

BALANCING DOMESTIC CONSTRAINTS AND INTERNATIONAL ENVIRONMENTS: THE CASE OF TAIWAN'S ENERGY POLICY

EQUILIBRANDO RESTRIÇÕES INTERNAS E CONTEXTOS INTERNACIONAIS: O CASO DA POLÍTICA ENERGÉTICA DE TAIWAN

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Abstract

In this research, we explore the energy environment in Taiwan shaped by domestic industrial demand and external geostrategic pressures. It is still very heavily dependent on imported fossil fuels and we find that electricity generating capacity is dominated by coal, oil and natural gas. Large consumers like TSMC highlight the strategic importance of energy security. The governance of the electric sector highlights the underlying tensions that exist between promoting economic development, environmental sustainability, and public opposition to the use of nuclear power. The government has responded to this with efforts to promote renewable sources of energy such as solar, wind, bio-energy, geothermal energy and ocean energy through feed in tariffs, electricity policy and infrastructure subsidies. However, by the end of 2024 renewable energy sources produced only 11.9% of Taipower's generated electricity which indicates the problems associated with fully substituting thermal supply. The decentralized nature of the supply of renewable energy sources exposes governmental policy problems in addressing the local energy demands. It is still far too uneven, and also notable are the demands of the businesses in the sector for efficiency in production that are at odds with socio-environmental objectives. The energy future for Taiwan lies in addressing the balance between sustainability, energy security and electricity diplomacy in response to changes in present international relations.

Keywords: Energy Transition. Renewable Energy. Energy Security. Industrial Demand. Taiwan Power Generation.

Resumo

Nesta pesquisa, exploramos o panorama energético de Taiwan, moldado pela demanda industrial interna e pelas pressões geoestratégicas externas. O país ainda depende fortemente de combustíveis fósseis importados, e constatamos que a capacidade de geração de eletricidade é dominada pelo carvão, petróleo e gás natural. Grandes consumidores, como a TSMC, destacam a importância estratégica da segurança energética. A governança do setor elétrico evidencia as tensões subjacentes que existem entre a promoção do desenvolvimento econômico, a sustentabilidade ambiental e a oposição pública ao uso da energia nuclear. O governo respondeu a isso com esforços para promover fontes renováveis de energia, como a solar, eólica, bioenergia, energia geotérmica e energia oceânica, por meio de tarifas de alimentação, políticas de eletricidade e subsídios à infraestrutura. No entanto, até o final de 2024, as fontes de energia renováveis produziram apenas 11,9% da eletricidade gerada pela Taipower, o que indica os problemas associados à substituição total do fornecimento térmico. A natureza descentralizada do fornecimento de fontes de energia renováveis expõe problemas nas políticas governamentais ao lidar com as demandas locais de energia. A situação ainda é muito desigual, e também são notáveis as demandas das empresas do setor por eficiência na produção, que estão em conflito com os objetivos socioambientais. O futuro energético de Taiwan reside em encontrar o equilíbrio entre sustentabilidade, segurança energética e diplomacia elétrica, em resposta às mudanças nas relações internacionais atuais.

Palavras-chave: Transição Energética. Energia Renovável. Segurança Energética. Demanda Industrial. Geração de Energia de Taiwan.



1 INTRODUCTION

The current energy situation in Taiwan encompasses energy supply, energy use, energy mix, and energy policies. This concept covers all aspects of Taiwan's energy sector, such as energy sources, energy demand, energy supply security, energy policy, and the impacts on the environment and climate. Taiwan's energy policy is focused on the enhancement of energy supply security and the response to the challenges of climate change and environmental protection. The government advocates energy-saving and carbon-reduction measures, encourages the public to use energy-efficient products, and advances smart grid technologies to improve the efficiency of energy management. In addition, the government also promotes public participation in the development of renewable energy, drives energy decentralization and fosters community involvement.

In Taiwan, energy use comes in a variety of methods and types. The main sources include petroleum, coal, natural gas, nuclear energy, renewable energy (such as wind and solar), and hydropower. For a long time, nuclear energy has been one of Taiwan's primary sources of electricity. However, Taiwan has established plans to gradually reduce the share of nuclear energy in its energy mix and to step up the development of renewable energy. Taiwan's energy policy emphasizes the increase of the share of renewable energy to reduce dependence on traditional energy, minimize environmental impacts, and promote energy diversification. Wind and solar power are regarded as key areas for future development. Through investment and technological progress, the government is committed to expanding the share of renewables.

However, limitations and challenges remain when it comes to energy use. These include energy supply stability; opinions from the American Chamber of Commerce (AmCham); threats from China, issues of political corruption; as well as public opinions and another referendum on Nuclear Power Plant. Ultimately, the government needs to ensure stable energy supply whilst seeking to resolve these issues and promote sustainable practices of energy use.

2 LITERATURE REVIEW

2.1 Importance of energy use in Taiwan

Taiwan currently has a population of 23 million, and its energy supply relies heavily on imports. Taiwan's energy mix is highly dependent on coal and petroleum. Since energy use is closely tied to industrial development—particularly the electricity demand of high-tech industries—energy supply is critical. The high-tech sector is a major consumer of electricity. For example, Taiwan Semiconductor Manufacturing Company (TSMC) consistently ranks among the top power users in Taiwan's industrial sector. From 2017 to 2022, TSMC accounted for 4.36%, 4.34%, 5.11%, 5.92%, 6.38%, and 7.54%, respectively, of Taiwan's total electricity consumption (Taiwan FactCheck Center, 2023).

The industries in Taiwan influence the global economy, especially the semiconductor industry. Taiwan holds a significant position in the global semiconductor sector. As TSMC is one of the world's largest semiconductor manufacturers, Taiwan is a key global supplier and electronics manufacturer on a global scale. Second, in the information technology (IT) industry, Taiwan is home to numerous IT companies, especially in hardware and electronics. The electronic components and finished goods produced in Taiwan are essential to the global IT and consumer electronics industries. Third, Taiwan's manufacturing industries cover a wide range, including auto parts, electronic components, home appliances, textiles, and more. Fourth, Taiwan's petrochemical industry is also well known, notably Formosa Plastics Group's Sixth Naphtha Cracker Complex. These patterns of energy use are closely linked to environmental factors and geopolitical dynamics (Wang, Ren and Li, 2024).

Industrial development in Taiwan is closely tied to energy consumption, with sectors like semiconductors, IT, and petrochemicals relying heavily on stable and intensive power supply. Understanding these energy demands is crucial for shaping sustainable strategies and ensuring long-term energy security. Relationship between industries and energy use is as follows.

- 1) Semiconductor manufacturing

The manufacturing of semiconductors is a highly precise and energy-intensive process. It requires large amounts of electricity, particularly for production of advanced chips. Semiconductor plants are therefore typically located in regions with stable power supply and relatively low electricity costs and constantly in pursuit of energy-saving and eco-friendly technologies to reduce energy waste and carbon footprints.

2) IT and telecommunications

Taiwan's strength in IT drives demand for high capacity and uninterrupted electricity to feed data centers and digital infrastructure. The backbone of the reliability of the internet, the cloud and connectivity to the world depend on these systems. As the digital industries grow, energy resilience is a necessary strategic imperative. Supplying a stable power supply is key to supporting Taiwan's technological edge as well as its economic momentum.

3) Petrochemicals

The petrochemical industry in Taiwan mainly depend on petroleum and natural gas for its energy use in the production of petrochemical products and the generation of power. For example, Taiwan's petrochemical industry refines imported crude oil into products like gasoline, diesel, and kerosene. This process demands significant energy, including the burning of natural gas to generate heat, electricity supply and power for operations. Petrochemical plants in Taiwan also manufacture plastics, rubber, synthetic resins, and other petrochemical products. These processes require high temperatures, high pressures, and specific catalysts, all of which need substantial energy, usually provided by natural gas. Finally, petrochemical complexes consume large amounts of electricity not only for production processes but also for support of operations, lighting, and monitoring systems. This electricity typically comes from central power plants possibly fueled by coal, natural gas, nuclear, or renewables.

On the other hand, Taiwan's leading industries include semiconductors, IT, and petrochemicals and are quite heavily dependent on intensive supplies of stable energy. They require enormous supplies of electricity and fossil fuels, especially natural gas, to sustain their operations and infrastructures. Hence, their heavy dependence indicates the urgency and importance for energy planning to achieve a proper balance between industrial growth and long-term sustainability.

2.2 Taiwan's energy governance

In terms of Taiwan's energy governance, Chou, Walther, and Liou (2019) point out that thermal power generation is currently the mainstream source. Moreover, over 97% of Taiwan's energy relies on imports. Taiwan's goal is to become a nuclear-free country by 2025, which involves replacing the current 8.3% share of nuclear power generation with domestic renewable energy (Kung and McCarl, 2020).

Over the past 20 years, Taiwan's low-carbon and energy transition plans have shown contradictions. From the perspective of the post-development theory, the government's economic orientation has caused Taiwan to lag behind other industrialized countries. Meanwhile, the economy is gearing toward energy-intensive industries at the expense of the environment and public health. However, after Taiwan's rapid rise in the 1970s to over US\$10,000 GDP per capita in 1992, its competitive advantage has been gradually weaning off reliance on low-cost labor or low production based on exploitative systems. During this period, environmental awareness grew, and the government placed greater focus on environmental protection and labor rights. In the 1980s, the electronics industry flourished in science parks and became one of the pillars of Taiwan's economy. In the meantime, from the commissioning of the Fifth Naphtha Cracker Plant in 1994 to the completion of the Sixth Naphtha Cracker Plant in 1998, the government continued to promote the chemical industry. This resulted in the coexistence of two energy-intensive industries in Taiwan: electronics and petrochemicals (Chou, Walther, and Liou, 2019).

Taiwan's energy use comes with several characteristics regarding energy mix, energy policy, and energy sustainability. Key information about energy use in Taiwan includes the following:

1) Energy Mix

Taiwan's main energy sources include petroleum, natural gas, coal, and some renewable energy. Petroleum dominates Taiwan's energy mix, mainly used as transportation fuel and for power generation. Natural gas is also an important energy source for electricity generation and industrial purposes. Renewable energy sources such as solar and wind are gradually increasing but still account for a relatively small percentage.

2) Carbon Emissions

The Taiwanese government is committed to improving the energy mix, reducing dependence on imported energy, and enhancing energy efficiency. To achieve these goals, Taiwan has adopted various policy measures, including encouragement of renewable energy development, strengthening of energy efficiency standards, reduction of carbon emissions, and advocacy for e-mobility. For example, policymakers encourage the use of waste wood as both a material and an energy to help reduce greenhouse gas emissions (Tsai, 2021).

3) Renewable Energy

Taiwan has abundant solar and wind energy resources and understandably, solar and wind power generation has been steadily increasing. The government supports the development of solar and wind power projects and has established regulations to encourage the use of renewable energy. For example, the Renewable Energy Development Act has authorized and integrated both the supervisory measures and incentives to drive the significant progress of solar energy in Taiwan since 2009. In this respect, the feed-in tariff system has played a decisive role in the development of renewable energy generation. For instance, solar photovoltaic power generation has shown a rapid growth trend (Tsai, 2021). The Taiwanese government must also take proactive actions in areas such as regulations and environmental impact assessments to promote the sustainable development of offshore wind power (Kao and Pearre, 2017).

4) Energy Security

Taiwan has long faced challenges in energy security because it is highly dependent on imported energy resources, especially petroleum and natural gas. The government has taken measures to diversify energy supply sources in order to reduce reliance on certain countries. Taiwan is striving to improve its energy mix, promote the use of renewable energy, and enhance energy efficiency to achieve a more sustainable outlook in terms of energy. These efforts help reduce carbon emissions, mitigate climate change, and strengthen energy security. Taiwan's energy policies and practices are likely to continue evolving in the future to adapt to ever-changing energy challenges (Chen, Lu, and Chang, 2007).

2.3 The need for and use of new energy in Taiwan

1) The Need for New Energy

As the opposition to nuclear power has gained certain public and political support in Taiwan, the demand for new energy has become urgent. With the decline in nuclear energy use, Taiwan must find alternative sources to fill the gap, such as solar, wind, biomass, and geothermal energy. Hamburger (2019) also discussed the importance of utilizing new energy.

2) Use of New Energy

Taiwan has been proactively promoting the development of renewable energy in order to reduce dependence on traditional fossil fuels, cut down greenhouse gas emissions, and achieve energy security and sustainable development. Taiwan's major initiatives and development directions in renewable energy are described below.

a) Solar Energy

Indeed, Taiwan owns abundant solar resources and the government has actively promoted solar energy by offering various incentives, including subsidies for solar power generation to encourage individuals and businesses to invest in and install solar facilities. In addition, tax reductions have provided economic backing for the solar industry. The government's support for the construction of solar rooftops and photovoltaic power plants has resulted in the expansion of solar infrastructure. Consequently, the photovoltaic industry in Taiwan has grown rapidly in recent years and become an important pillar of the local economy. This development not only helps reduce reliance on traditional energy sources but also increases the share of renewable energy in the overall energy mix, contributing to environmental protection and sustainable development (Chang, Lou, Ko, 2019).

b) Wind Energy

Taiwan's maritime areas indeed provide favorable conditions for wind power generation, particularly in the Taiwan Strait and the East China Sea. This has prompted the government to take a proactive stance in its wind energy policies to encourage the construction of wind power projects. These projects include both onshore and offshore wind farms, aiming to make full use of Taiwan's abundant wind resources. The wind farms already built have provided Taiwan with renewable energy and helped reduce its

reliance on traditional energy sources. The government plans to further expand wind power capacity in the coming years, involving the construction of new wind farms and the upgrade or expansion of existing ones. These measures will help increase the share of wind power in the overall energy mix, contributing to energy diversification and environmental sustainability (Zhang et al., 2017; Gao, Huang, and Lin, 2021).

c) Bioenergy

The Taiwanese government actively encourages the development of bioenergy, including biodiesel, bioethanol, and biomass energy. These bioenergy sources can be utilized in a wide range of use cases, such as transportation fuels, power generation, and hot water supply. Biodiesel, a fuel made from biomass raw materials, can replace traditional petroleum diesel and hence reduce carbon emissions of the transportation sector. Bioethanol is a biofuel that can be blended with gasoline, to help reduce the use of conventional gasoline and increase the renewable share of energy. In addition, biomass energy encompasses power generation and hot water systems based on biomass, to replace traditional fossil fuels and reduce dependence on non-renewable energy. The development of bioenergy not only helps reduce greenhouse gas emissions but also contributes to the creation of a greater supply of renewable energy. With governmental encouragement and corresponding policy support, Taiwan has made positive progress in environmentally friendly and sustainable use of energy (Chuang, Cheng, and Cheng, 2022).

d) Geothermal Energy

Located along the Pacific Ring of Fire, Taiwan is endowed with abundant geothermal resources. The government actively supports the development of geothermal energy for supply of heat and generation of electricity. Taiwan has already established several geothermal power plants and demonstrated the feasibility of electricity generation by harnessing underground heat. The development of geothermal energy serves as a clean power generation method, plays a role in heat supply and reduces the need for conventional energy sources. Geothermal plants typically use high-temperature underground water or steam to drive turbines and generate electricity. This method is environmentally friendly and provides a stable source of energy (Wang, Lo, Song, and Wu, 2021).

e) Ocean Energy

Thanks to its unique geographical location—situated between the Taiwan Strait and the East China Sea, Taiwan enjoys access to abundant marine energy resources, including tidal, ocean current, and wave energy. The government actively promotes the research and development of these ocean energy sources to make full use of renewable marine resources and meet the energy demands.

Tidal energy is generated by the movement of tides, whilst ocean current energy is about the transformation of the kinetic energy of marine currents into electricity. Wave energy, on the other hand, converts the mechanical motion of ocean waves into power. The stability and predictability of marine energy sources hold great potential to become an important part of Taiwan's energy mix.

In summary, the Taiwanese government is committed to gradually reducing dependence on fossil fuels and increasing the share of renewable energy in total energy consumption to address the challenges of climate change and energy security. Taiwan's renewable energy policies and developments will continue to evolve and adjust in response to changing needs and technological advancements.

3 INDUSTRIAL STRUCTURE AND ENERGY USE IN TAIWAN

As of the end of 2022, the total installation of renewable generation capacity reached 14,133 MW, including 2,098 MW of hydropower, 5 MW of geothermal power, 9,724 MW of solar photovoltaic power, 1,581 MW of wind power, 92 MW of biomass power, and 632 MW from waste-to-energy generation. The total generation of renewable energy reached 23,844,899 MWh, consisting of 5,836,503 MWh from hydropower, 25,008 MWh from geothermal power, 10,676,988 MWh from solar photovoltaic power, 3,543,061 MWh from wind power, and 3,605,128 MWh from waste-to-energy generation.¹

The energy mix in terms of supply and demand in Taiwan can be further summarized as follows (Huang and Wu, 2009):

1) Energy Mix

¹ <https://www.taipower.com.tw/en/page.aspx?mid=4495&cid=2827&cchk=ee217b56-d61e-430a-8a02-62862029bfab>. This webpage provides relevant information about Taiwan's renewable energy overview.

The energy mix in terms of production/consumption in Taiwan is highly diversified, mainly including petroleum, coal, natural gas, nuclear energy, renewable energy (such as wind and solar power), and hydropower.

2) Electricity Generation

The electricity generation in Taiwan primarily relies on coal, natural gas, and nuclear power. Nuclear power has historically accounted for a significant share; however, due to public concerns over nuclear safety, the government has planned to gradually reduce the use of nuclear energy and increase the share of renewable energy.

3) Development of Renewable Energy

Taiwan is actively promoting the development of renewable energy, particularly wind and solar power. The government has set renewable energy targets and implemented corresponding policies and subsidies to encourage the adoption of renewable sources.

4) Energy Security

Given its lack of natural resources, energy security has always been an important issue in Taiwan. Therefore, Taiwan strives to develop domestic energy sources and engage in international energy cooperation to ensure a stable and reliable energy supply.

5) Green Energy Policies

The government actively promotes green energy policies, including the reduction of dependence on fossil fuels, improvement of energy efficiency, advancement of energy transition, and mitigation of environmental impacts.

To supplement the above overview of major energy sources in Taiwan, the energy and power generation structure of Taiwan Power Company (Taipower) in 2024 is provided below:

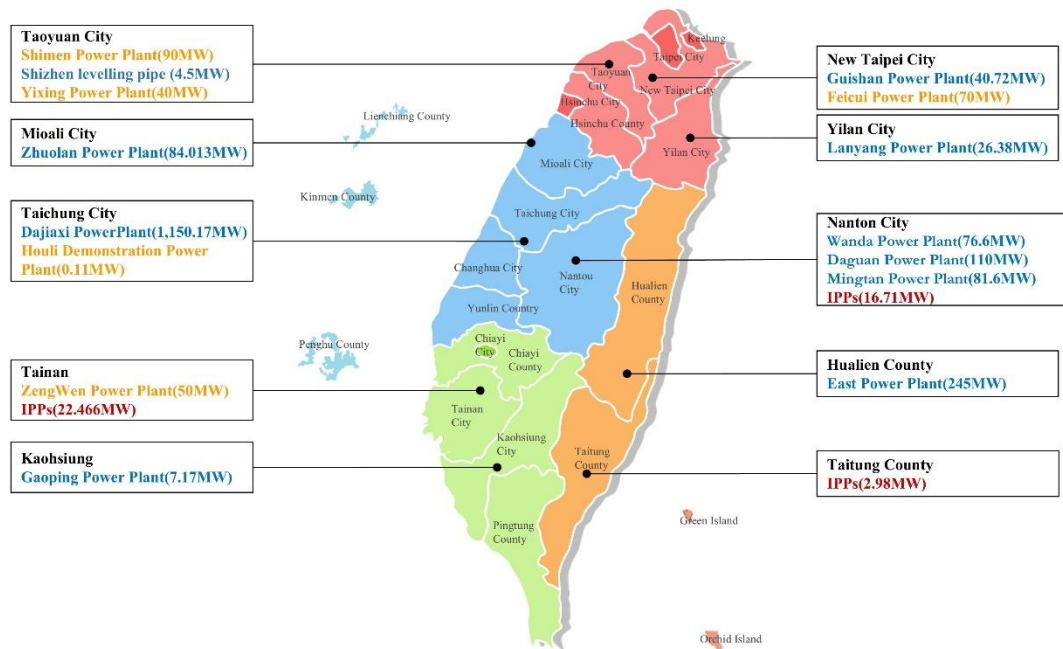
The total electricity generation of the Taipower systems amounted to 251.4 terawatt-hours (TWh). Among this, thermal power generation accounted for 79.7% of the total; cogeneration 2.4%; renewable energy 11.9% (including wind, solar, hydro, methane, and waste-to-energy); pumped-storage hydroelectric power 1.2%; battery energy storage systems 0.1%; and nuclear electricity 4.7%².

² <https://www.taipower.com.tw/2764/2826/2829/2834/25102/>. The webpage introduces historical electricity generation.

Taipower's generation mix in 2024 highlights Taiwan's heavy reliance on fossil-fuel-based power, with thermal power making up nearly 79.7% and indicates the still significant challenge of energy transition. Although renewable energy covers a diversity of sources such as wind power, solar photovoltaic (PV), hydropower, biogas, and waste-to-energy, its relatively low share at 11.9% of total generation suggests that green energy has yet to become mainstream. Nuclear power, accounting for only 4.7%, continues to be a subject of ongoing debate between energy policy goals and public consensus. Notably, energy storage technologies, such as pumped-storage hydro and battery energy storage, represent 1.2% and 0.1%, respectively. While currently limited in scale, these technologies are key to the enhancement of grid resilience and stability in the future. Overall, Taipower's generation profile underscores the policy challenges in balancing carbon reduction, energy diversification, and reliable electricity supply, reflecting both the real-world constraints and potential opportunities Taiwan faces on its path toward a sustainable energy future.

Furthermore, this study provides a detailed discussion on wind power generation, photovoltaic (PV) distribution, and the geographic locations of hydroelectric generation in Taiwan. For instance, the distribution map of wind power generation in Taiwan is shown below:

Figure 1
Distribution of Wind Power Generation in Taiwan



Blue Letter TPC Orange Letter Run by TPC Red Letter IPP follow MOEA https://www.moeaea.gov.tw/ecw/populace/content/Content.aspx?menu_id=1001

Source: <https://www.taipower.com.tw/en/page.aspx?mid=4495>

The figure above provides an overview of the distribution of power plants in Taiwan (by county/city and in terms of operating entities), with the locations and generation capacities summarized as follows.

- Taoyuan City: Shimen Power Plant (90 MW, Taipower) and Yixing Power Plant (40 MW, Taipower)
- Mioali City: Zhuolan Power Plant (84.013 MW, Taipower)
- Taichung City: Dajiaxi Power Plant (1150.17 MW, Taipower) and Houli Demonstration Power Plant (0.11MW, Taipower)³
- Tainan City: ZengWen Power Plant (50 MW, Taipower) and others (22.466 MW, IPPs)
- Kaohsiung City: Gaoping Power Plant (7.17 MW, Taipower)

³ The Organizational Act of the Energy Administration, Ministry of Economic Affairs, was enacted on September 26, 2023, and as a result, the Bureau of Energy (BOE) was upgraded into the Energy Administration (EA). The Energy Administration is under the jurisdiction of the Ministry of Economic Affairs (MOEA).

- New Taipei City: Guishan (40.72 MW, Taipower) and Feicui Power Plant (70 MW, Taipower)
- Yilan City: Lanyang (26.38 MW, Taipower)
- Nantou City: Wanda Power Plant (76.6 MW, Taipower), Daguang (110 MW, Taipower), Mingtan (69.62 MW, Taipower) and others (16.71 MW, IPPs)
- Hualien County: East Power Plant (245 MW, Taipower)
- Taitung County: Independent power plants, IPPs (2.98 MW, IPPs)

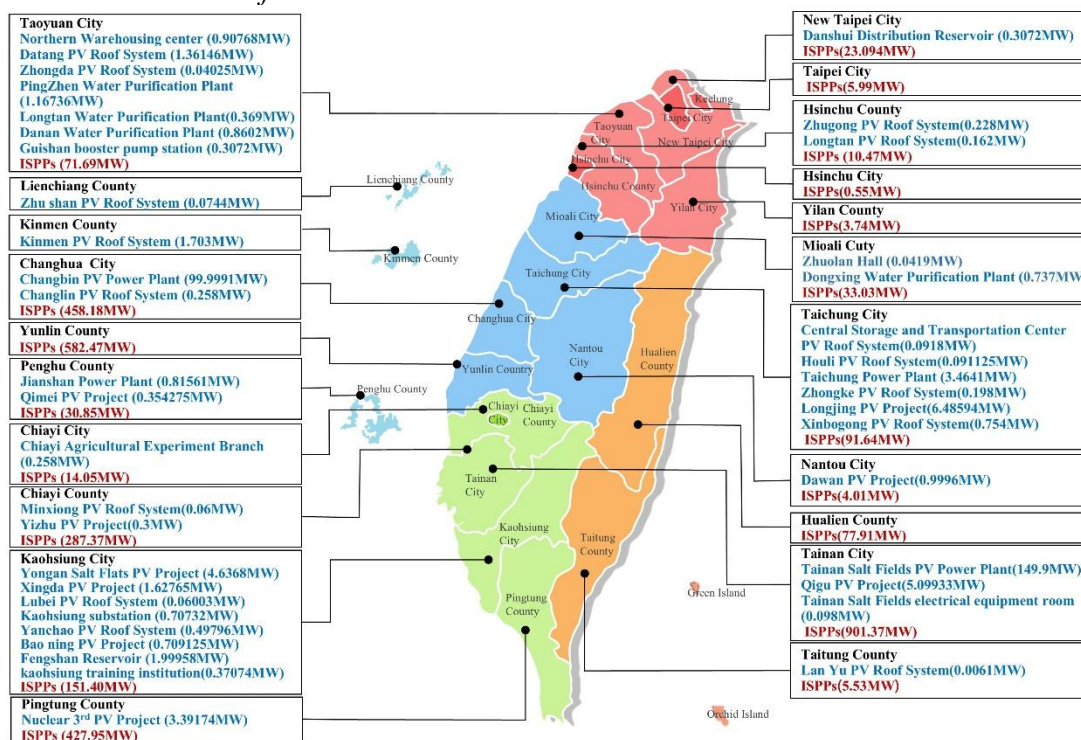
Indication of operating entities: Blue for Taipower, Orange for Energy Administration under Ministry of Economic Affairs, and Red for IPPs

This map presents the distribution of power generation facilities all over Taiwan and reflects the diversity of operating models and energy sources.

The following is the distribution of solar photovoltaic power generation in Taiwan:

Figure 2

Distribution of Solar Photovoltaic Generation in Taiwan



Blue Letter: TPC Red Letter: ISPPs –follow MOEA (https://www.moeaea.gov.tw/ecw/populace/content/Content.aspx?menu_id=1001)

Source: <https://www.taipower.com.tw/en/page.aspx?mid=4495>

The map above presents the distribution of power generation facilities (by region and by type) in Taiwan. Relevant details are provided below:

1) Norther region

Taipei City: City center (5.99 MW)

New Taipei City: Distribution systems at Dansui Reservoirs (0.3072 MW)

Taoyuan City: Northern Warehousing Center (0.90768 MW)

Note: The facilities in the northern region are primarily small-scale distributed generation and solar systems installed at warehousing centers. The capacity of each system is relatively small but these systems are densely located.

2) Central region

Taichung City: Solar rooftops (0.0918 MW) and others

Changhua County: Changbin PV Rooftop System (99.9991 MW)

3) Southern region

Tainan City: Solar PV rooftops (149.9 MW), etc.

Kaohsiung City: Yongan Salt Flats PV Project (4.6368 MW), etc.

With multiple large-capacity thermal power plants, the southern region is an important supplier of electricity in Taiwan.

4) Eastern region

Hualien County: ISPPs (77.91MW)

Taitung County: Lan Yu PV Roof System (0.0061 MW)

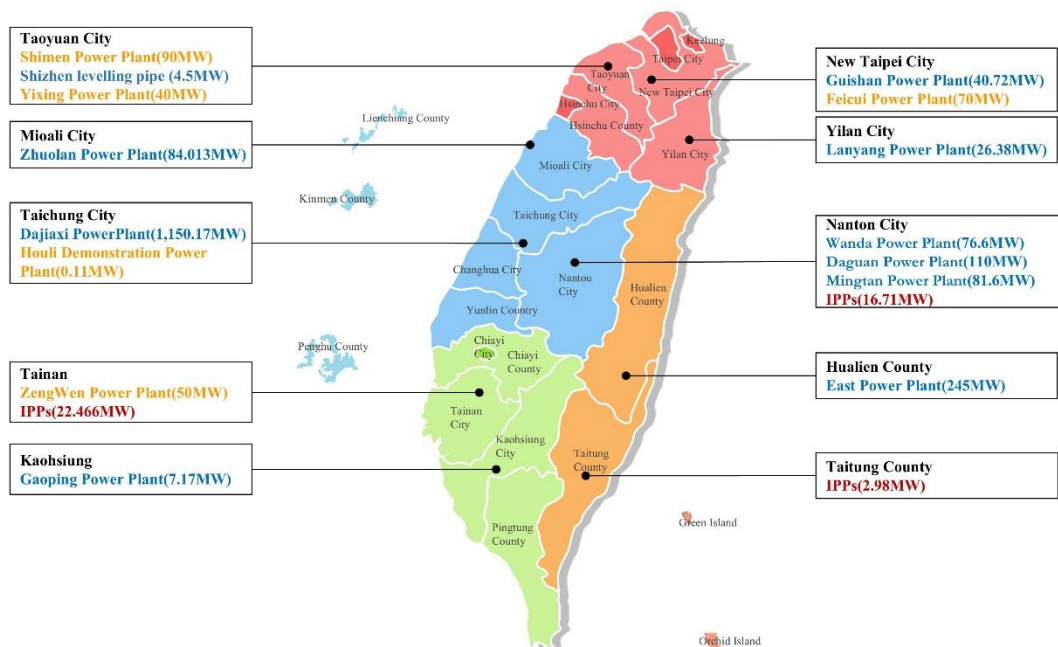
The facilities in the eastern region are most distributed generation systems, low in capacity but supportive to the region, nonetheless.

This map illustrates how offshore wind power embodies the direction of energy transition and the gradually growing share of renewable energy in Taiwan. Meanwhile, the geographical distribution of electricity generation facilities in Taiwan reflects both regional differences in energy policy and the development trends of renewable energy.

The locations of hydropower generation plants in Taiwan are shown as follows:

Figure 3

Locations of Hydropower Generation Plants in Taiwan



Blue Letter TPC Orange Letter Run by TPC Red Letter IPP follow MOEA https://www.moeaea.gov.tw/ecw/populace/content/Content.aspx?menu_id=1001

Source: <https://www.taipower.com.tw/en/page.aspx?mid=4495>

The above map illustrates the distribution of power plants (by county/city and in terms of operating entities) in Taiwan:

1) Northern region

Taoyuan City: Shimen Power Plant (90 MW, Taipower) and Yixing Power Plant (40 MW, Taipower)

New Taipei City: Guishan Power Plant (40.72 MW, Taipower) and Linkou Power Plant (70 MW, Taipower)

Yilan City: Lize Power Plant (26.38 MW, Taipower)

2) Central region

Miaoli City: Zhuolan Power Plant (84,013 MW, Taipower)

Taichung City: Dajiaxi Power Plant (1150.17 MW, Taipower) and Houli Demonstration Power Plant (0.11 MW, Taipower)

3) Southern region

Tainan City: ZengWen Power Plant (50 MW, Taipower) and others (22.466 MW, IPPs)

Kaohsiung City: Gaoping Power Plant (7.17 MW, Taipower)

4) Eastern and Central Mountain Range regions

Nantou City: Wanda Power Plant (76.6 MW, Taipower), Jiji Power Plant (110 MW, Taipower), Mingan Power Plant (69.62 MW, Taipower) and others (16.71 MW, IPPs)

Hualien County: East Power Plant (245 MW, Taipower)

Taitung County: Others (2.98 MW, IPPs)

This map clearly illustrates the geographical distribution and capacity differences of power generation facilities in Taiwan and reveals the different operating models and the energy mix of different regions. For instance, the high-capacity plants in Miaoli form a sharp contrast with the hydropower clusters in Nantou. Meanwhile, the southern region is dominated by thermal power plants. The distribution of power infrastructure in Taiwan demonstrates significant geographic and institutional diversity, reflecting not only regional variations in energy policy, but also the roles of different operational models in the progression towards energy transition. The different types, capacities, and management entities of power plants from north to south and from the western coast to the eastern mountains constitute a complex and dynamic energy landscape.

First, the northern region is dominated with small-scale power generation facilities and distributed systems at warehousing centers. Whilst the capacity of each site is relatively low, these systems are densely distributed, reflecting the urban demand for stable electricity supply and decentralized energy management. For example, Taipei as a regional center has a capacity of only about 6 MW. Tamsui Distribution Reservoir in New Taipei City and Northern Warehousing Center in Taoyuan City emphasize the electricity distribution and energy storage functions rather than large-scale power generation. Notably, there are also medium-sized plants managed by Taipower and the Energy Administration (MOEA), such as Shimen Power Plant and Guishan Power Plant, indicating the coexistence of state-owned and policy-oriented facilities in this region.

Second, the central region presents a markedly different energy profile. The hydro power plant on the Dajia River in Taichung City has a capacity exceeding 1,150 MW, one of largest hydro facilities in Taiwan. The solar farm in Changbin, Changhua, has a

capacity close to 100 MW. These two sites showcase the dual advantages of hydro and solar power in the central region. Also, Zhuolan Power Plant in Miaoli County has a capacity of over 84 MW, with the potential to become a large-scale thermal or hybrid facility. These installations not only support baseload power for the central region but also reflect the region's diversity and strategic balance of its energy mix.

Moreover, the southern region serves as the backbone of power supply in Taiwan. Tainan and Kaohsiung host several high-capacity thermal power plants and solar rooftop systems. The photovoltaic capacity reaches 149.9 MW in Taiwan and Yongan Salt Flats PV Project in Kaohsiung has a generation capacity of nearly 5 MW. Moreover, Xingda Power Plant along with independent power producer (IPP) facilities forms a network of baseload and renewable energy in southern Taiwan. This structure not only supports the region's industrial and urban development but also demonstrates the policy push towards renewables.

In contrast, the eastern and Central Mountain Range regions are mostly installed with hydropower and small-scale distribution facilities. Nantou City is home to several major hydropower plants (including Wanda, Dagan, and Mingtan) with a combined capacity exceeding 250 MW, underscoring the importance of mountain water resources to electricity supply. Hualien and Taitung, on the other hand, mainly feature private IPP facilities. Though smaller in scale, these plants play a supportive role in the region by supplying power to remote areas.

The distribution of Taiwan's power infrastructure shown in the figure above reflects not only geographical and resource conditions, but also a comprehensive manifestation of energy policy, operational models, and a shift towards renewable energy. State-owned Taipower leads in the establishment of core infrastructure; the Bureau of Energy promotes policy facilities and demonstration projects; and IPPs play a key role in the development of renewables and regional power supplementation. The gradual expansion of offshore wind power and rooftop solar systems symbolizes Taiwan's commitment and direction toward energy transition.

In summary, Taiwan has long relied heavily on imports in its energy supply, with over 97% of its energy sourced externally, mainly for coal, oil, and natural gas. This high dependence on imported fossil fuels not only exposes Taiwan to energy security risks, but also exacerbates carbon emissions and environmental pressures. Although the

government has set a “Nuclear-Free Homeland by 2025” target and has actively promoted renewable energy development, thermal power still accounted for nearly 80% of total generation as of 2024, with renewables making up only 11.9%. This reveals the structural bottlenecks that continue to challenge Taiwan’s progress towards energy transition.

Taiwan’s industrial structure has also intensified its energy consumption. Taking the semiconductor and information technology industries as examples, TSMC alone used 7.54% of the total electricity in 2022 on the island, reflecting the strong reliance of Taiwan’s high-tech sectors on stable and large-scale power supply. In addition, the petrochemical industry, such as the Sixth Naphtha Cracker Complex, is also an energy-intensive sector that requires vast amounts of oil and natural gas in its production processes and further drives up energy demand and carbon emissions. Whilst these industries are pillars of Taiwan’s economy, they have also placed energy policy in a constant tug-of-war between economic growth and environmental sustainability.

Over the past two decades, Taiwan’s energy governance has exhibited conflicts between policy goals and actual implementations. On one hand, the government has been advocating low-carbon transition and renewable energy development; on the other hand, it has continued to support energy-intensive industries and the construction of thermal power plants — resulting in slow progress in the adjustment of the energy mix. Although solar and wind energy hold great potential, institutional barriers remain in areas such as regulations, land utilization, and environmental impact assessment procedures. Meanwhile, emerging energy sources like offshore wind and geothermal power have yet to achieve large-scale deployment.

Regional distribution of energy facilities also highlights the mismatch between policy orientation and geographic conditions:

- The northern region is installed mostly with small-scale distribution and storage facilities, relatively low in capacity but densely located.
- The central region hosts the largest hydropower plant and major solar farms in Taiwan, demonstrating its advantage in renewable energy.
- The southern region is centered on thermal power generation, supporting industrial and urban growth.
- The eastern and Central Mountain Range regions rely mainly on hydropower and IPP facilities to supplement power needs in remote areas.

This geographical and institutional diversity illustrates the flexibility of Taiwan's energy policy but also exposes weaknesses in overall planning and resource integration. In other words, this geographic and institutional diversity reflects the flexibility of Taiwan's energy governance, even as it illustrates inefficiencies in strategic planning, inconsistent resource allocation, and the lack of an integrating mechanism for regional features into a coherent national energy vision. Addressing these deficiencies will be important for accomplishing a resilient, equitable, and sustainable energy future.

4 ENERGY STATUS IN TAIWAN

4.1 An analysis of internal factors and external environments

This study examines the current status and structural weaknesses of energy use in Taiwan and explores its governance challenges and opportunities for transformation under multiple pressures—including threats from China, concerns from the AmCham, the demand from the high-tech sector, and disruptions from local politics. The analysis on the outcomes of nuclear power referendums and the issues surrounding the distribution of interests during the development of renewable energy aims to uncover the institutional inconsistencies and social mobilization challenges underlying Taiwan's energy policy as follows.

4.2 Energy fundamentals in Taiwan

Taiwan faces several critical issues and challenges in its energy use and such issues may affect energy sustainability, energy security, and environmental protection, as outlined below (Huang and Wu, 2009; Lin, Liou and Chou, 2020; Lai and Huang, 2023):

1) Lack of domestic energy sources and strong dependence on imports

Although the Taiwanese government has invested significant resources in developing renewable energy, utilization remains limited due to technical constraints, high unit costs, and relative instability. Taiwan relies heavily on imported energy resources, particularly oil and natural gas, making its energy security vulnerable to threats such as international price fluctuations and supply disruptions.

2) Rising carbon emissions

The continued increase of thermal and gas-fired power generation in Taiwan has resulted in large amounts of greenhouse gas emissions and adverse effects on climate change. The reduction of carbon emissions, improvement of energy efficiency, and growth in the share of renewables have become urgent tasks to mitigate climate change. Taiwan's energy production and consumption have caused environmental degradation (including carbon emissions and air pollution) and placed constraints on energy sustainability and environmental quality.

3) Energy supply heavily dependent on oil and natural gas

Taiwan has a relatively less diverse energy supply that is heavily dependent on oil and natural gas. The government is actively promoting the development of renewable energy as a means of reducing reliance on imports, but this transition will take time and investment. The limited availability of domestic energy resources and their relatively limited storage capacity makes the movement to a sustainable energy supply that much more difficult. The integrated long-term energy security to be obtained will depend upon good strategic planning, a physical expansion in the available systems for the delivery of energy and regional cooperation.

4) Limited utilization of renewables and controversy of Third LNG Receiving Terminal

There will be more than three LNG receiving terminals, as Taipower is working on the fourth and the fifth ones and both projects are undergoing environmental assessments. The fourth terminal, in particular, involves potential impacts on the coral reef ecosystem off the Waimushan coast in Keelung. To address these challenges, the Taiwanese government has implemented a series of policies and measures, including an increased share of renewable energy, improvement of energy efficiency, advocacy of electric mobility, and enhancement of building energy performance. However, Taiwan must continue to make efforts to achieve more sustainable energy use and mitigate environmental impacts.

5) Energy management and challenges in Taiwan

Taiwan currently faces issues such as energy supply shortages, stability of power supply, and persistently high carbon emissions, highlighting the need for energy policies that balance supply security with environmental sustainability. Due to its heavy

dependence on imported energy, any geopolitical changes or market fluctuations could disrupt Taiwan's electricity stability and hence affect industrial operations and day-to-day life of the society. The study emphasizes that without effective energy governance and proactive renewable energy strategies, Taiwan will find it difficult to achieve its long-term goals of low-carbon transformation and energy self-sufficiency.

4.3 Threats from China

In addition to energy issues specific to the island, Taiwan must also confront energy-related threats from China, mainly in the following areas:

1) Energy supply risks

Taiwan's energy supply is significantly affected by its reliance on imports, especially oil and natural gas. Due to a lack of domestic natural resources, Taiwan depends on international markets, making its energy supply routes highly vulnerable to geopolitical and political factors. The complex relationship between China and Taiwan may aggravate this fragility. As a result, political and geopolitical risks could negatively impact Taiwan's energy security. It is necessary to diversify energy sources and strengthen international cooperation in order to address these challenges and ensure stable energy supplies.

Taiwan's heavy dependence on imported oil and natural gas leaves it highly exposed to global market volatility and geopolitics. Political or regional tensions could cause supply disruptions and pose threats to Taiwan's energy security. Meanwhile, the use of nuclear energy in Taiwan is currently a subject of public debates and political controversy. The contention between those for and against nuclear energy started in the early 1980s due to Taipower's fourth nuclear power plant project. Anti-nuclear advocates argue that Taiwan cannot withstand the risks of nuclear disasters and nuclear waste and hence insist on a "nuclear-free homeland" and promote the development of renewable energy. Pro-nuclear supporters, however, contend that nuclear power emits relatively less CO₂ compared with other energy sources (Huang and Wu, 2009).

2) Geopolitical pressure and military conflicts

Energy and geopolitics are closely interconnected (Campos and Fernandes, 2017). The tense political relationship between Taiwan and China, with China asserting that

Taiwan is part of its territory, may have negative influence on Taiwan's energy imports, cooperation, and supply chains. Such geopolitical dynamics may affect Taiwan's energy supply and policy and hence cause supply interruptions and heightened uncertainty (Yeoh, 2017).

Taiwan's geographic position also makes it a potential flashpoint for cross-strait military conflict. Any military confrontation could damage key energy infrastructure and affect energy supply and consumption. China might also gather intelligence and initiate cyberattacks targeting Taiwan's energy systems and policies to obtain sensitive information or interfere in Taiwan's energy supply.

Media pointed out that Taiwan's energy infrastructure is mainly for natural gas but its reserves can last only 11 days. In the event of war, natural gas storage tanks would be the first target of attacks, turning Taiwan's natural gas-based energy policy into the most pressing crisis of national security.⁴

Approximately half of Taiwan's electricity supply comes from liquefied natural gas (LNG). The report highlights that all of Taiwan's LNG and coal are imported and that Taiwan's limited storage capability represents a strategic threat. The Taiwanese government has been striving to reduce its dependence on imported energy, increase the share of renewable energy, and establish policies to confront these potential threats. Meanwhile, the international community continues to monitor the stability of the Taiwan Strait, encourages dialogues among all parties and advocates the solution of differences through diplomatic measures in order to maintain regional peace and security.

a. AmCham's Viewpoint on Taiwan's Energy Situation

As a representative organization of foreign companies, the AmCham observes Taiwan's energy development not only from the standpoint of industrial operational efficiency but also with deep concern for its potential implications on national security. Its key viewpoints are as follows:

The AmCham indicates that since Taiwan began to phase-out nuclear energy, the country's future energy sufficiency has become heavily dependent on the development of renewable energy, particularly offshore wind power. Meanwhile, Taiwan will also

⁴ <https://focustaiwan.tw/cross-strait/202509080009>. Taiwan relies heavily on imported energy, with oil and liquefied natural gas (LNG) accounting for the majority of its supply.

*become more reliant on liquefied natural gas (LNG). What is concerning is that Taiwan is seriously lagging behind its intended transformation of energy mix. This in turn affects both industrial operations and national security.*⁵

This delay not only affects the operational efficiency of energy-intensive sectors such as semiconductors and petrochemicals but may also undermine foreign investors' confidence and weaken Taiwan's strategic position within the global supply chain. More importantly, the sluggish pace of energy mix restructuring and the overreliance on a single energy source make Taiwan vulnerable to geopolitical risks. As a result, energy issues have escalated to the level of national security and become a core policy area in need of cross-departmental coordination and long-term strategic planning.

b. Impact on Taiwan's Industries

High-tech industries, especially semiconductor manufacturing and information technology sectors, require large amounts of energy. How energy consumption affects high-tech industries in Taiwan is described as follows:

1) Electricity demand

High-tech manufacturing processes, particularly semiconductor production, require enormous amounts of electricity. This is one of the reasons why the high-tech sectors in Taiwan are the largest electricity consumers. The government has long hesitated to push for an energy and industrial transformation aimed at reducing carbon emissions, as the industrial community generally resists carbon reduction policies.⁶

Since 2016 under President Tsai Ing-wen's administration, the government has finally established a goal for renewable energy to reach 20% of the energy mix by 2025, aiming for a low-carbon, nuclear-free transformation. Without such a clear political commitment, Taiwan could struggle to align with the global push toward net-zero emissions by 2050.

2) Energy costs

As high-tech manufacturing requires huge amounts of power and other energy resources, energy will probably make up a significant part of the total cost of production.

⁵ <https://udn.com/news/story/7238/7220342>. The American Chamber of Commerce in Taiwan (AmCham Taiwan) has consistently emphasized the importance of a stable and predictable energy supply.

⁶ <https://english.cw.com.tw/article/article.action?id=3522>. You can further explore Taiwan's environmental policies by visiting the website.

The stability of energy prices and the availability of energy directly influence the operating costs of high-tech businesses.

3) Environmental Impact

Energy consumption of high-tech industries may also have impacts on the environment. Extensive use of electricity may increase the carbon footprint. Given the current trend for and emphasis on environmental sustainability, this may affect corporate reputation and hinder progress toward sustainable development goals.

4) Renewable Energy and Transition

The high-tech sector has been endeavoring to improve energy efficiency to reduce dependency on energy inputs. The adoption of advanced manufacturing technologies and equipment and the implementation of energy-saving measures contribute to greater production efficiency.

For instance, the divergent renewable energy targets proposed by Taiwan's 2023 presidential candidates—ranging from Hou Yu-ih's 27% to Ko Wen-je's ambitious 40%—reflect a shared recognition of the urgency for energy transition, yet underscore differing levels of political will and strategic vision. Despite these pledges, the current reality—only 8% of total power generation from renewables—reveals deep structural challenges, particularly the land-use conflicts surrounding ground-mounted solar development. Agricultural preservation, fishery livelihoods, and environmental protection remain persistent barriers to large-scale solar expansion. To realize their respective targets, candidates must move beyond numerical goals and articulate concrete, regionally sensitive solutions: integrating agrivoltaics, incentivizing rooftop solar, streamlining permitting processes, and enhancing grid flexibility. Without reconciling ecological concerns with industrial energy demands, Taiwan's renewable ambitions risk remaining aspirational rather than actionable.⁷

Whilst the high-tech industries in Taiwan have made consistent efforts to enhance energy efficiency and reduce dependence, these issues highlight the numerous challenges associated with the transformation of the overall energy mix. Although all the presidential candidates demonstrate policy ambition with their renewable targets,

⁷ Same as Note 3.

the gap in reality is substantial. In particular, the conflicts in relation to land utilization, disagreement with agriculture and fishery industries, and concerns over environmental protection due to photovoltaic solar energy have become key barriers to promotion of renewable energy.

5) Government policy

Energy policies and regulations can also significantly affect the high-tech industries. The government may advocate the adoption of green energy and energy-saving measures, or formulate policies such as carbon emission limits. These may all influence the energy strategies of high-tech companies as analyzed below:

The top ten carbon-emitting companies in Taiwan account for 38% of the nation's total emissions. Petrochemical products are the largest source, followed by steelmaking. Achieving net-zero emissions requires a transition toward renewable energy (or hydrogen) and a circular economy. It is a daunting challenge to balance this transition, mitigate the impact on existing industrial workers and create new employment opportunities. TSMC, the leading company of the electronics industry, has pledged its electricity consumption to be 100% from renewables by 2040. However, as the company rapidly expands, its electricity demand is expected to surge—potentially accounting for up to 15% of Taiwan's total power consumption. How will this be resolved?⁸

Although high-tech industries represented by TSMC have committed to full adoption of renewable energy, their expansion and hence soaring electricity demand may further strain the already tight power supply. To address this dilemma, Taiwan must accelerate renewable energy deployment, strengthen energy storage and grid resilience, and develop emerging technologies such as hydrogen energy and circular economy systems.

c. Energy and Political Corruption

On top of the abovementioned controversies are political corruption issues and sharing of spoils related to energy. Examples include the Tainan “88 shootings” and subsequent violence over solar development interests, reportedly involving figures from both the Democratic Progressive Party (DPP) and the Kuomintang (KMT) as analyzed below:

⁸ Same as Note 3.

The Tainan “88 shootings” in Xuejia at the end of 2022 stemmed from quarrelling over “taking the whole bowl” of profits from solar power projects. Soon after this, another nine gunshots were fired in Beimen District on November 15, 2023, which was suspected to be again linked to the gains from solar energy construction contracts. Factional forces within the DPP and organized crime groups allegedly intervened to seize a share of the lucrative green energy market⁹.

In other words, the consecutive shootings in Xuejia District and Beimen District of Tainan reveal the struggle over solar energy interests has gone beyond industrial or policy issues and the deep involvement of local politicians and mafia members. Originally intended as a public policy for sustainable development and low-carbon transformation, green energy during its implementation has become the resource battlefield between political factions and local powers. This situation exposes the weaknesses in Taiwan's institutional design and oversight mechanisms in the process of energy transition. When land acquisitions, contract tenders, and profit allocations for solar projects lack transparency and fairness, it undermines public trust and risks eroding the legitimacy and public support of green energy policies.

d. Public Opinion and the Referendum on Restarting the Third Nuclear Power Plant

Amid energy instability and uncertainty, the referendum on restarting the Third Nuclear Power Plant (NPP-3) was one of the key indicators of public sentiment. The referendum did not pass, as the number of votes in favor failed to meet the statutory threshold of one-quarter of all eligible voters. Voter turnout reached 29.53% and among this, 74.17% votes were in favor. In every county and city, the number of “yes” votes exceeded “no” votes. Even in Hengchun Township, Pingtung County, where NPP-3 is located, more than 60% of voters supported restarting of the plant.

The referendum question was: “Do you agree that the Third Nuclear Power Plant should continue operating after confirmation from the competent authorities that there are no safety concerns?” According to the Central Election Commission (CEC), there were 20,002,091 eligible voters, of whom 5,906,370 cast ballots. The number of votes was 4,341,432 (74.17%) for “Yes” and 1,511,693 (25.83%) for “No”. CEC data further shows

⁹ <https://rwnews.tw/article.php?news=12556>. Photovoltaics involve a complex web of interests and political maneuvering.

that the votes in favor outnumbered the votes against in all counties and cities. The highest approval rates were in Kinmen County (94.21%), Lienchiang County (94%) and Miaoli County (86.56%). However, Kinmen and Lienchiang reported the lowest turnout in the country, at 12.38% and 19.23%, respectively. The lowest approval rates were in Pingtung County (57.16%), Kaohsiung City (64.85%) and Tainan City (66.52%). These were also the only three counties/cities where support did not exceed 70%. In Pingtung County, voter turnout was 31%, with 120,720 “Yes” votes and 90,460 “No” votes. Only seven townships had more “No” votes than “Yes” votes. In Hengchun Township where NPP-3 is located, the turnout was 27.33%, with 4,103 votes for “Yes” (60.69%) and 2,658 votes for “No”.¹⁰

In short, the referendum question “Do you agree that the Third Nuclear Power Plant should continue operating after confirmation from the competent authorities that there are no safety concerns?” —reflects the high level of public attention and division over the nuclear energy issue. Although the percentage of “Yes” votes was high overall, the low voter turnout failed to reach the statutory threshold. This outcome highlights that insufficient voter participation may become critical and lead to the failure of policy decisions. In general, the referendum results revealed a paradox of “high approval rate but low participation.” This reflects a certain degree of public support for nuclear energy in Taiwan, but there are still challenges in institutional design and civilian mobilization. If referendums are to remain a tool for energy policy decision-making in the future, increasing voter turnout and public engagement will be essential priorities.

As described in the above issues and concerns with Taiwan’s current energy status, the domestic problems are the political corruption and disputes over solar power profits; the AmCham’s viewpoint about Taiwan’s electricity landscape; efficiency of energy consumption; and the impact of inadequate power supply on high-tech and petrochemical industries. External issues include the overreliance on imported energy; insufficient domestic energy resources; increase of thermal and natural gas power; rising carbon emissions; and threats from China, particularly the risk of energy blockade. This is further summarized below:

¹⁰ <https://www.cna.com.tw/news/aip/202508230199.aspx>. A referendum reflects the will and opinions of the people.

Table 1*Impact of Electricity and Energy Issues on Taiwan*

Internal issues	Political corruption and distribution of solar project profits
	AmCham's viewpoints
	Energy efficiency
	Effects on the high-tech industry and petrochemical industry
	Public Opinion and the Referendum
External issues	Overreliance on imported energy
	Rising carbon emissions
	Energy blockade and threats from China

Source: This study

In short, Taiwan's electricity and energy challenges form a complex web of politics, industries, international relations, and public trust. From a domestic perspective, energy policymaking is not merely about technical choices but deeply intertwined with political structures and profit allocations. In the example of solar development, renewable energy is viewed as a key path toward net-zero emissions, but its implementation has often been marred by land acquisition disputes, controversy surrounding conversion of farmland, and suspected collusion between politicians and businesses. Unequal profit distribution of solar projects has even led to accusations of "green energy corruption", turning what should be an energy transition that builds social cohesion into an arena of political infighting.

From the perspective of foreign institutional investors, Taiwan's energy environment presents both great potential and risks. Based on its long-term observation of Taiwan's electricity stability and policy transparency, the AmCham indicated that without reliable and predictable power supply, Taiwan's attractiveness as a global high-tech manufacturing hub will diminish. In particular, both the semiconductor industry and the petrochemical industry are heavily electricity-dependent, any power outages or rising costs could directly impact global supply chains and foreign investors' confidence. Although energy efficiency improvements have been incorporated into policy planning, implementation within industrial sectors remains not insufficiently prevalent, leaving significant room in Taiwan for improvement in energy utilization efficiency. Public concerns over energy use in Taiwan include fears of power shortages and the challenges of initiating a referendum to restart the Third Nuclear Power Plant.

From an external perspective, Taiwan faces multiple challenges in energy security. The first is the structural problem of heavy dependence on imported energy. Taiwan relies on imports from overseas for almost all of its required natural gas, coal, and oil and this leaves the island vulnerable to fluctuations of international energy prices and geopolitical conflicts. Events such as the Russia-Ukraine war, tensions in the Middle East, or even typhoon seasons can disrupt energy transportation and price stability. Secondly, thermal power generation still dominates Taiwan's energy mix, keeping carbon emissions high and exposing Taiwan to international pressure, such as the EU's Carbon Border Adjustment Mechanism (CBAM), which could affect the island's export competitiveness and international reputation.

An even more sensitive issue is the potential threat from China to Taiwan's energy security. Possible scenarios include military blockades to cut off maritime energy transport routes, cyberattacks to cripple power systems, or political interference to disrupt Taiwan's energy cooperation and technology imports. China's influence thus remains a major challenge to Taiwan's energy autonomy. As a result, energy policy is not merely an environmental or economic matter, but lies at the heart of national security and democratic resilience. Under such multidimensional pressure, Taiwan needs a higher level of integrated thinking for its energy future, not only in terms of technological innovation and policy design, but also in rebuilding social trust, the cooperation between industry and government, and support from international partners.

5 CONCLUSIONS

Taiwan is home to the world-leading high-tech industry, represented most prominently by TSMC. The company's manufacturing processes demand extremely high stability and quality of electricity supply. As a result, the energy issue in Taiwan is more than just an environmental or economic topic. Rather, it is directly related to industrial competitiveness and national security. As the world increasingly emphasizes net-zero emissions and sustainable development, Taiwan's future energy policy will inevitably be subject to environmental, economic, technological, and social factors. How to balance between sustainability, energy security, and environmental protection has become a shared challenge for policymakers and industry leaders alike. Moreover, fluctuations in

global energy markets and the evolution of global climate policies will also profoundly influence Taiwan's energy choices and policy direction.

At the policy implementation level, the government has been proactively driving energy transition and striving to increase the share of renewables in Taiwan's overall energy mix and reduce dependence on fossil fuels. The development of wind and solar power has been a major focus, but the process also revealed many governance issues such as unequal distribution of photovoltaic profits, land use disputes, allegations of political corruption, and difficulties in restarting nuclear power — which have undermined public trust in the energy transition. Meanwhile, foreign business associations such as the AmCham have expressed concerns about the transparency and stability of Taiwan's energy policies, indicating that a lack of stable and predictable power supply may affect the willingness of foreign investors and the global strategy of Taiwan's high-tech industry. Although the enhancement of energy efficiency has been incorporated into government policy objectives, implementation within the industrial sector leaves room for improvement. In particular, the insufficiency of power supply has most noticeable influence on the semiconductor industry and the petrochemical industry.

Taiwan's energy challenges stem from not only internal governance and technological transformation, but also external issues due to structural vulnerabilities. With limited domestic energy resources, Taiwan relies heavily on imports of liquefied natural gas (LNG) and coal, leaving its energy security exposed to geopolitical risks—especially under the potential threat of China's blockade of energy transport routes. To fill its energy gap, Taiwan has expanded thermal and gas-fired power generation, but this has caused rising carbon emissions, in a stark contrast to the global trend toward decarbonization. Therefore, Taiwan's energy policy in the future must address internal governance challenges and external risks at the same time. Only through collaboration among the government, the industries, and the civil society can Taiwan build a more resilient and sustainable energy system.

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