

2016 Japan Country Report

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IEA Geothermal

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1. Introduction

The strategy for electricity supply in Japan has changed significantly following the accident at the nuclear power plant in Fukushima in 2011. The promotion measures for the introduction of Renewable Energy in Japan have brought new interests in geothermal development and several companies have announced that they have started exploratory research or geothermal power plant construction, but so far none of them have produced significant results. This is due to not only a long lead time required for developing a geothermal power plant through to construction, but also difficulty in gaining the understanding of local hot spring resort owners who are worried about the impact of the project on hot spring resources. There is also a wide technical knowledge gap between geothermal power businesses and local government officials, making it hard for those officials to moderate between concerned local residents and the businesses. To try to bridge this gap, JOGMEC established a third-party expert organization named "Advisory Committee for Geothermal Resources Development" in June 2016 to support local governments through providing consultation services. It is expected to support better communication.

Electricity		Direct Use	
Total Installed Capacity (MW _e)	522	Total Installed Capacity (MW _{th})	2,094
New Installed Capacity (MW _e)	0	New Installed Capacity (MW _{th})	N/A
Total Running Capacity (MW _e)	522	Total Heat Used (GWh/yr)	7,250
Contribution to National Capacity (%)	0.2%	Total Installed Capacity Heat Pumps (MW _{th})	N/A
Total Generation (GWh)	2,590	Total Net Heat Pump Use (GWh/yr)	N/A
Contribution to National Generation (%)	0.3%	Target (PJ/yr)	N/A
Target (% of national generation)	1.0-1.1%	Estimated Country Potential (GWh/yr)	N/A
Estimated Country Potential (MW _e)	23,470		

(N/A = data not available)

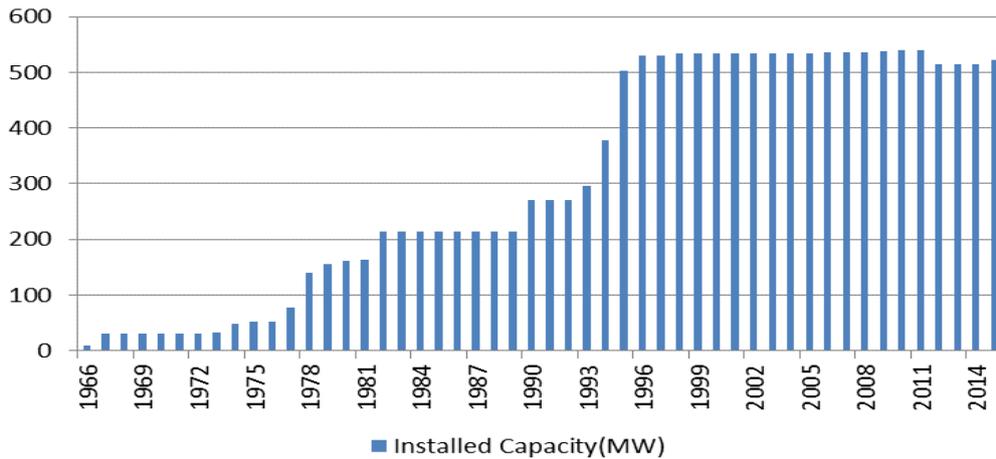


Figure 1 Total installed capacity of geothermal power plants¹

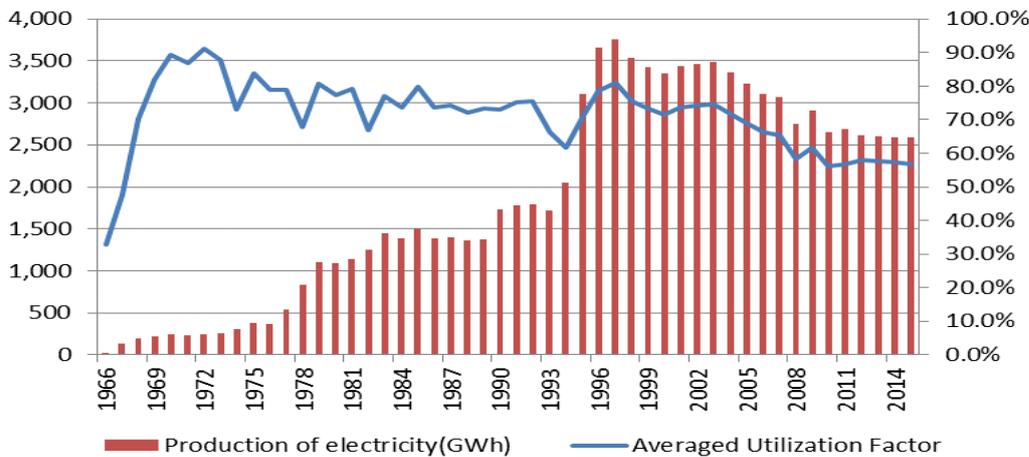


Figure 2 Total production of electricity and average utilization factor of geothermal power plants¹.

2. Changes to Policy Supporting Geothermal Development

The Japanese government initiated Japan's Feed-In-Tariff (FIT) in July 2012 to accelerate the introduction of renewable energy. The FIT system has been successful in bringing a substantial share of renewable energies into Japan's energy mix, but solar energy projects have dominated because solar projects are faster to build compared to larger projects such as wind or geothermal projects, which require quite a long lead time from plan through to build.

The Cabinet approved the Bill on the Partial Revision of the Act on Special Measures Concerning Procurement of Electricity from Renewable Energy Sources by Electricity Utilities. This Bill stipulates a new FIT scheme; geothermal, hydroelectric, and biomass projects will benefit from this slightly more favourable tariff framework. Ministry of Economy, Trade and Industry (METI) announced the tariff is applicable to projects certified in a given year "in advance", in order to reflect the longer period of time that geothermal, hydroelectric, and biomass projects take to become operational compared with other renewable energy projects.

3. Geothermal Project Development

3.1 Projects Commissioned

Development of geothermal resources takes a long time from exploration through to generation of electricity. In addition, there are risks specific to geothermal resource development which are different to the risks involved in the development of other thermal power plants. In order to assist in managing these risks, JOGMEC supports the development of geothermal resources using three financial support mechanisms; grant subsidies, investing equity capital, and liability guarantees for geothermal development.

In 2016, 26 projects applied for grant subsidies. Seven of the 26 projects were local industry and/or local government projects where 100% of the cost for the investigation is supported, while 50-100% of the cost is supported for the other 19 private sector developers. In 2016 the total subsidy grant was about 60 million USD.

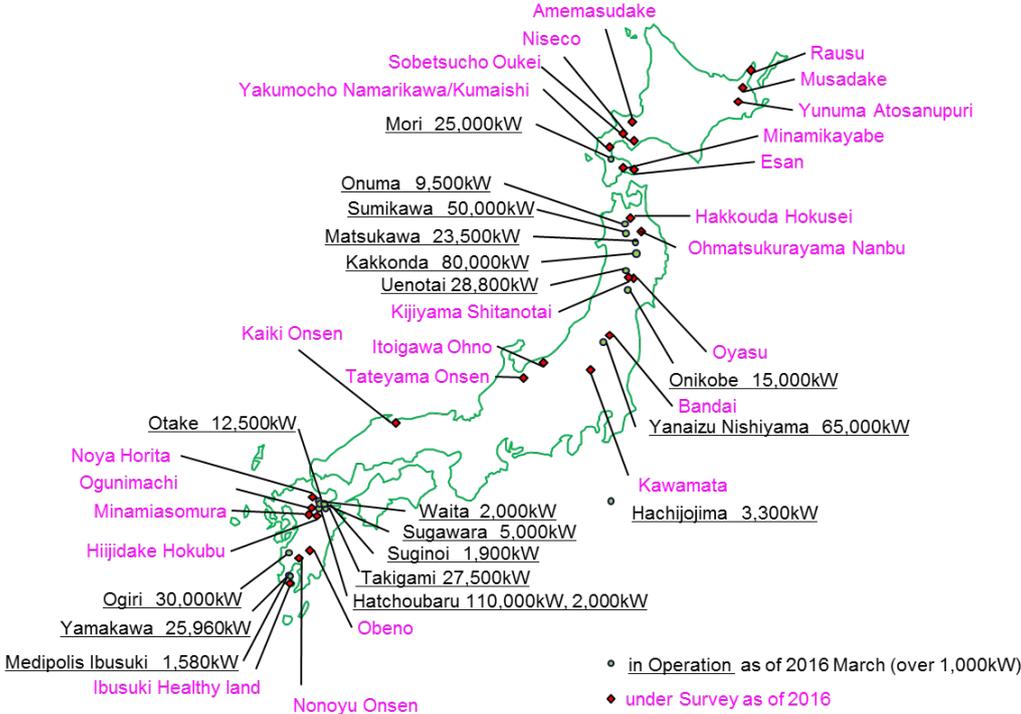


Figure 3 Geothermal projects in Japan

After initial survey work is completed, developers have to estimate production capacity. At this stage, JOGMEC can invest up to 50% of the equity capital of the company. The first equity capital investments were made in 2015 but no new investment projects were made in 2016.

At the construction stage, a significant amount of money is required to drill the wells. Therefore, JOGMEC guarantees the loans which private companies borrow from private financial institutions when they are constructing a geothermal power plant. Under this program JOGMEC provides a liability guarantee for up to 80% of the total loan. This support had been applied to 4 projects by 2016.

J-power announced the replacement of the facilities of Onikobe geothermal power plant. It started operation in 1975 and the facilities are degrading due to age. The project is under the environmental assessment process and the current power plant will be shut down in 2017 and the new power plant will commence operation in 2023.



Figure 4 Onikobe Geothermal power plant (15MW)

3.2 Projects Operational

In 2016, Japan had 522 MW of installed electric generating capacity, about 4 % of the world total.² Geothermal power plays a minor role in the energy sector in the country. In 2016, it supplied 2,590 GWh of electricity, representing about 0.3% of the country's total electricity supply.

Although no large scale geothermal power plant has been constructed for over a decade, recently some areas have been slated for geothermal power plant construction or operation. The Japanese government is seeking to expand the developable area for geothermal, reduce investment risk, and promote the understanding of local people. These measures have brought new interest in geothermal development, and at least 26 locations across the country are being surveyed for potential geothermal power generation by electric power companies, oil companies, construction companies, local governments, and other entities. In some areas, geothermal power plant construction has commenced.

Wasabizawa geothermal power plant (42MW), one of the new geothermal power plants under construction, is scheduled to commence operation in 2019.

4. Research Highlights

Two government enterprises, JOGMEC and NEDO (New Energy and industrial technology Development Organization), started projects for geothermal energy development in 2013. JOGMEC focuses on subsurface investigation and technology development while NEDO is mainly concerned with electricity generation and above-ground equipment technologies.

A helicopter airborne geophysical survey began to be conducted in 2013 aiming to acquire basic data for the evaluation of geothermal resources in order to promote geothermal development. Most geothermal resources are located within national parks or in mountainous areas where access for surface surveying is difficult. In fact, about 80% of geothermal resources exist in natural parks in Japan. Airborne geophysical surveying is an effective method to acquire data over a

wide area without any modification of the land surface. JOGMEC conducted this survey at several areas of Hokkaido in 2016.

JOGMEC have 3 R&D project themes; Geothermal Reservoir Evaluation and Management, improvement of exploration accuracy, and Drilling Technology Development.

In the Drilling Technology Development, new PDC bits were fabricated and used for the first field test in 2016.

NEDO launched an R&D program in 2013 concerned with the improvement of geothermal power generation. The program consists of many projects, including hybrid generation systems, reducing scaling potential in brine, development of facilities, designing support tools, etc. The program has been funded and will continue until 2017.



Figure 5: Fabricated PDC bit

5. Other National Activities

5.1 Geothermal Education

METI started a plan to increase the understanding of local residents in regard to geothermal power generation in 2013. 47 bodies have adopted this in 2016.

5.2 Conferences

Since Matsukawa Geothermal Power Plant, Japan's first geothermal power plant, celebrated its 50 years of operation, JOGMEC, the Japan Geothermal Association and the Federation of Electric Power Companies of Japan jointly registered the date of October 8 as the "Day of geothermal power generation". JOGMEC and Hachimantai city celebrated the registration of the certificate during the "Geothermal Symposium in Hachimantai" held at Hachimantai City in September, 2016.



Figure 6: Matsukawa Geothermal Power Plant (23.5MW)

GNS Science (New Zealand) and JOGMEC held an international workshop in Japan in June 2016. 173 people involved in geothermal power attended. In this workshop, speakers explained the current situation of the geothermal power generation, direct use, and R&D projects in both countries.



Figure 7: International workshop

5.3 Useful Websites

Ministry of Economy, Trade and Industry (METI): <http://www.meti.go.jp/>

Japan Oil, Gas and Metals National Corporation (JOGMEC): <http://www.jogmec.go.jp/>

New Energy and Industrial Technology Development Organization (NEDO):
<http://www.nedo.go.jp/>

6. References

[1] The Present State and Trend of Geothermal Power Generation of Japan in 2016: Thermal and Nuclear Power Engineering Society (2017)

[2] Geothermal Power Generation in the World 2010-2014 Update Report: Ruggero Bertani (2015)



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