

Chapter 1

Decarbonisation Initiatives of ASEAN Countries

October 2022

This chapter should be cited as

ERIA Study team (2022), 'Decarbonisation Initiatives of ASEAN Countries', in Matsumoto, A. and H. Phoumin (eds.), *Decarbonation of Thermal Power Generation in ASEAN Countries*. ERIA Research Project Report FY2022 No. 11, Jakarta: ERIA, pp.1-33.

Chapter 1

Decarbonisation Initiatives of ASEAN Countries

Overview

Amidst the global movement towards carbon neutrality, ASEAN countries are also being urged to abolish coal-fired thermal power decarbonisation. However, with coal power accounting for, e.g. around 60% of the power supply structure in Indonesia and about 50% in Viet Nam, and with energy demand anticipated to rise further with economic growth, the efficient use of coal-fired thermal power will remain indispensable as a stable power source in the future. Meanwhile, since countries may face difficulties in financing unless they decarbonise earnestly, each ASEAN country should start formulating a road map based on the concept of transition, in which decarbonisation efforts are implemented in phases according to the country's situation, beginning by the introduction of relatively affordable low-carbon technologies.

Given each country's energy mix and potential to introduce renewable energy, covering all additional electricity demand entirely with renewable energy is not realistic. Thus, it will be important to pursue realistic pathways in line with the supply and demand and each country's industrial structure.

Given these issues, we will explore in depth the anticipated challenges in pursuing decarbonisation. First, we examine the current power supply structure and future power development plans of five key ASEAN countries (Indonesia, Malaysia, the Philippines, Thailand, and Viet Nam) and their status in introducing climate measures and renewable energy capacity, and any decarbonisation efforts.

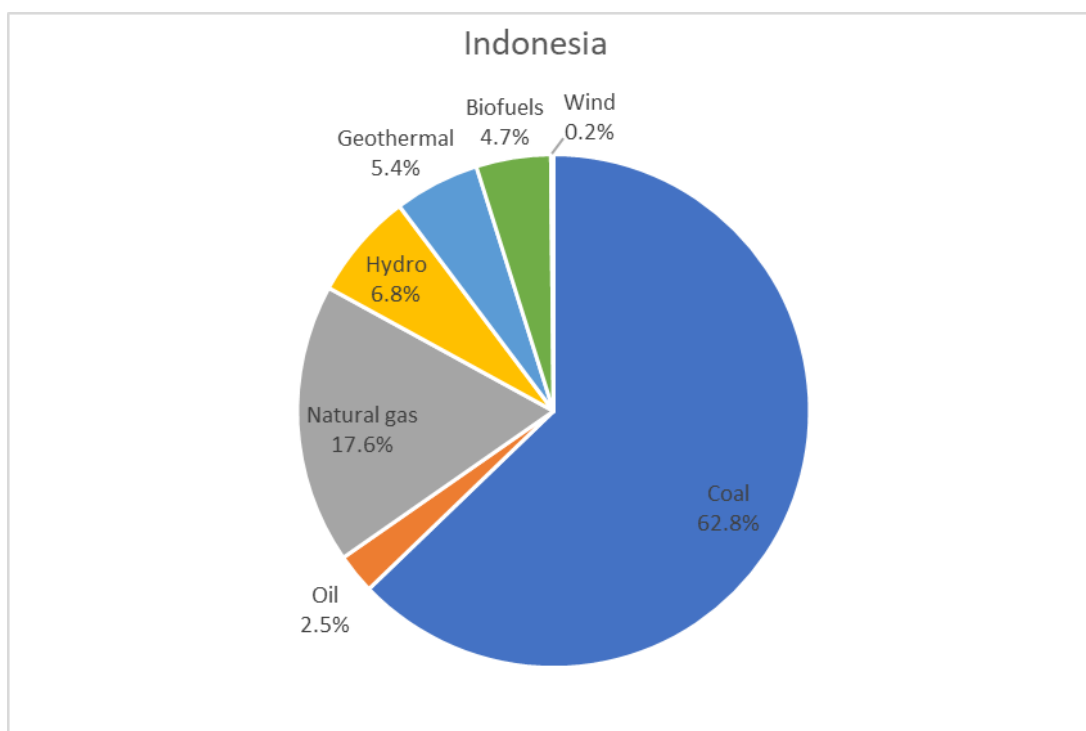
1. Indonesia

1.1. Current power supply structure

Indonesia is the fourth most populous country in the world and the largest amongst ASEAN countries. It continues to achieve stable growth, with a gross domestic product (GDP) growth rate of around 5% before the pandemic. However, its dependence on coal power is an issue. With its national greenhouse gas (GHG) emissions accounting for roughly half of the total for ASEAN countries, Indonesia must act to remain on a path of sustainable growth.

Indonesia's current power supply structure is shown in Figure 1.1. Coal power accounts for the largest share at 62.8%, followed by natural gas power at 17.6%. In 2019, the country had a total power output of 288 TWh.

Figure 1.1. Current Power Supply Structure in Indonesia (2019)



Source: IEA (2021a).

1.2. Power development plan

Indonesia's power development plan is under discussion. The country's nationally determined contribution (NDC) submitted in July 2021 states that it will follow its National Energy Policy¹ stipulated in 2014, its latest policy statement.

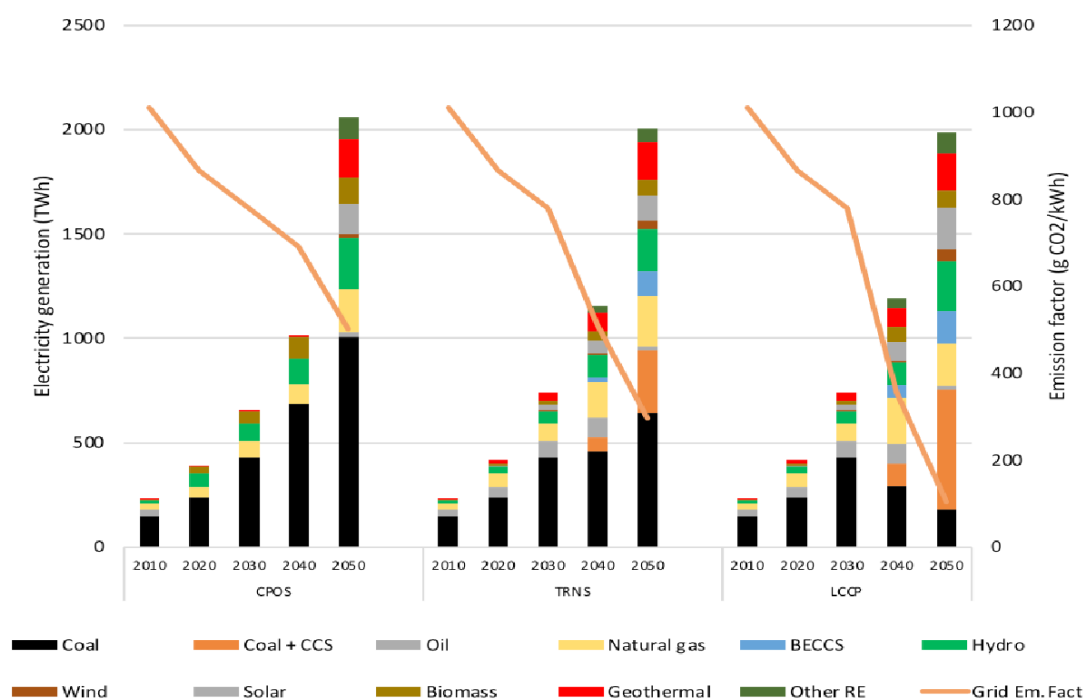
To shift to clean energy sources, the National Energy Policy sets the following targets for 2025 and 2050:

- 1) a share of at least 23% for new and renewable energies (NREs) in 2025 and 31% in 2050
- 2) a share of 25% or less for oil in 2025 and 20% or less in 2050
- 3) a share of 30% or less for coal in 2025 and 25% or less in 2050
- 4) a share of 22% or less for gas in 2025 and 24% or less in 2050

Furthermore, Indonesia's the Long-Term Strategy for Low Carbon and Climate Resilience 2050 (LTS-LCCR 2050) submitted to the United Nations in July 2021 predicts the country's power supply structure based on three scenarios: the Current Policy Scenario (CPOS), the Transition Scenario (TRNS), and the Low-carbon Scenario Compatible with the Paris Agreement Target (LCCP). The LCCP, the scenario with the highest degree of decarbonisation, predicts a power supply composition in 2050 of 43% NREs, 38% coal, 10% natural gas, and 8% bioenergy with carbon capture and storage (CCS), with roughly 76% of all coal power plants adopting CCS to achieve zero emissions. However, the power source plan in this scenario is a forecast rather than a backcast. All scenarios in the LTS-LCCR 2050 predict that coal power will remain in use in 2050.

¹<https://policy.asiapacificenergy.org/sites/default/files/Government%20Regulation%20No.%2079%3A2014%20of%202014%20%28EN%29.pdf>.

Figure 1.2. Power Supply Mix and Projected Grid Emission Factors



BECCS = bioenergy with carbon capture and storage, RE = renewable energy.

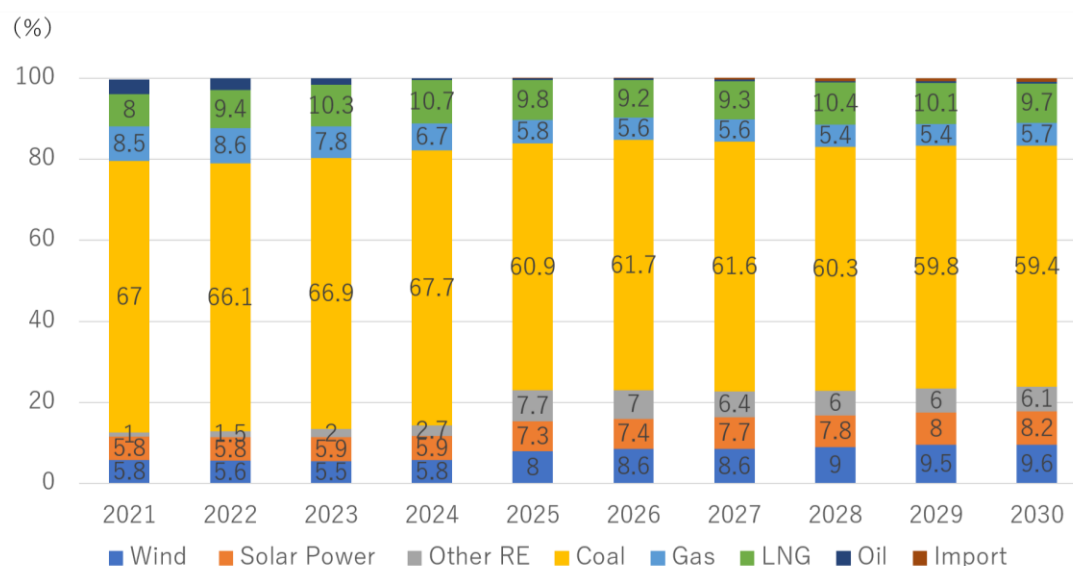
Source: Government of Indonesia (2021).

Meanwhile, in October 2021, the Ministry of Energy and Mineral Resources announced the power supply business plan (*Rencana Usaha Penyediaan Tenaga Listrik: RUPTL*)² of Indonesia's state-owned power company, PLN. According to the plan, the country will phase out its coal power plants from 2025, starting with the least efficient ones, and will not build new plants in 2025 and beyond unless a contract has already been signed.

Furthermore, PLN's 2021–2030 supply plan anticipates average annual growth of 4.9% in electricity output over the next 10 years. PLN's power supply plan is shown in Figure 1.3. Coal accounts for 60.9% and NREs for 23% in 2025 and 59.4% and 23.9%, respectively, in 2030.

² <https://web.pln.co.id/statics/uploads/2021/10/ruptl-2021-2030.pdf>

Figure 1.3. Electricity Supply Planning in the PLN



LNG = liquefied natural gas, RE = renewable energy.

Source: PLN (2021).

1.3. Climate change policy (NDC)

Indonesia submitted its updated NDC and Long-Term Strategy for Low Carbon and Climate Resilience 2050 (LTS-LCCR 2050) to the United Nations in July 2021.

In the updated NDC, Indonesia raised its 2030 GHG emission target from the previous target of 26% of business-as-usual scenario (BAU) figures to 29% and an ambitious level of up to 41% if international support is provided.

In the LTS-LCCR 2050, the country pledges to reach peak GHG emissions in 2030 and achieve net-zero emissions in 2060 or earlier.

Table 1.1. Outline of Nationally Determined Contribution

Target	Target Value	Target Year	Base Year	Basis Law
GHG Emissions	<p>▲ 29%</p> <p>(▲ 41%: with international support)</p>	2030	BAU	NDC

Source: UNFCCC (2021).

1.4. Outlook for coal

At the Conference of the Parties (COP26) held in November 2021, Indonesia signed the Global Coal to Clean Power Transition Statement, albeit with conditions.³ The country plans to phase out coal by 2056 and accelerate the timeline to the 2040s if international financial and technical assistance is provided.

In November 2021, the World Bank's Climate Investment Funds announced the launch of the \$2.5 billion Accelerating Coal Transition⁴ (ACT) programme to help India, Indonesia, the Philippines, and South Africa, accelerate the shift from coal power to clean energy. The four countries collectively account for 15% of the world's coal-related GHG emissions. ACT was approved⁵ by the G7. The programme seeks to assist the energy transition of coal-dependent countries and transform them into sustainable economies.

1.5. Outlook for renewable energy

Indonesia's installed renewable energy capacity was 49 TW in 2020, accounting for 17% of its total power output. It comprises 6.8% hydropower, 5.4% geothermal power, 4.7% biomass power, and 0.2% wind power.

As for the country's renewable energy outlook, the Ministry of Energy and Mineral Resources has revealed that a road map for achieving carbon neutrality by 2060 is being drawn up.⁶ The road map contains the following preliminary capacity targets for renewable energy:

- 2022: NRE law enacted
- 2025: NREs expanded to 23%
- 2030: NREs expanded to 42%
- 2035: NREs expanded to 57%
- 2040: NREs expanded to 71%
- 2050: NREs expanded to 87%

³ <https://ukcop26.org/global-coal-to-clean-power-transition-statement/>

⁴ <https://www.climateinvestmentfunds.org/news/cif-begins-historic-25b-coal-transition-pilot-four-developing-countries>

⁵ <https://www.climateinvestmentfunds.org/news/statement-g7-endorsement-climate-investment-funds>

⁶ <https://www.esdm.go.id/en/media-center/news-archives/road-map-to-carbon-neutrality-is-being-prepared-says-energy-minister>

- 2060: NREs expanded to 100%

The upcoming road map is expected to present an updated power supply structure.

1.6. Recent moves towards decarbonisation

• Carbon pricing

Indonesia aims to establish an emissions trading market by 2023. In March 2021, a trial of emissions trading began for the electricity subsector as a pilot project.⁷ In this project, participants were allowed to purchase credits for a maximum of 70% of the gap with their emission allowance. They must cover the remaining portion through other emission reduction and carbon offset activities, such as building renewable power plants. Participating in the project to gain expertise in CO₂ emissions trading are 80 coal power plants, including 59 owned by the state power company PLN.

From April 2022, a CO₂ emission quota was to be introduced in the power sector and a carbon tax was to be imposed on excess emissions with a very low tax of Rp 30,000 (\$2)/t-CO₂⁸.

However, the Ministry of Finance has twice postponed the introduction of the carbon tax due to the uncertain outlook caused by inflation due to rising fuel costs, and the timing of the introduction of the carbon tax is currently undecided.

• Energy Transition Mechanism by ADB

At COP26, held in November 2021, the Asian Development Bank (ADB), Indonesia, and the Philippines announced a partnership to establish the Energy Transition Mechanism (ETM).⁹ The mechanism aims to retire existing coal power plants ahead of schedule and replace them with clean power plants. When the ETM involving Indonesia, the Philippines, and possibly Viet Nam becomes fully operational, aiming to retire 50% of the total coal power output of 30 GW over the next 10 to 15 years, the parties believe it could cut 200 million tonnes of CO₂ emissions per year. The Japanese government has announced an aid of \$25 million for the

⁷ [https://www.esdm.go.id/en/media-center/news-archives/uji-coba-perdagangan-karbon-diikuti-80-pembangkit-](https://www.esdm.go.id/en/media-center/news-archives/uji-coba-perdagangan-karbon-diikuti-80-pembangkit)

⁸ <https://www.esdm.go.id/en/media-center/news-archives/energy-ministry-disseminates-carbon-tax-policy-in-electricity-subsector>

⁹ <https://www.adb.org/news/adb-indonesia-philippines-launch-partnership-set-energy-transition-mechanism>

ETM partnership.¹⁰

- **Japan–Indonesia memorandum of understanding (MOU) for achieving energy transition**

Japan and Indonesia signed an MOU on a phased transition towards net-zero emissions.^{11,12}

The parties recognise the important role of fuel ammonia in achieving a hydrogen energy society not only as a hydrogen carrier but also as a zero-emission fuel. Therefore, they will cooperate on the future development of the hydrogen and fuel ammonia markets. Examples of the technologies referred to in the MOU include hydrogen; fuel ammonia; carbon recycling; CCS/carbon capture, utilisation, and storage (CCUS); and enhanced oil/gas recovery. One project currently making progress is a joint study by the Mitsubishi Heavy Industries and Indonesia's Research and Development Center for Oil and Gas or LEMIGAS on the co-combustion of fuel ammonia in a coal power plant. The study aims to assess the technological and economic feasibility of partially substituting coal with ammonia to maintain the operating life of coal power plants.

2. Malaysia

2.1. Current power supply structure

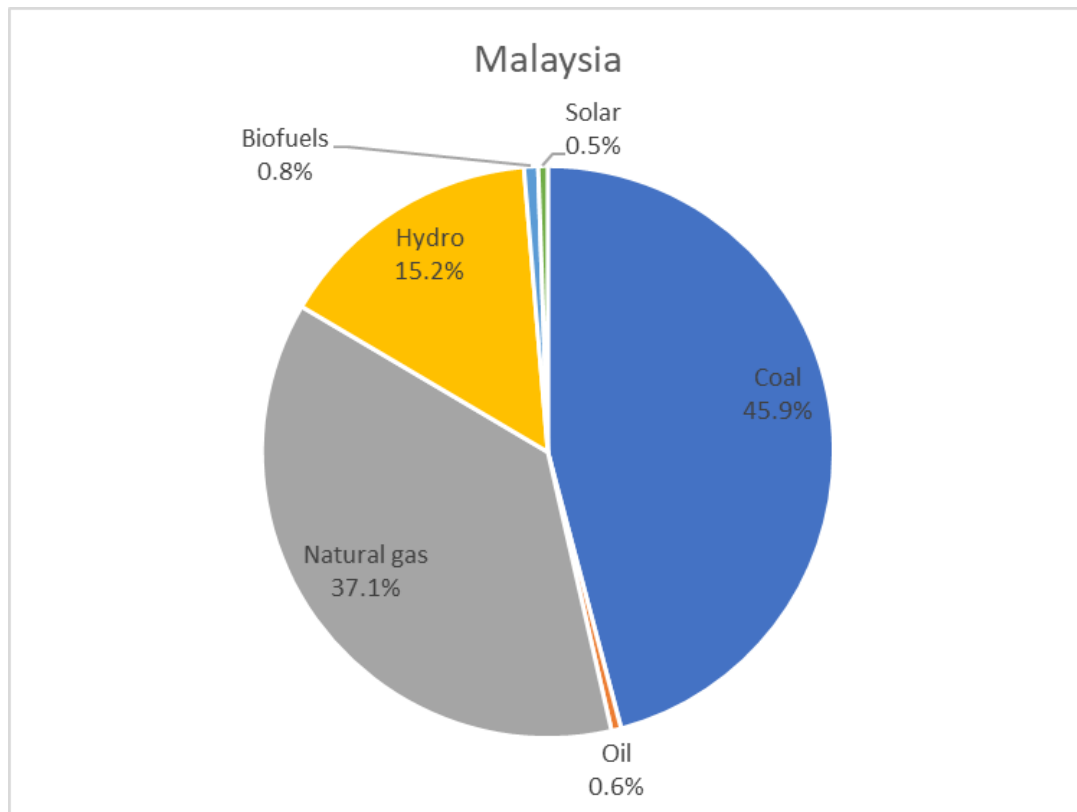
Malaysia's power supply structure consists of 45.9% coal power, 37.1% natural gas power, and 16.5% renewable electricity (including hydropower).

¹⁰ <https://www.adb.org/id/news/japan-announces-25-million-adb-led-energy-transition-mechanism-southeast-asia>

¹¹ <https://www.esdm.go.id/en/media-center/news-archives/indonesia-jepang-teken-kerja-sama-transisi-energi>

¹² <https://www.meti.go.jp/press/2021/01/20220113003/20220113003-1.pdf>

Figure 1.4. Current Power Supply Structure in Malaysia (2019)



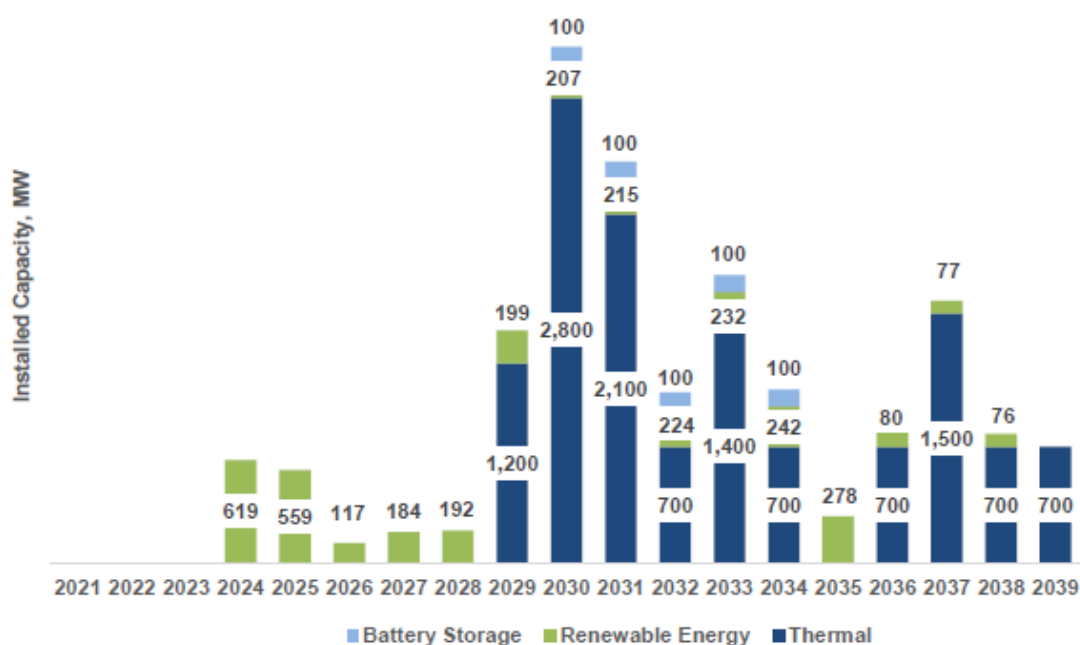
Source: IEA (2021a).

2.2. Power development plan

As for the development of coal power plants, according to the Report on Peninsular Malaysia Generation Development Plan 2020 (2021–2039) published by the Energy Commission (2021), there are plans to abolish 2,100 MW of coal power plants in 2031 and 1,400 MW in 2033. Meanwhile, there are two new build projects in 2021–2039: one 1,400 MW plant in 2031 and one 700 MW plant in 2037. In his speech on the national development plan (Malaysia Plan) on 27 September 2021, Prime Minister Ismail Sabri bin Yaakob stated that the government would build no new coal power plants (Economic Planning Unit, 2021).

There are no plans to build new thermal power plants until 2028, even though closing plants will be replaced (with 1,200 MW of new thermal power plants (combined cycle gas turbine) capacity in 2029 and 2,800 MW in 2030).

Figure 1.5. Power Supply Plan for Peninsular Malaysia (2021–2039)



Source: Energy Committee (2021),

2.3. Climate change policy (NDC)

Malaysia's NDC aims to reduce the national GHG emissions per unit GDP by 45% from 2005 levels by 2030. This is 10% higher than the target registered when Malaysia ratified the Paris Agreement on 16 November 2016. The government intends to draw up an NDC road map to formulate concrete mitigation actions to fulfil the Paris Agreement and to present clear reduction targets for each key GHG emission sector (Economic Planning Unit, 2021).

Table 1.2. Outline of Nationally Determined Contribution

Target	Target Value	Target Year	Base Year	Basis Law
GHG emissions intensity of GDP	▲ 45%	2030	2005	NDC

Source: UNFCCC (2021).

2.4. Outlook for coal

Malaysia does not have a national policy on coal production. However, coal is one of the key energies alongside oil, natural gas, and hydropower based on the Four-Fuel Diversification Policy¹³ (policy for fuel diversification using the four fuels), and the construction of coal power plants has been pursued since the 1980s.

Malaysia began to produce coal to supply its coal power plants in 1988 in the state of Sarawak. The country produced 350,000 tonnes of coal in 2000, 2.4 million tonnes in 2010, and 2.98 million tonnes in 2020 (IEA, 2021d).¹⁴

Meanwhile, coal consumption has increased with the construction of coal power plants. It rose from 410,000 tonnes in 1988 to 3.66 million in 2000; 23.16 million in 2010; and as much as 34.08 million in 2020. Coal imports grew from 410,000 in 1988 to 3.08 million in 2000, surpassed 20 million tonnes in 2010 with 20.74 million, and reached 31.10 million in 2020 (IEA, 2021d).¹⁵

The Energy Commission provides a forum for sharing information on facility planning and coal import and supply, as well as discussing the future coal-sourcing strategy. Its policy is to use mainly coal imported from Indonesia.

The Malaysian government plans to increase the share of renewables to 31% of its power source structure in 2025. It expects the installed capacity of coal power plants to decrease from 37% in 2021 to as low as 22% in 2039. Accordingly, coal consumption is expected to decrease gradually.

2.5. Outlook for renewable energy

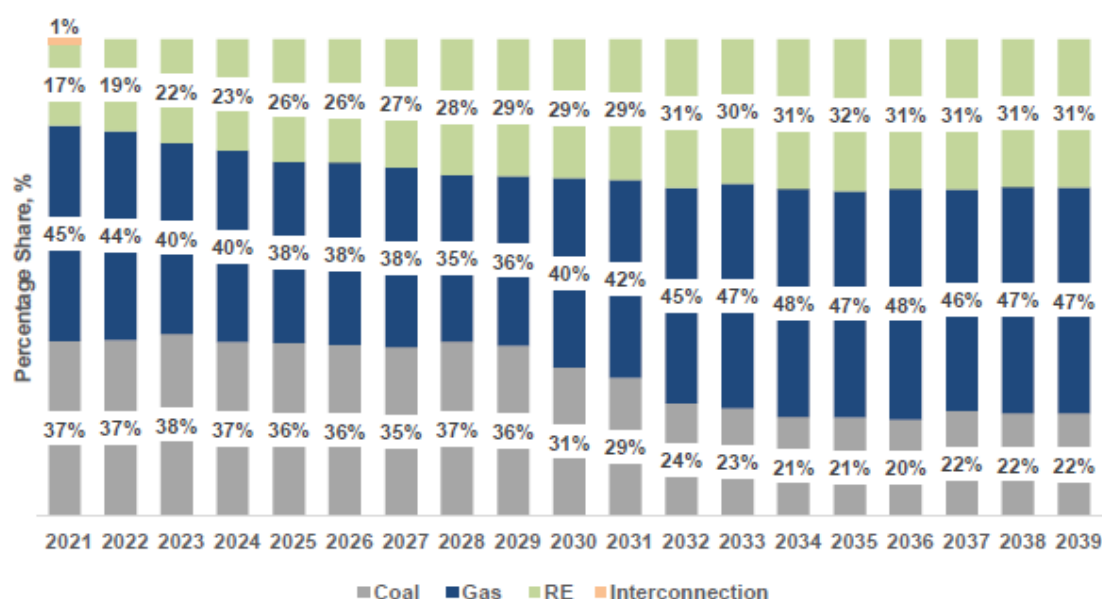
The government plans to increase the national target share of renewable capacity (including hydropower) to 31% in 2025 from the previous target of 20% (to 26% for the Malay Peninsula). The Malay Peninsula is slated to introduce an additional renewable energy capacity of 1,178 MW (including 1,098 MW of solar photovoltaic (PV) plants). Accordingly, the transmission network infrastructure is expected to be strengthened using highly needed technological solutions such as energy storage systems.

¹³ In 1999, the Five-Fuel Diversification Policy, which included renewable energy, entered into effect.

¹⁴ 2020 output is an estimate.

¹⁵ 2020 consumption and imports are estimates.

Figure 1.6 Prospects for the Power Supply Capacity Mix in the Malay Peninsula



Source: Energy Committee (2021).

2.6. Recent moves towards decarbonisation

a) The Twelfth Malaysia Plan

The current Malaysia Plan, the twelfth (2021–2025), aims to promote green growth by implementing a clean, green, and resilient development agenda through a nationwide approach. It sets the following strategic objectives:

- accelerate the transition to a circular economy
- promote green and resilient cities and townships
- strengthen green mobility
- increase low-carbon energies
- strengthen mineral resource management
- improve resilience against climate change and natural disasters

Furthermore, Malaysia plans to strengthen the development and utilisation of renewable energy resources. The country will also focus on using other renewable resources, such as biomass and biogas, as well as large-scale hydropower and solar PV. By utilising existing and

new technologies such as cogeneration, solar heat energy, and fuel cells, it seeks to provide the industry with more alternatives. Further, the plan refers to accelerating the introduction of energy storage systems and other new technologies to resolve the intermittency of solar power.

Regarding energy policy, the plan states that the growth potential related to energy will be studied, particularly new energies that use clean and sustainable resources, especially hydrogen.

Malaysia plans to use domestic gasoline and diesel oil, encourage high-value investment in the petrochemical industry, and expand the use of biofuels to ensure the development and sustainability of the domestic oil and gas industries.

b) Moves to adopt carbon pricing

Malaysia is also expected to conduct a feasibility survey on carbon pricing measures such as a carbon tax and emissions trading system (Economic Planning Unit, 2021). In his speech on the Malaysia Plan on 27 September 2021, Prime Minister Ismail Sabri bin Yaakob declared that Malaysia will become carbon neutral by as early as 2050.

c) Efforts towards decarbonisation

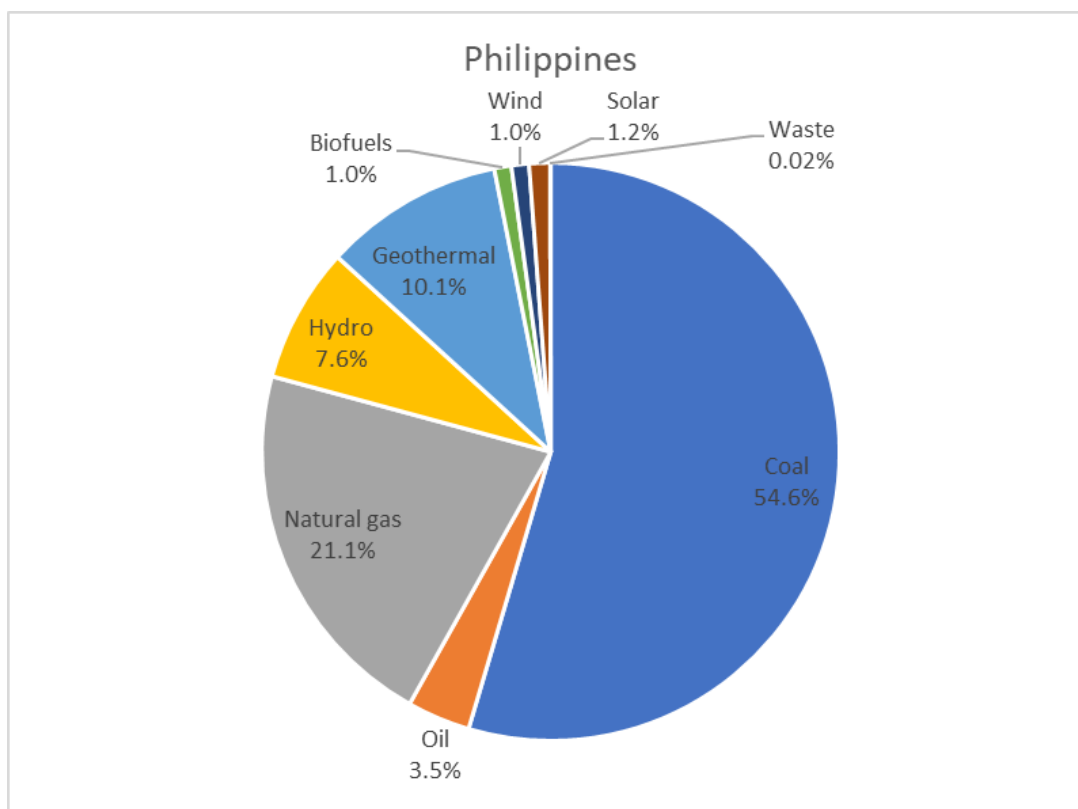
Malaysia's decarbonisation efforts include a technical and economic feasibility study on a business model conducted with subsidies from Japan's Ministry of Economy, Trade and Industry (METI) under its FY2021 feasibility studies on the overseas deployment of high-quality infrastructure (METI, 2021a). The project aims to significantly reduce CO₂ by adding an ammonia-biomass co-firing facility to an ultra-supercritical (USC) coal power plant (METI, 2021b).

3. Philippines

3.1. Current power supply structure

The power supply structure of the Philippines consists of 54.6% coal power, 21.1% natural gas power, and 20.7% renewable electricity (including hydropower).

Figure 1.7. Current Power Supply Structure in the Philippines (2019)

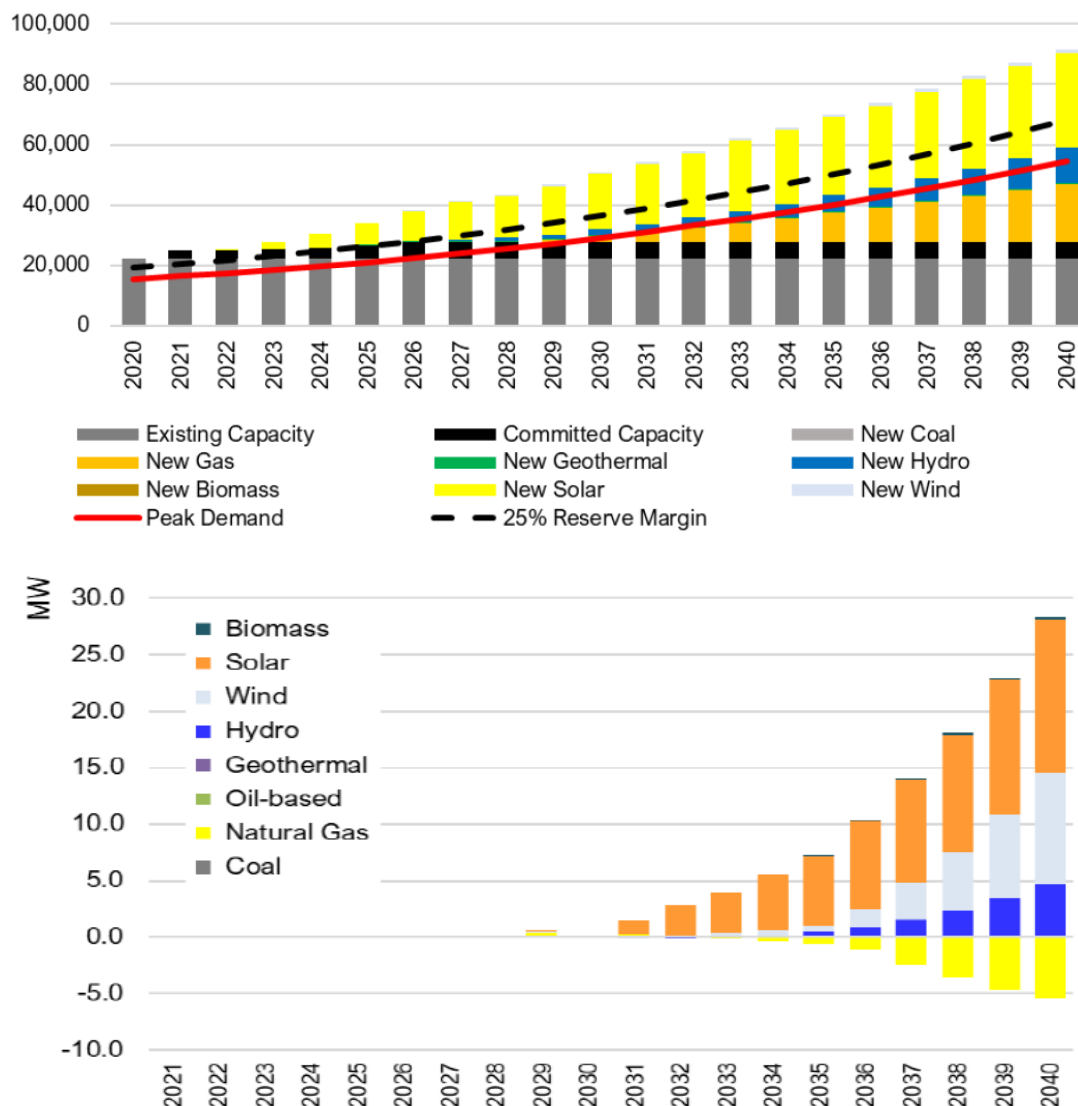


Source: IEA (2021a).

3.2. Power development plan

The Department of Energy (DOE) is responsible for preparing, integrating, coordinating, supervising, and regulating the Philippine government's energy-related plans and activities. In 2021, DOE unveiled the Philippine Energy Plan (PEP) 2020–2040, which presents the national energy supply–demand outlook up to 2040 (Department of Energy, 2021a). Future estimates are based on the Reference Scenario (REF) and the Clean Energy Scenario (CES). CES considers the expanded use of renewable energy, natural gas, and low-carbon, high-efficiency technologies in its estimate.

Figure 1.8. Future Power Supply Structures



Note: Upper figure (REF); Lower figure (CES - REF).

Source: Department of Energy (2021a)

In October 2020, DOE announced the suspension of the development of all new coal power plants apart from those that have already obtained a permit (Philippine News Agency, 2020). PEP 2020–2040 (released in October 2021) estimates that the coal power plant capacity will be 10.944 GW in 2020, 13.585 GW in 2030 and 2040, thus remaining flat from the 2030s. This is common to both the REF and CES scenarios.

The 2030 forecast for total power output under REF is 194 TWh, with coal accounting for a large percentage at 45.2%, followed by natural gas at 19.3%.

The 2040 forecast for total power output under CES is 350 TWh, anticipating a sharp increase in power output. Natural gas will have a higher share than coal, with 26.6% for the former and 23.1% for the latter.

Meanwhile, the 2040 forecast for total power output under REF is 364 TWh, with natural gas accounting for 40.3%, followed by 24.6% for coal, with natural gas having a larger share than coal. This presumably is because natural gas, which is more flexible as a fuel than coal, will contribute to the growth of solar PV, wind power, and other renewable energies. However, the Philippines will need to import liquefied natural gas (LNG) to meet its fuel demand in the future because of the depletion of the Malampaya gas field (Department of Energy, 2021a).

Table 1.3. Power Supply Capacity Outlook (2020, 2040) (REF)

(MW)

Fuel Type	Total Capacity		Capacity Additions				Total Capacity	
	2020		2021-2030		2031-2040		2040	
	Levels	% Shares	Levels	%	Levels	% Shares	Levels	% Shares
Coal	10,944	41.69	2,641	9.23	0	-	13,585	14.20
Natural Gas	3,453	13.15	381	1.33	0	-	24,263	25.36
Oil	4,237	16.14	3,570	12.48	17,240	42.24	4,618	4.83
Renewable	7,617	29.02	22,014	76.96	23,574	57.76	53,205	55.61
Geothermal	1,928	7.35	400	1.40	80	0.20	2,408	2.52
Hydro	3,779	14.40	1,987	6.95	9,660	23.67	15,426	16.12
Wind	443	1.69	216	0.75	90	0.22	2,027	2.12
Solar	1,019	3.88	18,639	65.16	12,932	31.69	32,590	34.07
Biomass	447	1.70	772	2.70	812	1.99	753	0.79
Total	26,250	100	28,606	100	40,814	100	95,670	100

Note: 'Total' may not equal the sum of each item due to decimal point processing

Source: Department of Energy (2021a).

Table 1.4. Electricity Generation Outlook (2040) (REF and CES)

(TWh)

Source	2020		2040				% Pts Diff in Shares CES vs REF
	Actual		REF		CES		
	Levels	% Shares	Levels	% Shares	Levels	% Shares	
Coal	58.18	57.17	89.72	24.62	80.83	23.09	-1.53
Natural Gas	19.50	19.16	146.86	40.30	93.24	26.63	-13.67
Oil-based	2.47	2.43	0.28	0.08	0.52	0.15	0.07
Renewable	21.61	21.24	127.54	35.00	175.49	50.13	15.13
Geothermal	10.76	10.57	16.18	4.44	16.18	4.62	0.18
Hydro	7.19	7.07	51.55	14.15	63.14	18.03	3.89
Wind	1.03	1.01	5.12	1.41	21.77	6.22	4.81
Solar	1.37	1.35	53.06	14.56	72.01	20.57	6.01
Biomass	1.26	1.24	2.39	0.66	2.39	0.68	0.24
Total	101.76	100	364.40	100	350.07	100	

Note: 'Total' may not equal the sum of each item due to the decimal point processing

Source: Department of Energy (2021a).

3.3. Climate change policy (NDC)

The Philippines' NDC aims to reduce GHG emissions by 75% from BAU levels by 2030. Of this reduction, 72.29% is conditional on the implementation of policies and initiatives that require aid and means made available based on the Paris Agreement.

Table 1.5. Outline of Nationally Determined Contribution

Target	Target Value	Target Year	Base Year	Basis Law
GHG emissions	▲ 75%	2030	BAU	NDC

Source: UNFCCC (2021).

3.4. Outlook for coal

The Philippines is reported to have 361 million tonnes of coal reserves (215 million tonnes of hard coal and 146 million tonnes of brown coal) (BGR, 2020). However, the country's production has recently remained at 14 million tonnes, mainly produced on Semirara Island.

PEP 2020–2040 sets targets for the exploration and production of coal to maintain and expand supplies for power plants. The exploration targets are 65 million tonnes of additional

reserves from 2020 to 2022; 223 million tonnes for the 18 years from 2023 to 2040; and explorable reserves of 766 million tonnes by the end of 2040. The production targets are 52 million tonnes from 2020 to 2022 and 282 million tonnes over the 18 years from 2023 to 2040.

The Annex to PEP 2020–2040 estimates that under the REF case, coal production will increase from 6.84 Mtoe in 2020 to 18.43 Mtoe in 2040 and that net imports will increase from 10.5 Mtoe in 2020 to 18.53 Mtoe in 2030. It will then decrease to 14.63 Mtoe in 2040.

3.5. Outlook for renewable energy

The Philippines has an abundance of suitable sites for renewable energy development. According to the National Renewable Energy Program (NREP) (Department of Energy, 2021b), the country has set a target (Department of Energy, 2021c) of increasing renewable power from 7.2 GW in 2018 to 15.3 GW by 2030 (output capacity basis). As of March 2021, the NREP was being revised to ramp up this target to 34 GW by 2040 (Department of Energy, 2021d).

Meanwhile, the renewable energy capacity targets under PEP 2020–2040 are 53 GW for REF and 81 GW for CES, both on an installed capacity basis.

Figure 1.9. Promising Candidate Sites for Renewable Energy



Source: Department of Energy (2021a).

3.6. Recent moves towards decarbonisation

a) Temporary freeze on construction permits for coal power plants

Even during the transition towards carbon neutrality, a certain amount of coal power is expected to remain in use to ensure the effective use of domestic resources. However, DOE has imposed a temporary freeze on construction permits for coal power plants, and there are no plans to build new ones.

Further, the need to build a carbon recycling platform is expected to increase. Financing will be a major issue in creating such a platform, but the prospects are uncertain because major banks have announced decisions to suspend loans for coal power plants (RCBC, 2020).

Finance Secretary Carlos G. Dominguez III had expressed support for abolishing coal power plants early on. He suggested that foreign governments purchase stocks held by Philippine coal power plant operating companies and donate the proceeds based on the Energy Transition Mechanism (ETM) initiative of the Asian Development Bank (Philippine Department of Finance, 2021). Meanwhile, Energy Secretary Alfonso G. Cusi is reluctant to abolish coal power plants in the near future, emphasising that energy security is paramount (Department of Energy, 2021e) because energy transition is a means to improve people's lives and enhance the country's economic development. However, views are divided on the overall direction within the country.

b) Issuance of \$500 million of green bonds

In February 2022, in an interview with US media, Secretary Dominguez stated that the government is considering issuing green bonds worth \$500 million to fund climate change mitigation projects.

c) Decarbonisation by conglomerates

Ayala Corporation announced that it will aim to achieve net-zero emissions group-wide by 2050 (including Scopes 1 to 3). Further, conglomerate San Miguel Corporation announced its withdrawal from the coal power business.

d) Efforts towards decarbonisation

Amongst technical and human resource assistance to decarbonise the Philippines are high expectations for using the Coal and Clean Coal Technology Programme led by the ASEAN

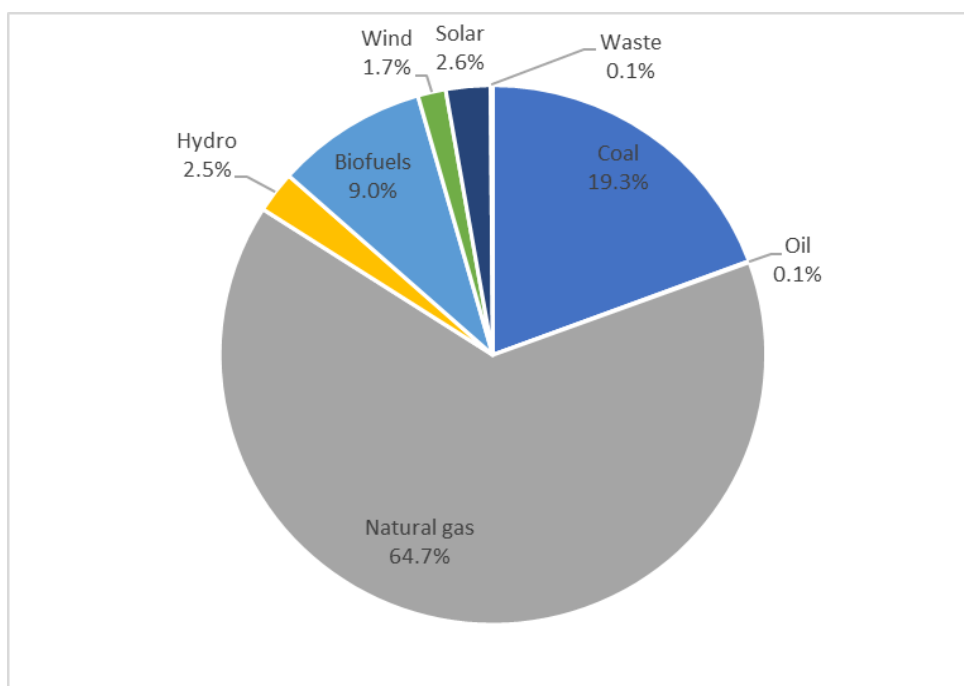
Forum on Coal and expanding its functions. Cooperation on using clean coal technology in the energy transition phase is anticipated, including human resource development through research on CCS and other technologies headed towards decarbonisation.

4. Thailand

4.1. Current power supply structure

Thailand's power supply structure comprises 64.7% natural gas power, 19.3% coal power, and 15.9% renewable electricity (including hydropower).

Figure 1.10. Current Power Supply Structure in Thailand (2019)



Source: IEA (2021a).

4.2. Power development plan

In April 2019, the cabinet of Thailand approved the Power Development Plan 2018–2037 (PDP 2018). As the plan aims to expand the total generation capacity to 77 GW in 2037 from 46 GW in 2018, and shut down 25 GW of power plants by the end of 2037, 56 GW of additional capacity will be necessary to achieve the capacity target. The additional capacity will comprise

the following: 20.7 GW of renewable energy, 0.5 GW from hydropower plants, 2.1 GW from cogeneration plants (which supply both heat and electricity), 13.1 GW from combined cycle plants, 1.7 GW from coal power plants, 5.8 GW purchased from other countries, 8.3 GW purchased from independent power producers (IPPs), and 4.0 GW from other sources.

In 2037, natural gas will account for 53% of the total power generation fuels; renewable energy, 20%; coal, 12%; and hydropower purchases from other countries, 9%. Nuclear power, which accounted for 5% of the total power capacity in PDP 2015, was removed from PDP 2018.

The installed capacity of coal power plants is expected to decrease from 6.1 GW in 2018 to 5.4 GW in 2037. The Electricity Generation Authority of Thailand plans to build two plants (1.2 GW in total) to replace the Mae Mo coal power plants in Northern Thailand, which are scheduled to be retired due to ageing.

Table 1.6. Total Capacity under PDP 2018 (MW)

Power Capacity	PDP2018
Installed capacity (2018–2037)	46,090
Retired capacity (2018–2037)	-25,310
New capacity (2018–2037)	56,431
Total capacity as of 2037	77,211

Source: EPPO (2018).

Table 1.7. Share of Fuel Used in Power Generation (%)

Fuel Type	PDP2015	PDP2018
Natural gas	37	53
Coal	23	12
Imported hydro	15	9
Renewable energy	20	20
Nuclear	5	0
Energy saving	0	6

Source: EPPO (2015, 2018).

4.3. Climate change policy (NDC)

In October 2015, the Thai government announced its NDC that aims to reduce GHG emissions by 20% from BAU levels by 2030. It also announced that the target may be raised to 25% if it gains sufficient international support. The NDC was later updated in October 2020. While no numerical reduction targets were changed, it included plans to formulate the Long-term low greenhouse gas emission development strategy to serve as the base for future NDC enhancements. The NDC update also stated that forest absorption is excluded from the country's NDC.

Thailand formulated the Climate Change Master Plan (Ministry of Natural Resources, 2015) to achieve sustainable, low-carbon growth and build resilience against climate change. The plan names six focus sectors for climate adaptation: (i) water resources management, (ii) agriculture and food security, (iii) tourism, (iv) public health, (v) natural resource management, and (vi) human security. The country's energy efficiency plan targets reducing energy intensity by 30% in 2036 from 2010.

Table 1.8. Outline of Thailand's Nationally Determined Contribution

Target	Target Value	Target Year	Base Year	Basis Law
GHG emissions	▲ 20% (▲ 25%: with international support)	2030	BAU	NDC

Source: UNFCCC (2021).

4.4. Outlook for coal

Thailand does not have a national policy on coal production. The country previously had plans for coal mine development, but there has been no progress. The country will produce coal from the Mae Moh coal mine to meet the demand from the neighbouring Mae Moh brown coal power plant. This plant plans to abolish Unit 8 in 2022, Units 9–11 in 2025, and Unit 12 in 2026, and to operate replacement plants for Units 8 and 9. Brown coal production is estimated at 14 million tonnes in 2022, falling to as low as 6 million tonnes in 2025 and remaining flat after that.

Meanwhile, Thailand's coal imports come mainly from Indonesia. In 2020, 8.47 tonnes were used for power generation (including 6.31 million tonnes by independent power producers (IPPs) and 15.27 million tonnes for the industry. According to the power source development plan, imported coal consumption by the IPPs will remain at the current level of approximately 6 million tonnes until 2031. Thereafter, BLCP Power Units 1 and 2 are scheduled to be abolished in 2032, and replaced by a new imported coal-fired power plant (1,000 MW) in 2033 and 2034, respectively. If things go as planned, imported coal consumption will be around 8 million tonnes in 2034 and beyond. However, the public has not accepted these new imported coal-fired power plants. The plan also indicates a possible switch to other fuels. In that case, imported coal consumption would be around 2 million tonnes in 2032 and beyond.

4.5. Outlook for renewable energy

Thailand's installed renewable capacity was 11.9 GW in 2019, with biomass power capacity having the largest share (28.8% of the total installed capacity), followed by hydropower (both large and small), solar PV, biogas, and waste.

Table 1.9. Number of Plants and Installed Capacity of Renewable Energy

Renewable Source	Number of Plants	Installed Capacity (MW)		Growth Rate (%)
		2018	2019	2018–2019
Biogas	175	505.2	530	4.9
Biomass	205	3,410.1	3,410.1	1.1
Hydro (small & large)	50	3,107.4	3,107.5	0.1
Solar	538	2,962.5	2,982.6	0.7
MSW	30	317.8	314.7	-1.0
Wind	26	1,102.8	1,506.8	36.6

Source: Department of Alternative Energy Development and Efficiency (2019).

The Thai government has formulated a plan for developing alternative energies (Department of Alternative Energy Development and Efficiency, 2019), announced the country's renewable-related power plan for up to 2037, and set a goal of increasing alternative energies to at least 30% of the total energy consumption. The target installed capacity for key power sources is as follows.

- Solar PV: 15.6 GW
- Biomass: 5.8 GW
- Wind power: 3.0 GW
- Hydropower: 3.0 GW
- Waste: 0.9 GW

4.6. Recent moves towards decarbonisation

a) Moves to adopt carbon pricing

Thailand is considering introducing carbon pricing as part of its climate change countermeasures. It introduced a voluntary emissions trading system or V-ETS in October 2014 and implemented pilot emissions trading projects targeting industry, including the electricity, cement, paper and pulp, steel, and petrochemical sectors. However, the electricity sector later left the pilot project as it did not function well under a regulated electricity market.

In a recent move, the Ministry of Finance announced that it is considering introducing a carbon tax on GHG emissions from industry. The government has set a target of electrifying 30% of new cars produced in Thailand by 2025. The introduction of the carbon tax is believed to be motivated by the decrease in the excise tax on fossil fuels in response to the increase in electric vehicles (EVs). When the carbon tax is introduced, the excise tax system for EVs is also planned to be revised. Discussions are underway on setting a lower excise tax rate for EVs than fossil fuel-powered cars.

b) Efforts to achieve carbon neutrality

In August 2021, the National Energy Policy Committee (chaired by Prime Minister Prayuth) approved the National Energy Plan. The plan includes a policy of transitioning to clean energy in stages and achieving carbon neutrality between 2065 and 2070, or the next 50 years. In addition, the plan pledges to work on the following energy areas to realise a low-carbon economy and society:

- to raise the percentage of renewable electricity to at least 50% (considering long-term battery system costs)
- to improve energy efficiency by employing innovative technologies
- to restructure the energy industry based on the 4D1E principles:
 - decarbonisation: reduce CO₂ emissions in the energy sector
 - digitalisation: adopt digital systems for energy management
 - decentralisation: decentralise power generation and infrastructure
 - deregulation: relax energy-related regulations

- electrification: use electricity to the maximum in place of fossil fuels

Later, at the COP26 held in November 2021, Prime Minister Prayuth announced that Thailand would strive to reach carbon neutrality by 2050 and net-zero emissions by 2065.

c) Efforts towards decarbonisation

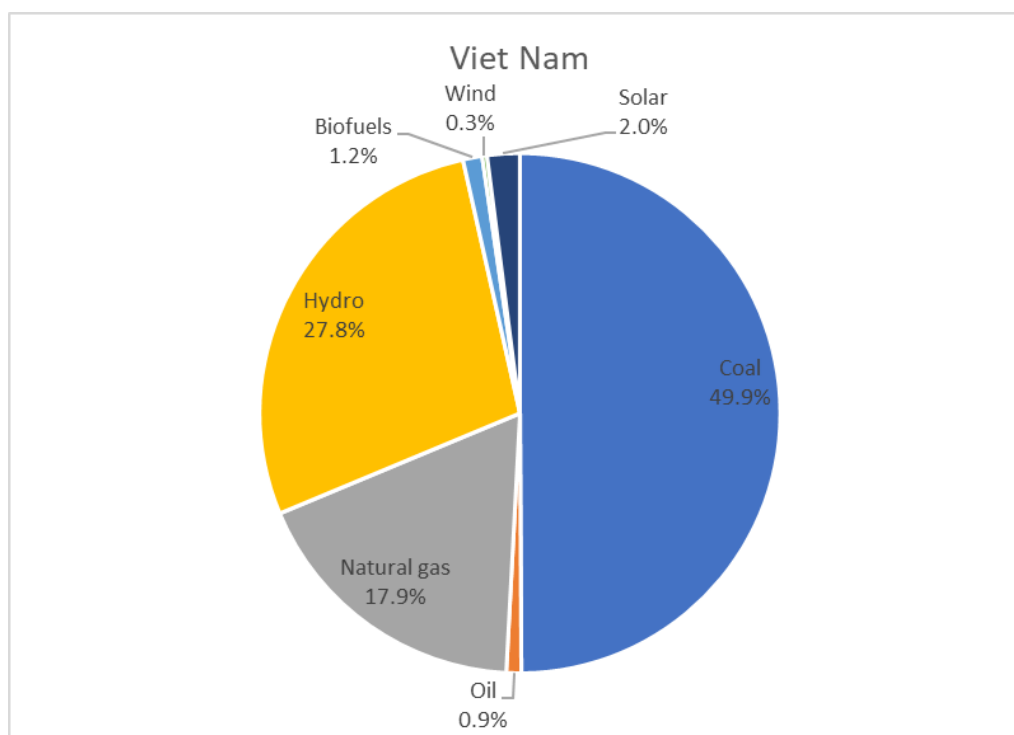
Thailand's decarbonisation efforts include building a platform to make Thailand a decarbonised society through the Clean Development Mechanism and Joint Crediting Mechanism (JCM), in which carbon credits are created using Japan's low-carbon technologies (technologies, products, systems, services, and infrastructure). For example, for the JCM, 32 model projects were in progress as of August 2020, consisting mainly of energy efficiency projects for air-conditioners and renewable energy projects for solar PV. This is the second-largest number of projects, only following Indonesia with 34 projects.

5. Viet Nam

5.1. Current power supply structure

Coal power accounts for 49.9% or roughly half of Viet Nam's power supply structure, followed by 27.8% of hydropower, 17.9% of natural gas power, and 3.5% of renewable power (excluding hydropower).

Figure 1.11. Current Power Supply Structure in Viet Nam (2019)



Source: IEA (2021a).

5.2. Power development plan

In March 2021, Viet Nam published the first draft of the National Power Development Plan (PDP) for 2021–2030 with a vision to 2045 (PDP8), presenting the country's power development policy. The PDP was in its last stage of finalising.

Currently, Viet Nam has no specific data (share and capacity). So, the following data were under discussion in December 2021.

While discussions on a review are still in progress, according to an announcement¹⁶ by the Ministry of Industry and Trade, Viet Nam forecasts an installed generation capacity of 130,371 MW–143,839 MW in 2030. The share of coal power – so far the country's main power source – accounts for 28.3%–31.2%, while gas power (including LNG), a low-carbon thermal power, accounts for 21.1%–22.3%. Large, medium, and pumped-storage hydropower accounts for 17.73%–19.5%, renewable energy sources (wind and solar PV) for 24.3%–25.7% aiming to reach carbon neutrality, and imported electricity for 3%–4%. Meanwhile, in 2020, the total installed capacity was 69,258 MW, and each power source's share was 29.5% for coal power,

¹⁶ <https://moit.gov.vn/tin-tuc/phat-trien-nang-luong/nhung-diem-nhan-trong-quy-hoach-dien-viii.html>

10.3% for gas power, 29.9% for hydropower, 25.8% for renewable energy, and 1.7% for imported electricity.

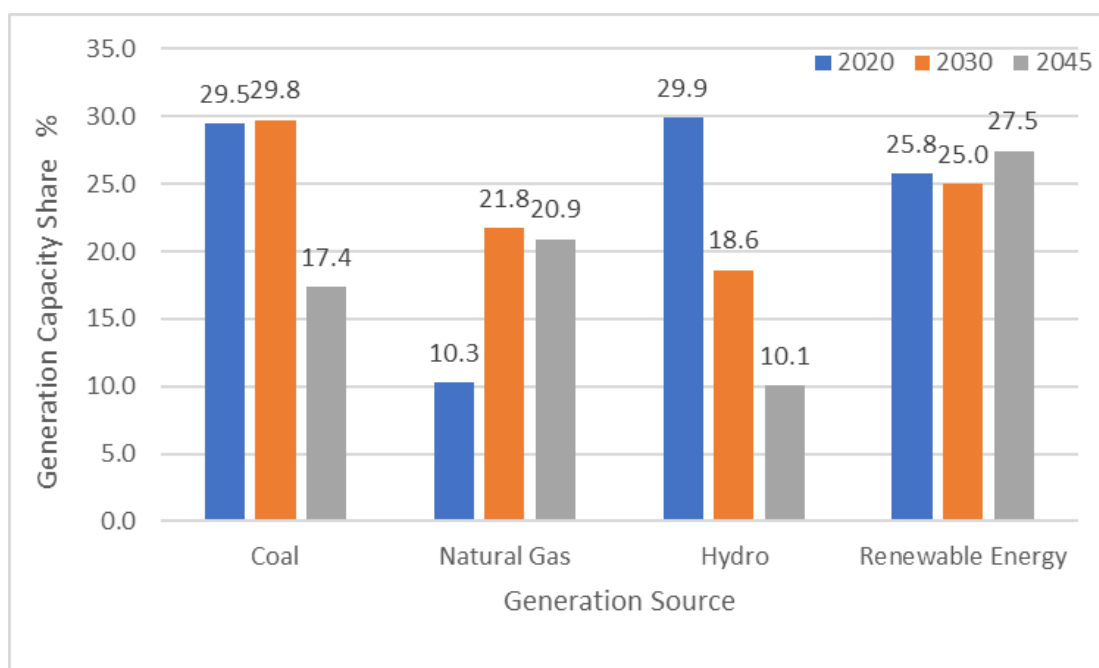
A comparison of the installed capacity–basis power mix in 2030 with that of 2020 shows that the share of coal power will be almost the same, gas power will be nearly double, hydropower will decrease, and renewable power will stay mostly unchanged. Further, a comparison of the 2045 power mix with that of 2020 indicates that coal power will decrease sharply by around 40%, gas power will double, hydropower will account for about one third, and renewable power will remain unchanged. As for the construction of new coal power stations, the policy states that those included in the revised PDP7, the precursor to PDP8, will be built as planned, but not those that are yet to gain approval or excluded in the plan.

The ongoing revision enhances measures to achieve carbon neutrality. Given that the policy declares the accelerated introduction of renewable energy, the ongoing review will strengthen this policy. Meanwhile, according to the plan, some coal will continue to be used even in 2045, so measures will need to be put in place.

During COP26 held in 2021, Viet Nam announced its participation in the Global Coal to Clean Power Transition Statement,¹⁷ a joint statement pledging to phase out coal power stations and end support for new ones.

¹⁷ <https://ukcop26.org/global-coal-to-clean-power-transition-statement/>

Figure 1.12. Share of Power Generation Capacity (2020/2030/2045)



Source: MOIT (Draft) (2021).

5.3. Climate change policy

Viet Nam submitted its first NDC to the United Nations Framework Convention on Climate Change secretariat in November 2016. It later updated and resubmitted its NDC in July 2020. The updated NDC kept the target year and reference year unchanged but raised the target value. As with the previous one, two target values were set: –9% (–8% before the update) for reduction with domestic efforts only, and –27% (from –25%) with international support.

Table 1.10. Outline of Viet Nam's Nationally Determined Contribution

Target	Target Value	Target Year	Base Year	Basis Law
GHG emissions	<p>▲ 9% (Reduction: 83.9 Mt-CO₂)</p> <p>▲ 27%: with international support (Reduction: 250.8 Mt-CO₂)</p>	2030	BAU	NDC

Source: UNFCCC (2021).

5.4. Outlook for coal

The Vietnamese government formulated a development plan for the coal industry to utilise coal, presenting policies on domestic coal development and production. The master plan for the coal industry was prepared in January 2012¹⁸ and was revised in March 2016.¹⁹ According to the revised plan, 40 projects are underway to develop new coal mines and expand existing ones, with plans to launch another 31 projects by 2030. Seven of these are for new development, and the rest are for expansion of existing mines.²⁰

Although Viet Nam is a coal-producing country, it exports its premium domestic coal to match the needs of the domestic market. Instead, it supplies the domestic market with coal that meets its needs using imported and domestically produced coal. The government has permitted to export 2 million tonnes of coal yearly until 2030.²¹

¹⁸ Adjusted Master Plan on Development of Vietnam's Coal Industry through 2020, No. 403/QD-TTg.

¹⁹ Master Plan on Development of Vietnam's Coal Industry through 2020, with the Prospects toward 2030 Taken into Consideration, No. 60/QD-TTg.

²⁰ FY2020 Overseas Coal Development Support Project, Overseas Coal Development Enhancement Survey 'FY2020 World Coal Survey', March 2021, JOGMEC.

²¹ Ibid.

5.5. Outlook for renewable energy

The Vietnamese government plans to increase renewable energy to reach carbon neutrality. The revisions to PDP8 currently being discussed may increase renewable power generation even further.

A substantial increase in the total power output is anticipated towards 2045. Renewable energy share is planned to be maintained, and its amount is set to increase in line with the growth in electricity demand.

Further, as a policy to accelerate the increase in renewable energy, a feed-in-tariff (FiT) system has been launched. The launch of the FiT system for solar PV in 2017 increased solar power generation sharply and resulted in more solar power being generated than planned. Viet Nam also anticipates investment in renewable energy by foreign capital.

The renewable energy potential varies by region, as Viet Nam is geographically very long and narrow. Solar PV potential tends to be high in the southern and central parts of the country, with abundant sun throughout the year, but lower in the mountainous north. Meanwhile, wind power has potential mainly in the southern and central coastal and mountainous areas. However, an issue with connecting capacity in the mountains to the grid must be resolved to realise the potential.

5.6. Recent moves towards decarbonisation

Viet Nam and Japan issued the Joint Statement for Cooperation on Energy Transition to Carbon Neutrality,²² in which Japan announced that it would provide financial and technical assistance to support Viet Nam's efforts towards carbon neutrality. The countries agreed that the keys to success are reducing the costs of renewable energy and the energy storage system, introducing state-of-the-art energy efficiency technologies, and decarbonisation technologies such as hydrogen, ammonia, and CCUS/carbon recycling.

The countries also announced in the Joint Cooperation Plan on Climate Change towards Carbon Neutrality by 2050 that they will step up collaboration to enable Viet Nam to reach carbon neutrality by 2050. This cooperation plan was agreed upon between Japan's Minister of the Environment and Viet Nam's Minister of Natural Resources and Environment. The

²² <https://www.meti.go.jp/press/2021/11/20211125005/20211125005-2.pdf>

ministers will strengthen cooperation to accelerate the transfer of advanced decarbonisation technologies from Japan to Viet Nam under the Joint Crediting Mechanism, including hydrogen and CCUS/carbon recycling.

Vietnam Electricity, which generates, transmits, supplies, and trades electricity, held a clean coal workshop²³ in February 2022 with Japan's METI, the New Energy and Industrial Technology Development Organization, and the Japan Coal Frontier Organization.

One of the workshop objectives is to facilitate technical exchange between Viet Nam and Japan to advance the introduction of renewable energy and share clean coal technologies, aiming to fulfil Viet Nam's 2050 carbon neutrality commitment. Specifically, information was shared on biomass combustion, the use of ammonia in coal power, and environmental protection measures.

Aiming to reach carbon neutrality by 2050, Viet Nam is strengthening cooperation with Japan as described above. However, no specific activities have been announced regarding the use of low-carbon/decarbonisation technologies, such as hydrogen and mixed combustion of ammonia and CCUS/carbon recycling.

²³ <https://moit.gov.vn/tin-tuc/phat-trien-nang-luong/evn-trao-doi-ve-cong-nghe-than-sach-voi-cac-doi-tac-nhat-ban.html>