EVN
TẬP ĐOÀN ĐIỆN LỰC VIỆT NAM
NHÀ MÁY NHIỆT ĐIỆN VĨNH TÂN 4

ENHANCE FLEXIBILITY
VINH TAN 4 THERMAL POWER PLANT



Hanoi, January 2026

Reporting Entity: Vinh Tan 4 Thermal Power Plant

EVN
TẬP ĐOÀN ĐIỆN LỰC VIỆT NAM
NHÀ MÁY NHIỆT ĐIỆN VĨNH TÂN 4



CONTENT

01 Overview of Vinh Tan 4 Thermal Power Plant

02 Operating Context

03 Technical Challenges

04 Test Results

05 Operating Solutions

06 Recommendations

OVERVIEW OF VINH TAN 4 THERMAL POWER PLANT

- **Location:** Vinh Tan Power Center, Lam Dong Province.
- **Capacity:** 1,800 MW (3 units x 600 MW).
- **Technology:** Once-through boiler with **supercritical** steam parameters.
- **Fuel:** Imported bituminous/sub-bituminous coal.
- **Environmental technology:** Modern, closed-loop wastewater and flue gas treatment systems (ESP, FGD, SCR).



KEY MILESTONES

Commercial Operation

UNIT S1: 12/2017
UNIT S2: 03/2018
UNIT S3: 10/2019

Generation

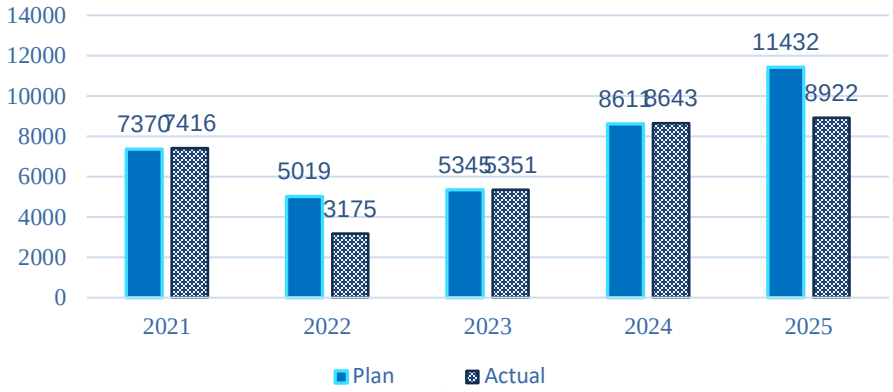
Total generation by the end of 2025:
60.57 billion kWh

Budget

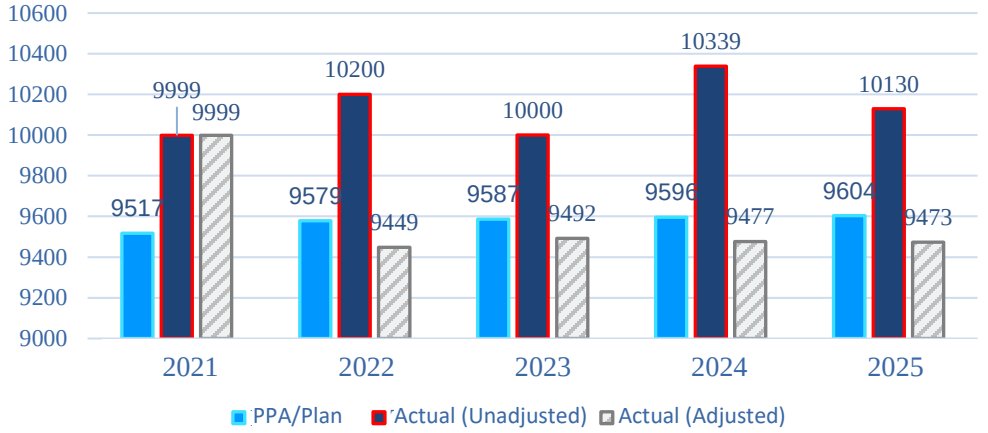
Contribution to the State budget by the end of 2025:
> 4,863 billion VND

Achieved economic indicators

Actual Generation (2021 - 2025)



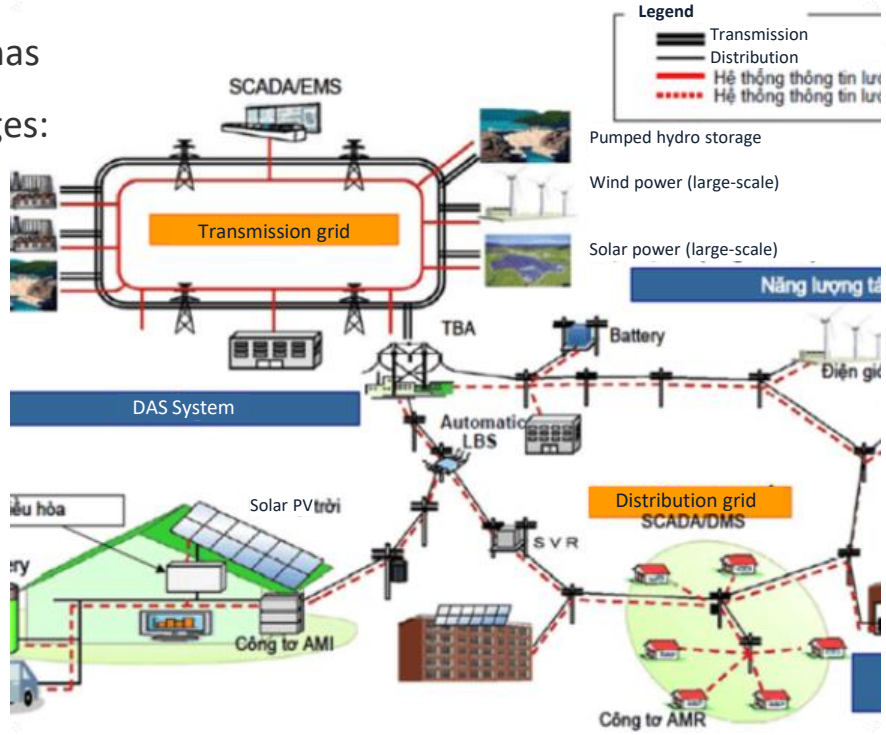
Heat Rate (2021 - 2025)



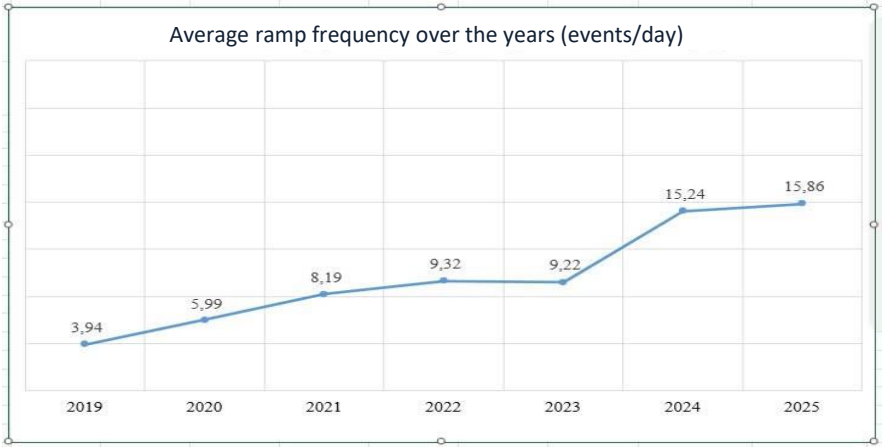
RENEWABLE ENERGY CHALLENGES

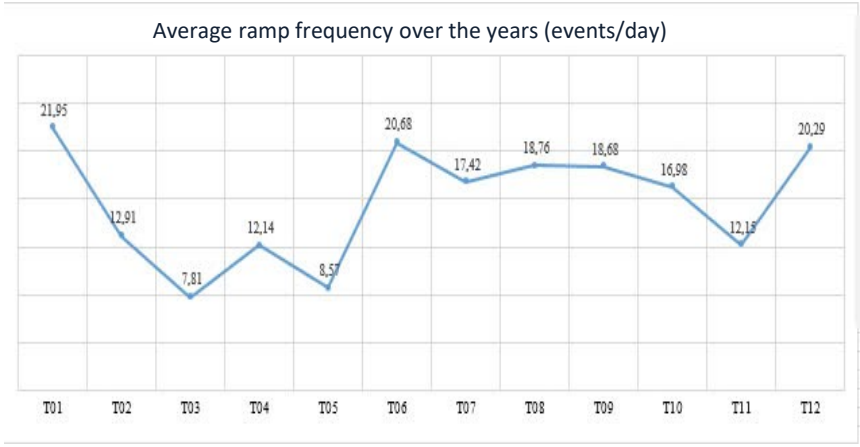
The share of renewable energy (wind and solar power) has increased significantly since 2020, posing major challenges:

- **System variability:** Renewable energy intermittency increases the need for flexible reserve capacity.
- **Role change:** Coal-fired plants are transitioning from base-load to peaking and flexible operation.
- **Frequency regulation pressure:** More frequent involvement in primary and secondary frequency regulation is required.



RAMP FREQUENCY





Previously (Design Basis)

- Base-load operation
- High and stable output
- Infrequent start-ups/shutdowns

Present & Future

- Peaking and flexible operation
- Low-load operation (Pmin)
- Fast ramping

LOW-LOAD OPERATING CONDITIONS (< 300MW)

Current Situation: The original design was only tested at 240 MW for 3 hours. Long-term stable low-load operation has not been fully validated.

Key Issues

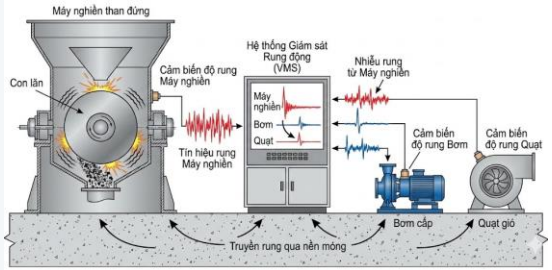
- **High heat rate:** Due to a sharp decline in boiler and turbine efficiency.
- **Increased auxiliary power consumption:** Auxiliary systems continue to operate near base-load power levels.
- **Boiler instability:** Combustion control becomes difficult, often requiring support oil firing.



IMPACTS ON MAIN EQUIPMENT

Coal mill

Thin coal bed on the grinding table increases metal-to-metal contact and causes severe vibration. Elevated risk of bolt failure and gearbox damage.



Boiler

Temperature fluctuations in steam tubes cause material fatigue. Increased risk of tube cracking and reduced design life.



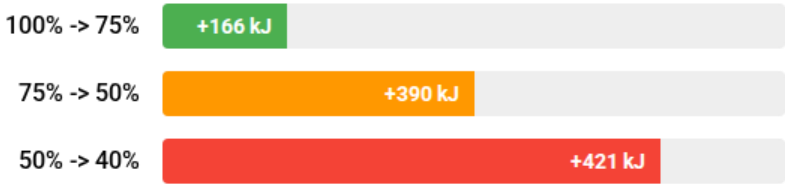
Sootblowing system

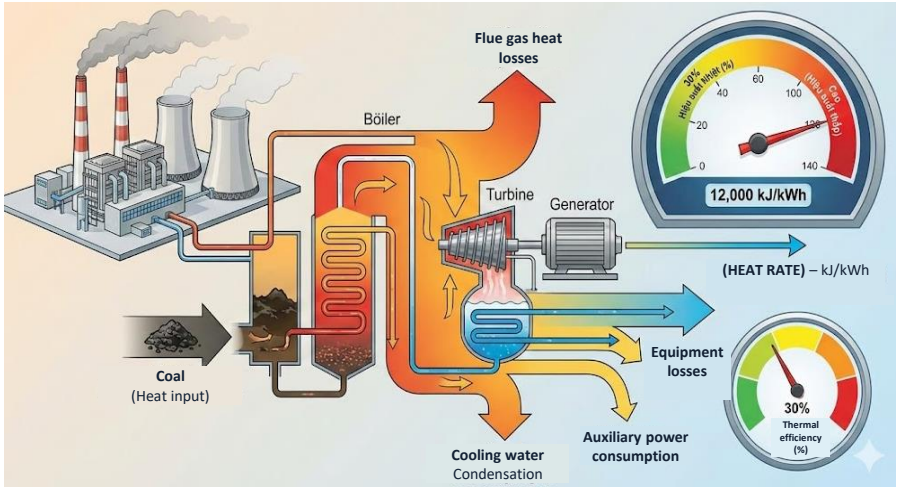
Flame instability at low load prevents safe operation. This leads to local slag formation.



NON-LINEAR EFFICIENCY DEGRADATION

Increase in heat rate (kJ/kWh):





When load drops significantly below 50%, the heat rate increases sharply (**~7.0 kJ/MW reduction**). The current PPA pricing mechanism (calculated at 85% load) does not cover this additional cost.

LOWEST LOAD TEST RESULTS

Objective: Stable long-term operation at 240 MW.

Result: 260 MW was achieved for a short duration, and oil support was required.

Parameter	Recorded Value	Assessment
Steam temperature difference (Branch A/B)	~ 40°C	**Severe imbalance**
RH Stage 1 metal temperature	552-556°C	**Exceeds limit (549°C)**
Combustion stability	Poor, oil support required	**High cost**

TEMPORARY MEASURES IMPLEMENTED

- **Ramp-down rate limitation:** Maintain a ramp rate of 1–2 MW/min when load is < 300 MW.
- **Fuel management:** Careful coal blending to stabilize combustion quality.
- **Operational adjustments:**
  - Enhance monitoring of superheat temperature.
  - Allow sootblowing only when load is > 300MW.
  - Perform air preheater sootblowing using auxiliary steam.



These are temporary measures and do not address the root causes.

PMIN DEFINITION

A clear distinction between the following two concepts is required to ensure equipment safety and cost transparency:

Technical Pmin

The minimum load at which flame stability can be maintained (may require oil support). To be dispatched only under **emergency** conditions of the power system.

Commercial Pmin

The minimum load at which **long-term stable operation** can be sustained without oil support, while ensuring equipment lifetime and compliance with environmental standards.

Recommendation: Operation below Commercial Pmin should be classified as an Ancillary Service.

PRICING MECHANISM

To ensure fairness and encourage flexible operation:

- **Dynamic kHR application:** The kHR factor (heat-rate adjustment factor) should not be treated as a constant.
- **Variable kHR table:** A kHR table by load range should be established to accurately reflect non-linear efficiency degradation at low load.
- **Flexible compensation:** Payments should be based on actual low-load operating cycles dispatched by the system operator.

Objective: Compensate for additional fuel costs and equipment wear when the plant provides system support.

CONCLUSION

"Flexible operation is an inevitable trend. However, sustainability requires alignment between **system requirements**, **technical limitations**, and **financial mechanisms**."

Vinh Tan 4 Thermal Power Plant stands ready to cooperate in pilot testing and data sharing to support the development of a regulatory framework for flexible operation of coal-fired power plants in Viet Nam.

EVN

TẬP ĐOÀN ĐIỆN LỰC VIỆT NAM

NHÀ MÁY NHIỆT ĐIỆN VĨNH TÂN 4



Thank you!