ASEANのエネルギー分野の現状・関連動向に係る調査 – 定点調査業務2023

報告書 - Vietnam

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エネルギー定点調査

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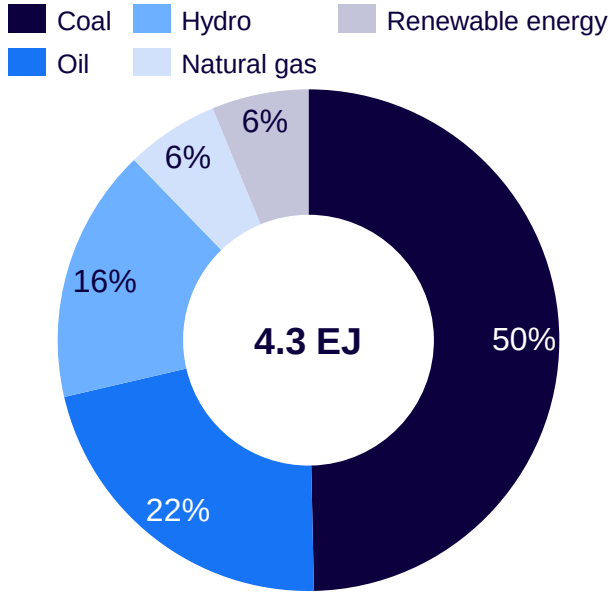
1. 一次エネルギー構成

ベトナムの1次エネルギーMixの中心は、石炭、石油が主である

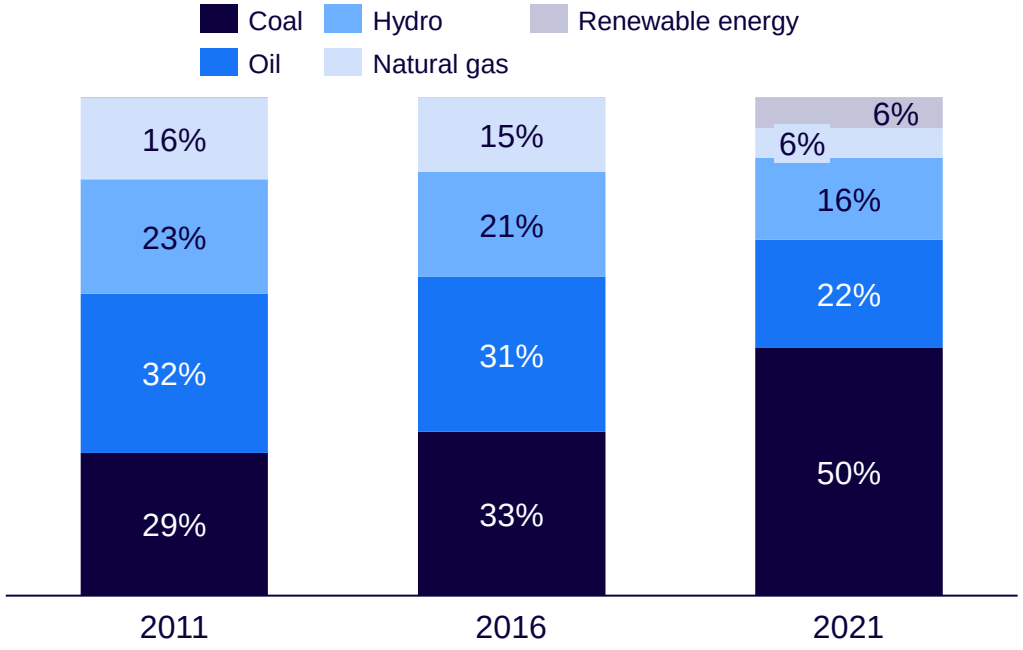
Primary energy consumption
2021, Exajoules

Vietnam's primary energy demand in 2021 is 4.33 exajoules, which comes mainly from fossil fuels (~71%), especially coal at 2.15 EJ and oil 0.94 EJ



Historical primary energy consumption
2011 – 2021, %

Vietnam has had a lasting dependence on coal consumption in the past decade with a steep increase of 17% from 2016 to 2021. However, there is effort being made to increase the renewable energy consumption which likewise has increase from <1% to 6% in the same period



Source: BP Statistical Review of World Energy 2013, 2017, 2022, Arthur D. Little analysis

23年5月に「第8次国家電力開発基本計画（PDP 8）」にて電源計画が刷新された

	政策	政策概要
2012	Vietnam Green Growth Strategy (VGGS)	• Orientation toward 2030: Reduce GHG emissions by 1.5%–2% per year, reduce GHG emissions in the energy sector by 20%–30% compared with BAU (the upper bound is dependent on international support). • Orientation toward 2050: Reduce GHG emissions by 1.5%–2% per year.
2015	Renewable Energy Development Strategy 2016-2030 with outlook until 2050 (REDS)	• Renewable power (excluding hydropower) aims to cover 7% and 10% of total generation by 2020 and 2030 respectively. Currently, renewable energy (biomass, wind and solar) accounts for 26% of generation capacity, ahead of target. • Reduce GHG (to BAU scenario) by 5% in 2020; 25% in 2030 and 45% in 2050
2020	Paris Climate Agreement: updated Nationally Determined Contribution	• Vietnam has unconditionally committed to reduce GHG emissions by 9% by 2030 below business-as-usual (BAU) levels - 903 MtCO2e/yr in absolute emissions levels for 2030 (excluding LULUCF) • Vietnam committed to a conditional target of reducing GHG emissions by 27% below BAU based on international support.
2023 May	National Power Development Plan (PDP8)	• Period of 2021 – 2030 – No additional development of new coal-fired power plants – Substantial development in to replace coal with natural gas plant, and renewable (wind power) to reach 21% & 13% of total installed capacity • Period of 2031 – 2045 – Ratio of renewable energy sources (including large-scale hydropower) will reach 53% of total capacity

Source: Vietnam National Power Development Plan 8 2023, Multiple news articles, Arthur D. Little analysis

PDP8において、新たな電源計画を公表し、再エネ目標を設定した

Power Development Plan 8: 2023 Revision

TIMING

Planning for the period of 2021 - 2030, with a vision to 2050

OVERALL

The PDP8 focuses on:

- **Electricity production, consumption, and distribution** by expanding the electricity grid and doubling capacity
- Aiming to **boost renewable energy shares** while reducing reliance on coal (full transition away from coal by 2050)

KEY NOTES

Primary Electricity Target (billion kWh)	**2025**	**2030**	**2050**
Commercial Electricity Consumption	335	505.2	1,114.1 - 1,254.6
Electricity Production & Import	378.3	567	1,224.3 - 1,378.7

Power Generation Capacity Mix Target:

- **By 2030:** Wind power, Hydropower, Coal, and Gas will be the major source, accounting for 18.5%, 19.5%, 20%, and 25% respectively. While other renewable energy sources like solar power (8.5%), biomass (1.5%), stored power (1.8%), cogeneration (1.8%), and imports (3.4%) are the minority
- **By 2050:** Wind power and Solar power will play the dominant role, with 28.1% and 33.6% respectively. And the rest will be made of biomass (1.1%), hydropower (6.8%), stored power (7.2%), cogeneration (0.8%), converted coal (5.5%), gas (2.8%), hydrogen (4.8%), imports (2.1%), and flexible power sources (7.2%)

Source: Vietnam National Power Development Plan 8 2023, LawNet Vietnam 2023, Vietnam Briefing 2023

また、石炭発電からの脱却を目指すことを宣言

Status of introduction of coal-fired power generation

Deputy Prime Minister Trinh Dinh Dung
announcing the drafting of PDP8

“Gradually reduce the proportion of coal-fired thermal power plant” - Power Development Plan 8th

Before Power Development Plan 8

2019 Clean coal production reached **38-46** million tons (mainly from Vinacomin)

After Power Development Plan 8

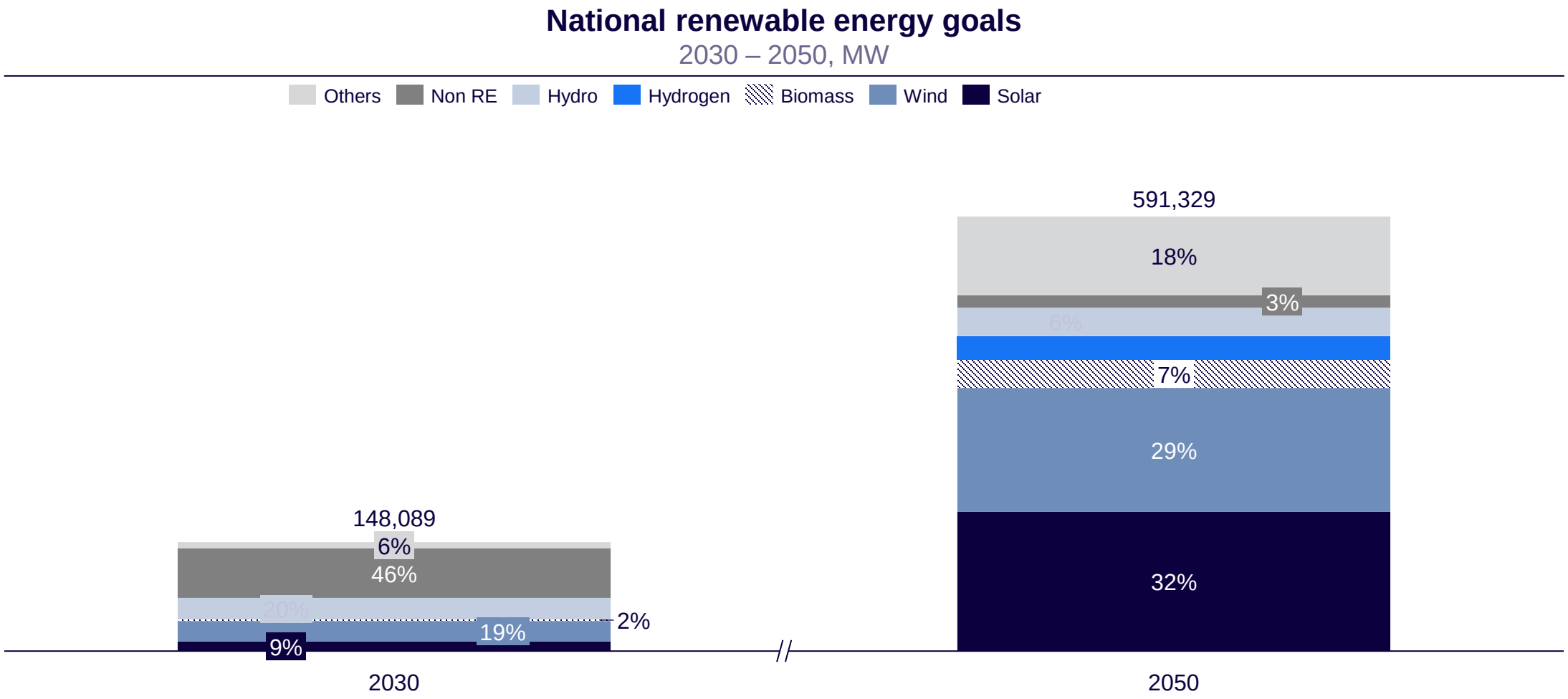
Gradually reduce coal-fired power plants:

- 6 projects already included in the Power Development Plan 7th: Continue to construct until 2030.
- Plants operating for 20 years: Shift the fuel conversion direction to biomass and ammonia
- Plants operating for over 40 years: Cease operations (if fuel conversion is not feasible)

0 Coal generation: By 2050, no longer use coal for power generation and completely shift the fuel to biomass and ammonia. The total capacity of converted coal will be between 25,632 - 32,432 MW, producing 72.5 - 80.9 billion kWh

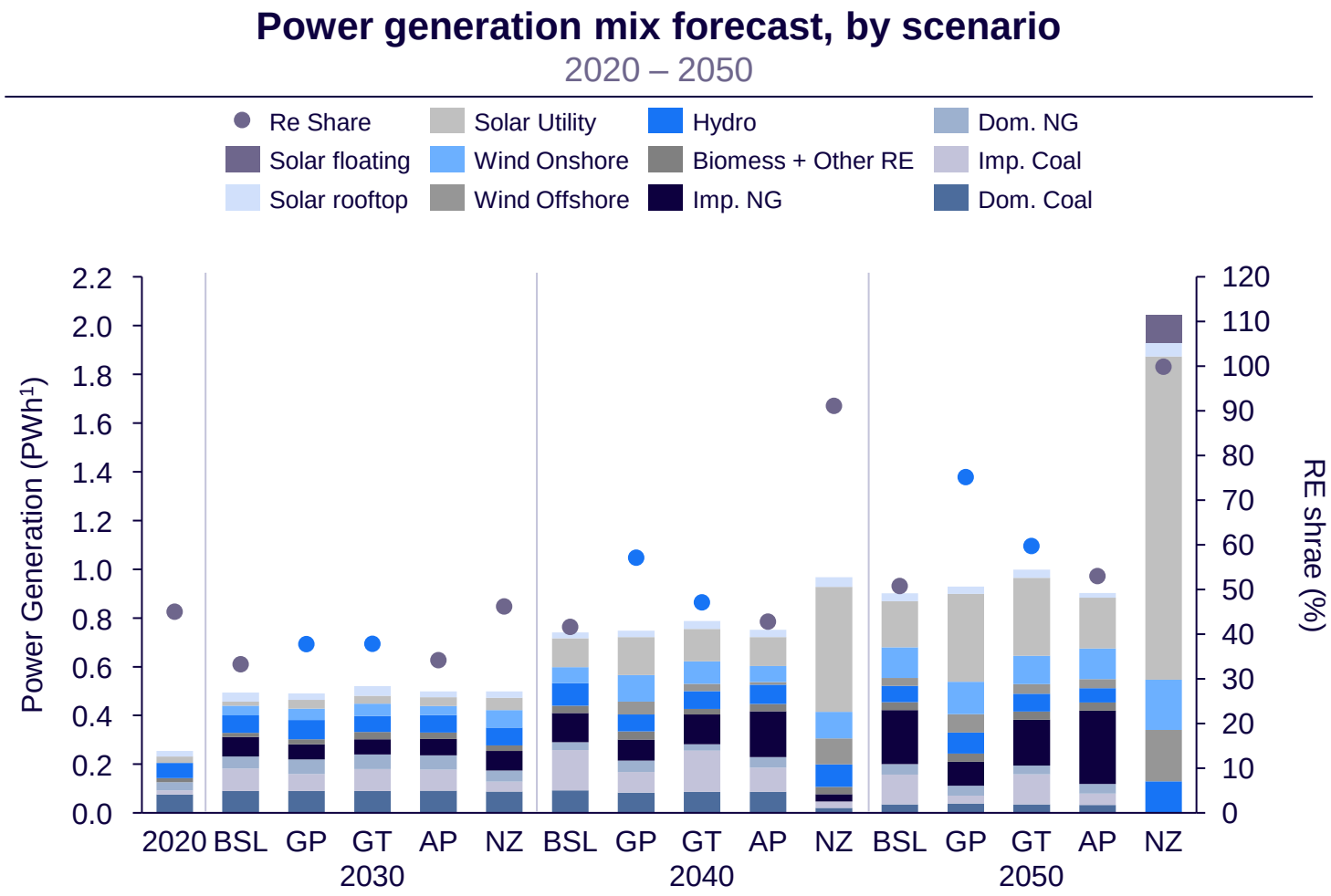
Source: Vietnam National Power Development Plan 8 2023

ベトナムは、太陽光発電容量を2030年の9%から2050年には32%/風力発電を19%から29%まで拡大する計画



Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

ネット・ゼロ目標を達成するため、ベトナムは2050年までに石炭を廃止し、太陽光、風力、水力発電への依存度を高める計画



Description

- The electricity generation doubles by 2030 in all scenarios due to **continued economic growth** (GDP per capita expected to double from $3586 in 2020 to $7500 in 2030)
- The electricity generation in 2050 is 10% higher in GT than in BSL due to **electrification of the transport sector**.
- The electricity generation in NZ is more than double of BSL in 2050 due to the **comprehensive electrification of all other sectors.**
- Thus, the power sector is expected to fuel the green transition of the other sectors towards the net zero society. **The main resources are solar PV, wind power and hydro power.**

Note : BSL = Baseline; GP = Green Power; GT = Green Transport; AP = Air Pollution; NZ = Pathway to Net Zero; 1) PWh = 1,000,000,000 kWh
Source: Vietnam Energy Outlook Report 2021, Vietnam National Power Development Plan 8 2021, Arthur D. Little analysis

List of notable previous and recent renewable energy policies in Vietnam

Previous Renewable Energy Policies (Pre-2016)

Title	Year	Policy Status	Policy Type	Policy Target
Vietnam Renewable Energy Development Strategy 2016-2030 (REDS)	2016	In Force	Policy Support > Strategic planning, Policy Support > institutional creation	Multiple RE Sources > All, Multiple RE Sources > Power
National Power Development Plan 7 (Revised)	2016 (March)	In Force	Policy Support > Strategic planning	Multiple RE Sources > All
Decision on support mechanisms for the development of biomass power projects	2014 (Oct 5th)	In Force	Economic instruments > Fiscal/financial incentives > Feed-in tariffs/premiums	Bioenergy > Biomass for power
Decision on support mechanisms for the development of waste-to-energy power projects	2014 (June 20th)	In Force	Economic instruments > Fiscal/financial incentives > Feed-in tariffs/premiums	Bioenergy > Biomass for power, Bioenergy > Co-firing with fossil fuels
Accelerated depreciation tax relief for renewable energy projects	2013 (Nov 25th)	In Force	Economic instruments > Fiscal/financial incentives > Tax relief	Multiple RE Sources > All
National Power Development Plan 2011-2030	2011	Superseded	Policy Support > Strategic planning, Policy Support, Economic instruments> Fiscal/ financial incentives> Tax	Wind > Onshore, Bioenergy> Biomass for power, Hydro-power, Solar, Wind
Electricity Law	2005	In Force	Relief, Economic instruments > Fiscal/financial incentives > Feed-in tariffs/premiums	Multiple RE Sources
Decree No. 45/2001/ND-CP on electric power operation and use	2001	In Force	Regulatory Instruments, Regulatory instruments > Other mandatory requirements	Multiple RE Sources > Power

Renewable Energy Policies (Post-2016)

Name	Policy Target
National Power Development Plan 8 (May 2023)	Illustrate the vision of electricity production & distribution in Vietnam, aiming to boost renewable energy while reducing reliance on coal (entirely transition away from coal by 2050)
Decision 21/QD-BCT (Jan 2023)	Issues electricity generation price bracket for transitional solar & wind power plants
Decision No. 13/2020/QD-TTg	Provide for the mechanism to encourage the development of solar power in Vietnam (i.e., FiT Scheme)
Decision No. 08/2020/QĐ-TTg	Provide for the mechanism to encourage the development of biomass power in Vietnam (i.e., FiT Scheme)
Decision No.39/2018/QD-TTg	Support the development of Wind power projects (i.e., FiT Scheme for Wind power, capital subsidy, grant, or rebate; reductions in taxes)

Source: Multiple government policies and websites

原子力発電へ投資することを想定していた費用を風力や太陽光などの再エネへ投下する方針

Vietnam abandons plan for first nuclear power plants

Vietnam's National Assembly voted on Tuesday to abandon plans to build two multi-billion-dollar nuclear power plants with Russia and Japan, after officials cited lower demand forecasts, rising costs and safety concerns.

The vote to scrap the country's first atomic energy project deals a blow to the global nuclear business and to Japan's drive to begin exporting reactors after the Fukushima disaster left its nuclear industry in a deep freeze.

When the government approved plans for the two plants in 2009, growth in Vietnam's annual power demand was projected at 17-20 percent.

Vietnam's decision to scrap the project is a further setback for the nuclear industry as countries from Germany to Indonesia have decided to either pull out of nuclear energy or cancel development plans in the wake of the Fukushima nuclear disaster in Japan in 2011, the world's worst since Chernobyl in 1986.

Environmental campaign group Greenpeace, however, welcomed the decision to drop the nuclear plan, saying it would have been a waste of money when renewable energy alternatives are available.

In 2016, the cancel the formation of 2 nuclear plants with 4000 MW capacity. Officers of the MOIT[1] disclosed that Vietnam will now focus on developing renewable energy such as wind and solar, rather than spending budget and fundings on nuclear power.

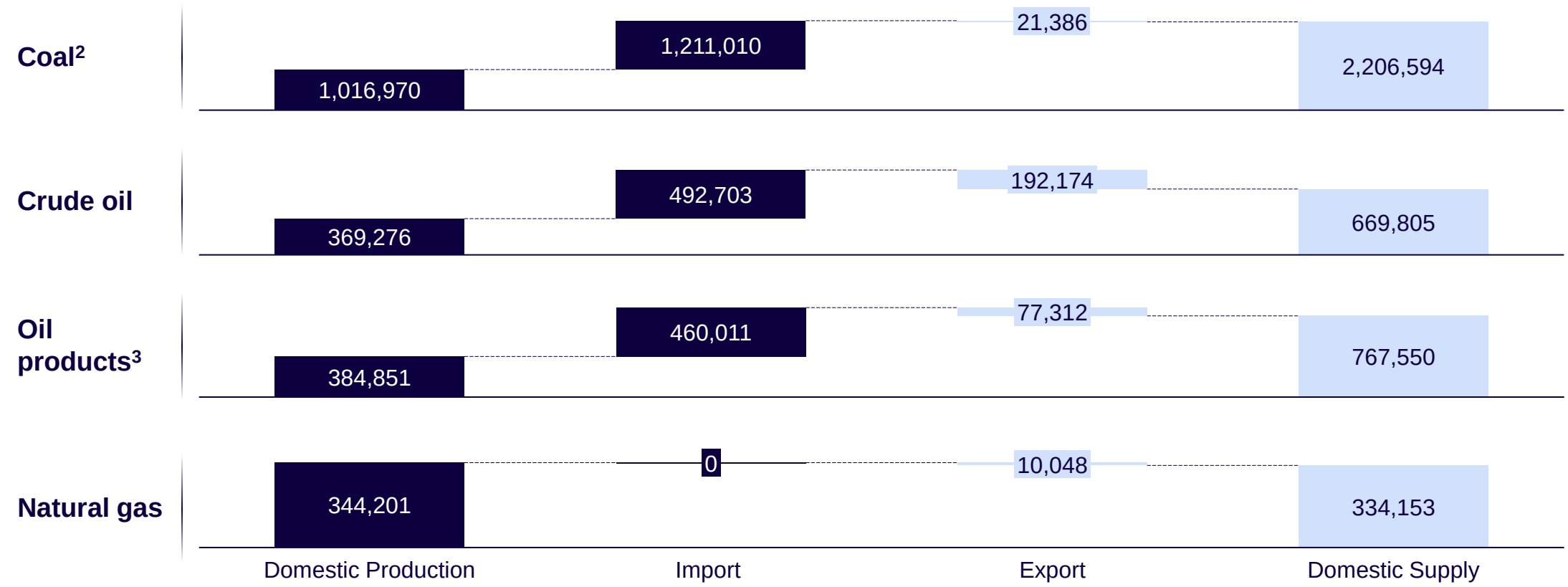
Note: 1) Ministry of Industry and Trade
Source: Multiple news articles 2016 and 2022, Arthur D. Little analysis

2. 化石エネルギー

ベトナムは石炭の輸入国で、天然ガスは地産地消で賄えている

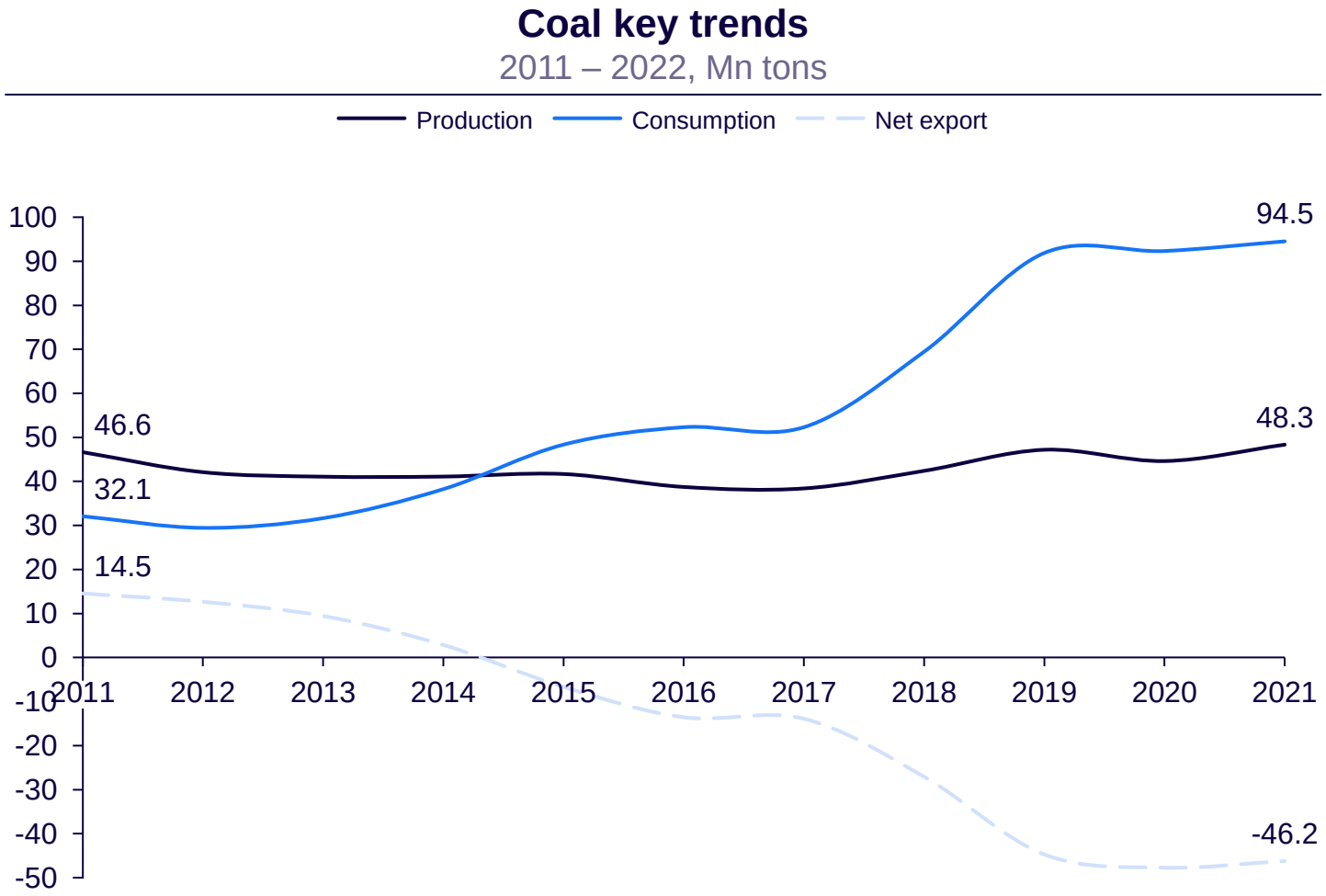
Rate of domestic production and import/export of fossil fuel energy

2020, TJ[1]



Note: Stock changes have been excluded due to lack of data; 1) Possible inconsistencies in data due to conversions via units of measurement; 2) Production is comprised of anthracite and coking coal; 3) Incl. of crude oil and natural gas liquids
Source: International Energy Agency 2023, Arthur D. Little analysis

石炭消費は2011年から2021年の間に11%で増加している



Description

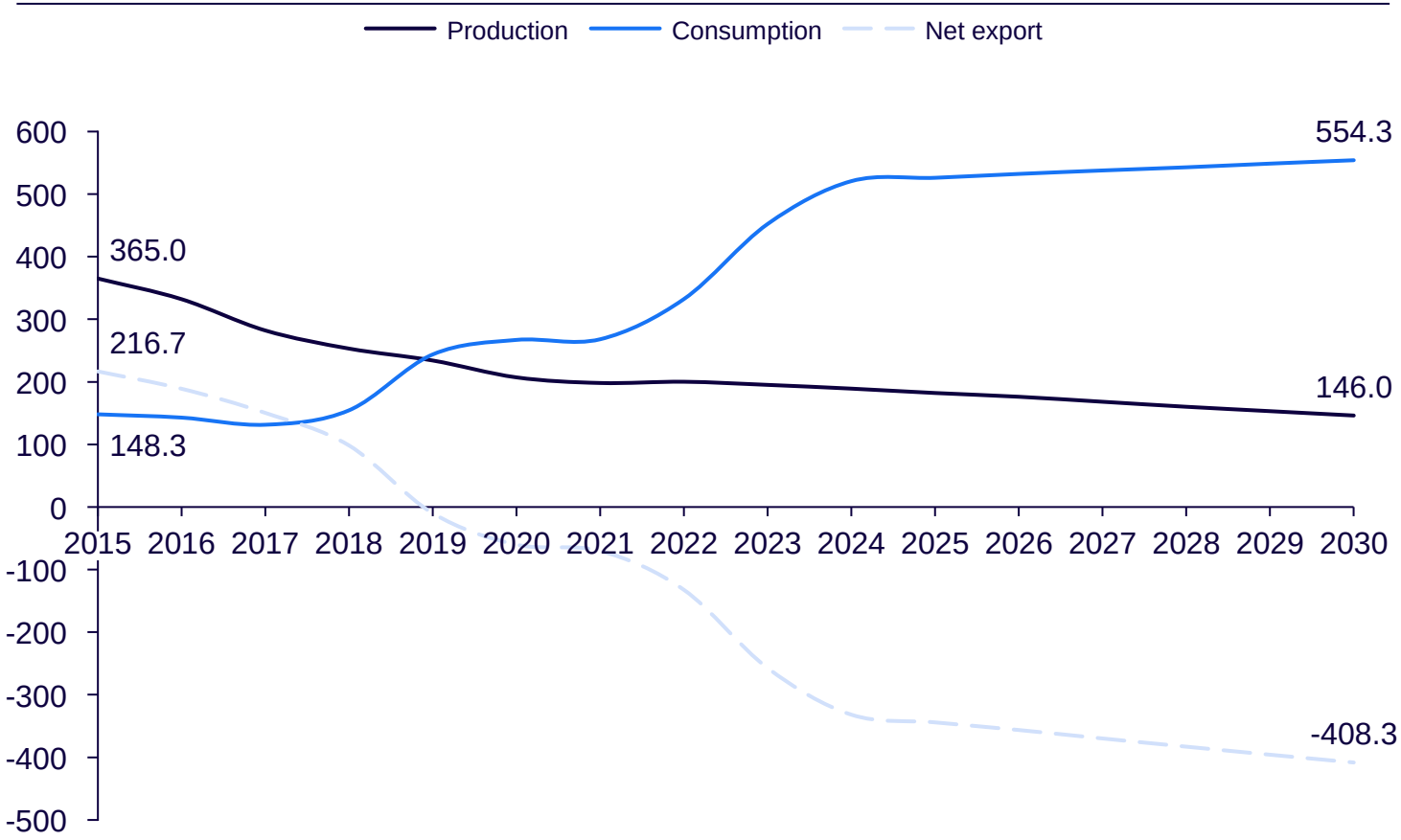
- With consumption growing at a YOY rate of 11.4%, it outpaced coal production's rate of 0.3% in mid 2014, thereby requiring Vietnam to increase its coal imports as demand surged and production was unable to keep up from mid 2014-2021
- This sudden increase in demand was due to Vietnam experiencing a severe drought in 2015, which impacted hydroelectric power plants
- Further increase of coal consumption from 2016 to peak of 92mn tons in 2020 was demand driven, largely by the growing number of coal-fired power plants
  - This shows the country's continued and increased dependence on coal as fuel source, despite government efforts to increase usage of renewables in the same time frame

Note: The negative net export refers to import greater than export; 1) PPs = power plants
Source: CEIC 2023, Statista 2023, Arthur D. Little analysis

需要が増加しているにもかかわらず、政府が化石燃料からの脱却を推進していることなどから生産が追い付かず石油は輸入に依存する見込み

Crude oil, NGPL & other liquids key trends

2015 – 2030, 000's bpd



Description

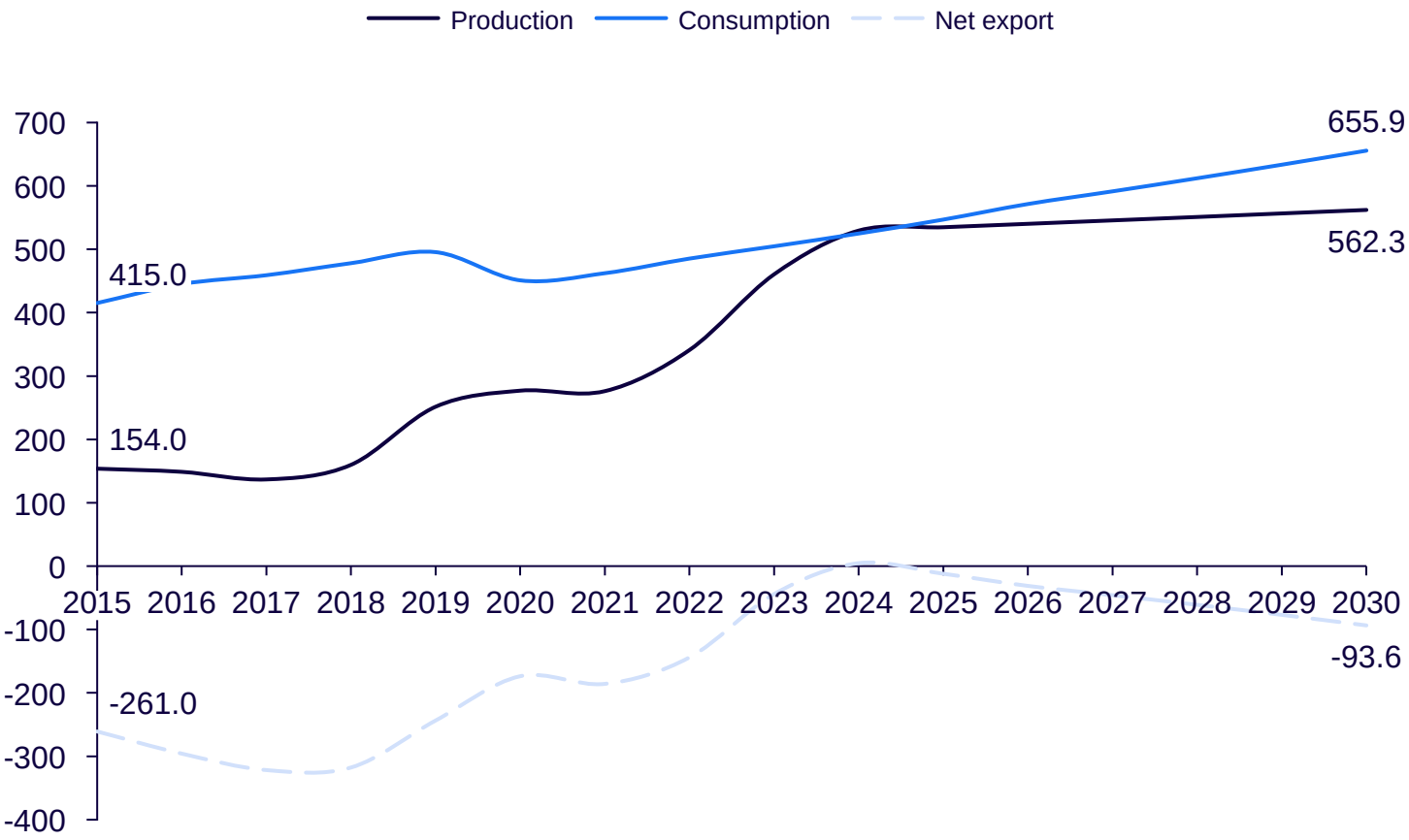
- Despite PetroVietnam;s (PVN) investment to meet demand following COVID-19, lack of upcoming projects and FDI[1] investment resulted in steep decline of 5.9% in production expectation from a high of 365k bpd in 2015 to 146k bpd in 2030
- Despite increase demand, factors such as the government's push away from fossil fuels and majority of Vietnam's upstream projects being in capital-intensive offshore and deep-water blocks, high-breakeven levels combined with decreased investor appetite has severely impacted production capabilities
- The Bach Ho field which accounts for ~60% of production is also rapidly declining with no new discoveries in the pipeline, further impacting production levels

Note: The negative net export refers to import greater than export
Source: Fitch Solutions Vietnam Oil & Gas Report 2023, Multiple news sources 2021 and 2022, Arthur D. Little analysis

精製能力への投資が増加し、着実なプロジェクトが進行中であることから需要を賄えるだけの生産能力の実現する見込み

Refined petroleum products key trends

2015 – 2030, 000's bpd[1]



Description

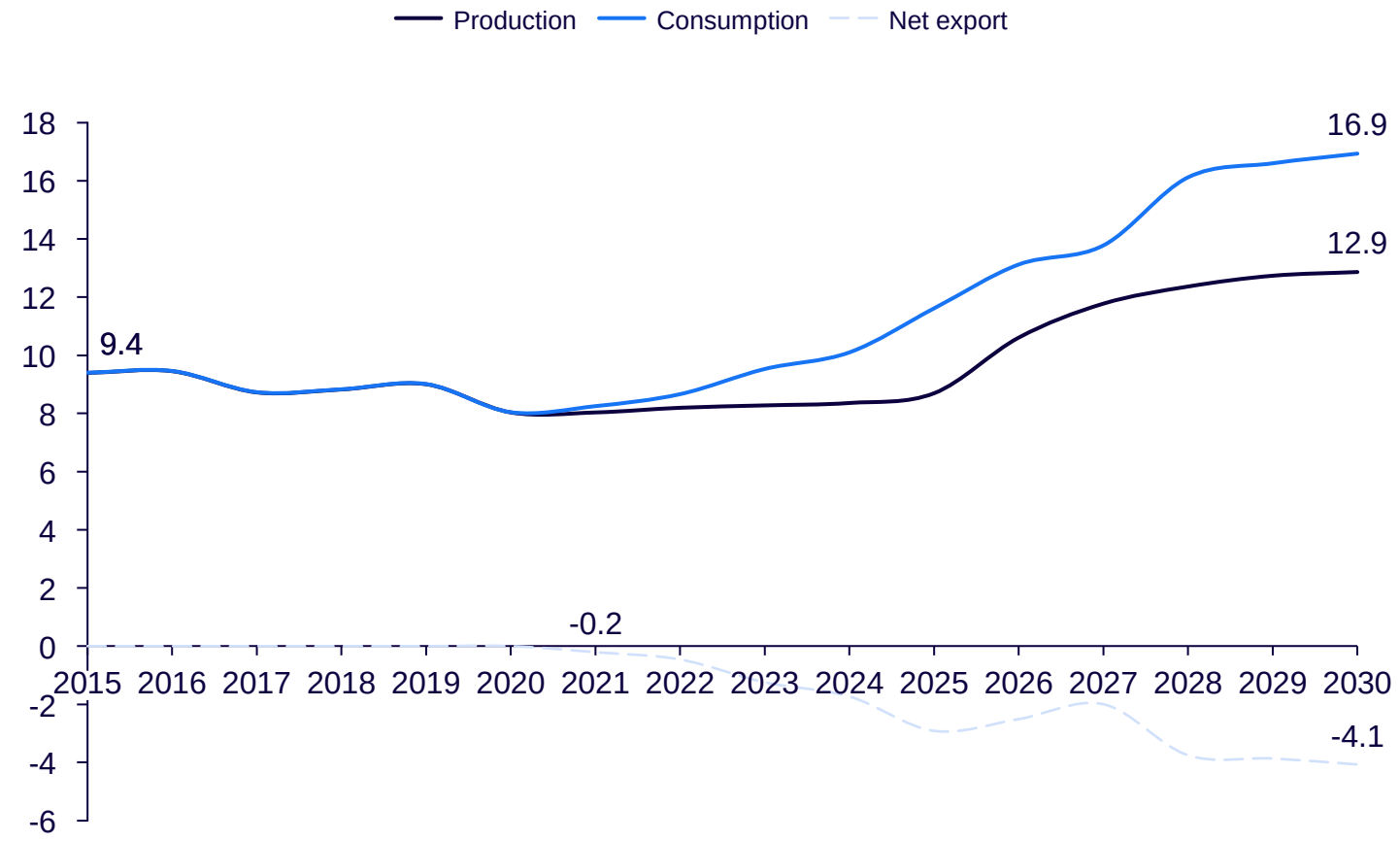
- Vietnam has managed to decrease its reliance in importing refined petroleum products via the Long Son Petrochemical Complex which became operation in 2023, greatly driving up production from 341.2k bpd to 529.7k bpd
  - This led to production growth of 9%, outpacing consumption growth of 3.1% despite construction and transport largely driving demand
- Furthermore, BSR has stated that it plans to expand the capacity of its Dung Quat refinery in Apr 2022,to complete by 2025. In Mar 2023,PVN said it was undergoing regulatory process for opening its 3rd refinery in the Ba Ria-Vung Tau province leading to more projects in the pipeline to boost production

Note: The negative net export refers to import greater than export; 1) barrels per day
Source: Fitch Solutions Vietnam Oil & Gas Report 2023, Multiple news sources 2022, Arthur D. Little analysis

大規模なLNGターミナルが完成し、2022年から2026年にかけて外国資本の大規模プロジェクトが稼動するため輸入が増加する見込み

Dry natural gas key trends

2015 – 2030, bcm[1]

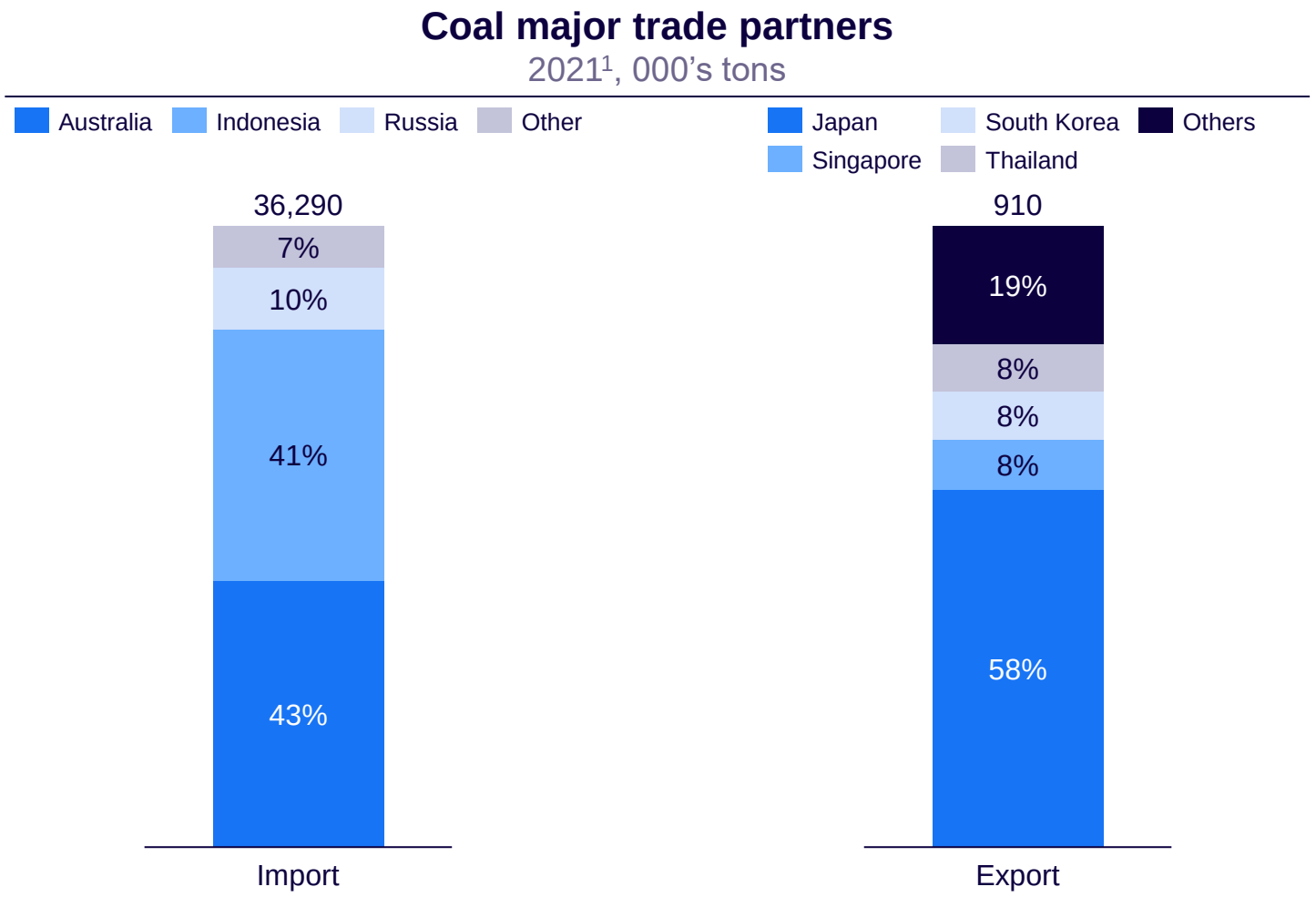


Description

- The country is currently self-sufficient in natural gas, but PVN predicts a growing supply gap characterized by demand surpassing supply in 2021 outpacing production at a rate of 6.8% vs 3.8% YOY from 2021-2030, particularly in southern Vietnam.
- The Vietnamese government has considered importing liquefied natural gas (LNG) in the southern part of the country to meet growing natural gas demand and fill the supply gap.
- PV Gas, a subsidiary of PVN, expects the Thi Vai and Son My liquefied natural gas (LNG) terminals to be operational in 2017 and 2018, respectively. In 2014, PV Gas signed a sales and purchase agreement with Russia's Gazprom. Under the agreement, PV Gas will receive 48 billion cubic feet of natural gas per year through the Thi Vai LNG terminal.

Note: The negative net export refers to import greater than export; 1) barrels per day
Source: Fitch Solutions Vietnam Oil & Gas Report 2023, International Energy Agency 2023, Arthur D. Little analysis

ベトナムは現在、オーストラリアやインドネシアから石炭を輸入

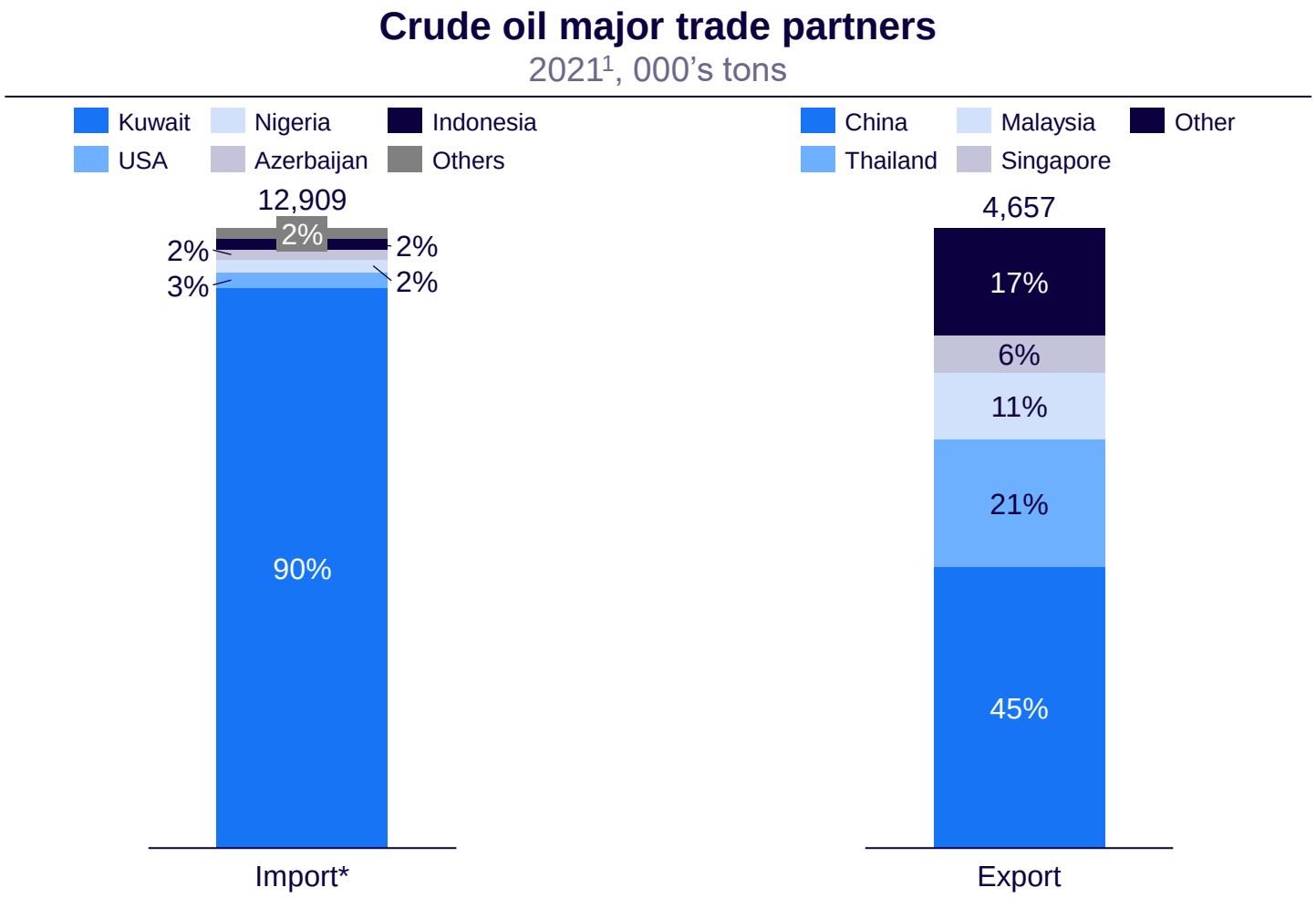


Description

- Coal was the 2nd most exported fuel source and 9th most exported product in 2020 at , with apparel, fishery and agricultural products being more exported at USD 118 mn[2]
- Currently Japan dominates with 58% market share of exports, followed by Singapore, South Korea and Thailand all at 8%. However, with the increased discouragement of coal usage on environmental grounds, regulatory policies in Japan and South Korea are shifting towards more green sources, which would potentially impact coal export demand severely in the coming years
- Coal was the 13th most imported product, following machinery imports, with Australia (43%) and Indonesia (41%) accounting for over 80% of total imports. With rising prices of Australian coal, we could potentially see increased dependence on Indonesia for Vietnam's coal demands

Note: 1) Preliminary figures; 2) Not agglomerated;
Source: General Statistics Office International Merchandise Trade 2022, Arthur D. Little analysis

原油は主に中東から輸入している

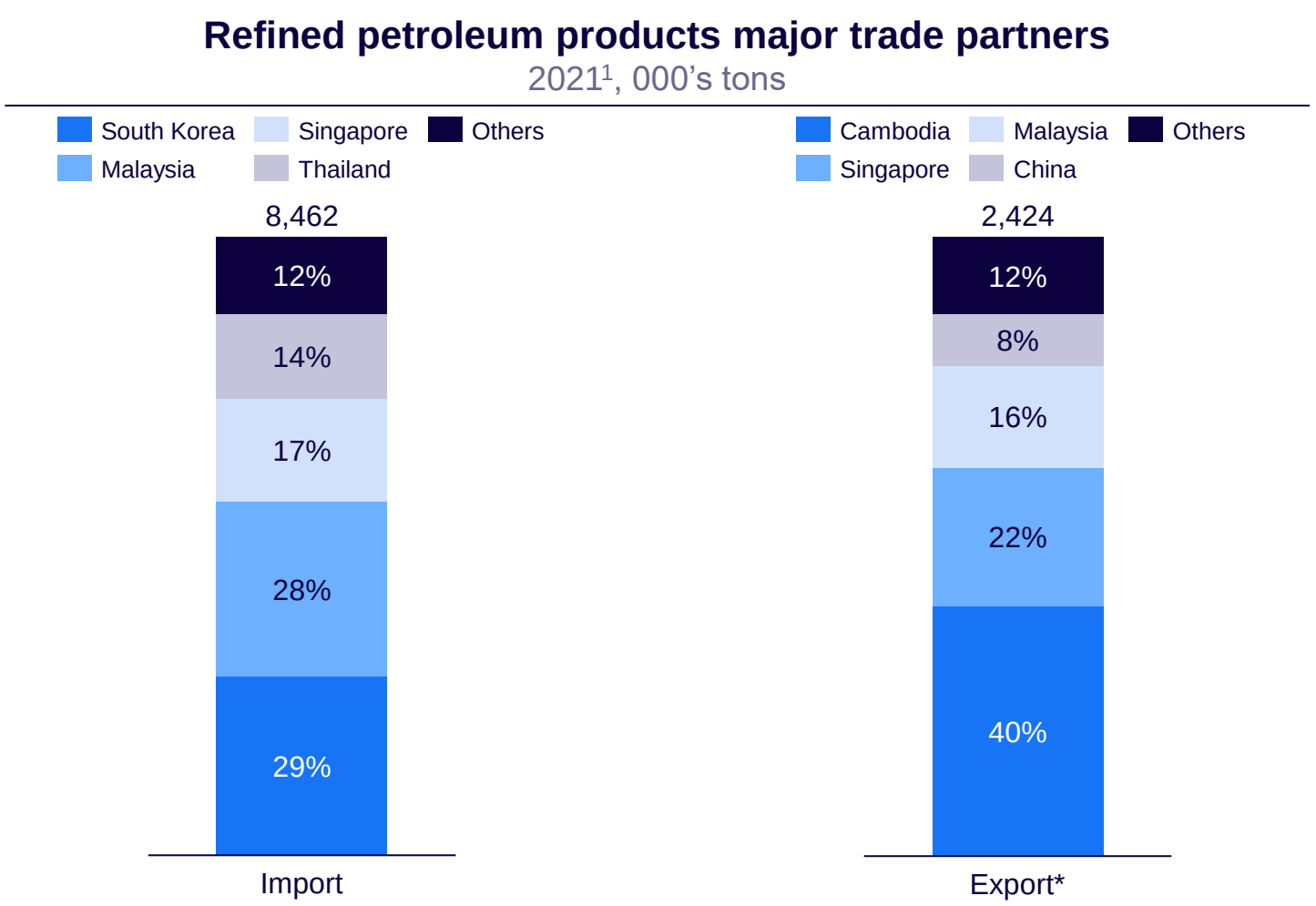


Description

- Growing refinery capacity, combined with decreased production capabilities have led to Vietnam becoming a net importer, spending USD 4.4bn with 90% (USD 3.9bn) being earned by Kuwait which has an obscene level of market dominance.
- This is largely due to Kuwait Petroleum owning 35.1% of stake in the Nghi Son refinery and thus supplying feedstock
- Despite its low share of 3% competitive pricing and better trade relationships with USA is set to increase imports in the coming years
- Imports are set to increase with PVN saying it will slash output from its fields due to high operating costs

Note: *Assumption that price of refined petroleum products is the same for imports as it is for exports; 1) Preliminary figures;
Source: General Statistics Office International Merchandise Trade 2022, Fitch Solutions Oil & Gas Report 2023, Arthur D. Little analysis

マレーシアや韓国から石油精製品を輸入し、カンボジアなどに輸出



Description

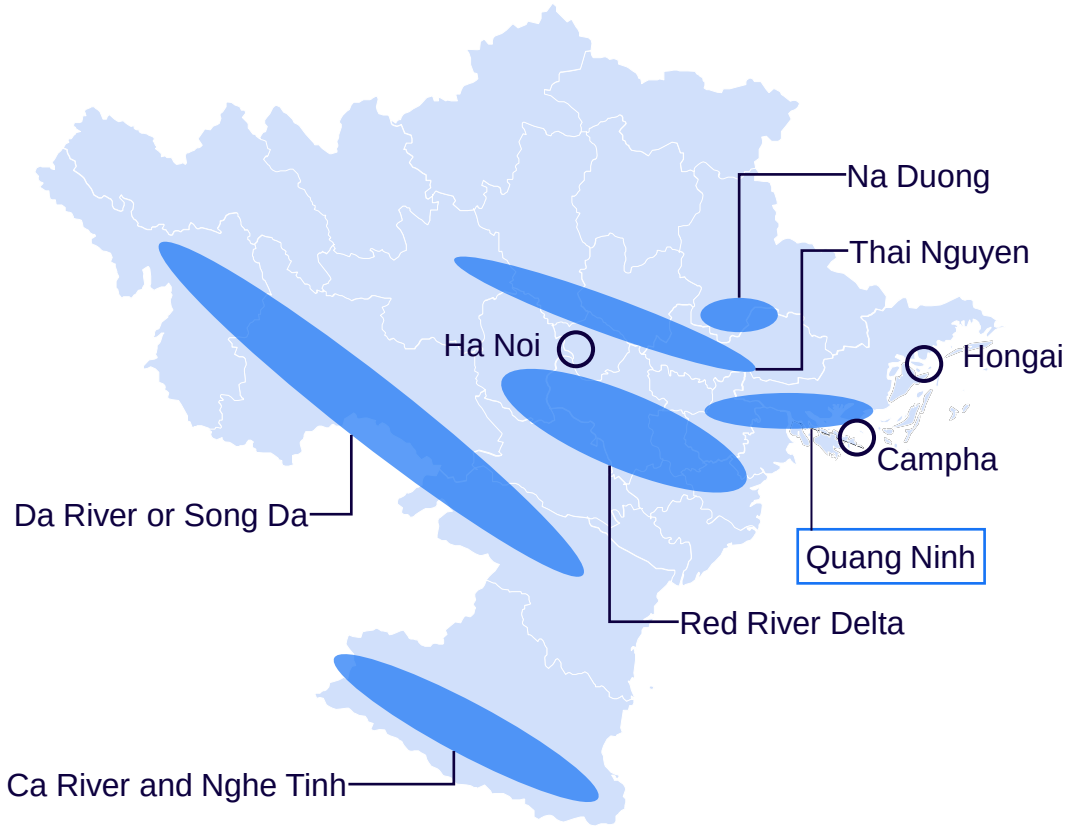
- The country remains the biggest RON95 supplier, accounts for 28% of fuel imports. This is said to see a further increase once output commences from the 300,000b/d RAPID refinery in Johor. Singapore and Thailand each make up about 17% and 14%, respectively
- However, once the projects in the pipeline are finished, it is estimated to run down the imports required, which could potentially shift Vietnam toa net exporter of refined petroleum products
- Top 4 trade partners account for over 60% of refined petroleum earnings of USD 980 mn in 2020, with Singapore at the top at 22% followed by Malaysia, Cambodia and China at 16%, 12% and 8% respectively

Note: *Assumption that price of refined petroleum products is the same for exports as it is for imports; 1) Preliminary figures; Source: General Statistics Office International Merchandise Trade 2022, Fitch Solutions Oil & Gas Report 2023, Arthur D. Little analysis

北部地域は石炭生産量の90%以上を占める

Map of coal producing regions

2022



Description

- The coal producing region around the Red, Da, and Ca river deltas, and particularly in the Quang Ninh Province produce over 90% of all domestic coal in the country
- The Vang Danh mine in Quang Ninh provice is the largest coal mine producing over 3.45 Mt in 2019 and has been in operation since 1964
- Vinacomin is a state-owned company which owns and operates most of the coal mines and plants in Vietnam
  - Despite producing >22 Mt of raw coal in the first 6 months of 2022, up 7% over the same period in 2021, Vinacomin petitioned MOIT to allow for increased capacity by <15% at Vang Danh (225 kt/year), Bac Coc Sau (800 kt/year) and exploit coal at maximum capacity at Cao Son (3.5 Mt/year)

Source: World Bank Climate and Development report 2022, Multiple news articles 2022, Arthur D. Little analysis

石油とガスの埋蔵量予測では、それぞれ～1%と～2%の割合で枯渇し、さらに2021年から2032年にかけてガスのRPRが～7%低下する

Proven oil and gas reserves (Vietnam 2021 - 2026)						
Indicator	**2021**	**2022e**	**2023f**	**2024f**	**2025f**	**2026f**
Proven oil reserves. bn bbl	4.4	4.3	4.3	4.2	4.1	4.1
Proven oil reserves. mn bbl	4,400.0	4,331.8	4,265.6	4,201.4	4,139.8	4,080.6
Proven oil reserves. % y-o-y	-	-1.6	-1.5	-1.5	-1.5	-1.4
Reserves to production ratio (RPR), years	61.0	59.2	60.0	60.8	62.2	63.6
Natural gas proven reserves, tcm	0.7	0.7	0.7	0.7	0.7	0.7
Natural gas proven reserves, bcm	699.7	684.8	677.3	662.2	654.2	636.9
Natural gas proven reserves, % y-o-y	-2.8	-2.1	-1.1	-2.2	-1.2	-2.7
Natural gas reserves-to-production ratio, years	87.0	83.5	81.8	79.2	75.2	60.0
e/f = Fitch Solution estimate/forecast Source: EIA, Fitch Solutions						
Proven oil and gas reserves (Vietnam 2027 - 2032)						
Indicator	**2027f**	**2028f**	**2029f**	**2030f**	**2031f**	**2032f**
Proven oil reserves, bn bbl	4.0	4.0	3.9	3.9	3.8	3.8
Proven oil reserves, mn bbl	4,024.4	3,971.0	3,920.3	3,872.1	3,826.4	3,782.9
Proven Oil reserves, % y-o-y	-1.4	-1.3	-1.3	-1.2	-1.2	-1.1
Reserves to production ratio (RPR), years	65.8	68.1	70.4	72.9	75.4	78.1
Natural gas proven reserves, tcm	0.6	0.6	0.6	0.6	0.6	0.5
Natural gas proven reserves, bcm	625.9	606.8	594.8	575.2	563.0	543.1
Natural gas proven reserves. % y-o-y	-1.7	-3.1	-2.0	-3.3	-2.1	-3.5
Natural gas reserves-to-production ratio, years	53.1	49.0	46.7	44.7	43.3	41.4

Source: Fitch Solutions Oil & Gas Report 2023

Thermal power plants by fuel type (1/4)

NON-EXHAUSTIVE

#	Name	Installed capacity, MW	Assigned project owner/remarks	Input fuel
I	**Period 2021-2025**			
1	Nhon Trach 3&4 gas turbine combined cycle (GTCC) power plants	1500	PVPower	LNG
2	Hiep Phuoc GTCC power plant	1200		LNG
3	Bac Lieu 1 GTCC power plant	800	Delta Offshore Energy PTE LTD	LNG
4	O Mon III GTCC power plant (Gas Lot B)	1050		Domestically extracted gas
5	O Mon IV GTCC power plant (Gas Lot B)	1050	EVN	Domestically extracted gas
6	Na Duong II thermal power plant	110	TKV	Coal
7	An Khanh – Bac Giang thermal power plant	650	An Khanh – Bac Giang Thermal Power JSC	Coal
8	Thai Binh II thermal power plant	1200	PVN	Coal
9	Nghi Son II thermal power plant	1200	Marubeni	Coal
10	Cong Thanh thermal power plant	660	Cong Thanh Thermal Power JSC	Coal
11	Quang Trach I thermal power plant	1200	EVN	Coal
12	Van Phong thermal power plant	1432	Sumitomo	Coal
13	Duyen Hai II thermal power plant	1200	Janakuasa SDN BHD	Coal
14	Song Hau I thermal power plant	1200	PVN	Coal
II	**Period 2026-2030**			
1	Quang Ninh I (Cam Pha) GTCC power plant	1500		LNG
2	Hai Phong No.1 1&2 (Tien Lang) GTCC power plant	1500		LNG
3	Thai Binh 1 GTCC power plant	750		LNG

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Thermal power plants by fuel type (2/4)

NON-EXHAUSTIVE

#	Name	Installed capacity, MW	Assigned project owner/remarks	Input fuel
4	Nghi Son 1,2 GTCC power plant	1600		LNG
5	Ca Na GTCC power plant	1500		LNG
6	Son My 1 GTCC power plant	2250	EDF, Kyushu, Sojitz, Pacific Ocean Group JSC	LNG
7	Son My II GTCC power plant	2250	AES Group (US)	LNG
8	Bac Lieu 2, 3, 4 GTCC power plant	2400	Delta Offshore Energy PTE LTD	LNG
9	Long An I GTCC power plant	1500		LNG
10	Dung Quat I GTCC power plant (using CVX gas)	750	EVN	Domestically extracted gas
11	Dung Quat II GTCC power plant (using CVX gas)	750	Sembcorp Utilities Pte., Ltd.	Domestically extracted gas
12	Dung Quat III GTCC power plant (using CVX gas)	750	EVN	Domestically extracted gas
13	Central Region I GTCC power plant (using CVX gas)	750	PVN	Domestically extracted gas
14	Dung Quat II GTCC power plant (using CVX gas)	750	PVN	Domestically extracted gas
15	Quang Tri GTCC power plant (Bao Vang gas field)	340	Gazprom International	Domestically extracted gas
16	O Mon II GTCC power plant (Gas Lot B)	1050		Domestically extracted gas
17	Hai Ha combined heat and power (CHP) power station	600	Cogeneration in the industrial park	Coal
18	Pha Lai 3 thermal power plant[1]	220		Coal
19	Nam Dinh I thermal power plant	1200	Tackwang Power Holdings – ACWA Power	Coal
20	Quynh Lap I thermal power plant	1200		Coal
21	Quynh Lap II thermal power plant	1200		Coal

Note: 1) Incremental installed capacity (deconstruct old plants and build a new plant on the same location)
Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Thermal power plants by fuel type (3/4)

NON-EXHAUSTIVE

#	Name	Installed capacity, MW	Assigned project owner/remarks	Input fuel
22	Vung Ang II thermal power plant	1200		Coal
23	Formosa Ha Tinh #6-10[1] CHI power plant	750	Cogeneration in the industrial park	Coal
24	Quang Trach II thermal power plant	1200	EVN	Coal
25	Vinh Tan III thermal power plant	1800	VTEC	Coal
26	Long Phu I thermal power plant	1200		Coal
27	Song Hau II thermal power plant	2000	TOYO Ink Group	Coal
28	Quang Tri I thermal power plant	1200	EGATI	Coal
III	**Period 2031-2035**			
1	Hai Phong I #3, 4 (Tien Lang) GTCC power plant	1500		LNG
2	Hai Phong II (Cai Trap) GTCC power plant	1600		LNG
3	Quang Ninh II (Cam Pha) GTCC power plant	1500		LNG
4	Thai Binh #2, 3, 4 GTCC power plant	2250		LNG
5	Nghi Son #3, 4 GTCC power plant	1600		LNG
6	Thanh Hoa #1, 2 GTCC power plant	1600		LNG
7	Tan Phuoc #1 GTCC power plant	800		LNG
8	Long Son GTCC power plant	1500		LNG
9	Long An II GTCC power plant	1500		LNG
10	Hai Ha CHP plant (phase 2)[1]	1500		Coal
11	Bao Dai coal-fired power plant (Bac Giang)	600	With the coal extraction of Bao Bai coal mine	Coal

Note: 1) Thermal cogeneration in industrial parks
Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Thermal power plants by fuel type (4/4)

NON-EXHAUSTIVE

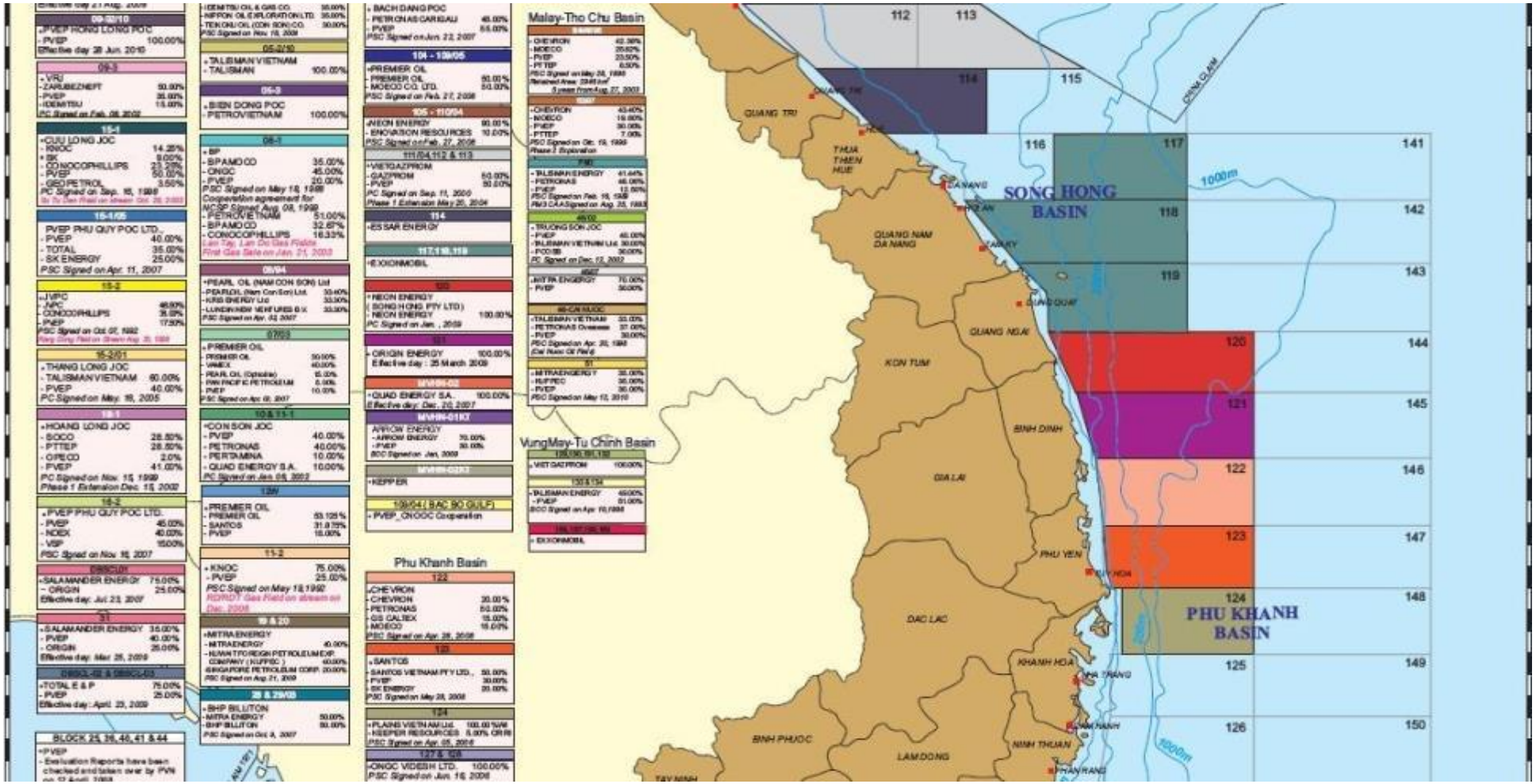
#	Name	Installed capacity, MW	Assigned project owner/remarks	Input fuel
12	Duc Giang CHP plant[1]	100		Coal
13	Vung Ang III thermal power plant	2400	Under proposal to change input fuel to LNG	Coal
14	Long Phu II thermal power plant	1320		Coal
15	Long Phu III thermal power plant	2000		Coal
IV	**Period 2036-2040**			
1	Hai Phong 1#5,6 (Tien Lang) GTCC power plant	1500		LNG
2	Thai Binh#5,6 GTCC power plant	1500		LNG
3	Nghi Son#5,6 GTCC power plant	1600		LNG
4	Thanh GTCC #3,4,5,6 GTCC power plant	3200		LNG
5	Northern Region GTCC power plant	4500		LNG
6	Hai Lang GTCC power plant[2]	1500		LNG
7	Tan Phuoc 1 #2 GTCC power plant	750		LNG
8	Phu My 3,1 GTCC power plant	850		LNG
V	**Period 2041-2045**			
1	Northern Region GTCC power plant	8500		LNG
2	Hai Lang GTCC power plant	1500		LNG
3	Chan May GTCC power plant[3]	1500		LNG

Note: 1) Thermal cogeneration in industrial parks; 2) Incremental installed capacity (deconstruct old plants and build a new plant on the same location); 3) To be constructed in case of incapability to develop more LNG-fired power plants in the North after 2035
Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Map of oil & gas fields in Vietnam (1/3) – North Vietnam

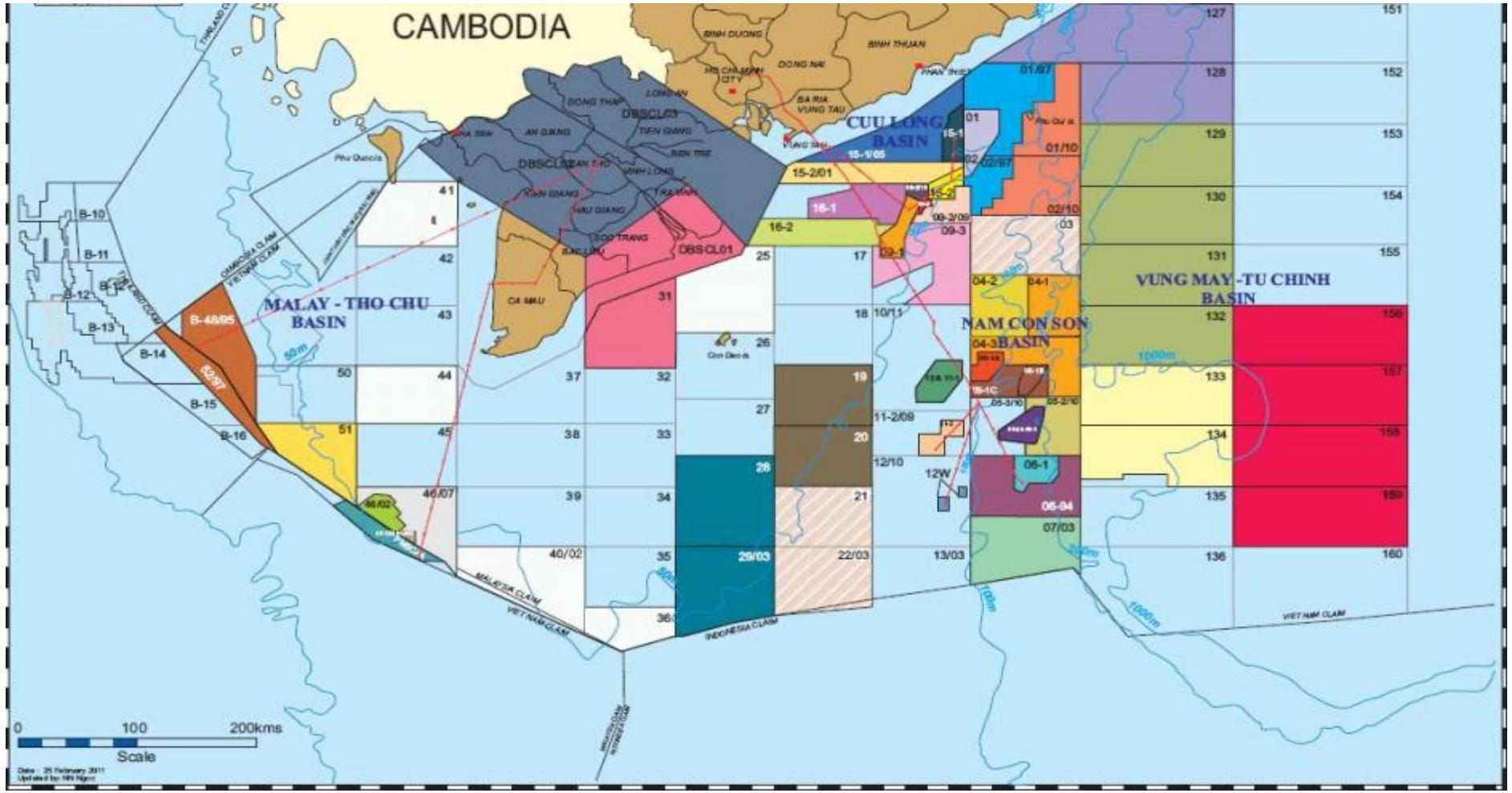
Source: Korea National Oil Corporation 2011

Map of oil & gas fields in Vietnam (2/3) – Central Vietnam



Source: Korea National Oil Corporation 2011

Map of oil & gas fields in Vietnam (3/3) – South Vietnam



Source: Korea National Oil Corporation 2011

Oil & gas projects in operation (1/2)

NON-EXHAUSTIVE

#	Name	Field	Company	Status	Est. peak oil/liquids range, bpd	Est. peak gas output, bcm	Input fuel
1	Tien Hai C, Song Hong basin	Tien Hai C	Petrovietnam Exploration Production Corporation	Production			Gas
2	Block 05-1b& 05- 1c, Nam Con Son basin	Sao Vang, Dai Nguyet	Idemitsu Kosan (43.1%), Teikoku Oil (36.9%), PetroVietnam (20%)	Production		1.5	Gas & Condensate
3	Block 06. 1, Nam Con Son basin	Lan Do	Rosneft (35%), ONGC Videsh (45%), PetroVietnam (20%)	Production		1.8	Gas & Condensate
4	Block 06. 1, Nam Con Son basin	Lan Tay	Rosneft (35%), ONGC Videsh (45%), PetroVietnam (20%)	Production		4.4	Gas & Condensate
5	Block 46, Malay-Tho Chu basin	Cai Nuoc	PetroVietnam (30%), Repsol (33.2%), Petronas (36.8%)	Production			Gas & Condensate
6	Block 01/97	Ho Xam South	Petronas (50%), PetroVietnam (50%)	Production			Oil
7	Block 05. 1A, South Con Son basin	Dai Hung	Petrovietnam Exploration Production Corporation (100%)	Production	18,000		Oil
8	Block 09- 1, Cuu Long	Bach Ho (White Tiger), Rong	Vietsovpetro Joint Venture	Production	2,63,000		Oil
9	Block 15-2/01, Cuu Long basin	Hai Su Trang, Hai Su Den	Repsol (60%), PetroVietnam (40%)	Production	35,000		Oil
10	Block 12E, Nam Con Son basin	Dua	Santos (32%), PetroVietnam (15%), Premier Oil (53%)	Production	80,000		Oil

Source: Fitch Solutions 2023

Oil & gas projects in operation (2/2)

NON-EXHAUSTIVE

#	Name	Field	Company	Status	Est. peak oil/liquids range, bpd	Est. peak gas output, bcm	Input fuel
11	Block 01/97 & 02/97, Cuu Long Basin	Thang Long, Dong Do	Petronas (50%), PetroVietnam (50%)	Production	20,000		Oil
12	Block 46/02	Song Doc	PetroVietnam (100%)	Production	30,000		Oil
13	Block 05-2, 05-3	Mok Tin, Hai Thak, Kim Cuong Tay	PetroVietnam (5 1%), Gazprom (49%)	Production	13,000	2	Oil & Gas
14	Block 12E, 12W, NamCon SonBasin	Chim Sao (Blackbird)	Premier Oil (53.125%), Santos (3 1.875%), Petrovietnam Exploration Production Corporation (1 5%)	Production	30,000		Oil & Gas
15	Block 9-2, Cuu Long Basin	Ca Ngu Vang	PetroVietnam (50%), Soco International (25%), PTT Exploration and Production Public Company (25%)	Production	20,000	0.5	Oil & Gas
16	Block 15-I	Su Tu Den, Su Tu Vang, Su Tu Den Northeast, Su Tu Trang (White Lion), Su Tu Nau, Su Tu Vang Northeast, Su Tu Vang Southwest	ConocoPhillips (23.25%), Petrovietnam Exploration Production Corporation (50%), Korea National Oil Corporation (14.2%), Geopetrol (3.5%), SK Corporation (9%)	Production	82,000	1.5	Oil & Gas
17	Block 16-1 Phase II	Ngna O, Voi Trang, Voi Vang	PetroVietnam (41%), Soco International (28.5%), OPECO (2%), PTT Exploration and Production Public Company (28%)	Production	45,098	1.3	Oil & Gas
18	Block 11-2	Block 11-2	Korea National Oil Corporation (75%), Petrovietnam Exploration Production Corporation (25%)	Production		1.2	Oil & Gas
19	Blocks 102 &106	Ham Rong, Thai Binh	Petronas (50%), ATI Petroleum (10%), PetroVietnam (20%), Singapore Petroleum Company (20%)	Production	20,000		Oil & Gas

Source: Fitch Solutions 2023

Oil & gas projects in the pipeline (1/4)

NON-EXHAUSTIVE

#	Name	Field	Company	Status	Est. peak oil/liquids range, bpd	Est. peak gas output, bcm	Input fuel
1	Tuna Block	Kuda Laut, Singa Laut	(25%), Premier Oil (65%)	Appraisal		1.4	Gas
2	Blocks 117, 118 and 119	Ca Voi Xanh (Blue Whale)	PetroVietnam (36%), ExxonMobil (64%)	Appraisal			Gas & Condensate
3	Block 48/95, Malay-Tho Chu basin	Block 48/95	Petrovietnam Exploration Production Corporation (65.88%), PTT Exploration and Production Public Company (8.5%), Mitsui (25.62%)	Appraisal			Gas & Condensate
4	Block 52/97, Malay Basin	Block 52/97	Petrovietnam Exploration Production Corporation (73.4%), PTT Exploration and Production Public Company (7%), Mitsui (19.6%)	Appraisal			Gas & Condensate
5	Block B, Malay-Tho Chu basin	Block B	PetroVietnam (65.9%), Mitsui & Co. (25.6%), PTT Exploration and Production Public Company (8.5%)	Appraisal	7000	5.6	Gas & Condensate
6	Block 15-1/05, Cuu Long basin	Lac Da Vang Prospect	Murphy Oil (35%), SK Energy (25%), PetroVietnam (40%)	Appraisal			Oil
7	Block 51	U Minh, Tho Chu	Jadestone Energy (70%), Petrovietnam Exploration Production Corporation (30%)	Appraisal			Oil & Gas
8	Mang Cau, Nam Con Son basin	Mang Cau	Vietsovpetro Joint Venture	Appraisal			Oil & Gas
9	Block 46/07	Nam Du	Jadestone Energy (70%), Petrovietnam Exploration Production Corporation (30%)	Appraisal			Oil & Gas
10	Block 10-11.1, Nam Con Son basin	Gau Chua, Gau Ngua, Ca C	Petronas (40%), Petrovietnam Exploration Production Corporation (50%), Pertamina (10%)	Appraisal			Oil & Gas

Source: Fitch Solutions 2023

Oil & gas projects in the pipeline (2/4)

NON-EXHAUSTIVE

#	Name	Field	Company	Status	Est. peak oil/liquids range, bpd	Est. peak gas output, bcm	Input fuel
11	Block 06. 1, Nam Con Son basin	Phong Lan Dai	PetroVietnam (20%), ONGC Videsh (45%), Rosneft (35%)	Development			Gas & Condensate
12	Block 06. 1, Nam Con Son basin	Wild Orchid	PetroVietnam (20%), ONGC Videsh (45%), Rosneft (35%)	Discovery			Gas & Condensate
13	Block 107	KY Lan Miocene	Petrovietnam Exploration Production	Discovery			Gas & Condensate
14	Block 09-3/12, South Con Son basin	Sturgeon	Vietsovpetro Joint Venture	Discovery			Oil
15	Block 11-2/11, Nam Con Son basin	Block 11-2/11	Petrovietnam Exploration Production Corporation (40%),Murphy Oil (60%)	Discovery			Oil
16	Block 16-1, Cuu Long basin	Te Giac Trans (TGT)	PTT Exploration and Production Public Company (28.5%), Soco International (30.5%), PetroVietnam (41%)	Expansion	55000		Oil & Gas
17	Block 115/09, Southern Song Hong basin	Block 115/09	KrisEnergy (100%)	Exploration			Gas
18	Block 05.3/11 , Nam Con Son basin	Block 05.3/11	Rosneft (100%)	Exploration			Gas & Condensate
19	Block 128	Block 128	ONGC Videsh (100%)	Exploration			Oil & Gas
20	Block 127, Phu Khanh basin	Block 127	Jadestone Energy (100%)	Exploration			Oil & Gas

Source: Fitch Solutions 2023

Oil & gas projects in the pipeline (3/4)

NON-EXHAUSTIVE

#	Name	Field	Company	Status	Est. peak oil/liquids range, bpd	Est. peak gas output, bcm	Input fuel
21	Block 125, 126, Phu Khanh basin	Block 125, 126	Soco International (70%), SOVICO, PetroVietnam	Exploration			Oil & Gas
22	Block 122, Phu Khanh basin	Block 122	Eni (60%), PetroVietnam (40%)	Exploration			Oil & Gas
23	Block 116, Song Hong basin	Block 116	Eni (100%)	Exploration			Oil & Gas
24	Block 124, Phu Khanh basin	Block 124	Eni (60%), PetroVietnam (40%)	Exploration			Oil & Gas
25	Block 144, Phu Khanh basin	Block 144	Petrovietnam Exploration Production Corporation (PVEP) (35%), Murphy Oil (65%)	Exploration			Oil & Gas
26	Blocks 135 &136/3	Blocks 135 & 136/3	Repsol (40%), Mubadala Petroleum (20%), PetroVietnam (40%)	Exploration			Oil & Gas
27	Block 105-110/4, Song Hong basin	Block 105	PetroVietnam (49%), KrisEnergy (51%)	Exploration			Oil & Gas
28	Block 120	Block 120	Eni (66.67%), KrisEnergy (33.33%)	Exploration			Oil & Gas
29	Block 114, Song Hong basin	Block 114	Eni (50%), Essar (50%)	Exploration			Oil & Gas
30	Block 111/04, 112 & 113	Block 111/04, 112 & 113	PetroVietnam, Gazprom	Exploration			Oil & Gas

Source: Fitch Solutions 2023

Oil & gas projects in the pipeline (4/4)

NON-EXHAUSTIVE

#	Name	Field	Company	Status	Est. peak oil/liquids range, bpd	Est. peak gas output, bcm	Input fuel
31	Block 129, 130, 131, 132	Block 129, 130, 131, 132	PetroVietnam, Gazprom	Exploration			Oil & Gas
32	Block 145, Phu Khanh basin	Block 145	Petrovietnam Exploration Production Corporation (35%), Murphy Oil (65%)	Exploration			Oil & Gas
33	Block 39	Block 39	Sumitomo (25%), Idemitsu Petroleum (75%)	Exploration			Oil & Gas
34	Block 40/02	Block 40/02	Sumitomo (25%), Idemitsu Petroleum (75%)	Exploration			Oil & Gas
35	PM3 commercial arrangement area	West Bunga Kekwa, East Bun	PetroVietnam (30%), Petronas (35%), Repsol (35%)	Upgrade/EOR	60,000	2.7	Oil & Gas
36	Block 15-2, Cuu Long basin	Rang Dong, Phuong Dong	JX Nippon Oil & Energy Corporation (46.5%), Per-enco (36%), PetroVietnam (17.5%)	Upgrade/EOR	140,562		Oil & Gas

Source: Fitch Solutions 2023

ベトナムは石炭の依存度が高いが、一部発電所では環境対応が必要

Description

- Despite coal making up 50% of the primary energy consumption, due to lack of investment in infrastructure and administrative barriers, there has been little headway with regards to implementation of clean coal technology, even with the absence of pilot tests
- In Feb 2022, an international relationship between Vietnam and Japan saw a meeting of state-owned EVN, Ministry of Industry and Trade, Ministry of Economy (MoIT), Trade and Industry of Japan, New Energy and Industrial Technology Development Organization of Japan and Coal Energy Center of Japan to discussed the technical aspects of incorporating CCT technologies to help meet carbon goals
  - No further steps have been taken by EVN or MoIT since

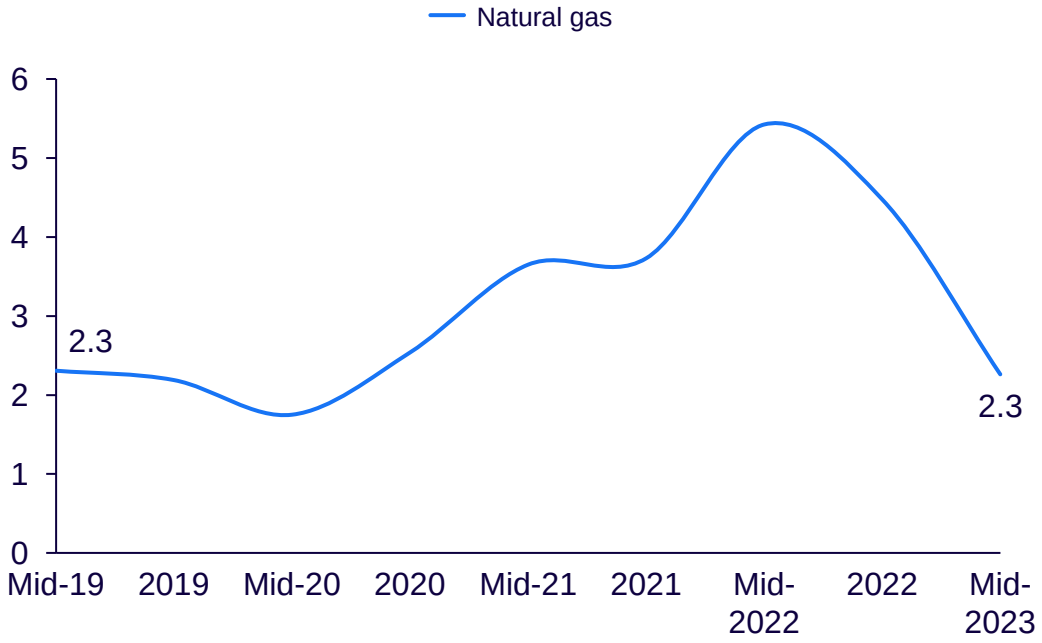
Source: Vietnam Electricity 2022, Arthur D. Little analysis

ポストCOVID 19では、欧州における戦争の緊張がさらに煽り、需要の回復に伴って燃料価格が上昇し、2022年半ばにピークに達した後、価格はコロナ前の価格へ収れん

Official selling price of Natural gas

2019 – 2023, USD/MMBtu

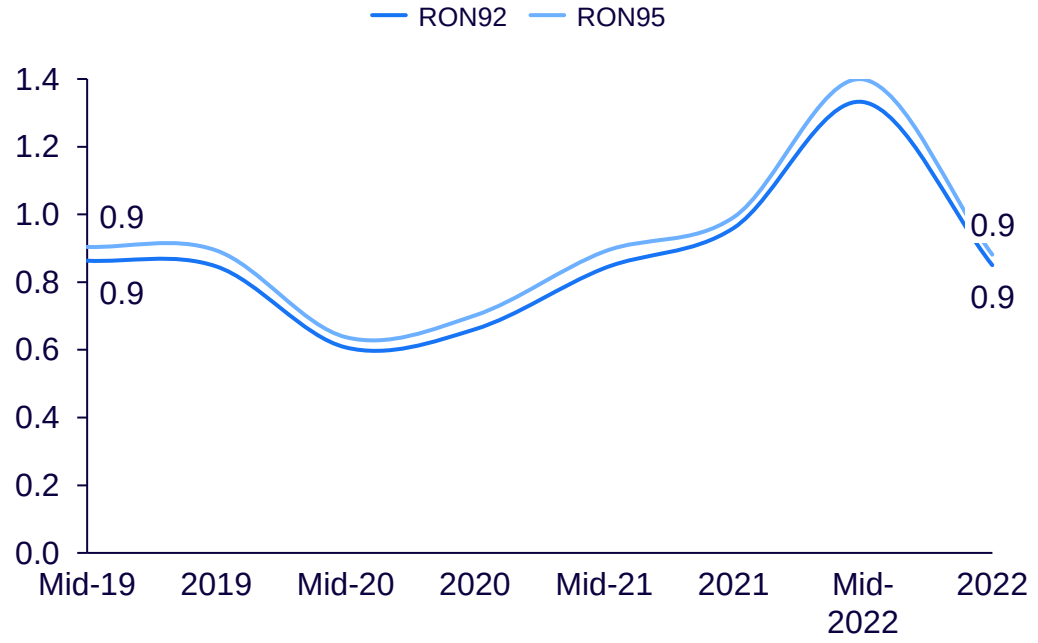
Before experiencing an upward trend in 2020, Natural gas was sold around $1 to $2 per MMBtu, which later reached its peak at $5.5 per MMBtu in mid-2022. However, this scenario did not remain long before a steep decline kicked in.



Official selling price of Gasoline

2019 – 2023, USD/Litre

From 2019 - 2021, price of gasoline in Vietnam fluctuated around 60 USD cents to $1 per liter. Yet, in 2021 to mid-2022 Vietnam witnessed a spike in price at $1.4 per liter, which then cooled down to the normal level of 80 cents in the late 2022



Source: Multiple news articles, Arthur D. Little analysis

ベトナムのエネルギーセクターの主要官庁はMOITであり、EREA、IE、ERAV等で構成される

Ministry	Department	Role & responsibility
Ministry of Industry and Trade (MOIT)	• Oil gas department • Domestic Markets Department	• Formulate national energy development plans • Manage investment of energy projects • Manage production & distribution activities of petroleum • Manage electricity demand, promoting energy conservation and efficiency • Regulate, operate competitive electricity markets • Set price for electricity
	旧GDE Electricity and Renewable Energy Authority (EREA)	• Formulate energy planning and policies • Establish regulations, guidelines, and techincal standards for energy sectors • Develop policies to incentivize renewable energy projects
	旧GDE Oil, Gas and Coal Department	• Natural resource management
	旧GDE Energy Efficiency and Sustainable Development Department	• Energy Policy development
	IE (Institute of Energy)	• it is a research institute specialized in the energy field in charge of analyzing and reviewing The PDP is a research institute specialized in the field of energy that is in charge of analytical studies. IE is also in charge of the development of the PDP, the master plan for electric power, the revision of the PDP, and the long-term demand forecast.IE is also in charge of the development of the PDP, which is the master plan for electric power, the revision of the PDP, and the long-term demand forecast.
	Energy Regulatory Authority of Vietnam (ERAV)	• Regulate electricity sector; Ensure fair competition; Maintain quality standards • Grant licenses to electricity companies and applications for market entry • Set electricity tariffs and pricing
Ministry of Finance (MOF)		• Set price and tariffs for electricity, oil, and gas • Formulate taxation for energy sectors and customs for energy imports & exports • Allocate funds for energy development, infrastructure, and investment projects • Subsidize for renewable energy development
Ministry of Planning and Investment (MPI)		• Evaluate & implement energy development plans • Attract domestic & foreign investment for energy sector • Facilitate public-private partnerships i.e. Electricity projects

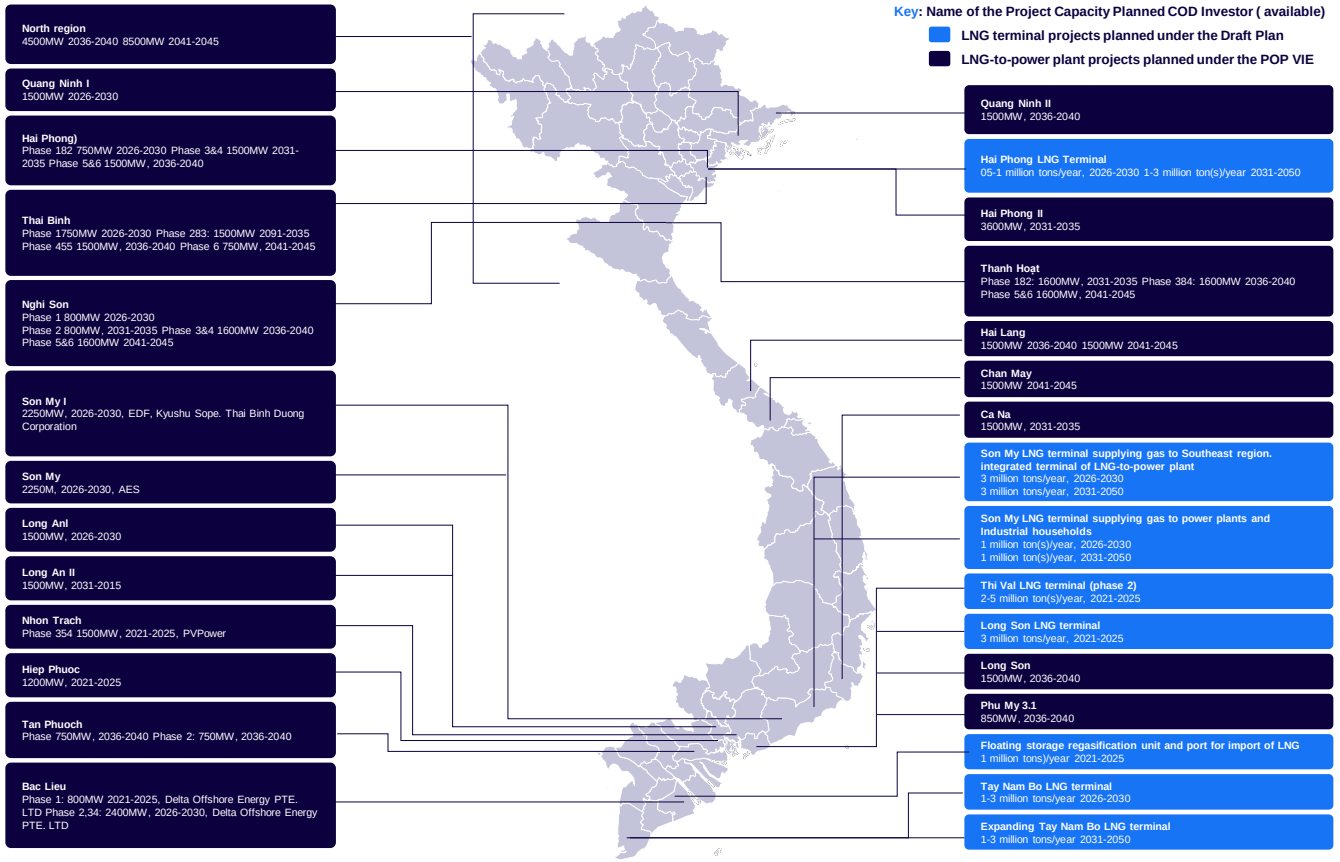
Source: MOIT 2023, MOF 2023, MPI 2023, GDE 2023, ERAV 2023

3. パイプライン（ガス・石油）

ペトロベトナムは4つのガス生成システムを保有している

Proposed natural gas pipeline network, by region

2018 – 2050



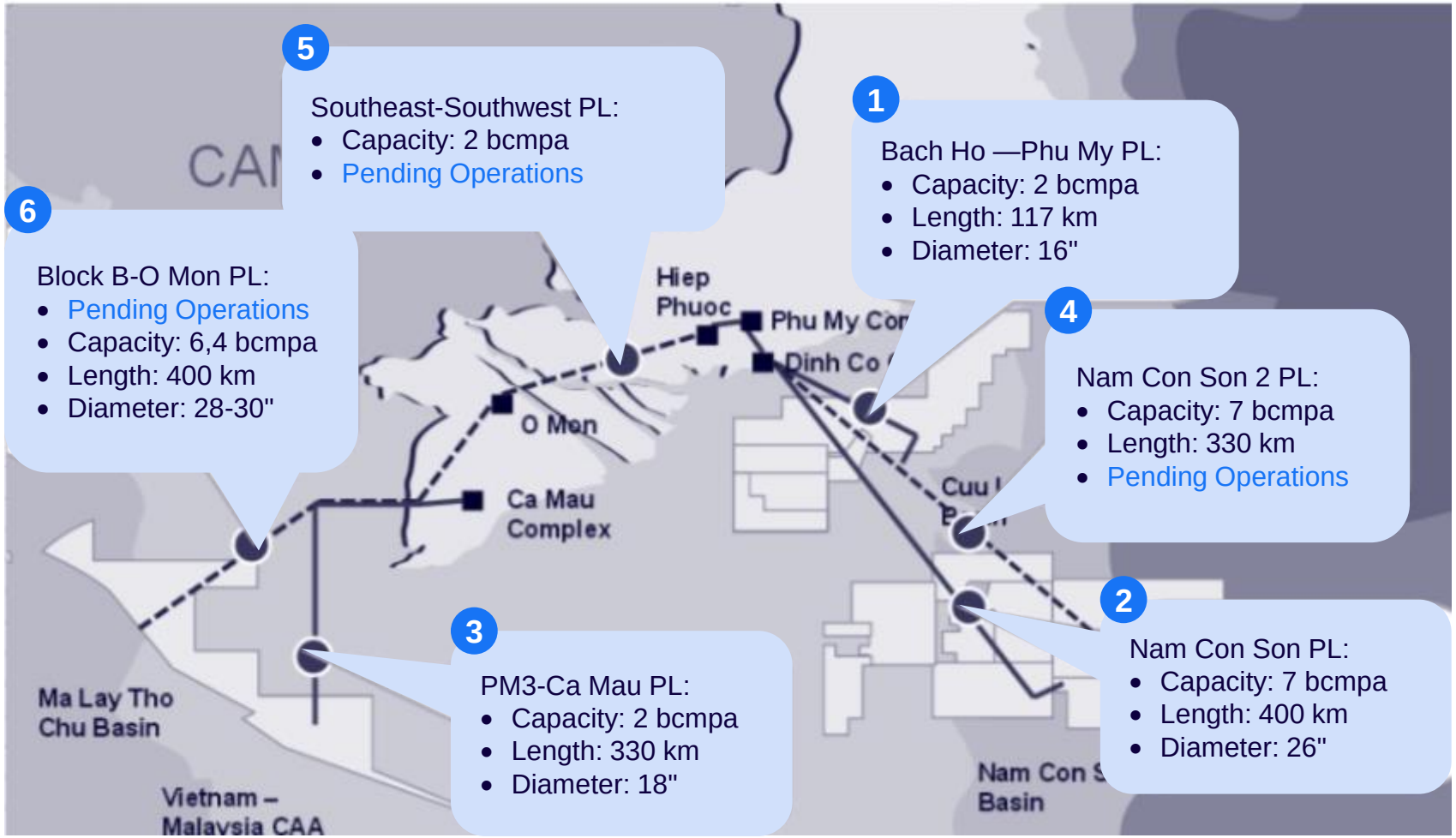
Region[1]	Number of pipelines	Total capacity, bcm	Total length, km
North	4	1.1-1.6	195-200
North Central	1	1.5	10
South Central	5	9.6-9.9	175-185
Southeast	6	0.6	226
Southwest	6	6.7-7.2	145-175
Total	**22**	**19.5-20.8**	**751-796**

1. In the high scenario, planned COD of phase 2&3&4 (Thai Binh project) with the total capacity of 2250MW is 2031-2035 and phase 5&6 with the total capacity of 1500MW is 2036-2040.
2. In the high scenario, planned COD of both phase 1&2 of Nghi Son is 2026-2030 and planned COD of phase 3&4 is 2031-2035
3. In the high scenario, planned COD of Ca Nais 2026-2030
4. In the high scenario, planned COD of Quang Ninh II is 2031-2035
5. In the high scenario, planned COD of phase 3&4&5&6 of Thanh Hoa project is 2036-2040
6. In the high scenario, Tan Phuoc I has the capacity of 800 MW and planned COD is 2031-2035
7. In the high scenario, planned COD of Long Son is 2031-2035
8. The specific address for this project have not yet been clarified under the POPS

* Additional projects in case of high scenario

Note: 1) Values are downwards estimates as roughly half the figures are undisclosed
Source: Vietnam National Power Development Plan 8 2021, Baker McKenzie 2022, Arthur D. Little analysis

既に稼働中のパイプラインはBack Ho-Phu 、Nam Con Son、PM3-Ca Mau 、今後の稼働予定のパイプラインはNam Con Son 2、Southeast-Southwest、Block B-O Mon



Source: Various secondary sources

List of 4 current systems (1) Cuu Long, (2) Nam Con Son, (3) Phu My – My Xuan – Go Dau (4) PM3-Ca Mau

Name	Section	Beginning station	Ending station	Length, km	Capacity, bcm/year	2012 output, bcm/year, efficiency %	Owner(s)
Cuu Long	Su Tu Vang - Rang Dong – Bach Ho - Long Hai – Dinh Co Gas Pipeline (offshore)	Center Compression Platform	Dinh Co Gas Processing Plant	116.5	2	1.25 (62.50%)	PV Gas
	Dinh Co - Ba Ria - Phu My Gas Pipeline (onshore)	Dinh Co Gas Processing Plant	Customers (eg. Ba Ria power plant)	28.8	1.5		
	Dinh Co - Thi Vai liquid pipelines	Dinh Co Gas Processing Plant	Customers	N/A	N/A		
Nam Con Son	Offshore pipeline	Blocks 06.1, 11.2 and 12W	Phu My Gas Distribution Center	370	7	6.215 (88.79%)	Rosneft (32.7%), Perenco (16.3%) and PV Gas (51%).
	Phu My - Nhon Trach - Hiep Phuoc Gas Pipeline	Phu My Gas Distribution Center	Customers	40	2	-	
Phu My – My Xuan – Go Dau	Phu My – My Xuan – Go Dau Low-Pressure Gas Pipeline	Dinh Co Gas Processing Plant	Customers	7	1	0.25 (25%)	PV Gas
PM3 - Ca Mau	-	Blocks PM3 CAA & 46-Cai Nuoc	Ca Mau Gas Distribution Center for customers	298 km (offshore) + 27 km (onshore)	2	1.903 (95.10%)	PV Gas

Source: Various secondary sources

List of 3 planned systems (5) Blue Whale, (6) Nam Con Son 2, (7) Block B – O Mon

Name	Section	Beginning station	Ending station	Length, km	Capacity, bcm/year	Status	Owner(s)
Blue Whale	Offshore section	-	-	88	150 (total)	• Nov 2021, Exxon confirmed on working on the final development plan, regulatory approval issues • Pre-FID	Vietnam National Oil and Gas Group (36%) Exxon Mobil (64%)
Nam Con Son 2	Offshore section	Hai Thach, Moc Tinh (block 05.2, 05.3), Thien Ung, Mang Cau (block 04.3), block 04.1	Long Hai station	325 (offshore) 39 (onshore)	7	• NCS-2 Phase I in 2020, with plants to add output from Thien Ung-Dai Hung fields to boost total gas flows by 2-3 bcm • Phase II is slated for 2022 and would double NSC-2's current takeaway capacity	PV Gas (51%), Gazprom International (49%)
	Onshore section	Long Hai station	Dinh Co Gas Processing Plant Fumi’s fertiliser plant and gas refinery	9 (onshore)			
Block B – O Mon	Offshore section	Center Processing Platform	Mui Tram Landfall station	246 (offshore)	6.4	Jan 2023 Mon II gas-fired power plant secured the prime minister's approval to move forward. It has a capacity of 1.05 GW, set to commence operations in 2024-2025 Mon I is active and currently being supplied by fuel oil, although it will be run on gas in 2021. O Mon III and IV are still awaiting approvals	PetroVietnam Gas Corporation (51%), the rest owned by Mitsui Oil Exploration Company (Japan), PTT Exploration and Production Public Company (Thailand)
	Onshore section	Mui Tram Landfall station	O Mon Gas distribution center	152 (onshore)			
		O Mon Gas distribution center	Tra Noc Gas Distribution Station	9.5 (onshore)			

Source: Various secondary sources

Oil & gas key upstream projects (1/6)

NON-EXHAUSTIVE

Name	Field	Companies	Status	Est. peak oil/ liquid range, bpd	Est. peak gas output, bcm	Project type
Tuna Block	Kuda Laut, Singa Laut	GS Energy (10%), Moeco Oil & Gas (25%), Premier Oil (65%	Appraisal	-	1.4	Gas
Blocks 117, 118 and 119	Ca Voi Xanh (Blue Whale)	PetroVietnam (36%), ExonMobil (64%)	Appraisal	-		Gas & Condensate
Block 48/95, Malay-Tho Chu Basin	Block 48/95	Petrovietnam Exploration Production Corporation (65.88%), PTT Exploration and Production Public Company (8.5%), Mitsui (25.62%)	Appraisal	-	-	Gas & Condensate
Block 52/97, Malay Basin	Block 52/97	Petrovietnam Exploration Production Corporation (73.4%), PTT Exploration and Production Public Company (7%), Mitsui (19.6%)	Appraisal	-	-	Gas & Condensate
Block B, Malay-Tho Chu Basin	Block B	PetroVietnam (65.9%), Mitsui & Co. (25.6%), PTT Exploration and Production Public Company (8.5%	Appraisal	7,000	5.6	Gas & Condensate
Block 15-1/ 05, CuuLong Basin	Lac Da Vang Prospect	Murphy Oil (35%), SK Energy (25%), PetroVietnam (40%)	Appraisal	-	-	Oil
Block 51	U Minh, Thọ Chu	Jadestone Energy (70%), Petrovietnam Exploration Production Corporation (30%)	Appraisal	-	-	Oil & Gas
Mang Cau, Nam Con Son basin	Mang Cau	Vietsovpetro Joint Venture	Appraisal	-	-	Oil & Gas
Block 46/07	Nam Du	Jadestone Energy (70%), Petrovietnam Exploration Production Corporation (30%)	Appraisal	-	-	Oil & Gas

Source: Fitch Solutions Oil & Gas Report 2023

Oil & gas key upstream projects (2/6)

NON-EXHAUSTIVE

Name	Field	Companies	Status	Est. peak oil/ liquid range, bpd	Est. peak gas output, bcm	Project type
Block10-11.1, Nam Con Son Basin	Gau Chua, Gau Ngua, Ca Cho	Petronas (40%), Petrovietnam Exploration Production Corporation (50%), Pertamina (10%)	Appraisal	-	-	Gas & Condensate
Block 06.1, Nam Con Son Basin	Phong Lan Dai	PetroVietnam (20%), ONGC Videsh (45%), Rosneft (35%)	Development	-	-	Gas & Condensate
Block 06.1, Nam Con Son Basin	Wild Orchid	PetroVietnam (20%), ONGC Videsh (45%), Rosneft (35%)	Discovery	-	-	Gas & Condensate
Block 107	Ky Lan Miocene	Petrovietnam Exploration Production Corporation	Discovery	-	-	Gas & Condensate
Block 09-3/ 12, South Conson Basin	Sturgeon	Vietsovpetro Joint Venture	Discovery	-	-	Oil
Block 11-2/ 11, Nam Con Son Basin	Block-11-2/11	Petrovietnam Exploration Production Corporation (40%), Murphy Oil (60%)	Discovery	-	-	Oil
Block 16-1, Cuu Long Basin	Te Giac Trang (TGT)	PTT Exploration and Production Public Company (28.5%), Soco International (30.5%), PetroVietnam (41%)	Expansion	55,000	-	Oil & Gas
Block 115/ 09, Southern Song Hong Basin	Block 115/09	KrisEnergy (100%)	Exploration	-	-	Gas
Block 05.3/ 11, Nam Con Son Basin	Block 05.3/11	Rosneft (100%)	Exploration	-	-	Gas & Condensate
Block 128	Block 128	ONGC Videsh (100%)	Exploration	-	-	Oil & Gas
Block 127, Phu Khanh Basin	Block 127	Jadestone Energy (100%	Exploration	-	-	Oil & Gas

Source: Fitch Solutions Oil & Gas Report 2023

Oil & gas key upstream projects (3/6)

NON-EXHAUSTIVE

Name	Field	Companies	Status	Est. peak oil/ liquid range, bpd	Est. peak gas output, bcm	Project type
Block 125, 126, Phu Khanh Basin	Block 125, 126	Soco International (70%), SOVICO, PetroVietnam	Exploration	-	-	Oil & Gas
Block 122, Phu Khanh Basin	Block 122	Eni (60%), PetroVietnam (40%)	Exploration	-	-	Oil & Gas
Block 116, Song Hong Basin	Block 116	Eni (100%)	Exploration	-	-	Oil & Gas
Block 124, Phu Khanh Basin	Block 124	Eni (60%), PetroVietnam (40)	Exploration	-	-	Oil & Gas
Block 144, Phu Khanh Basin	Block 144	Petrovietnam Exploration Production Corporation (PVEP) (35%), Murphy Oil (650	Exploration	-	-	Oil & Gas
Blocks 135 & 136/3	Blocks 135 & 136/3	Repsol (40%), Mubadala Petroleum C20%), PetroVietnam (40	Exploration	-	-	Oil & Gas
Block 105-110/4, Song Hong Basin	Block 105	PetroVietnam (49%), KrisEnergy (51%)	Exploration	-	-	Oil & Gas
Block 120	Block 120	Eni (66.67%), KrisEnergy (33.33%	Exploration	-	-	Oil & Gas
Block 114 Song Hong Basin	Block 114	Eni (50%), Essar (50%)	Exploration	-	-	Oil & Gas
Block 111/ 04, 112 & 113	Block 111/04, 112&113	PetroVietnam, Gazprom	Exploration	-	-	Oil & Gas
Block 129, 130, 131, 132	Block 129, 130, 131, 132	PetroVietnam, Gazprom	Exploration	-	-	Oil & Gas
Block 145, Phu Khanh Basin	Block 145	Petrovietnam Exploration Production Corporation (35%), Murphy Oil (65%	Exploration	-	-	Oil & Gas

Source: Fitch Solutions Oil & Gas Report 2023

Oil & gas key upstream projects (4/6)

NON-EXHAUSTIVE

Name	Field	Companies	Status	Est. peak oil/ liquid range, bpd	Est. peak gas output, bcm	Project type
Block 39	Block 39	Sumitomo (25%), Idemitsu Petroleum (75%)	Exploration	-	-	Oil & Gas
Block 40/02	Block 40/02	Sumitomo (25%), Idemitsu Petroleum (75%)	Exploration	-	-	Oil & Gas
Tien Hai C, Song Hong Basin	Tien Hai C	Petrovietnam Exploration Production Corporation	Production	-	-	Gas
Block 05-1b & 05-1c, Nam Con Son Basin	Sao Vang, Dai Nguyet	Idemitsu Kosan (43.1%), Teikoku Oil (36.9%), PetroVietnam (20%)	Production	-	1.5	Gas & Condensate
Block 06.1, Nam Con Son Basin	Cai Nuoc	Rosneft (35%), ONGC Videsh (45%), PetroVietnam (20%)	Production	-	1.8	Gas & Condensate
Block 06.1, Nam Con Son Basin	Cai Nuoc	Rosneft (35%), ONGC Videsh (45%), PetroVietnam (20%)	Production	-	4.4	Gas & Condensate
Block 46, Malay-Tho Chu Basin	Cai Nuoc	PetroVietnam (30%). Repsol (33.2%), Petronas (36.8%)	Production	-	-	Gas & Condensate
Block 01/97	Ho Xam South	Petronas (50%), PetroVietnam (50%)	Production	-	-	Oil
Block 05.1A, South Con Son Basin	Dai Hung	Petrovietnam Exploration Production Corporation (100%)	Production	18,000	-	Oil
Block 09-1, Cuu Long Basin	Bach Ho (White Tiger), Rong	Vietsovpetro Joint Venture	Production	263,000	-	Oil
Block 15-2/ 01, Cuu Long Basin	Hai Su Trang, Hai Su Den	Repsol (60%), PetroVietnam (40%)	Production	35,000	-	Oil
Block 12E, Nam Con Son Basin	Dua	Santos (32%), PetroVietnam (15%), Premier Oil (53%	Production	8,000	-	Oil

Source: Fitch Solutions Oil & Gas Report 2023

Oil & gas key upstream projects (5/6)

NON-EXHAUSTIVE

Name	Field	Companies	Status	Est. peak oil/ liquid range, bpd	Est. peak gas output, bcm	Project type
Block 39	Su Tu Den, Su Tu Vang, Su Tu Den Northeast, Su Tu Trang (White Lion), Su Tu Nau, Su Tu Vang Northeast, Su Tu Vang Southwest	ConocoPhillips (23.25%), Petrovietnam Exploration Production Corporation (50%), Korea National Oil Corporation (14.2%), Geopetrol (3.5%), SK Corporation (9%)	Production	82,000	1.5	Oil & Gas
Block 16-1 Phase II	Ngna 0, Voi Trang, Voi Vang	PetroVietnam (41%), 5000 International (28.5%), OPECO (2%), PTT Exploration and Production Public Company (28%)	Production	45,098	1.3	Oil & Gas
Block 11-2	Block 11-2	Korea National Oil Corporation (75%), Petrovietnam Exploration Production Corporation (25%)	Production	-	1.2	Oil & Gas
Blocks 102 & 106	Ham Rong Thai Binh	Petronas (50%), ATI Petroleum (10%), PetroVietnam (20%), Singapore Petroleum Company (20%)	Production	20,000	-	Oil & Gas
Block 13-03, Nam Con Son Basin	Block 13-03	Government of Vietnam	Suspended	-	-	Oil
Block 102/ 10, Song Hong Basin	Block 102/10	Government of Vietnam	Suspended	-	-	Oil & Gas
Block 106/ 10, Song Hong Basin	Block 106/10	Government of Vietnam	Suspended	-	-	Oil & Gas
Block 07/03, Nam Con Son Basin	Ca Rong Do (Red Emperor)	Government of Vietnam	Suspended	-	-	Oil & Gas

Source: Fitch Solutions Oil & Gas Report 2023

Oil & gas key upstream projects (6/6)

NON-EXHAUSTIVE

Name	Field	Companies	Status	Est. peak oil/ liquid range, bpd	Est. peak gas output, bcm	Project type
Block 04-2	Block04-2	Government of Vietnam	Suspended	-	-	Oil & Gas
PM3 Commercial Arrangement Area (CAA	West Bunga Kekwa, East Bunga Kekwa-Cai Nuoc, East Bunga Raya, West Bunga Raya, NW Bunga Raya and Bunga Seroja, Bunga Orkid	PetroVietnam (30%. Petronas (35%), Repsol (35%)	Upgrade/ EOR	60,000	2.7	Oil & Gas
Block 15-2, Cuu Long Basin	Rang Dong Phuong Dong	JX Nippon Oil & Energy Corporation (46.5%), Perenco (36%), PetroVietnam (17.5%	Upgrade/ EOR	140,562	-	Oil & Gas

Source: Fitch Solutions Oil & Gas Report 2023

Oil refineries

NON-EXHAUSTIVE

Location	Name	Capacity, bpd	Status	Construction completion date	Main owner(s)
Quang Ngai	Dung Quat	148,000	Active	2009	Petro Vietnam (Binh Son Refinery Limited)
Thanh Hoa	Nghi Sơn	200,000	Active	2018	Nghi Son Refinery& Petrochemical LLC
Ba Ria-Vung Tau	Long Son	200,000	Construction completed	2023	Siam Cement Group
Khan Hoa	Nam Van Phong	200,000	Cancelled	-	Petrolimex
Phu Yen	Vung Ro	160,000	Cancelled	-	Vung Ro Petroleum
Binh Dinh	Nhơn Hoà	400,000	Cancelled	-	PTT, Saudi Aramco

Source: Fitch Solutions Oil & Gas Report 2023

Gas pipelines

NON-EXHAUSTIVE

Name	Status	Capacity, bcm/year	Owner	Remarks
Nam Con Son	Active	4.8	TNK-BP	Transports gas from the Lan Tay-Lan Do gas fields to an onshore processing and distribution facility in Ba Ria Vung Tau, largely for power generation.
Cuu Long	Active	NA	NA	Transports gas from the Bach Ho field to an onshore processing and distribution facility in Ba Ria Vung Tau, mostly for commercial use
Su Tu Vang- Rang Dong- Bach Ho – Long Hai - Dinh Co	Active	3.3	NA	Transports gas from the Bach Ho, Rang Dong. Su Tu Vang gas fields to the Dinh Co processing facility
Dinh Co - Phu My	Active	NA	NA	Carries dry gas processed at the Dinh Co processing plant to end-users.
Phu My - Nhon Active Trach-Heip Phuoc	Active	NA	NA	Sends gas from the Nam Con Son field to the Nhon Trach and Heip Phuoc districts for distribution into power plants and industrial zones.
PM3-Ca Mau	Active	NA	NA	Delivers gas from the offshore PM3 CAA and 46-Cai Nuoc fields to the Ca Mau gas distribution center, to be fed into two power plants and a fertiliser plant in the Ca Mau industrial area.
Vietnam Gas Project	Construction	NA	NA	Planned to distribute gas from the Block B gas development in the Cuu Long Basin, to the power plants and fertiliser plants along the southwest coast of Vietnam. However, development remains stunted due to Chevron's exit from the joint venture.
Can Tho	Proposed	5.8-6.6	PetroVietnam	PetroVietnam has announced plans to build a 398km gas pipeline to transport gas from the offshore fields in the southwest coast to the power plants in the city of Can Tho. However, it has yet to specify which field would supply the gas.

Source: Fitch Solutions Oil & Gas Report 2023

LNG import terminals

NON-EXHAUSTIVE

Name	Location	Status	Type	Capacity, mpta	Capacity, bcm	Owner(s)	Start-up date
Ca Na	Ninh Thuận	Approved	Onshore	6.0	8.2	Gulf Energy Development	2025-2026
Haiphong I	Cat Hai	Approved	Onshore	3.0	4.1	ExxonMobil	2026-2027
Haiphong II	Cat Hai	Approved	Onshore	3.0	4.1	ExxonMobil	2029-2030
Ca Mau	Hon Khoai	Proposed	Onshore	3	4.1		2026
Mul Ke Gal	Binh Thuan	Proposed	FSRU	1.5	2.0	Energy Capital Vietnam, KOGAS	2025
My Glang	Khanh Hoa	Proposed	Onshore	3	4.1		2030-2035
Son My Phase II	Bin Thuan	Proposed	Onshore	2.4	3.3	AES Corporation	2024-2025
South East LNG	Tien Giang	Proposed	Onshore	4.0-6.0	5.4-8.2		2023-2025
Thai Binh FSRU	Thai Binh	Proposed	FSRU	0.2-0.5	0.3-0.7		2026-2030
Son My Phase I	Bin Thuan	Under construction	Onshore	3.6	4.9	EDF (37.5%), Pacific Corporation (25.0%), Sojitz (18.75%), Kyushu Electric (18.75%)	2023-2024
Thi Vai	Vung Tau	Construction Completed	Onshore	1.0	1.4	Petro Vietnam (PV Gas)	2023

Source: Fitch Solutions Oil & Gas Report 2023

Current natural gas and LNG projects (1/2)

NON-EXHAUSTIVE

Name	Location	Capacity, mtpa	Type	Start-up date
Ca Na	Ninh Thuận	6.0	Onshore	2025-2026
Haiphong I	Cat Hai	3.0	Onshore	2026-2027
Haiphong II	Cat Hai	3.0	Onshore	2029-2030
Ca Mau	Hon Khoai	3.0	Onshore	2022-2025
Mul Ke Gal	Bình Thuận	1.5	FSRU	2025
My Glang	Khanh Hoa	3	Onshore	2030-2035
Son My Phase I	Bin Thuần	3.6	Onshore	2025
South East LNG	Tien Glang	4.0-6.0	Onshore	2022-2025
Thai Binh FSRU	Thai Binh	0.2-0.5	FSRU	2026-2030
Son My Phase II	Bản Thuận	24	Onshore	2028
Thi Val	Vung Tau	1.0	Onshore	2022
Bac Lieu	Bac Lieu	3,200	LNG-To-Power Plant	2024
Ca Na I	Ninh Thuan	1,500	LNG-To-Power Plant	2025-2026
Ca Na II	Ninh Thuan	4,500	LNG-To-Power Plant	-
Chan May I	Thua Thien Hue	2.400	LNG-To-Power Plant	2024
Chan May II	Thua Thien Hue	1,600	LNG-To-Power Plant	2028
Dung Quat I	Quang Ngai	750	Gas-To-Power Plant	2023
Dung Quat II	Quang Ngai	750	Gas-To-Power Plant	2024

Source: Fitch Solutions Oil & Gas Report 2023

Natural gas and LNG projects in the pipeline (2/2)

NON-EXHAUSTIVE

Name	Location	Capacity, mtpa	Type	Start-up date
Haiphong	Haiphong	4,000	LNG-To-Power Plant	2025-2030
Kien Giang II	Kien Giang	750	Gas-To-Power Plant	2023
Long An I	Mekong Delta	1,500	LNG-To-Power Plant	2026
Long An II	Mekong Delta	1,500	LNG-To-Power Plant	2027
Long Son I	Ba Ria-Vung Tau	1,200	LNG-To-Power Plant	2025-2026
Long Son II	Ba Ria-Vung Tau	2,400	LNG-To-Power Plant	-
Mien Trung I	Quang Nam	750	LNG-To-Power Plant	2023
Mien Trung II	Quang Nam	750	LNG-To-Power Plant	2024
Mul Ke Ga I	Binh Thuan	3,200	LNG-To-Power Plant	2025
Nam Van Phong I	Khanh Hoa	4,800	LNG-To-Power Plant	-
Nam Van Phong II	Khanh Hoa	4,800	LNG-To-Power Plant	-
Nghi Son I	Thnah Hoa	4,800	LNG-To-Power Plant	2030
Nhon Trach III	Dong Nai	750	LNG-To-Power Plant	2023
Nhơn Trach N	Dong Nai	750	LNG-To-Power Plant	2023
Son My I	Binh Thuan	2,000	LNG-To-Power Plant	2023-2024
Son My II	Binh Thuan	2,250	LNG-To-Power Plant	2024-2025
Hai Lang	Quang Tri	1,500	LNG-To-Power Plant	2028

Source: Fitch Solutions Oil & Gas Report 2023

Natural gas projects proposed (1/2)

NON-EXHAUSTIVE

Project	Location	Capacity, MW	Construction completion date	Project cost, USD bn	Gas source	Developer(s)
Bac Lieu	Bac Lieu	3,200	2024	4.3	LNG	Delta Offshore
Ca Nal	Ninh Thuận	1,500	2025-2026	2.0	LNG	Gulf Energy Development
Ca Nall	Ninh Thuận	4,500	-	5.9	LNG	Gulf Energy Development
Chan May I	Thua Thien Hue	2,400	2024	6.2	LNG	Chan May LNG
Chan May II	Thua Thien Hue	1,600	2028	-	LNG	Chan May LNG
Dung Quat I	Quang Ngai	750	2023	1.8	Blue Whale	Vietnam Electricity
Dung Quat II	Quang Ngai	750	2024	-	Blue Whale	Vietnam Electricity
Haiphong	Haiphong	4,000	2025-2030	-	LNG	ExxonMobil
Kien Giang II	Kien Giang	750	2023-2024	0.5	Block B	Petro Vietnam
Long An I	Mekong Delta	1,500	2026	3.1	LNG	GS Energy
Long An II	Mekong Delta	1,500	2027	-	LNG	GS Energy
Long Son I	Ba Ria-Vung Tau	1,200	2025-2026	1.5	LNG	Vietnam Electricity

Source: Fitch Solutions Oil & Gas Report 2023

Natural gas projects proposed (2/2)

NON-EXHAUSTIVE

Project	Location	Capacity, MW	Construction completion date	Project cost, USD bn	Gas source	Developer(s)
Long Son II	Ba Ria-Vung Tau	2,400	-	3.0	LNG	Vietnam Electricity
Mien Trung I	Quang Nam	750	2023-2026	1.7	Blue Whale	PetroVietnam, GE
Mien Trung II	Quang Nam	750	2024-2026	-	Blue Whale	PetroVietnam, GE
Mul Ke Ga l	Binh Thuan	3,200	2025	-	LNG	Energy Capital Vietnarh, KOGAS
Nam Van Phong l	Khanh Hoa	4,800	-	8.0	LNG	Millenium Group
Nam Van Phong II	Khanh Hoa	4,800	-	7.0	LNG	Millenium Group
Nghi Son I	Thnah Hoa	4,800	2030	7.0	LNG	Millenium Group
Nhơn Trạch III	Dong Nai	750	2023-2025	1.5	LNG	PetroVietnam
Nhơn Trạch IV	Dong Nai	750	2023-2025	-	LNG	PetroVietnam
Son My I	Binh thuan	2,000	2023-2024	1.3	LNG	Corporation & Kyushu Electric Power
Son Myll	Binh thuan	2,250	2024-2025	1.7	LNG	AES Corporation
Hai Lang	Quang Tri	1,500	2028	2.3	LNG	KOGAS, Hanwha Energy Corp, KOSPO, T&T Group

Source: Fitch Solutions Oil & Gas Report 2023

4. 次世代・再生可能エネルギー

改訂されたPDP 8では、再生可能エネルギーがより重視され、特に2025年の目標容量が上方修正された

Electricity production target, by renewable energy sources

2025 – 2045

	2025	2025[2]	2030	2030[3]	2045	2045[4]
	Old	New	Old	New	Old	New
Wind[5] - Total capacity (MW)	2,000	11,320 – 11,820	6,000	13,820 – 15,820	-	48,110 – 68,720
Wind[5] - Electricity prod.	1%	-	2.1%		-	
Hydro - Total capacity (MW)	24,600	-	27800	-	-	-
Hydro - Electricity prod.	20.5%	23.2 - 24%	15.5%	15.4 - 16.8%	-	8.2 - 9.8%
Biomass - Total capacity (MW)	-	-	-	-	-	-
Biomass - Electricity prod.	1.1%	-	2.1%	-	-	-
Solar - Total capacity (MW)	4,000	17,240 – 18,540	12000	18,640 – 22,040	-	51,540 – 63,540
Solar - Electricity prod.	1.6%	-	3.3%	-	-	-
Total prod. & imported electricity	-	378.3-391.3 bn kWh	-	551.3 - 595.5 bn kWh	-	977 – 1,213 bn kWh

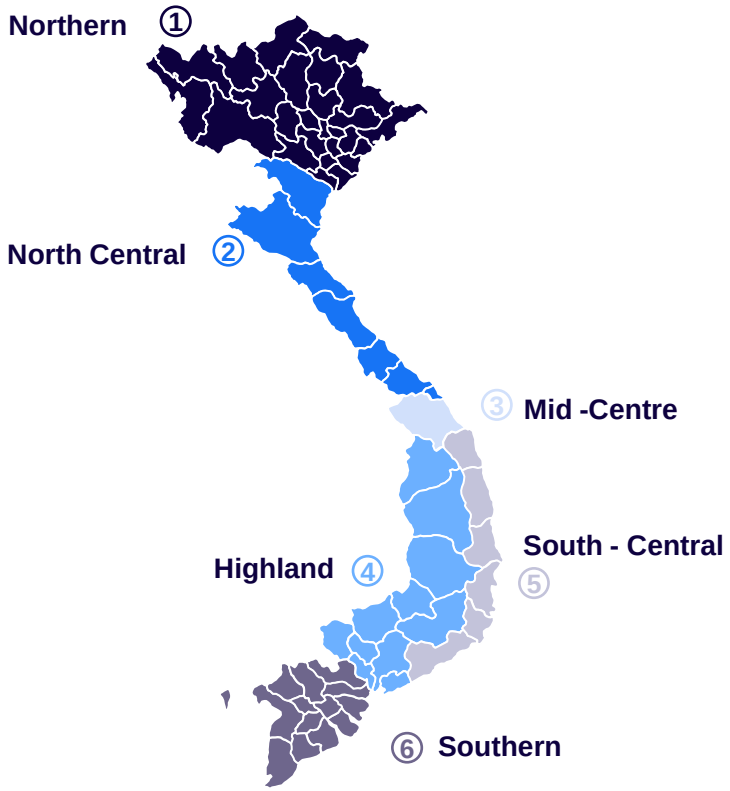
Note:1) Despite lack of explicit information of hydro and biomass increased capacity targets, we estimate an upward revision based on the increased electricity production targets set; 2) 2025 Solar+Wind+Biomass 16.4-17.0%; 3) 2030 Solar+Wind+Biomass+Small hydro 11.9-13.4%; 4) 2045 Solar+Wind+Biomass+small hydro 26.5-28.4%; 5) Wind is inclusive of onshore and offshore figures

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

2025年から2045年にかけて、南部地域がベトナムの太陽光発電容量のほとんどを占め、その割合は約74%、北部地域は2030年以降、5年ごとに約3GW急増すると予想されている。

Solar capacity, by region

2025 – 2045, MW



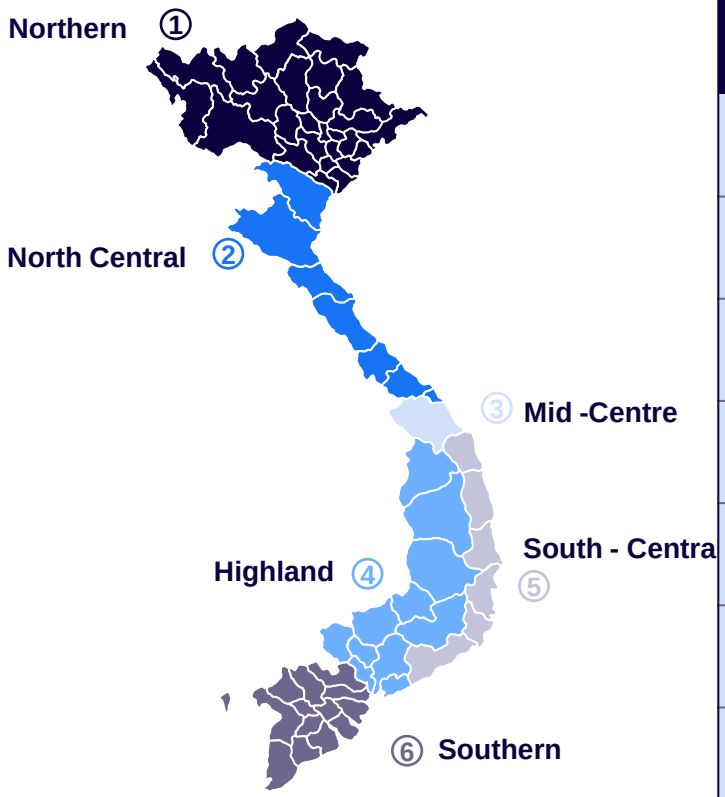
#	Region/Year	2025	2030	2035	2040	2045
1	Northern	860	860	3,560	6,560	9,560
2	North-Central	950	950	950	950	950
3	Mid-Central	730	730	930	950	930
4	Highland	2,500	3,800	4,000	4,000	4,000
5	South-Central	6,300	6,800	7,500	7,500	7,500
6	Southern	7,200	8,900	18,800	30,600	40,700
	Total	**18,540**	**22,040**	**35,740**	**50,540**	**63,640**

Note: There is no significance to the colours of the geographic regions
Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

太陽光発電と同様に、南部地域では2025～2045年の陸上風力発電容量が69%程度と最も大きく、2036年以降には2GWの洋上風力発電容量が開発される見込み

Wind capacity, by region

2025 – 2045, MW



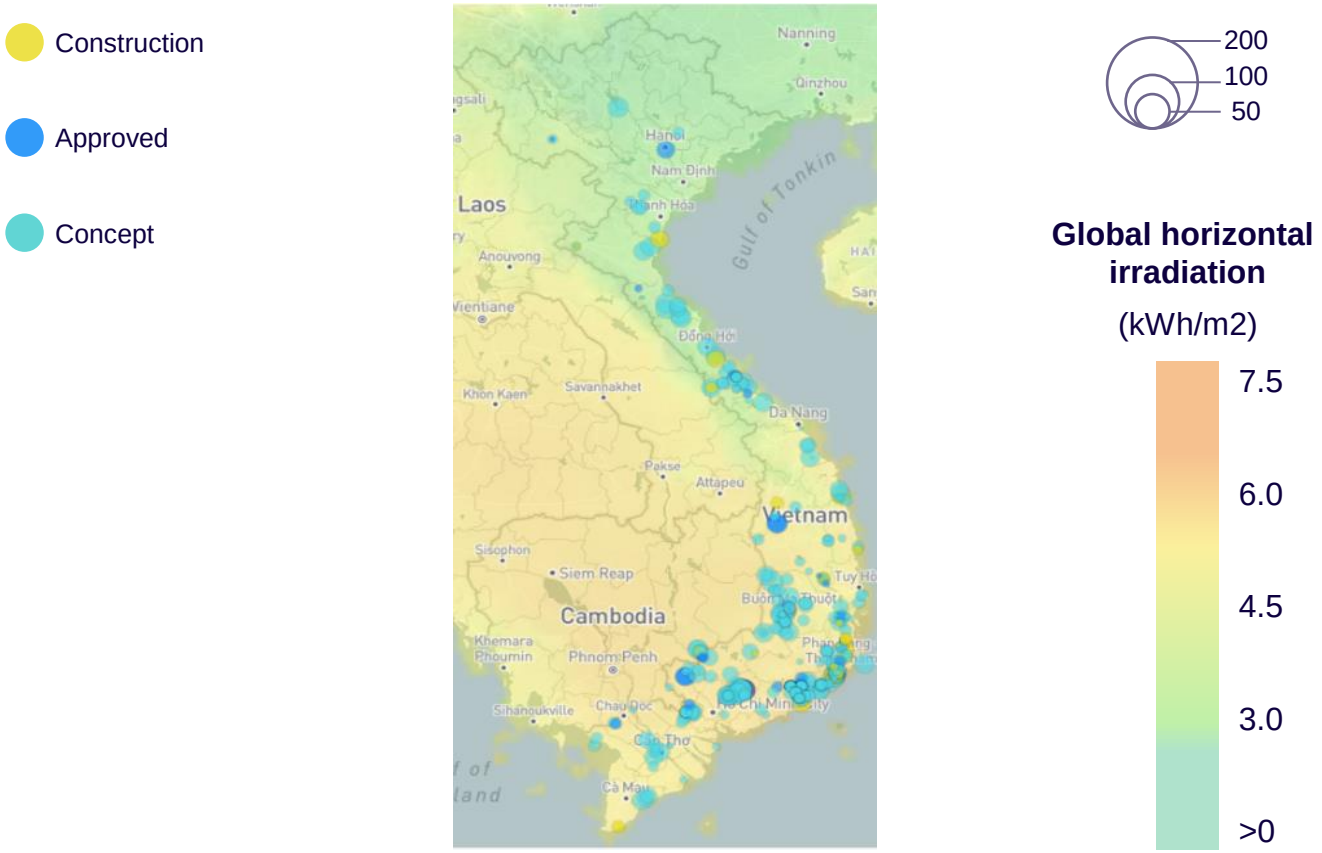
#	Region/Year	2025	2030	2035	2040	2045	Offshore wind power (MW)	
							Period 2021-2025	Period 2026-2030
1	Northern	420	420	1,020	1,520	2,020		2,000
2	North-Central	400	400	400	500	1,500		2,000
3	Mid-Central	800	800	1,300	1,800	2,000		2,000
4	Highland	2,500	2,500	3,600	5,000	5,200		-
5	South-Central	2,500	2,500	2,500	2,500	2,500		2,000
6	Southern	5,200	5,200	12,900	16,700	19,500		2,000
	Total	**11,820**	**11,820**	**21,720**	**28,020**	**32,720**		**-**

Note: There is no significance to the colours of the geographic regions
Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

ベトナムのソーラー産業に対する投資家の関心は高く、全体の設備容量は今後数年で増加すると予想される

Map of pipeline solar projects

2023 - 2050



Description

Overall, there has been an inflow of FDI, with some notable transactions being:

- **ACEN Corp**, Ayala Group's energy platform has finished the first phase of acquiring a significant 49% stake in Super Energy Corp. Public Company Limited's solar power business in Vietnam, estimated at US$ 165 mn, deal is expected to close at the ned of the year, bringing ACEN's Vietnam-Lao PDR portfolio to 1,200 MW in attributable renewables capacity
- Singaporean utilities company **SP Group** acquired 100 MWp[1] of solar power assets via 2 solar farms; Europlast Phu Yen Solar PP (50 MWp) and Thanh Long Phu Yen Solar PP (50 MWp)
- British **ThomasLloyd Energy Impact Trust** made its first investment in Vietnam of US$ 30mn in 2022 with Solar Electric to acquire Viet Solar System
- International firms like Indian conglomerate **Adani Ports** (US$ 3 bn[2]), Dutch development bank **FMO** (US$ 8.2 mn) and Swiss **Susi Partners** investing in existing projects either via equity or loan products

Source: Rystad Energy 2023, Multiple news sources, Arthur D. Little analysis
Note: 1) Megawatts Peak; 2) US$ 3bn is split between seaport ecosystem, solar and wind project investements

Hydropower projects in the pipeline (1/4)

NON-EXHAUSTIVE

#	Name	Installed capacity, MW	Investor(s)/Owner(s)
I	Period 2021-2025		
1	Hoa Binh hydropower plant expansion	480	EVN
2	Long Tao hydropower plant	42	IPP
3	Yen Son hydropower plant	90	Binh Minh Construction and Tourism Group JSC
4	Song Lo 6 hydropower plant	60	Xuan Thien Ha Giang Co., Ltd.
5	Pac Ma hydropower plant	140	Pac Ma Hydropower JSC
6	Nam Cum 1, 4, 5 hydropower plants	94	IPP
7	Nam Cum 2, 3, 6 hydropower plants	66	IPP
8	Hoi Xuan hydropower plant	102	IPP
9	Song Hieu (Ban Mong) hydropower plant	45	IPP
10	Nam Pan 5 hydropower plant	28	IPP
11	Yaly hydropower plant expansion	360	EVN
12	Tra Khuc 1 hydropower plant	36	IPP
13	Dak Mi 1 hydropower plant	84	IPP

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Hydropower projects in the pipeline (2/4)

NON-EXHAUSTIVE

#	Name	Installed capacity, MW	Investor(s)/Owner(s)
14	Dak Mi 2 hydropower plant	147	IPP
15	Song Tranh 4 hydropower plant	48	IPP
16	Upper Kon Tum hydropower plant	220	EVN
17	Tri An hydropower plant expansion	200	EVN
18	La Ngau hydropower plant	36	La Ngau Hydropower JSC
19	Northern Region mini hydropower	2311	
20	Central Region mini hydropower	68	
II	**Period 2026-2030**		
1	Nam Mo (Viet Nam) hydropower plant	95	IPP
2	Da Nhim 2 hydropower plant expansion	80	EVN
3	Sesan 3 hydropower plant expansion	130	EVN
4	Sesan 4 hydropower plant expansion	120	EVN
5	Bac Ai pumped storage hydropower plant	1200	EVN
6	Phuoc Hoa pumped storage hydropower	1200	IPP

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Hydropower projects in the pipeline (3/4)

NON-EXHAUSTIVE

#	Name	Installed capacity, MW	Investor(s)/Owner(s)
III	**Period 2031-2035**		
1	Thai An hydropower plant expansion	41	IPP
2	Tuyen Quang hydropower plant expansion	120	EVN
3	Huoi Quang hydropower plant expansion	260	EVN
4	Son La hydropower plant expansion (phase 1)	400	EVN
5	Trung Son hydropower plant expansion	130	EVN
6	Ban Ve hydropower plant expansion	120	EVN
7	Quang Tri hydropower plant expansion	48	EVN
8	Song Tranh 2 hydropower plant expansion	95	EVN
9	Buon Kop hydropower plant expansion	140	EVN
10	Srepok 3 hydropower plant expansion	110	EVN
11	Lower Song Ba hydropower Plant expansion	60	EVN
12	Northern Region mini Hydropower	198	
13	Central Region mini hydropower	607	
14	Southern Region mini hydropower	750	

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Hydropower projects in the pipeline (4/4)

NON-EXHAUSTIVE

#	Name	Installed capacity, MW	Investor(s)/Owner(s)
IV	**Period 2036-2040**		
1	Son La hydropower plant expansion (phase 2)	400	EVN
2	Ban Chat hydropower plant expansion	110	EVN
3	My Ly hydropower plant	250	IPP
4	Northern Region mini hydropower	40	
V	**Period 2030-2045**		
1	Lai Chau hydropower plant expansion	400	EVN
2	Northern Region mini hydropower	110	EVN

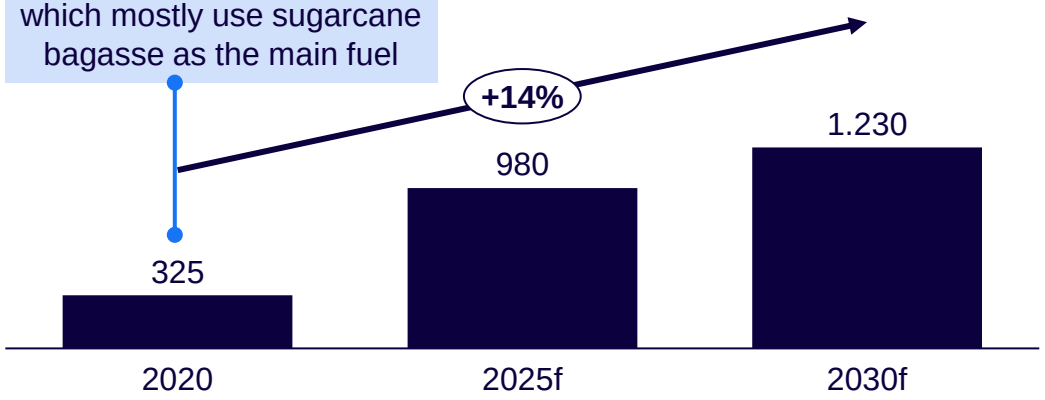
Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

バイオマス燃料はいくつかあるが、2023年5月に発効した第8次国家電力開発基本計画（PDP 8）では、木質ペレットを含む木材原料の残渣の使用を提案

Biomass power capacity forecast

2020 – 2030, MW

About 10 power plants, which mostly use sugarcane bagasse as the main fuel



Biomass energy potential in Vietnam is around 5.300 MW, in 2020:

Woods (52%)	Bagasse (18%)	Rice husks (16%)	Other trees (14%)

Initial directions for biomass development

Excerpt from current PDP8 draft

(MOIT[1] proposal to PM – 11 Nov 2022)

> **2.2.5. Điện sinh khối**
>
> Được coi là nguồn điện không phát thải CO_2, điện sinh khối là loại hình được xác định ưu tiên phát triển trong Quy hoạch điện VIII nhằm tận dụng phụ phẩm nông lâm nghiệp, chế biến gỗ, thúc đẩy trồng rừng. Dự kiến năm 2030 công suất điện sinh khối là 2.270 MW.

Key takeaways

- Biomass power could be prioritized to **leverage the wood residues in forestry and wood processing industry, promote more forest plantation**
- However, **no further policies or incentives have been released to encourage the use of wood pellets**

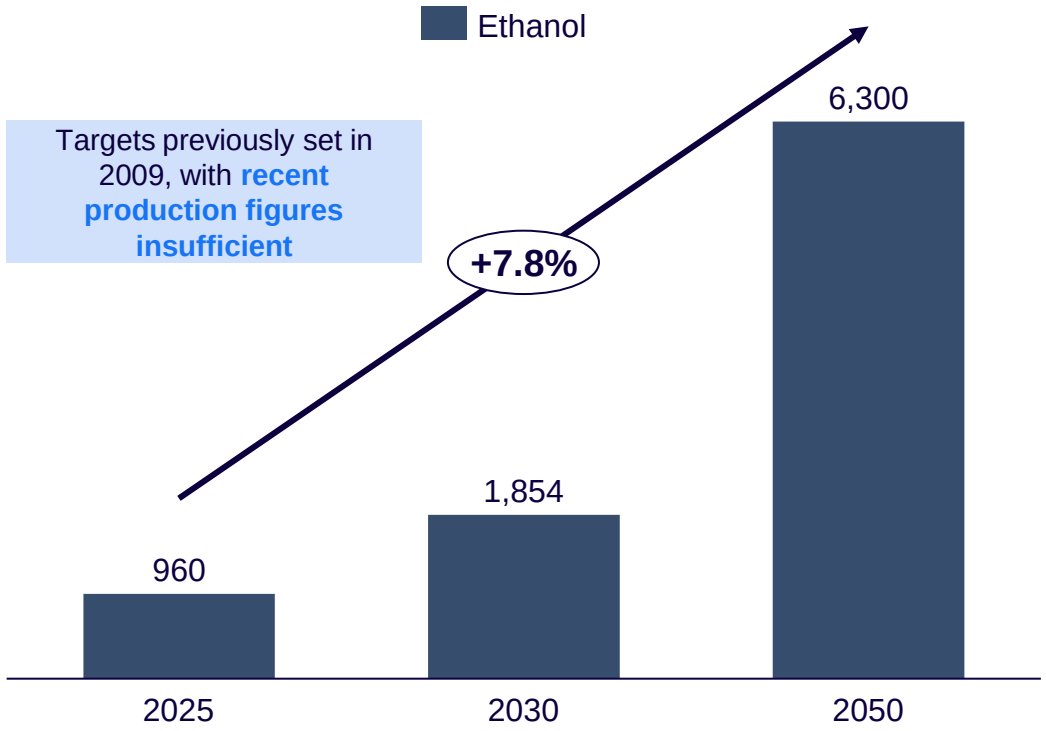
Note: The expected capacity of 2.270 MW seems misaligned with actual data in the tables of the same document, thus we disregard this information

Notes: (1) 2023 revised PDP 8 does not amend the previously mentioned draft
Source: GIZ 2022, Ministry of Industry and Trade 2022, Vietnam National Power Development Plan 8 2022, Arthur D. Little analysis

ベトナムではエタノールとバイオディーゼルの生産量増加が見込まれる

Targeted Production of Ethanol (Vietnam)

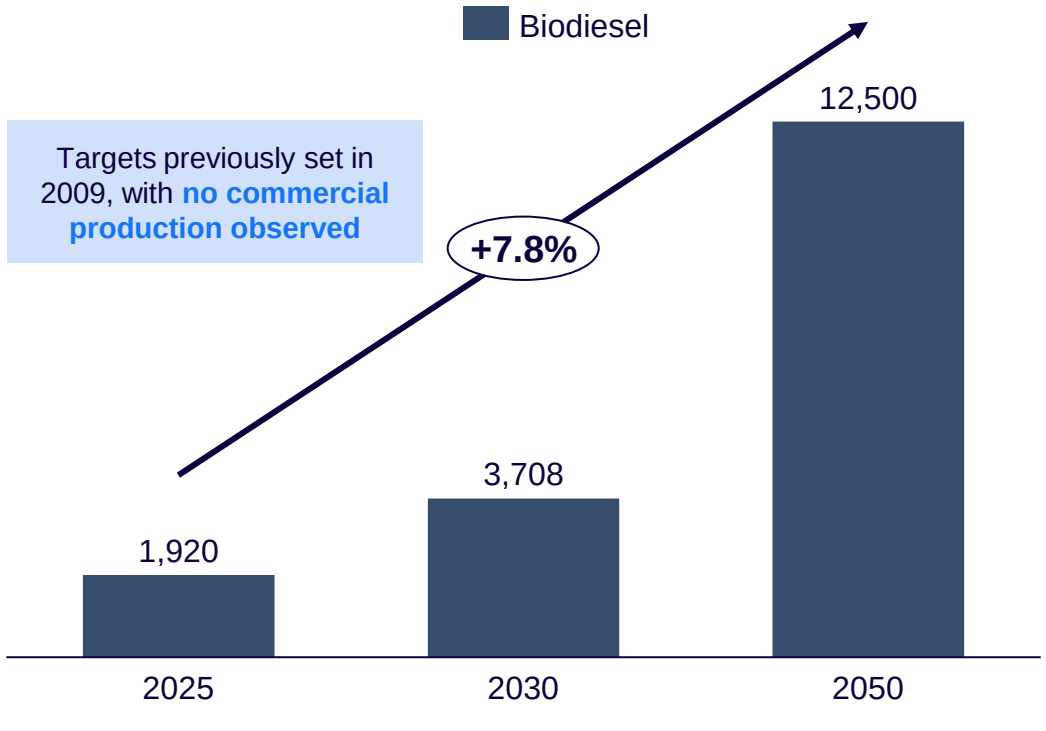
In Thousand Tons



Only 2 domestic ethanol plants were observed in Vietnam in 2020, with a total capacity of 200,000 cubic meters/year

Targeted Production of Biodiesel (Vietnam)

In Thousand Tons



Domestic biodiesel production in Vietnam remains in the development phase, with no commercial production observed

Note: Based on Decision No. 177/2007/QD-TTg which targeted biofuels as a new renewable energy source and an alternative to conventional fossil fuels to promote energy security and environmental protection
Source: United States Department of Agriculture 2020, Asian Development Bank 2009

Biomass and cogeneration projects

NON-EXHAUSTIVE

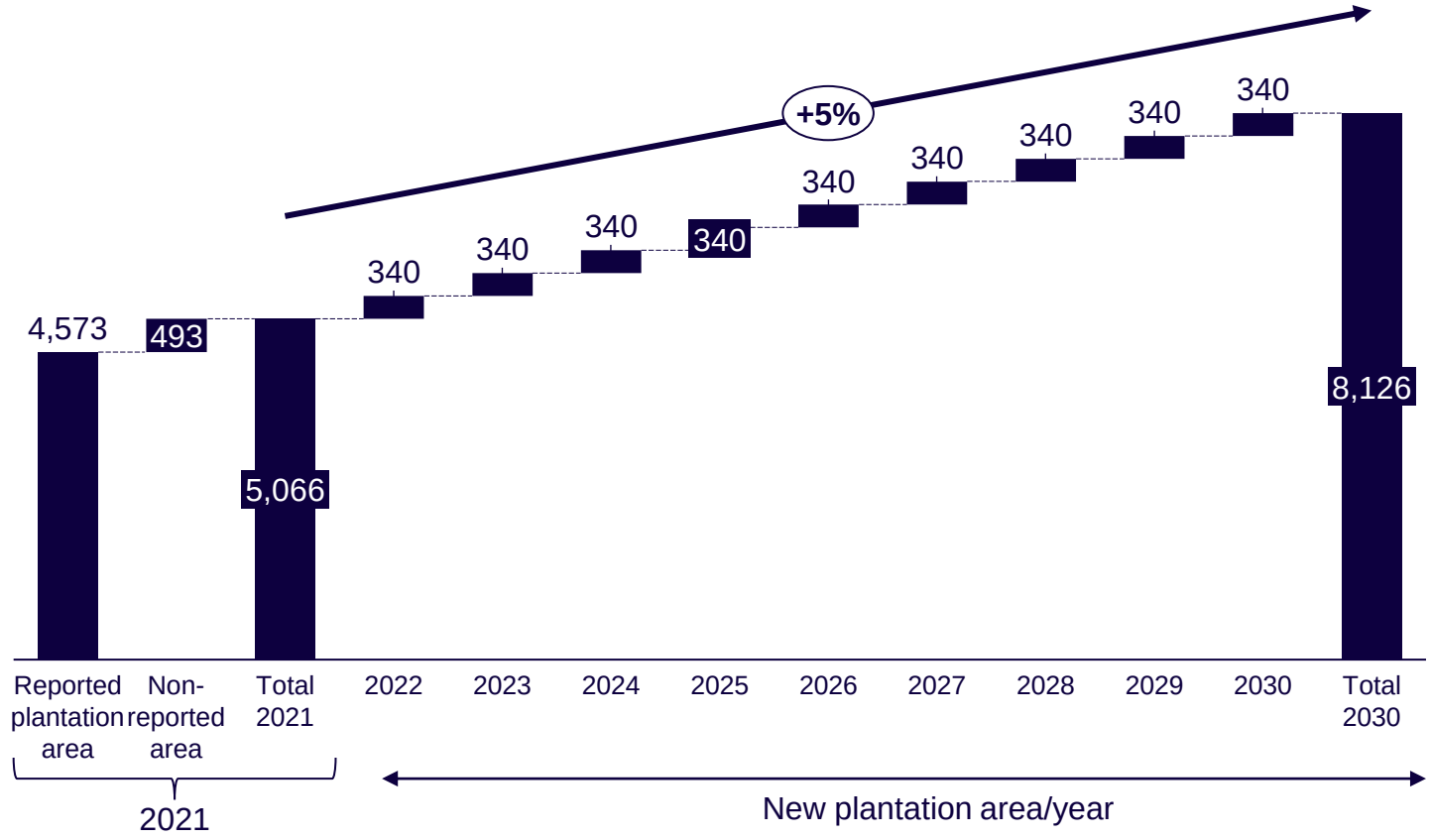
#	Project	Capacity (MW)	Location
1	Nui To I biomass power plant	30	An Giang
2	Nui To II biomass power plant	30	An Giang
3	Cam Lo biomass power plant	20	Quang Tri
4	Quang Tri biomass power plant	60	Quang Tri
5	PIR-1 Quang Binh biomass power plant	50	Quang Binh
6	Soc Trang rice husk powered plant	25	Soc Trang
7	Bac Kan biomass power plant	30	Bac Kan
8	Biomass cogeneration from steam-power and brewer's spent grains drying project of Heineken Vung Tau	12.6	Ba Ria - Vung Tau
9	Phu Thuan steam cogeneration plant (phase 1)	30	Ben Tre
10	S.P.V An Giang biomass power plant	30	An Giang
11	DIVI Binh Phuoc biomass power plant	10	Binh Phuoc
12	Lang Son biomass power plant	30	Lang Son
13	Biomass cogeneration plant	15	Da Nang
14	Yen Binh biomass power plant	50	Yen Bai
15	Nhu Thanh biomass power plant	10	Thanh Hoa

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

ベトナム政府は、年間34万ヘクタールの作付面積を拡大する目標を掲げており、その大半はアカシア

Vietnam forest plantation development plan

2021 – 2030, kHa



Description

- Vietnam government targets to develop 340 thousand ha of new plantation areas per year up to 2030
- Assuming acacia accounts for at least 80% of the new plantation area each year, in total 8,1 mn ha by 2030, there will be around 74% of the areas are acacia and eucalyptus by 2030

Source: Expert interviews, Decision 523/QD-TTg of the government on Forestry development strategy, Arthur D. Little analysis

Municipal waste projects

NON-EXHAUSTIVE

#	Name	Capacity (MW)	Location
1	Hon Dat W2P plant	10	Kien Giang
2	Tay Ninh W2P plant	10	Tay Ninh
3	Soc Trang solid waste powered plant	15	Soc Trang
4	Quang Trung W2P plant, in Thong Nhat district, Dong Nai province	3,42	Dong Nai
5	Thai Nguyen municipal waste powered plant	10	Thai Nguyen
6	Soc Son W2P plant (capacity adjustment)	19	Ha Noi
7	Greenity Nam Dinh W2P plant	12	Nam Dinh
8	Ha Noi W2P plant	37	Ha Noi
9	Bac Giang waste treatment and power generation plant	8	Bac Giang
10	Hai Phong W2P plant	20MW in the first phase (2021-2025) and 20MW in the second phase (2026-2030)	Hai Phong
11	Tam Sinh Nghĩa (Cu Chi) waste-to-energy | power plant	40	Ho Chi Minh City
12	Tam Sinh Nghĩa (Long An) waste-to-energy power plant	10	Long An
13	Tho Xuan Thanh Hoa W2P plant	12	Thanh Hoa

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

ベトナムにおいては、CCUS絡みの政策、規制は現状ないがCO_2回収・利用の可能性も言及しているため今後整備されていく見込み

ベトナム動向サマリ

ベトナムのCCUS導入に対する意向

CCUS事業の推進に対する意向	• ベトナムが提出したNDCの中にCCUSにまつわる言及はないが、The Orientation of Vietnam's National Energy Development StrategyのアクションプログラムにおいてCO_2回収・利用について言及１）
各種政策（産業/エネルギー/環境）	• 現状無し
規制	• 現状無し（環境法はあり）
補助金	• 現状無し
CCUS事業の反対活動	• CCSを国民があまり認知しておらず、現時点では具体的な反対意見は出ていない

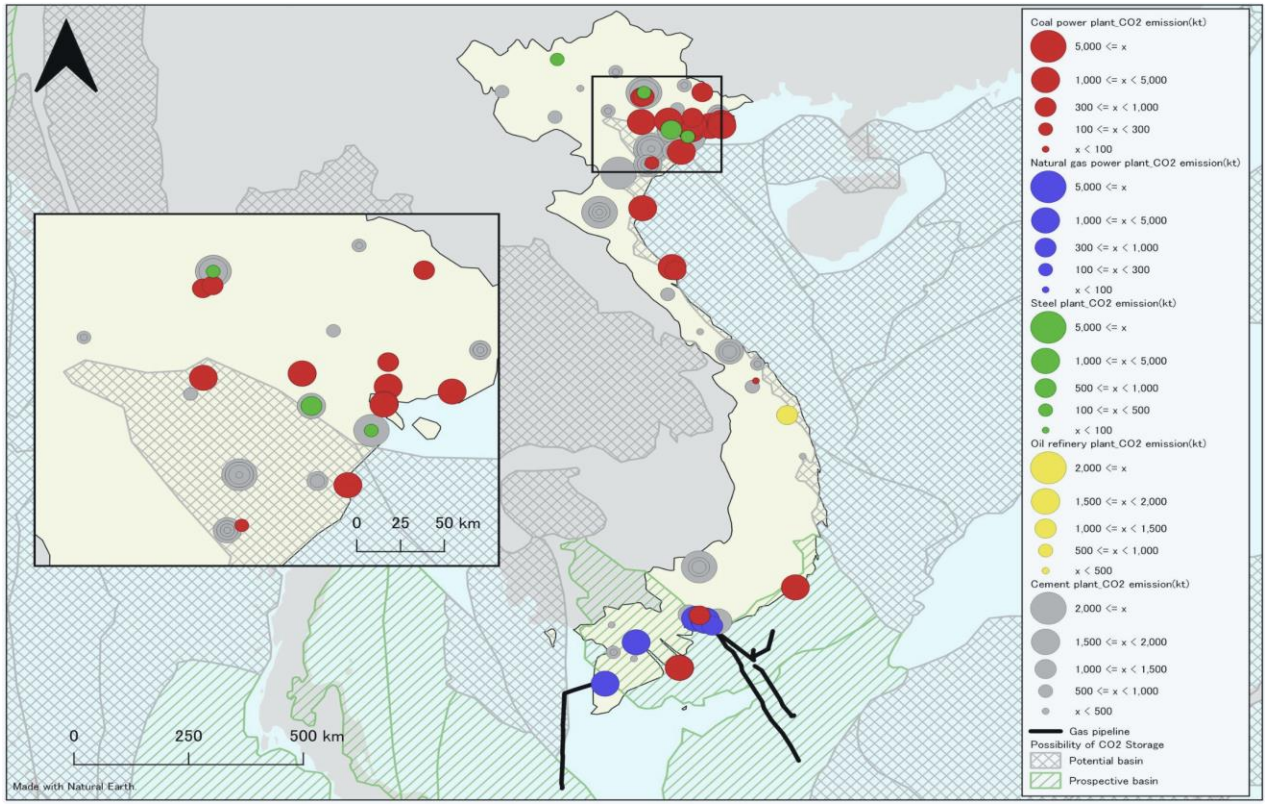
ベトナムでの事業参入における有望手段

CCUS事業の意思決定者におけるパワーバランス	• MONREとMOITが中心となり政策策定を行う可能性が高い１）

Note: 1）令和２年度二国間クレジット取得等のためのインフ ラ整備調査事業（国際貢献定量化及びＪＣＭ実現可能 性調査（ＣＣＵＳ含む）、人材育成事業支援事務局及 びＣＥＦＩＡ国内事務局業務）報告書

ベトナムには23Mt～357Mtの貯留ポテンシャルが存在

ベトナムのCCS適地



Description

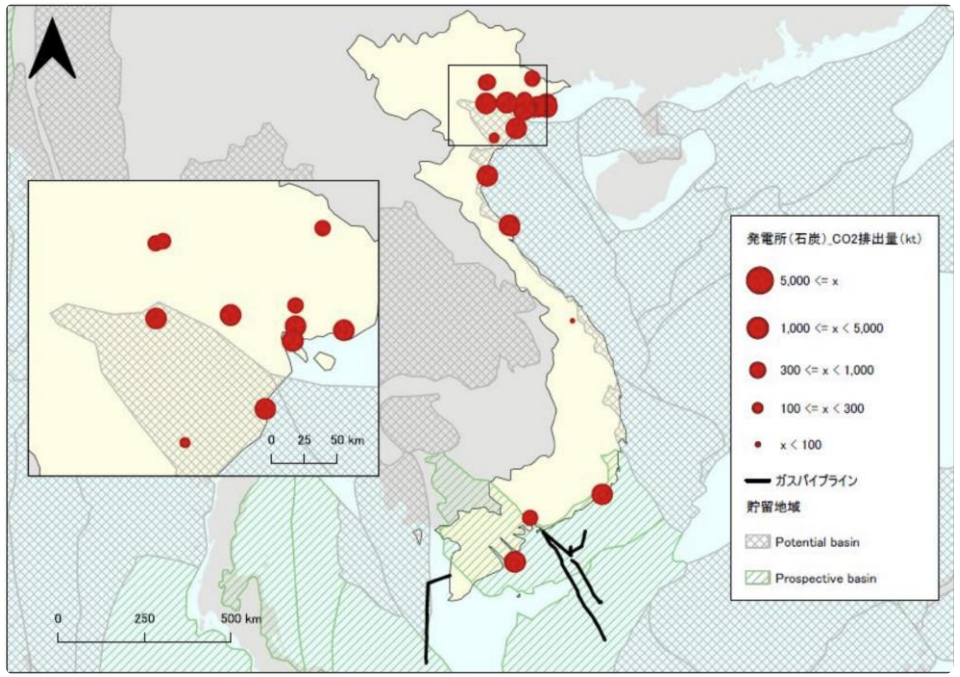
ベトナムでは南部の海域に貯留ポテンシャルがあることが示されている。北部の海域にも貯留ポテンシャルはあるものの、商業化を 鑑みると、小規模とされる。ベトナムにおける上位 10 カ所の貯留サイトを合計すると、貯 留ポテンシャルは 23 Mt から 357 Mt CO2 と推計されている

Source: Asia CCUS Network

排出源-石炭火力発電/天然ガス火力発電

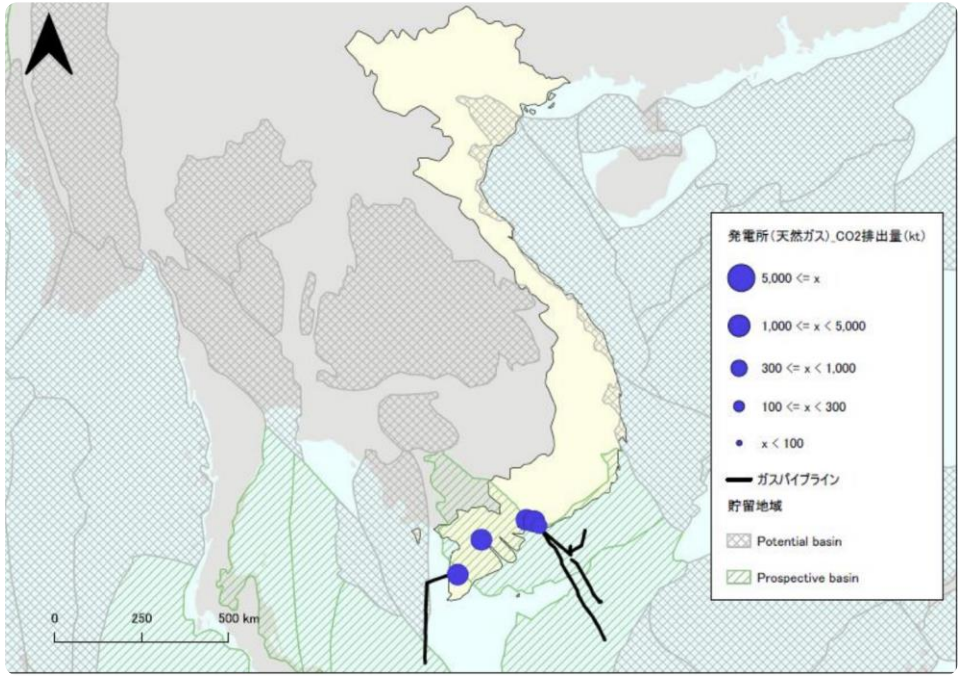
石炭火力発電×貯留地

石炭火力発電所は、主に北部・北中部・南部に分布している。年間 CO2 排出量 が 300 ~ 1,000kt または 1,000 ~5,000kt である石炭火力発電所がベトナム国内の約 90%を占め ている。



天然ガス火力発電×貯留地

天然ガス火力発電所は主にベトナム南部に分布している。天然ガス火力発 電所の年間 CO2排出量は 1,000 ~5,000kt のものが多い。

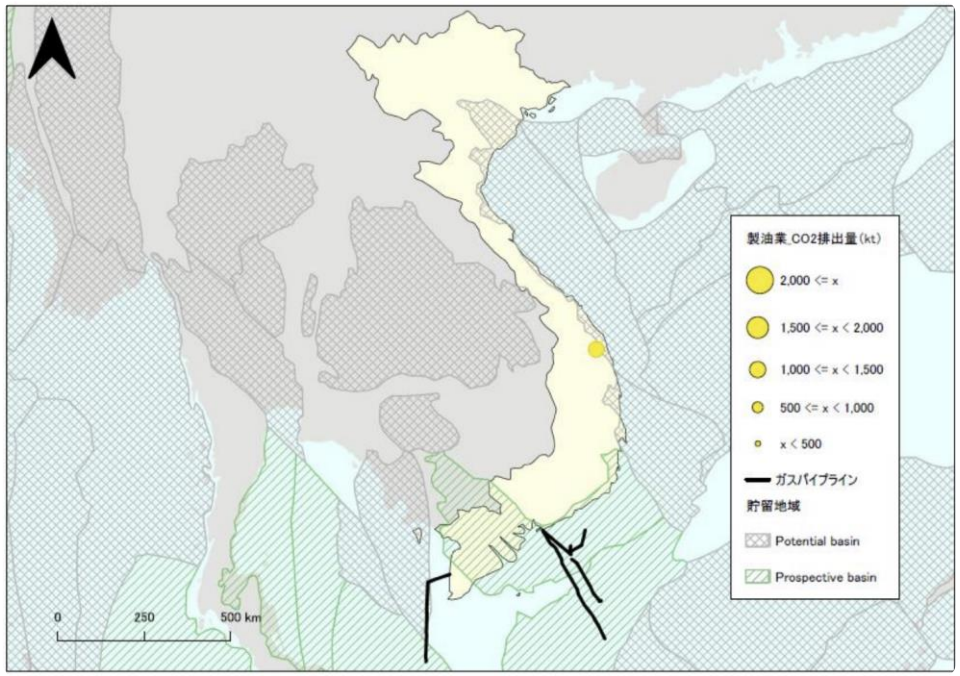


Source：令和２年度二国間クレジット取得等のためのインフ ラ整備調査事業（国際貢献定量化及びＪＣM実現可能 性調査（ＣＣＵＳ含む）、人材育成事業支援事務局及 びＣＥＦＩＡ国内事務局業務）報告書

排出源-製油所/製鉄所

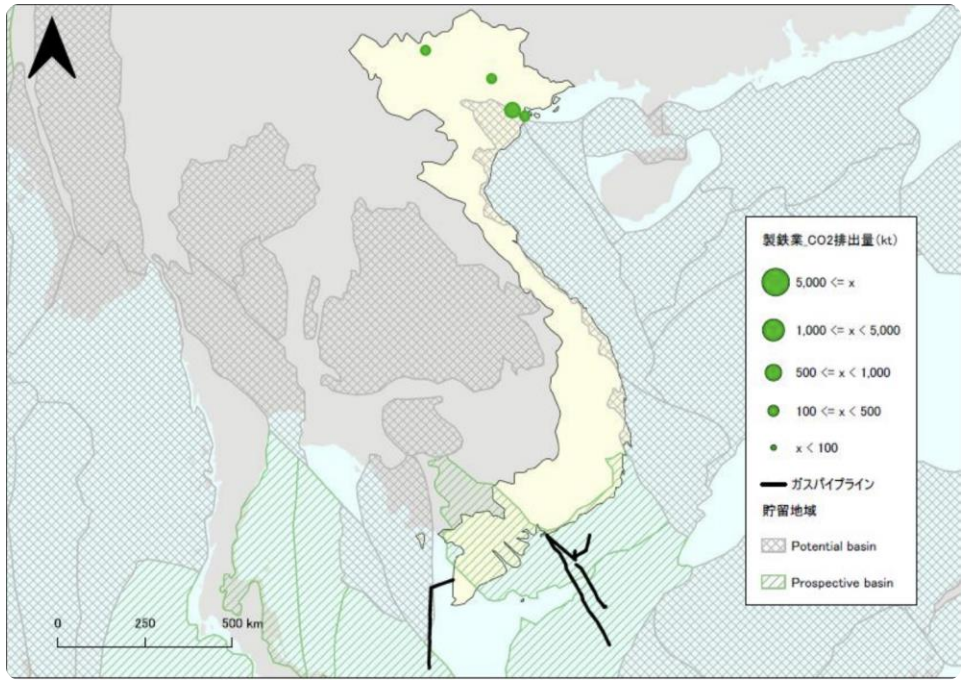
製油所・ガス×貯留地

製油所は主にベトナム中部に分布している。製油所の年間 CO2 排出量は 1,000 ~1,500kt 程度のものが多い



製鉄所×貯留地

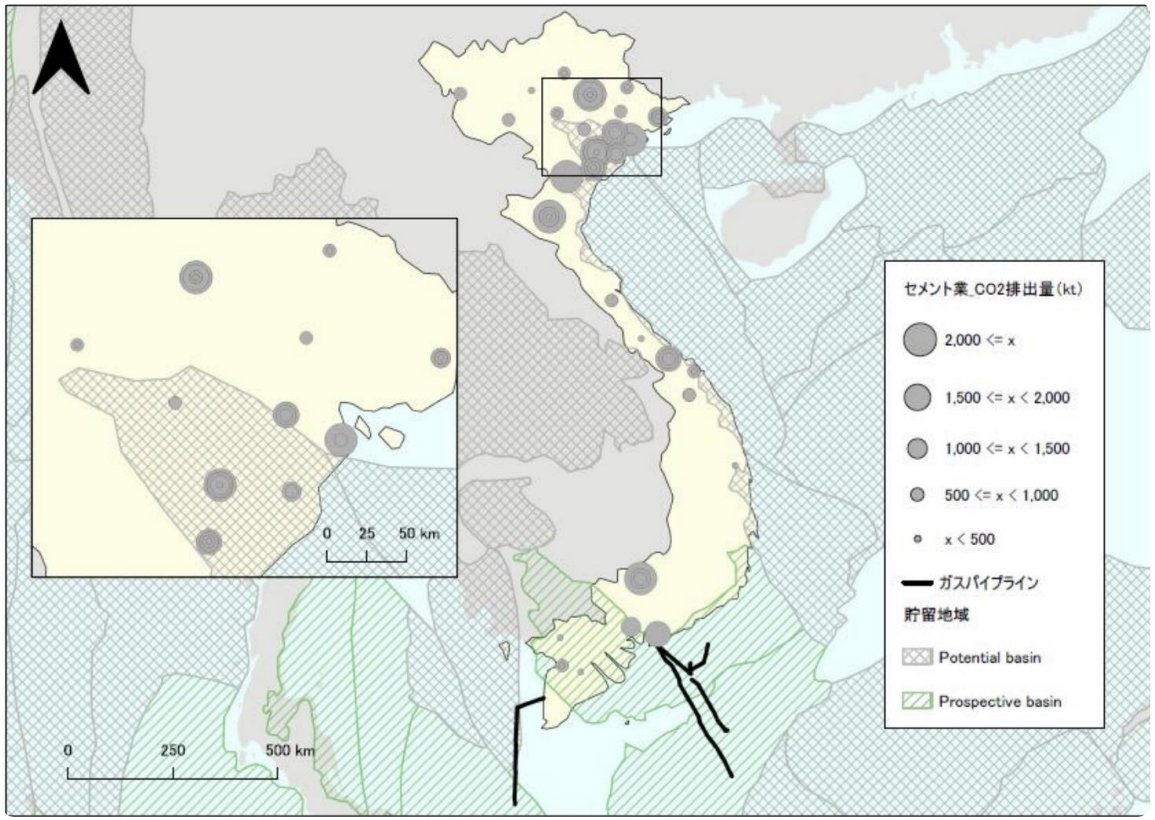
製鉄所は主にベトナム北部に分布している。製鉄所の年間 CO2 排出量は 100 ~500kt 程 度のものが多い。同北部にある排出源（石炭火力発電所等）と比較して、数も排出量も少な い



Source：令和２年度二国間クレジット取得等のためのインフ ラ整備調査事業（国際貢献定量化及びＪＣＭ実現可能 性調査（ＣＣＵＳ含む）、人材育成事業支援事務局及 びＣＥＦＩＡ国内事務局業務）報告書

排出源-セメント

セメント×貯留地



Description

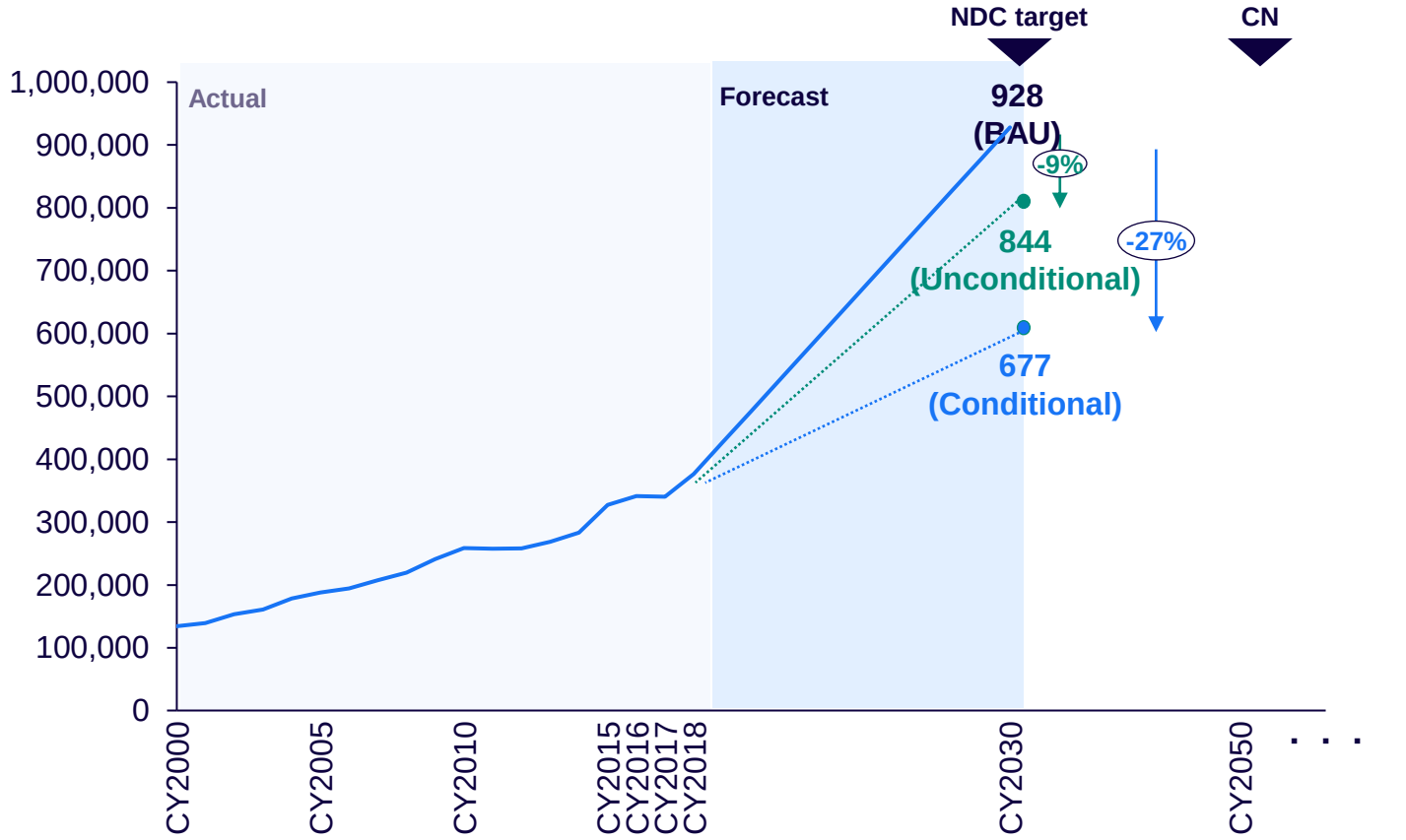
セメント工場はベトナム全国に幅広く分布しているが、南部・中部よりも北部の 方に密集している。セメント工場の年間 CO2 排出量は様々であり、それぞれの規模による ものと考えられる。

Source：令和２年度二国間クレジット取得等のためのインフ ラ整備調査事業（国際貢献定量化及びＪＣＭ実現可能 性調査（ＣＣＵＳ含む）、人材育成事業支援事務局及 びＣＥＦＩＡ国内事務局業務）報告書

NDCでは2030年に無条件でBAU比9%削減、国際的な支援が得られる場合は27%減を宣言。専門家によると、CN達成は2050年になる見込み

GHG target

2000 – 2050, BAU



Description

- **Official CN target is 2050**
- **Current GHG emission target follows Vietnam's 2015 NDC** to Paris Agreement of **9% unconditional** and 27% conditional GHG emission reduction by 2030
- Target industries are **power generation, transport and manufacturing**
- New tool e.g. ETS may be utilized, which currently under discussion and drafting period with no announced timeline for enforcement

Source: Vietnam's NDC Update, World Bank Historical GHG Data

ベトナムの政策は、主に再生可能エネルギープロジェクトの導入と効率性の向上を促す規制に重点を置いている

	GHG Target Action	Detail
アメの政策	助成金	• Subsidy is provided to alternative energy sector to boost adoption and usage • Preferred loan rates • Exemptions from the land use fees, land and water surface rents • Feed-in tariff (FiT)	• Financial subsidy for preferred loan rate for renewable energy projects up to 70% of CAPEX from VDB / VEPF1 aiming to overcome lack of capital challenges • Feed-in-tariffs for RE project (Wind, Solar, Biomass, Waste to energy) • Special consumption tax rate for xEV (under consideration)
	税制優遇措置	• Tax related incentives such as reduced overall tax or tax exemptions overall financial viability	• Special income tax rate and tax holidays for RE project with 4 years tax exemption and up to 30 years discounted CIT (10% CIT, from 20%) • Import duty exemption for RE project equipment
ムチの政策	排出権取引制度 (ETS)	• Carbon credit trading system to meet carbon credit/emission related criteria	• Planned ETS implementation pilot to start around 2025 with fully operational in 2027, according to Environmental Protection Law (2022)
	罰則	• Penalty imposed via increased taxes	• Increase tax on oil and petroleum products • Carbon tax to be introduced as a part of emission trading scheme according to Environmental Protection Law (2022)
	規制	• Mandates to increase renewable energy mixture ratio • Limiting new coal fire plant construction • Higher emission standard for all road vehicles	• Road vehicles to apply EURO 5 emission standard by 2022 • Biofuel usage promotion with national fuel standard • Companies with ~3kTCO2eq. GHG emission p.a. will be required to declare emission record (under consideration) • Ozone damaging substance2 control over 2022-2040 (under consideration)

Source: Arthur D. Little Analysis, Secondary Research, Expert Interview

ベトナムでは、発電における再生可能エネルギーの利用拡大と、製造業におけるエネルギー効率の向上が重要な政策課題

産業別		CN目標	政策方針の概要
エネルギー起源		• **51.5** MTCO2eq. by 2030 – 5.5% reduction compared to BAU scenario	• Increase energy efficiency in household appliances, industries and commercial – incl. energy-saving construction material in housing and commercial sector • Reduce clinker content in cement manufacturing • Development of low carbon emission technologies for manufacturing and construction (under Green Growth Strategy 2021-2030) • Increase renewable energy in power generation mix (PDP8) • Green hydrogen production masterplan to be developed as a part of national strategy on green growth (TBD) • Promote public transport usage and shift to biofuels for private transport
非エネルギー起源	産業プロセス	• **0.8** MTCO2eq. by 2030 – ~0.8% reduction compared to BAU scenario	• Implement standard measure for griding, blast furnace slag, fly ash, pozzolana and limestone to replace high energy intensity clinker in cement production • Reduce HFCs product consumption
	廃棄物	• **9.1** MTCO2eq. by 2030 – 1% reduction compared to BAU scenario	• Increase solid waste collection and management with standard
	農業	• **6.8** MTCO2eq. by 2030 – ~0.7% reduction compared to BAU scenario	• Develop modern agriculture with clean and sustainable cultivation technology • Manage agricultural waste to treat and re-use by-products in agriculture and livestock production • Develop organic agriculture industry

Note: 1) Energy usage includes energy generation and consumption e.g., Power generation, Transport, Manufacturing
Source: Ministry of Environment and Water (KASA)

Blue CarbonやE-fuelへの取り組みは限定的

Blue Carbon

ベトナムはBlue Carbonの適地とされているが
実証事例等はまだ限定的

E-Fuel/E-Methanol

現状事例は限定的

Source: Arthur D. Little

5. 発電事業者

スマートグリッドを含めた今後の電力事業開拓において、電力価格の低さや事業規制による新規参入障壁など、改善されるべき課題は多い

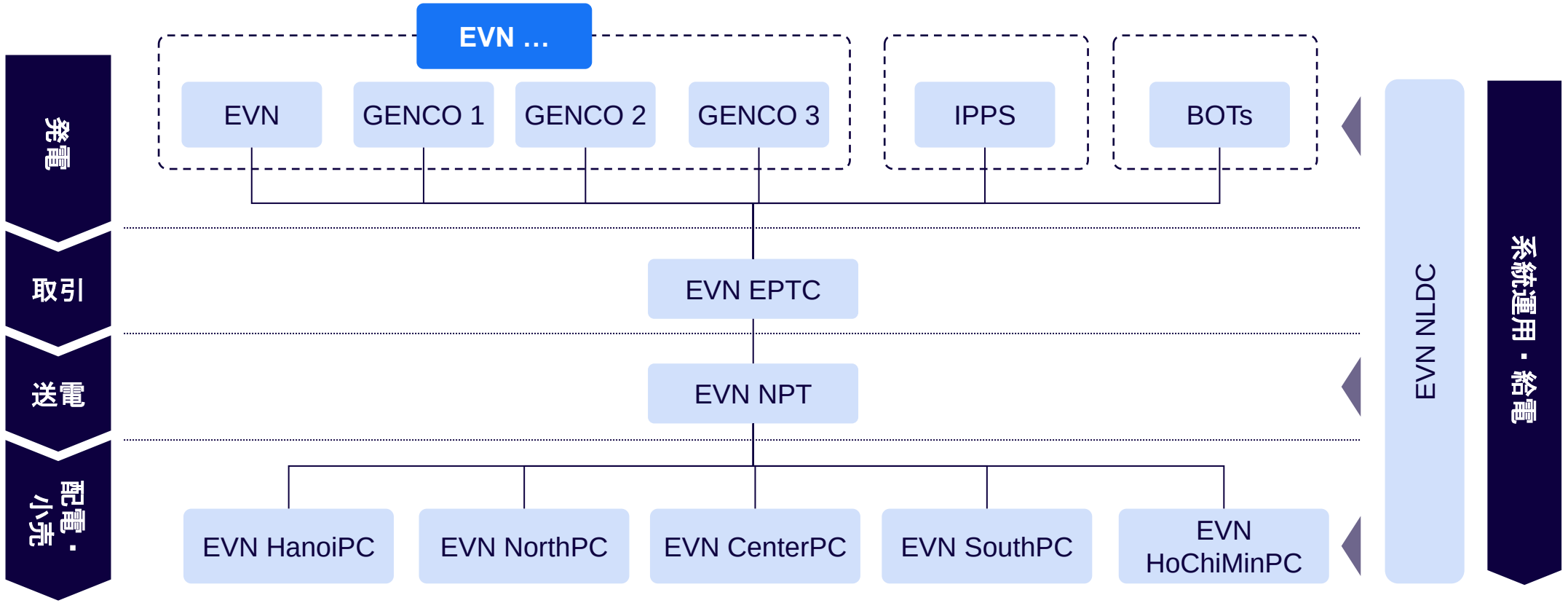
Current energy sector landscape

	Key issues	Proposed Solution
Energy Demand & Supply	• Within the next 20-30 upcoming years, the gas and crude oil reserves of Vietnam will become exhausted • In 2020 Vietnam is expected to import 100 million of coal annually when all existing thermo-electricity plants come into operation; • **Electricity demand of Vietnam is expected to increase at 10% per year until 2020**; – 4,000 MW should be added to the national grid annually	• Directive No. 171/CT-TTg instructing ministries, sectors and localities to seriously implement energy saving • Government has assigned the Electricity of Vietnam (EVN) to renovate and upgrade the newly received rural power grid system, strive to reduce losses to 15 % in late 2011 and 10% in 2015. • Project managed by MOIT and UN to promote energy efficiency in industry through optimizing energy systems and management standards in Vietnam.
Environmental Issues	• Opportunities for hydro power are exhausted and water levels become uncertain	• Expansion plans are focusing on coal fired generation • Coal-fired plants account for about 12% of Vietnam's 18.5GW capacity, and this is expected to rise to 32.3GW by 2020, overtaking gas and hydropower. • RE also considered but the power supply target stays small: 5% of energy coming from RE by 2020
Economic Issues	• **Prices of electricity have remained extremely low** in Vietnam with a double negative consequence: • EVN is not earning enough money to modernize its infrastructures and networks. Energy wastage stays high • Energy market is not attractive for foreign IPP with low gains expected	• Government has introduced a new pricing policy scheme to increase electricity selling price by 5% per quarter, gradually increasing until price reaches its real level without subsidies • Agreement on the introduction of new reforms to build-operate and transfer (BOT) projects to make the sector more attractive to independent power producers (IPPs).
Specific Issues for Smart Grids Development	• Low prices of energy will be a challenge to find a viable business model to develop smart grid • Legal obstacles to develop smart grid in industrial parks. . • Power grid control type SG also faces a lot of controversy and regulatory issues	• Introduction of SCADA/EMS system is about to start in HCMC to limit power outage within the city • SCADA/DMS is still at the bidding stage • This should pave the way to the introduction of smart grid

Source: Vietnam Power Development Plan 8 2023

ベトナムの電力市場の構成は発電は自由化済み

Vietnam Power Generation Structure



Source: JICA「ベトナム国電力セクターにまつわる情報収集・確認調査」

発電事業、電力卸売市場（2016～）、電力小売市場（2021～）の自由化が始まっている

Roadmap for the development of electricity power liberation

Competitive Generation Market (VCGM) (2011 – 2015)

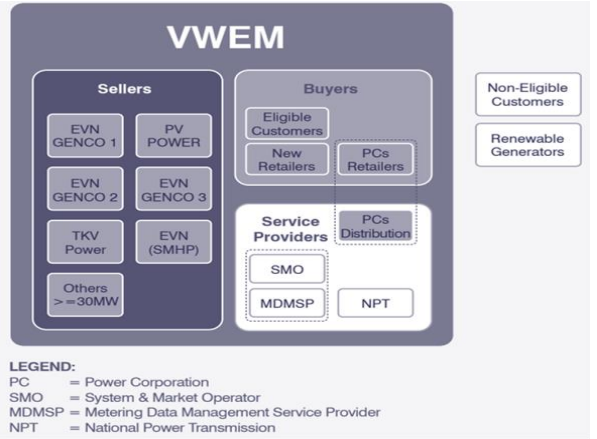
- VCGM **started** on July 01, **2011** and was followed by full VCGM on July 01, 2012.
- The VCGM has operated for more **than 5 years** with the **tasks** including: (1) Construction and operation of the IT infrastructure for the electricity market; (2) Development of procedures, regulations for electricity market; (3) Training human resources for the electricity market operation
- **Since 2018**, the Vietnam's competitive generation market has been operating in a transparent manner
- **90 power plants** with a total installed capacity of **23,054 MW** directly participated in the electricity market, accounting for **52.6%** of the national power system.

Electricity Wholesale Market (VWEM) (From 2016, full operation 2019 – 2021)

- The Vietnam's wholesale electricity market (VWEM) has been **piloted since 2018**, in which Power Purchase Agreement of nominated power plants were located to Power Corporations while specific trade volume and payment were contracted following market base.
- **Since early 2019**, the VWEM (wholesale electricity market) has **officially operated**.
- By the end of 2020, **100 power plants** directly participated in the power market with a total installed capacity of **27,640** MW, accounting for **40%** of the national power system.

Electricity Retail Market (VREM) (From 2021, full operation in 2023)

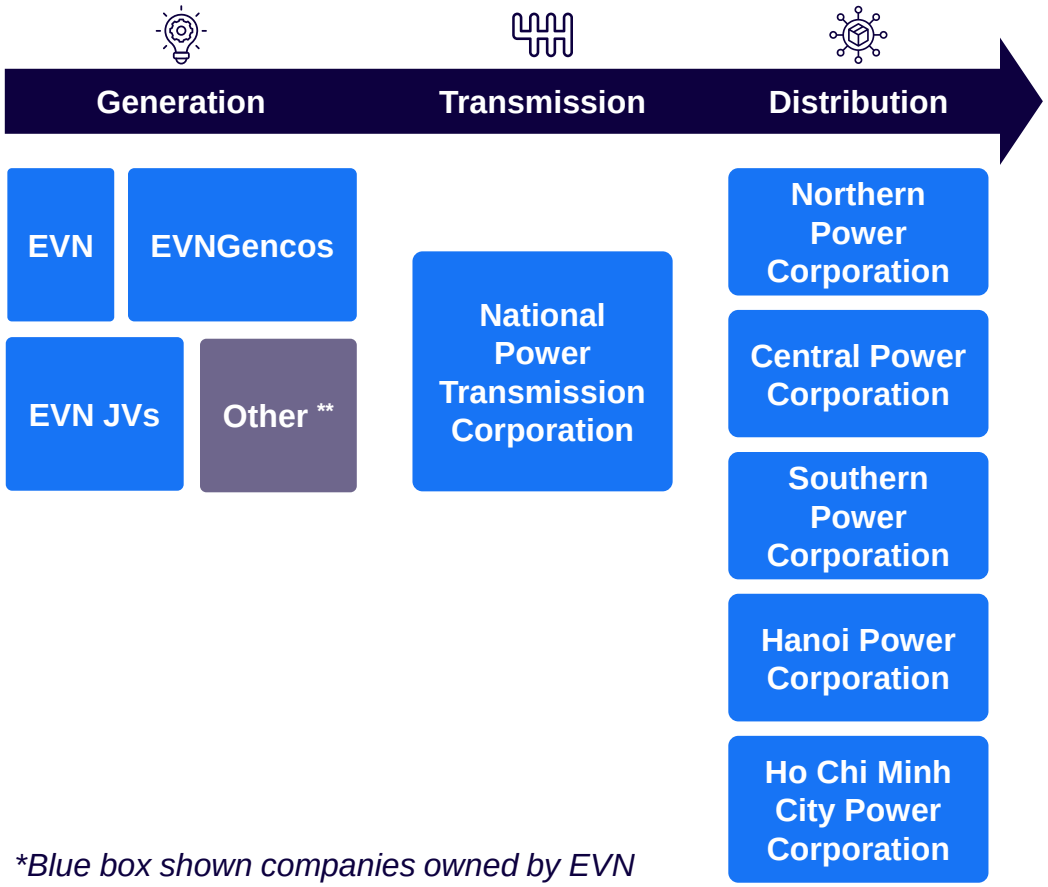
- Split distribution company activities into network management and operation, and retailing, with end users served by the distribution company and free to choose their suppliers.



Source: EVN Annual Report 2021, 2018, and 2016

EVNはベトナムの電力部門における主要プレーヤー。 EVNの流通における寡占が、強い交渉力に繋がっている

Value chain of the power sector



**Blue box shown companies owned by EVN*

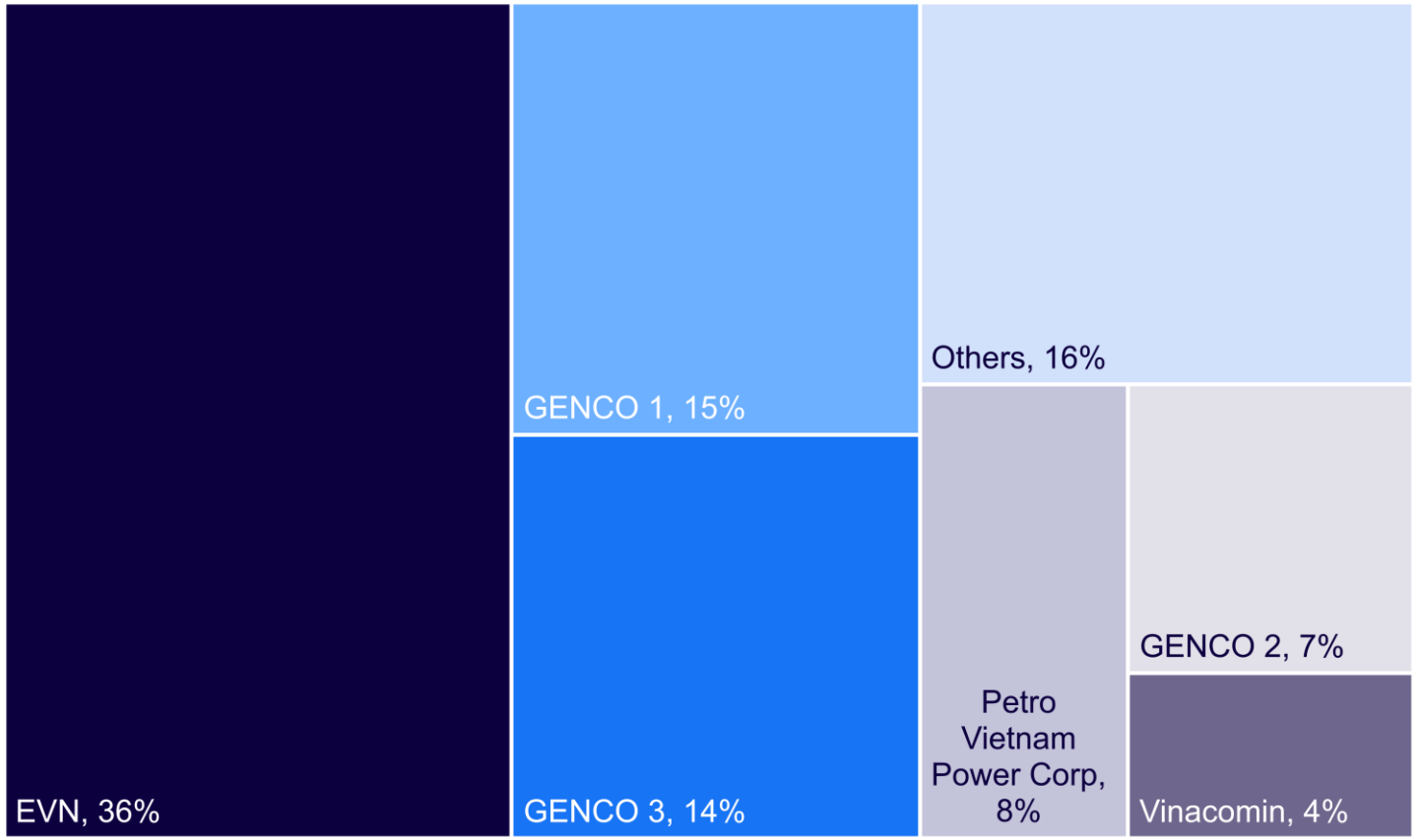
EVN **monopolizes electricity distribution** through three power corporations across Vietnam as well as the National Load Dispatch Centre which controls the electricity load and conduct market trading

- EVN owns **National Power Transmission Corporation (EVNNPT)** which charges distribution for transmission of electricity, with the price set by the Electricity Regulatory Authority of Vietnam
- It also manages the **five distribution companies** that covers all provinces and cities, and sells electricity to end users countrywide, namely Northern Power Corporation (EVNNPC), Central Power Corporation (EVNCPC), Southern Power Corporation (EVNSPC), Hanoi Power Corporation (EVNHANOI) and Ho Chi Minh City Power Corporation (EVNHCMC)
- Furthermore, EVN runs its own strategic and multipurpose hydropower plants and those power plants belonging to **3 power generation corporations (GENCOs 1, 2, 3)**

Source: EVN Annual Report 2021 and 2018

ベトナムにおける発電量の多くが、EVN及び他の国有企業（GENCO）に依存する

Market share in terms of generated power in 2020



Description

- In 2020, **EVN and its 3 power generation corporations** (GENCOs 1, 2, 3) accounted for almost 72% of the national power generation system, leaving 28% to other players like Petro Vietnam, Vinacomin, etc.
- **EVN:** Vietnam Electricity was established by the Government of Vietnam as a State-owned company in 1994 and officially operated as a one-member limited liability company in 2010

Source: EVN Annual Report 2021, Statista 2022

ベトナムは、再生可能エネルギー発電資産への投資を誘致するためのさまざまなインセンティブを提供

NON-EXHAUSTIVE

Applicable incentives offered for renewable energy projects

Description	Details
Reduction or exemption of land rental	• Potential exemption of land rental for up to 3 years • If a renewable energy project is in a difficult socio-economic area, the project could be entitled to exemption of land rental for 15 years, or even up to the entire term of the land lease
Corporate income tax	• A preferential tax rate of 10% for 15 years from the year the project generates revenue • 4 years exemption and reduction of 50% of the payable tax in the next 9 years • The current standard CIT rate in Vietnam is 20%
Exemption of import duties	• For equipment and machinery imported to create fixed assets of the renewable energy projects
Capital incentives	• Access to low-interest loan from VDB: can obtain loans of up to 70% of the investment cost, with the maximum term of 12 years, at an interest rate equivalent to government bond interest rates with a term of 5 years plus 1%

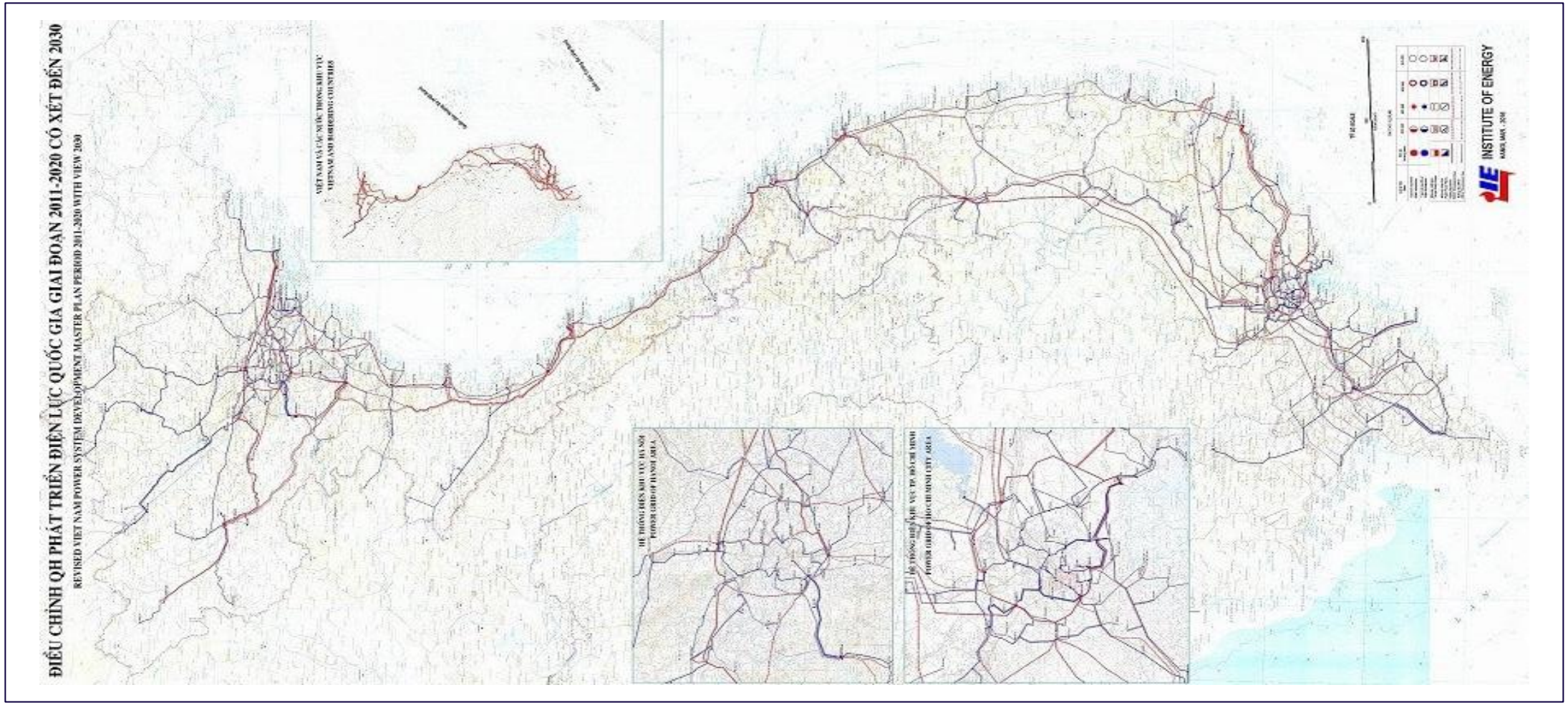
Various incentive schemes are **in place to support investors**, covering capital, land rental, corporate income tax, and import duties

Despite the availability of incentives, there **remains room to improve administrative procedures**, enhance the **clarity of legal frameworks and documents**, and **review FiT prices** relative to regional counterparts

Source: Freshfield Bruckhaus Deringer 2021, Clifford Chance 2017, Vietnam Plus 2023

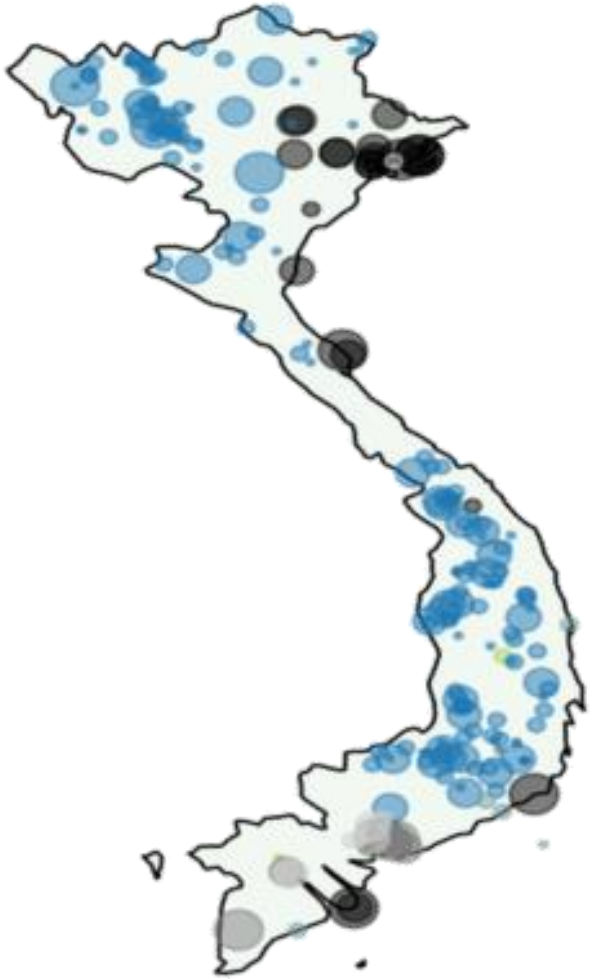
6. 発電所

発電所のマップ



Source: Institute of Energy

List of power plants (1/3): Owned by EVN



#	Name	Installed capacity, MW
I	EVN	10,540
a	Hydropower	8,462
1	Tri An	420
2	Hoa Binh	1,920
3	laly	720
4	Se san 3	260
5	Tuyen Quang	342
6	se san 4	360
7	Pleikrong	100
8	Son La	2,400
9	Ban Chat	220
10	Lai Chau	1,200
11	Huoi Quang	520

#	Name	Installed capacity, MW
I	EVN	10,540
b	Coal fired	1,800
1	Thai Binh	600
2	Vinh Tan 4	1,200
c	Gas turbine (oil)	113
1	Thu Duc	113
d	Oil fired	165
1	Thu Duc	165

Source: EVN Annual Report 2016

List of power plants (2/3): Owned by GENCO 1 & GENCO 2 & GENCO 3

#	Name	Installed capacity, MW
II	GENCO 1	6,938
a	**Hydropower**	**2,018**
1	Ban Ve	320
2	Dai Ninh	300
3	Song Tranh 2	190
4	Dong Nai 3	180
5	Dong Nai 4	340
6	Da Nhim + Song Pha	168
7	Da Nhim extension	45
8	Ham Thuan	300
9	Da Mi	175
b	**Coal fired**	**4,920**
1	Uong Bi extension 1	300
2	Uong Bi extension 2	330
3	Quang Ninh 1	600
4	Quang Ninh 2	600
5	Nghi Son 1	600
6	Duyen Hai 1	1,245
7	Duyen Hai 3	1,245

#	Name	Installed capacity, MW
III	GENCO 2	4,496
a	**Hydropower**	**1,408**
1	Quang Tri	64
2	An Khe - Kanak	173
3	Song Bung 4	156
4	Trung Son	260
5	Thac MO + Thac MO extension	225
6	A Vuong	210
7	Song Ba Ha	220
8	Song Bung 2	100
b	**Coal fired**	**2,240**
1	Pha Lai 1	440
2	Pha Lai 2	600
3	Hai Phong 1	600
4	Hai Phong 2	600
C	**Gas turbine (Oil)**	**155**
1	Can Tho	155
D	**Oil fired (FO)**	**693**
1	Can Tho (S4)	33
2	O Mon I	660

#	Name	Installed capacity, MW
IV	GENCO 3	6,195
a	**Hydropower**	**842**
1	Buon Kuop	280
2	Buon Tua Srah	86
3	Srepok 3	220
4	Thac Ba	120
5	Vinh Son	66
6	Song Hinh	70
b	**Coal fired**	**2,424**
1	Ninh Binh	100
2	Vinh Tan 2	1,244
3	Mong Duong 1	1,080
c	**Gas turbine**	**2,929**
1	Phu My 2.1	945
2	Phu My 1	1,118
3	Phu My 4	477
4	Ba Ria	389

Source: EVN Annual Report 2016

List of power plants (3/3): Owned by other players

#	Power plant name	Installed capacity, MW
V	Others	14,973
a	**Hydropower (≥30MW)**	**3,474**
1	Cua Dat	97
2	Nam Chien 2	32
3	Thai An	82
4	Su Pan	35
5	Huong Son	33
6	A Luoi	170
7	Bac Ha	90
8	Nho Que 3	110
9	Ba Thuoc	80
10	Muong Hum	32
11	Chiem Hoa	48
12	Ta Co (Nam Cong 2)	30
13	Nam Phang	36
14	Nam Chien 1	200
15	Khe Bo	100
16	Hua Na	180
17	Ta Thang	60
18	Van Chan	57
19	SeSan3A	108
20	song Con 2	63
21	Srepok 4	80
22	KRong H'Nang	64
23	Huong Dien	81
24	Bac Binh	33
25	Binh Dien	44
26	Za Hung	30
27	Dak Psi 4	30
28	Se San 4A	63
29	Dak R'Tih	144
30	Dak My 4	190
31	Song Bung 5	57
32	Song Bing 4A	49
33	Srepok 4A	64
34	Can Don	78
35	Srokphmieng	51
36	Da Dmg	34
37	Dam Bri	75
38	Ngoi Phat	72
39	Song Bac	42
40	Dak Drinh	125
41	Dong Nai 2	70
42	Song Giang	37
43	Nam Pong	32
44	Nam Na2	44
45	Ngoi Hut 2	48
46	Nam Muc	44
47	DongNai5	150

b	**Coal fired power**	**4,460**
1	Na Duong	110
2	Cao Ngan	115
3	Formosa Dong Nai	310
4	Formosa Ha Tinh	150
5	Son Dong	220
6	Cam Pha	300
7	Cam Pha II	300
8	Mao Khe	440
9	Vung Ang I	1,245
10	Mong Duong 2	1,120
11	An 101anh I	120
12	Norg Son	30
c	**Oil fired power**	**675**
1	CO Lan	39
2	Amata	13
3	Bourbon	24
4	Vedan	72
5	Hiep	375
6	Phu My fertilizer	18
7	Dung Quat oil refinery	104
8	Bauxit aluminum factory	30,0

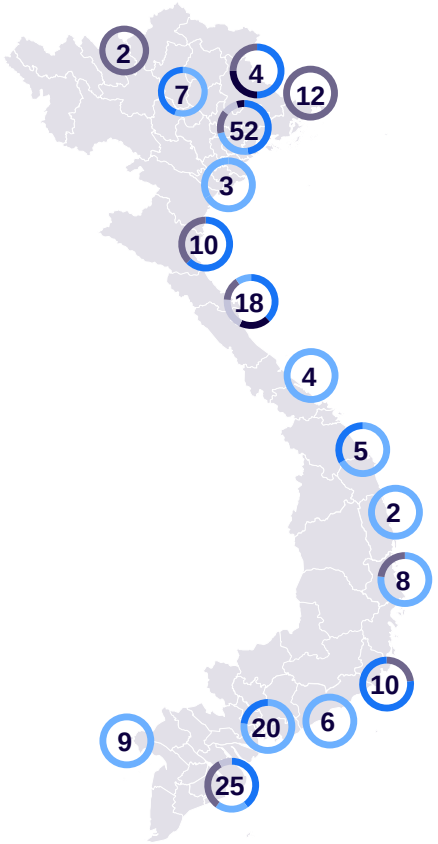
d	**Gas fired power**	**4,223**
1	Phu My 3	733
2	Phu My 22	733
3	Ca Mau 1	771
4	Ca Mau 2	771
5	Nhon Trach 1	465
6	Nhon Trach 2	750
E	**Wind power**	**135**
1	Tuy Phong	30
2	Phu Quy	6
3	Bac Lieu Wind power-stage 1	16
4	Bac Lieu Wind power-stage 2	83
f	**Small hydropower & others**	**2,006**
1	Northern small hydropower	1,008
2	Central small	787
3	Southern small hydropower	154
4	Gia Lai Sugar-cane	12
5	Ayun Pa Sugar-cane	20
6	Ninh Hoa baggasse	8
7	Cam Ranh baggasse	11
8	Soc Trang baggasse	6

Source: EVN Annual Report 2016

石炭火力発電所の開発マップ

Coal Fired Power Plant

2023



- Pre-permit
- Operating
- Cancelled
- Shelved
- Construction

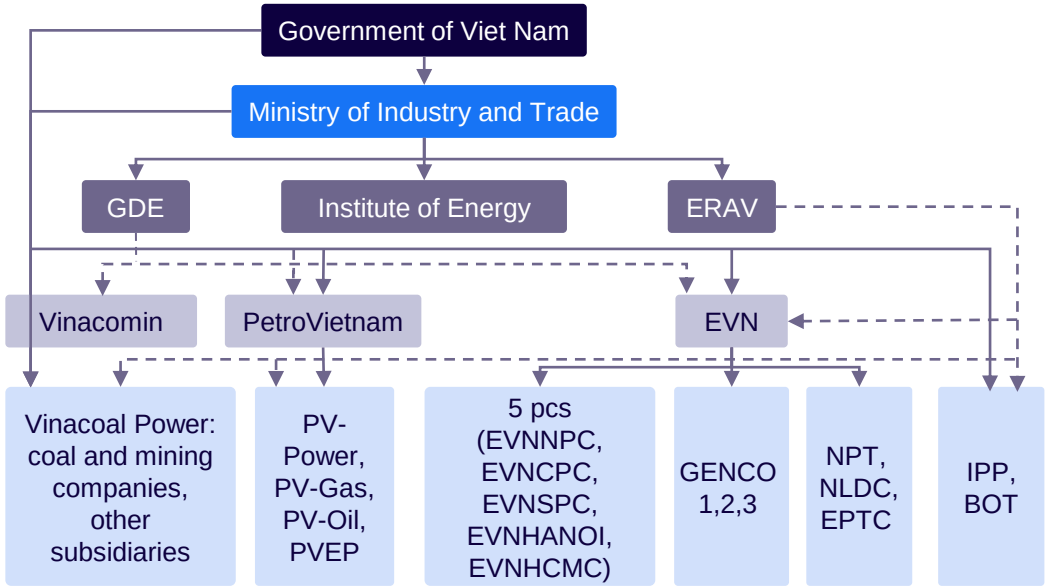
Description

- According to Global Energy Monitor, out of 198 Coal-fired projects in Vietnam, 73 of them are operating and other 10 are under construction.
- While the number of projects being cancelled or shelved or in pre-permit accounts for a larger portion with 68, 41, and 6 projects respectively.
- This scenario of Coal projects being shelved or cancelled might be explained by the issuance of Power Development Plan 8th which reflects Vietnamese goal of 0 coal economy in 2050.

Source: Global Energy Monitor

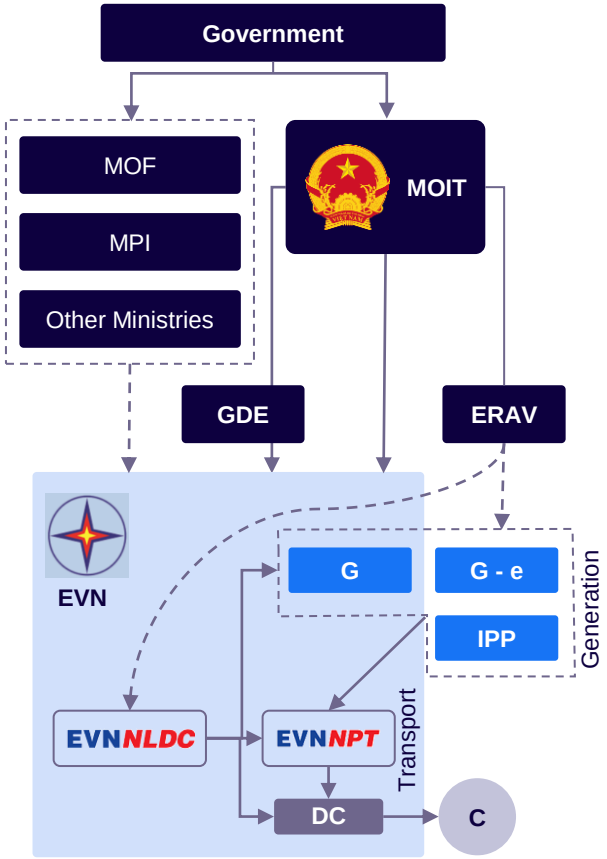
電力発電を運営している組織体制は以下

Organization of energy sector



BOT = build-operate-transfer, EVNCPC = Central Power Corporation, EVNHANOI = Hanoi Power Corporation, EVNHCMC = Ho Chi Minh City Power Corporation, EVNNPC = Northern Power Corporation, EVNSPC = Southern Power Corporation, EPTC = Electric Power Trading Company, ERAV = Electricity Regulatory Authority of Vietnam, EVN = Viet Nam Electricity, GENCO = power generation corporation, GDE = General Directorate of Energy, HCMC = Ho Chi Minh City, IPP = independent power producers, NLDC = National Load Dispatch Center, NPT = National Power Transmission Corporation, PCs = Power Corporations, PVEP = PetroVietnam Exploration Production Corporation, PV-Gas = PetroVietnam Gas Corporation, PV-Oil = PetroVietnam Oil Corporation, PV-Power = PetroVietnam Power Corporation.

Institutional framework of the electricity sector



MOIT	Ministry of Industry and Trade
MOF	Ministry of Finance
MPI	Ministry of Planning and Investment
GDE	General directorate of energy
ERAV	Energy Regulatory Authority of Vietnam
EVN	Electricity of Vietnam
G	EVN owned Generation Companies
G-e	Equitized Generation Companies (i.e. privatized or partly privatized)
IPP	Independent Power Producer
NLDC	National Load Dispatch Center
NPT	National Power Transmission Corporation
DC	Distribution Companies
C	Consumer
	State Management
	Electric Flows
	Power System Operation Interface

Source: BMI Key Power Projects Database 2016, ADB.

7. 電力品質

ベトナムでは、電力供給の信頼性が大きな懸念材料となっているが、インフラ整備は資金面での壁に直面

Overview of challenges in the power market

Unreliable supply of electricity

Economic growth has driven electricity consumption across Vietnam…

- Pre-COVID, Vietnam's rapid growth has already led to annual electricity consumption increases of ~10%
- Vietnam's annual electricity demand is expected to **grow by 10% to 12% per year** over the **next decade**, making it one of the fastest growing countries in Asia in terms of electricity consumption

…which has strained already limited power generation infrastructure

- Power cuts are a **frequent occurrence**, with power cuts **3-4 days per week** common in some provinces
- Vietnam relies on **hydropower** for almost **half its energy needs**. However, in 2023, heatwaves and subsequent low water levels **severely interrupted** power generation at **11 plants**

Barriers to infrastructural development

Predominantly state-backed infrastructure projects have faced significant delays…

- Cumbersome administrative procedures and political inertia have led to challenges in comprehensive planning and concrete action

…while governmental grip on electricity has disincentivized private investment…

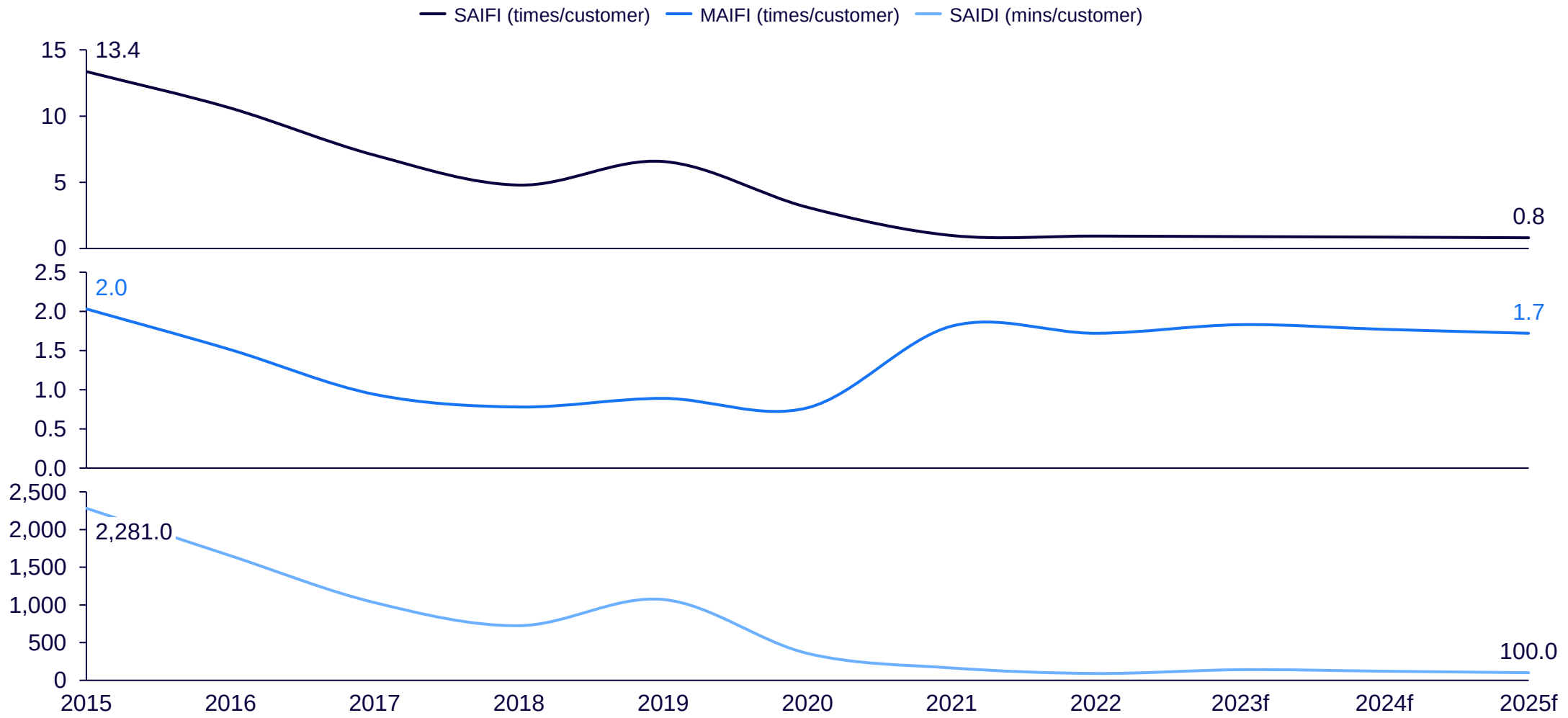
- Electricity prices are **tightly controlled** and generally remain relatively low among ASEAN countries – hence **potential returns remain relatively unattractive** to private investment

…further increasing the projected shortfall in energy infrastructure investment

- An estimated financing requirement of **US$532 billion** is required by **2050**, with **government funding insufficient** to cover this

Source: ASEAN Briefing 2022, Various secondary sources

電力供給の質は徐々に改善されており、SAIFIとSAIDIは同様の傾向を示している



Source: Vietnam Energy Statistics 2020, Vietnam Electricity 2023, Arthur D. Little analysis

電力供給の質は徐々に改善されており、SAIFIとSAIDIは同様の傾向を示している

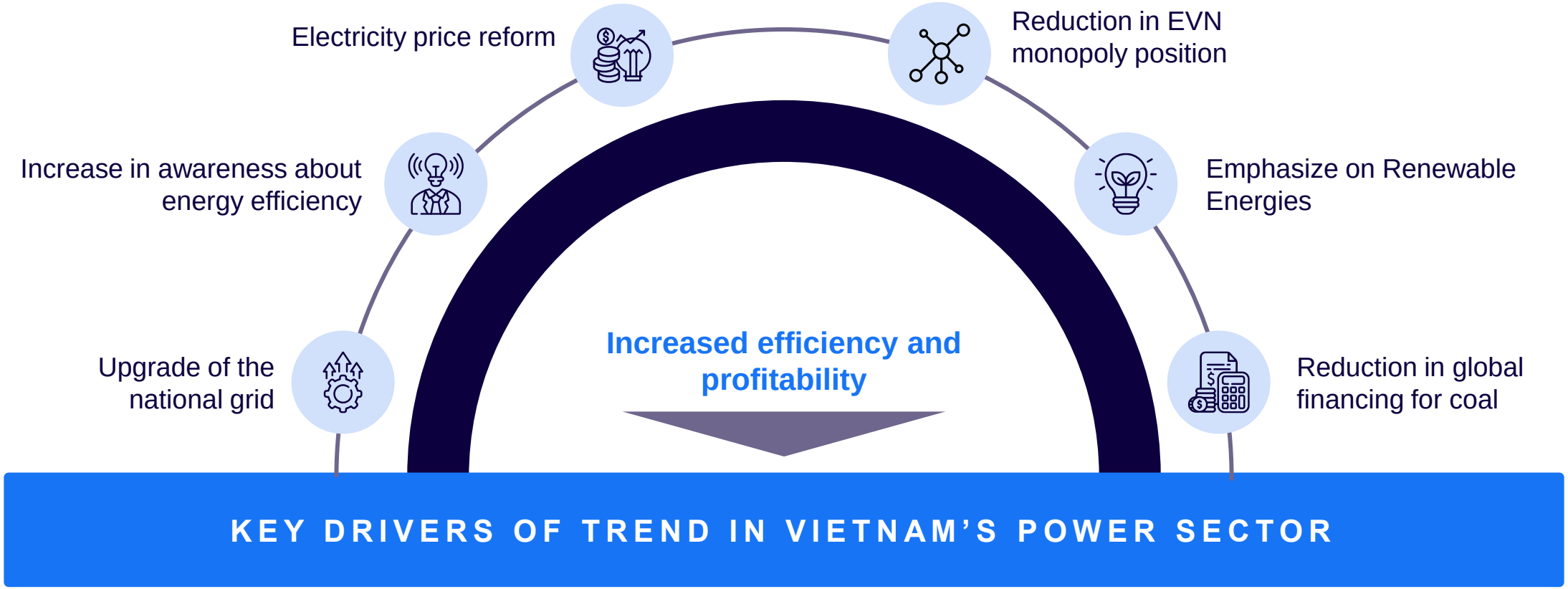
Energy security metrics, by energy source

2015 - 2020[1]

Item	Unit	2015	2016	2017	2018	2019	2020 [1]
Reserve / production ratio ratio (R/P)	years	Coal reserve~70 years, Natural gas~40 years, Crude oil~20 years					
Dependence of net import import energy	%	6.45	16.39	18.50	27.07	39.65	39.12
Energy import cost/ Total import cost	%	4.79	3.909	4.683	5.942	4.815	4.810
Energy import cost /National Export revenue	%	4.890	3.869	4.619	5.776	4.617	4.471
Energy import cost/GDP	%	4.100	3.316	4.418	5.735	4.658	4.660
Diversity of import Source countries	HHI index	1.835	1.587	1.425	1.328	1.213	1.210
Diversity of energy sources of power	HHI index	3.209	3.272	3.503	3.496	3.580	3.605
Diversity of energy sources of TPES	HHI index	2.773	2.792	2.806	3.046	3.316	3.597
TFEC/GDP	kgOE/1,000USD	308	307	305	322	321	319
Reserve factor	%	34.4	33.5	33.9	29.8	32.4	38.0
System Average Interruption Duration Index (SAIDI)	mins/cust	2.281	1.651	1.029	724	1.071	356
System Average Interruption Frequency Index (SAIFI)	num/cust	13.36	10.6	7.04	4.79	6.57	3.11
Momentary Average Interruption Frequency Index (MAIFI)	num/cust	2.03	1.51	0.94	0.78	0.89	0.77
Days of on-land 011 stocks	days	62.7	86.7	90.8	92.4	91.3	92.9

Note: 1) Preliminary
Source: Vietnam Energy Statistics 2020, Vietnam Electricity 2023, Arthur D. Little analysis

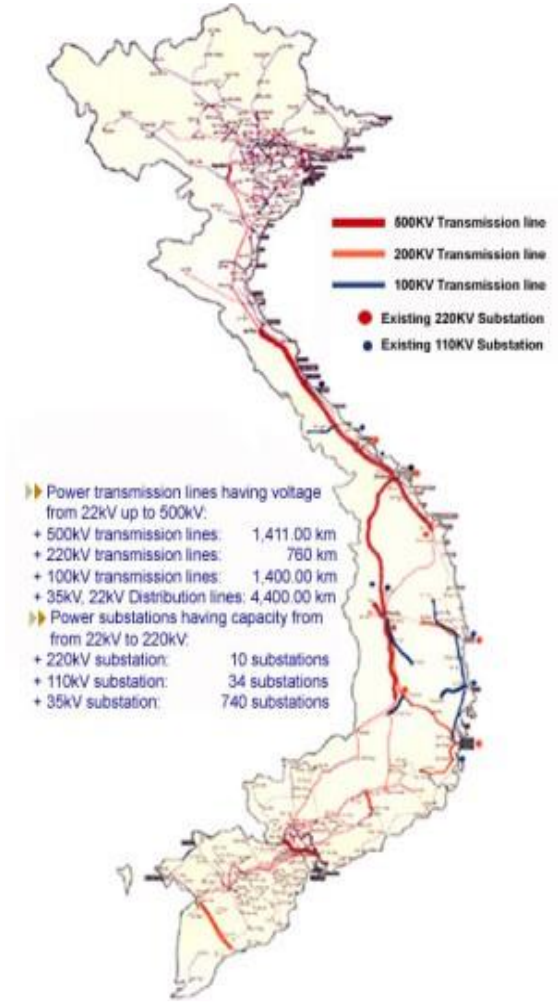
電力部門は、政府の政策、国際的な動向、関係者の省エネ技術やグリーン技術に関する知識の増加の影響を受ける



Source: Suruhanjaya Tenaga Energy Commission 2016

8. 送電網

Maps of the transmission grid (500kV, 220kV ,110kV)



Source: Global Energy Network Institute 2010

Transmission line projects in the pipeline (500 kV) – North (1/3)

NON-EXHAUSTIVE

#	Names	No. of circuit x km	Notes
I	**Projects to be put into operation by 2025**		
1	West Ha Noi - Vinh Yen	2x44	New construction
2	Long Bien Branch Pho Noi - Thuong Tin	2x5	New construction, connection of 500kV Long Bien substation
3	West Ha Noi — Thuong Tin	2x40	New construction
4	Circuit-2 Nho Quan – Thuong Tin	1x75	New construction, upgrade of one circuit to two circuits
II	**Projects to be put into operation in the period 2026-2030**		
1	South Ha Noi – Branch Nho Quan | – Thuong Tin	4x5	New construction, connection of 500kV South Ha Noi substation
2	Dan Phuong - Branch West Ha | Noi — Vinh Yen	4x5	New construction, connection of 500KV Dan Phuong substation
3	Son Tay – Dan Phuong	2x20	New construction, connection of 500kV Son Tay substation. Temporarily transition to the 500kV West Hanoi Vinh Yen line in case the 500kV Son Tay substation has yet to operate
4	Hai Phong 2 – Gia Loc	2x48	New construction, connection of Hai Phong 2

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Transmission line projects in the pipeline (500 kV) – North (2/3)

NON-EXHAUSTIVE

#	Names	No. of circuit x km	Notes
III	**Projects to be put into operation in the period 2031-2035**		
1	Hai Phong 1 (Tien Lang) LNG – Hai Phong	4x10	New construction, connection of Hai Phong I (Tien Lang) LNG power plant
2	Hai Phong 2 (Cat Hai - Cai Trap) | LNG – Branch Hai Phong 1 LNG | — Hai Phong 2	4x5	New construction, synchronization of Hai Phong 2 LNG power plant
3	Hai Phong 1 (Tien Lang) LNG – Hai Phong 2	2x54	New construction, synchronization, capacity absorption for Hai Phong 1 & 2 LNG power plants
4	Connection of the Northern offshore wind power	2x25	New construction, connection of the Northern offshore wind power
IV	**Projects to be put into operation in the period 2036-2040**		
1	Gia Loc- Pho Noi (circuit 3, 4)	2x38	New construction, improvement the hosting of capacity of LNG power plant in the Northeastern region, consideration of changing connection of two circuits to Bac Ninh
2	Ha Nam Branch Thanh Hoa - LNG-South Ha Noi	4x5	New construction, connection of 500kV Ha Nam substation
3	Nam Dinh 2 – Branch Nam Dinh thermal power plant - Thai Binh	2x12	New construction
4	Thai Binh LNG – Hung Yen	2x70	New construction, synchronization of Thai Binh LNG power plant

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Transmission line projects in the pipeline (500 kV) – North (3/3)

NON-EXHAUSTIVE

#	Transmission line	No. of circuit x km	Note
V	**Projects to be put into operation in the period 2041-2045**		
1	Connection of expanded Lai Chau hydropower plant	2x5	Synchronization of expanded Lai Chau hydropower plant
2	Boulapha – Ha Tinh	2x90	New construction, connection of the power source from Laos in the high scenario
3	Connection of the Northern LGN power plant (2)	4x10	New construction synchronization of LNG power plants in the North in the high scenario
4	Backup plan: new construction and upgradation of the North region 500kV transmission line in the period 2041-2045	67	Estimated volume

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Transmission line projects in the pipeline (500 kV) – Central (1/3)

NON-EXHAUSTIVE

#	Names	No. of circuit x km	Notes
I	**Projects to be put into operation by 2025**		
1	Doc Soi – Pleiku 2	2x209	New construction
2	Quang Tri – Branch Vung Ang – Da Nang	4x5	New construction, connection of 500kV Quang Tri substation
3	Quang Tri 2 switching station – Branch Quang Trạch – Doc Soi	4x5	New construction, connection of Quang Tri 2 switching station
4	Lao Bao (Huong Hoa) – 500KV Quang Tri 2 switching station	2x31	New construction
II	**Projects to be put into operation in the period 2026 – 2030**		
1	Hatsan (Laos) – Kon Tum	2x100	New construction, in case of increasing power purchase from Laos
2	Kon Tum – Branch Thanh My – Pleiku 2	4x5	New construction, connection of 500kV Kon Tum switching station
3	Upgrade of Thanh My – Pleiku 2 to two-circuit line	2x199	New construction, upgrade of circuit 1, change of connection to 500kV Pleiku substation
4	Circuit 2 of Da Nang – Doc Soi line	2x100	New construction of circuit 2, upgrade of circuit 1, change of connection of circuit 2 to Central gas turbine power plant in case of impossibility to expand Doc Soi bay

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Transmission line projects in the pipeline (500 kV) – Central (2/3)

NON-EXHAUSTIVE

#	Names	No. of circuit x km	Notes
III	**Projects to be put into operation in the period 2031 – 2035**		
1	Quang Tri thermal power – plant Quang Tri	2x17	New construction, synchronization of Quang Tri thermal power plant
2	Quang Binh – Branch Vung Ang – Quang Tri	4x5	New construction, connection of 500KV Quang Binh substation, branch circuit 2 of 500kV line
3	Huong Thuy 500kV – Branch Quang Tri – Da Nang (circuit 1, 2)	4x5	New construction, connection of 500kV Huong Thuy substation
4	Da Nang 2 – Branch Quang Tri 2 switching station – Thanh My (circuit 500kV 3, 4)	4x5	New construction, connection of 500kV Da Nang 2 substation
IV	**Projects to be put into operation in the period 2036 – 2040**		
1	Dak Lak 1 RE collector station – Chon Thanh	2x250	New construction, in harmonization with the development of RE sources in the Highland
2	Dak Lak 2 RE collector station – Branch Dak Lak 1 RE collector station – Chon Thanh	4x5	New construction, in harmonization with the development of RE sources in the Highland
3	Dak Nong RE collector station – Branch Krong Buk – Tay Ninh	4x7	New construction, synchronization of 500kV Dak Nong wind power plant substation

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Transmission line projects in the pipeline (500 kV) – Central (3/3)

NON-EXHAUSTIVE

#	Names	No. of circuit x km	Notes
4	Backup plan: new construction and upgradation of the Central region 500kV transmission line in the period 2036 – 2040	35	Estimated volume
V	**Projects to be put into operation in the period 2041 – 2045**		
1	Hai Lang LNG – Quang Tri thermal power plant	2x6	New construction, synchronization of Hai Lang LNG power plant in the high scenario
2	Backup plan: new construction and upgradation of the Central region 500kV transmission line in the period 2041 – 2045	100	Estimated volume

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Transmission line projects in the pipeline (500 kV) – South (1/3)

NON-EXHAUSTIVE

#	Name of transmission line	Nos. of circuit x km	Note
I	**Projects to come into operation by 2025**		
1	Thuan Nam – Chọn Thanh	2x308	New construction, RE capacity absorption in South Central region
2	Ninh Son – Branch Thuan Nam – Chon Thanh	4x2	New construction, connection of Ninh Son 500 kV substation
3	Ninh Son – Branch Van Phong – Thuan Nam	4x13	New construction, connection of Ninh Son 500 kV substation
4	Improvement of Di Linh – Tan Dinh 500 kV line loadability		Line upgradation, series capacitor replacement
II	**Projects to come into operation in the 2026 – 2030 period**		
1	Bac Ai pumped storage hydropower – Ninh Son	2x25	New construction, synchronization of TBKHH Bac Ai, replacement of Bac Ai pumped storage hydropower – Branch Van Phong – Thuan Nam
2	Phuoc Hoa pumped storage hydropower – Branch Bac Ai pumped storage hydropower – Ninh Son	2x12	New construction, synchronization of TBKHH Phuoc Hoa in high scenario, faster progress compared to baseline scenario
3	Ca Na pumped storage hydropower – Thuan Nam	2x30	New construction, synchronization of TBKHH Ca Na in high scenario, faster progress compared to baseline scenario

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Transmission line projects in the pipeline (500 kV) – South (2/3)

NON-EXHAUSTIVE

#	Name of transmission line	Nos. of circuit x km	Note
4	Ca Na pumped storage hydropower – Binh Duong	2x280	New construction, synchronization of TBKHH Ca Na; TBKHH Ca Na and South Central offshore wind power capacity absorption; faster progress compared to baseline scenario.
III	**Projects to come into operation in the 2031 – 2035 period**		
1	Pumped storage in the South – Branch Ninh son – Chon Thanh	4x18	New construction, synchronization of pumped storage in the South
2	Ninh Thuan 2 offshore wind power – Ninh Son	2x55	New construction, absorption of Ninh Thuan offshore wind power capacity
3	Binh Thuan 2 offshore wind power – Long Thanh	2x110	New construction, absorption of Binh Thuan offshore wind power capacity
4	Da Phuoc – Branch Phu Lam – Nha Be	2x8	New construction, connection of Da Phuoc 500 kV substation
IV	**Projects to come into operation in the 2036 – 2040 period**		
1	Ninh Thuan 3 offshore wind power – Branch Ninh Thuan 2 offshore wind power – Ninh Son	2x37	New construction, release of offshore wind power capacity in Ninh Thuan province
2	Binh Thuan 4 offshore wind power – Binh Thuan 2 offshore wind power	2x25	New construction, release of offshore wind power capacity in Binh Thuan province
3	TBKHH Phu My 3.1 – Phu My 500 kV	2x2	New construction, synchronization of TBKHH Phu My 3.1 in high scenario. This is an addition to baseline scenario.

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Transmission line projects in the pipeline (500 kV) – South (3/3)

NON-EXHAUSTIVE

#	Name of transmission line	Nos. of circuit x km	Note
4	Connection of offshore power in the South in the 2036 – 2040 period	100	New construction, synchronization of offshore power in the South in high scenario. This is an addition to baseline scenario
V	**Projects to come into operation in the 2041 – 2045 period**		
1	Dong Nai 3 – Branch Song May-tan Uyen	2x10	New construction, connection of Dong Nai 3 500 kV substation
2	Connection of offshore power in the South in the 2041 – 2045 period	50	New construction, synchronization of offshore power in the South in high scenario. This is an addition to baseline scenario.
3	Backup plan for new construction, upgradation in the 2041 – 2045 period	100	New construction or upgradation, loadability improvement

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Transmission line projects in the pipeline (220 kV) – North (1/3)

NON-EXHAUSTIVE

#	Project	Nos. of circuit x km	Note
I	**Projects to be put into operation by 2025**		
1	Van Dien – Branch Ha Dong – Thuong Tin	4x4	New construction, connection of 220kV Van Dien substation including change of connection of Van Dien substation to Van Dien – Hoa Binh, Van Dien – Xuan Mai
2	West Ha Noi – Thanh Xuan	4x16	New construction
3	500kV Dong Anh – Van Tri	2x13	New construction
4	Improvement of loadability of Hoa Binh – Chem line	1x74	Upgrade, loadability improvement to ensure the power supply for Ha Noi
II	**Projects to be put into operation in the period 2026 – 2030**		
1	500kV Dan Phuong – Me Linh	2x15	New construction
2	Connection of 500kV Dan Phuong	4x11	Branch Van Tri – Tay Ho and Tay Ho – Chem
3	Soc Son 2 – Branch Hiep Hoa – Dong Anh	2x3	New construction, connection of 220kV Soc Son substation
4	500kV Son Tay – Hoa Lac 2	2x15	New construction, connection on the 220kV side of 500kV Son Tay substation

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Transmission line projects in the pipeline (220 kV) – North (2/3)

NON-EXHAUSTIVE

#	Project	Nos. of circuit x km	Note
III	**Projects to be put into operation in the period 2031 – 2035**		
1	Thanh Cong – Mai Dong	1x8	New construction
2	Dong Anh 2 – Branch Van Tri – Tay Ho and Van Tri – Chem	4x2	New construction, connection of 220kV Dong Anh 2 substation
3	Dong Anh 3 – Branch Van Tri – Dong Anh 500kV	4x2	New construction, connection of 220kV Dong Anh 3 substation
4	500kV Dan Phuong – Phuc Tho	2x13	New construction
IV	**Projects to be put into operation in the period 2036 – 2040**		
1	Thanh Tri – Branch Thuong Tin – Mai Dong	2x5	New construction, connection of 220kV Thanh Tri
2	Gia Loc 500kV – Thanh Mien	2x11	New construction
3	Nam Dinh 2 – Branch Ninh Binh – Thai Binh	2x5	New construction, connection of 500kV Nam Dinh 2
4	Ninh Binh 500kV – Branch Ninh Binh –Tam Diep	4x21	New construction, connection on the 220kV side of 500kV Ninh Binh substation

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Transmission line projects in the pipeline (220 kV) – North (3/3)

NON-EXHAUSTIVE

#	Project	Nos. of circuit x km	Note
V	**Projects to be put into operation in the period 2041 – 2045**		
1	Thanh Oai – Branch Ung Hoa – Ha Dong	2x5	New construction, connection of 220kV Thanh Oai substation
2	Thanh Ha – Branch Gia Loc – 500kV Hai Phong (circuit 2)	2x6.5	New construction, synchronization and capacity upgrade of 220kV Thanh Ha substation to 750 MVA
3	Yen My – Branch Long Bien 500kV – Van Giang (circuit 2)	2x2	New construction, synchronization and capacity upgrade of 220kV Yen My substation to 750 MVA
4	Tuyen Quang 500kV – Branch Yen Son hydropower plant – Son Duong	2x5	New construction, connection of 500kV Tuyen Quang substation

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Transmission line projects in the pipeline (220 kV) – Central (1/3)

NON-EXHAUSTIVE

#	Project	Nos. of circuit x km	Note
I	**Projects to come into operation by 2025**		
1	Ba Don – Branch Vung Ang – Dong Hoi	2x3	New construction, to be transited via the other circuit in case of high penetration of RE in Ba Don 220 kV substation
2	B&T1 wind power – Branch Dong Hoi – Dong Ha	4x10	New construction, synchronization of B&T1 wind power, connection work changes from the connection plan approved at Document 911/TTg-CN dated 15 July 2020
3	B&T2 wind power – B&TI wind power	2x18	New construction, synchronization of B&T2 wind power; connection plan was approved at Document 911/TTg-CN dated 15 July 2020
4	Improvement of Dong Hoi – Dong Ha loadability	2x108	Upgradation, improvement of loadability in case of major development of Quang Tri wind power
II	**Projects to come into operation in the 2026 – 2030 period**		
1	Xebanghieng (Lao) power plant cluster – Lao Bao 500 kV (Huong Hoa)	2x24.5	New construction, synchronization of Xebanghieng (Lao) power plant cluster
2	TBKHH Quang Tri – Branch Dong Nam – Quang Tri 500 KV	2x5	New construction, synchronization of TBK Quang Tri
3	TBKHH Quang Tri – Branch Dong Nam – Quang Tri 500 kV	2x5	New construction, synchronization of TBK Quang Tri

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Transmission line projects in the pipeline (220 kV) – Central (2/3)

NON-EXHAUSTIVE

#	Project	Nos. of circuit x km	Note
4	Huong Thuy – Branch Hue – Hoa Khanh	4x2	New construction, connection of Huong Thuy 220 kV substation
III	**Projects to come into operation in the 2031 – 2035 period**		
1	Le Thuy – Branch Dong Hoi – Dong Ha	4x2	New construction, connection of Le Thuy 220 kV substation
2	Quang Binh 500 kV – Branch Dong Hoi – Dong Ha	4x5	Proposed to connect Quang Binh 500 kV substation and Le Thuy 220 kV substation. In case of different investors, a 220 kV line should be constructed to connect Quang Binh 500 kV substation.
3	Quang Binh 1 RE collector substation – Quang Binh 500 kV	2x21	New construction, synchronization of Quang Binh 1 RE collector substation
4	Quang Tri 2 RE collector substation – Lao Bao 500 kV	1x16	New construction, connection of Quang Tri 2 RE collector 220 kV substation
IV	**Projects to come into operation in the 2036 – 2040 period**		
1	Quang Binh 2 RE collector substation – Quang Binh 500 kV (*)	2x25	New construction, synchronization of Quang Binh 2 RE collector substation
2	Vinh Linh – Branch Dong Hoi – Dong Ha	4x2.2	New construction,

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Transmission line projects in the pipeline (220 kV) – Central (3/3)

NON-EXHAUSTIVE

#	Project	Nos. of circuit x km	Note
3	Quang Tri 3 RE collector substation – Branch Lao Bao – Dong Ha	2x5	New construction, connection of Quang Tri 3 RE collector substation
4	Kon Tum 500 kV – Branch Bo Y – Kon Tum 220 kV	4x5	Connection on the 220 kV side of Kon Tum 500 kV substation
V	**Projects to come into operation in the 2041 – 2045 period**		
1	Ang Son – Quang Binh 2 RE collector substation	2x8	New construction, connection of Ang Son 220 kV substation
2	Tam Quan – Branch Phu My – Quang Ngai	4x5	New construction, connection of Tam Quan 220 kV substation
3	Mang Yang – Branch An Khe hydropower – Pleiku	2x5	New construction, connection of Mang Yang 220 kV substation
4	Backup plan: new construction and upgradation of the Central Region 220 kV line in the 2041 – 2045 period	45	Estimated volume

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Transmission line projects in the pipeline (220 kV) – South (1/3)

NON-EXHAUSTIVE

#	Name of transmission line	Nos. of circuit x km	Note
I	**Projects to come into operation by 2025**		
1	Circuit 2 of Bao Loc – Song May	1x127	Construction of Circuit 2 of Bao Loc – Song May
2	Improvement of Bao Loc – Song May (circuit 1) loadability	1x127	Improvement of Bao Loc – Song May (circuit 1) loadability
3	Da Nhim – Di Linh 220 kV switching substation	2x85	Construction of a new double-circuit transmission line, RE capacity absorption; new construction of Da Nhim 220 kV switching substation as Da Nhim 220 kV distribution yard cannot expand its 220 kV feeder
4	Da Nhim — Di Linh 220 kV switching substation – Branch Thap Cham – Da Nhim	2x1	New construction, synchronization of Da Nhim 220 kV switching substation
II	**Projects to come into operation in the 2026 – 2030 period**		
1	Da Nhim hydropower expansion project – Da Nhim hydropower	1x2	New construction, synchronization of Da Nhim hydropower expansion project
2	Ta Nang – Branch Duc Trong – Di Linh (new circuit)	2x20	New construction, RE capacity absorption, connection to the 220 kV line of Da Nhim switching substation– Duc Trong – Di Linh which is newly constructed

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Transmission line projects in the pipeline (220 kV) – South (2/3)

NON-EXHAUSTIVE

#	Name of transmission line	Nos. of circuit x km	Note
3	Hong Phong 500 kV – Branch Phan Ri – Phan Thiet	4x5	New construction, synchronization of Hong Phong 500 kV substation
4	Improvement of Phan Ri – Phan Thiet loadability	2x52	Upgradation, loadability improvement for the route with a cross-sectional area of ACSR-2x330mm² on the 220 kV line Phan Ri – Phan Thiet to absorb RE capacity
III	**Operation in the 2031 – 2035 period**		
1	Da Lat – Da Nhim 220 kV switching substation	2x30	New construction
2	Phuoc Dinh –Thuận Nam 500 kV	2x20	New construction, RE capacity absorption in Ninh Thuan province
3	Thanh Hai –Thap Cham	2x23	New construction, RE capacity absorption in Ninh Thuan province
4	Long Dien 500 kV – Phuoc Thuần	2x16	New construction, synchronization of Long Dien 500 kV substation
IV	**Projects to come into operation in the 2036 – 2040 period**		
1	Da Lat 2 Da Lat	2x12	New construction

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Transmission line projects in the pipeline (220 kV) – South (3/3)

NON-EXHAUSTIVE

#	Name of transmission line	Nos. of circuit x km	Note
2	Tanh Linh – Branch Ham Thuan – Long Thanh	2x0.5	New construction
3	Tan Chau 2 – Branch Binh Long – Dau Tieng Lake PV power	2x10	New construction
4	Go Dau – Ben Cau	2x10	New construction
V	**Projects to come into operation in the 2041 – 2045 period**		
1	Dong Phu – Dong Xoai	2x15	New construction
2	Xuyen Moc – Phuoc Thuan	2x14	New construction
3	Nha Be 2 – Branch Nha Be 500 kV – Phu My 500 kV	4x1	New construction
4	Thu Duc 2 – Branch Thu Duc – Tan Uyen 500 kV	4x2	New construction

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

国内・海外ネットワークともにベトナムは現在、全国送電インフラの拡張・強化を目指している

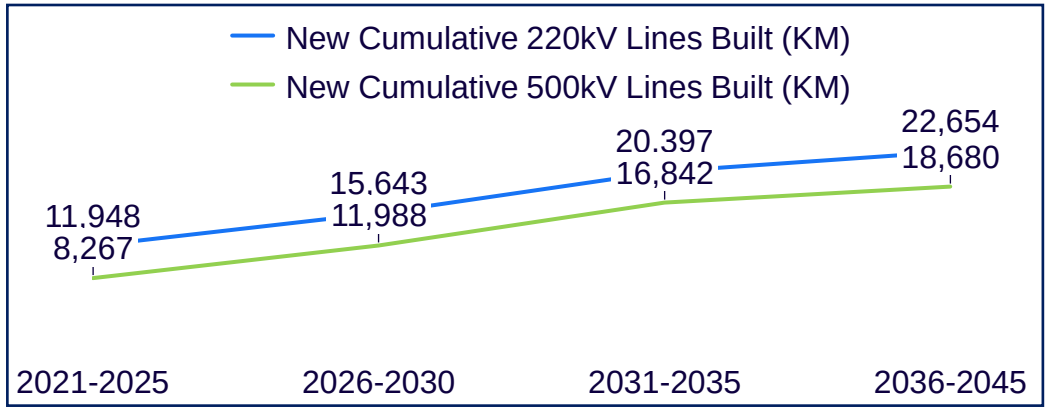
	Objectives	Planned & ongoing initiatives
Extend existing transmission & distribution network, domestically and internationally	• Improve power supply reliability, reduce power losses and ensuring a favorable mobilization of power in the rainy season, dry season and peak periods • Enhance grid interconnection with neighboring countries, including Laos, Cambodia, and China	• **Planned:** In the PDP8, MOIT proposes to continue building a 500kV power transmission system to transmit electricity from major power source centers in the Central Highlands, South Central Coast, and North Central region to major load centers of Vietnam (Ho Chi Minh City) • **Planned:** Between 2021 and 2030, build a total of about 86 GVA capacity of 500kV stations, to achieve N-1 criterion for power supply for loads and N-2 criterion for particularly important loads • **Ongoing:** Research and development of the application of a smart grid and technology 4.0 in power transmission
Higher voltage transmission study	• Study the possibility of developing voltages of 750 kV, 1000 kV or DC transmission	• NIL. Still in proposal stage

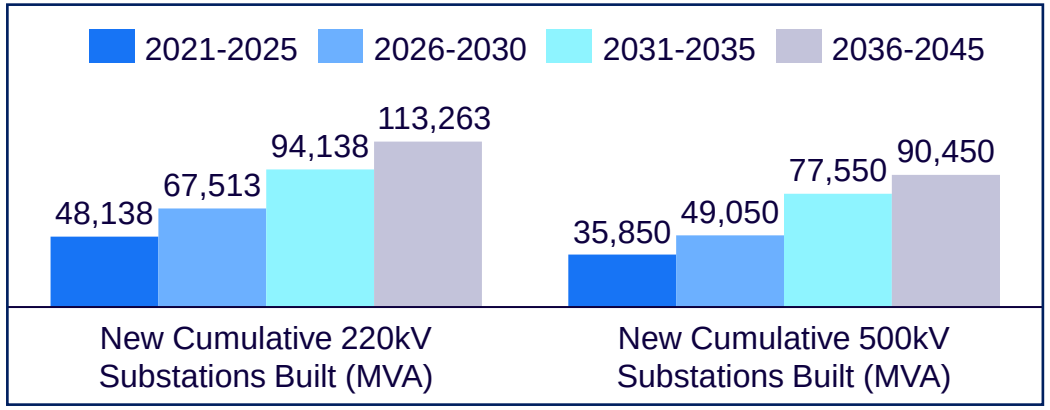
Source: International Trade Administration (United States of America) 2022, Vietnam Electricity Corporation 2022, Asian Development Bank 2015

国内・海外ネットワークともにベトナムは現在、全国送電インフラの拡張・強化を目指している

Targets of Domestic Transmission Network

Cumulative across time periods 2021 - 2045





Targets of International Transmission Network

Electricity Imports:

- Import at least 3,000 MW from Laos by 2025 and 5,000 by 2030, through a 220 kV transmission line
- Following an **intergovernmental cooperation agreement** in 2019

Electricity Imports:

- To **enhance energy security** during domestic production shortfalls, with current annual imports of 2 billion kilowatts
- Vietnam has purchased electricity from China since 2005, via transmission lines in Lao Cai and Ha Giang provinces

Electricity Exports:

- Export **renewable energy** to neighboring countries in the ASEAN region
- E.g., Connected to the Cambodian power grid through the Chau Do-Ta Keo 220kV transmission line for 10+ years

Source: Vietnam National Power Development Plan 8 2023, Vietnam Electricity Corporation 2023

Substation projects in the pipeline (500 kV) – North (1/3)

NON-EXHAUSTIVE

#	Substation	Total capacity (MVA)	Note
I	**Period up to 2025**		
1	West Hanoi	1800	Improvement, capacity upgrade
2	Long Bien	900	New construction
3	Hai Phong	900	New construction
4	Nam Dinh thermal power plant	900	New construction, connection of the 500kV distribution yard of Nam Dinh 1 thermal power plant
II	**Period 2026 – 2030**		
1	Dong Anh	2700	Improvement, capacity upgrade
2	Long Bien	1800	Improvement, capacity upgrade
3	Son Tay	900	New construction
4	Dan Phuong	900	New construction

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Substation projects in the pipeline (500 kV) – North (2/3)

NON-EXHAUSTIVE

#	Substation	Total capacity (MVA)	Note
III	**Period 2031 – 2035**		
1	Long Bien	2700	Improvement, capacity upgrade
2	Son Tay	1800	Improvement, capacity upgrade
3	Dan Phuong	1800	Improvement, capacity upgrade
4	South Ha Noi	1800	Improvement, capacity upgrade
IV	**Period 2036 – 2040**		
1	Dan Phuong	2700	Improvement, capacity upgrade
2	Son Tay	2700	Improvement, capacity upgrade
3	South Ha Noi	2700	Improvement, capacity upgrade
4	Hai Phong 2	1800	Improvement, capacity upgrade

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Substation projects in the pipeline (500 kV) – North (3/3)

NON-EXHAUSTIVE

#	Substation	Total capacity (MVA)	Note
V	**Period 2041 – 2045**		
1	Thuong Tin	2400	Improvement, capacity upgrade
2	West Ha Noi	2400	Improvement, capacity upgrade
3	Hai Phong 2	2700	Improvement, capacity upgrade
4	Gia Loc	2700	Improvement, capacity upgrade

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Substation projects in the pipeline (500 kV) – Central (1/3)

NON-EXHAUSTIVE

#	Project	Total capacity (MVA)	Note
I	**Period to 2025**		
1	Lao Bao (Huong Hoa) (*)	900	New construction, RE source synchronized
2	Quang Tri 2 switching station	Switching station	Construction of new switching station, transition of circuit 3 and 4 (Quang Trạch – Doc Soi)
3	Quang Tri	900	New construction
4	Thanh My	1200	Improvement, capacity upgrade
II	**Period 2026 – 2030**		
1	Lao Bao (Huong Hoa) (*)	1800	Improvement, capacity upgrade
2	Quang Tri	1800	Improvement, capacity upgrade
3	Da Nang	1800	Improvement, capacity upgrade
4	Pleiku	2700	Improvement, capacity upgrade, absorption of RE capacity of Gia Lai, Kon Tum provinces

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Substation projects in the pipeline (500 kV) – Central (2/3)

NON-EXHAUSTIVE

#	Project	Total capacity (MVA)	Note
III	**Period 2031 – 2035**		
1	Quang Binh (Le Thuy) (*)	900	New construction, absorption of RE capacity
2	Huong Thuy	900	New construction
3	Da Nang 2	900	New construction
4	Tam Thang	900	New construction
IV	**Period 2036 – 2040**		
1	Quang Binh (Le Thuy) (*)	1800	Improvement, capacity upgrade, absorption of RE capacity
2	Kon Ray (*)	1800	Improvement, capacity upgrade, implementation progress subjected to the development RE sources
3	Kon Tum (*) (**)	900	Installation of devices in the switching station, implementation progress subjected to the development of mini hydropower and RE sources
4	Dak Lak 1 wind power plant (*) (**)	180	Improvement, capacity upgrade, synchronized development of RE sources

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Substation projects in the pipeline (500 kV) – Central (3/3)

NON-EXHAUSTIVE

#	Project	Total capacity (MVA)	Note
V	**Period 2041 – 2045**		
1	Doc Soi	1800	Improvement, capacity upgrade
2	Huong Thuy	1800	Improvement, capacity upgrade
3	Da Nang 2	1800	Improvement, capacity upgrade
4	Tam Thang	1800	Improvement, capacity upgrade

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Substation projects in the pipeline (500 kV) – South (1/3)

NON-EXHAUSTIVE

#	Name of substation	Total capacity (MVA)	Note
I	**Period up to 2025**		
1	Ninh Son	1800	New construction, RE capacity absorption. Recommendation: to design a substation which allows flexible operation, busbar segments supporting different operation modes.
2	Cu Chi	1800	New construction
3	Tay Ninh 1	1800	New construction
4	Binh Duong 1	900	New construction
II	**Period 2026 – 2030**		
1	Son My	900	New construction
2	Hong Phong	1800	New construction, RE capacity absorption
3	Tay Ninh 2	1800	New construction
4	Tien Giang	900	New construction

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Substation projects in the pipeline (500 kV) – South (2/3)

NON-EXHAUSTIVE

#	Name of substation	Total capacity (MVA)	Note
III	**Period 2031 2035**		
1	Da Phuoc	1800	New construction. Recommendation: to design a substation which allows flexible operation, busbar segments supporting different operation modes.
2	Thu Duc city	1800	New construction. Recommendation: to design a substation which allows flexible operation, busbar segments supporting different operation modes.
3	Binh Duong 2	900	New construction
4	Long Dien	900	New construction
IV	**Period 2036 – 2040**		
1	Dong Nai 3	900	New construction
2	Cu Chi	2700	Upgradation, capacity improvement
3	Da Phuoc	2700	Upgradation, capacity improvement
4	Thu Duc city	2700	Upgradation, capacity improvement

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Substation projects in the pipeline (500 kV) – South (3/3)

NON-EXHAUSTIVE

#	Name of substation	Total capacity (MVA)	Note
V	**Period 2041 – 2045**		
1	Tay Ninh 2		Upgradation, capacity improvement
2	Binh Duong 2		Upgradation, capacity improvement
3	Dong Nai 3		Upgradation, capacity improvement
4	Duc Hoa 2		Upgradation, capacity improvement

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Substation projects in the pipeline (220 kV) – North (1/3)

NON-EXHAUSTIVE

#	Substation	Total capacity (MVA)	Note
I	**Period to 2025**		
1	Xuan Mai	500	Improvement, capacity increase
2	Van Tri	750	Improvement, capacity increase
3	Long Bien	750	Improvement, capacity increase
4	Me Linh	500	New construction
II	**Period 2026 – 2030**		
1	Soc Son 2	500	New construction
2	Phu Xuyen	500	New construction
3	Van Dien	750	Improvement, capacity increase
4	Long Bien 2 (Gia Lam)	750	Improvement, capacity increase

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Substation projects in the pipeline (220 kV) – North (2/3)

NON-EXHAUSTIVE

#	Substation	Total capacity (MVA)	Note
III	**Period 2031 – 2035**		
1	Ung Hoa	750	Improvement, capacity increase
2	West Ha Noi	750	Improvement, capacity increase
3	Dan Phuong	750	Improvement, capacity increase
4	Dong Anh 2	500	New construction
IV	**Period 2036 – 2040**		
1	Hoa Lac	750	Improvement, capacity increase
2	Soc Son	750	Improvement, capacity increase
3	Thuong Tin	750	Improvement, capacity increase
4	Thanh Cong	750	Improvement, capacity increase

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Substation projects in the pipeline (220 kV) – North (3/3)

NON-EXHAUSTIVE

#	Substation	Total capacity (MVA)	Note
V	**Period 2041 – 2045**		
1	Xuan Mai	750	Improvement, capacity increase
2	Dong Anh	750	Improvement, capacity increase
3	Me Linh	750	Improvement, capacity increase
4	Soc Son 2	750	Improvement, capacity increase

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Substation projects in the pipeline (220 kV) – Central (1/2)

NON-EXHAUSTIVE

#	Project	Total capacity (MVA)	Note
I	**Period to 2025**		
1	Dong Hoi	375	Improvement, capacity upgrade
2	Da Bon	375	Improvement, capacity upgrade
3	Dong Ha	375	Improvement, capacity upgrade
4	Lao Bao	500	New construction
II	**Period 2026-2030**		
1	Huong Thuy (Phu Loc)	250	New construction
2	Lien Chieu	250	New construction
3	Da Nang Airport	250	New construction
4	Hai Chau	500	Improvement, capacity upgrade
III	**Period 2031-2035**		
1	Le Thuy	250	New construction
2	Dong Hoi	500	Improvement, capacity upgrade
3	Ba Don	500	Improvement, capacity upgrade
4	Quang Binh I RE collector station (*)	250	New construction, RE sources synchronized

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Substation projects in the pipeline (220 kV) – Central (2/2)

NON-EXHAUSTIVE

#	Project	Total capacity (MVA)	Note
IV	**Period 2036-2040**		
1	Le Thuy	500	Improvement, capacity upgrade
2	Bo Trach	250	New construction
3	Quang Binh 1 RE collector station (*)	500	Improvement, capacity upgrade subject to the development of RE sources
4	Quang Binh 2 RE collector station (*)	250	New construction, RE source synchronized
V	**Period 2041-2045**		
1	Ang Son	250	New construction
2	Bo Trach	500	Improvement, capacity upgrade
3	Quang Binh 2 RE collector station (*)	500	Improvement, capacity upgrade subject to the development of RE sources
4	Vinh Linh	250	

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Substation projects in the pipeline (220 kV) – South (1/3)

NON-EXHAUSTIVE

#	Name of substation	Total capacity (MVA)	Note
I	**Period up to 2025**		
1	Da Nhim 220 kV switching substation	Switching substation	New construction, RE capacity absorption as Da Nhim 220 kV substation's 220 kV feeder cannot be expanded
2	Ca Na	250	New construction
3	Ham Thuan Nam	500	New construction
4	Thai Hoa 220 kV switching substation (*)	Switching substation	New construction, RE capacity absorption
II	**Period 2026-2030**		
1	Ta Nang (RE collector) (*) (**)	250	New construction, RE capacity absorption, faster progress compared to baseline scenario
2	Tay Bac Cu Chi	250	New construction, Recommendation: to design a substation which allows flexible operation, busbar segments
3	Phu Hoa Dong	250	New construction
4	Binh Chanh 2	500	Recommendation: to design a substation which allows flexible operation, busbar segments

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Substation projects in the pipeline (220 kV) – South (2/3)

NON-EXHAUSTIVE

#	Name of substation	Total capacity (MVA)	Note
III	**Period 2031-2035**		
1	Da Lat	250	New construction
2	Phuoc Dinh	750	New construction, RE capacity absorption in Ninh Thuan province
3	Thanh Hai (*)	750	New construction, RE capacity absorption in Ninh Thuan province
4	Hong Liem (*)	500	New construction, RE capacity absorption in Binh Thuan province
IV	**Period 2036-2040**		
1	Tanh Linh	250	New construction
5	Cu Chi 2	500	New construction
6	Tan Chau 2	250	New construction
7	Go Dau	250	New construction

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

Substation projects in the pipeline (220 kV) – South (1/3)

NON-EXHAUSTIVE

#	Name of substation	Total capacity (MVA)	Note
V	Period 2041-2045		
1	Da Lat 2	500	New construction
2	Nha Be 2	500	New construction
3	Thu Duc 2	500	New construction
4	Dong Phu	250	New construction

Source: Vietnam National Power Development Plan 8 2023, Arthur D. Little analysis

9. 電力料金

電力小売価格は政府によって厳しく規制

NON-EXHAUSTIVE

	Policy Name	Policy Targets on Electricity Retail Prices
2023	Decision No.1062/QĐ-BCT	• Increase in the average retail electricity price to VND 1,920.3732 per kWh (exclusive of VAT), to cover rising costs of production
2013	Decision No. 69/2013/QD-TTg	• If cost increase <7%, EVN can recover the cost in the next tariff adjustment; if between 7%–10% and still within the approved tariff range, the increase must be approved by the MOIT. Cost increases >10% or beyond the established range for average tariffs require the Prime Minister's approval. • Revised retail tariffs are calculated every 6 months instead of every 3 months
2013	Decision No. 2165/QD-TTg	• Retail tariff between $6.81 cents-$8.70 US cents/kWh. Any adjustment to this bracket due to cost fluctuations will be decided by the MOIT, Ministry of Finance, and PM
2011	PDP VII	• Prices increase gradually to $8–9 US cents/kWh to cover long-term marginal cost of the system by 2020

Electricity retail prices are recommended by the Ministry of Industry and Trade, before requiring approval by the Prime Minister

Source: International Trade Administration (United States of America) 2022, Vietnam Electricity Corporation 2023, Arthur D. Little analysis

電力小売価格は、電力消費グループのプロファイルと消費期間に基づいて区別される（1/2）

Retail electricity tariff for manufacturers

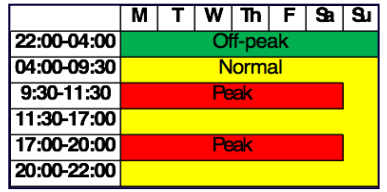
May 2023

Voltage of 110kV and above	Rate, VND/kWh	Rate, USD/kWh
a) Standard hour	1,584	0.07
b) Off-peak hour	999	0.04
c) Peak hour	2,844	0.12
Voltage of 22kV - 110kV		
a) Standard hour	1,604	0.07
b) Off-peak hour	1,037	0.04
c) Peak hour	2,959	0.12
Voltage of 6kV - 22kV		
a) Standard hour	1,661	0.07
b) Off-peak hour	1,075	0.05
c) Peak hour	3,055	0.13
Voltage of <6kV		
a) Standard hour	1,738	0.07
b) Off-peak hour	1,133	0.05
c) Peak hour	3,171	0.12

Retail electricity tariff for admin. offices

May 2023

Hospitals, nurseries, kindergartens, schools	Rate, VND/kWh	Rate, USD/kWh
Voltage of 6kV and above	1,690	0.07
Voltage of <6kV	1,805	0.08
Public lighting, administrative units		
Voltage of 6kV and above	1,863	0.08
Voltage of <6kV	1,940	0.08



Note: Data as of May 2023, Exchange rate used: 1 VND to 0.000042 USD
Source: Vietnam Electricity Corporation 2023

電力小売価格は、電力消費グループのプロファイルと消費期間に基づいて区別される（2/2）

Retail electricity tariff for businesses

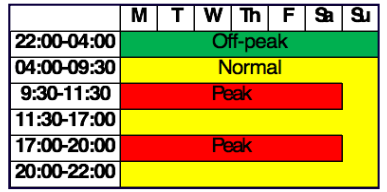
May 2023

Voltage of 22kV and above	Rate, VND/kWh	Rate, USD/kWh
a) Standard hour	2,516	0.11
b) Off-peak hour	1,402	0.06
c) Peak hour	4,378	0.18
Voltage of 6kV - 22kV		
a) Standard hour	2,708	0.11
b) Off-peak hour	1,594	0.07
c) Peak hour	4,532	0.19
Voltage of <6kV		
a) Standard hour	2,746	0.12
b) Off-peak hour	1,671	0.07
c) Peak hour	4,724	0.20

Retail electricity tariff for households

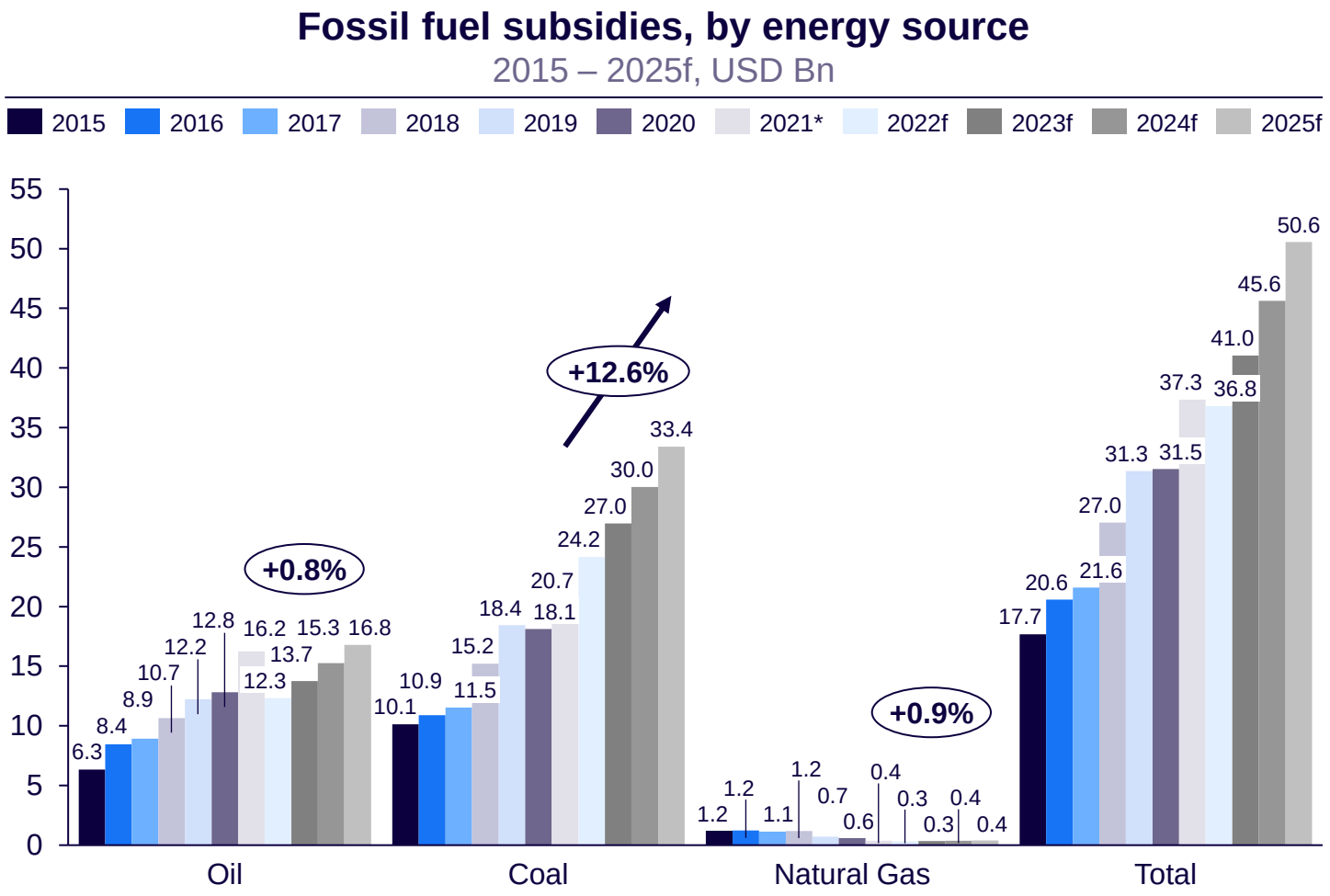
May 2023

Retail price for household electricity	Rate, VND/kWh	Rate, USD/kWh
Rate 1: For the kWh from 0 – 50	1,728	0.07
Rate 2: For the kWh from 51 – 100	1,786	0.08
Rate 3: For the kWh from 101 – 200	2,074	0.09
Rate 4: For the kWh from 201 – 300	2,612	0.11
Rate 5: For the kWh from 301 – 400	2,919	0.12
Rate 6: For the kWh from 401 onwards	3,015	0.13
Retail price for household electricity via prepaid card meter	2,535	0.11



Note: Data as of May 2023, Exchange rate used: 1 VND to 0.000042 USD
Source: Vietnam Electricity Corporation 2023

短期的には石炭への補助金が増えていくが2030年をピークに減少していく見込み



Description

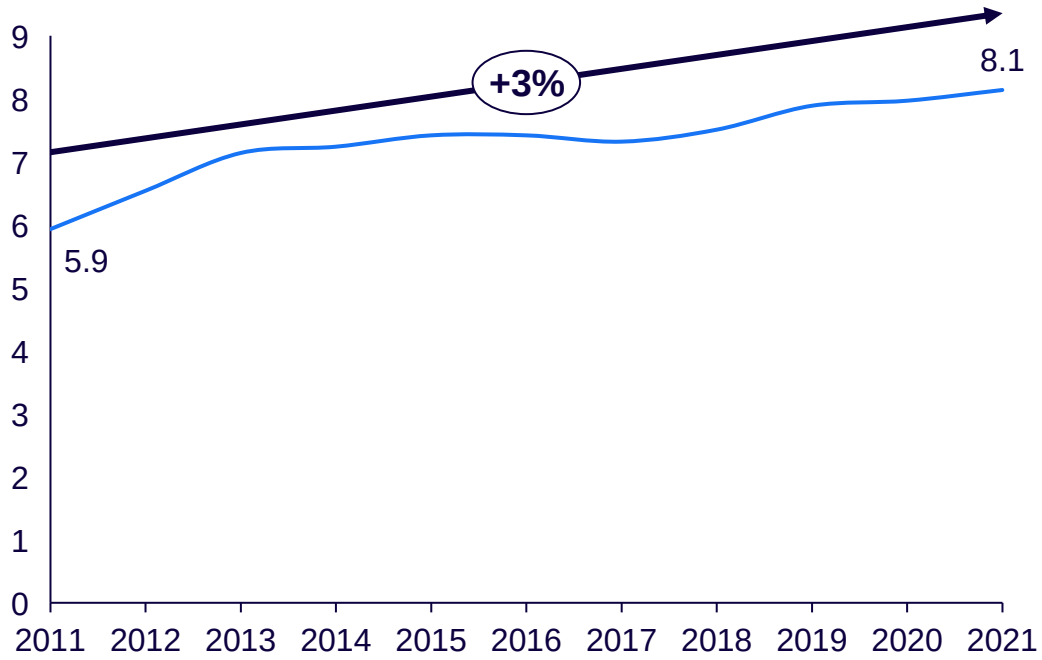
- With coal being the most consumed primary energy source at ~50%, it comes as no surprise that it accounts for >55% of all fossil fuel subsidies in 2021, expecting to grow at a CAGR of 12.6%, from USD 20.7 bn to USD 33.4 bn in 2025, at which it would account for >65% of all fossil fuel subsidies
  - This runs true with the estimated increase in coal dependency in the short run, in alignment with the USD 15.5 bn international financing it will receive to help transition away from coal**, after peaking in 2030**
- This comes as no surprise in contrast to oil and natural gas which are trailing almost insignificantly at 0.8% and 0.9% respectively for the period 2021 – 2025, due to decreased overall dependence on these fuel sources for energy

Source: International Monetary Fund 2021, Multiple news sources, Arthur D. Little analysis

ベトナムの平均電力小売価格は前年同期比で上昇しているものの、ASEAN諸国と比較すると依然として低い水準にある

Average electricity retail price

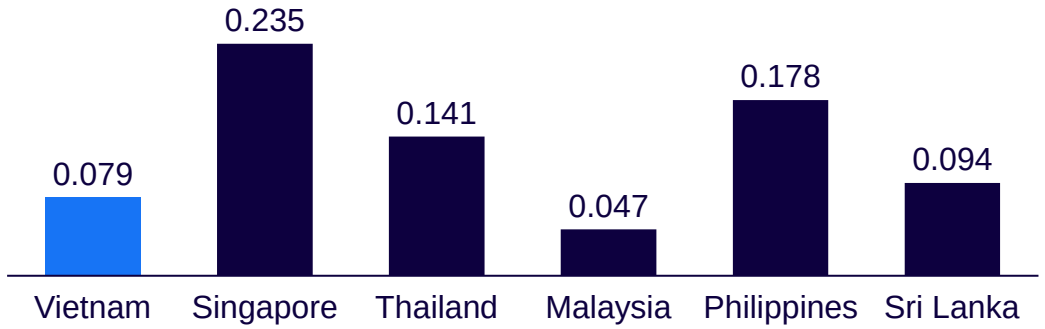
2011 – 2021, US cents/kWh



Vietnam's average electricity retail price has witnessed a **CAGR of 3.2%** for the period 2011 - 2021

Household electricity retail prices in ASEAN[1]

Dec 2022, USD/kWh



Vietnam's average electricity retail price is **relatively low among selected ASEAN countries**

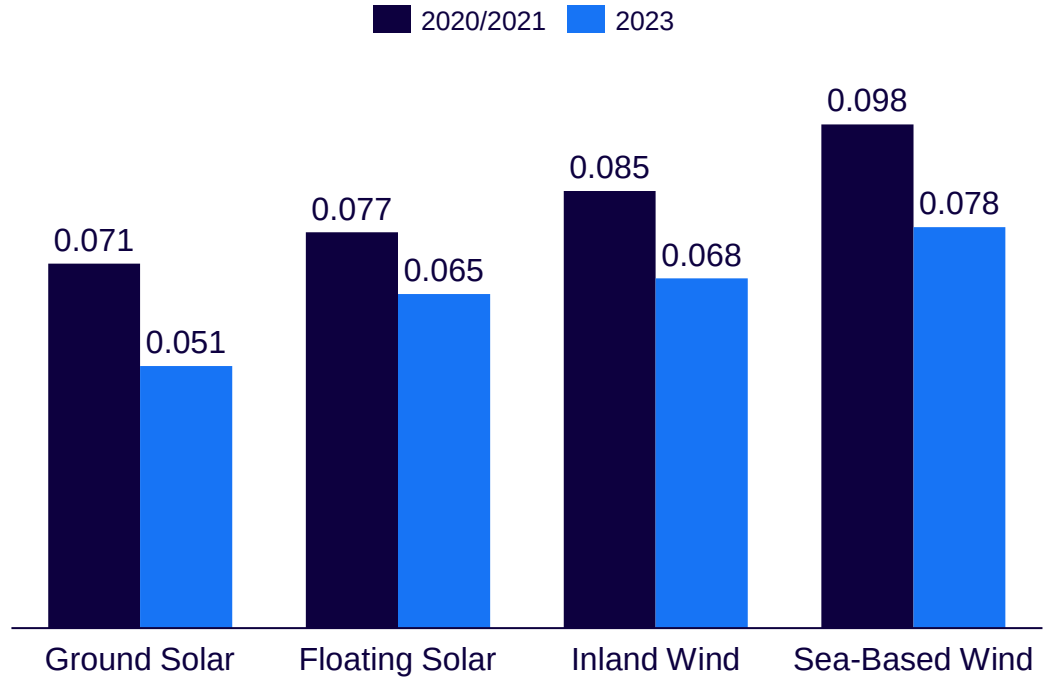
- Vietnam's average **electricity prices have risen** in tandem with **rising costs of production**, a global trend
- Despite this, it remains relatively affordable, compared to regional ASEAN counterparts

Note: (1) Prices for households referenced, for selected ASEAN countries
Source: Statista 2023, Vietnam Electricity Corporation 2022, Global Petrol Prices 2023, Arthur D. Little analysis

太陽光発電や風力発電の固定価格買取制度（FiT）は、2023年前年比減少している

Change in FiT, solar and wind

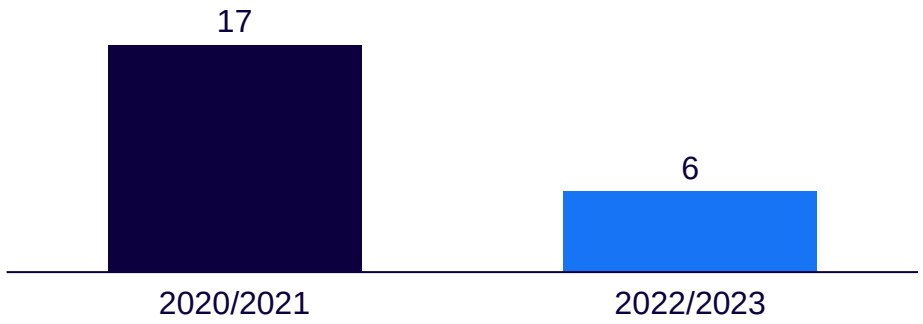
2020/2021 – 2023, USD/kWh



Electricity from solar and wind sources **remains cost-competitive against alternatives**, with coal power costing US$0.17/kWh

Renewable Capacity Additions,

2020/2021 – 2022/2023, GW



Previously, Vietnam set relatively **generous solar/wind FiT** rates to **attract investment**. The recent fall in FiT rates has contributed to a **decline in renewable capacity additions**

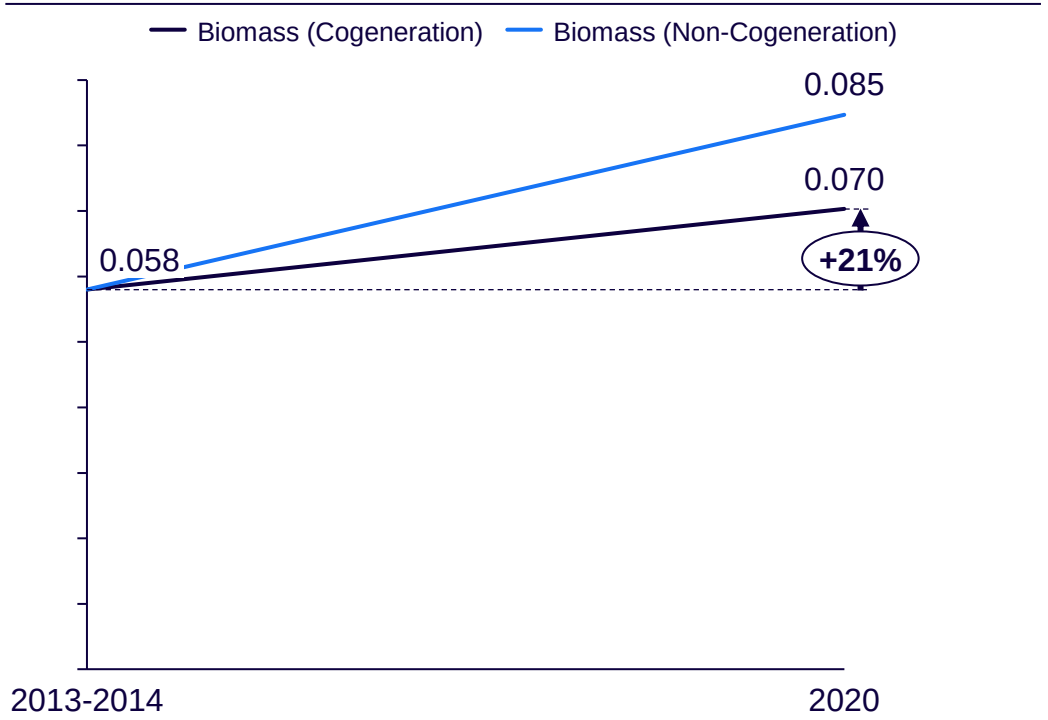
- FiT rates often decline with time:
  - To **cater for increased capacity and lower costs of production**, as technology matures
  - To reduce governmental budgetary pressure

Note: Data as of May 2023, Exchange rate used: 1 VND to 0.000042 USD
Source: Vietnam Electricity Corporation 2023

バイオマスFiTの引き上げは、2030年までに9,600MWのバイオマス発電を追加を促す重要施策

Change in FiT, biomass

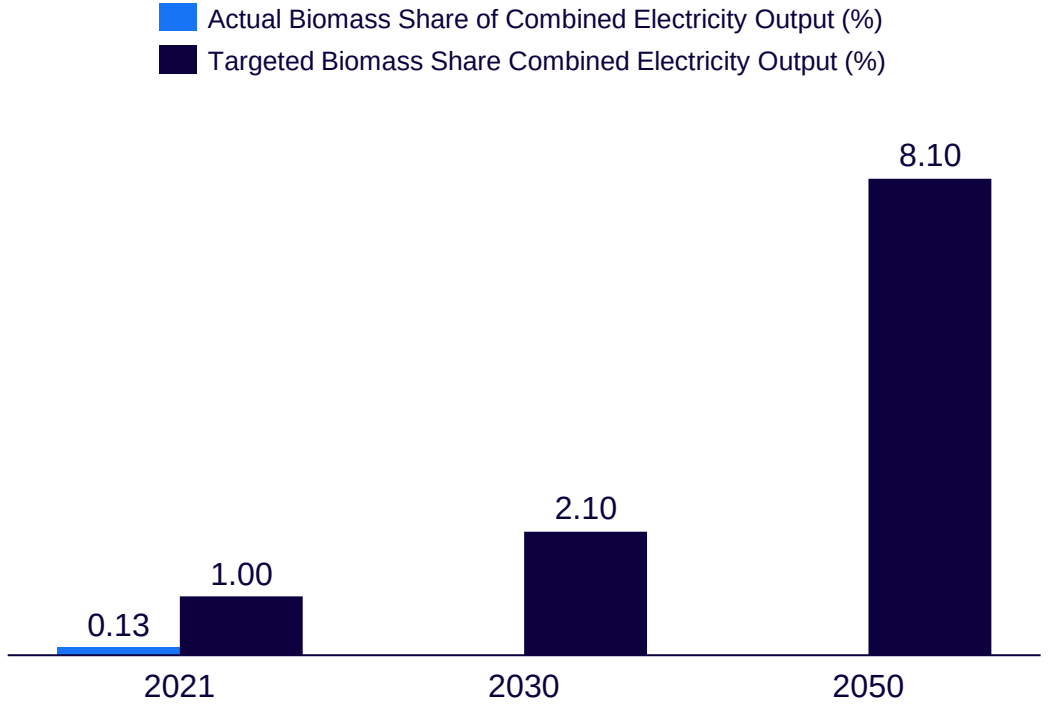
2013/2014 - 2020, USD/kWh



Between 2014 and 2020, the **FiT price of biomass power generation was significantly raised** by the Prime Minister's decision (No.8 / 2020 / QD-TTg)

Biomass share of electricity output

2021 – 2050, %



Increases in biomass FiT rates in Vietnam are to **support its vision to add 9,600 MW of power from biomass** by 2030, with further increases by 2050. Yet, **production is currently lagging**

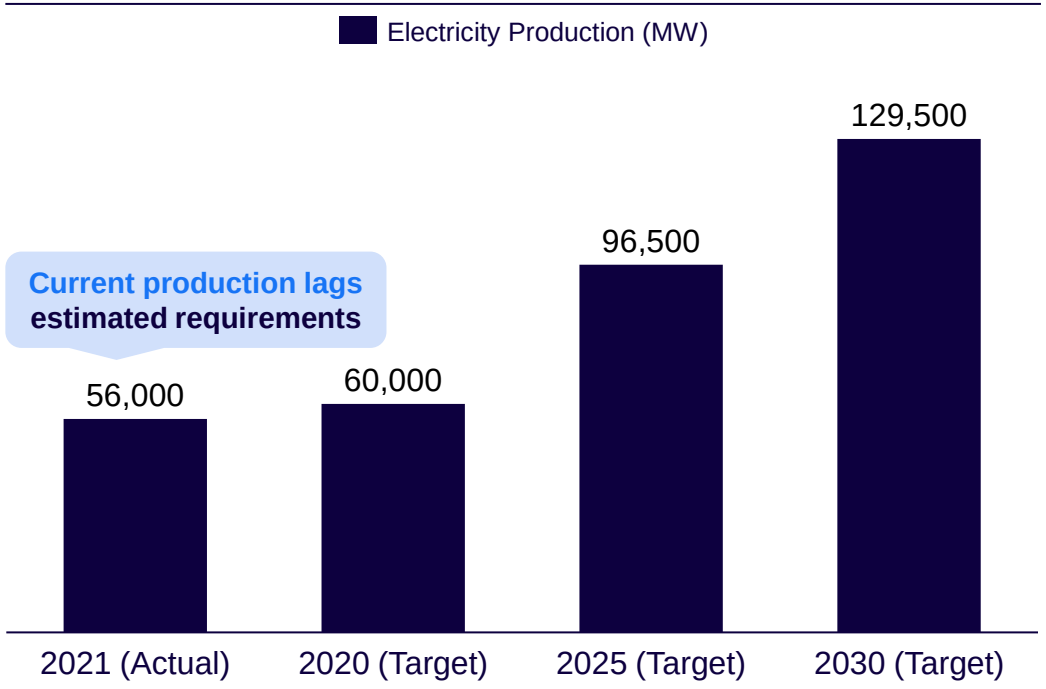
Source: Vietnam Investment Review 2022, Vietnam Plus 2022

10. 電力需給状況

現在のエネルギー生産レベルが必要量を下回っているため、今後、需給の不均衡に対処するための対処が必要

Projected energy production requirements

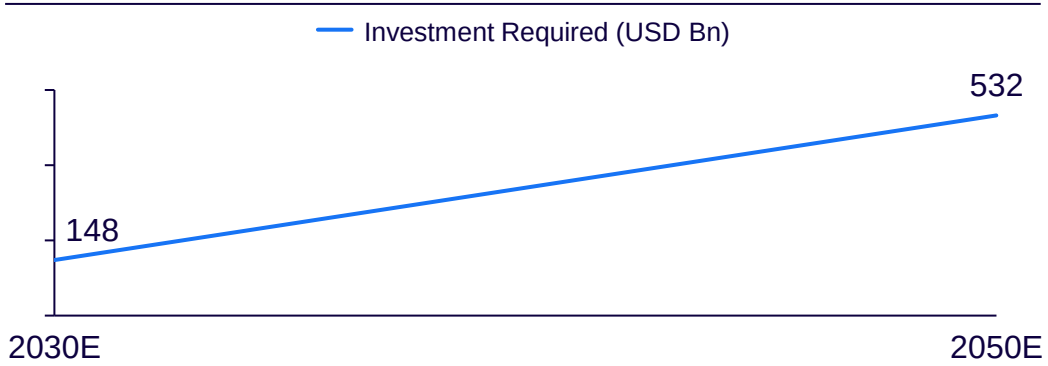
2020 - 2050, MW



To mitigate shortages and keep up with demand, **129,500 MW of electricity supply is estimated to be required by 2030.** However, **current progress is lagging**

Investment required in energy sector

2030 – 2050, USD Bn



Vietnam requires **significant investment in its energy sector** to address the supply-demand imbalance, with the **securing of private sector sources of funding critical**

- **Government funding is likely to be insufficien**t to plug the energy infrastructure funding gap in Vietnam
- Securing private investment will require a **significant transformation** of the Vietnamese legal and administrative landscape

Source: International Trade Administration 2022, Multiple news sources 2023, Arthur D. Little analysis

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