



IEA GEOTHERMAL



Japan Country Report 2012

**IEA Geothermal
Implementing Agreement**

National Activities

Chapter 14 of Draft 2012 GIA Annual Report

Japan



Figure 14.1 Drilling of an investigation well at the Toyoha field in Hokkaido, Japan, conducted by JX Nippon Mining & Metals Corporation
(Photo courtesy of JOGMEC on 21 November 2012)

14.0 Introduction & Overview

After a ten-year break a new framework for geothermal energy development started in 2012, where JOGMEC (Japan Oil, Gas and Metals National Corporation) played an important role for the development, including financial supports and subsurface technology development. The restart was caused by the public opinions that the renewable energy is expected to help mitigate global warming and that stable energy is also expected instead of nuclear power after the Fukushima Daiichi accident happened on 11 March 2011.

The Japanese Government initiated Japan's Feed-In-Tariff (FIT) in July 2012 to accelerate the introduction of renewable energy. The selling price of electricity to a power company under FIT system is very attractive to promote geothermal power generation.

The Japan Geothermal Association was established to exchange information on the geothermal energy development in December 2012.

Some hot spring owners are also interested in power generation using their hot spring water, and a plant was designed and constructed to demonstrate the use of the hot spring water which discharged into sea directly. Some more small power generation plants are planned to be constructed in the coming years. Considering a large power plant, more than 10 years is needed to complete a plant with the installed capacity greater than 30 MW. A new geothermal power plant with the capacity of 42 MW is now under environmental assessment, and is expected to be commissioned after several years.

Table 14.1 Status of geothermal energy use in Japan for 2012.

Electricity	
Total Installed Capacity (MW _e)	540
New Installed Capacity (MW _e)	0
Contribution to National Capacity (%)	0.2
Total Generation (GWh)	2,689
Contribution to National Generation (%)	0.3
Direct Use	
Total Installed Capacity (MW _{th})	2,094
New Installed Capacity (MW _{th})	na
Total Heat Used (PJ/yr or GWh/yr)	26.1 [7,250]
Total Installed Capacity Heat Pumps (MW _{th})	na
Total Net Heat Pump Use [GWh/yr]	na

na = data not available

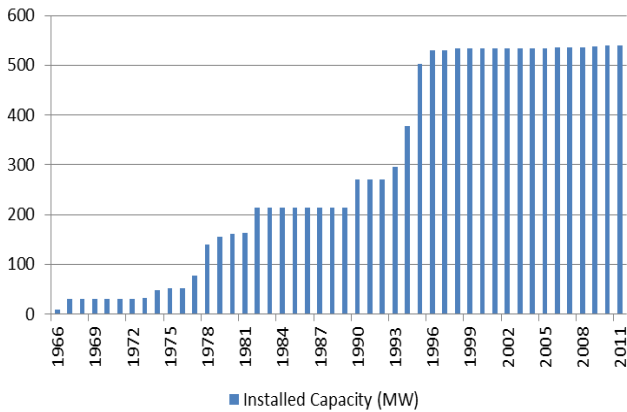


Figure 14.2 Total installed capacity of geothermal power plants in Japan.

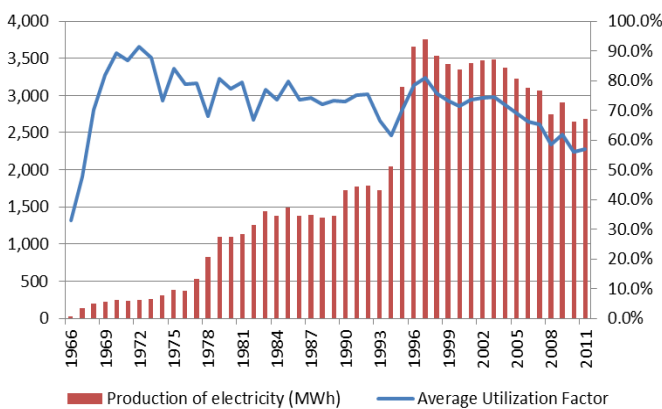


Figure 14.3 Total production of electricity and average utilization factor of geothermal power plants in Japan.

14.1 Highlights and Achievements

- Japan Oil, Gas and Metals National Corporation (JOGMEC) was established in 2004 as a government enterprise, with succeeding functions of predecessors, Japan National Oil Corporation (JNOC) and Metal Mining Agency of Japan (MMAJ). JOGMEC has much experience to develop subsurface resources such as oil and metals, and Geothermal Resource Development was newly added to promote to develop geothermal resources in JOGMEC in September 2012. New Energy and Industrial Technology Development Organization (NEDO), which was the operation agency for the geothermal energy development 10 years ago, is also involved in developing the ground equipment in geothermal energy.
- Several private companies, which do not have experience of developing underground resources, are interested in developing geothermal energy. To combine these companies, Japan Geothermal Association was established in December 2012, which aims to 1) research and study for geothermal power generation, 2) recommend and petition the government and related organizations, 3) information exchange among members on geothermal power generation, and 4) press release and promotion of the understanding about geothermal power generation.

14.2 National Programme

Promotion of deregulation for the development in national parks made the Ministry of Environment to have a plan to permit the development in the 2nd and 3rd classes of conservation areas. However, the Ministry requests an ideal example of the environmentally-balanced development. A working group has been discussing the ideal example and has not gotten the result yet.

After the nuclear incident happened in March 2011, the demand for the stable energy supply, including geothermal energy, has been increasing and geothermal energy development has been expected with research and study, which were suspended in 2003.

Japan boasts the world's third highest geothermal potential, which is estimated through heat assessments. To promote the use of low enthalpy geothermal resources, potentials were estimated not only for high temperature geothermal resources but also for middle to low temperature hot waters. The estimated potentials were 23.5 GW, 1.1 GW, and 8.5 GW for temperatures more than 150 °C, ranging between 120 and 150 °C, and ranging between 53 and 120 °C, respectively. The lowest temperature of 53 °C was set by the tentative temperature and power generation relationship calculated for the Kalina cycle.

14.3 Industry Status & Market Development

- There are 16 geothermal power units for commercial use with the installed capacity of 527.6 MW, and 4 units for private use with the capacity of 12.49 MW as of March 2012. The number of geothermal power plants and the amount of installed capacity in 2012 are the same as in 2011.
- Production of electricity increased in 2012 because of the completion of the repair of the electricity generation in the Uenotai Geothermal Power Plant. The total geothermal electricity generation in 2011 was 2,689 GWh and amounted to 0.26% of the electrical generation in Japan.
- For the annual heat usage, 2.467 TJ heat was used for homes, including private baths, and amounted to more than half of the available heat. The 2nd most usage is heat for the public welfare, and was 665 TJ. The 3rd and the 4th are for the heat for hotels and inns of 464 TJ and for road snow melting of 432 TJ, respectively. The total installed capacity for the direct use and the amount of heat in 2012 were 408 MW_t and 5,367 TJ/y, respectively, which were almost the same as the previous year. Note that heat usage for public baths in hotels and inns was excluded in this statistic.

14.4 Research, Development & Demonstration

Fifteen areas (Musa-dake, Toyoha, Amemasu-dake, Ashoro, Biei, Iwaki-san, Matsuo-hachimantai, Kijiyama-Shitanotai, Oyasu, Unazuki-Hotspring, Atagawa-Hotspring, Hongu, Arifuku-Hotspring, Two Oguni areas) were selected to investigate the geothermal development (Figure 14.4). Each area was subjected to surface surveys as well as surveys using investigation wells.

The demonstration of a small geothermal power plant using hot water was planned and the plant started to generate electricity at Obama Hot Spring. The hot water is used for the public baths in hotels and inns, but more than 70% of it used to be discharged into the sea directly.

14.5 Future Outlook

Airborne gravimeter and electro-magnetic surveys will be conducted around major geothermal fields in Kyushu and Tohoku districts in 2013 and in 2014. These surveys will be expected to investigate new geothermal fields, especially in the national parks, where deregulation was made for the development of geothermal energy. After the technique is confirmed, the investigation area will be expanded to other major geothermal fields after 2014.

Another technology development in JOGMEC is the technology for the maintenance of the geothermal reservoir. Some geothermal fields have reservoir problems, such as pressure drops and superheat. Water is added into the reservoir to maintain the reservoir pressure. The experiment will be conducted in a geothermal field from 2014.

The last effort for technology development is to apply the seismic reflection method to geothermal fields. The seismic survey methods are believed to provide very high resolution, but are very difficult to carry out in the complex geothermal field environment. JOGMEC has a plan to re-analyse the seismic data recorded in the geothermal field using the recent techniques for analyses.

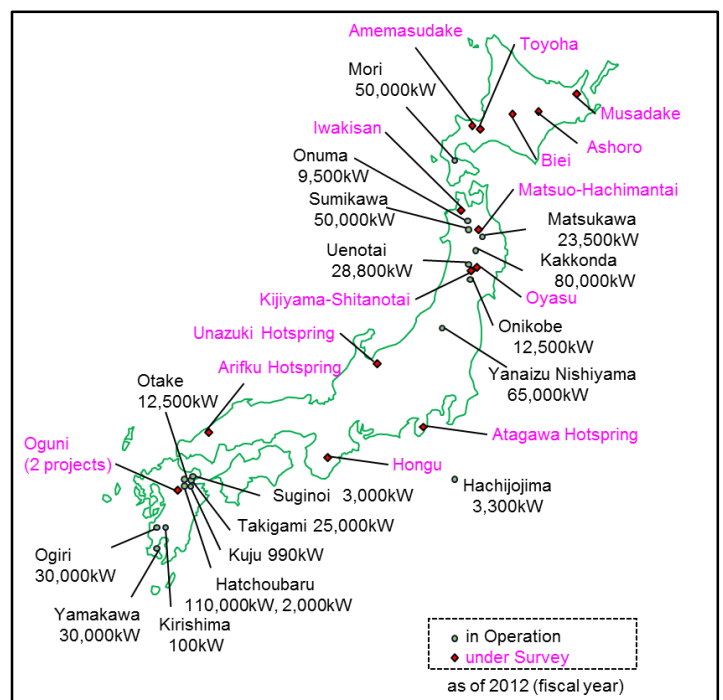


Figure 14.4 Geothermal projects in Japan as of 2012.

14.6 Publications and Websites

Thermal and Nuclear Power Engineering Society (2012): The Present State and Trend of Geothermal Power Generation of Japan in the Fiscal Year 2010 and 2011. Thermal and Nuclear Power Engineering Society, 99p (in Japanese).

http://www.env.go.jp/earth/ondanka/ghg/2012sokuho_gaiyo.pdf (in Japanese)

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