經濟部

TAIWAN

Green Energy

Key Innovative Industries in Taiwan

Information Security	Next-Generation Vehicle	Communications Industry	Circular Economy	**Green Energy**
Biopharmacy Industry	Smart Machinery	Semiconductor Industry	Internet of Things	International Logistics and E-commerce

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Policy Initiatives —

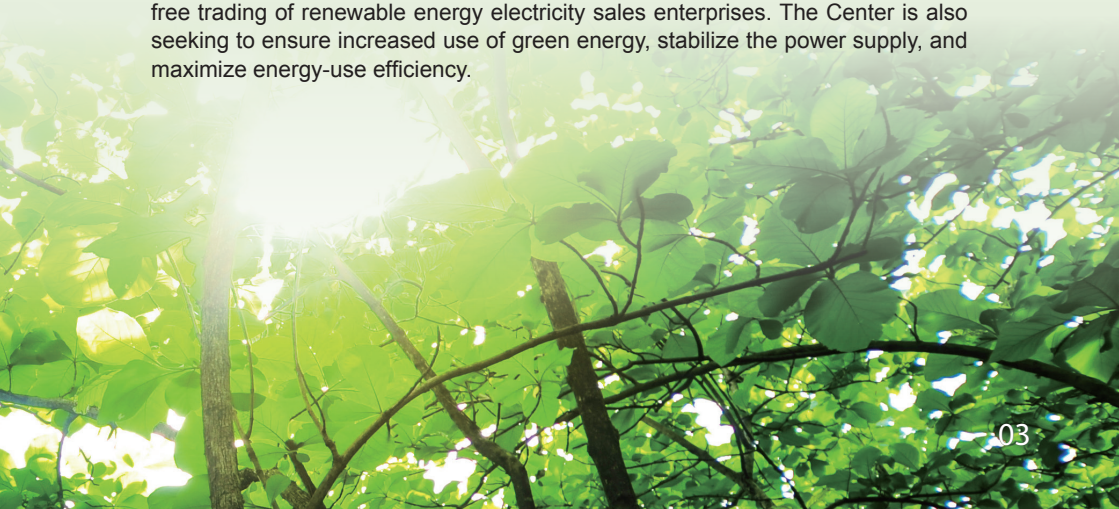
Green Energy Technology Industry Innovation Promotion Plan

The Taiwanese government views green power and renewable energy as one of the core strategic industries for responding to rapid changes in the energy environment, global trends in greenhouse gas reduction, and the goal of creating a non-nuclear homeland by 2025. The "Green Energy Technology Industry Innovation Promotion Plan" is the core of the new energy policy announced by the government in October 2016. The Plan focuses on the three major goals of "green energy promotion," "industrial development," and "technological innovation," which go together hand-in-hand with the four major themes of "energy creation, energy storage, energy conservation, and system integration." In addition to aiming for the policy goal of attaining 29,424MW in renewable energy power generation capacity by 2025, it also seeks to promote green energy technology development and industry development, create green employment, and build a safe, stable, and efficient supply and demand system for clean energy in Taiwan.

Taiwan's overall green energy development consists mainly of solar

photovoltaic and wind power. It plans to install, by 2025, 20GW of solar photovoltaic equipment, including 8GW rooftop systems and 12GW ground-mounted systems. It has set a goal of installing 6.5GW of wind energy, including 886MW in land-based wind turbines and 5.6GW in offshore wind turbines. In terms of offshore wind power, Taiwan continues to expand the construction of offshore wind farms in 2021, such as the installation of a Taipower demonstration wind farm on 27 August. In addition, on 23 July the Ministry of Economic Affairs (MOEA) issued the "Directions Governing Application for Offshore Wind Zonal Development," and on 19 August the MOEA issued the "Directions for Allocating Installed Capacity of Offshore Wind Potential Zones." Taiwan has now formally begun to implement its wind power zonal development policy, which is expected to release 1.5 GW every year from 2026 to 2035, for a total of 15 GW.

In terms of energy use, the MOEA issued the "Regulations for the Management of Setting up Renewable Energy Power Generation Equipment of Power Users above a Certain Contract Capacity" (known colloquially as the "major power user" regulations) in January 2021 to facilitate the introduction of renewable energy power generation by major power users. It requires power users with a contract capacity of 5,000KW or more to install renewable energy power generation facilities for 10% of their contract capacity within 5 years to facilitate companies' installation of renewable energy power generation facilities. The MOEA's Bureau of Standards, Metrology and Inspection has also established the "National Renewable Energy Certification Center" to support the Executive Yuan's 2025 energy policy objective of increasing total renewable energy electricity generation to 20% of total electricity generation. The Center will create renewable energy trading mechanisms with a particular focus on the free trading of renewable energy electricity sales enterprises. The Center is also seeking to ensure increased use of green energy, stabilize the power supply, and maximize energy-use efficiency.



1 | Single Service Window for Solar PV |

The MOEA has established the "Single Service Window for Solar PV" to oversee the policies and measures for the promotion of solar PV. It supports efforts to achieve the target of installing 20GW of solar PV equipment by 2025 and provides professional technical and consultation services. It helps the central and local governments, companies, and private individuals to resolve issues involving application submissions, installation, regulations, taxation, and technologies. It also provides referral services and has established a communication platform to create a positive environment for installing solar PV equipment.

Contact Information

Single Service Window for Solar PV

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2 | Thousand Wind Turbines Promotion Office |

The MOEA established the "Thousand Wind Turbines Promotion Office" in May 2012. Its primary missions are to integrate policy formulation and promotion, and develop and expand technologies. The office assists businesses in the application process for the establishment of wind power (land-based and offshore) in Taiwan, and also provides information on site planning, the capacity allocation mechanism, the selection procedure, and auction results for Taiwan's offshore wind power projects.

Contact Information

Thousand Wind Turbines Promotion Office

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3 | Shalun Smart Green Energy Science City |

The "Shalun Smart Green Energy Science City" of Tainan was officially inaugurated at the end of 2020 (Figure 1) and related investment promotion campaigns were launched. The Science City includes core areas A, B, C, D, E, F, and X, and is intended to strengthen the competitiveness of industries and explore international markets. Research institutions such as "Academia Sinica South Campus" will also be accommodated in Area E. In addition, investment promotion and development will continue in Areas B, F, and X to use the results of high-tech research and development to power the development of the green energy industries and form a sustainable cycle for the green energy industry innovation ecosystem. The Tainan City Government has also planned a series of related parks in the areas around the Science City to facilitate accelerated development and creation of urban amenities for the Science City.

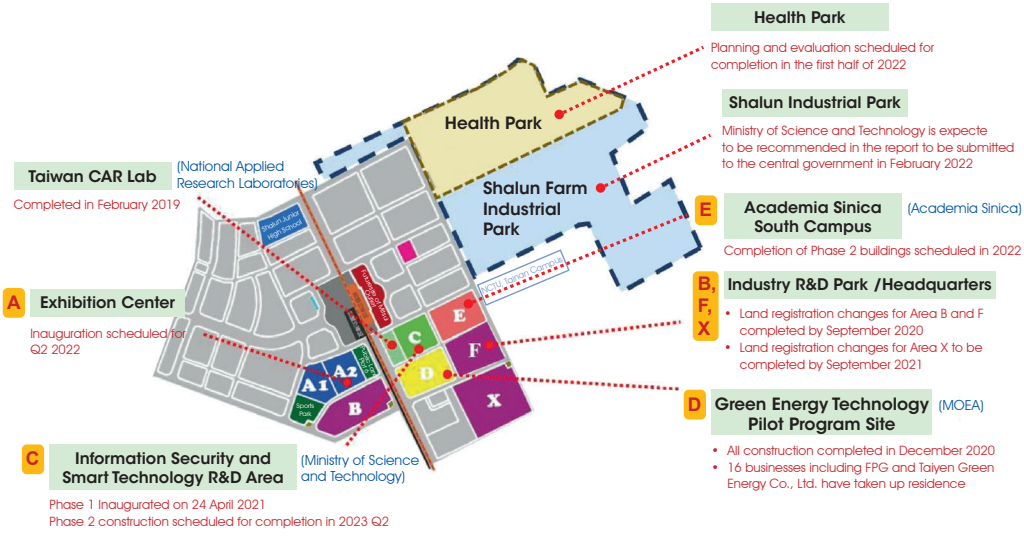

Figure 1 Shalun Smart Green Energy Science City

The "Information Security and Smart Technology R&D Area" in Area C of the "Shalun Smart Green Energy Science City" is under the jurisdiction of the Ministry of Science and Technology. It will become a site for the development of the information security industry and cultivation of world-class professional talent. The "Green Energy Technology Pilot Program Site" managed and promoted by the MOEA will coordinate with energy suppliers and users to work out arrangements for energy storage and power conditioning. It will provide high-efficiency decentralized renewable energy power technologies and systems, assist with the diversification of power dispatching systems, construct fixed energy storage devices, and provide a smart energy-efficient technology integration demonstration (Figure 2).

In terms of the development of "green energy technologies" in the demonstration site, its "R&D technologies" have integrated energy creation, energy storage, energy conservation, and system integration to provide a systematic and comprehensive site for domestic and foreign green energy R&D technologies and industrial tests, certification, and matchmaking. The Demonstration Site, which has an Energy Control Center, Subtropical Performance-Testbed for Innovative Energy Research in Buildings (SPINLab), and an Intelligent Green Energy Demonstration House, is working to integrate intelligent energy conservation and energy control, and demonstrates how green energy technologies can find their way into our everyday lives. A total of 73 teams have located at the Demonstration Site, including Motech, Dyna Rechi, FPG, and Hanbell.

Contact Information

Shalun Green Energy Technology Demonstration Site

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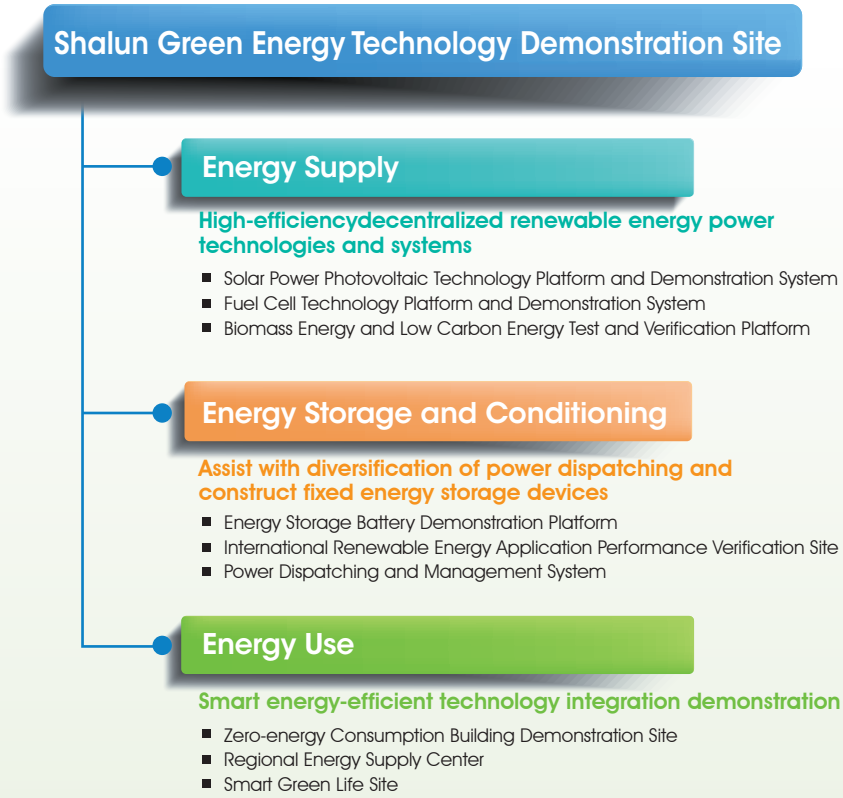


Figure 2 Shalun Green Energy Technology Demonstration Site

Overview of Industrial Development

1 | Output Value |

Recent figures and future forecasts for Taiwan's green energy output value are shown in Table 1. Since the announcement of the "Green Energy Technology Industry Innovation Promotion Plan," Taiwan's solar photovoltaic power installed capacity has reached 6,623.44 MW as of June 2021. Although the output of the solar PV industry has declined in recent years due to the US-China trade war and the launch of the "May 31 New Policy" in mainland China, market demand has continued to grow. As industries rapidly restructure and actively invest in innovative research and development, the output value in 2019 and 2020 exceeded NT$60 billion. The cumulative wind power installed capacity as of February 2021 was 846.71 MW. As foreign investors continue to view the industrial development favorably and continue to expand investments in Taiwan, the output value of the wind power industry is expected to grow from NT$17 billion in 2019 to NT$31.3 billion in 2021.

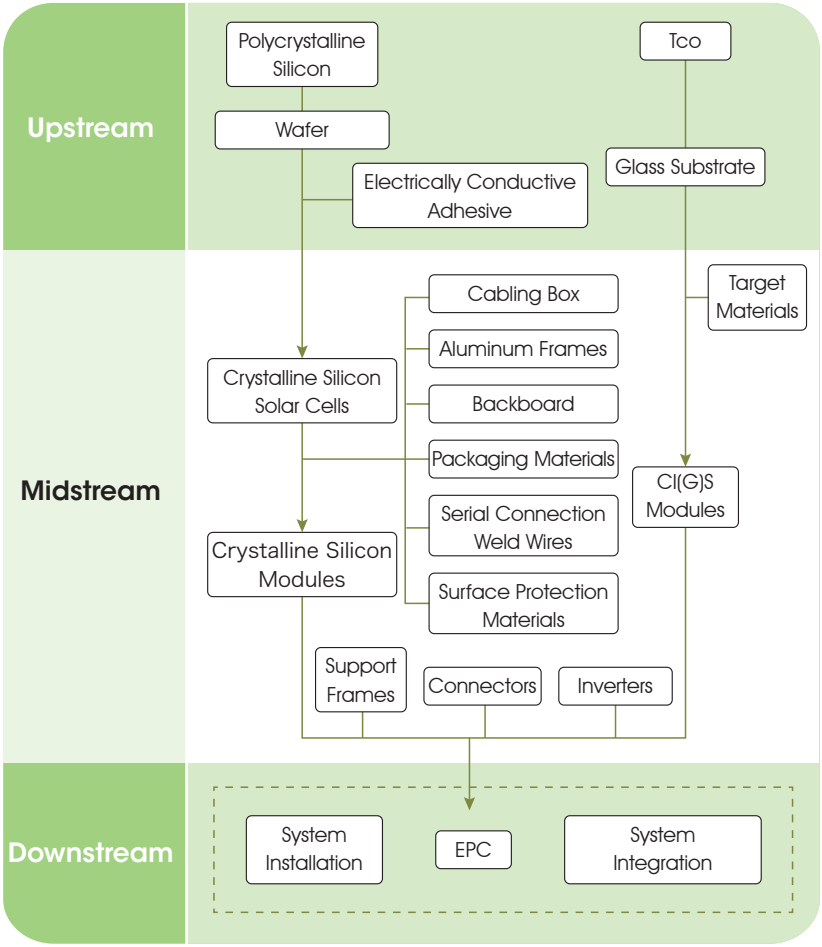
Table 1 Output Value and Cumulative Installed Capacity of the Solar PV and Wind Power Industries in Taiwan

Sector		Output value (or demand)				Capacity installed capacity from 2000 to February 2021 (MW)
		2019 (million NTD)	2020(e) (million NTD)	2021(f) (million NTD)	2020(e)/2019	
PV industry	Wafer	12,941	1,534	1,642	-88.1%	6,623.44
	Crystalline silicon solar cells	36,096	24,051	25,734	-33.4%	
	Crystalline silicon modules	10,871	24,409	26,118	+124.5%	
	Related materials	9,433	8,772	9,648	-7.0%	
	Polycrystalline silicon, thin-film solar cell modules, and others	542	531	516	-2.1%	
	Total	69,883	59,297	63,658	-15.1%	
Wind power industry		16,695	26,123	31,347	+54.0%	846.71

Source: Emerging Energy Industry Yearbook 2020, Industry, Science and Technology International Strategy Center, Industrial Technology Research Institute (May 2020); Energy Statistical Monthly Report, Bureau of Energy, MOEA (June 2021).

2 | Industry Chain |

Solar PV and wind power constitute the bulk of Taiwan's current green energy industry. The solar PV industry includes upstream silicon materials, midstream solar cells and modules, and downstream solar PV systems. In terms of upstream wafers, most of the production capacity in Taiwan exited the market prior to 2020. Sino-American Silicon Products Inc. currently retains production capacity while AUO Crystal Corp. produces mainly mono-crystalline wafers. In terms of midstream silicon solar cells, Taiwanese companies previously specialized in silicon solar cells, but companies have shifted to the domestic market in recent years by supplying domestic module plants. Well-known companies include United Renewable Energy, Motech, Sino-American Silicon Products, TSEC Corporation, Tainergy, Inventec Solar Energy, and E-Ton Solar Tech. In terms of midstream silicon modules, the rapid growth in the domestic market and the incentive of an additional 6% feed-in tariff provided by the voluntary module certification regulations in Taiwan have accelerated growth in the domestic production capacity for silicon modules. This segment is expected to account for an increasing share of the industry's production capacity in the future. Well-known companies include United Renewable Energy, AU Optronics, TSEC, Gintung, and TSMMC. In terms of downstream development, with policies that support the installation of solar PV modules and foreign investments in domestic system development, system providers have become a powerful engine of growth for the green energy industry in Taiwan. Major suppliers include Tatung Forever Energy, AU Optronics, EnergyTrend, ANJI Technology, and SunEdge PV Technology. (Figure 3)



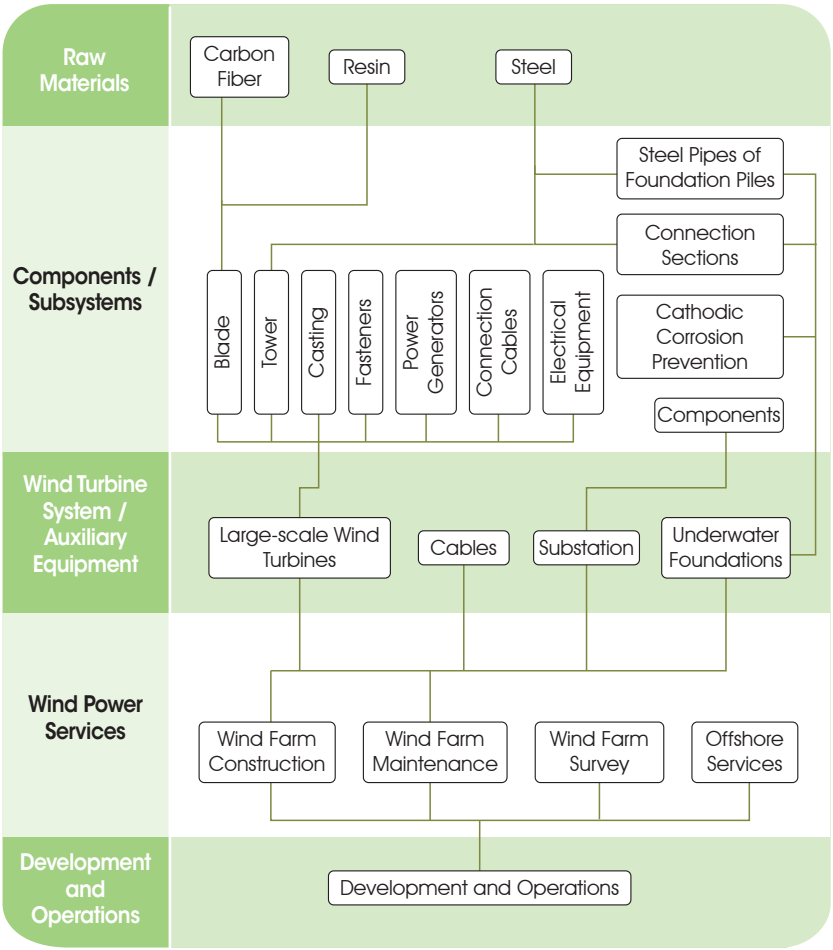
Source: Industry, Science and Technology International Strategy Center, ITRI.

Figure 3 Taiwan's Solar PV Industry Chain

Wind power generation consists mainly of wind power equipment manufacturing (components/subsystems and wind turbine systems/auxiliary equipment), wind power services, and development and operations. In terms of wind power equipment manufacturing, the main companies include Swancor Renewable Energy (blade resin), Fortune Electric (transformers), Yeong Guan Energy (casting), and Sinbon Electronics (connection cables). The recent development of offshore wind farms in the Taiwan Strait has encouraged new companies to join the supply chain. Short-term development consists mainly of underwater foundations, land-based substations, and tower production. Medium to long-term development has been expanded to the blades, casting, and electric equipment of wind turbine systems, which will increase the comprehensiveness of the offshore wind power supply chain in Taiwan. Companies that specialize in underwater foundations include Sing Da Marine Structure, Century Steel, Ming Rong Yuan, and China Steel Structure. Companies that specialize in electrical equipment include Fortune Electric, Delta Electronics, and Shihlin Electric. (Figure 4)

3 | Industrial Clusters |

Compared to other countries, Taiwan has advantages in the development of green energy industries, including a solid foundation in the ICT industry, a comprehensive semiconductor industry supply chain, and strong industrial capacity in metallurgy, mechanical engineering, composite materials, and electronic controls. To increase the international competitiveness of Taiwan's wind farms, the government has integrated the needs of the industry to construct ports necessary for the underwater foundations and heavy equipment for offshore wind power. It has also transformed ports into development bases for the offshore wind power industry, including the Port of Taipei (underwater foundations), the Port of Taichung (offshore wind power components), and the Kaohsiung Xingda Fishing Port (underwater foundations). They will become home to important clusters for green energy industries in the future.



Source: Industry, Science and Technology International Strategy Center, ITRI.

Figure 4 Taiwan's Wind Power Industry Chain

Potential Investment and Collaboration Opportunities in Taiwan

1 Grasp Green Energy Business Opportunities Powered by Energy and Industry Policies

To attain the goal of building a non-nuclear homeland, the government has established green energy installed capacity goals which are expected to drive approximately NT$2.2 trillion in related green energy investments by 2025. With the support of the "Green Energy Technology Industry Innovation Promotion Plan," the government has attracted domestic and foreign companies in investments in the blades, castings, tower, nacelle assembly, wind farm maintenance, inverters, and energy storage systems in the solar PV industry, and electrical power, chassis, and entire vehicle investments for electric vehicles. Foreign companies can expand their investments in Taiwan or form partnerships to jointly create a green energy industrial chain.

2 Expand Wind Potential Zones and Offshore Wind Power Business Opportunities in Taiwan

Taiwan has abundant offshore wind power resources. According to survey data on the professional offshore wind power website 4C Offshore, nine out of the top ten offshore wind power sites with potential for development lie along the coast of Taiwan (Figure 5).

To help domestic and foreign businesses invest in business opportunities in Taiwan's offshore wind power development, the government has provided a

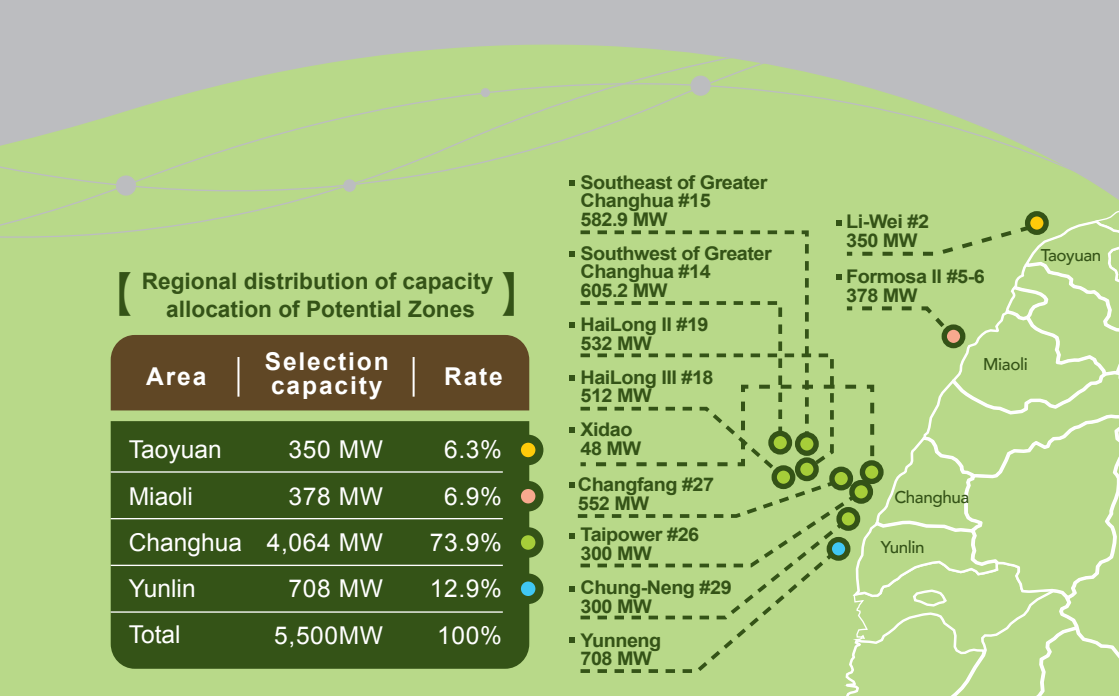


Figure 5 Overview of Wind Power Siting in Taiwan

reasonable feed-in tariff system and planned 36 offshore wind potential zones. In addition, it plans to set up ports along the west coast of Taiwan dedicated to heavy parts used for the construction of offshore wind farms as well as industrial parks for the production, assembly, construction, and maintenance of wind turbines to fully support the construction of a comprehensive offshore wind power industry chain. The government expects to create NT$1 trillion in business opportunities through investments by 2025.

3 Continuous Growth of Solar PV Market Demand

To attain the goal of 20GW in solar PV installed capacity by 2025, the government has created comprehensive plans and management mechanisms to encourage companies to commence development in suitable areas. The government will resolve issues in administrative procedures while companies integrate the necessary land and central government units cooperate with local governments. It is expected to generate approximately NT$222 billion in investments and assist the development of solar PV and related technologies. The American company Corning actively responded to the Plan and worked with AU Optronics in 2018 to set up solar PV equipment on the rooftops of its glass substrate plants in the Central and Southern Taiwan Science Parks, thus

taking concrete action to support Taiwan's green energy power generation policy. French company Ciel & Terre set up the first power plant built atop private ponds in March 2021 to develop diverse applications of green energy facilities on land. Taiwan's future solar PV market demand is expected to expand steadily, which will help attract international system companies into more intensive partnerships with related industries in Taiwan.

4 Distributed Power Supply Trends Increase Demand for Energy Technology Services and Energy Storage Equipment

Taiwan's energy supply is shifting toward diversification and regional development with the increase in the use of renewable energy such as offshore wind power and solar energy. However, as renewable energy generates power intermittently and is affected by sunshine duration and seasonal winds, energy storage systems must be created. Such systems are expected to increase the demand for energy technology services and energy storage equipment which will support flexible dispatching of energy between different regions and between peak/off-peak periods, and increase energy use efficiency. Related testing facility programs have been implemented in Taiwan including the "2020 Taichung City Pilot Site Subsidy Program for Smart Energy-efficient Apartment Complexes" announced by the Economic Development Bureau of the Taichung City Government. Two apartment complexes will be selected as smart microgrid demonstration sites, and will be provided with free smart green energy facilities for "energy conservation, storage, and creation." The program will also set up solar power generation systems, energy storage systems, smart home energy management systems, and smart green energy facilities based on the power consumption type and structure of the site. Foreign companies can evaluate the business opportunities for investment.

Investment Incentive Measures

1 | Tax Incentives |

Taiwan's profit-seeking enterprise income tax rate is 20%. To encourage foreign companies to invest in Taiwan, support industrial innovation, and promote industry-academia collaboration, foreign companies are eligible for the following preferential taxes (Table 2):

Table 2 Preferential Taxes

Item	Preferential tax(es)
R&D and introduction of technology or mechanical equipment	• Up to 15% of the company's R&D expenditures may be deducted from its profit-seeking enterprise income tax for current year; or up to 10% of such expenditures may be credited over three years against the profit-seeking enterprise income tax payable by the company. • Royalty payments to foreign companies for imported new production technologies or products that use patents, copyrights, or other special rights owned by foreign companies is, with the approval of the Industrial Development Bureau, MOEA, exempt from the corporate income tax. • Imported machinery which local manufacturers cannot produce are eligible for duty-free treatment.
Employee stock compensation	• A company employee who has obtained stock compensation worth a combined total of less than NT$5 million and continuously held the stock while remaining in the company's employ for at least two years may choose to be taxed on the market price of the stock at either the time the stock was obtained or the time the stock is sold, whichever is lower.

Item	Preferential tax(es)
Investment in smart machinery / 5G	• Smart machinery: Automatically scheduled, flexible, or mixed-model production lines that utilize big data, AI, and IoT. • 5G: Related investment projects include 5G communication systems, and new hardware, software, technology, or technical services. • For investments of no less than NT$1 million and no more than NT$1 billion, either "5% of investment spending is deducted from profit-seeking enterprise income tax (current FY)" or "3% of investment spending is deducted from profit-seeking enterprise income tax, if total spending is spread over three years" may be selected, but the total amount deducted may not exceed 30% of corporate income tax that year. • The applicable periods are 1 January 2019 through 31 December 2021 (smart machinery) and 1 January 2019 through 31 December 2022 (5G).
Foreign special professionals	• Foreign special professionals who meet criteria are eligible for a 50% deduction of total income tax for amounts exceeding NT$3 million.
Setting up operations in industry parks	• Companies that set up operations in export processing zones, science industrial parks, or free trade ports are eligible for exemptions on import duties, commodity tax, and business tax for the import of machinery and equipment, ingredients, fuel, materials, and semi-finished products for their own use.
Others	• Companies that use undistributed earnings to engage in substantive investments may exclude the amount when calculating their profit-seeking enterprise income tax.

2 | Subsidies |

1. Global R&D Innovation Partner Program

Some foreign companies have a high degree of complementarity with Taiwan's industries, so we encourage them to come to Taiwan to plan and develop forward-looking technologies more advanced than those that Taiwanese firms currently possess, as well as key technologies or integrated technologies. By engaging in R&D work on such technologies in cooperation with Taiwanese firms, they could exert a key influence on Taiwanese industry by: (a) spurring R&D work on industrial technologies as well as the establishment and development of supply chains; (b) improving R&D efficiency; (c) accelerating the timetable from R&D to production; and (d) contributing actively to expansion of international markets. Foreign companies that achieve such things, after gaining approval from the MOEA, will be eligible for subsidies of up to 50% of total R&D expenditures.

2. Program for the Development of Pioneering Companies

The purpose of this program is to build Taiwan into a high-tech R&D center and encourage leading international manufacturers to establish cutting-edge R&D bases in Taiwan so that they can work here on forward-looking technologies and link up with the Taiwan supply chain, thereby creating a division of labor in the areas of research, co-creation, and development, with an eye to strengthening the technological competitiveness of Taiwan's leading industries and accelerating the formation of clusters in emerging industries. Program funding of up to 50% of total expenditures may be granted for any project that has been approved by the Ministry of Economic Affairs.

3. Taiwan Industry Innovation Platform Program

The MOEA Industrial Development Bureau and the Ministry of Science and Technology are jointly implementing the "Taiwan Industry Innovation Platform Program" to guide industries to develop toward greater value, and to encourage companies to enter high-end product application markets to increase industry's overall added value. For companies owning R&D teams in Taiwan, the program provides 40-50% of the funding required for theme-based R&D projects, and up to 40% of funding for R&D projects proposed by the companies themselves.

Leading Taiwanese Companies

The overview of the current operations of well-known companies in the solar PV and wind power sectors in Taiwan is explained below:

1 | Photovoltaics |

1. Sino-American Silicon Products

Sino-American Silicon Products Inc. was founded in Hsinchu Science Park in 1981 and is the largest supplier of 3 to 12-inch silicon wafer materials in Taiwan. Sino-American Silicon Products provides high-efficiency solar energy products such as solar power ingots, wafers, cells, modules, and power generation systems. It uses vertical integration for expansion across systems to expand development in solar energy industries and become a global green energy solution provider.

2. United Renewable Energy

United Renewable Energy Co., Ltd. was founded in 2018 by Neo Solar Power, Gintech Energy, and Solartech Energy. It specializes in supplying the systems, modules, cells, and wafers in Taiwan's green energy industry supply chain through a vertical integration business model. It has maintained its top ranking in market share in modules sold in Taiwan in the past two years. The company will focus on energy storage development to provide total solutions for renewable energy.

2 | Wind Power |

1. Swancor

Swancor is a leader in Taiwan's offshore wind power industry. It began investments in offshore wind farms in 2012 with Formosa I," which was completed and began commercial operations in 2019. The "Formosa II" project is now under construction and the total capacity of the two wind farms is expected to reach 504MW.

2. Fortune Electric

Fortune Electric Co., Ltd. was founded in 1969 and has accumulated years of experience in the design and production of high-voltage electrical equipment, EPC projects for substation and electrical systems, construction of energy storage systems, and electric vehicle charging stations. It is the only high-voltage electrical equipment supplier in Taiwan with a proven track record in the production of onshore electrical equipment for offshore wind farms, and experience in producing related equipment in wind turbine towers.

Examples of Successes Achieved by Foreign Companies

1 Construction of Solar Power Plants and Related Services and Collaboration

Thailand's Mitr Phol Group and TSEC Corporation established a joint venture named Formosa Sun Energy Corp. to provide solar PV power plant development, construction, maintenance, and operation services. The "Taiwan Mingus Solar Project" built by the Singaporean company Vena Energy in Chiayi County's Budai Township has commenced commercial operations. The Japanese thermal coal power generation developer Marubeni announced its NT$2.7 billion acquisition of all the shares of Taiwan's Chenya Energy and its green energy equipment (with capacity of 270MW) in February 2020 in a bid to take advantage of business opportunities in solar PV development in Taiwan and increase the proportion of renewable energy in the Group's business.

2 Wind Power Collaboration

The German company WPD has invested in land-based wind power in Taiwan since 2001. It will focus on offshore wind power and solar PV in its future investments. It has completed project financing for its 640 MW Yunlin Yunneng Offshore Wind Farm, which is currently the largest offshore wind farm financing project in the Asia-Pacific region, with an investment of NT$94 billion. It is expected to commence commercial operations by 2022.

Canada's Northland Power joined forces in 2020 with Siemens

Gamesa Renewable Energy, the largest offshore wind turbine system producer in the world, to introduce the latest offshore wind turbine technologies at the 300MW Hai Long 2A offshore wind farm 50 kilometers from the coast of Changhua as an "anchor project" as part of the "Hai Long Offshore Wind Farm"[1] project. They expanded the cooperation project in May 2021 and included Hai Long 2B (232MW) and Hai Long 3 (512MW) and increased the total installed capacity of their cooperation to 1,044MW (1.04 GW). Their goal is to work with Taiwan's local supply chain to build up Taiwan as an offshore wind power export center for the Asia-Pacific region. The total investment in Hai Long offshore wind farms has reached NT$45 to 75 billion and created more than 5,200 job opportunities.

The Australian company Macquarie Group and Danish company Ørsted are working with Taiwan's Swancor Renewable Energy in the development of Formosa I in Miaoli. Swancor Renewable Energy is responsible for the development, operation, maintenance, and management of the wind farm. Ørsted will provide consulting services for the wind farm development. Macquarie Group will provide financial consulting and financing services. In addition, Swancor Renewable Energy is also working with Macquarie Group on Formosa II in Miaoli County's Houlong Township, and is working with Macquarie Group and EnBW of Germany in the development of Formosa III.

In addition, Ørsted sees the the Port of Taichung as capable of playing a crucial role in the construction and operation of Taiwan's offshore wind farms, and announced its lease of Taichung Port facilities and auxiliary land for 20 years in February 2020. The facilities and land will be used for the construction of the "Greater Changhua Offshore Wind Farm" and serve as its flagship O&M center in the Asia-Pacific region. The site is expected to be completed and inaugurated in 2022.

1 Hai Long offshore wind farm is a joint venture of Canada's Northland Power, Singapore's Yushan Energy Pte Ltd., and Japan's Mitsui & Co. Three wind farms are located 45 to 55 kilometers from the coast of Changhua and are expected to begin commercial operations in 2024.

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