

**Let's see
our Geothermal Power!**

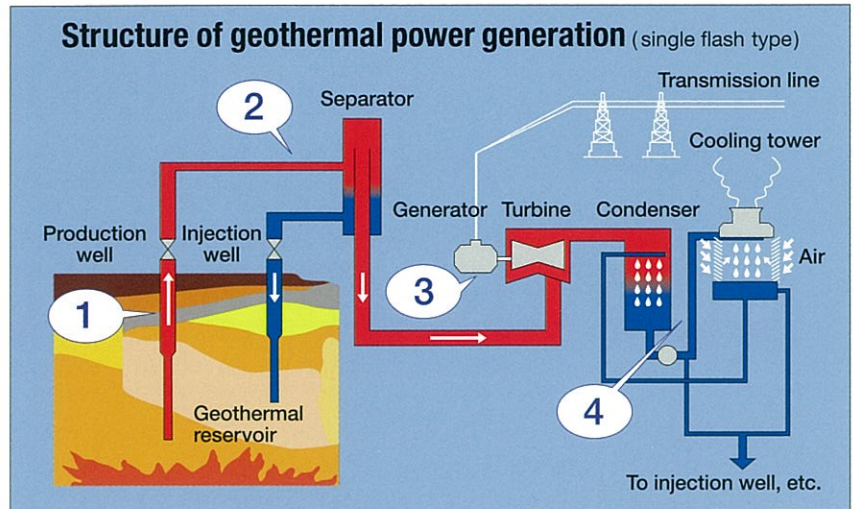


Japan Geothermal Association
(JGA)

Geothermal power generation

Geothermal energy is generated by turbines rotated by hot ($\geq 200^{\circ}\text{C}$) geothermal fluids.

- 1 A production well is drilled into the geothermal reservoir to extract fluids.
- 2 The fluids are separated into vapor and hot water via a separator, and the hot water is returned underground via injection wells.
- 3 Vapor is sent to the turbines for generating power.
- 4 Subsequently, the vapor is converted to hot water by a condenser, and after cooling in the cooling tower, the water circulates into the condenser.



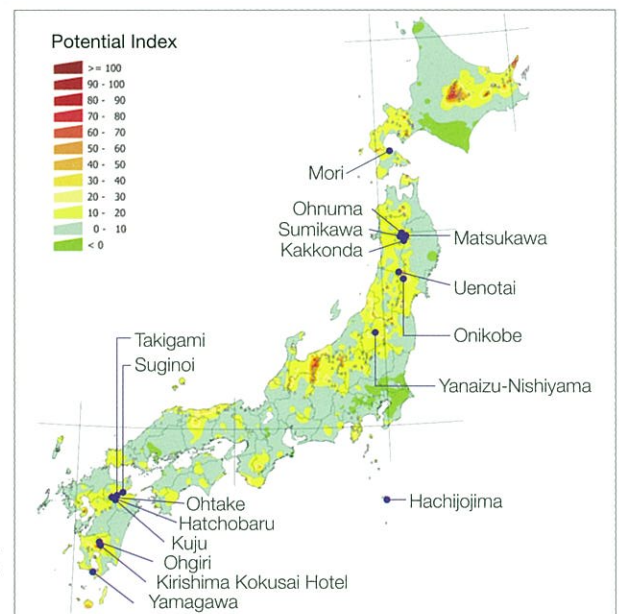
Geothermal power plants in Japan

The total installed capacity of geothermal power plants in Japan as of 2010 is 515,000 kW, which is the 8th in the world.

So many geothermal plants in Japan!

However, they account for only 2.2% of the geothermal resources in Japan!
Most of our resources has been undeveloped yet!

Locations of geothermal power plants in Japan on the Geothermal Resources Potential Map (Muraoka et al., 2007)



	Plant name	Location	Power Supplier	Steam Supplier	kW	Type	Since
For Electric Business	Mori	Mori, Hokkaido	HEPCO	HEPCO	25,000	DF	1982.11.26
	Matsukawa	Hachimantai, Iwate	TOHGEC	TOHGEC	23,500	DS	1966.10.08
	Kakkonda	Shizukuishi, Iwate	Tohoku-EPCO	TOHGEC	(1) 50,000 (2) 30,000	SF SF	1978.05.26 1996.03.01
	Sumikawa	Kazuno, Akita	Tohoku-EPCO	Mitsubishi Materials Co	50,000	SF	1995.03.02
	Uenotai	Yuzawa, Akita	Tohoku-EPCO	TOHGEC	28,800	SF	1994.03.04
	Onikobe	Osaki, Miyagi	J-POWER	J-POWER	15,000	SF	1975.03.19
	Yanaizu-Nishiyama	Yanaizu, Fukushima	Tohoku-EPCO	Okuaizu Geothermal Co	65,000	SF	1995.05.25
	Hachijojima	Hachijo, Tokyo	TEPCO	TEPCO	3,300	SF	1999.03.25
	Takigami	Kokonoe, Oita	Kyushu-EPCO	Idemitsu Oita Geothermal Co	27,500	SF	1996.11.01
	Ohtake	Kokonoe, Oita	Kyushu-EPCO	Kyushu-EPCO	12,500	SF	1967.08.12
	Hatchobaru	Kokonoe, Oita	Kyushu-EPCO	Kyushu-EPCO	(1) 55,000	DF	1977.06.24
					(2) 55,000	DF	1990.06.22
					2,000	B	2006.04.01
in-house use	Ohgiri	Kirishima, Kagoshima	Kyushu-EPCO	Nittetsu Mining Co	30,000	SF	1996.03.01
	Yamagawa	Ibusuki, Kagoshima	Kyushu-EPCO	Kyushu-EPCO	30,000	SF	1995.03.01
	Ohnuma	Kazuno, Akita	Mitsubishi Materials Co	Mitsubishi Materials Co	9,500	SF	1974.06.17
	Suginoi	Beppu, Oita	Suginoi Hotel	Suginoi Hotel	1,900	SF	2006.04.01
	Kuju	Kokonoe, Oita	Kuju Kanko Hotel	Kuju Kanko Hotel	990	SF	2000.12
	Kirishima Kokusai Hotel	Kirishima, Kagoshima	Daiwabo Kanko	Daiwabo Kanko	100	SF	2010.11.01

[Generation Type] DS: dry steam; SF: single flash; DF: Double flash; B: binary.
Revised of / Thermal and Nuclear Power Engineering Society of Japan (2013)

Why geothermal energy in Japan?

What are the advantages of geothermal energy?

Domestic energy with abundant resources in Japan!

Japan has a huge geothermal potential!

Japan with many volcanoes is abundant in geothermal resources, which is the 3rd amount in the world. (23,470MW)

Green energy with little CO₂ emissions!

Geothermal energy does not require fuel, because it uses thermal energy from the earth.

In addition, CO₂ emissions is very low level though the lifecycle of power plants, which prevents global warming.

Renewable energy!

Underground balance is important!

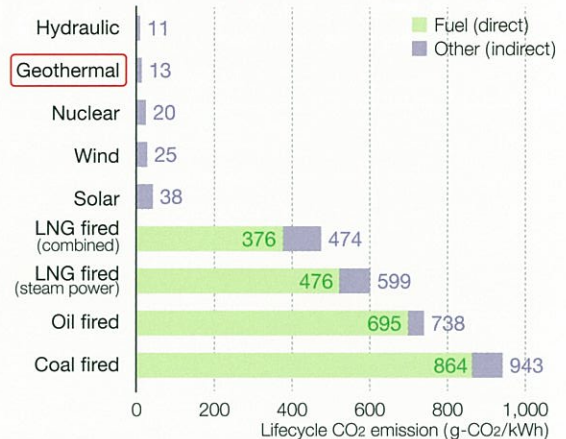
When vapor and hot water are retrieved from underground for geothermal power generation, the amount of fluid in the geothermal reservoir decreases. Consequently, fluids from the surrounding area flow to the reservoir to fill in the space. In addition, the hot water from the geothermal plant is also injected down to the reservoir, and it is heated again. Thus, geothermal energy is sustainable.

Stable baseload power source!

Geothermal energy can generate power for continuously 24hours, regardless of time and weather.

In addition, amongst natural energy sources, the output is very stable, and thus it can provide a baseload power source.

Average lifecycle CO₂ emission of each power supply



Nuclear includes the reprocessing, the use of plutonium, and the waste disposal, after Imamura and Nagano(2010).

Appropriate reservoir control by continuous monitoring of the pressure and the flow rate is important.

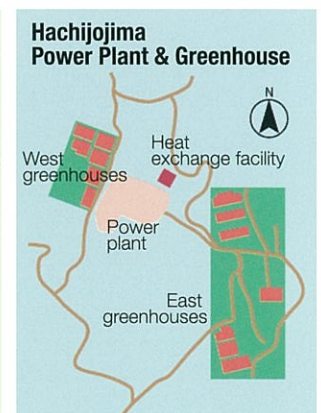
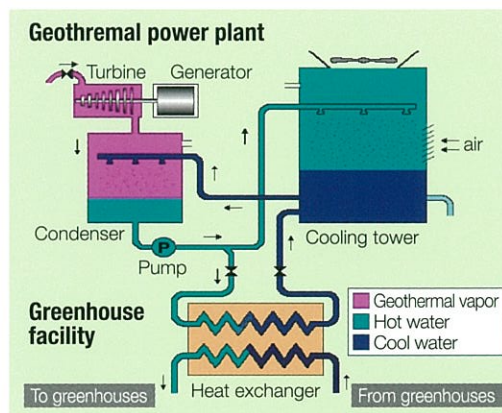
Will geothermal power plant impact hot springs? What are the local benefit?

Harmonious symbiosis with the inhabitants is the primary consideration

Environmental impact assessment on the area is essential when planning of a geothermal power plant. Meetings, information sessions, and discussions with the local people are frequently held at all time.

No environmental impact must be always confirmed by continuous monitoring in the whole related area.

In addition, it is promoted that heat generated in the geothermal plant system is effectively utilized for the region.



after TEPCO

Example of hot water utilization at the Hachijojima Geothermal Power Plant

Hot water is supplied to greenhouses around the geothermal power plant from December to March, and the temperature in the greenhouses is kept as warm as 15 °C.

Greeting

In 2012, the national supporting system for the geothermal power generation was reformed. Feed-in tariff for the renewable energy came into effect, and deregulation for geothermal development in natural parks where most of the geothermal resource prospects exist came about. As a result, our surroundings for the geothermal development was highly improved.

Meanwhile, concerns about the environmental impact by geothermal development activity are being expressed by the local people. Eliminating any impact on the environment and co-existence between hot spring business and geothermal industry are primary consideration more than ever.

Hereat, the new organization, Japan Geothermal Association (JGA), has been established by broadly calling for the participation of Japanese geothermal companies with the aim of improving the various common issues of the industry.

JGA represents Japanese geothermal industry both in name and reality, and promotes the best utilization of our geothermal energy for all people in Japan.

Established: Dec.4,2012

Chairman: Susumu Tanaka (Idemitsu Kosan Co.,Ltd.)

Main Activities:

- To conduct studies and surveys related to geothermal power generation
- To suggest public opinion to the Government
- To exchange information about geothermal development
- To promote public acceptance of geothermal development

Regular Members as of Nov.22,2013 (49 companies)

- | | | |
|--|--|--|
| • AKEMA BORING Co.,LTD. | • Asunaro Aoki Construction Co.,Ltd. | • Chuo Electric Power Co.,Ltd. |
| • Daido Steel Co.,Ltd. | • Dai-ichi Heat Treatment Industry, Co., Ltd. | • Electric Power Development Co.,Ltd.(J-POWER) |
| • ENNET Corporation | • FUJI ELECTRIC CO., LTD. | • Geophysical Surveying Co., Ltd.(GSC) |
| • Geothermal Energy Research & Development Co., Ltd. | • Idemitsu Kosan Co.,Ltd. | • INPEX CORPORATION |
| • ITOCHU Corporation | • Japan Drilling Co., Ltd. | • Japan Metals & Chemicals Co., Ltd. |
| • Japan Petroleum Exploration Co.,Ltd.(JAPEX) | • JFE Engineering Corporation | • JGC Corporation |
| • JGI, Inc. | • JX Nippon Mining & Metals | • Kawasaki Heavy Industries, Ltd. |
| • KYOKUTO VALVE MFG. CO., LTD. | • Marubeni-Itochu Techno Steel Inc. | • Mitsubishi Corporation |
| • MITSUBISHI GAS CHEMICAL COMPANY, INC. | • Mitsubishi Heavy Industries, Ltd. | • Mitsubishi Materials Corporation |
| • Mitsubishi Materials Techno Corporation | • Mitsubishi UFJ Lease & Finance Company Limited | • MITSUI & CO., LTD. |
| • Mitsui Oil Exploration Co.,Ltd. | • NIPPON STEEL & SUMIKIN ENGINEERING CO., LTD. | • Nittetsu Mining Co., Ltd. |
| • NKKTUBES | • Obayashi Corporation | • OKUAIJU GEOTHERMAL CO.,LTD. |
| • ORIX Corporation | • SB Energy Corp. | • SHIMIZU CORPORATION |
| • Shinko Engineering & Maintenance Co.,Ltd. | • SK ENGINEERING CO.,LTD. | • SUMITOMO CORPORATION |
| • Sumitomo Mitsui Banking Corporation | • Sumitomo Mitsui Construction Co., Ltd. | • Sumitomo Mitsui Finance and Leasing Company, Limited |
| • TEISEKI DRILLING Co.,Ltd. | • TELNITE CO., LTD. | • TIX-TSK Corporation |
| • TOSHIBA CORPORATION | | |

[alphabetical order]

Special Members (2 institutions)

- | | |
|--|---|
| • Institute for Sustainable Energy Policies (ISEP) | • Thermal and Nuclear Power Engineering Society |
|--|---|

Head office

Address : 4-11, Higashikanda 1-chome, Chiyoda-ku, Tokyo 101-0031, JAPAN
Phone : +81-3-5823-4639
Fax : +81-3-5823-4640
E-mail : jga@chinetsukyokai.com
URL : <http://www.chinetsukyokai.com/>