

GEOTHERMAL TECHNOLOGIES IN JAPAN

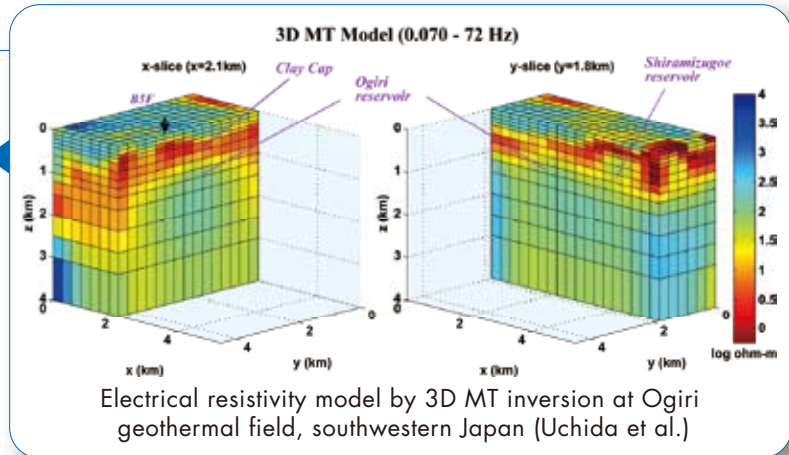
Japan has the most advanced technologies on geothermal exploration, development, utilization, and monitoring, which are used not only domestically but in international co-operations. Followings are examples of these technologies.

Exploration

Geology: remote sensing, alteration dating, etc.
Geochemistry: fluid inclusion, isotope analysis, etc.
Geophysics: 3D magnetotelluric (MT) method, high temperature well logging, seismic and VSP methods, etc.



Drilling rig at Kakkonda, which recorded the world highest temperature of 500°C (Geo-E)



Development

Drilling: directional drilling in very high temperature reservoir. **The world's highest drilling temperature (over 500°C)** was recorded in 1995 at a depth of 3700m at Kakkonda field, Japan.

HDR/EGS: At Hijiori and Ogachi fields in north-eastern Japan, research of HDR/EGS system was carried out with circulation and tracer test, micro-earthquake monitoring, binary power generation test, etc. The results are applied in overseas projects.



Turbine at Kawerau, NZ (Fuji Electric)

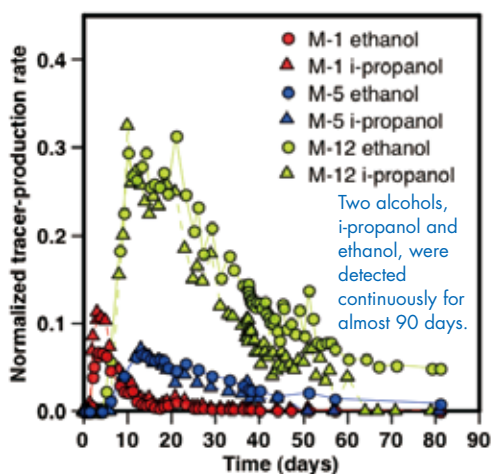
Utilization

Power plants (turbines): Japanese turbines have been used worldwide with **a share of 75%** of capacity for conventional steam power plants and in the recent 10 years 67% for all geothermal power plants including binary systems.

Scale prevention: scale inhibitor (polyacrylate), etc.

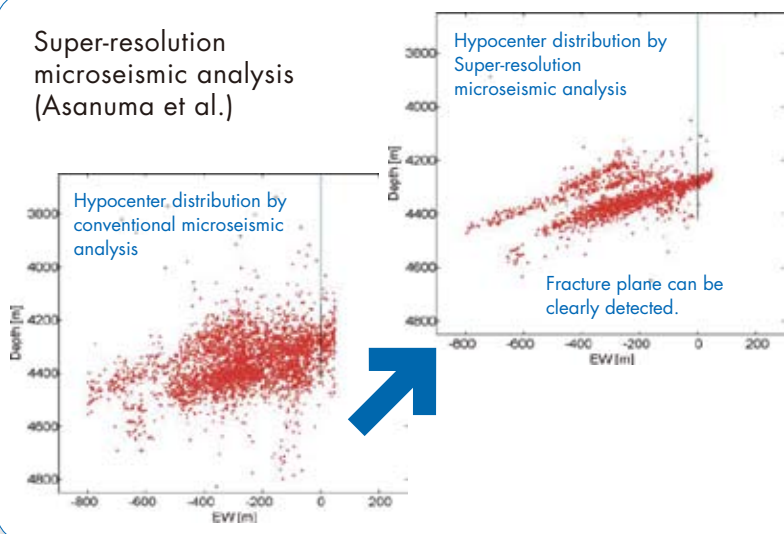
Monitoring

Geochemistry: chemical monitoring of produced fluid, two-phase tracer test, etc.



World's first two-phase tracer test: normalized tracer-return curves from the tracer test at Matsukawa in 2000 (Fukuda et al.)

Super-resolution microseismic analysis (Asanuma et al.)



Geophysics: super-resolution microseismic analysis, micro gravity, self potential, reservoir simulation with geophysical post-processors, etc.