

# SEA approaches for Geothermal Development in Japan and New Zealand

— Comparison of Development Processes —

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After a nuclear accident in Fukushima, promoting the diffusion of renewable energy has been an urgent issue in Japan. Among the renewable sources, since the stabilized supply characteristics, geothermal has been recognized as a renewable base-load power in geothermal area. Both Japan and New Zealand are located on the Pacific volcanic ring, and have prospect for geothermal power. However, though geothermal power supply has been rapidly increasing in NZ, Japanese geothermal projects have been struggling against development barriers. This paper compares the planning systems for geothermal development in Japan and New Zealand, and clarifies the lessons to learn for improving the Japanese geothermal statutory planning process more efficient and effective in terms of risk management and consensus building. Classification of geothermal systems into development system or protected system by regional government prior to the development project by the power company is effective for managing the regional total enthalpy and using geothermic resources in a sustainable manner. Stakeholder consultation of the SEA in those policy making phase, contributes to building consensus among the stakeholders including traditional spa owners with scientific data-based discussion. These institutional points are applicable to Japanese statutory process of geothermal development.

*Keyword: Geothermal Development, Planning Process, SEA, Japan, New Zealand*

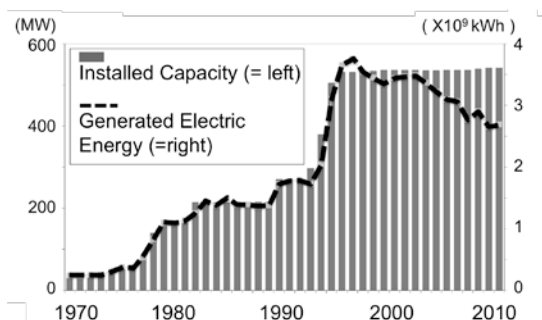
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## 1. Introduction

After the worst level nuclear power plant accident at Fukushima in 2011, Japanese national government has been positive about renewable energy including photovoltaic, wind, biomass and geothermal. Especially in the world of geothermal, there has been growing expectations in geothermal power developments because of Japan's location at the Pacific Ring of Fire. Actually, Japan has world's-third geothermal resource potential (23-GW) behind US (39-GW), and Indonesia (27-GW) (Williams, C.F. *et.al.*, 2008, Darma, S. *et al.*, 2010).

However, the Japanese electric capacity of

installed geothermal power (537-MW) ranks 8th in the world lists behind US, Philippine, Indonesia, Mexico, Italy, New Zealand, Iceland. Geothermal power development in Japan has been started in the early 1970's, and currently 16 geothermal power plants are in operation, but the total geothermal electric power generation is only 0.2% of the total electric power supply in the country (Thermal and Nuclear Power Engineering Society, 2012). Further more, after the late 1990's, only one new plant was developed and the geothermal power generation has been decreasing (**Fig 1**). As of 2014 though, 38 plans of new geothermal power plant developments have been formulated in



**Fig 1. Geothermal power capacity and generation in Japan (1970–2011)**

[Thermal and Nuclear Power Engineering Society, 2012]

many different areas. Those plans go into deadlock in almost all cases because of the negotiation with traditional hot spring spa (Onsen) businesses. In those cases, hot spring spa businesses strongly oppose to the new geothermal power developments due to fear of negative impacts on the hot spring resources such as hot spring depletion. To resolve these deadlock situations, Japanese government needs to establish an adequate planning process for consensus building between the geothermal power developers and regional stakeholders including hot spring spa businesses.

On the other hand, in New Zealand, the installed capacity of geothermal power has rapidly grown (723-MW as of 2011, 8.5% of the total electric power supply in New Zealand) after the establishment of new development system based on Resource Management Act (RMA) in 1991 (Ministry of Business, Innovation and Employment, 2013). This paper aims to clarify the problems of Japanese geothermal

**Table 1. Interview Survey in NZ (Dec. 2014)**

Category	Interviewee
Nation/Regional Government	Ministry for the Environment
	Department of Conservation
	Waikato Regional Council
Developer	Might River Power (=private company, Nagatamariki Geothermal Power Plant)
Local Stakeholder	Orakei Korako Tourism Operator (=hot spring owner)

development system from the comparative analysis between Japan and New Zealand.

## 2. Overview of Survey

To analyze the two development systems of geothermal power in Japan and New Zealand, this paper compares legal procedures for the geothermal developments in these two countries. In Japan, there is no specific law for establishing the geothermal power plant. Other acts apply, such as the Onsen Act (1948), which defines the permitting process of hot spring well drilling, the Electricity Business Act (1964), which defines the permitting process of power plant development and EIA Act (1997) are in place. This paper describes the Japanese geothermal development system based on those three laws. On the other hand, in New Zealand, the Resource Management Act (RMA) (1991) defines comprehensively all permitting processes of geothermal development including the EIA requirement. This paper describes the system based on RMA. In addition to the legal survey, we conducted interview survey with multiple stakeholders of the newest large geothermal power plant, Nagatamariki Geothermal Power at Waikato Region in New Zealand (Table 1).

## 3. Development Process in Japan

### 3.1 Policy and Plan Phases

The Japanese system of geothermal development is basically established by the Onsen Act, which was enacted to protect the hot spa resources and the culture (Fig 2). In this system, there is no legally required policy or plan for geothermal development at these phases. Though the National Energy Policy shows the long-range target of geothermal development (1,650-MW in 2030), it doesn't refer to the specific strategy for the geothermal resource management and development. Neither the national government nor any local government located in geothermic region adopted an official plan, which refers to the specific geothermal area nor geothermal reservoir

### 3.2 Project Phase

At the beginning of this phase, the developer (=private company) conducts a geographical prospecting survey for geothermal potential. In

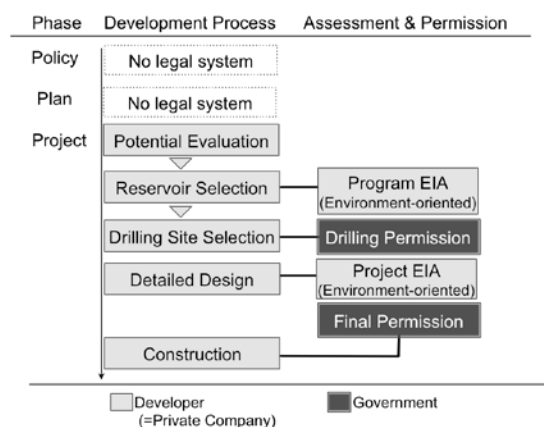


Fig 2. Development Process - Japan

many geothermic areas local stakeholders, including the traditional hot spa businesses strongly oppose against this survey activities. The consensus building at this stage is generally very difficult due to the lack of scientific data such as geological structure and ground water flows. As a result, the developer faces a difficult situation and the lead times for development become long, resulting in the increase in development cost.

After the potential evaluation, the developer establishes the reservoir modeling and prepares a program-EIA. This reservoir modeling and result of environmental research allow the appropriate drilling site selection and drilling permission application. This application is reviewed by Onsen Committee which consists of geologist and representatives of hot spring businesses. After the drilling permission, final permission for electric power generation business is issued based on the application documents including detailed plant design, transmission design and the project EIA report.

## 4. Development Process in New Zealand

### 4.1 Policy and Plan Phases

Geothermal Developments in New Zealand

are conducted based on the Resource Management Act (RMA) which was enacted to promote sustainable management of natural and physical resources including geothermal (Fig 3). The word

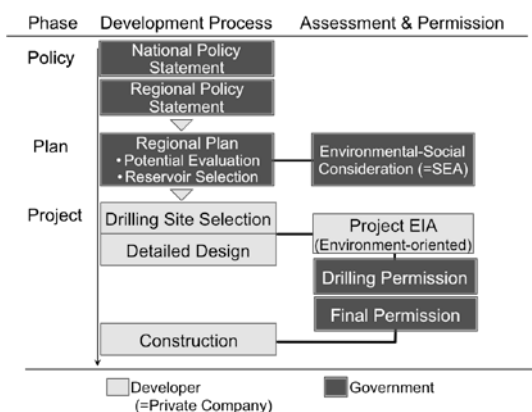
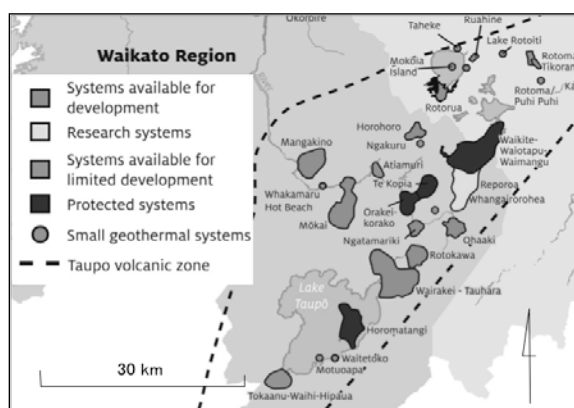


Fig 3. Development Process – New Zealand

“sustainable management” in RMA is defined as managing natural and physical resources in such a way that social, economic, cultural well being and health and safety of people and communities will be provided for over generations. In this system, the National Policy Statement formulates nation-wide standards of geothermal resource management. These standards give fundamental direction to the regional governments and allow them to establish a Regional Policy Statement, Regional Plan.

In the Regional Policy Statement, a long-term resource management strategy, the development target and resource protection criterion are indicated. In the Regional Plan, a system classification, significant geothermal features (=biologically, geologically, economically historically unique and/or important environment) and measurement of the protection are indicated. Waikato regional Council and the Geothermal Review Panel Team had built up this policy and plan through multi stakeholder consultation. In the consultation process, various parties not only the geothermal developer but also local residents, tourism businesses, farmers, related agencies such as a Department of

Conservation had been involved to the policy/plan making. As the result, 15 high temperature and 30 small geothermal systems (=geothermal reservoir) in Waikato Region were classified into 5 categories: Systems available for development,



**Fig 4. Geothermal system classification map**

[ Waikato Regional Council, Regional Plan]

Research systems, Limited development, Protected system, Small geothermal systems (Fig 4). Government sector drives the development process with environmental-Social consideration (it seems to be equivalent to SEA) in the policy/plan phases.

#### 4.2 Project Phase

In this phase, the developer mainly precedes the development process. In the case of Ngatamariki geothermal project at Waikato Region, Mighty River Power prepared the final permission application documents (=Resource Consent Application under the RMA). Those documents included long-term (50 years) simulation modeling of the geothermal system management plan, design of the power plant and transmission, and the project EIA (=AEE: Assessment of Environmental Effects under the RMA) reports. At this phase, the final permission was issued without any conflict among the local stakeholders because the Ngatamariki geothermal system had already been

officially classified as “Systems available for development”.

## 5. Conclusion

As the result of the comparison of those two countries, there is a large difference in the legal base for geothermal development. It seems reasonable to conclude that the existence of a specific legal system for resource management including geothermal resources contributes to establish a streamlined development process, which integrates planning process, and environmental-social consideration. Additionally, it is also important to mention that the classification of individual geothermal systems (or geothermal reservoir) by regional government through the stakeholder consultation in the policy/plan-making phase is effective for conflict avoidance at the project phase, which is driven by developer.

It remains a challenge for future research to analyze the detail of criterion for the geothermal system classification and consensus building among the local stakeholders. Added to this, feasibility of introducing New Zealand’s development approach into Japan needs to be discussed in the future.

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