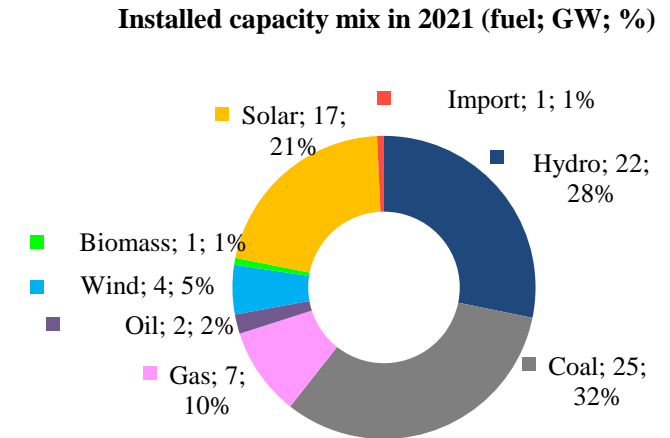
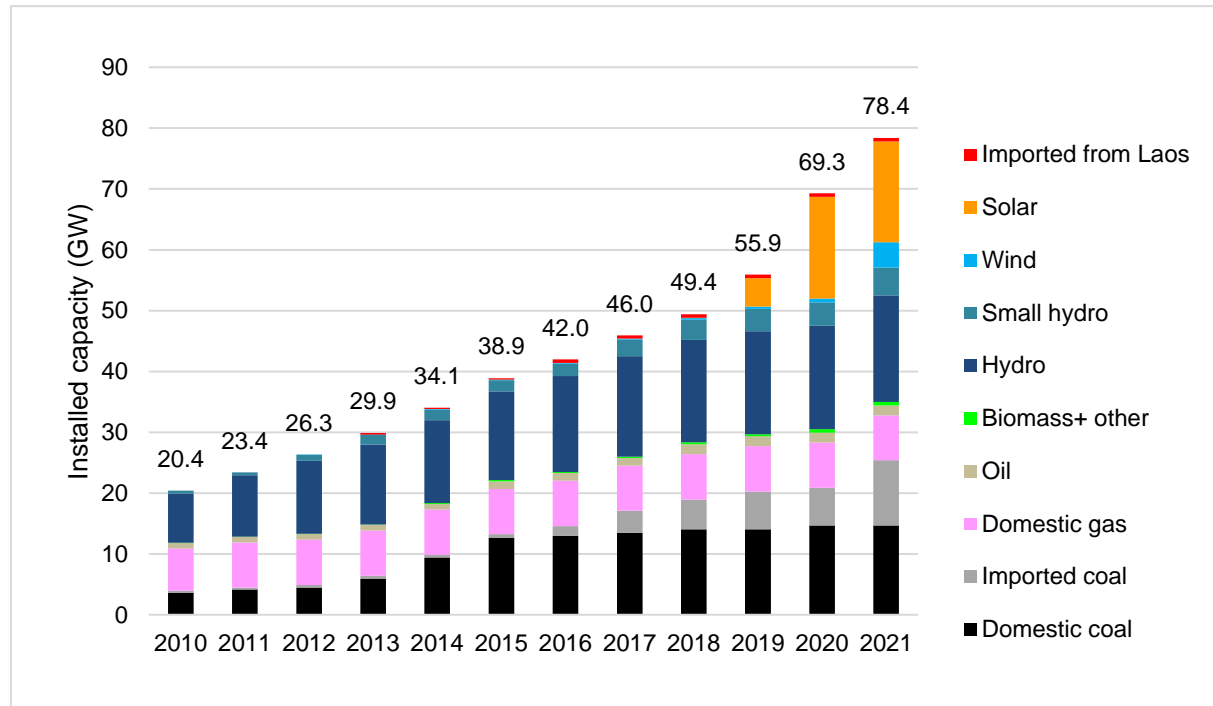


# **ROLE OF HYDROGEN IN POWER GENERATION DEVELOPMENT PLAN (PDP VIII)**

Hanoi, June – 2022



**Total install capacity in 2021 ~ 78.4 GW (North 27,9 GW (35,7%), Center 15,6 GW (20%) and South 34,5 GW (44,2%);**

**Wind: 4.1 GW, Farm solar: 8.9GW, Rooftop solar: 7.7 GW (26.5% VRE)**

**Coal power generation accounts for the largest proportion in the generation capacity structure**

**Pmax in 2021: 42.5 GW, North: 20.95GW, Center: 3.8GW, South: 20.1GW**

## Coal and natural gas thermal projects in PDP7R that can not remove from PDP8 because of legal problem

### Coal fired power plant projects in PDP7R that can not remove in PDP8

Item	Capacity (MW)	Progress according to PDP7 Revised	Update the progress
<b>1. North</b>	<b>1600</b>		
Nam Dinh TPP	2x600	2023	2026
Hai Ha I TPP – cogeneration	300	2019	2026
Duc Giang TPP– cogeneration	100	2022	2026
<b>2. North Central</b>	<b>3650</b>		
Vung Ang II TPP	2x600	2021-2022	2026
Quang Trach I	2x600	2021-2022	2024-2025
Cong Thanh TPP	1x600	2019	2025
Formosa Hà Tĩnh II – cogeneration	650	2020	2026
<b>3. Center Central</b>	<b>1200</b>		
Quang Tri I TPP	2x600	2023-2024	2028-2029
<b>4. South Central</b>	<b>3412</b>		
Van Phong I TPP	2x716	2022-2023	2023-2024
Vinh Tan III TPP	3x660	2022-2023	2028-2030
<b>5. South</b>	<b>3200</b>		
Long Phu I TPP	2x600	2019	2027
Song Hau II TPP	2x1000	2021-2022	2027-2028
Total committed capacity	13062		

**13 GW committed coal thermal projects**

### Gas fired power plant projects in PDP7R

Name of project (mine)	Capacity (MW)	Progress to PDP7 Revised	Update the progress
<b>Total</b>	<b>7240</b>		
Dung Quat I (CVX)	750	2023	2028
Dung Quat II (CVX)	750	2024	2028
Dung Quat III (CVX)	750	2026	2028
Mien Trung I (CVX)	750	2023	2029
Mien Trung II (CVX)	750	2024	2029
Quang Tri (Bao Vang-Center)	340	2024	2028
O Mon III (Block B)	1050	2020	2025
O Mon IV(Block B)	1050	2021	2025
O Mon II (Block B)	1050	2026	2026

LNG Project	Capacity (MW)	Progress to PDP7 Revised	Update the progress
<b>1. North</b>	<b>1500</b>		
LNG Quang Ninh I	1500	2026-2027	2027-2028
<b>2. Center Central</b>	<b>1500</b>		
LNG Hai Lang	1500	2025-2026	2028-2029
<b>3. South Central</b>	<b>6000</b>		
LNG Ca Na	1500	2025-2026	2028-2029
Son My II CCGT	2250	2023-2024	2026-2028
Son My I CCGT	2250	2026-2028	2028-2030
<b>4. South</b>	<b>8600</b>		
Nhon Trach 3&4 CCGT	1500	2021-2022	2024-2025
Bac Lieu CCGT	3200	2025-2027	2025-2032
LNG Hiep Phuoc I	1200	2021-2022	2023
LNG Long Son I	1200	2025-2026	2027-2028
LNG Long An I	1500	2025-2026	2027-2028

**7.2 GW committed domestic gas  
17.6 GW committed LNG CCGTs**

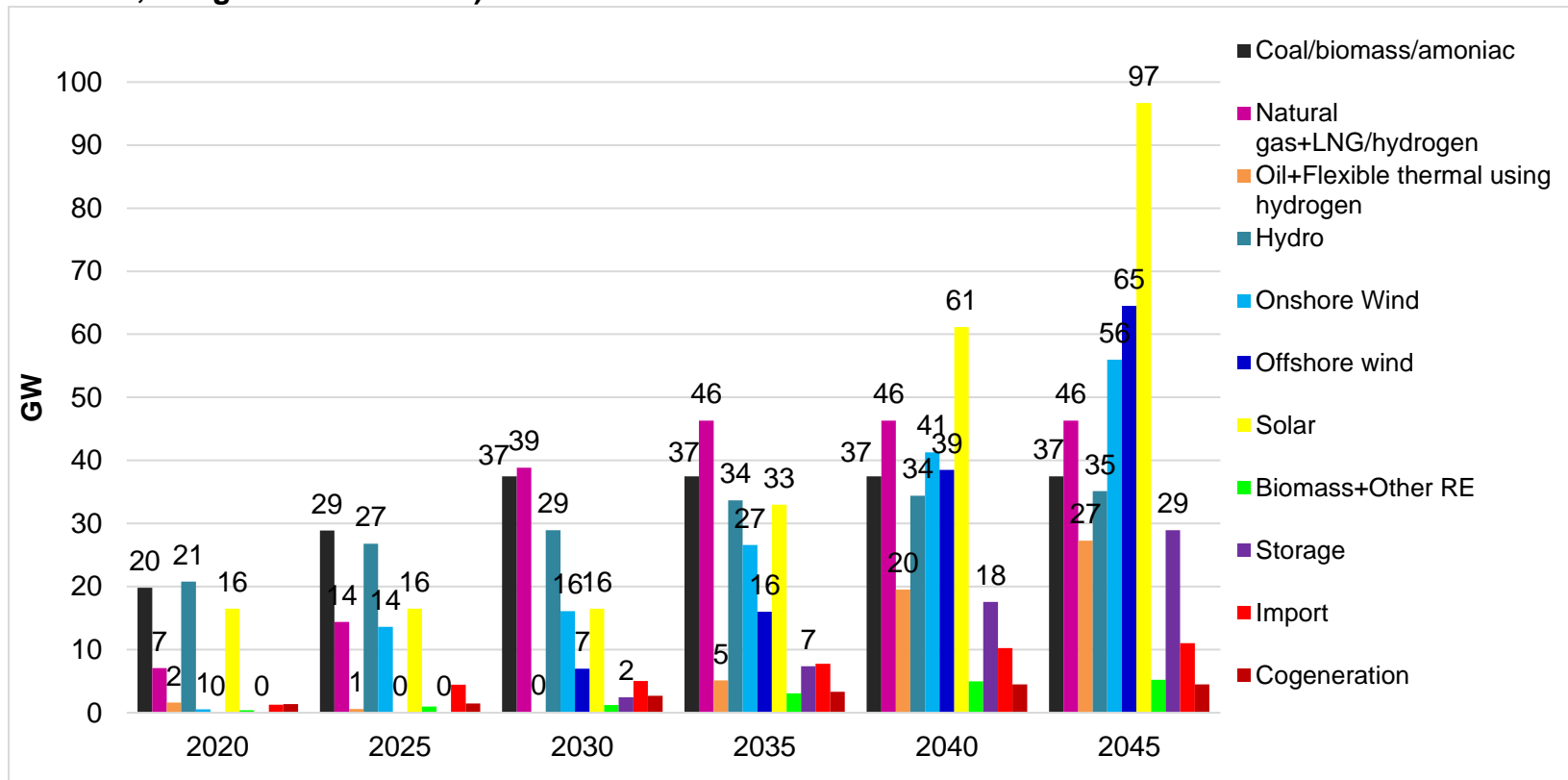
- Coal and gas thermal power projects that were in the revised PDP VII and already have investors cannot be eliminated due to legal issues.
- There has not been a consensus of the National Assembly on the issue of developing nuclear power sources
- The demand for electricity is forecasted to grow strongly in the Northern region, where renewable energy potential is low and economic efficiency is poor. While renewable energy sources have great potential in the South and Central regions
- The ability to further expand the inter-regional transmission grid from the South to the North is limited, due to limited land funds and the ability to build 1000-1500km long transmission lines.
- It is very difficult to solve the problems of social security for the workforce and financial problems of coal and gas thermal power plants when forcing these plants to stop operating.
- Limited potential to build CCS system (only have potential to store more than 20 million tons of CO<sub>2</sub>/year in exploited oil and gas fields in the Southeast region)



The conversion of fuel for coal and gas thermal power plants to using biomass, ammonia and hydrogen is the chosen solution in PDP VIII to handle with the above difficulties.

# EXECUTIVE SCALE ABOUT POWER GENERATION CAPACITY IN PDP8 ( VERSION APRIL 2022)

- This option includes a 15% reserve for the additional power source scale in the 2021-2030 period of the high load - energy conversion scenario, corresponding to 85% of the planning implementation rate for high load in period 2021- 2030.
- The added power generation capacity is also meaningful to reserve in case some coal-fired thermal power plants that can not operate in the period up to 2030 (including Nam Dinh -1200 MW, Cong Thanh -600 MW, Quang Tri -1200 MW, Vinh Tan III -1800 MW, Song Hau II -2000 MW).



Content	Installed capacity(GW)					
	2020	2025	2030	2035	2040	2045
Pmax (GW) – high demand scenario	38.7	61.4	93.3	128.8	162.9	189.9
Total installed capacity(GW)	69.3	107.6	156.4	219.6	315.9	413.1
Total installed capacity(without rooftop solar and cogeneration)	60.2	98.4	145.9	208.4	298.2	387.9

- Coal-fired thermal power sources will have to gradually switch to using biomass or ammonia (gradually increasing the proportion of combustion) and switch to using this fuel after 30 years of operation. Coal-fired power plants will start burning with biomass or ammonia (from 20%) after 20 years of operation. For plants that have not reached the end of their economic life by 2050, it is necessary to accelerate the fuel conversion process to be able to switch fuel completely by 2050.
- LNG gas thermal power source will also gradually switch to using hydrogen (gradually increasing the proportion of combustion) and completely switch to using hydrogen after 20 years of operation. After 10 years of operation, LNG gas thermal power plants will have to start burning with hydrogen (from 20%).
- For existing thermal power sources, if their economic life ends before 2035, they will start burning with biomass, ammonia or hydrogen from 2028, gradually increasing the rate of burning with the following years, until 2035, they will turn completely. switch to using fuel that does not emit CO<sub>2</sub>.
- For domestic gas-using power sources, according to the principle of autonomy in electricity production, priority is to be given to using up all the domestically-exploited gas that can be supplied for electricity production. When necessary (not enough domestic gas) will be burned with hydrogen fuel

## + Potential of using biomass for generation electricity:

According to the National Biomass Power Development Plan for the period to 2025, with a vision to 2035, established by the Institute of Energy in 2017, the potential of biomass for electricity production is about 40 million tons/year. Total biomass potential for electricity production can supply for about 2.5GW of new-build biomass power source and about 4GW of CFB coal-fired power source to convert fuel completely to biomass.

The remaining coal-fired power plants will have to gradually switch to using ammonia.

## + Potential of using ammoniac and hydrogen for generation electricity:

- Supply green ammoniac and hydrogen from domestic production from wind and solar: With large potential offshore wind (165GW), beside supply directly electricity for power system, remain capacity or curtailment portion of VRE can be used to product hydrogen.
- Import from foreign country if the price is more competitive. Example: Australia's energy export plan in the future: will not export coal and gas, but switch to exporting hydrogen, ammonia and exporting electricity from renewable energy sources

*High demand scenario – normal water frequency*

Year	Heat rate	2025	2030	2035	2040	2045
Domestic coal (Million ton)	4,800 (kcal/kg)	37,7	40,0	35,8	27,6	10,1
Imported coal (Million ton)	6,000 (kcal/kg)	26,6	51,9	48,4	44,0	30,1
Domestic gas (billion m3)	8,600 kcal/m3	8,5	10,6	7,7	7,7	7,7
Imported LNG (Million ton)	(41MJ/m <sup>3</sup> -HHV)	2,1	11,8	21,6	17,5	11,3
Hydrogen (Million ton)	120 (MJ/kg)	0,0	0,4	1,8	6,4	10,6
Biomass (Million ton)	3000 (kcal/kg)	1,5	7,2	20,7	29,6	36,2
Ammoniac (Million ton)	18,6 (MJ/kg)	0	0,2	6,3	20,8	56,3



**1. PDP VIII has set great ambitions on the use of Hydrogen and ammonia for power generation in current and projected coal-fired power plants and CCGTs in order to reduce CO2 emissions.**

- From 2028, about 7.1GW CCGTs of Phu My, Ba Ria, Nhon Trach I & II and Ca Mau gas plants will start co-firing with 10% hydrogen. By 2035, these plants will switch entirely to use hydrogen.
- By 2030, there will be about 1600MW of coal-fired power plants co-firing with biomass and about 4000MW of coal-fired power plants co-firing with ammonia
- By 2050, there will be about 33GW of thermal power plants using ammonia, 38 GW of CCGTs using hydrogen.

**2. Green hydrogen is also used in flexible thermal power plants (ICE, SCGT) for backup to ensure system reliability and operational backup for wind and solar power: In 2030, there will be about 200MW , by 2045 the scale will be up to 27 GW**

# Thank you !

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