



ETP ROUNDTABLES –VIETNAM DEEP DIVE

# Overview of the Energy Sector & grid congestion in Vietnam

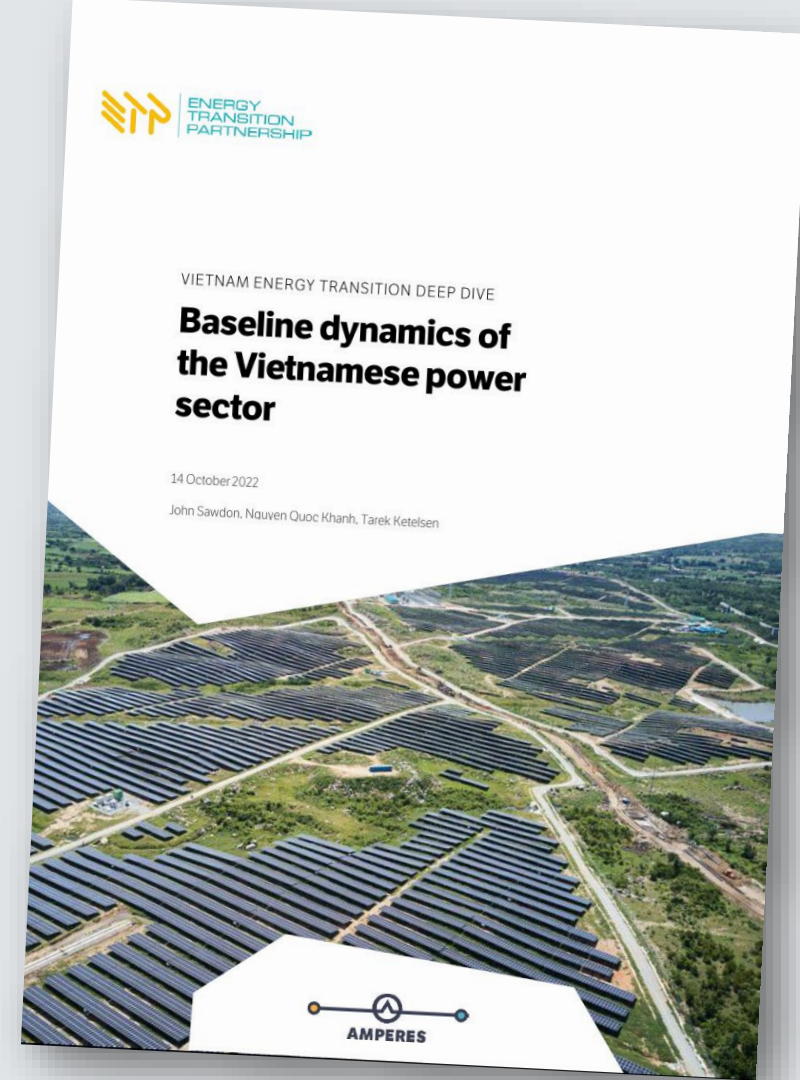
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**AMPERES**

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*Part 1 – Evolution of the Vietnamese power sector*

*Part 2 – grid congestions and RE curtailment challenges*



*Source of information: Sawdon, J. Nguyen, Q. K., Ketelsen, T. 2022. Vietnam Energy Transition Deep Dive: Baseline dynamics of the power sector. Ho Chi Minh City, Viet Nam. Australia – Mekong Partnership for Environmental Resources and Energy Systems (AMPERES). 42 pp.*

# Context

With the transition to a middle-income, industrial economy, Vietnam has become increasingly energy intensive, and increasingly reliant on electricity.

Ensuring energy supply, and power supply in particular, have been central prerequisites for rapid growth.

- Electricity consumption grew from 6.84 TWh in 1990 to 223.8 TWh by 2019, equivalent to an average annual growth rate of around 12.8% per year, almost double the rate of GDP growth.
- proportion of households with access to electricity expanded from approximately 10% in 1990 to over 99% in 2019.

This growth was enabled by a large capital investment program that has seen increasing involvement of the private sector

- Installed capacity 1,165 MW to 69,344 MW between 1986 and 2019.
- 220kV transmission lines 1,000 Km in 1985 to over 18,391 Km by 2019, and the development of over 8,496 Km of 500 kV

# Context

Despite the relative successes of Vietnam's power sector in enabling economic development and providing basic public services to a large majority of the population, it continues to face multiple challenges.

- Rapid demand growth,
- energy security
- sector financial sustainability
- attracting much needed investment to the sector
- market and governance reform.
- Ensuring energy affordability for various consumer groups,
- Managing the systematic transition to a low carbon power sector.



EVOLUTION OF THE POWER SYSTEM

# Arrival of electricity (pre-unification)

- Vietnam built its first electricity systems just 12 years after Thomas Edison turned on the world's first commercial electricity distribution system at the Pearl Street Station, New York.
- However, pre-reunification, electricity in Vietnam remained a niche service, reaching just 2.5% of the rural population and concentrated in the urban centres of Hanoi, Hai Phong and Saigon, as well as some industrial facilities.



EVOLUTION OF THE POWER SYSTEM

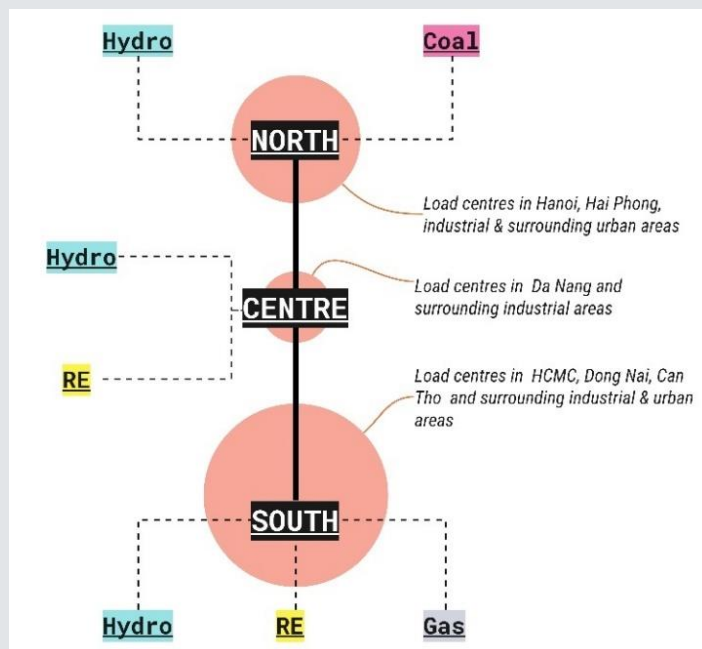
# Hydropower & the development of the national grid 1970s – 2000s

With technology and know-how from Eastern Europe and China, Vietnam exploited its abundant water resource endowment to advance a universal electricity access agenda through the development of hydropower.

- By 2000 most economically feasible large hydropower had been exploited and constituted 75% of installed capacity,
- two North-South 500kV transmission lines had been built,
- electricity had reached 80% of the total population

## EVOLUTION OF THE POWER SYSTEM

# Geographical structure of the power system



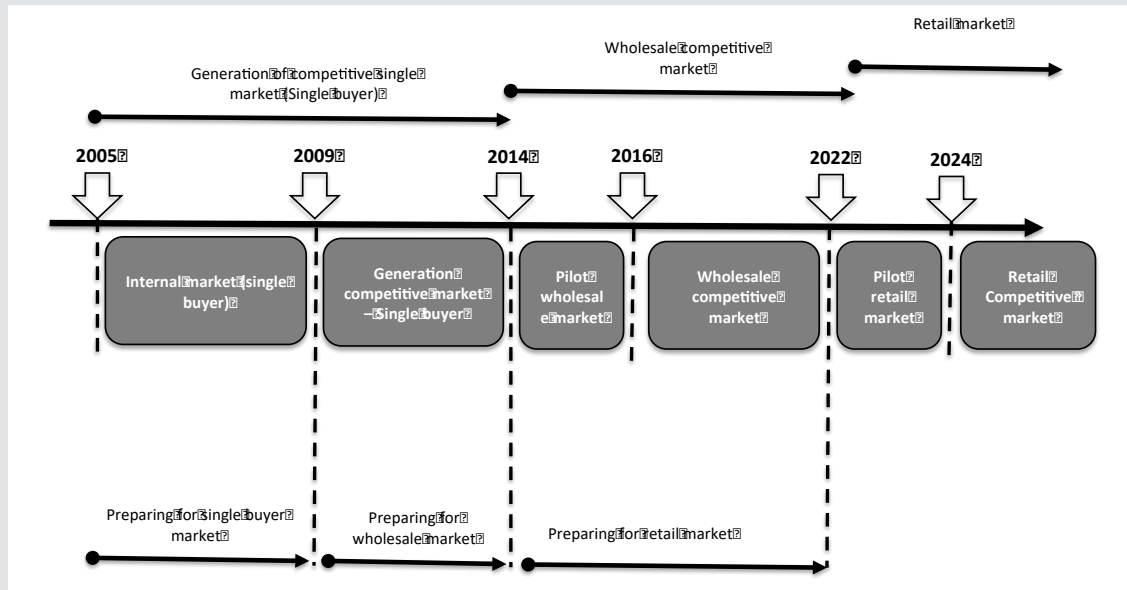
Surplus generation in the north transmitted to the larger load centres in the South.

- Hydro power plants are located predominantly in the North and Mid-Central regions
- gas turbine plants are based in the South (Nam Con Son basin and Malay-Tho Chu basin gas pipelines).
- Coal fired power plants were initially developed near coal reserves (predominately in the north) and later, as coal-generation began to rely on imports, close to major ports.

## EVOLUTION OF THE POWER SYSTEM

# Creation of EVN & sector reforms

### mid-90s – mid-2000s



Government of Vietnam (GoV) undertook major policy and regulatory reforms, which saw the creation of Electricity Vietnam as the State-owned Enterprise (SoE) responsible for electricity services and replacing the publicly owned national and subnational modalities.

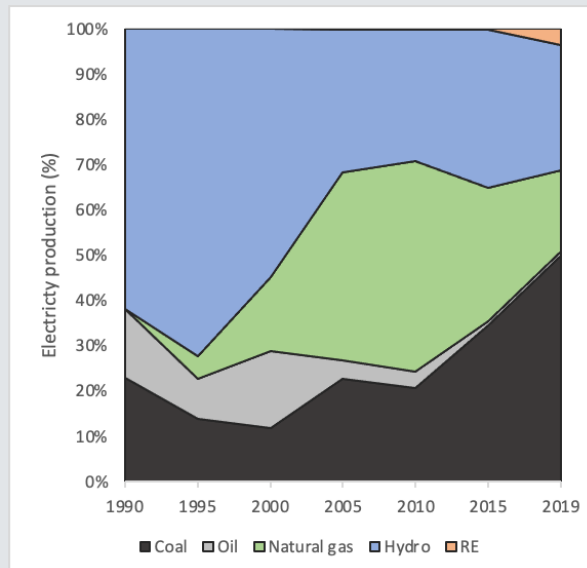
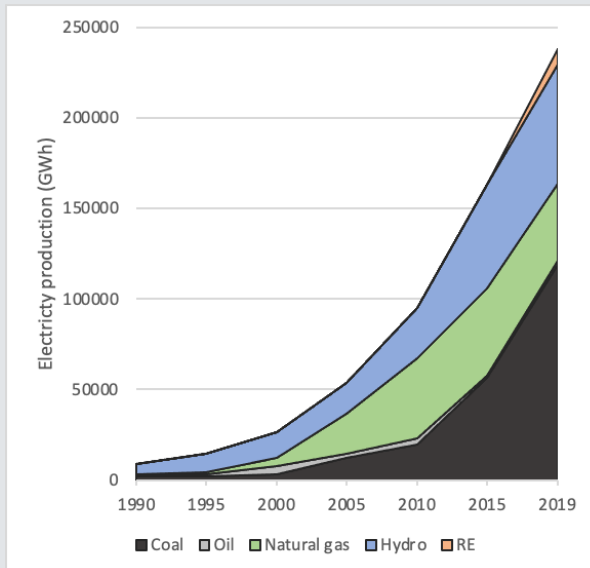
By mid-2000s

- EVN accounted for 76% of national generation capacity,
- Electricity Regulatory Authority of Vietnam (ERAV) had been established
- Vietnam's first national Electricity Law was passed (2004).
- The Electricity Law mandated a major transformation in the power system, including a roadmap for unbundling EVN and a long-term commitment to transition towards a competitive retail electricity market.



## EVOLUTION OF THE POWER SYSTEM

# Coal & keeping up with energy demand 2000s - 2015



Vietnam was approaching universal electricity access and meeting the rapidly increasing demand for electricity to support economic growth was an increasing priority.

Meeting demand was exacerbated by issues of load-shedding (mid to late 2000s) brought about by Vietnam's over-reliance on hydro and a number of dry climatic years.

With limited other options, EVN made a significant pivot towards fossil fuels.

- Between 2000 and 2018 the share of fossil fuels in power production increased from 45% to 65%.
- Between 2010 and 2015 the installed capacity for coal-fired power stations, tripled.
- Between 2015 – 2018, it doubled again.

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EVOLUTION OF THE POWER SYSTEM

# Fossil fuels & energy security 2015 - present

Since 2015 Vietnam has become a net energy importer due to the reliance on coal.

In addition, coal alone has not been capable of solving Vietnam's energy supply issue, many planned fossil-fuel power plants have suffered delays and cancellations

- Between 2016 – 2020 only 58% of the planned coal capacity was actually realized
- Delays in the development of fossil fuel plants is due to difficulties in securing finance, investment risks, unfavourable PPA structures, opposition from local communities and governments, and a global shift towards renewable energy.

Government of Vietnam looked to gas as an alternative to replace coal as a source of base-load generation (i.e., PDPVII)

- Gas has suffered similar delays across the supply chain from the development of gas fields, the infrastructure for storage and transport to the power stations for electricity production.



EVOLUTION OF THE POWER SYSTEM

# Fossil fuels & energy security 2015 - present

Maintaining a secure and reliable energy system will require investment in Vietnam's energy sector at an unprecedented scale :

- In the order of 130GWe of capacity is needed by 2030,
- requiring, in the order of USD150 billion in investment.

EVOLUTION OF THE POWER SYSTEM

# Introduction of solar and wind 2015 - present

2015 Vietnam begins to promote renewable energy development, due to:

- global trends in RE,
- the challenges facing gas and coal deployment,
- the power sectors urgent need for additional capacity and
- the country's abundance of RE resources

Vietnam's approach was to implement a FiT for Solar and Wind

- Utility Solar 8.85GW (2020)
- Roof top solar 7.78GW (2020)
- On-shore wind 3.98GW (2021)

**Table 9** | The FiT for grid-connected solar PV in 2017 - 2022<sup>46</sup>

Year	RTS* (USc/kWh)	SPP (USc/kWh)		Wind (USc/kWh)		Tariff duration (Years)	Note
		Floating	Ground	On-shore	Off-shore		
2011				7.8		20	Updated by Decision 39/2018/DQ-TTg (from 2019)
2017	9.35	9.35	9.35			20	Decision 11/2017/QD-TTg, until 20/6/2019
2019				8.5	9.8	20	Decision 39/2018/QD-TTg, until 1/11/2021
2020**	8.38	7.69	7.09			20	Decision 13/2020/QD-TTg (FIT 2), COD before 31/12/2020

## CURRENT STATUS OF POWER SYSTEM

# Current Electricity Generation mix

**Table 1** | Power production by technology 2020 (GWh): technology with the largest generation capacity is highlighted **BLUE**  
(Source: EVN 2021)

	2016	2017	2018	2019	2020	AAGR 2016-2020 (%)
<b>Hydropower</b>	<b>64,167</b>	<b>87,599</b>	<b>84,489</b>	66,542	73,382	3.4
<b>Coal fired</b>	63,974	62,613	83,845	<b>111,180</b>	<b>114,765</b>	15.7
<b>Gas and oil fired</b>	46,013	39,957	40,277	43,639	35,203	(6.5)
<b>Renewables</b>	364	400	935	6,100	12,060	139.9
<b>Imported</b>	2,716	2,345	2,762	3,313	3,059	3.0
<b>Total</b>	<b>177,234</b>	<b>192,914</b>	<b>212,308</b>	<b>230,774</b>	<b>238,469</b>	<b>7.7</b>

# Transmission assets

Transmission and distribution grids have been substantially upgraded over the last decade, but they remain under substantial pressure and in need of significant investment.

- 3 lines of 500 kV of which two are in operation and a third is currently under construction.
- 220 kV grid acts as regional transmission system.

Changing geographical location for generation plants is also causing congestion in distribution lines.

**Table 2** | Power production by technology 2020 (GWh)  
(Source: EVN 2021)

Items	Unit	2020
500 kV line	Km	8,527
500 kV transformer	MVA	42,900
220 kV line	km	18,477
220 kV transformer	MVA	67,824

# RE curtailment

Utility scale solar deployment has been concentrated in provinces with high solar irradiation and lower LCOE (e.g., Ninh Thuan and Binh Thuan in the South-Central Coast and Dak Lak in the Central Highlands).

Historically these areas had low power demand and so grid capacity is limited.

Estimated that 365 GWh of solar power was curtailed in 2020 to avoid overloading the grid

Expected that a further 1.3 billion TWh was curtailed in 2021.

# Committed RE investments & the expired FIT


Generous FIT and short eligibility windows led to a rapid expansion in RE.

COVID pandemic (and other factors) meant that not all projects met the FIT deadline,.

As of Nov 2021, 7,459MW wind projects signed a PPA with EVN

- 325MW began commercial operations (15projects)
- 3,655MW reached COD (69 projects)
- 3,479MW (62 projects) did not reach COD





Part 2 - ISSUES

# Solution for transition RE projects

Addressing this issue is a key issue for the  
Vietnamese power sector

- Investor confidence
- Financial sustainability of a number of private companies that have become strategically important for Vietnam's RE development.

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# Next step, solutions...