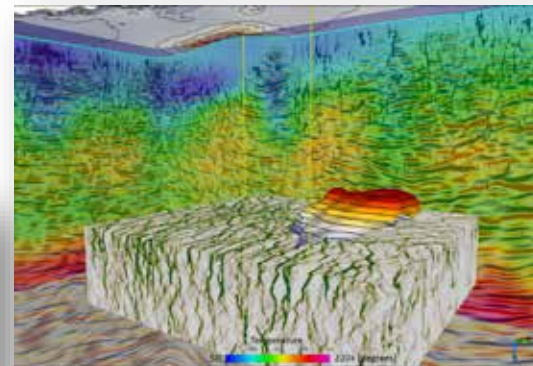


Geothermal Development in Japan



Japan Oil, Gas and Metals National Corporation

JOGMEC Overview

Mission and Activities



1

Mission

Secure constant and stable supplies of oil, natural gas and mineral resources to support industries and citizens in Japan through various activities relating these resources. In 2012 Geothermal function was added to the role of JOGMEC.

Activities

Oil & Gas
Upstream
Investment and
Research &
Development



Metals Strategy &
Exploration, and
Technology
Development



Stockpiling



Mine Pollution
Control



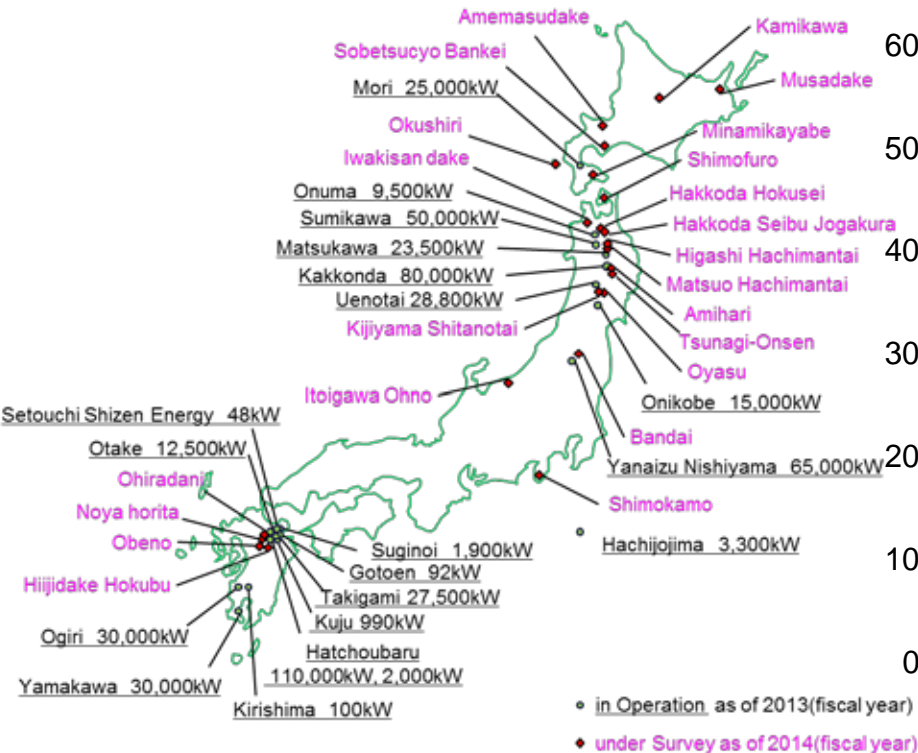
Coal Strategy &
Exploration, and
Technological
Support



Geothermal
Resources
Development

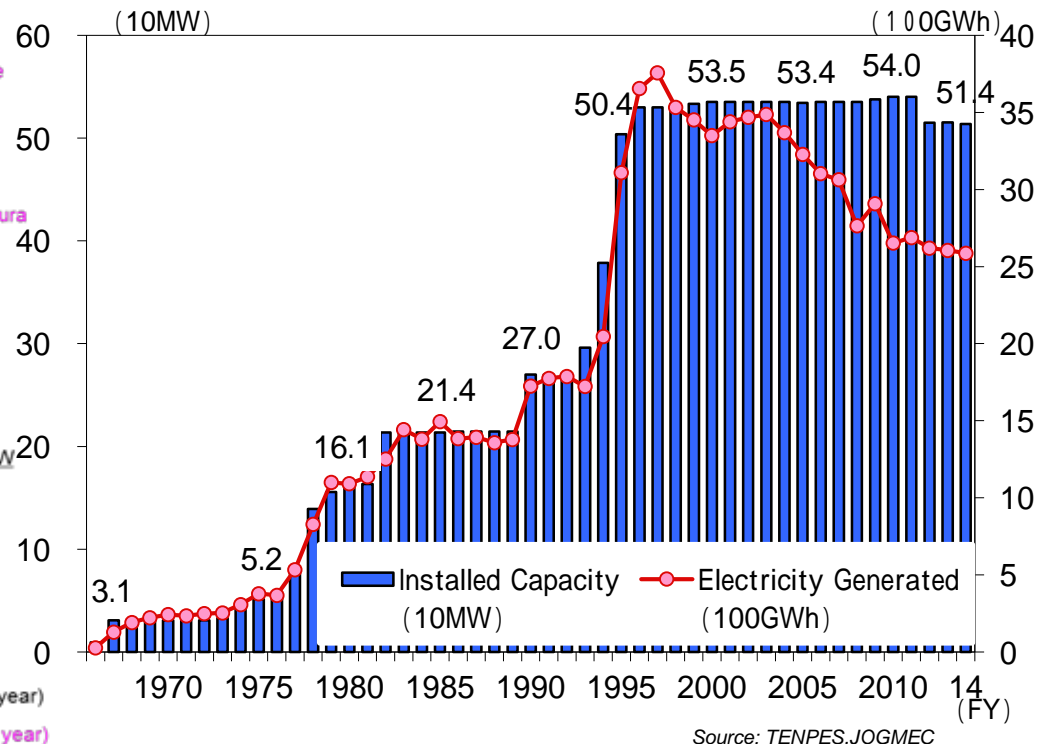


Main geothermal power plants in Japan



Installed Capacity & Electricity Generated

Decreasing gradually for the past decade.

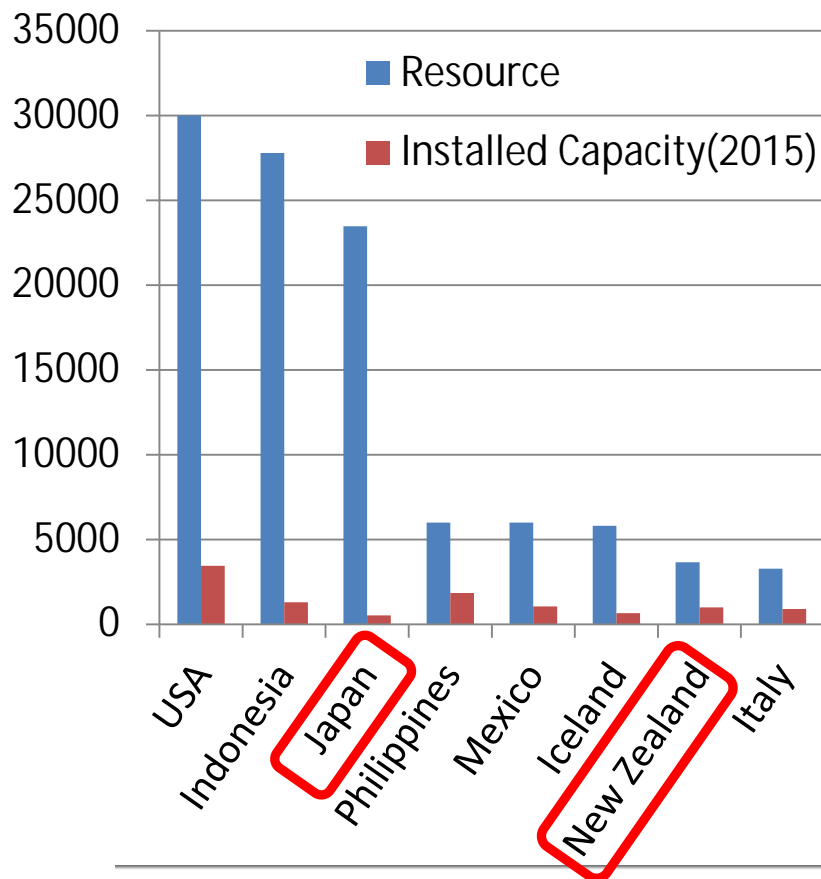


Source: TENPES, JOGMEC

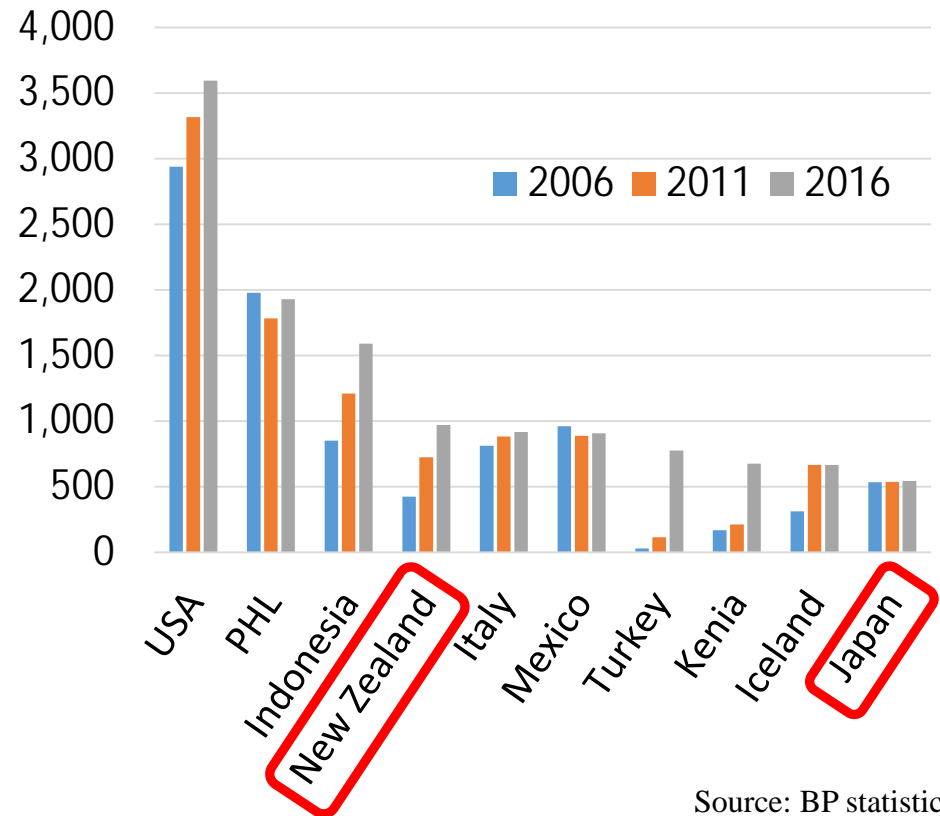
Total Installed Capacity: 514MW

Reserve of geothermal resources / Installed capacity

Ø Japan has the world's third largest reserve of geothermal resources(23,400MW), however has only 520MW(2.2%) to have been developed.



Installed geothermal power capacity

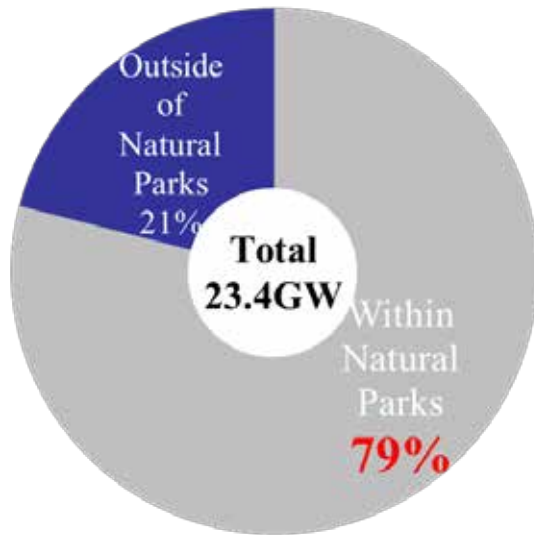


Source: BP statistic

Geothermal potential area in Japan



- Ø Approximately 80% of energy potential of geothermal is located within the areas of Natural Parks stipulated by Natural Parks Act.
- Ø Consequently, Geothermal Power Plants have been developed mainly outside of these natural parks.
- Ø However, after the accident at nuclear power plants in Fukushima, Ministry of Environment issued the guideline which lifted restrictions on drilling at national parks.

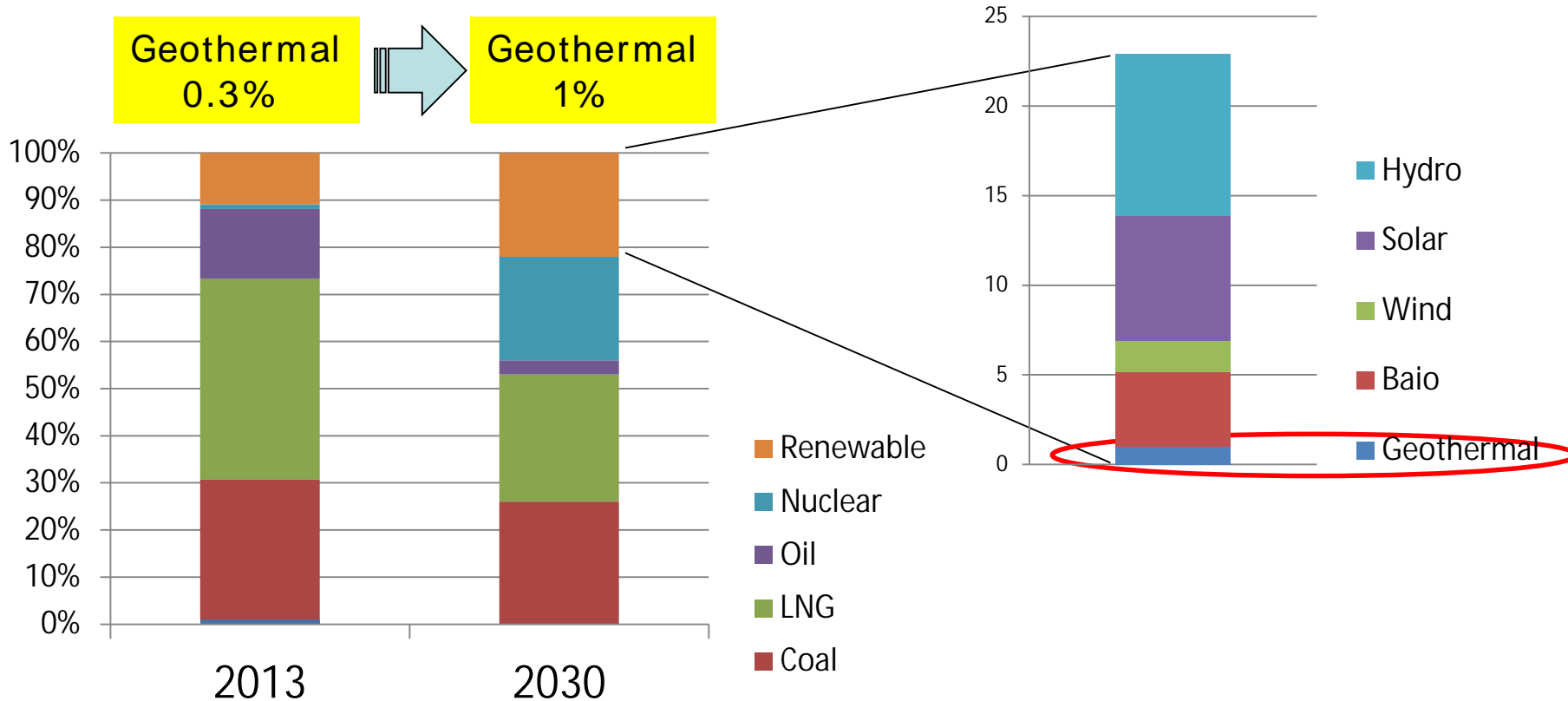


Category of Natural Parks	Potential (MW)	
Special Protection Zone	7,000MW	(29.9%)
Special Zone I	2,600MW	(11.1%)
Special Zone (II & III)	7,700MW	(32.9%)
Ordinary Zone	1,100MW	(4.7%)
Outside of Natural Parks	5,000MW	(21.4%)
Total	23,400MW	(100%)

Drilling toward Zone I %
 +
Accessible 59 %

Strategic Energy Plan in Japan

Ministry of Economy, Trade and Industry, METI, announced “Long-term Energy Supply and Demand Outlook” pursuant to the policies of the Strategic Energy Plan, what mentioned Geothermal energy would be increased to 1.0-1.1% of the power supply by FY 2030.



Our Big Goal

- ü Promote the activation of domestic geothermal development.

Action assignments






- ü Financial supports for cost issue
- ü Reduce exploration risk (Geological aspect)

JOGMEC implements three approaches

- ü Financial supports
(Subsidy, Equity Capital Finance Liability Guarantees)
- ü Technology development
- ü Regional air-borne geophysical survey

n Additional to above approaches, JOGMEC also active in promotion in order to achieve public acceptance.

Outlines of Financial Assistance

Potential Survey	Exploration	EIA	Development	Operation
<ul style="list-style-type: none"> - Geological Survey - Geophysical Exploration - Structural Boring 	<ul style="list-style-type: none"> - Drilling of Investigation Well - Discharge Test 	<ul style="list-style-type: none"> - Environmental Impact Assessment 	<ul style="list-style-type: none"> - Drilling of Production Well & ReInjection Well - Construction, Start-up & Commissioning of Power Plant 	<ul style="list-style-type: none"> - Commercial Operation <p>Hatchobaru (Oita Pref.)</p> 
Resource Risk				

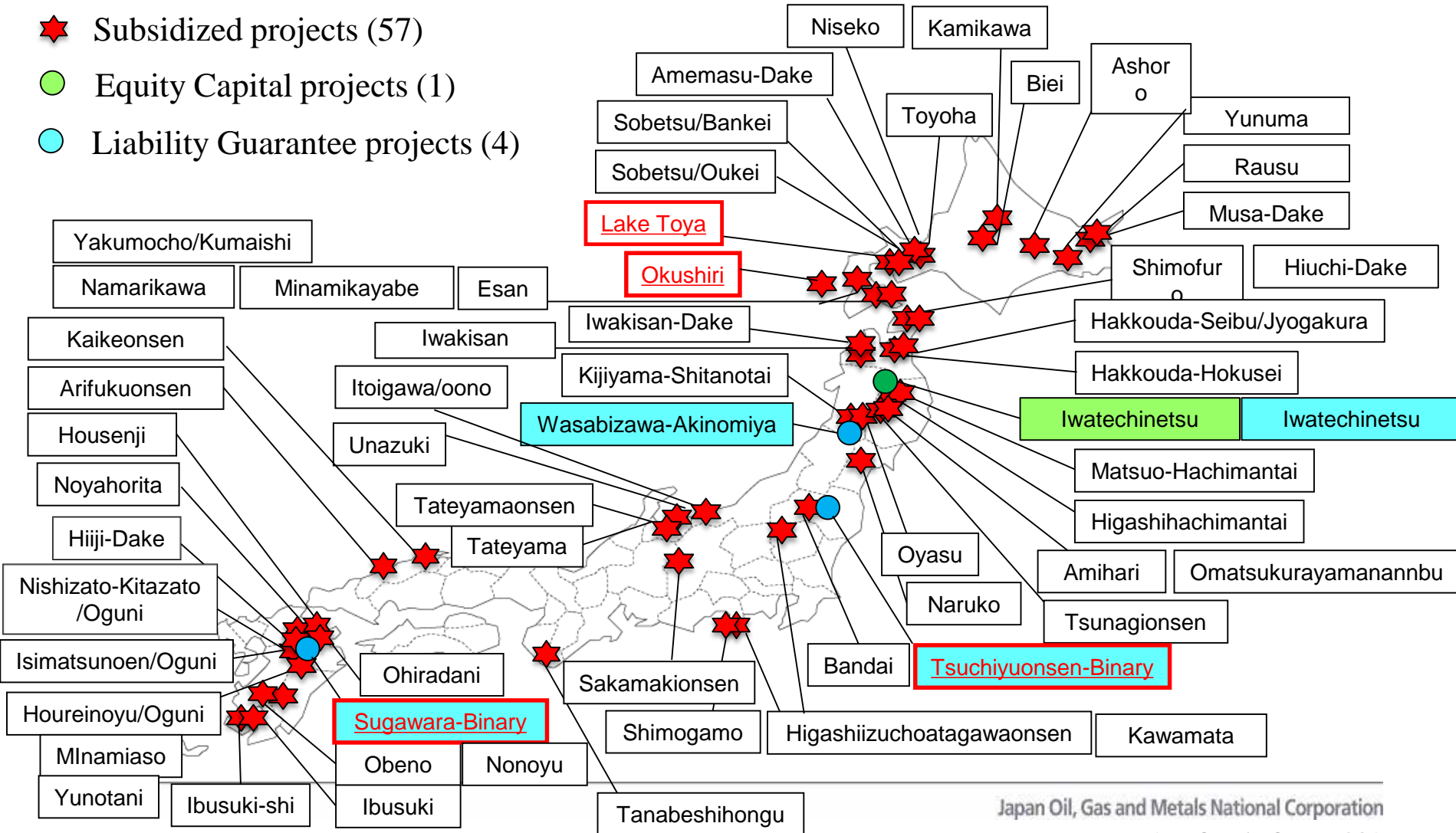
Financial Assistance provided by JOGMEC

Subsidy	Equity Capital	Liability Guarantees
<ul style="list-style-type: none"> - Up to 50%~100%* of necessary funds (* depends on terms and conditions) 	<ul style="list-style-type: none"> - Up to 50% of equity capital (JOGMEC is not allowed to be the largest shareholder.) 	<ul style="list-style-type: none"> - Up to 80% of loan provided by financial institutions

Adopted Projects from FY2012 to FY2016

Currently, more than 50 exploration projects are on the road by electric companies, oil companies, mining companies, local government and other entities.

- ★ Subsidized projects (57)
- Equity Capital projects (1)
- Liability Guarantee projects (4)



Wasabizawa Geothermal Power Plant



9

- Ø Wasabizawa geothermal power plant (in Yuzawa city, Akita Pref.) under construction and will be commenced to operate with a capacity of 42MW in 2019.
- Ø This is the first large-scale project in about twenty years for constructing such a plant with a capacity of 10,000 kW or more.
- Ø JOGMEC provide a liability guarantee for 80% (Approx. 21 billion yen) of the total loan.
- Ø This project is expected to be the herald of booming geothermal development in the near future.



Regional Potential Survey /

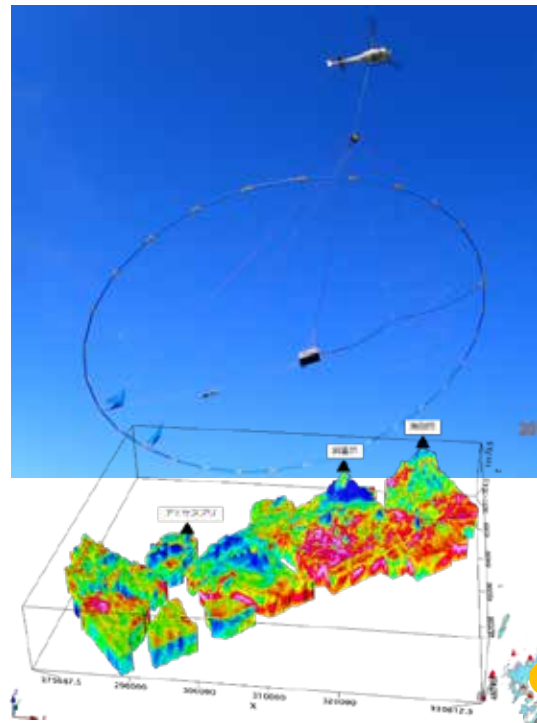
Investigation well for temperature logging

JOGMEC conducts heli-borne geophysical survey that aims to acquire basic data for the evaluation of geothermal resources in order to promote geothermal development start-up.

Air-borne Gravity Gradiometer (AGG)



Time Domain Electromagnetic Survey (HTEM)

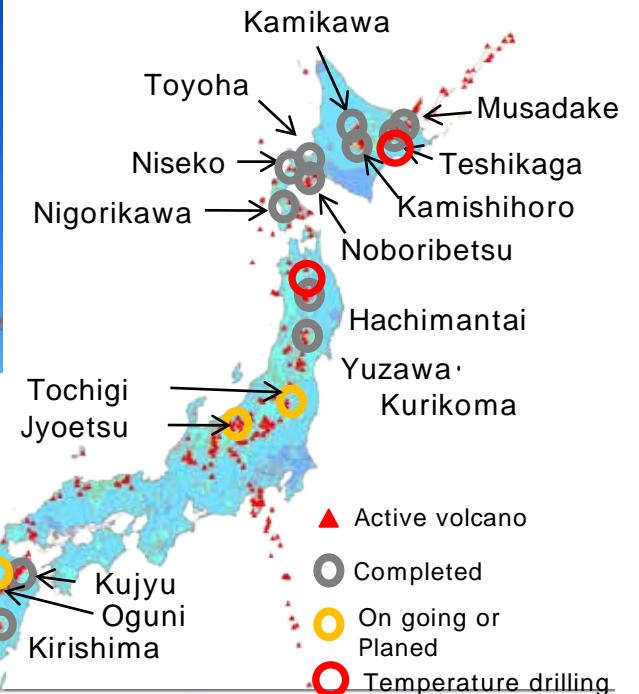


Acceptance of local people and communities are required for all activities!!

[NEW] 2017 Temperature measurement drilling



Drill well for the temperature logging in order to promote geothermal development start-up.



Ø Artificial recharge by river water(EGS technology)

The research and development to stabilize the geothermal production by improving evaluation accuracy of fluid flow, and optimizing artificial recharge technique

This project is carried out under a collaborative research with EPRI (Electric Power Research Institute in USA)

Ø Technology for Exploration of Geothermal Reservoirs

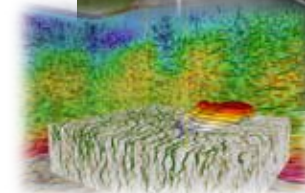
Improvement of exploration accuracy will be expected by applying the seismic method to image the geothermal reservoir structure by solving these issues.

Ø Drilling Technology

Develop the PDC* bit cutter and body for geothermal well drilling and conduct verification test in order to reduce a drilling cost.



Yanaizu-nishiyama power plant



*PDC : Polycrystalline Diamond Compact

Promote public acceptance

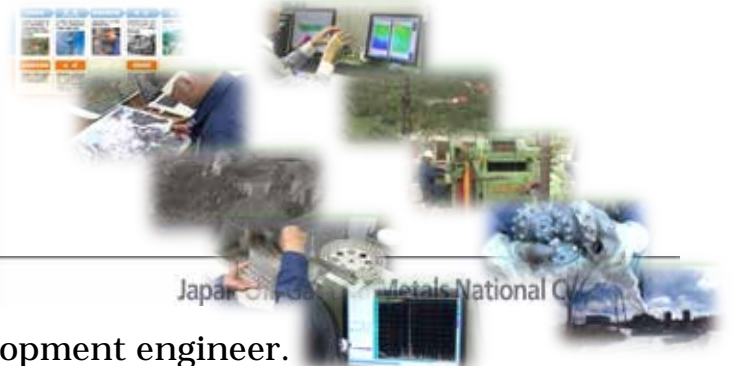
Promotion at conference, event, and by TV

Source: JOGMEC



Special classes for students

Training courses for young engineers



Japan Geothermal Energy Association

Guideline for geothermal power plant

Educational video making for geothermal development engineer.

Ø Japanese Government has been trying to expand the developable area, reduce investment risk and promote understanding of local people.

It might create some ideas in order to cope with stakeholders by learning from NZ experiences.

Appropriate approaches for the promotion is important not only for local communities but also local governments.

Ø These measures are expected to bring new interest and new investment in geothermal development in the future.

New players are now playing important roles for geothermal developments in Japan.

An aerial photograph of a lush, green forested landscape. In the center, a tall, dark drilling rig stands prominently. To its right, there are several buildings with red roofs and a paved area. The background shows rolling hills under a clear blue sky. The text "Thank you for your attention!" and "KAPAI" is overlaid in white on the image.

Thank you for your attention!
“KAPAI”