Major breakthroughs must be achieved for geothermal energy to be maximised

Asia's geothermal energy is not gaining steam

Despite Asian countries' vast geothermal resources and increased regulatory support, it seems their hands are tightly tied in terms of developing more geothermal projects in the region.

When industry insiders write a report card for Asia's geothermal power development in 2016, the title should read: "Underperforming." Geothermal capacity growth has slowed across the region and not for a lack of demand or effort. Most Asian countries have been attempting to ramp up their geothermal capacity to sate growing energy needs as well as reduce their reliance on nuclear power and fossil fuels. But governments and developers are encountering significant challenges, including high exploration costs and strong public opposition. Experts insist the region's geothermal potential remains very promising as shown in landmark projects popping up in Malaysia and Taiwan, but it will take major breakthroughs to clear the path for large-scale projects in some countries like Japan.

Sparks in Southeast Asia

Capacity growth in Southeast Asia and the South Pacific regions hit a slump last year, but industry observers are excited about the rise of milestone projects and regulatory support across the region. "Although developing capacity growth has slowed in Southeast Asia and the South Pacific regions since March, it is exciting to see Malaysia entering the market with the announcement of its pilot geothermal project," says **Anthony Rocco,** author of the Geothermal Energy Association's 2016 geothermal power international market update.

Tawau Green Energy is leading the development of Malaysia's first geothermal plant at Apas Kiri-Tawau, a 30 megawatt (MW) binary plant that will use turbines from Exergy and is expected to officially operate commercially by June 2018. The plant will also benefit from the feed-in tariff (FIT) rate of US$0.10 (MYR 0.45)/kWh announced in May 2015 for Malaysian geothermal plants up to 30MW.

In Indonesia, Enel Green Power (EGP) announced it will be developing its first project, the Way Ratai plant in Lampung, which will have an expected generating capacity of 55MW. US$60m was financed from PT Geo Dipa Energy's own equity in the form of equipment and fresh funds, whilst the remainder of the project is being financed by a consortium led by PT Bank Negara Indonesia Tbk. A new 45MW project, PT Jabar Rekind Geothermal, was also announced in the second half of 2016 with a target operation date in the first half of 2020.

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More geothermal developers will also be encouraged to pursue projects as the Indonesian government prepares a FIT mechanism and legislation to attract larger investments in the sector. "The new tariff will adopt a fixed-price system where energy suppliers do not need to negotiate with the state-owned electricity firm PLN as the primary power-off taker. This new mechanism is targetted at power plants that fall within the capacity range of 5 to 220MW," says Rocco.

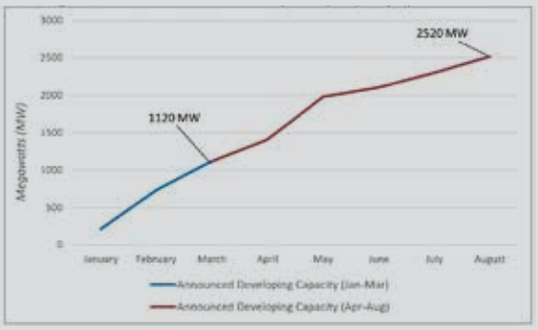
The Indonesian Energy and Mineral Resources Ministry is also working on new legislation that would provide the geothermal industry with priority investment services, as well as let investors obtain necessary permits within three hours at the Investment Coordinating Board, which is already an implemented standard in other industries.

Indonesia has a poor track record in promoting geothermal, and these proposed changes should at least increase the incentives available to geothermal developers and investors, who often feel neglected. "Clearly what's missing is the renewable framework. We still don't have solid regulatory framework for geothermal, for instance," says **Gilles Pascual**, partner, infrastructure advisory at Ernst & Young.

"The energy roadmap initially didn't even include geothermal. Renewable energy is low on the government agenda," concurs **Peter Wijaya,** vice president Commercial and Business Development at Star Energy. "If I were the government, I would say the tariff is attractive. If I were a developer, I would also say so. But the problem is implementation. To qualify for the tariff, you first need to prove that you have started exploration. That's the law. The risk is entirely on the developer," Wijaya notes.

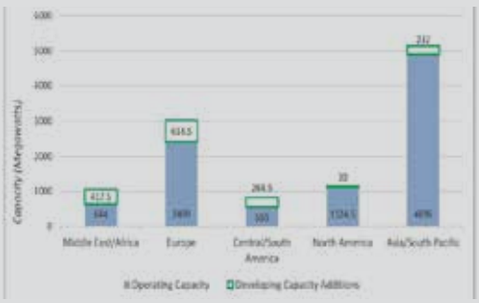
Indonesia has an ambitious target to produce 6,023MW of geothermal power by 2020. It also aims to raise the share of geothermal in the entire renewable energy share to 5.8%. But as of 2016, that share stoods at a measly 1.1%.

International geothermal nameplate capacity



Source: Geothermal Energy Association

Geothermal power operating and developing capacity by region



Source: Geothermal Energy Association

Many experts expect the country to come up short due to ongoing regulatory challenges and high exploration costs. These issues make it especially risky for investors and developers to commit to geothermal projects, and skew the market towards the development of low-risk, established fields. A single field can cost up to US$5m, excluding other costs, says **Sugeng Triyono,** president director of PT Tangkuban Parahu Geothermal Power.

Tough times for funding

"Funding for exploration is tough — investors have to take on the full risk," says Wijaya. "The exploration risk is very similar — though not as high — as oil and gas. However, the returns of geothermal is not as high as oil and gas." Wijaya reckons geothermal reservoirs are much more complex than oil and gas, estimating that as much as US$7m to US$10m can be spent exploring each well. To reach the 2020 target, Indonesia will need to add roughly 300MW of geothermal energy — or drilling around 60 wells — annually. This means the sector requires a large amount of capital, but developers and investors remain concerned about risk-sharing for such capital-intensive geothermal projects.

"Cost rises steeply the moment drilling and construction begins," says Triyono. "Someone has to catch the risk, whether it is the project owner or the government." The result is a dearth of interest to explore untapped "greenfield" projects despite the high potential for return. A positive aspect is that there has been moves to broaden the financing options for riskier geothermal projects. "Indonesian geothermal assets are extremely attractive to the private sector," says Pascual. "There are financing solutions for this on a pure non-recourse basis. For instance, the Asian Development Bank can provide funding for exploration."

Across the South China Sea, exploratory drilling has begun for Taiwan's new geothermal plant and is expected to finish in February 2017. The country has been supporting the development of geothermal projects and renewable energy through duty exemptions and subsidies.

China National Petroleum Corporation, National Taiwan University, and the Industrial Technology Research Institute will work together to develop the binary plant in Sanxing, drilling for which began in August 2016. Under Taiwan's Renewable Energy Development Act, the government will exempt developers who import machinery from the customs duty as well as provide developer subsidies of up to 50% of exploration costs or not exceeding US$1.5m (TW$50m) to the developer. A FIT of US$0.156 (TW$ 4.9315) per kWh is also granted for 20 years given that the installed capacity must be over 500kW.

Taiwan has shown increased interest in exploring geothermal as a key energy source, and the Sanxing project should serve the country's first geothermal demonstration plant that will help draw in more investors and suppliers. Meanwhile, in Japan, the prospect of building more geothermal projects, especially large-scale ones, remains grim. There is strong public opposition to the development of geothermal power on economic and environmental grounds. Detractors believe geothermal projects can have a detrimental impact on booming hot springs resorts and treasured national parks, although smaller-scale projects will face less resistance.

Gilles Pascual

Daniel Brenden

Sugeng Triyono

Japan's geothermal winter

"We do not forecast an uptick in Japanese geothermal capacity growth over the next decade despite the country's substantial geothermal energy potential," says **Daniel Brenden**, renewable energy analyst, BMI Research. "This is due to popular opposition to large-scale developments, high upfront costs, and long development time frames."

Brenden reckons only 0.1% of the projects supported under Japan's clean-energy programme use geothermal technology, and he sees little scope for geothermal to substantially increase its share in the power mix given a contraction in subsidy support. "As the country overstretched its support for new solar power capacity over the last three years, the renewables support mechanism has been reformed in order to reduce the government's subsidy burden and improve the cost-competitiveness of solar projects in the country," he says.

Amongst renewable energy sources, solar currently has the rosiest outlook in Japan. Almost US$20b is invested annually in new solar developments, making the country one of the top solar installation markets in the world. With solar power shining so bright, geothermal is taking a backseat. Combined with strong opposition from the multi-billion-dollar hot springs resort industry and the fact that roughly 80% of geothermal resources are in national parks — where development is highly restricted — Brenden believes Japan's geothermal power segment will post lacklustre growth over the coming decade. Large-scale geothermal projects, particularly, will find it difficult to overcome the stringent and long environmental assessment requirements.

"Our muted outlook for Japan's geothermal segment is largely attributed to the staunch popular opposition against geothermal developments in the country," says Brenden. "Geothermal developments pose a pertinent risk to nearby spas by potentially depleting water volumes and lowering the water temperature in springs." Geothermal power plants need hot water underground to turn their turbines, the same hot water needed by more than 21,000 spas and inns that draw around 120m customers annually for overnight visits.

"A large-scale geothermal ramp-up would likely prompt heavy opposition," says Brenden. Investor interest is also slowing on the back of long processes when it comes to environmental assessments and other pre-operational procedures of large-scale geothermal projects in Japan. This is on top of the fact that most of the country's geothermal resources are within protected national parks. "Large-scale geothermal developments in Japan

can require up to nine years of environmental assessments and survey drilling before a site can be considered workable which has reduced investor appetite," he adds. Additionally, high upfront costs of new installations also weigh on the rationale of developing large-scale geothermal projects. It should be noted that key prefectures that had been overly reliant on nuclear power are becoming more open to large-scale geothermal projects like the Fukushima prefecture's plan to build a 270MW geothermal power plant. The Fukushima Daiichi nuclear disaster in 2011 led the government to ramp up its renewable energy production as an alternative to nuclear energy, prompting the Ministry of Environment to lift restrictions to drill at national parks.

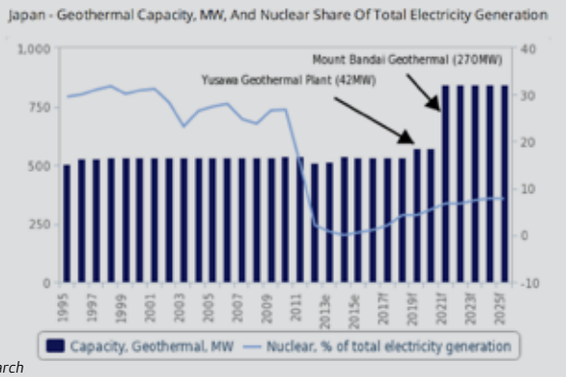
The Wasabizawa geothermal power plant in Yuzawa city in Akita prefecture — Japan's first large-scale geothermal project in about 20 years after the Takigami geothermal power plant went into operation — is also under construction and is expected to commence operations with a capacity of 42MW in 2019. Whilst large-scale geothermal projects face several challenges in the business and environmental fronts, small-scale geothermal projects have been gaining government support and look to expand in the coming years.

"Whilst our core scenario for Japan's geothermal sector is one of muted growth, we stress that our outlook for small-scale geothermal power is more buoyant," says Brenden. He points out that the Japanese government has relaxed regulation for the development of small-scale geothermal projects, including the expansion of allowable zones for surface surveys and small-scale developments to S2 and S3 in addition to the S1 or ordinary zones.

Smaller-scale facilities are less intrusive and undergo less regulatory scrutiny — facilities with a capacity higher than 77MW must undertake more extensive environmental assessments — which helps speed up the overall development time. Japanese geothermal energy companies have also been working closely with the community to lessen local opposition. Tokyo-based financial services company Orix plans to develop up to 152MW facilities by 2020, an initiative that has enabled Chuo Electric Power Company to develop Japan's first facility in 15 years — the 2MW Kumamoto geothermal plant. "The development of this plant was made possible through close cooperation with the local hot spring company Waita-kai and the Oguni resort. We believe similar developments will support some growth in Japan's geothermal segment," says Brendan.

Rocco, meanwhile, cites Sumitomo Forestry's recent announcement to develop a small 2MW power plant in Kurikoma National Park in Japan. The developer is planning to invest around US$181m in its renewable energy portfolio. Japan offers an enticing FIT rate for geothermal at 40 Yen/kW (~$.33/kW), which provides an advantageous policy framework for further development of similar projects.

Fukushima prefecture to boost geothermal capacity growth



Source: BMI Research

"We believe this change in attitude towards small-scale geothermal energy was prompted by the Fukushima disaster in 2011, which has intensified efforts to boost power generation capacity that can be sourced domestically," says Brenden. "This is particularly pertinent in light of Japanese nuclear reactors having been turned offline and fossil fuel imports spiking as the thermal sector have plugged power supply gaps stemming from nuclear closures."

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India embraces small-scale geothermal

Governments and developers are starting to focus more on smaller-scale geothermal projects, benefitting countries like India in the form of increased life expectancy and standard of living in remote, resource-poor communities. There is no geothermal power plant yet in India, a World Energy Resources report says, but geothermal resources are present in seven provinces. One such project is a collaboration between India and Norway in the northwest part of the Himalayas. Two pilot demonstration projects investigating the utilisation of low and medium temperature geothermal resources for heating purposes, successfully improved the livelihood of the local population. The area has a very short supply of electricity of roughly three hours per day, and temperatures can drop to below 20°C in winter. There is also a dearth of natural resources such as wood, so people mainly rely on fossil fuels like coal to heat their homes.

"The researchers assessed the resource potential and heat load for heating up a hotel and restaurant, and successfully managed to install heating systems that keep the indoor temperature at about 20°C. Due to the shortage of available electricity, solar panels have been installed to make the continuous operation of heat pumps possible," says the World Energy Resources report.

India has unveiled plans to develop 10,000MW of geothermal energy by 2030 with the cooperation of several countries that are amongst the top producers of geothermal power generation in the world, including the United States, the Philippines, Mexico, and New Zealand. The geothermal target is part of the government's pledge to increase the share of renewable power to 175 gigawatt (GW) by 2022, and then to 350GW by 2030. India's share of renewable energy in the total capacity mix has improved to 14.1% in FY2016 from 12.5% in FY2013, but it should be noted that the government is looking to prioritise solar and wind. Solar power holds a key advantage over geothermal and wind because it is more distributed in nature.

Still, the Indian renewable sector is gathering a lot of investment interest not only from Indian firms but foreign utilities as well, particularly European and Asian power generation companies. Geothermal energy exploration has begun in several sites such as Cambay Graben in Gujarat, Puga and Chhumathang in Jammu and Kashmir, Tattapani in Chhattisgarh, Manikaran in Himachal Pradesh, Ratnagiri in Maharashtra, and Rajgir in Bihar.

Southeast Asia Pacific Geothermal Power

Source: Geothermal Energy Association