

Taiwan

Geothermal Energy Market Overview

September 2021



Key Facts



- Installed capacity 4.5 MW.
- Goal of reaching 200 MW by 2025.
- EGS prototype geothermal plant with a 1 MWe capacity will be built in a few years.

Abstract:

Due to volcanic activity and plate collision, Taiwan, which is positioned on the Pacific Ring of Fire, has valuable geothermal resources. Taiwan is located on a plate boundary, and geothermal activity can be seen throughout the island, which has abundant geothermal resources. Taiwan may develop around 1 GWe of potential shallow geothermal energy, which is less than 3% of national total power output, based on accessible data prior to 1980. Finding alternative energy sources for generating power, particularly clean, renewable, and sustainable ones, is becoming increasingly vital for Taiwan's government in the coming years.



price of energy through Feed-in Tariffs (FIT) (BOE, 2018), subsidising funds for explorations and drillings (BOE, 2018), and investing heavily in geothermal R&D.

The Country's Energy Market

By 2025, the government has set lofty goals to shift the fundamental fuel mix, with a “20-30-50” formula that will see renewable energy provide 20% of Taiwanese electricity, coal 30%, and natural gas 50%. However, Taiwan still has a long way to go in order to achieve that lofty goal. Renewable energy accounted for only 6% of Taiwan's electrical supply in 2019. And when the grid is upgraded to handle increased capacity, the system is expected to be stressed. Furthermore, the transition from coal to gas may result in a slew of stranded assets. By 2028, Taipower plans to operate 25 GW of gas power plants. This, along with roughly 10 GW of gas-generated energy from independent power providers, might result in system overcapacity. The final conclusion is that Taiwan has a high bar—as well as competition from other Asian economies—in meeting its ambitious environmental goals and attracting the necessary investment. The government hopes to attract \$59 billion (NT\$1.8 trillion) in international investment to add 27 GW of renewable power capacity. Take, for example, offshore wind power. By 2050, Asia is expected to be the world's largest offshore wind market, accounting for up to 60% of worldwide capacity. Taiwan, on the other hand, is already a regional leader in this regard. The Ministry of Economic Affairs has expanded

Country Overview

Taiwan suffers from a scarcity of energy resources. The country is primarily reliant on energy imports from other countries. Imports account for as much as 98 percent of domestic energy output. Furthermore, the local manufacturing industry is export-oriented, and the population's and industrial sector's energy consumption are continuously high. As a result, a reliable supply of low-cost energy is a crucial condition for Taiwan's economic development. In 2018, an analysis of Taiwan Power Company's installed capacity and power generation ratio reveals that fossil fuel-based power generation accounts for 71.8 percent, with coal accounting for 38.4 percent, natural gas 31.1 percent, and fuel oil accounting for 2.3 percent, while nuclear power generation and other forms of power generation co-generation accounting for 3.4 percent, renewable energy 4.5 percent, and pumping accounting for 2.3 percent. Geothermal energy may also be used to provide base-load power and as a fossil fuel replacement. Taiwan, as a result, offers exceptional prospects, such as ensuring the



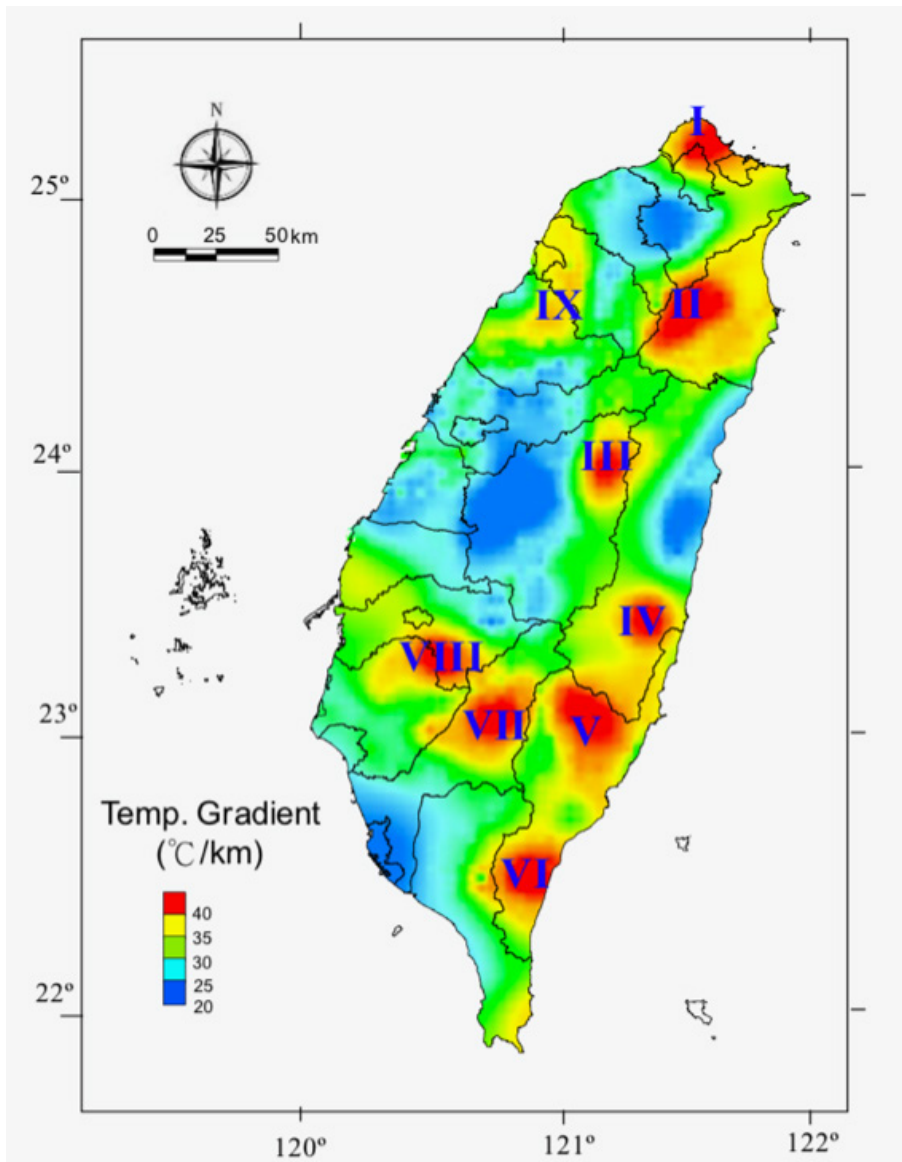
offshore wind development through competitive auctions that specifically target foreign partners, such as the \$627 million, 128 MW Formosa 1 wind complex off the coast of Miaoli County in west Taiwan, which is the first of its kind in the Asia-Pacific region. This is one of eleven offshore wind projects in Taiwan that have garnered significant investment, mainly from Nordic nations, and are anticipated to contribute 5.5 GW of capacity to Taiwan’s electrical system by 2025, with an additional 10 GW planned for 2035.

Geothermal resources and potential

Geothermal exploration has been going on since the 1960s, although it has been on hold for a long time. Taiwan may contain around 1 GWe of potential shallow geothermal energy, which is roughly 2% of national total power output, according to known data prior to 1980. As a result,

numerous small pilot geothermal power plants have been built and abandoned due to project completion, non-economic benefits, or difficult-to-solve difficulties. Geothermal energy is a vital kind of renewable energy, according to a recently released National Science & Technology Program (NSTP) planning study. Geothermal energy is anticipated to have an installed power capacity of 7.15 GWe by 2050, which is 14.65% of the present national installed capacity of 48.8 GWe. Across the past year and a half, the NSTP-sponsored geothermal energy research project in the Chingshui Area of Ilan County has used the EGS concept to evaluate the quantity of geothermal energy present in deep strata all over the island. According to the findings, Taiwan has 159.6 GWe of geothermal resources, with 33.6 GWe of exploitable quantity.

One of the NSTP initiatives has recently been doing research and re-evaluating deep geothermal energy around the island. Four possible hotspots have been identified. The Tatun Volcano Group is located in northern Taiwan; the I-Lan Plain is located in northeast Taiwan; the Lu-Shan region is located in central Taiwan; and the Hua-Tung area is located in eastern Taiwan.



Temperature Gradient Map of Taiwan with identified 108 geothermal Prospects - source: Industrial Technology Research Institute

Regulatory framework

The Renewable Energy Development Act defines ‘renewable energy’ as the direct use or processing of energy sources such as solar energy, biomass, geothermal energy, ocean energy, wind power, non-pumped storage hydroelectricity, energy from domestic and



industrial waste, or other sources of energy that are determined to be sustainable by the central authority. Biomass energy is obtained through the direct usage or processing of agricultural and forestry plants, biogas, and household organic waste, whereas geothermal energy is sourced from the soil, rocks, steam, or hot springs under the surface. The Electricity Act, the Renewable Energy Development Act, and the Implementation Regulation Governing Voluntary Renewable Energy Certificates, as well as other related rules and regulations, provide the legal framework for the development and environmental benefits of renewable energy projects in Taiwan.

The Renewable Energy Development Act and associated laws all support the formation of renewable energy-based power production and sales companies through a range of incentives in order to promote the development of renewable energy. Following a change to the Electricity Act in 2017, renewable energy electricity can now be sold directly to end consumers, with the new Regulations on Renewable Energy-Based Power Generation Enterprises Applying for Direct Supply governing the details, including eligibility and review standards. The Regulations for Favourable Power Dispatching and Wheeling Expenses govern how wheeling fees are computed for power that is wheeled out through TPC's system. TPC is also required to apply feed-in tariffs to all power generated by qualified renewable energy-based generating facilities as the sole body authorised to run the electrical grid. The National Renewable Energy Certification Centre was created in



Quingshui geothermal plant, Taiwan (source: Shou-cheng Wang)

2017 to design and execute rules related to the Taiwan Renewable Energy Certificate (T-REC) process, verification standards, and tracking system for environmental characteristics. The T-REC is proof of renewable energy consumption and environmental advantages once the renewable energy generation equipment and production quantity have been confirmed.

Geothermal Energy Utilisation today

In the Chingshui geothermal area in Ilan, northern Taiwan, a 3-MW pilot plant was built in 1981 and shut down in 1993. A new 4.2 MW binary cycle geothermal power plant has been constructed nearby and started operation in 2021. The country has enormous potential and geothermal remains one of the primary goals of the National Energy Program, Phase II (NEP-II).

Taiwan has a developed economy that requires the construction of a variety of power plants to generate large amounts of gross energy for domestic and industrial usage on a consistent basis. Taiwan, on the other hand, is located in the tropical and subtropical zones and does not require winter space heating. As a result, geothermal energy is used to generate power, although it is practically never used directly, with the exception of few hot spring swimming pools used for spa and thermal therapy in Taiwan. In Taiwan, there is now just a 300 kW geothermal power facility.

Geothermal energy, among other energy sources, may provide base-load power and a chance for a country with abundant natural resourc-



es to reduce its reliance on fossil fuels. However, geothermal energy development has been halted for more than 30 years, and there is presently no functioning geothermal power plant in Taiwan. Taiwan needs to bring technology from outside the nation to jump-start geothermal extraction rather than relying only on knowledge.

Geothermal Market & Industry

Taiwan is pursuing renewable energy projects and is contemplating offering the most appealing alternatives for the sector's development through a number of new regulatory schemes that include various incentives. With new rules, the government is promoting firms that are eager to conduct business. There are, however, a variety of market entrance techniques that might aid the process. The most successful firms in the past have maintained their local presence through smart, local joint venture initiatives.

Sources

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Current Project Development

Taiwan's Bureau of Energy plans to build 150 MW geothermal power plants in five counties by 2020, with the goal of reaching 200 MW by 2025. North Taiwan is one of the major places for installing 100 MWe power plants, while the others are about 50 MWe. Geothermal explorations, drilling, operations, and maintenance, for example, require robust staffing numbers and large investments. Taiwan must accelerate the development and installation of geothermal power plants in order to meet the objectives. Several teams, both private and public, are actively conducting additional explorations and exploitations in Taiwan.

Outlook

In a few years, Taiwan will perform more comprehensive geothermal energy assessments on select planned hot spots, and build an EGS prototype geothermal plant with a 1 MWe capacity.

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