

FROM EARTH TO ENERGY: JAPAN SHARES EXPERTISE IN SUSTAINABLE GEOTHERMAL DEVELOPMENT

Geothermal power is garnering attention as renewable energy that can provide a stable supply of electricity regardless of the weather. In Indonesia—the country with the world's second-largest geothermal resources—a Japanese plant-engineering company is helping to develop a Geothermal Master Plan, as it seeks to contribute to that country's decarbonization and advancements in the development of geothermal energy.

As the world moves toward decarbonizing amid the switch to renewable energy, one promising solution is geothermal power, which harnesses the heat of magma beneath the Earth's surface to generate electricity. Geothermal power's strength lies in its ability to generate electricity at a steady output without emitting CO₂, regardless of the weather or other environmental conditions. Meanwhile, its ability to operate continuously allows it to serve as a baseload power source, namely, as a stable, low-cost source of electricity

that can be supplied at any time of the year, day or night.

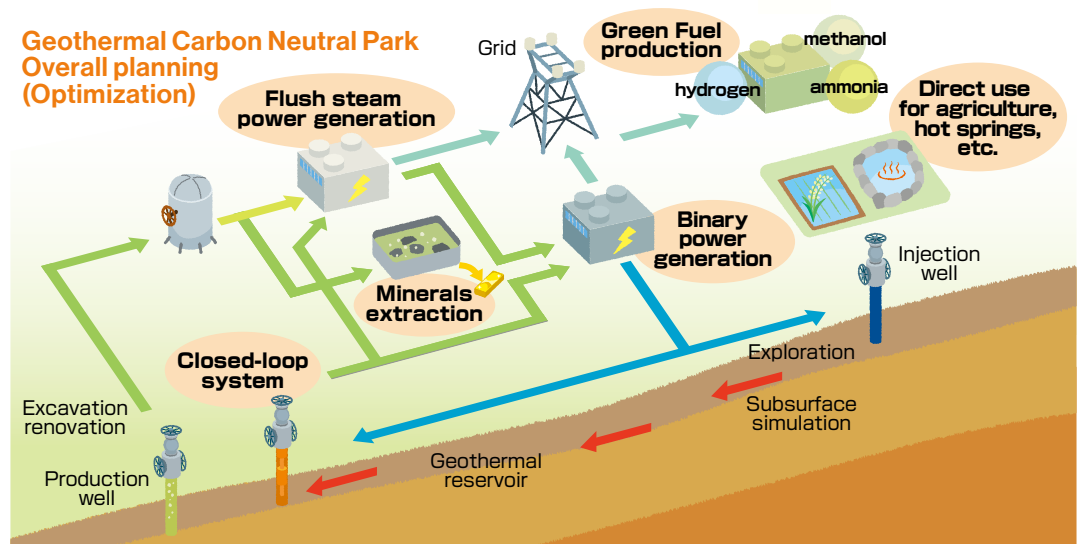
Indonesia, boasting the world's second-largest geothermal resources after the United States, seeks to achieve carbon neutrality by 2060. The country is currently accelerating its transition to clean energy by capitalizing on geothermal resources.

However, geothermal development carries significant risks. Besides the high cost of drilling, the drilled site may not end up yielding enough steam to power a turbine. Failures in drilling projects can also

harm the environment. "Although geothermal energy has great potential, when it comes to its actual development, there may not be a sufficient number of locations that have both the necessary amount of water and heat," said SAKATA Eiji, executive officer and Carbon Neutral Business Division director at Toyo Engineering Corporation, a plant-engineering company that undertakes contracts for engineering, procurement, and construction (EPC) in a single package.

To reduce risks and ensure sustainable development, the company has proposed the concept of a "geothermal carbon neutral park," which maximizes the energy production potential of existing geothermal fields, both to reduce risk and to promote sustainable development.

To generate power, for example, the project plans to employ a closed-loop system: a next-generation technology for heat extraction and power generation that is highly touted. The system, which draws water from the ground and circulates it internally, can even extract heat from fields with insufficient steam. In addition to generating electricity, it is intended to enhance the added



Toyo Engineering aims to build a sustainable, geothermal carbon neutral park to optimize existing geothermal fields and handle operations, ranging from power generation to green-fuel manufacturing. TOYO ENGINEERING CORPORATION



Toyo Engineering President and CEO HOSOI Eiji (left), together with officials from Indonesia's Ministry of Energy and Mineral Resources, attended the signing ceremony for the letter of intent on cooperation to develop the master plan.

value of the entire geothermal field by producing next-generation fuels that use such geothermal resources as green hydrogen—which does not generate CO₂ during production—and such green fuels as ammonia and methanol, while also recovering valuable mineral resources within the geothermal water, including silica and lithium.

The concept of using new technology to maximize energy from existing geothermal fields, rather than conduct new drilling with some degree of uncertainty, was so well received that Toyo Engineering recently signed a letter of intent, in August 2024, with Indonesia's Ministry of Energy and Mineral Resources (MEMR) to cooperate in developing the Geothermal Master Plan. "The MEMR expects us to propose a plan that addresses the issues particular to each geothermal field," said Sakata. The plan is set for demonstration work in Indonesia in 2025, with

commercialization in Indonesia slated for 2026–27.

Since the 1970s, Toyo Engineering has established relationships with entities in Indonesia to construct fertilizer and ammonia production facilities. In 2012, it acquired IKPT—a local Indonesian company with an extensive track record in geothermal power—as a subsidiary. The company is confident in its ability to communicate smoothly with the people in Indonesia.

Japan has an abundance of geothermal resources, but the capacity of the country's geothermal facilities is limited owing to the concentration of

these resources in volcanic areas. Another factor is the response of local communities, which oppose power-generation developments due to their potential impact on hot-spring resources using geothermal heat, despite the fact that a closed-loop system is not expected to affect the hot springs. Toyo Engineering envisions applying its geothermal development demonstrations in Indonesia to Japan and eventually expanding the technology on a global scale.

Japan will continue to pursue advanced geothermal development to help harness geothermal potential, thereby contributing to global decarbonization. ●



Left: The Dieng Small-Scale Geothermal Power Plant, managed by Toyo Engineering's Indonesian subsidiary IKPT.
Below: SAKATA Eiji, executive officer of Toyo Engineering, is in charge of its Carbon Neutral Business Division.

