

The expansion and challenge of LNG receiving terminals in Chinese Taipei, June 2021

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Introduction

After Chinese Taipei's government announced in 2016 the target of zero-nuclear by 2025 and plans to increase natural gas share to 50% in power mix in 2025 to replace nuclear power, there have been plans to construct more LNG receiving terminals to expand the receiving capacity. The government-owned oil and gas company CPC Corporation, Taiwan, is no longer the sole LNG importer and supplier after the government-owned utility Taipower obtained approval from the government to purchase and import LNG directly from foreign suppliers bypassing CPC in 2014.

Supplementing its existing LNG terminals, CPC plans to construct a third LNG terminal in Guantang while Taipower plans to construct two terminals in Taichung and Xie-He village, Keelung. However, the construction of Guantang LNG terminal is facing a big challenge because the construction site is also where a 7500-year-old algal reef inhabits. To protect the algal reefs, there will be a referendum on 28 August 2021 against the construction of the Guantang LNG terminal.

According to a poll on 25 May, more people are still in favour of moving the third terminal to another place. But if the covid outbreak is not controlled by August, the referendum might be rescheduled and the result might be affected. Even if the referendum turns out to be favourable of the terminal, the construction schedule is expected to be delayed significantly.

[Background]

98% of energy supply is imported

With very limited natural resources on the islands¹, Chinese Taipei is highly dependent on energy imports to meet domestic energy demand. According to the United States Energy Information Administration (EIA), Chinese Taipei has

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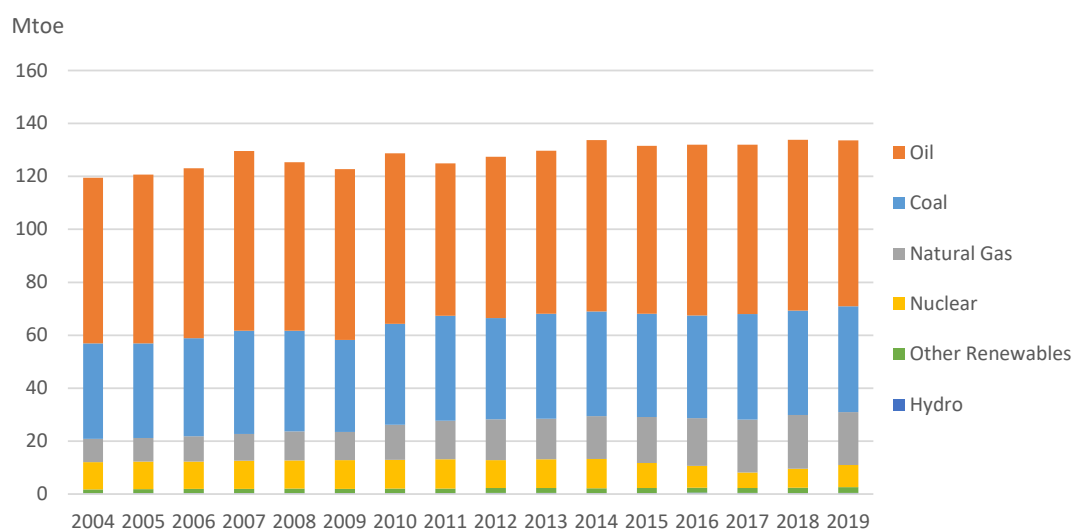
¹ Chinese Taipei is an archipelago economy comprising Taiwan, Penghu, Kinmen and Matsu.

approximately 2.4 million barrels of oil reserves.² The country used to produce coal, but the production stopped in 2000 because of scarce coal reserves and high mining cost.

In 2019, as 98% of total primary energy supply was imported, indigenous sources only accounted for 2.1% of total primary energy supply. Chinese Taipei heavily relies on oil and coal for its energy demand. In 2019, out of its total primary energy supply of 134 million tonnes of oil equivalent (Mtoe), oil (47%) and coal (30%) accounted for almost 80%, while natural gas accounted for 15%, nuclear 6.3%, hydro and other renewables 2.0% (See Figure 1).³

Most of the natural gas is consumed in the power sector in Chinese Taipei. In 2019, 78% of natural gas was consumed for power generation, 14% was consumed in industrial sector, 3.5% in residential, 2.1% in services, 1.8% in energy sector's own use, 0.48% in refinery and 0.02% in agriculture sector.⁴

Figure 1. Total primary energy supply, 2004-2019



Source: Bureau of Energy, Ministry of Economic Affairs, Energy statistics, https://www.moeaboe.gov.tw/ECW/populace/content/SubMenu.aspx?menu_id=893

² U.S. Energy Information Administration, Taiwan Overview, 2016, <https://www.eia.gov/international/overview/country/TWN>

³ Bureau of Energy, Ministry of Economic Affairs, Energy Statistics, 2021, https://www.moeaboe.gov.tw/ECW/populace/content/SubMenu.aspx?menu_id=893

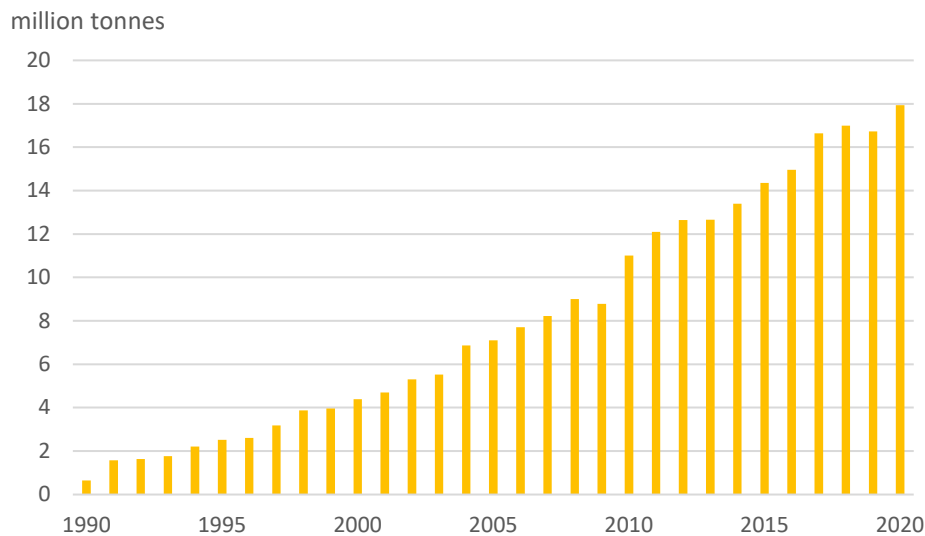
⁴ Bureau of Energy, Ministry of Economic Affairs, Energy Statistics Handbook 2019, 2020, https://www.moeaboe.gov.tw/ECW_WEBPAGE/FlipBook/2019EnergyStaHandBook/index.html#p=

Chinese Taipei started importing LNG in 1990 and is the 5th largest LNG importer in the world

According to GIIGNL’s annual LNG industry report published in 2021, Chinese Taipei is the 5th largest LNG importer in the world in 2020 with 18 million tonnes or 5.0% share of world’s LNG imports.⁵ Lacking domestic resources, Chinese Taipei started importing LNG in 1990. The imports grew significantly by 60% from 11 million tonnes to 18 million tonnes in the past decade (2010-2020) (See Figure 3).⁶

According to the energy statistics of the Bureau of Energy in Chinese Taipei, 55% of LNG imports were from Qatar (28%) and Australia (27%) in 2020. With Russia accounting for 14%, the rest was from Papua New Guniea (9.2%), Indonesia (6.4%), United States (5.7%), Malaysia (4.0%), Brunei (1.4%), United Arab Emirates (1.0%), Trinidad and Tabago (0.7%), Egypt (0.6%), Oman (0.4%) and others (0.4%).

Figure 2. LNG imports, 1990-2020



Source: Bureau of Energy, Ministry of Economic Affairs, Energy supply and demand database, 2021, <http://www.esist.org.tw/Database/Search?PageId=0>

⁵ GIIGNL, The LNG Industry Annual Report 2021, April 2021, https://giignl.org/sites/default/files/PUBLIC_AREA/giignl_2021_annual_report_apr27.pdf

⁶ Bureau of Energy, Ministry of Economic Affairs, Energy supply and demand database, 2021, <http://www.esist.org.tw/Database/Search?PageId=0>

More LNG imports are needed as nuclear gradually phases out by 2025

In 2011, the Fukushima nuclear accident led to public concerns and fears regarding nuclear safety in Chinese Taipei. In response to the public concerns, Chinese Taipei's government released an energy policy in 2011 to steadily reduce nuclear power and move towards a “nuclear-free homeland.”⁷ In 2014, the government made a concession and announced to seal the 4th nuclear plant, Lungmen power plant which was under construction.⁸

In 2016, the newly-elected government reassured the target of zero-nuclear in 2025 and released New Energy Policy in the same year to promote energy transition to achieve this target. The energy transition strategy was later incorporated into Energy White Paper which was approved by the Executive Yuan in 2020. The energy transition comprises two main objectives⁹:

- Enlarge the share of natural gas and renewable energy in the power mix. (See Figure 2)
Natural gas: 33% in 2019 to 50% in 2025
Coal: 46% in 2019 to 27% in 2025
Renewable energy: 6% in 2019 to 20% in 2025
Nuclear: 12% in 2019 to 1% in 2025¹⁰
Others: 3% in 2019 to 2% in 2025
- Decommission the three existing nuclear plants when their authorised 40-year lifespans expire between 2018 and 2025 to achieve a ‘nuclear-free homeland’ by 2025.

To reach the target of 50% gas share in power mix in 2025, more gas-fired power plants, larger LNG receiving capacity and storage capacity are required. However, expanding the LNG receiving capacity is not so easy in Chinese Taipei given the

⁷ Office of the President, Republic of China (Taiwan), Energy policy press conference, 2011, <https://www.president.gov.tw/NEWS/16016>

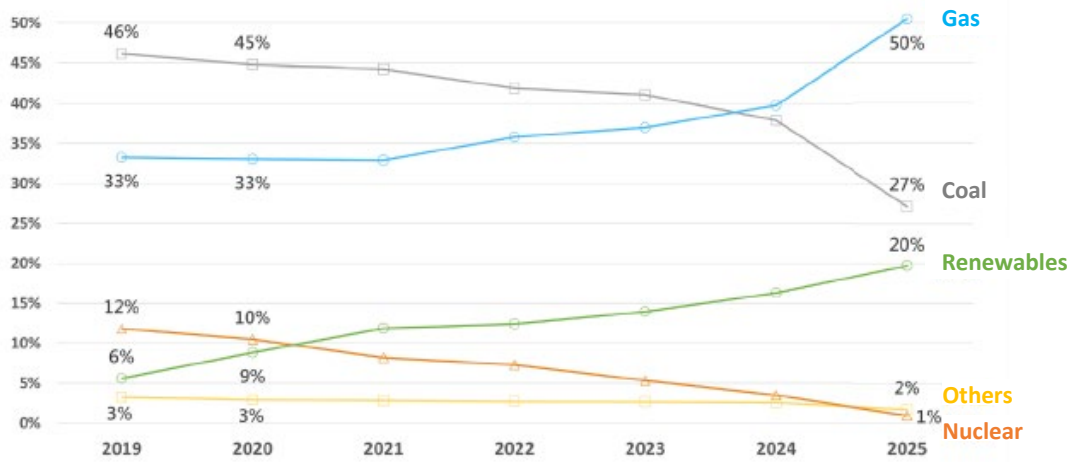
⁸ Atomic Energy Council, Lungmen power plant, 2021, https://www.aec.gov.tw/%E6%A0%B8%E8%83%BD%E7%AE%A1%E5%88%B6/%E5%8E%9F%E9%B%E8D%E9%96%80%E9%9B%BB%E5%BB%A0%E7%AE%A1%E5%88%B6%E5%B0%88%E5%8D%80-3_4622.html

⁹ Bureau of Energy, Ministry of Economic Affairs, Energy White Paper, 2021, https://www.moeaboe.gov.tw/ECW/main/content/wHandEditorFile.ashx?file_id=5964

¹⁰ The 2nd unit of the third nuclear power plant, Maansham power plant will operate until May 2025, so there is still 1% of nuclear power in the power mix in 2025.

environmental concerns over algal reef.

Figure 3. The power mix roadmap, 2019-2050



Source: Bureau of Energy, Ministry of Economic Affairs, Energy White Paper, 2021, https://www.moeaboe.gov.tw/ECW/main/content/wHandEditorFile.ashx?file_id=5964

[The expansion of LNG terminals]

Two terminals in operation, three terminals under construction or planning

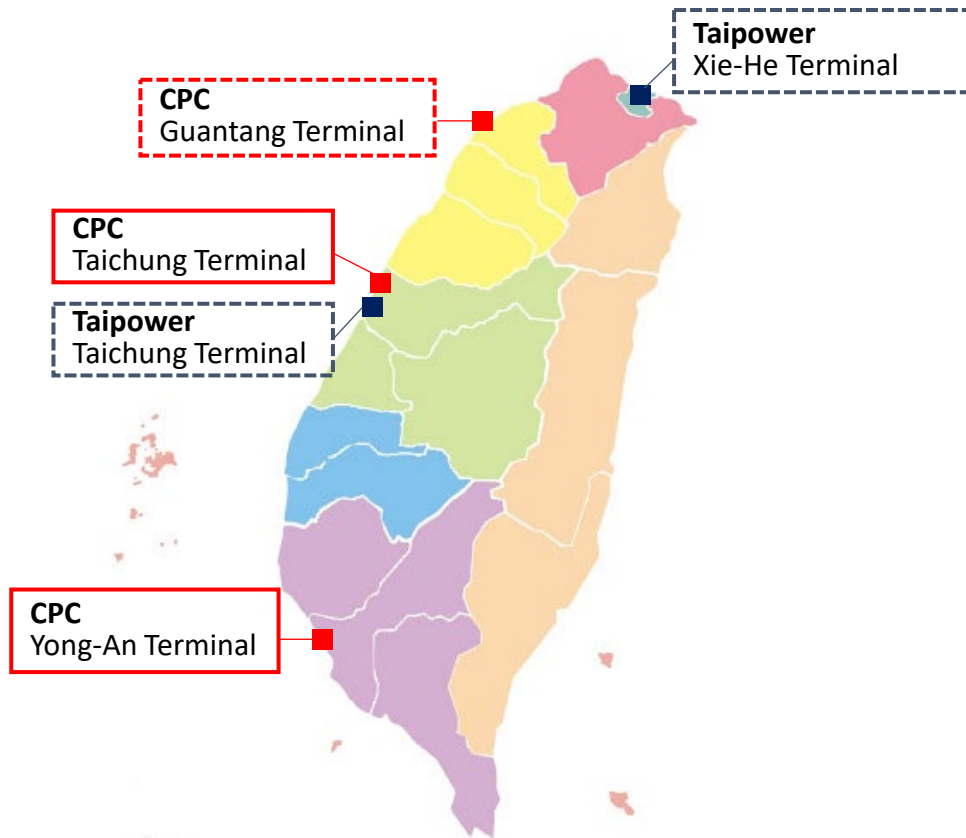
There are currently two LNG receiving terminals in operation: the Yong-An LNG and the Taichung LNG receiving terminals (owned by CPC); and three LNG receiving terminals under construction or in the planning stage: the Guantang LNG terminal (CPC), the Taichung and Xie-He LNG terminals (planned by Taipower).

The combined receiving capacity of the Yong-An and Taichung terminals in 2019 was 16.5 million tonnes per annum (mtpa).¹¹ The LNG imports 16.72 million tonnes¹² of the year was slightly higher than the nominal capacity, indicating the utilisation rate of the LNG terminals is over 100% and thus more receiving capacity is needed.

¹¹ Chinese Institute of Engineers, The planning and construction of LNG terminals in accordance of energy policy, 2021, http://www.cie.org.tw/cms/JournalFiles/11003_chapter06.pdf

¹² Bureau of Energy, Ministry of Economic Affairs, Energy supply and demand database, 2021, <http://www.esist.org.tw/Database/Search?PageId=0>

Figure 4. Existing and planned LNG terminals



Source: [IEEJ](#) analysis

In 2019, the Bureau of Energy convened a meeting to discuss energy policy after the public had voted to keep nuclear in energy mix.¹³ The government announced that the total receiving capacity will reach 26.2 million tonnes in 2025 following the phase 3 expansion of CPC’s Taichung terminal and expected completion of CPC’s Guantang terminal and Taipower’s Taichung and Xie-He terminals.

CPC’s LNG terminal projects

The Yong-An LNG terminal is the first and the largest LNG receiving terminal in Chinese Taipei. The terminal is located in southern Chinese Taipei, Yong-An District of Kaohsiung City. It started commercial operation in 1990. To meet the growing demand for power generation and city gas in northern Chinese Taipei¹⁴,

¹³ The government stated that the removal of the zero-nuclear target in 2025 did not mean that the operating nuclear power plants will be extended or the 4th nuclear power plant, Lungmen power plant will be restarted.

¹⁴ There is a 36-inch diameter, 238 km long undersea gas pipeline connecting from the Yong-An terminal to the gas-fired power plant in Tonghsiao, Miao-Li Prefecture.

the receiving capacity grew from an initial capacity of 1.5 mtpa to 10.5 mtpa in 2021 after four phases of expansion. The received volume reached 11 million tonnes in 2018.¹⁵

There are currently six underground LNG storage facilities at the Yong-An terminal: three tanks of 100,000 cubic metre capacity each and three tanks of 130,000 cubic metre capacity each. To meet the target of 50% gas share in power mix in 2025, CPC announced an expansion plan to add three LNG tanks of 200,000 cubic metres each and two regasification facilities with capacity of 200 tonnes/hour each. The construction is scheduled to complete in December 2026. As a result, the nominal receiving capacity of Yong-An terminal should reach 11 mtpa from current 10.5 mtpa in 2027. This expansion plan was approved by the government in 2018, followed by its environmental impact assessment (EIA) in 2020. CPC is now in the process of explaining the expansion plan to the local community.¹⁶¹⁷

The Taichung LNG terminal started operation in 2009 as the second LNG terminal in the country. It is located in the harbour in Taichung City and was designed for the purpose of supplying natural gas to the gas-fired power plant in Datan, as well as to the industrial and household users in central and northern Chinese Taipei.

After two phases of expansion, the terminal has a capacity of 6 mtpa and three LNG storage tanks of 160,000 cubic-metre capacity each as of 2020. The phase 3 expansion plan is to add another wharf, two LNG tanks of 180,000 cubic-metre capacity each and regasification units of combined 1,600 tonne/hour capacity. The new wharf, regasification units, and the two LNG tanks are scheduled to be completed in 2022, 2024, and 2026, respectively.¹⁸ In 2020, CPC announced a

¹⁵ CPC, "CPC natural gas department celebrates 30th anniversary of Yong-An LNG terminal", 2019, https://www.cpc.com.tw/News_Content.aspx?n=28&s=4097

¹⁶ CPC, "Yong-An terminal expansion plan supports growing natural gas supply", 2019, https://www.cpc.com.tw/News_Content.aspx?n=31&sms=8968&s=4248

¹⁷ LTN, "CPC held community briefing for Yong-An LNG terminal's expansion plan", 2021, <https://ec.ltn.com.tw/article/breakingnews/3456316>

¹⁸ Taichung City Government Investment Opportunity, CPC's Taichung terminal expansion complete in 2024, 2020, <https://www.invest-taichung.com.tw/%E4%B8%AD%E6%B2%B9%E8%87%BA%E4%B8%AD%E6%B8%AF%E5%A4%A9%E7%84%B6%E6%B0%A3%E6%8E%A5%E6%94%B6%E7%AB%99%E6%93%B4%E5%BB%BA-113%E5%B9%B4%E5%AE%8C%E6%88%90/>

phase 4 expansion project for the Taichung terminal, which is to add another four LNG storage tanks of 180,000 cubic metre capacity each, further additional regasification units of combined 1,600 tonne/hour capacity and two wharves. The phase 4 expansion is scheduled to be completed in 2028.¹⁹²⁰

A third LNG terminal is proposed by CPC to be in the Guantang industrial park at Guanyin District, Taoyuan City. The terminal is designed to supply natural gas to the nearby Datan gas-fired power plant. The first phase project consists of two LNG storage tanks of 160,000 cubic metre capacity each and a receiving capacity of 3 mtpa. When CPC obtained the development right in 2017, the company planned to start operation of the terminal in October 2022 with the initial capacity of 1 mtpa and stepping up to full capacity operation in 2025. The second phase of the third LNG terminal consists of six LNG storage tanks of 180,000 cubic metre capacity each, another wharf and regasification facilities. The second phase is scheduled to be completed in 2030.²¹²² However, the schedule of the first phase in late 2022 will most likely be delayed because the referendum against the construction will be held in August.

Table 1. CPC's existing and planned LNG storage tanks

	Existing LNG tank	Planned LNG tank
Yong-An terminal	100,000 m ³ x 3 130,000 m ³ x 3	200,000 m ³ x 3 (COD 2027)
Taichung terminal	160,000 m ³ x 3	180,000 m ³ x 2 (COD 2026) 180,000 m ³ x 4 (COD 2028)
Guantang terminal	N/A	180,000 m ³ x 6 (COD 2030)

Note: COD refers to commercial operation date

Taipower obtained approval to import LNG in 2014

As the government-owned oil and gas company, CPC has always been the sole LNG importer and supplier. However, given 80% of the natural gas is consumed for power generation, the government-owned utility Taipower would also like to

¹⁹ Commercial Times, CPC invests 11.86 billion NTD on four projects, 2020, <https://ctee.com.tw/news/industry/344572.html>

²⁰ CPC, 2021 Annual Report, 2021, <https://ws.cpc.com.tw/cpcannual/2021/index.html#p=I>

²¹ CPC, 2021 Annual Report, 2021, <https://ws.cpc.com.tw/cpcannual/2021/index.html#p=I>

²² CPC, CPC's projects and plans, <https://en.cpc.com.tw/cp.aspx?n=2720>

procure LNG on its own without purchasing through CPC. After several discussions, Taipower obtained the government's approval to procure LNG by itself in 2014.²³

To reduce the air pollution problem, Taipower plans to construct gas-fired power units to replace four existing oil-fired power units at its Xie-He power plant. While two units were decommissioned in 2019, two units are still in operation. To supply natural gas to the Datan gas-fired power plant, as well, Taipower plans to construct the Xie-He LNG receiving terminal nearby the Datan power plant in Keelung City. The project includes an LNG receiving terminal of 0.9 mtpa capacity in 2025 and 1.8 mtpa in 2030, as well as two LNG tanks of 160,000 cubic metre capacity each.²⁴

Taipower also plans to construct another LNG receiving terminal in Taichung to supply gas to its Taichung gas-fired power plant. The project consists of an LNG receiving wharf, five LNG storage tanks and other related facilities.²⁵

Currently the two LNG terminal projects by Taipower are undergoing EIA. However, CPC's controversial Guantang LNG terminal has caused some concerns in the public regarding environmental impacts of LNG terminals in general. Taipower has admitted that its two LNG terminals will not be able to come online in 2025 because of the impact of public concerns. Taipower will seek CPC's support for its Taichung gas-fired power plant, and use a floating storage regasification unit (FSRU) for Xie-He power plant before the LNG terminal is completed.²⁶

²³ Taipower, Taipower's natural gas procurement, 20220,
<https://www.taipower.com.tw/en/page.aspx?mid=4490>

²⁴ Legislative Yuan, Republic of China (Taiwan), Analysis of increasing gas share in power mix, 2018,
<https://www.ly.gov.tw/Pages/Detail.aspx?nodeid=6590&pid=168831>

²⁵ Taipower, Taichung's gas-fired power plant, 2021,
<https://www.taipower.com.tw/tc/page.aspx?mid=223&cid=3027&cchk=1a4d14c4-93f6-47a1-bd8a-7dd2c88954a2>

²⁶ Radio Taiwan International, Taipower's two LNG terminals might be affected by the domino effect from the algae reef referendum, 2021, <https://www.rti.org.tw/news/view/id/2093263>

Table 2. Current and planned capacity of all LNG receiving terminals (including terminals under construction and planning)

Unit: million tonnes		2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
CPC	Yong-An terminal, current (started in 1990)	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5				
	Yong-An terminal, phase 5									11	11	11	11
	Taichung terminal, phase 1,2 (started in 2009)	6	6	6	6	8	8						
	Taichung terminal, phase 3							10	10	10			
	Taichung terminal, phase 4										13	13	13
	Guantang terminal, phase 1					1	2	3	3	3			
	Guantang terminal, phase 2										3.5	4.5	5.5
Taipower	Taichung terminal					0.3	1.35	1.8	1.8	3	3.8	4.1	4.1
	Xie-He terminal							0.9	0.9	0.9	0.9	0.9	1.8
Combined receiving capacity		16.5	16.5	16.5	16.5	19.8	21.85	26.2	26.2	27.9	32.2	33.5	35.4
Bureau of Energy's demand forecasts		16.7	16.74	16.88	18.93	19.62	20.42	24.9	23.93	24.32	25.91	26.61	27.11

Source: Chinese Institute of Engineers, The planning and construction of LNG terminals in accordance of energy policy, 2021, http://www.cie.org.tw/cms/JournalFiles/11003_chapter06.pdf

[The environmental challenge of the third LNG terminal]

Guantang LNG terminal development started in the 1990s

In 1996, industrial conglomerate Tuntex Group's (東帝士集團) subsidiary, Tun-Ting Liquefied Gas Corporation (東鼎業化瓦斯興業), obtained approval from the government to develop the Guantang industrial park. Tung-Ting's development plan was to construct an LNG receiving terminal at the industrial park in a bid to acquire the natural gas supply contract with Taipower. However, after a few rounds of bidding, CPC won the natural gas supply contract with Taipower.²⁷²⁸²⁹

²⁷ Business Today, Tung-Ting's 40 billions dream of Guantang industrial park, 2003, <https://www.businesstoday.com.tw/article/category/80392/post/200311200026/%E5%9B%9B%E5%8D%83%E5%84%84%E7%9A%84%E6%9D%B1%E9%BC%8E%E8%A7%80%E5%A1%98%E5%A4%A7%E5%A4%A2%E5%BE%9E%E9%99%B3%E7%94%B1%E8%B1%AA%E5%88%B0%E5%8A%89%E6%B3%B0%E8%8B%B1%E9%83%BD%E7%99%BD%E5%BF%99%E4%B8%80%E5%A0%B4%20P.46>

²⁸ LTN, The crisis of gas supply to Datan power plant, 2004, <http://old.ltn.com.tw/2004/new/feb/4/today-p1.htm>

²⁹ LTN, Tung-Ting's Guantang investment, 2004, <http://old.ltn.com.tw/2004/new/jul/28/today-fo6.htm>

Later in 2017 CPC acquired the development right of the Guantang industrial park from Tung-Ting and started developing a third LNG terminal.³⁰

To meet the 50% of gas share in power mix target, Taipower has plans to add additional gas-fired power generation units in Datan power plant. Accordingly, CPC has chosen the Guantang industrial park to construct the third LNG receiving terminal in Chinese Taipei. The decision was contributed by several factors. One was that the Guantang industrial park already underwent several EIAs, including the EIA approval in 1999 and completed comparative environmental impact analyses in 2000, 2002, 2004, 2007 and 2009. CPC expected a shorter timeline of the new assessment given the completed assessments in old days. As a result, after several meetings with governmental officials and algal reef experts, the government approved CPC's new EIA in September 2018. CPC started construction of the third receiving terminal in December 2020.³¹

Referendum against third LNG terminal is scheduled on 28 August 2021

There are 7500-year-old algal reefs in Taoyuan, extending 27 kilometers (km) along the coastal line. It is the home to many marine creatures and endangered coral species. The 27-km algal reef could be divided into six algal reef regions based on the neighboring town: Shalun, Xucuo gang, Chaoyin, Shulin, Baiyu, Datan and Guanxin algal reefs. The location of Datan algal reef is also the location of the Guantang LNG receiving terminal.³²

To avoid the Datan algal reef area, CPC has proposed several revisions of the development area, which was reduced from the initial plan of 232 hectares to 23 hectares. However, the environmental activists have claimed that even though the development area is reduced, the construction in the sea will still cause disruptive impact, which is known as groyne effect³³, leading to greater sedimentation and bring negative impacts to the algal reefs.³⁴

³⁰ Fair Trade Commission, CPC acquired Tung-Ting to establish national natural gas supply system, 2017, <http://www.ftc.gov.tw/upload/1061101-2-2.pdf>

³¹ Taipei Times, Informing people about the Datan LNG project, 2021, <https://www.taipeitimes.com/News/editorials/archives/2021/03/29/2003754668>

³² Save Algal Reef in Taiwan, 2021, <http://140.109.28.23/wordpress/savealgalreef/>

³³ When a groyne works as intended, sand moving along the beach in the downdrift direction is trapped on the updrift side of the groyne, causing a sand deficit and increasing erosion rates on the downdrift side.

³⁴ Save Algal Reef in Taiwan, Crisis of Datan algal reef, 2021,

To protect the algal reef ecosystem, the Rescue Datan's Algal Reefs Alliance (珍愛藻礁) initiated a campaign to start a referendum against the Guantang LNG terminal plan. After massive support from the public, the referendum proposal gained 643,371 valid signatures and surpassed the signature threshold. The referendum "Do you agree that CPC's LNG terminal should be relocated from its planned site on the algal reef coast of Datan and its adjacent waters?" is scheduled on 28 August 2021.³⁵

The government proposed a new plan to push the LNG project farther offshore

To prevent the Guantang project from being blocked by the upcoming referendum, the government announced in May that it had updated the plan to further push the industrial port by 455 metres from the previous proposal by extending the hollow pier bridge to 1197 metres (See Figure 5). The government explained that with the terminal farther out into deeper water, the ocean floor no longer needs to be dredged so the Datan algal reef could be completely reserved.³⁶

<http://140.109.28.23/wordpress/savealgalreef/crisis/>

³⁵ Taipei Times, Referendum proposals reach signature threshold, 2021,
<https://www.taipeitimes.com/News/taiwan/archives/2021/05/08/2003757046>

³⁶ LTN, Ministry pushes LNG project farther offshore, 2021,
<https://www.taipeitimes.com/News/biz/archives/2021/05/04/2003756772>

Figure 5. The revised plan of the Guantang LNG terminal in May 2021



Source: CPC, Revised plan of Guantang LNG terminal, 2021, <https://ws.cpc.com.tw/Download.ashx?u=LzAwMS9VcGxvYWQvMS9yZWxmaWxlLzkwMzYvNTkyOS84M2EyZDdlNiooNmFiLTRjZWetOTg5Mii1OWE5ZWU2Y2U3YTmucGRm&n=5LiJ5o6l5aSW5o6o5a6j5bC0LnBkZg%3d%3d>

The government said that the new proposal would add TWD 15 billion (USD 540 million) to the project budget and the gas supplying time would delay from December 2022 to June 2025. CPC plans to send out the comparative environmental impact analyses by 28 August, the referendum date. The environmental activists have proposed to move the receiving terminal to either the Taipei or Linkou harbour, which have been turned down by the government as they might take 11 more years worsening the power shortage problem.³⁷

³⁷ Ibid.

Regarding the updated plan by the government, some people still reckon the construction will damage the algal reef but others think this is a solution between potential power shortage and the algal reef protection. It is worth being noted that there were several unexpected blackouts and rolling blackouts, implemented in May 2021 because of some power system failures.

One of the causes of the blackouts was rapidly increasing power demand of households as more people stayed home after a nationwide Level 3 epidemic alert by the government for the Covid-19 outbreak. Another cause was inadequate resilience and design of the power network, rather than power shortage. Nevertheless, the blackouts have given the public the impression that there is a potential risk of power shortage even though the problem is much more complex. As of now, the result of the referendum in the end of August is still uncertain and should be watched closely.

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