



EVN

TRUNG TÂM ĐIỀU ĐỘ
HỆ THỐNG ĐIỆN QUỐC GIA

MANAGING GRID OPERATION WITH HIGH RE SOLAR PENETRATION



Member of JIS Register (Holdings) Ltd

8327

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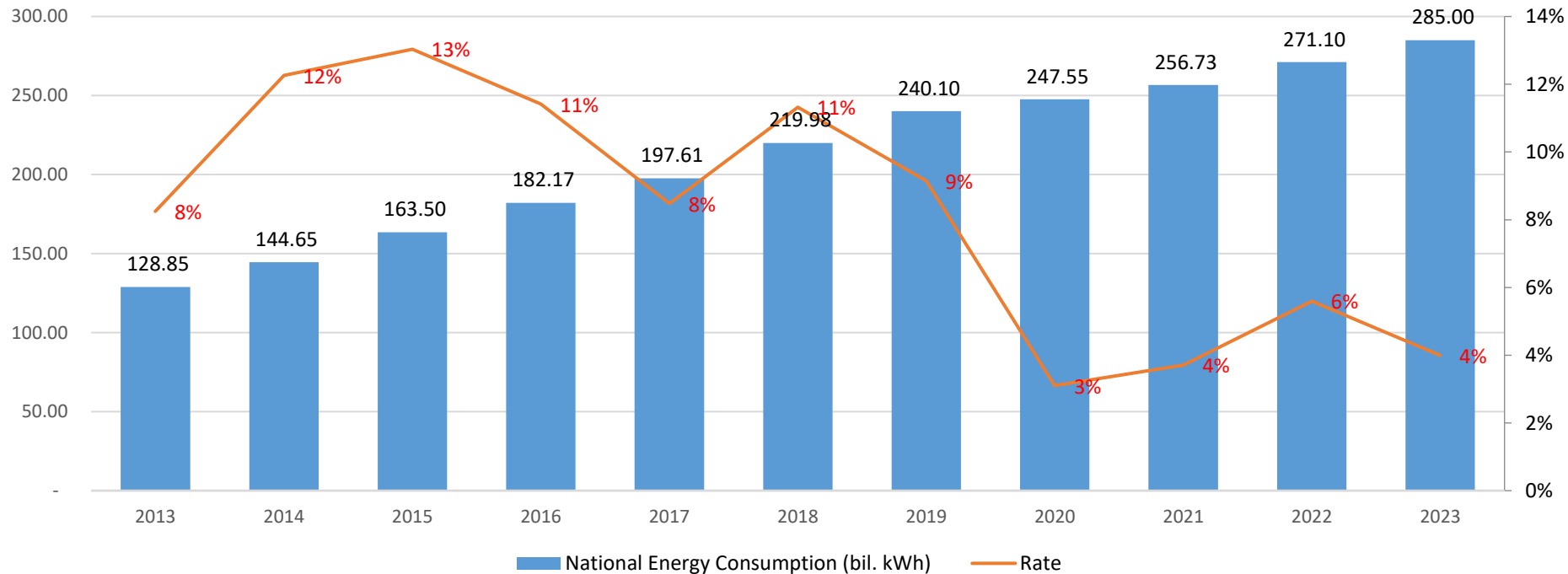
OVERVIEW OF VIETNAM RENEWABLE ENERGY OPERATION



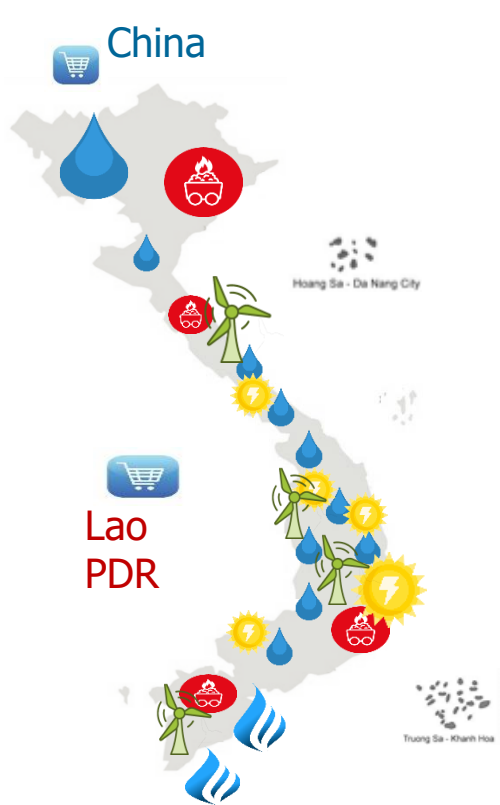
LOAD DEMAND








National Load Demand Growth

10 Years Period (2013-2023)



POWER GENERATION

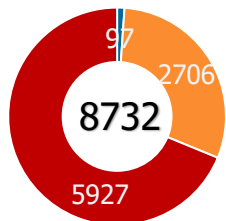


Hydro		23511 MW (28%)
Coal		27532 MW (32%)
Oil & Gas		8664 MW (11%)
Solar Farm & Rooftop		16672 MW (20%)
Wind		5869 MW (7%)
Import		1122 MW (1%)
Others		443 MW (0.5%)

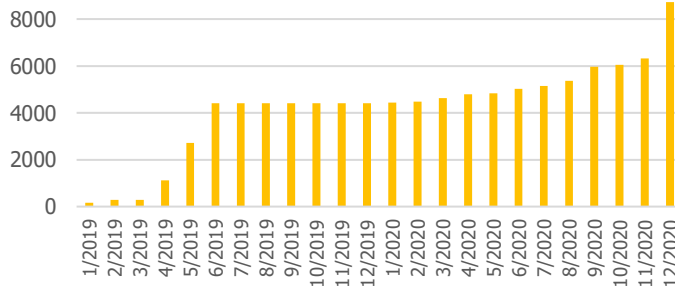
Total  **84360 MW**
By the end of 2023

DEVELOPMENT OF RENEWABLES

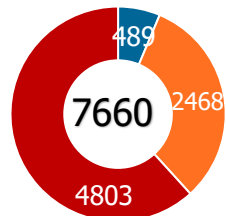
COD capacity of Solar farm (MW)



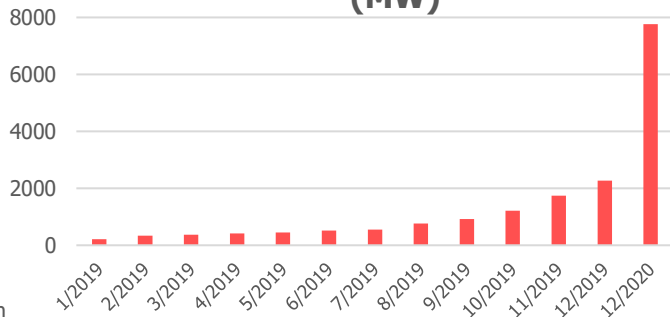
■ North ■ Central ■ South



Installed capacity of Rooftop (MW)



■ North ■ Central ■ South



FITs incentives for renewables:

Solar farm:

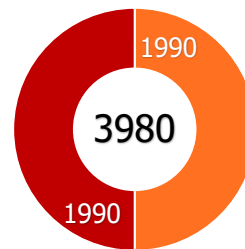
- FIT1: 9.35 UScents/kWh COD before 30/06/2019
- FIT2: COD before 31/12/2020
 - 7.09 UScents/kWh – ground-mounted solar farm
 - 7.69 UScents/kWh – floating solar farm

Rooftop:

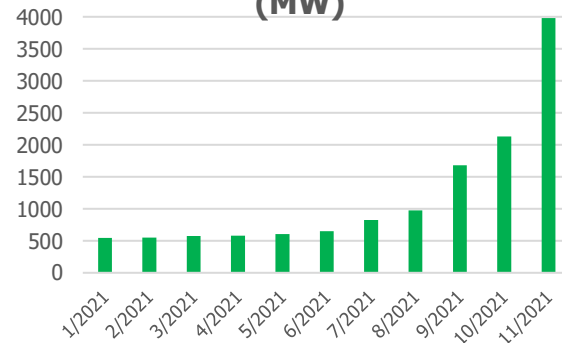
- FIT1: 9.35 UScents/kWh COD before 30/06/2019
- FIT2: 8.38 UScents/kWh completed before 31/12/2020

- Wind: 8.5 UScents/kWh for onshore and 9.8 UScents/kWh for offshore COD before 1/11/2021

COD capacity of Wind (MW)



■ Central ■ South



RENEWABLE PENETRATION RATE IN VIETNAM

5869 MW

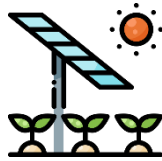
Wind Farm
6.9%



11.587 bil.kWh
3.3%

8950 MW

Solar Farm
10.6%



14.978 bil.kWh
5,7%

7722 MW

Rooftop Solar
9.2%



12.248 bil.kWh
4,9%

410 MW

Biomass
0.5%

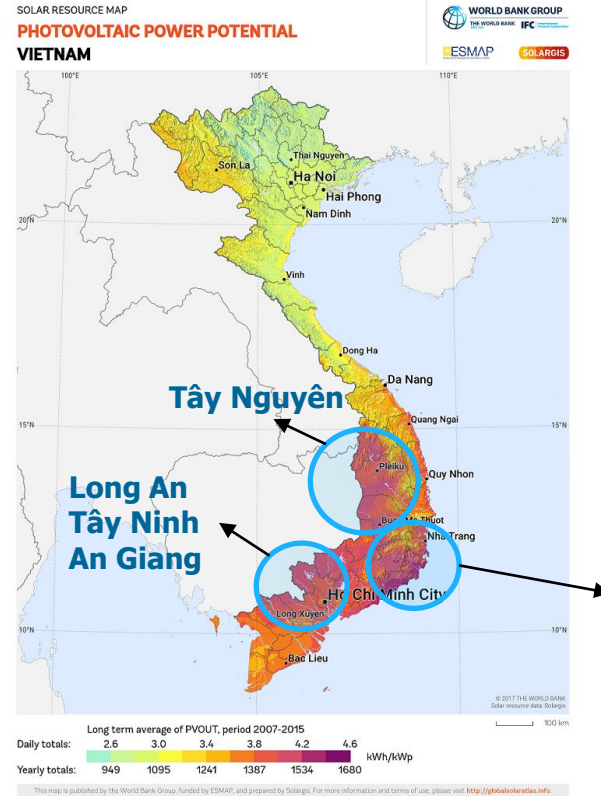
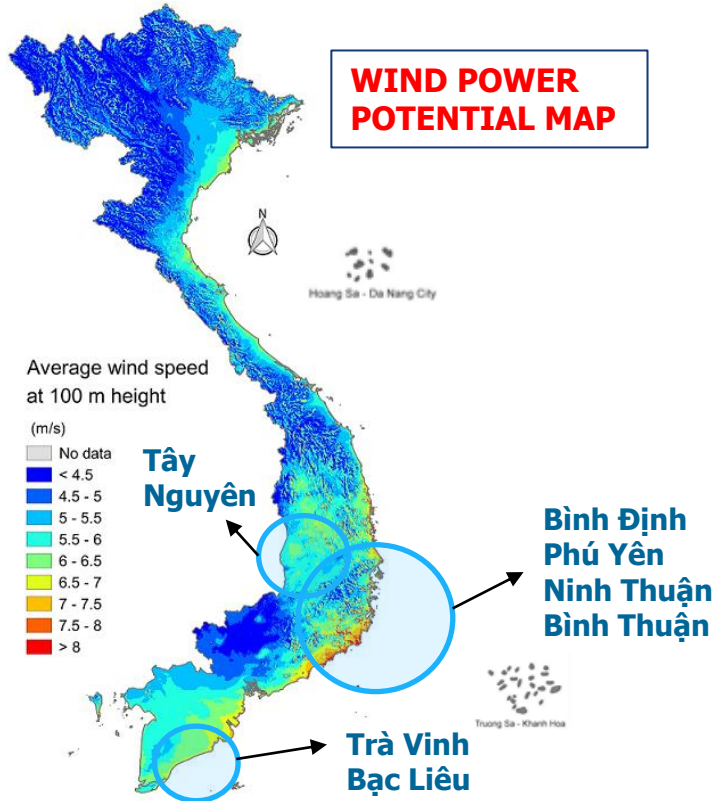


0.868 bil.kWh
0,1%

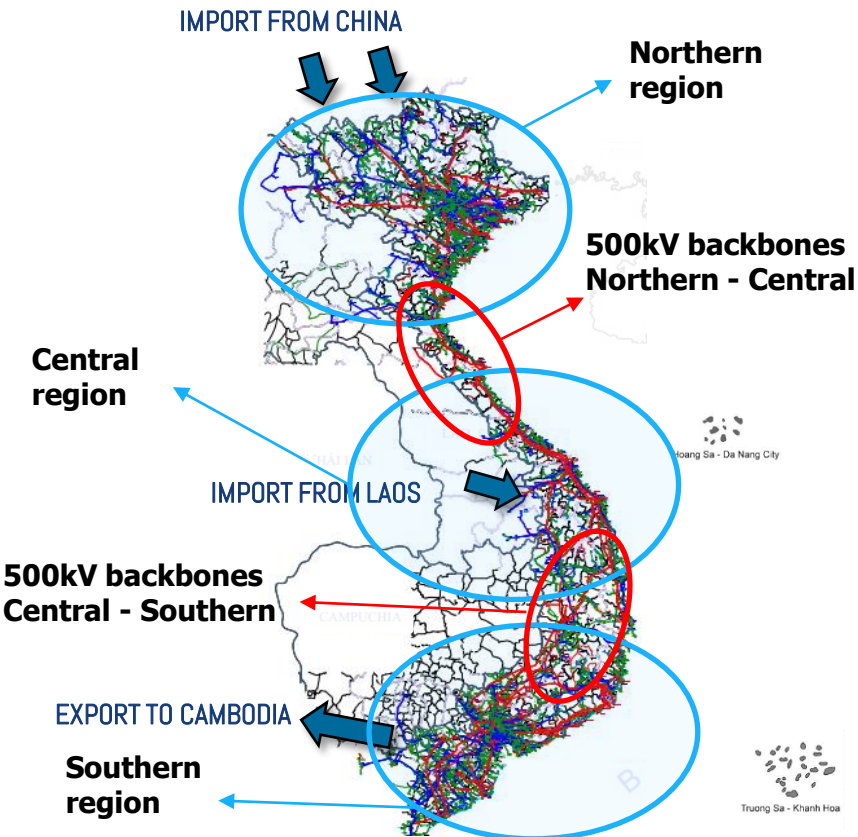
NATIONAL RENEWABLE ENERGY PENETRATION RATE: 27.2%

BY THE END OF 2023

DISTRIBUTION OF RENEWABLE SOURCES IN VIETNAM



VIETNAM TRANSMISSION GRID



Vietnam Transmission System

500-220kV transmission grid

National Power Transmission Corporation with 4 subsidiaries

Vietnam Distribution System

110kV distribution grid

05 Distribution Power Corporations

Import power from China and Laos

Export power to Cambodia

VOLTAGE	TOTAL LINE LENGTH (KM)	TOTAL NUMBER OF SUBSTATION	TOTAL TRANSFORMERS
500 KV	10471	41	71 (50400 MVA)
220 KV	20429	160	350 (75849 MVA)
110 KV	25932	1118	2042 (97363 MVA)

By the end of 2023

02

CHALLENGES AND SOLUTION TO RENEWABLE ENERGY OPERATION



CHALLENGES IN OPERATING RENEWABLES



GRID CONGESTION



- Currently, 20 overload 220/110kV lines/transformers
- 500kV regional transmission
- 220 RE power plants haven't been fully mobilized due to local congestion



DIFFICULTY IN PLANNING



During low-peak hours, especially weekends and Lunar New Year holiday, due to constraint that RE has to be fully deployed,
→ Difficult for operation planning



LOW SYSTEM INERTIA



- Low system inertia
→ Risk of system instability



RE FORECAST ERRORS



High RE forecast errors increase the absolute value of imbalance and bring difficulties in system planning



SUPPORTING MECHANISM



- The incentive mechanism for ancillary services is not attractive => lack of reserve to meet the uncertainty of renewables
- Currently, the number of power plant participating in ancillary services (frequency response, fast start) is not high, and there is no mechanism for BESS

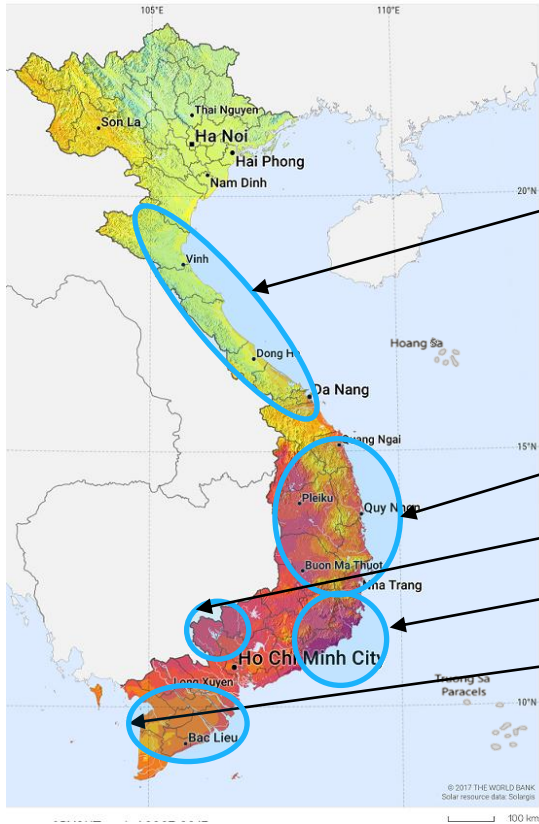


LOW SCR



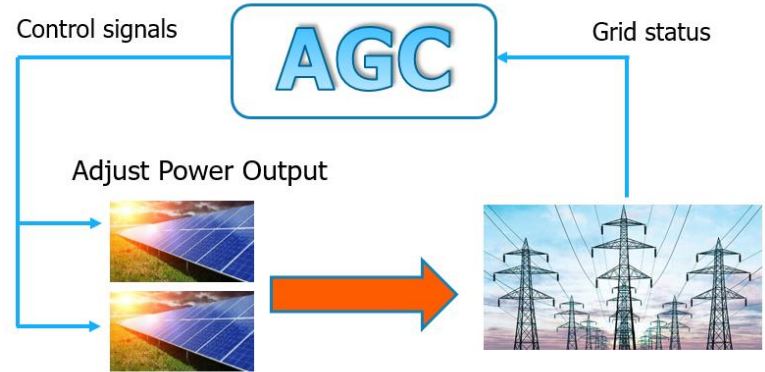
- Low Short-Circuit Ratio lead to power swing in grid

LOCAL CONGESTION AND 500KV CONGESTION



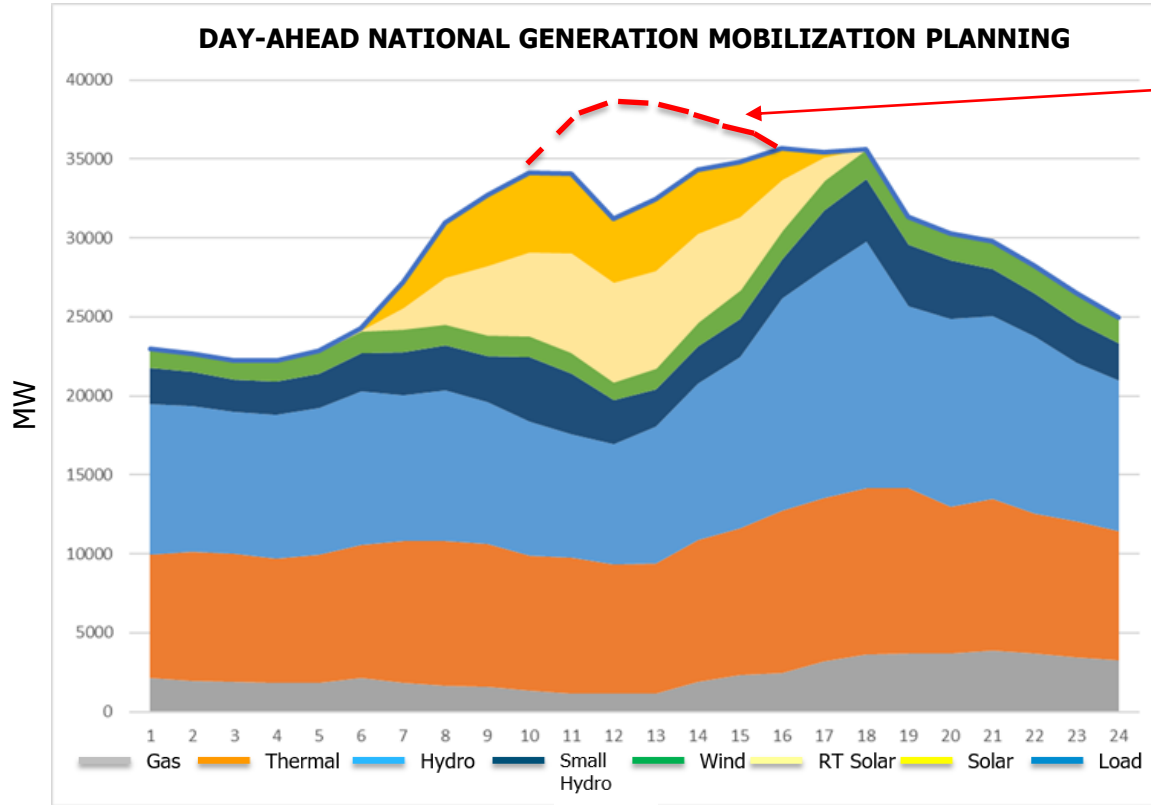
500kV backbones
North - Centre

20 regional congested
components are
monitored:
8 220kV components 12
110kV components



All power plants that are connected
to 110/220/500kV grid must be
equipped with AGC system

DAY/PERIOD AHEAD GENERATION MOBILIZATION PLANNING



RE curtailment to ensure total generation does not surpass the peak load demand

POTENTIAL FOR ENERGY STORAGE IN VIETNAM

High demand
in the future

Technical
performance

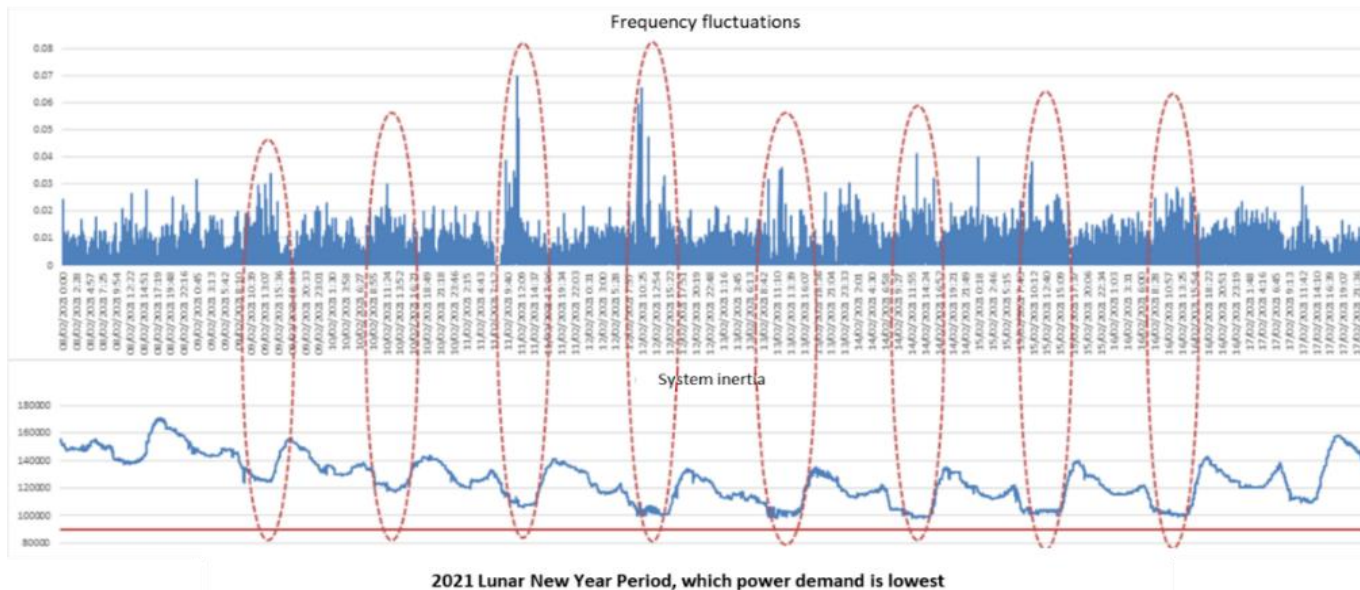
VS

High cost

Incentive
mechanism

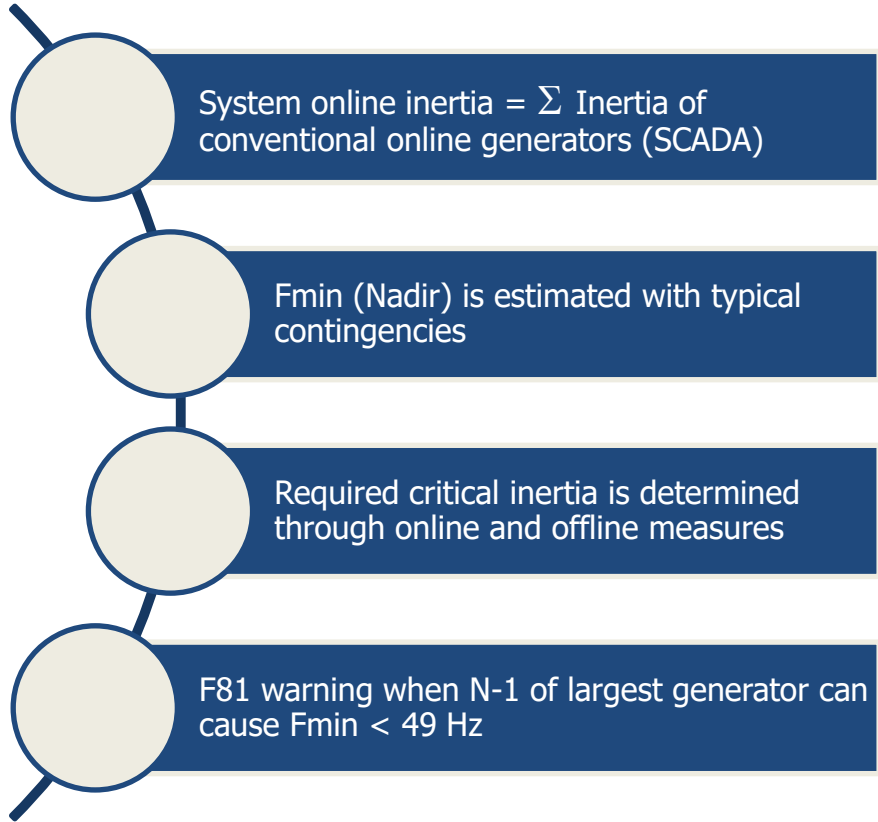
Lack of
regulation

SYSTEM INERTIA



During low-load conditions such as New Year holidays, the Vietnamese power system has faced low system inertia during midday when solar-generated maximum power while conventional generators have to be switched off due to low demand → **frequency fluctuation**

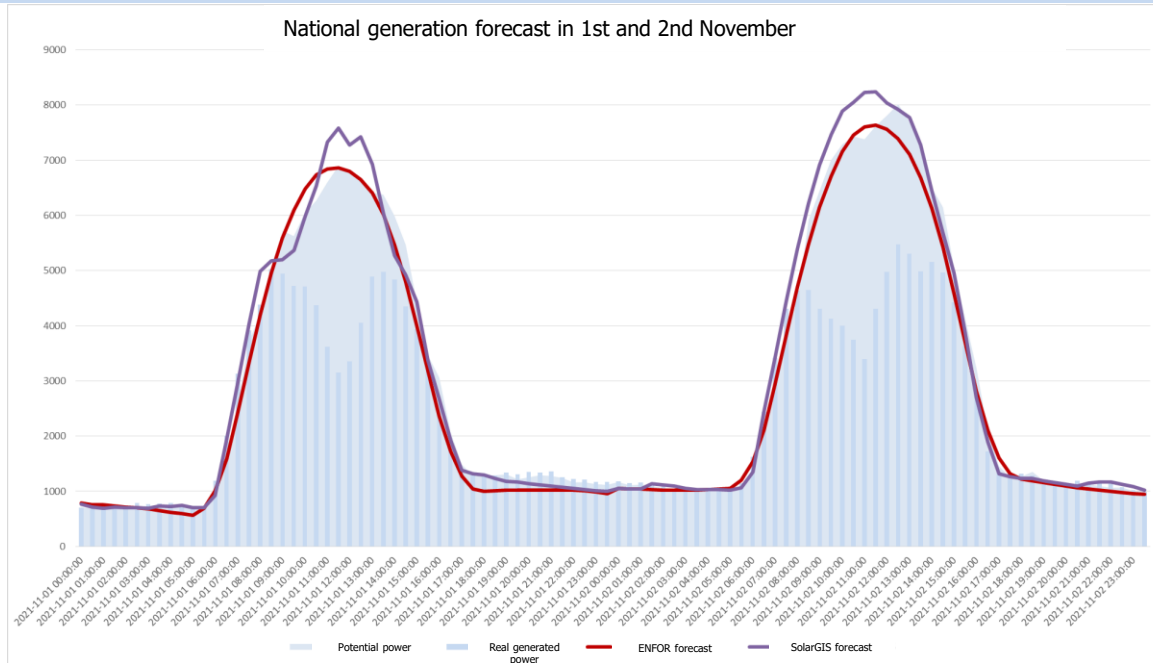
ONLINE INERTIA MONITORING TOOL



GEN LOSS FREQ. FORECAST		
P loss (MW)	f min (Hz)	Min Inertia Not F81
300	49.76	41,180
600	49.56	82,361
1200	49.15	164,722
Current Max Gen.	NT5-MONGDUONG2_	
621.0	49.54	85,244

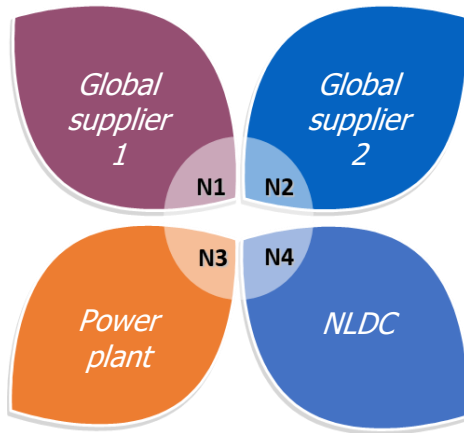
FORECAST ERRORS

Errors in renewable forecasts will cause difficulties in the operation of power system. After a period of coordination with various forecast data providers, the forecast error has been improved, in general, the daily RE forecast error now does not exceed 10%.

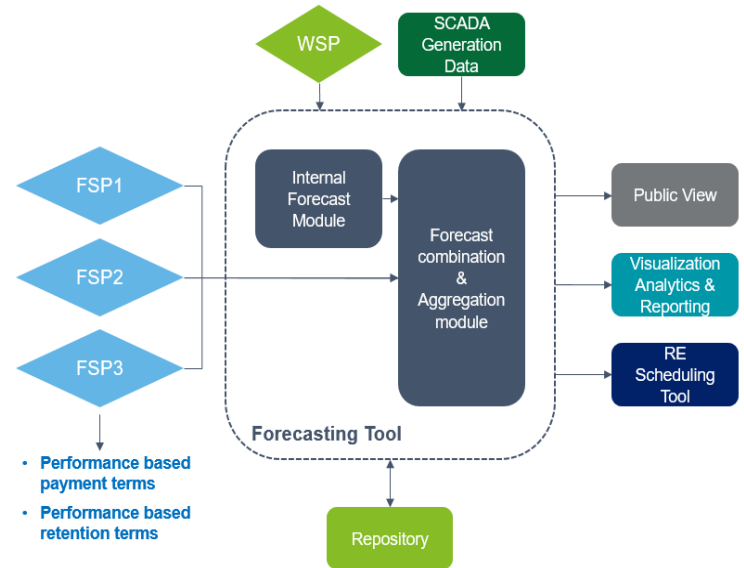


FORECAST ERRORS

Integrate more resources of forecast input (04 resources)



Put into operation the Forecast resource selection System

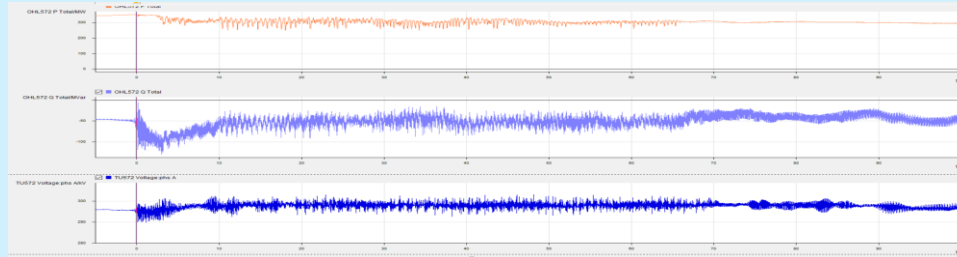


This project has been finished, will be put into operation after being approved by EVN

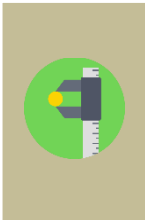
LOW SHORT CIRCUIT RATIO (SCR) ISSUE

Easup event

On November 28th 2021, SCADA system recorded that the Easup solar plant had very high generation capacity, reaching 349.93 MW. Following the event, the voltage of the plant fluctuated, and high-order harmonics were detected. It was later found out that low SCR was the cause of the event, as the SCR of Easup solar plant is only 5.4



Solutions:



Review and calibrate voltage control mode, Fault Ride Through response mode of RE



Optimize and active Power System Stabilizer (PSS) of traditional power plants to improve grid stability



THANK YOU FOR LISTENING!