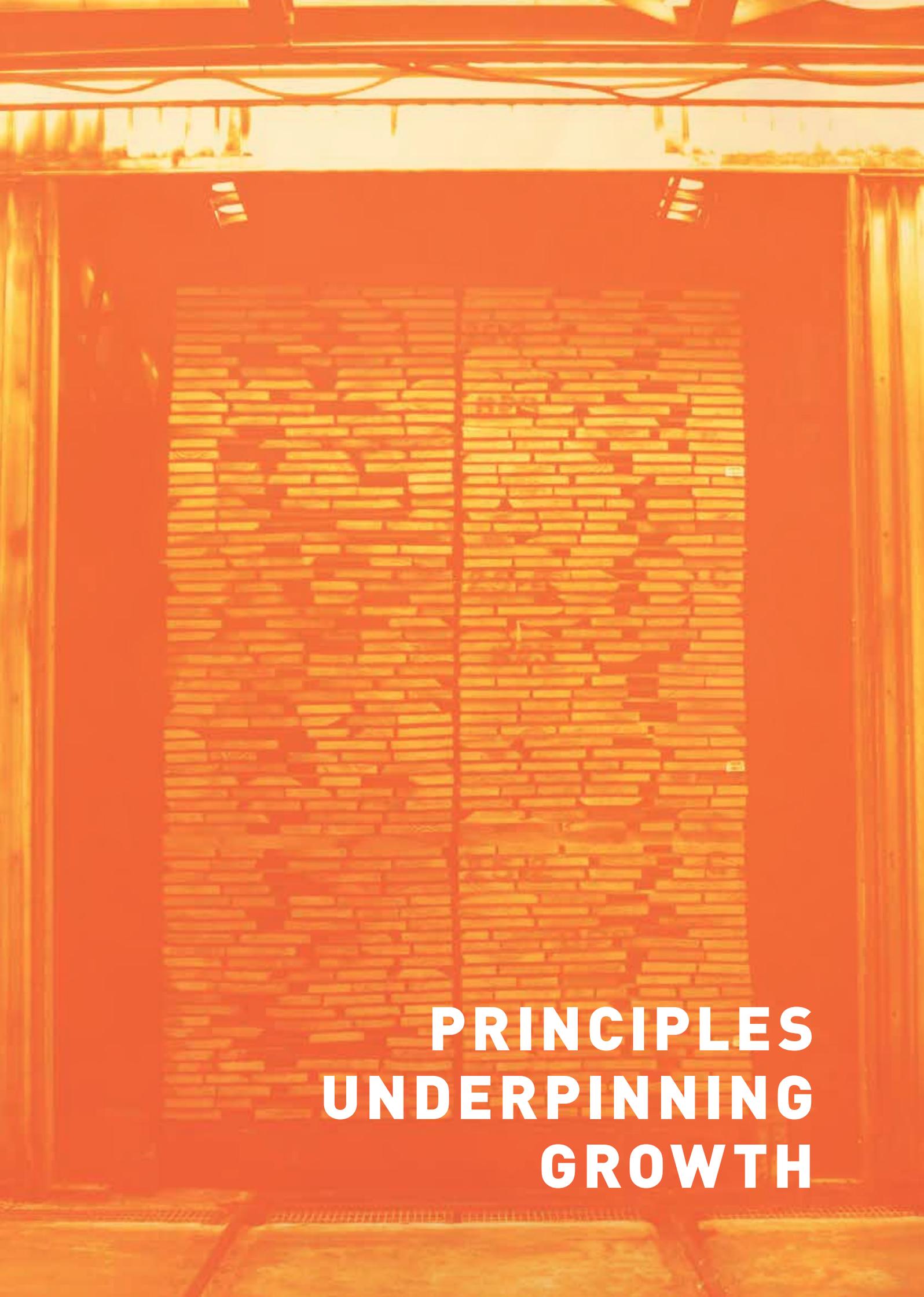
Expertise: We have readily accessible, world-leading capability

Policy: National, regional and district level policy are aligned to enable sustainable geothermal utilisation

Geothermal Resources Information: Data is accessible on resources and uses

Market & Economics: Geothermal energy is integrated in business structures as a clear value proposition generating advantage, including through 'green' branding

Technology: Best practise application of technologies and generation of innovative ideas



**PRINCIPLES
UNDERPINNING
GROWTH**



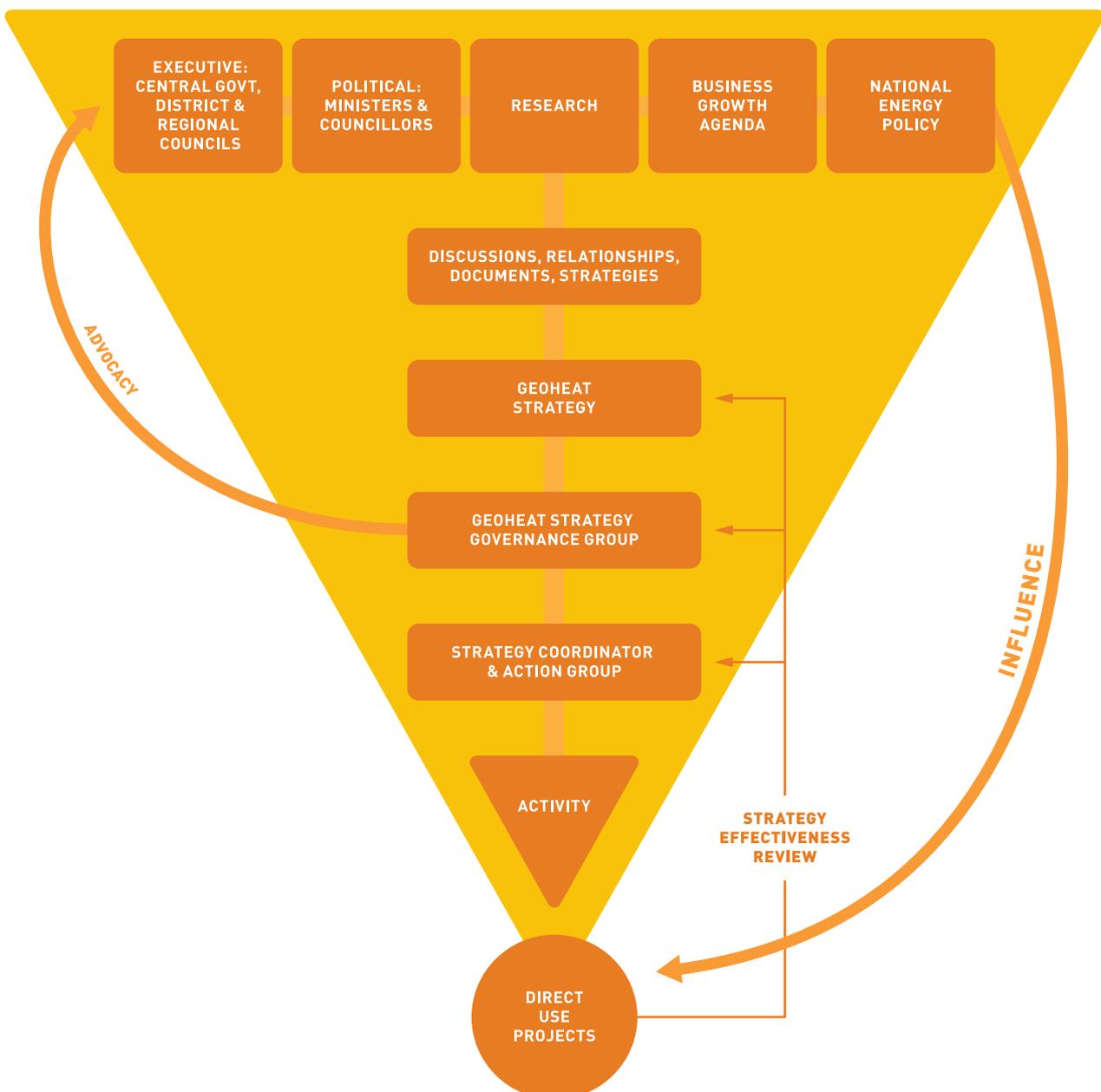
**ADVOCACY,
ACTION AND
INFLUENCE**

2.4 RELATIONSHIPS TO OTHER STRATEGIES AND PROCESSES

To be effective, the Geoheat Strategy cannot exist in isolation. There is a broad range of activity within the energy space across central and local government, and other sectors that will influence the success of the Strategy and its ability to achieve its goals. The diagram below shows how the Geoheat Strategy relates to various areas of activity.

The primary concepts are:

1. National, Regional and Local strategy and activity will **INFLUENCE** the Geoheat Strategy processes and outcomes
2. The Strategy will need to **ADVOCATE** back in to that activity to improve outcomes for direct geothermal use
3. The Strategy will drive a series of direct **ACTIONS** that are aimed at generating new direct geothermal projects
4. **STRATEGY EFFECTIVENESS REVIEWS** will drive a nimble and responsive Strategy



An aerial photograph of a volcanic landscape, likely a cinder cone volcano, with a winding river in the foreground and thick plumes of white smoke or steam rising from the mountain's summit and various vents. The entire image is overlaid with a semi-transparent blue filter.

**PRIORITY
ACTIONS
FOR GROWTH**

ACTIONS TO GROW DIRECT GEOTHERMAL USE IN NEW ZEALAND

3.1 PRIORITY ACTIONS (2017–2018)

To activate this Geoheat Strategy, five key steps are necessary to build a foundation for successful implementation. Five priority actions for 2017–18 are proposed:

PRIORITY ACTION 1: ESTABLISH GEOHEAT STRATEGY GOVERNANCE GROUP

The Strategy requires oversight and guidance from a governance committee to provide accountability for implementation. It is suggested that this group comprise experienced people in relevant fields e.g. Industry and technology/science expertise, Tangata Whenua, Central Governmental, Local Government, regional representation (Northland, Waikato, Bay of Plenty), economic development and end users of heat. It requires seed funding to commence activities under this strategy.

Estimated Cost: \$30,000 — one off

Responsibility: NZGA with support from GNS Science

Sources of Funding: Joint funding — NZGA and GNS Science funding from Geothermal Resources of New Zealand Research Programme

PRIORITY ACTION 2: STRATEGY COORDINATION

Central government funding support is being sought for a Strategy Coordination Role; regional government and industry funding has already been secured. The primary focus for the role is to coordinate, communicate, enthuse, engage and organise the implementation of regional strategies, action plans and an investment attraction campaign, that will drive and convert interest into investment in geothermal direct use projects. It's anticipated that a senior, experienced business person will be required for this role, in order to make the necessary impact. The role would be supported by the Geoheat Strategy Governance Group.

Estimated Cost: 1 FTE for 24 months

Responsibility: Geoheat Strategy Governance Group

Sources of Funding: Regional, Central Government and industry funding sources.

PRIORITY ACTION 3: ESTABLISH GEOHEAT STRATEGY ACTION GROUP

The Strategy requires a group of interested persons to take ownership over key actions and priorities and drive input into various sectors. The group will be facilitated by the Strategy Coordinator. GNS Science will initially assist to establish this group.

Estimated Cost: None required

Responsibility: GNS Science

PRIORITY ACTION 4: ESTABLISH A CENTRE FOR GEOTHERMAL DIRECT USE ADVOCACY AND ACTIVITY

A direct use geothermal research and advisory hub for New Zealand would greatly simplify access to expertise, information and advice. The research and advisory hub could also host the Strategy Coordinator role. It is envisioned that this will initially be established as a 'virtual' centre through an online presence.

Estimated Cost: \$10,000 incidental costs

Responsibility: Geoheat Strategy Governance Group

Sources of Funding: NZGA, Regional and Central Government funding sources with support from industry

PRIORITY ACTION 5: IDENTIFY AND PRIORITISE WORK PLAN FOR IMPLEMENTATION OF STRATEGY ACTIONS

The following section outlines possible actions identified through the stakeholder engagement and consultation process. A priority order has been suggested. This list is not exhaustive, but provides a strong base from which to further the aims of this Strategy. Following the appointment of the Strategy Coordinator, these actions should be reviewed, added to, and re-prioritised with guidance from the Geoheat Strategy Governance Group. It is suggested that the 'United Purpose' task is pursued as a top priority in this phase.

Estimated Cost: N/A — core function of Strategy Coordinator Role

Responsibility: Strategy Coordinator and Geoheat Strategy Governance Group

Sources of Funding: Core function of Strategy Coordinator Role

3.2 DRAFT WORK PLAN (2018+)

In the table are suggested action areas with the priority preliminarily assigned by the team writing the strategy as follows:

A—Must B—Should C—Could D—Not yet given a priority

Action	Description	Success Factors						Preliminary Priority		
		Funding	Awareness	Expertise	Policy	Resource Info	Market & Economics		Technology	
1	United Purpose	Develop clusters of 'like minds' to assist with implementation. It is natural for businesses to focus on their own enterprise, however a more united, connected and cooperative industry can affect a far greater amount of change than an individual approach particularly in the areas of policy reform, research and funding.	•	•	•	•	•	•	•	A
2	Establish and Network with Potential Geothermal Heat Users	Establish connections and networks to raise the geothermal profile with potential geothermal heat use businesses. Geothermal energy can be used to produce a variety of products, but accessible markets must exist for those products in order for business to be profitable and successful. Business advantage needs to exist for New Zealand business to go geothermal.	•	•	•	•	•	•	•	A
3	Māori Economic Development	Connect with Māori economic interests and entities to explore geothermal direct use opportunities. Māori Economic Development is expected to play a significant role in New Zealand's geothermal future.		•						A
4	Matauranga Māori	Explore opportunities for Māori knowledge, resources and people to contribute to research, science and technology in the geothermal direct use space.		•				•		A
5	Engaging Expertise	Secure funding to allow the Strategy Coordinator to engage consultant expertise to study and develop material that supports strategy implementation.	•	•	•	•	•	•	•	A
6	Showcase	Actively showcase existing success stories in geothermal energy use to increase awareness and stimulate further development.	•	•			•	•	•	A
7	Share Lessons Learned	Share information. By sharing lessons learned, future projects can learn from and build on past successes. Success breeds success.	•	•			•	•	•	A
8	Strategy Effectiveness Monitoring	Collect data that enables effective monitoring of the strategy goals (annually).	•	•	•	•	•	•	•	A
9	Direct Use Data	Establish a system that enables geothermal direct use data across New Zealand to be captured, improves data quality, and is regularly updated (three yearly).		•				•		A
10	Data	Create a source of accessible data for Geothermal users/developers to use. Geothermal developments require good knowledge of the resource in order to answer project feasibility questions, assess environmental effects and reduce commercial risk. Access to such data will remove the need for developers to develop their own; reducing costs and uncertainty.		•	•		•			B

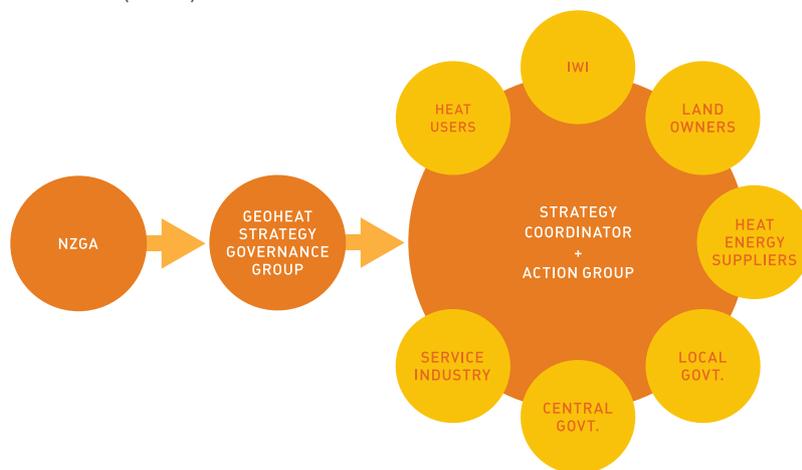
Action		Description	Success Factors						Preliminary Priority	
			Funding	Awareness	Expertise	Policy	Resource Info	Market & Economics		Technology
11	Best Practice Resource Utilisation	Establish a 'best practice' resource. Accessing and using geothermal resources requires expertise. Ensuring that all users are operating to industry and regulatory standards will protect the resource and the reputation of the sector.		•	•				•	B
12	Project Feasibility	Create tools and information to aid in feasibility studies. For most, whether to use geothermal energy in favour of another energy source becomes a question of economics and feasibility — access to tools, information, and assistance to answer feasibility questions can encourage more business to go geothermal.			•			•	•	B
13	Policy	Develop guidance material for geothermal heat developers. Regulatory barriers, particularly for smaller-scale developments, can be reduced through improved Policy Statements, Regional Plans, and to some extent, District Plans. There is also more potential for enabling non-regulatory documents, such as Energy Strategies.				•	•			B
14	Energy Dating Service	Establish a service that provides interaction between potential geothermal heat users and heat suppliers. Some owners of land with geothermal resources under them don't have the connections or expertise to realise geothermal use aspirations. A service to connect these landowners with industry and business interests seeking energy solutions can help to unlock this potential.		•				•		B
15	Policy Alignment	Improve policy alignment across the three major geothermal regions — Northland, Waikato and Bay of Plenty. Regional Plans are the primary source of environmental regulation for geothermal energy development, and increased alignment of sound environmental policy can reduce regulatory barriers.		•				•		C
16	How-to Guide	Develop a 'how-to' reference guide. Particularly at the smaller scale, the complexity of developing a geothermal use can be a significant barrier. Plain language advice and information on regulatory requirements, technology and resource information could assist to reduce these barriers.		•				•		C
17	Incentives	Create incentives for the uptake of geothermal direct use development. Incentives, in their various forms, could greatly assist businesses to actively pursue geothermal opportunities to the broader benefit of New Zealand; where this results in the displacement of fossil fuel use and increased competitiveness for New Zealand businesses.	•	•				•		C
18	Payback	Establish a toolkit that allows for pay back calculations to be done. Calculations on pay back periods can assist decision making when adopting new technologies. These calculations can be complex; access to tools and assistance to calculate pay back periods for geothermal energy could encourage more businesses to go geothermal.		•				•		D
19	Logistics and Infrastructure	Advocate for improved infrastructure. Direct use geothermal energy is not transportable over large distances (i.e. more than 30km); strategic transportation connections for products to reach markets for areas rich in geothermal energy opportunities will boost the competitiveness of businesses seeking to utilise this resource.						•		D

The background of the image is a vibrant orange color with a complex, organic pattern of concentric ripples and swirls, resembling water or a textured surface. The ripples are most prominent in the center and right side, creating a sense of movement and depth. The overall effect is warm and dynamic.

**DIRECT
GEOTHERMAL
ENERGY USE
BENEFITS
LOCALLY,
REGIONALLY
AND NATIONALLY**

STRATEGY IMPLEMENTATION

The following schematic presents the proposed approach to strategy implementation for both the priority actions (2017–18) and future initiatives (2018+).



Key components of this process include:

New Zealand Geothermal Association Board: Project Sponsor.

Geoheat Strategy Governance Group: consists of cross-sector representatives (industry, Tangata Whenua, government, heat users, etc.) who guide and direct strategy implementation.

Strategy Coordinator: a dedicated role (estimate one Full Time Equivalent for the first 24 months) that is responsible for coordinating and ensuring the Strategy outcomes are delivered. Reports to the Governance Group.

Action Group: consists of interested persons to drive strategy actions and activities, facilitated by the Strategy Coordinator.

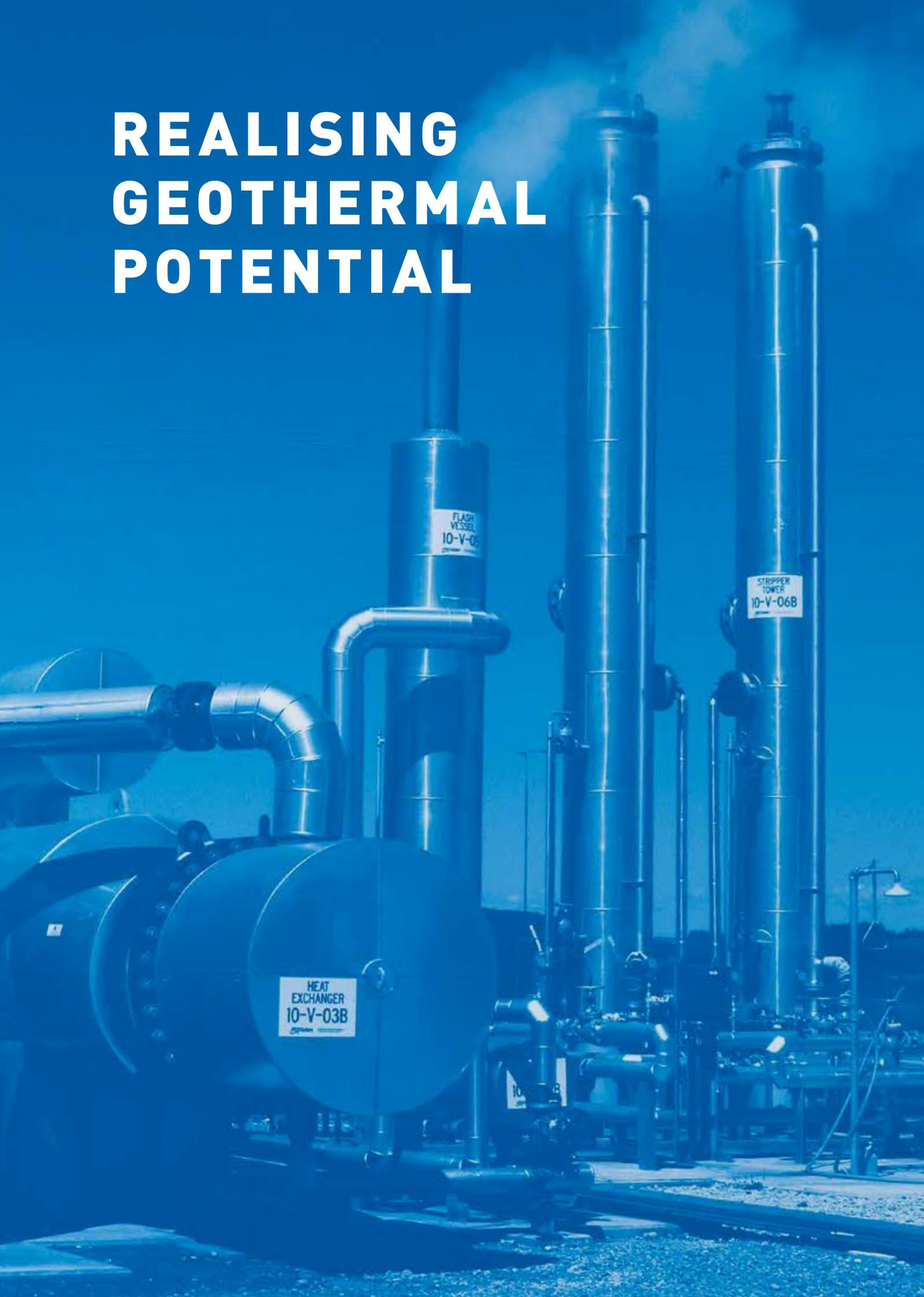
Sectors and Interest Groups: in order to be successful, multiple sectors and interests must be engaged and active in various roles. The Strategy Coordinator must establish these cross sector relationships and coordinate activities to drive strategy success.

4.1 REPORTING AND REVIEW PROCESS

The following is a suggested process for monitoring and evaluating the effectiveness of strategy implementation.

Type	Frequency	Responsibility	Reporting To	Key Outcomes
Progress Report — Operations	Bi-monthly	Strategy Coordinator	- Geoheat Strategy - Governance Group	- Report against current priority tasks - Review effectiveness of actions to date - Identify opportunities - Review work programme
Progress Report — Governance	Bi-annually	Geoheat Strategy Governance Group	- NZGA Board - Strategy Funders	- Report on progress on current priority tasks - Review strategic direction - Review work programme
Annual Review — Operations	Annually	Strategy Coordinator	- Geoheat Strategy - Governance Group	- Full review of Action Plan - Effectiveness review with key stakeholders
Annual Review — Governance	Annually	Geoheat Strategy Governance Group	- NZGA Board	- Funding review - Effectiveness review — Strategy Coordinator
Strategy Review	Every 3 years	Geoheat Strategy Governance Group	- NZGA Board - Strategy Funders	- Comprehensive revision of Strategy

REALISING GEOHERMAL POTENTIAL



STRATEGY DEVELOPMENT PROCESS

This Geoheat Strategy for New Zealand was initiated in 2012 and was presented as a paper and keynote address at the 2012 New Zealand Geothermal Workshop (Carey and Climo, 2012). Sufficient interest was shown such that GNS Science staff and the then NZGA President (Brian Carey) pursued the development of the Strategy.

The development was supported by GNS Science's geothermal research funding, and a team from GNS Science (M Climo and B Carey) and Environmental Management Services Limited, now Mitchell Daysh (S Bendall), were formed to develop and write the Strategy.

The importance of sector involvement to the ultimate uptake of the Strategy formed the basis for the consultation process. The process aimed to be inclusive, stakeholder-led, non-partisan and unbiased.

NZGA was deemed the appropriate host for the Strategy and the NZGA website was used to deliver consultation material and receive feedback.

Through 2015, a number of workshops were held with a broad cross-section of interested persons, including:

1. NZGA Generation and Industrial Heat Interest Group — 3 August 2015 (Wairakei)
2. Bay of Connections Governance Group — 10 August 2015 (Taupō)
3. Waiariki Māori Geothermal Advisory Group — 9 September 2015 (Rotokawa)
4. 2015 New Zealand Geothermal Workshop — 18 and 19 November 2015 (Wairakei)

At the time of writing, a workshop in Northland is also proposed.

PARTICIPANTS IN THESE FORUMS INCLUDED REPRESENTATIVES FROM THE FOLLOWING:

Iwi, Māori Landowners and Māori Trust Representatives

Government Agencies

- Ministry of Business, Innovation and Employment
- Energy Efficiency and Conservation Authority
- GNS Science
- Te Puni Kōkiri
- New Zealand Trade and Enterprise

Regional and Local Government

- Bay of Plenty Regional Council
- Waikato Regional Council
- Rotorua Lakes Council
- Taupō District Council
- Kawerau District Council

NZGA Members

NZGA Industry Groups

- Direct heat
- Power and industrial heat
- GHANZ — the Geothermal Heat-pump Association of NZ

Conference Participants from the Geothermal Sector (at the New Zealand Geothermal Workshop 2015)

Regional Development Agencies

- Bay of Connections
- Northland Inc. (Preliminary Discussions)

District Development Agencies

- Grow Rotorua
- Enterprise Great Lake Taupō
- Kawerau Enterprise Agency Incorporated

Through these workshops key success factors were identified and participants contributed a wealth of material on potential actions to drive change. The detail of the material collected at these workshops is published as a conference paper (Climo et al, 2016).

This material was used to develop an initial draft of the Strategy, which was published for comment in March, 2016. The document was circulated directly to key contributors and interested parties and made available online through the New Zealand Geothermal Association Website, with submissions and feedback on the draft document being accepted until the end of May 2016. Comments were received from a number of individuals and these have been built into this current version of the Strategy.

Through the above process, the Strategy has been developed in a consultative and collaborative way and reflects the inputs and views of multiple people across New Zealand with an interest in our geothermal future.

The authors would like to thank all those that contributed their time and effort through this process.



DEVELOPING A STRATEGIC APPROACH

GLOSSARY OF TERMS USED

Direct Use: Refers to the use of geothermal energy directly as heat. Essentially this is any application of geothermal energy use other than converting it to electricity.

Geothermal Energy: Energy sourced from the ground.

PJ: Peta Joule, a unit of energy equal to 10^{15} Joules. A larger scale glasshouse (approx. 12 ha) might require less than 0.3 PJ/annum of primary energy.

Primary Geothermal Energy: The total amount of geothermal energy supplied to a process. This will be greater than the actual amount of energy used in the process.

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