

GEO THERMAL ENERGY IN JAPAN

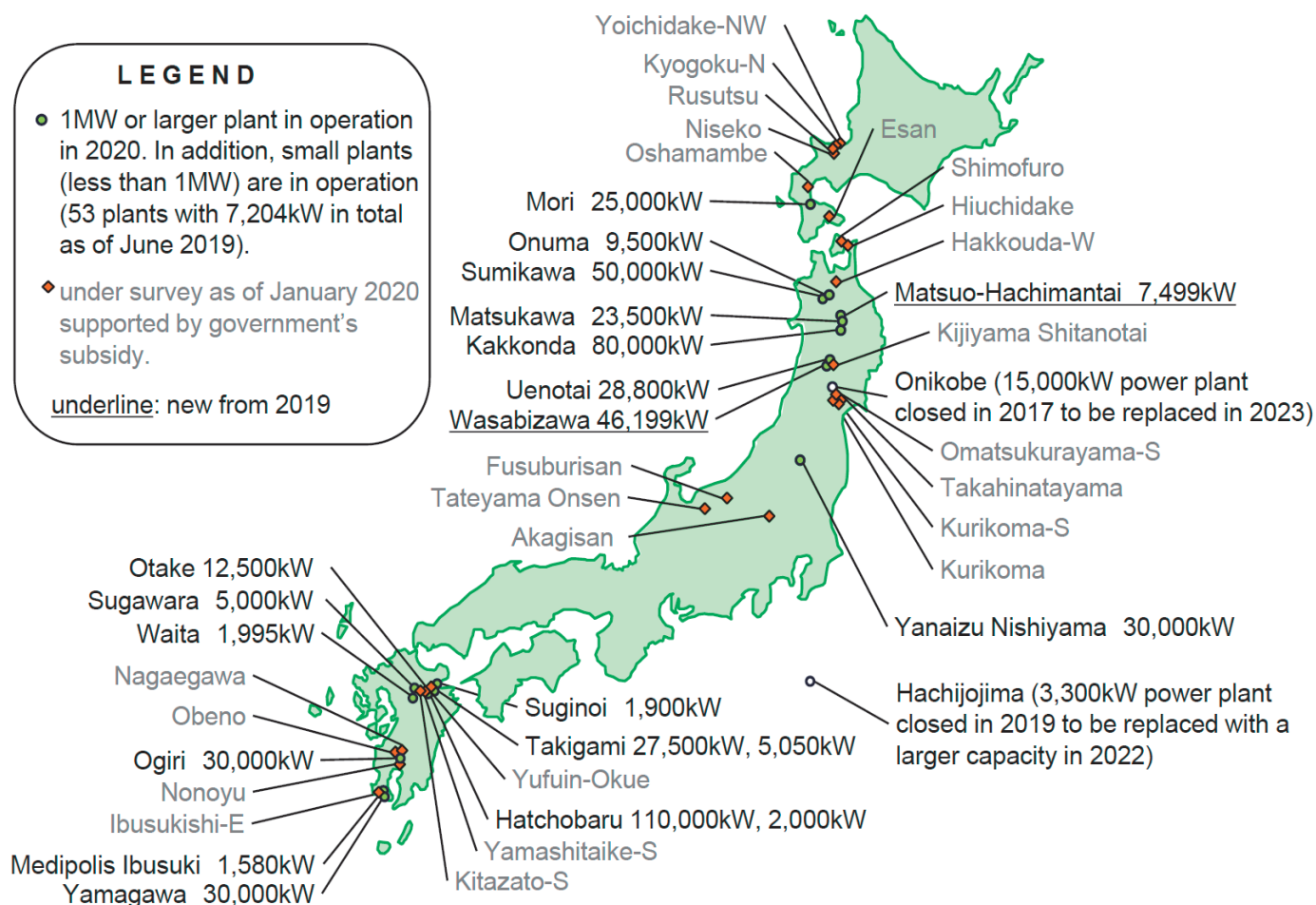


LEGEND

- 1MW or larger plant in operation in 2020. In addition, small plants (less than 1MW) are in operation (53 plants with 7,204kW in total as of June 2019).

- ◆ under survey as of January 2020 supported by government's subsidy.

underline: new from 2019



Geothermal power plants and undergoing survey projects in Japan as of January 2020

POWER GENERATION



Wasabizawa Geothermal Power Plant
(Photo by Yuzawa Geothermal Power Co., Ltd.)

Capacity : 46,199kW (Double flash)
In operation since : 20 May 2019

History

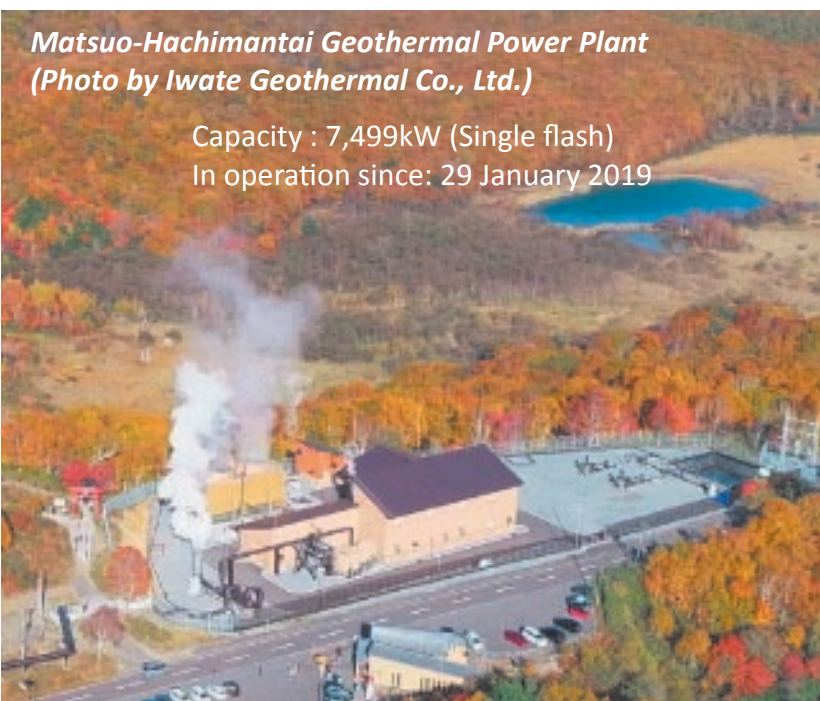
Located along the Circum-Pacific Volcanic Belt “Ring of Fire,” Japan is blessed with geothermal energy. Matsukawa geothermal power plant, the first one in Japan, started its operation in 1966. The total capacity of the domestic geothermal power plants already reached over 500 MW in 1995. Since then, however, new installation had been stagnated almost for two decades mainly due to socio-economic reasons.

Renewed Opportunity

Following the nuclear power plant accident in Fukushima in 2011, the promotional measures implemented by the Ministry of Economy, Trade and Industry (METI) to intensify deployment of renewable energy have prompted renewed interest in geothermal development in Japan. Although the development progress is still slow, two large geothermal power plants, Matsuo-Hachimantai (7,499 kW) and Wasabizawa (46,199 kW), were commissioned in 2019, in addition to many smaller geothermal power plants opened recent years. Total installed capacity in Japan is 535,227 kW. (As of 2019)

Challenges

The slow progress of new development is partly due to the long lead time, including environmental assessment required for the construction of largescale geothermal power plants. But a more serious reason is the difficulty in gaining social acceptance, especially from local hot spring resort owners who are worried about the impact of geothermal development on hot spring resources. Therefore, the government, private sectors and academia have been making effort to get better understanding of local communities.

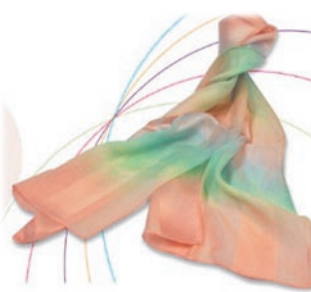


Matsuo-Hachimantai Geothermal Power Plant
(Photo by Iwate Geothermal Co., Ltd.)

Capacity : 7,499kW (Single flash)
In operation since: 29 January 2019

DIRECT USE

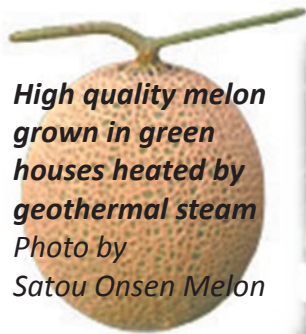
Conventional Direct Use



Fabric dyeing with geothermal steam
Photo by GEOCOLOR



Sea salt drying with geothermal steam
Photo by "ecologeo"



High quality melon grown in green houses heated by geothermal steam
Photo by Satou Onsen Melon



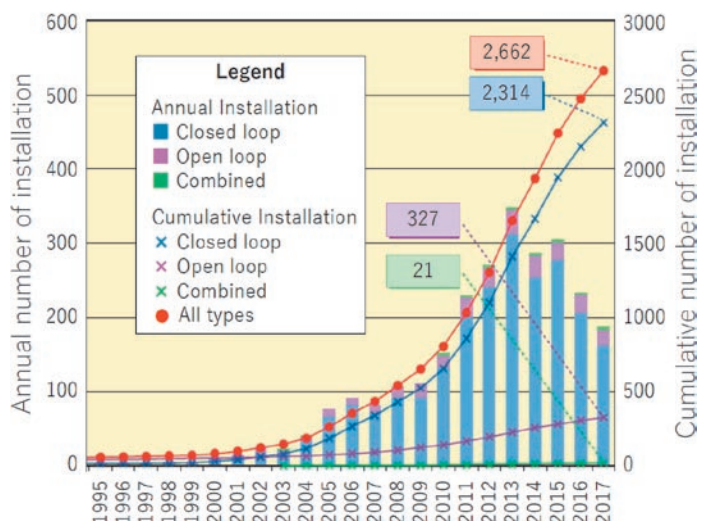
Milk and yogurt sterilization

Photo by KURIKOMA FOODS

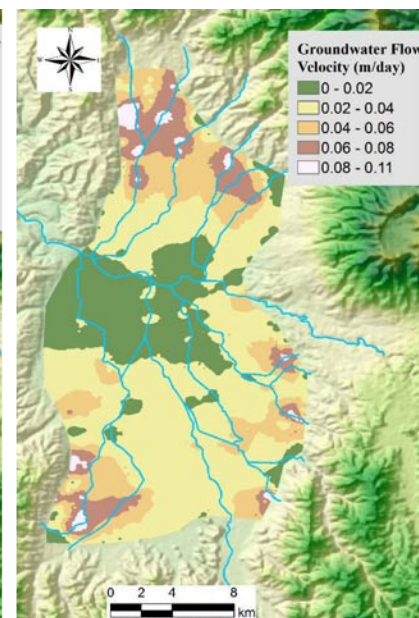
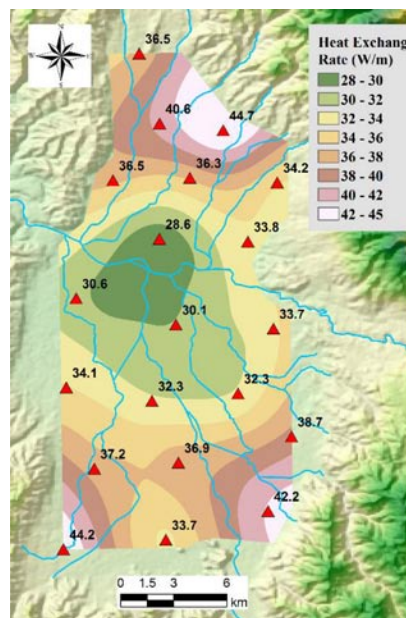


Although most of direct use in Japan is bathing application, followed by space heating and green houses, geothermal energy is industrially used to add higher value to the products.

Ground Source Heat Pump (GSHP)



The cumulative number of facilities using GSHP
(Ministry of the Environment, 2019)



An example of suitability map: Distribution of sustainable heat exchange rate (left) and groundwater flow velocity (right)
(Shrestha et al., 2018)

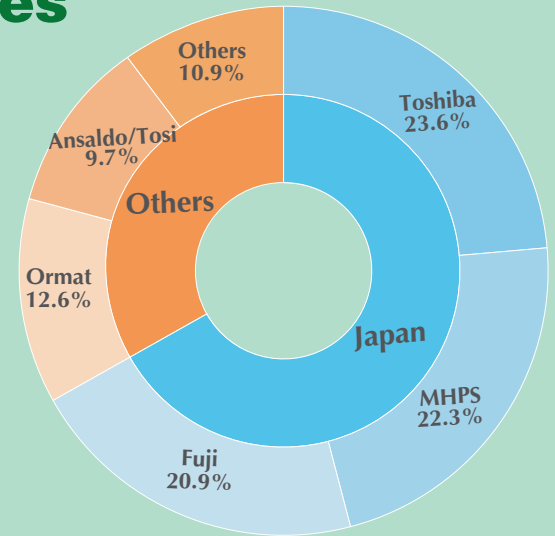
The installation of GSHP in Japan has been exponentially increasing recent years although the total number is still small. Recent installations in landmark buildings such as the international terminal building of Haneda Airport and the commercial zone of Tokyo Sky Tree (the tallest tower in Japan) have spotlighted GSHP. One of the topical studies in Japan is the suitability mapping of GSHP systems based on the groundwater flow modelling in a basin or a plain. Based on such studies, several municipals have compiled suitability maps of their administrative districts, aiming at the dissemination of GSHP from the environment-friendly aspects.

TECHNOLOGY FOR SUSTAINABLE DEVELOPMENT OF THE WORLD

Power Generating Technologies



Photo by Landsvirkjun (Iceland)



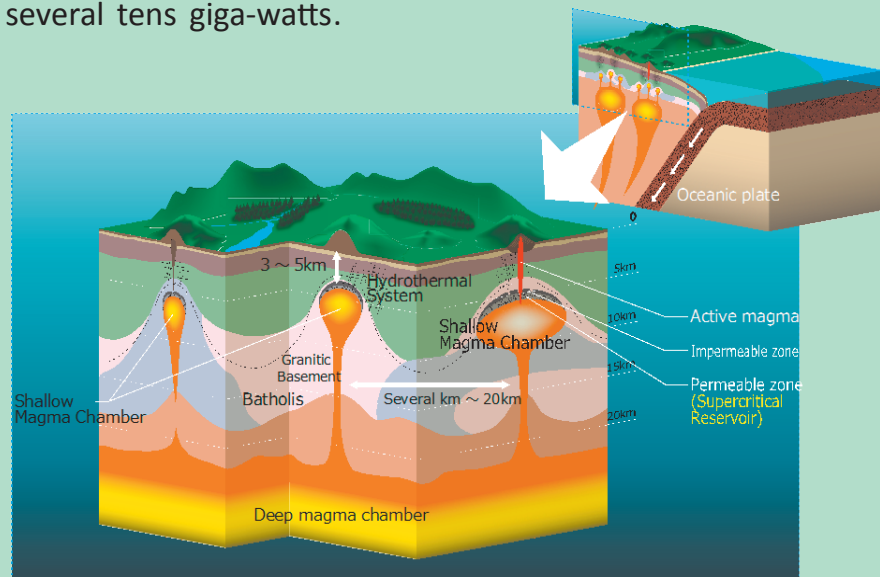
Share of geothermal power generating units in the World (installed capacity)

Geothermal power generating units by Japanese manufactures are installed worldwide with an almost 70% share of the total installed capacity, contributing to utilization of the geothermal energy.

Supercritical Geothermal Resources

In 2017, Japan launched an R&D project “Development of subduction-origin supercritical geothermal resources” to utilize 400 to 500°C supercritical fluid at a depth shallower than 5km. Earlier surveys suggested such resources may exist in/around many of the volcanic zones in Japan and total potential reaches several tens giga-watts.

The project has a target year of around 2040 for the operation of a pilot plant. To overcome problems with acid fluid in supercritical condition, various basic scientific studies as well as technology developments will be done led by the National Institute of Advanced Industrial Science and Technology (AIST) and Kyoto University, funded by New Energy and Industrial Technology Development Organization (NEDO).



Conceptual model of “SuperCritical Geothermal System (SCGS)” in northeastern Japan

Geothermal Research Society of Japan

GRSJ devotes its effort to the progress of geothermal science and technology by publishing a quarterly journal, holding annual conference, and hosting occasional domestic and international symposia. It is the best community when you want to make contact with Japanese geothermal specialists. IGAJ, an affiliated organization of IGA, was established by GRSJ in 2003 to promote international activity of the society. For more info, please visit <http://grsj.gr.jp/en/>.