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Key Aspects of New Zealand's Policy and Regulatory Regimes for the Sustainable Management of Geothermal Resources

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ABSTRACT

There was little in the way of planning and resource management regulatory imperatives or constraints in the 1950s when New Zealand was a pioneer in the development of geothermal resources. Since those early years of investigation, trial and error, and the development of several geothermal power stations, New Zealand has developed and implemented policy and regulatory regimes that seek to achieve the sustainable management of geothermal resources. This includes the development, use and protection of geothermal resources.

This paper identifies the key aspects of New Zealand's policy and regulatory regimes in the Waikato and Bay of Plenty Regions where most of the country's geothermal resources are located. It discusses how the implementation of those policy and regulatory regimes have worked in practice over the last 10 – 15 years and illustrates how competing interests and values can be reconciled so that economic, environmental, social, and cultural values can all be appropriately addressed.

Due to the unique and dynamic nature of geothermal resources, and the competing values associated with those resources, a 'one size fits all' approach does not work in relation to the management of geothermal resources. However, the key aspects of the New Zealand geothermal policy and regulatory regimes represent global best practice that can be exported and adapted to fit local circumstances elsewhere in the world.

1. INTRODUCTION

There was little in the way of planning and resource management regulatory imperatives or constraints in the 1950s when New Zealand was a pioneer in the development of geothermal resources. Since those early years of investigation, trial and error, and the development of several geothermal power stations, New Zealand has developed and implemented policy and regulatory regimes that seek to achieve the sustainable management of geothermal resources. This includes the development, use and protection of geothermal resources.

This paper identifies the key aspects of New Zealand's policy and regulatory regimes in the Waikato and Bay of Plenty Regions where most of the country's geothermal resources are located. It discusses how the implementation of those policy and regulatory regimes have worked in practice over the last 10 – 15 years and illustrates how competing interests and values can be reconciled so that economic, environmental, social, and cultural values can all be appropriately addressed.

2. GEOTHERMAL RESOURCES IN THE WAIKATO AND BAY OF PLENTY REGIONS

Most of New Zealand's geothermal resources are located within the Taupo Volcanic Zone (TVZ) which extends from Tongariro National Park in the central North Island to Whakaari / White Island in the Bay of Plenty (see Figure 1). Most of the TVZ is located within the Waikato and Bay of Plenty Regions.

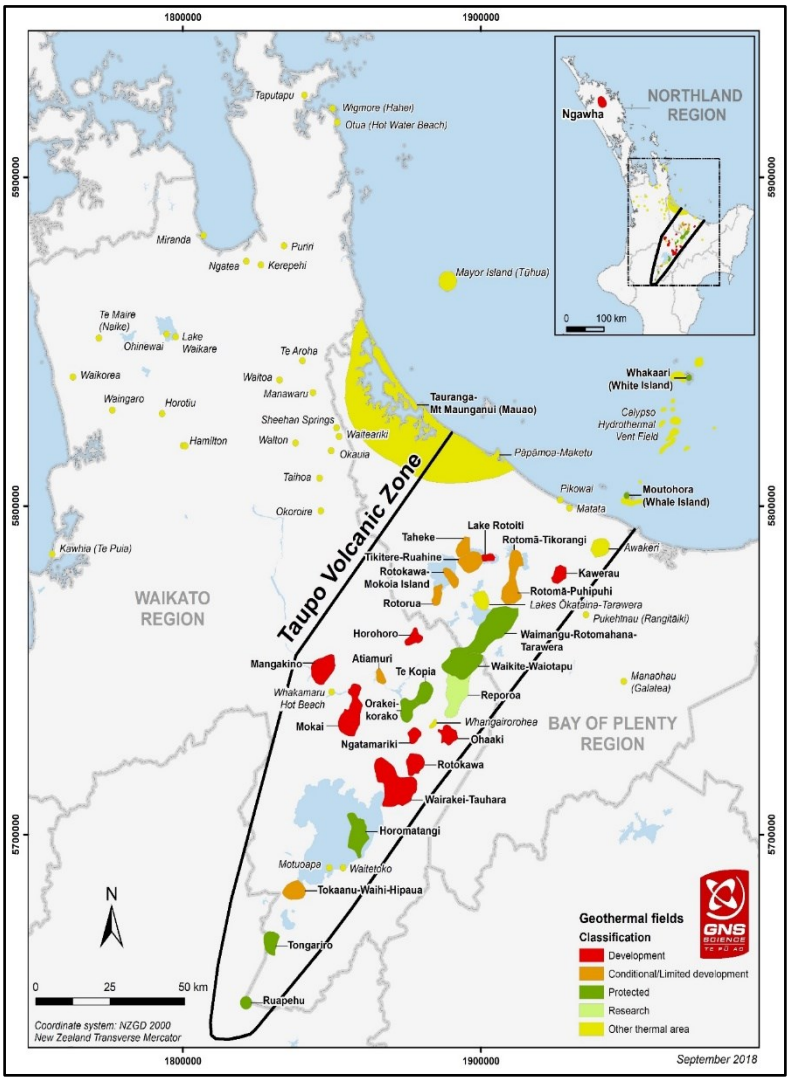

Figure 1: Geothermal Systems in the Taupo Volcanic Zone

(Source: New Zealand Geothermal Association https://nzgeothermal.org.nz/nz_geo_fields)

3. POLICY AND PLANNING DOCUMENTS

In New Zealand, geothermal resources are managed in accordance with the provisions of the Resource Management Act 1991 (RMA). The RMA specifies a range of functions that are relevant to the management of geothermal resources at the central, regional and local levels of government and a range of policy and planning documents that govern the management of geothermal resources are produced at each of these three levels of government illustrated in Figure 1 (the key aspects of which are discussed as follows).

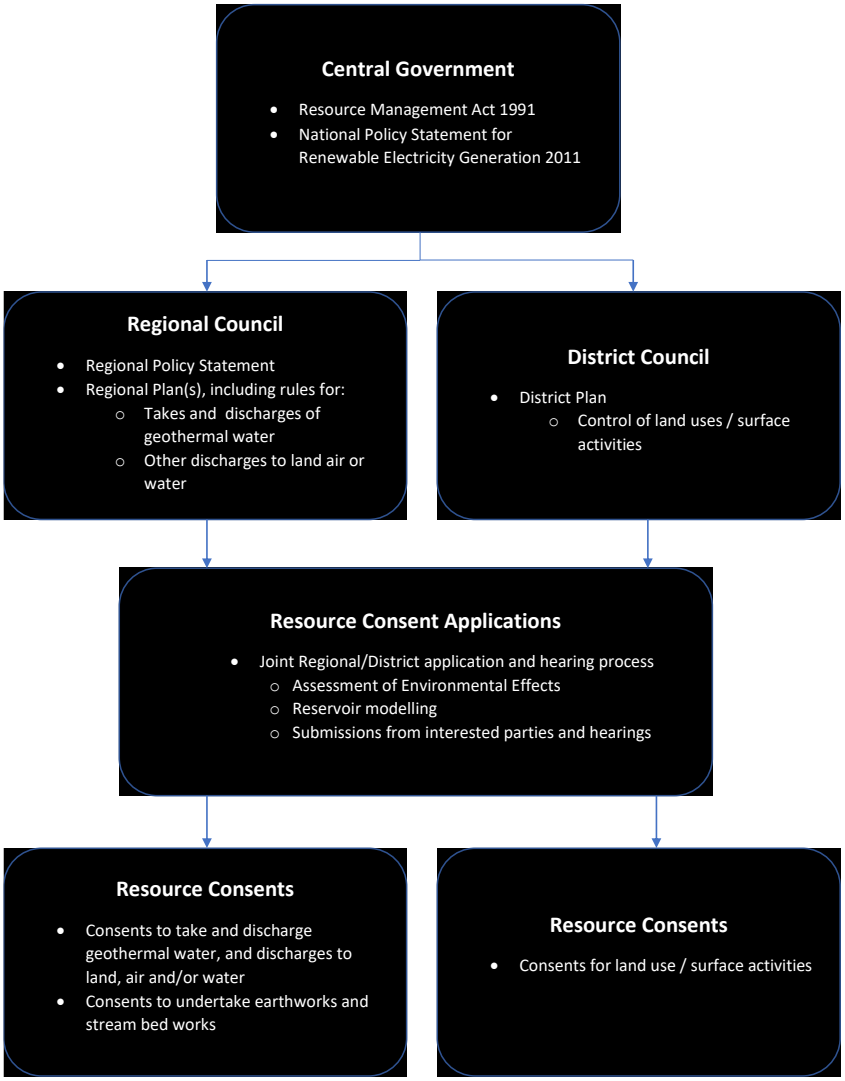

Figure 2: The Regulatory Framework for Resource Use within New Zealand

3.1 New Zealand Central Government

Central Government is responsible for national environmental policy and sets the strategic direction for the management of resources at a national level. To that end, and of greatest relevance to geothermal resources, Central Government has prepared a National Policy Statement for Renewable Electricity Generation 2011 (NPS-REG) which came into effect on 13 May 2011. The NPS-REG defines the term "renewable electricity generation" which includes the generation of electricity from geothermal energy sources.

The objective of the NPS-REG is:

"To recognise the national significance of renewable electricity generation activities by providing for the development, operation, maintenance and upgrading of new and existing renewable electricity generation activities, such that the proportion of New Zealand's electricity generated from renewable energy sources increases to a level that meets or exceeds the New Zealand Government's national target for renewable electricity generation."[1]

The NPS-REG works alongside other government initiatives as part of New Zealand's wider response to tackling climate change.

The NPS-REG ensures that the national benefits of renewable electricity generation are appropriately considered in consenting decisions. It also requires decision-makers to have particular regard to the locational requirements, the logistical or technical practicalities, and infrastructure requirements associated with developing, upgrading, operating or maintaining renewable electricity generation activities.

Central Government has also produced National Policy Statements in relation to the transmission of electricity and the management of fresh water which are often relevant to the consideration of any geothermal electricity generation activities.

[1] The Government's national target for renewable electricity generation is 90 per cent of electricity from renewable sources by 2025.

3.2 Regional Councils

Regional Councils are responsible for the sustainable management of natural and physical resources at a regional level. As part of their functions under the RMA, Regional Councils control the taking and using of geothermal fluid and the discharge of geothermal fluid and other contaminants onto or into land, air or water. Regional Councils are the regulatory organisations that have the most direct level of control over the development, use and/or protection of geothermal resources in New Zealand.

To help address that responsibility, Regional Councils produce a Regional Policy Statement and one or more Regional Plans. The preparation of a Regional Policy Statement is a mandatory requirement of Regional Councils under the RMA and addresses all natural and physical resources within a region. Regional Plans can relate to the management of a wide range of resources. For example, the Waikato Regional Plan covers all resources within the jurisdiction of the Waikato Regional Council except for the Coastal Marine Area which is covered by a separate Regional Coastal Plan. In contrast, there a number of Regional Plans produced by the Bay of Plenty Regional Council including one that specifically relates to a single geothermal system – the Rotorua Geothermal System.

The Regional Policy Statements for the Waikato and Bay of Plenty Regions set the overall approach to the management of the geothermal resources in those regions. They recognize that geothermal systems have a wide range of values, not all of which are compatible (in fact some values can be mutually exclusive to other values). The often-competing values associated with geothermal systems can include landscape, visual, scientific, ecological, intrinsic, cultural, and economic (ranging from the extraction of minerals, tourism and electricity generation). The various geothermal systems within a region being considered as a single 'regional geothermal resource' is an important aspect of the approach to the management of geothermal systems. Rather than attempting to fully provide for all values and desired outcomes associated every geothermal system (which is not realistic), each geothermal system is classified for a particular primary purpose.

Classification of Geothermal Systems

Using the naming conventions in the Waikato Region (which are very similar to the Bay of Plenty Region), geothermal systems are classified as one of the following five types of systems:

- Development Geothermal Systems – To be managed in a way that enables the large-scale use and development of geothermal energy and water in an efficient manner; allows controlled depletion of energy to provide for the energy needs of present and future generations; takes and integrated management approach; requires reinjection/injection of geothermal water; and avoids, remedies or mitigates adverse effects on other natural and physical resources including overlying structures.
- Limited Development Geothermal Systems – To be managed in a similar way to Development Geothermal Systems but at a lesser scale of development and with an emphasis on avoiding, remedying or mitigating any significant adverse effects on the environment.
- Protected Geothermal Systems - These systems are to be managed in a way that protects Significant Geothermal Features from adverse effects, including by maintaining the natural stocks and flows of geothermal energy and water, and encourages the protection of other geothermal features where they are valued for amenity, cultural or scientific reasons.
- Research Geothermal Systems – To be managed in a way that protects their characteristics whereby takes and discharges are limited for the purposes of research.
- Small Geothermal Systems – To be managed in a way that allows sustainable and efficient use and development but with an emphasis of protecting Significant Geothermal Features. Limited takes and uses are provided for if the effects can be appropriately avoided, remedied or mitigated.

Management and Protection of Significant Geothermal Features

A key aspect of the regulatory regimes in the Waikato and Bay of Plenty Regions is the management and protection of Significant Geothermal Features (SGFs). Different types of SGFs are identified and there is a comprehensive set of criteria to determine what qualifies as a SGF.

Any SGFs located in a Protected Geothermal System are automatically protected under the regulatory regime due to the 'protected' classification of those geothermal systems.

For Development Geothermal Systems the policy regime recognises the fact that it is impossible to have large-scale development and use of a geothermal system without resulting in changes to that system, which in turn can result in changes to SGF, including adverse effects. Accordingly, the regulatory regime does not require that adverse effects on SGFs be avoided, but rather the requirement is that adverse effects on SGFs be remedied or mitigated. This can include adverse effects being offset by works in a different geothermal system.

Recognition of Māori Cultural Values

Many geothermal systems and features within those systems have been used by Māori (the indigenous people of New Zealand) for 500 years or more and are highly valued. An important part of the policy regimes in the Waikato and Bay of Plenty Regions is to identify, recognise and provide for the relationship of tangata whenua (people of the land) with geothermal systems and features. This includes traditional and contemporary values associated with geothermal systems.

System Management Plan

A System Management Plan (SMP) is a tool used in geothermal management which is embedded in the Regional Policy Statement of both Waikato and Bay of Plenty Regions. A SMP is required for Development Geothermal Systems, or other types of systems, where the cumulative take of geothermal water exceeds 1,000 tonnes per day.

The primary purpose of the SMP is to allow for the integrated management of the whole geothermal system and respond to changes that occur through the use of the system. SMPs provide a strategy to facilitate adaptive use and development. In geothermal systems where there is only one party taking large volumes of geothermal water within a particular geothermal system (often referred to as a 'single tapper'), that party is typically required to prepare the SMP for that geothermal system (e.g. Contact Energy Ltd prepares the SMP for the Wairakei-Tauhara Geothermal System as required by the conditions of its resource consents authorising the take of geothermal water). Where there are 'multiple tappers', the relevant Regional Council typically prepares the SMP (e.g. as recently occurred in relation to the Kawerau Geothermal System in the Bay of Plenty[2]).

The policy regime in the Waikato Region includes a prescriptive list of matter that must be addressed in a SMP. This includes:

- A requirement to specify the objectives for the management of the geothermal system, including:
  - operational flexibility and adaptive management;
  - reservoir and subsidence modelling;
  - mechanisms to ensure the co-ordination and promote co-operation between all consent holders for large-scale takes of geothermal water);
  - research, monitoring and reporting; and
  - identification of anticipated significant adverse effects on SGFs and the remediation or mitigation to be undertaken, which may include 'like for like' remediation or mitigation in any geothermal system.
- A recognition that the geothermal water remaining after use should be reinjected/injected;
- Management of controlled depletion, including through modelling assessments, to determine appropriately stepped production; and
- The preparation of a Discharge Strategy (which has its own comprehensive list of matters that must be addressed).

SMPs are reviewed by a Peer Review Panel established for each Development Geothermal System.

3.3 Local Authorities

Under the RMA, local authorities (mostly referred to as District Councils) are responsible for, inter alia, the management of the effects of land uses. This responsibility is addressed though the development and administration of a District Plan for each district. In relation to the development, use and/or protection of geothermal resources (in the districts in which they are located), District Plans include objectives, policies and rules in relation to the development of geothermal power stations and steamfield activities (e.g. drilling, well heads, geothermal pipelines and separation plants) and other uses of geothermal systems (e.g. walking tracks and tourism developments).

Under the rules in the various District Plans, the development of a geothermal power station and associated steamfield activities typically requires a Land Use Consent to be obtained from the relevant District Council. An application for a Land Use Consent for a geothermal power station must include an Assessment of Environmental Effects which needs to address actual or potential effects on the environment such as:

- Landscape and Visual Effects;
- Traffic Generation Effects;
- Noise and vibration; and
- Dust and odour.

4. THE SUCCESS OF NEW ZEALAND'S GEOTHERMAL POLICY REGIME

The successful implementation of New Zealand's geothermal policy regime can be illustrated in several ways, discussed as follows.

4.1 Reconsenting Existing Geothermal Power Stations and Consenting New Developments

The reconsenting of existing geothermal power stations (required when consents held expire) and the consenting of new geothermal power stations have been significantly assisted by the 'enabling' policy regime relating, in particular, to Development Geothermal Systems. The policy regime provides a clear focus and intended outcomes for each type of geothermal system based on its classification. This is not to say that these consenting processes are not without their challenges. Existing geothermal power stations which have been operating for decades often have old plant and ways of operating that need to re-engineered and upgraded in terms of environmental performance. New geothermal power stations can represent a significant change to a local environment and can face opposition from surrounding landowners. Despite these challenges, there has been a significant level of renewable electricity generation from geothermal sources of energy consented with the benefit of the policy regimes established in the Waikato and Bay of Plenty Regions. The table below sets out the extent to which new geothermal power stations have been consented over approximately the last decade. This includes geothermal power stations such as Te Mihi and Tauhara II.[3]

[2] The author of this paper was engaged by the Bay of Plenty Regional Council to facilitate the preparation of the 'Kawerau Geothermal System Management Plan' including engagement with, and obtaining input from, the four companies that are each consented to take more than 1,000 tonnes per day of geothermal water within the Kawerau Geothermal System.

[3] The author of this paper was the Resource Management Planner (as part of a team of experts) who prepared the resource consent applications for these new geothermal power stations.

Geothermal System	Name of Power Station	Operator	Consented Capacity (Approximate MW)	Commissioned Date
Kawerau	Kawerau (NST/TOPP1)	Norske Skog Tasman	25	2012
Kawerau	Te Ahi o Maui	Kawerau A8D Ahu Whenua Trust and Eastland Generation	24	2018
Ngatamariki	Ngatamariki	Mercury	82	2013
Rotokawa	Nga Awa Purua	Tauhara North No.2 Trust and Mercury	140	2010
Wairakei-Tauhara	Te Huka	Contact Energy	23	2010
Wairakei-Tauhara	Te Mihi	Contact Energy	220	2014*
Wairakei-Tauhara	Tauhara II	Contact Energy	250	Yet to be built

*Te Mihi has 2 units installed to date however there is the ability to install a 3rd unit as part of the consented power station.

Table 1: Consented New Geothermal Power Stations in the Waikato and Bay of Plenty Regions since 2010

4.2 Protection of Geothermal Systems and SGFs

The classification of some geothermal systems as Protected Geothermal Systems and the associated policy regime has ensured that they remain protected including the SGFs within those systems. The listing and mapping of SGFs in Development Geothermal Systems and Limited Development Geothermal Systems (in the Waikato Regional Plan) has also enhanced the likelihood of their protection. To the extent that there are any adverse effects on SGFs in Development Geothermal Systems, these effects are remedied or mitigated by works elsewhere (including in other geothermal systems).

4.3 Exportation of Experience and Knowledge

The benefit and value of the geothermal management regimes in the Waikato and Bay of Plenty Regional (or at least the key elements of those policy regimes discussed in this paper) can be 'exported' and utilised by other countries. An example of where the key elements of the policy regime for the management of geothermal resources in New Zealand have been exported to another country and adapted to local circumstances, is the development of a Geothermal Resources Policy for Papua New Guinea.[4]

5. CONCLUSION

Due to the unique and dynamic nature of geothermal resources, and the competing values associated with those resources, a 'one size fits all' approach does not work in relation to the management of geothermal resources. However, the key aspects of the New Zealand geothermal policy and regulatory regimes represent global best practice that can be exported and adapted to fit local circumstances elsewhere in the world.

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REFERENCES

Bay of Plenty Regional Policy Statement

New Zealand Legislation - Resource Management Act 1991

Rotorua Geothermal Regional Plan

Waikato Regional Plan

Waikato Regional Policy Statement

[4] The development of the Geothermal Resources Policy for Papua New Guinea is the subject of a separate paper submitted for the World Geothermal Congress 2020 by the author of this paper.