VEPG Technical Working Group 5 on Energy Market

Recent developments in the Australian National Electricity Market and Implications for Viet Nam

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Topics

- Brief Overview of the NEM
- Energy Transition: 2050 Capacity Expansion Outlook, Technology Mix & System Operation Considerations
- Drivers for New Investments
- Risks and Challenges
- Implications for Viet Nam

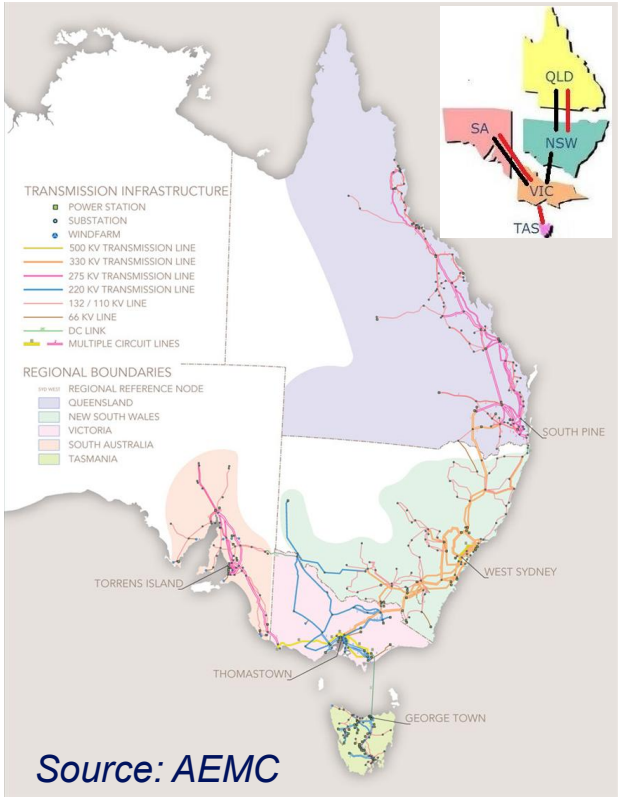
Overview of the NEM

NEM Geographic Coverage

- The National Electricity Market (NEM) serves five regions on the east coast of Australia: QLD, NSW (inc. ACT), VIC, SA, TAS
- Different state power grids are connected by the transmission interconnectors (sub-image)
- The NEM operates on one of the world's longest interconnected power systems, ~5,000 Km
- Nearly 650 registered participants, supplies around 80% of Australia's electricity consumption (exc. WA and NT)

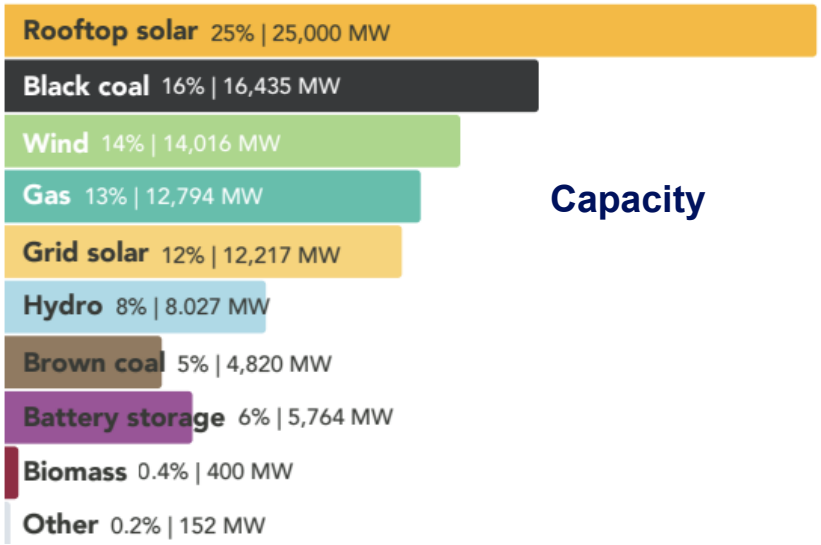
Market Characteristics

- Mandatory Gross Pool Market: All electricity scheduled and physically delivered through the NEM, operated by AEMO (since December 1998)
- 5-minute dispatch and pricing
- Energy only bid-based market, spot price cap @ AU$20,300/MWh
- Financial contracts are traded separately from the physical market, futures & options can be bought on the Australian Securities Exchange (ASX)

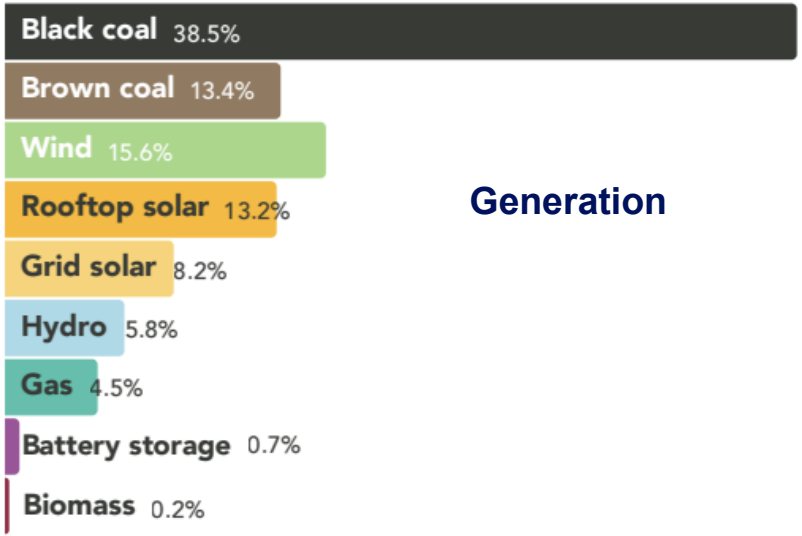


Source: AEMC

NEM Technology Mix (2025)



Capacity

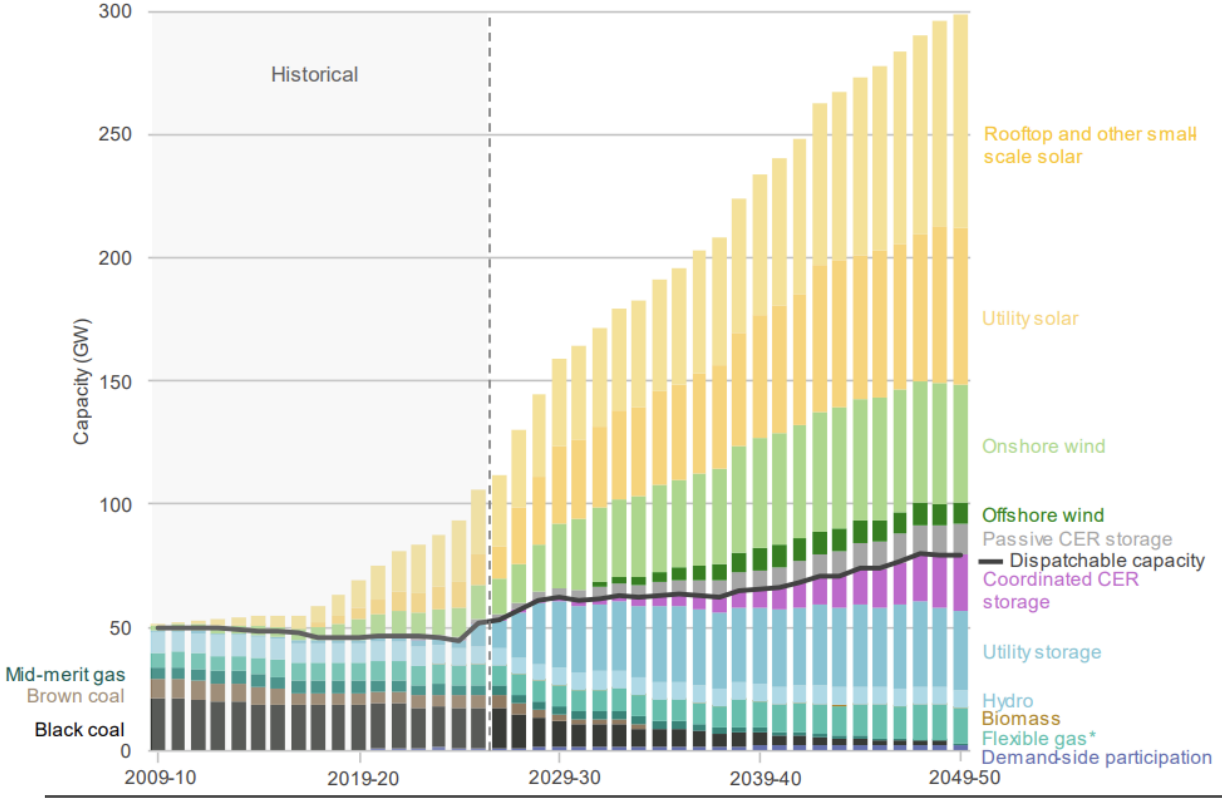


Generation

- By 2025, total generation capacity in the NEM was ~100 GW: rooftop solar had the highest share, at 25%; all renewable technologies (rooftop solar, solar farms, wind and hydro) represented 65%.
- Average annual energy supply from RE and storage was 43,7%, exceeding 50% for the first time in Q4 2025.

Source: AEMO

NEM Energy Transition: A Bigger Picture

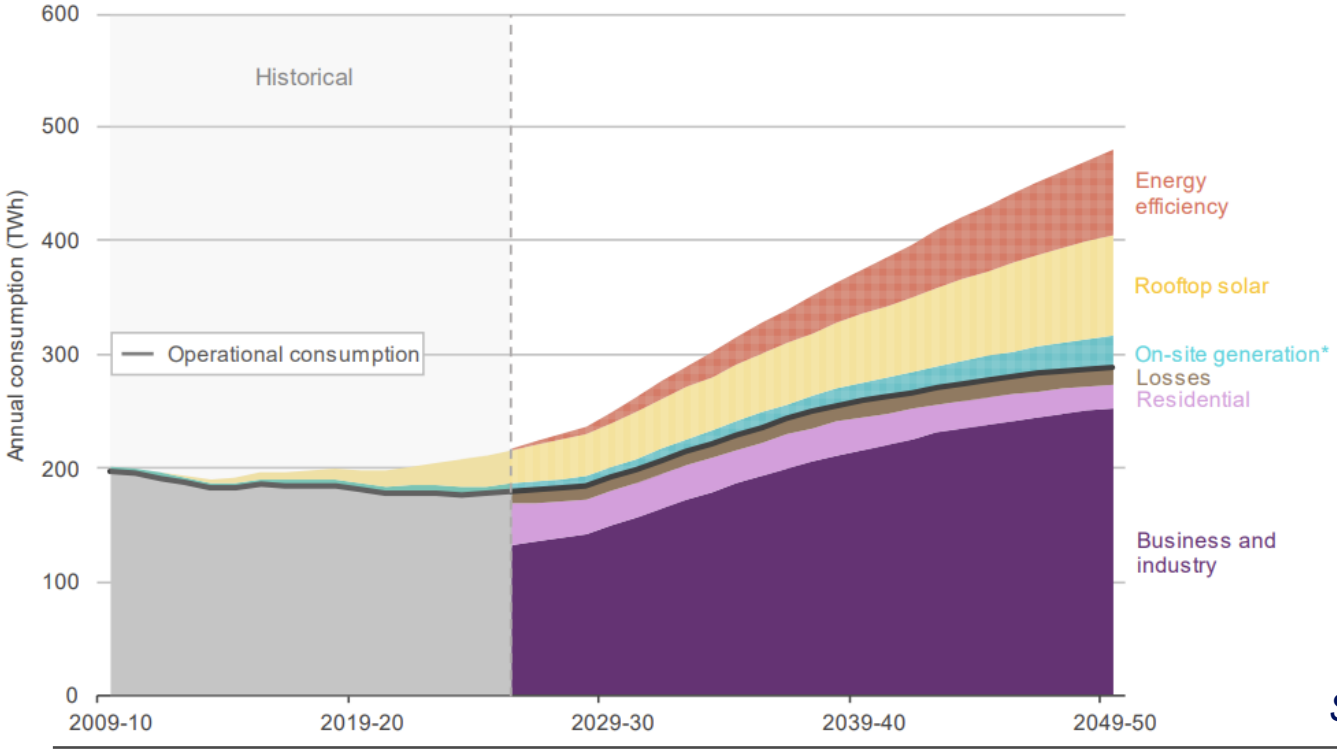


2050 Capacity Outlook

- AEMO publishes the Integrated System Plan (ISP) every 2 years as an optimal investment pathway for the transition of the NEM power system.
- The Draft 2026 ISP projects nearly 300 GW of installed capacity for the NEM by 2049-50 FY
  - Sharp growth in RE resources to replace retiring coal plants and accommodate elevated power demand due to electrification
  - Firmed with utility and consumer storage
  - Backed up by flexible gas-powered generation (GPG).
  - Grid upgrades and expansions to connect new REZs to demand centres (“Rewiring the Nation”)

Source: AEMO Draft 2026 ISP

Net Zero Power Generation by 2050

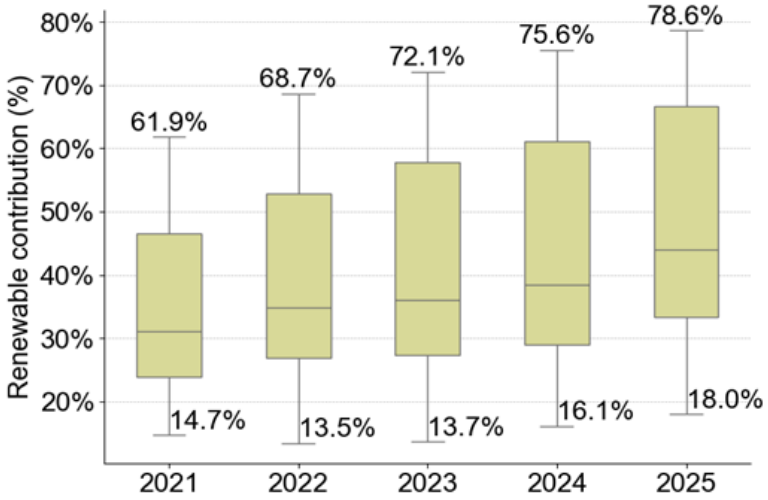


- NEM underlying consumption has not been growing at high rates but is expected to pick up rapidly, almost doubled by 2050 as the economy is getting decarbonised through electrification.
- Nearly one third would be supplied from rooftop PVs and other on-site generation sources.
- National net zero emissions by 2050.
- 82% renewable energy target for 2030, requiring ~6 GW of added VRE capacity each year.
- The power grid of some states (SA, TAS) have already achieved 100% RE operation for prolonged periods.

Source: AEMO Draft 2026 ISP

Increasing RE Contribution

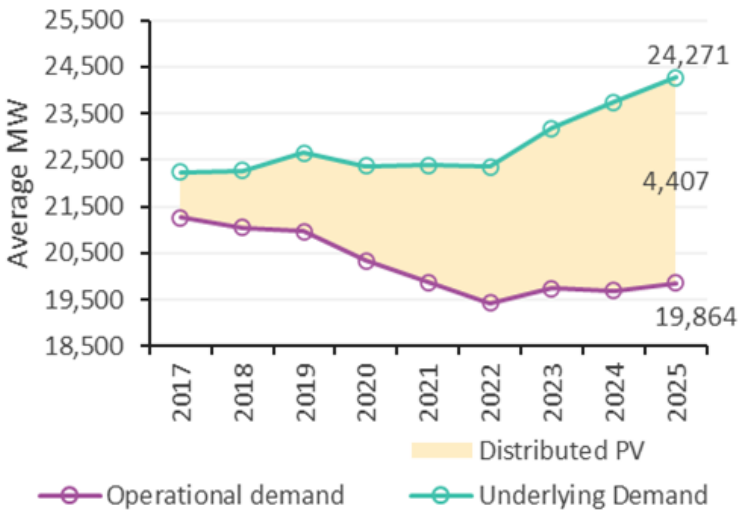
Maximum and minimum renewable contribution



- RE contribution (measured half hourly) in the total generation output increased steadily between 2021-2025

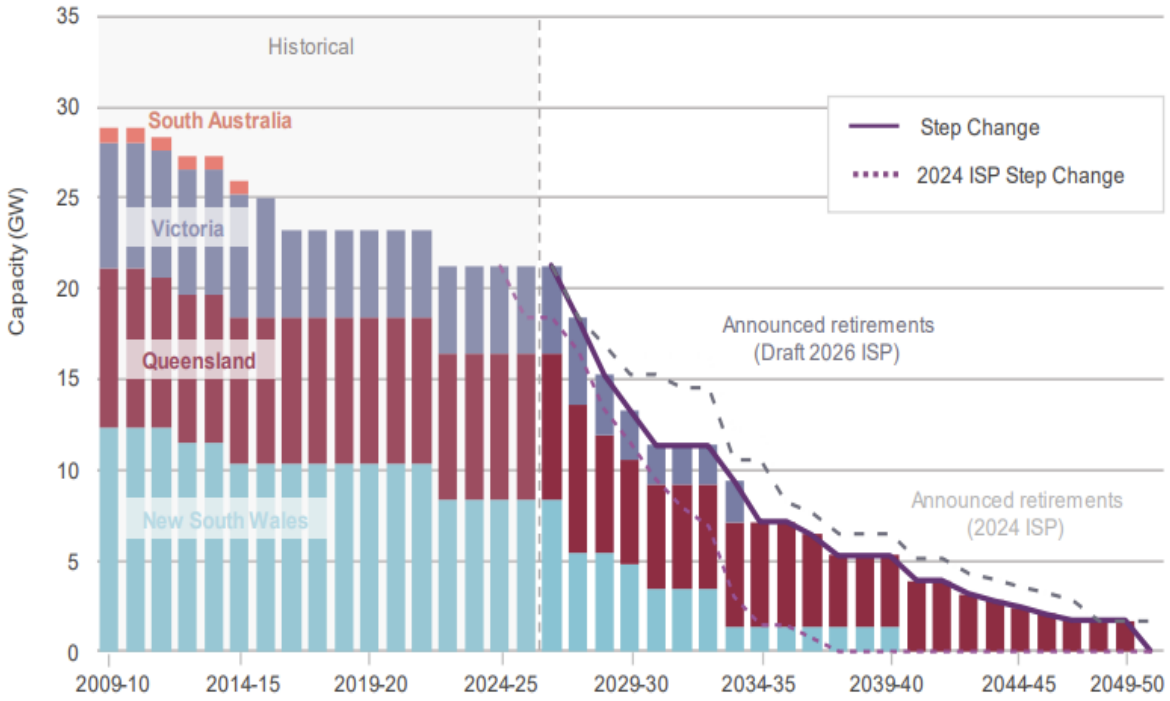
Source: AEMO

Average underlying and operational demand



- NEM-wide distributed PV output grew by 8.7% in 2025, reaching 4,407 MW which largely offset higher underlying demand during daytime hours

Coal Retirement

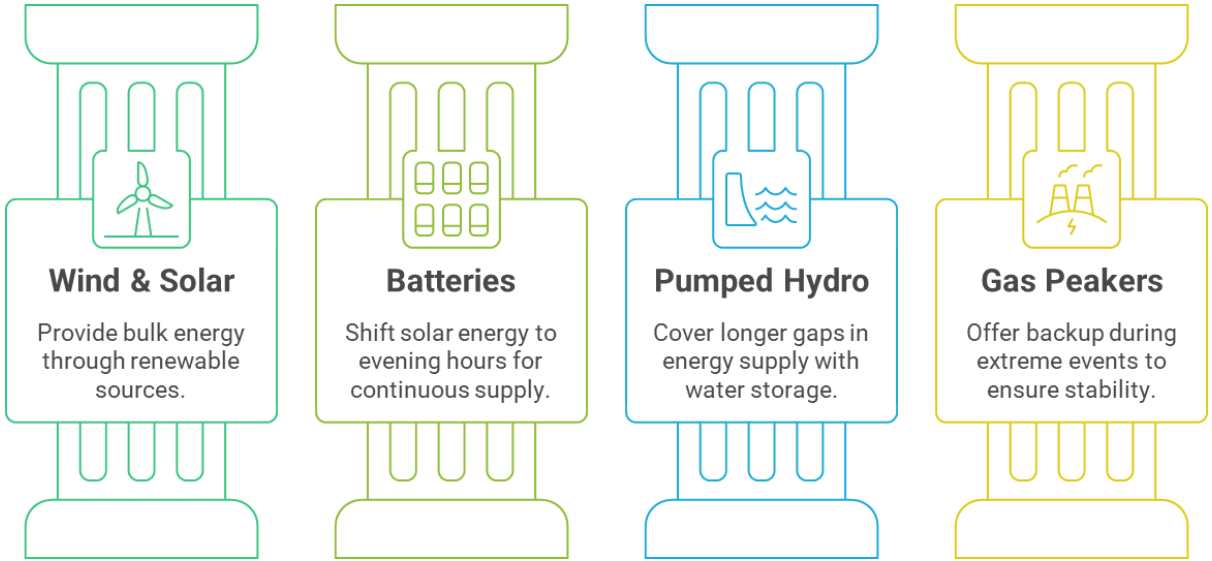


- No new bult coal fired power plant since 2008
- All coal generation to completely close by 2049 (compared to 2038 in the 2024 ISP due to extensions in Queensland)
- Fuel conversion is not an option
- Recent closures:
  - Liddell (NSW, 2,000 MW): 2023
  - Hazelwood (VIC, 1,600MW): 2017
- The transition is underway but not all smooth
- Plan to close Eraring (2,880 MW) in NSW has been delayed twice, from 2025 to 2027 and then 2029
  - to ensure grid stability and moderate energy prices while RE, storage and transmission assets are rolled out

How to ensure post-coal system reliability?

- Wind and solar increasingly provide the bulk of energy
- Batteries and pumped hydro provide flexibility and energy shifting
- Gas peaking plants remain in the system primarily as reliability insurance during rare periods of low renewable output (e.g., extended wind lulls)
- Synchronous condensers & advanced inverter capabilities (grid-forming) to support grid stability and strength

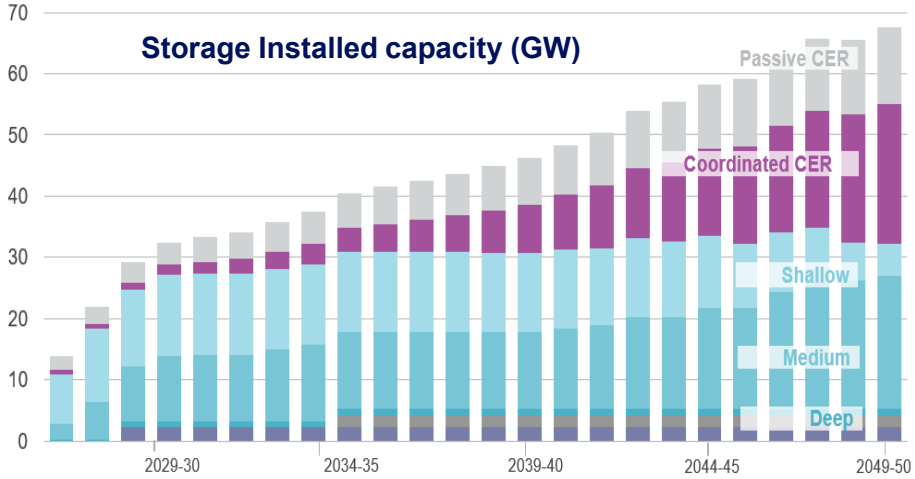
Australia's Post-Coal Energy System



Source: based on AEMO 2024 ISP

Vital Roles of Energy Storage

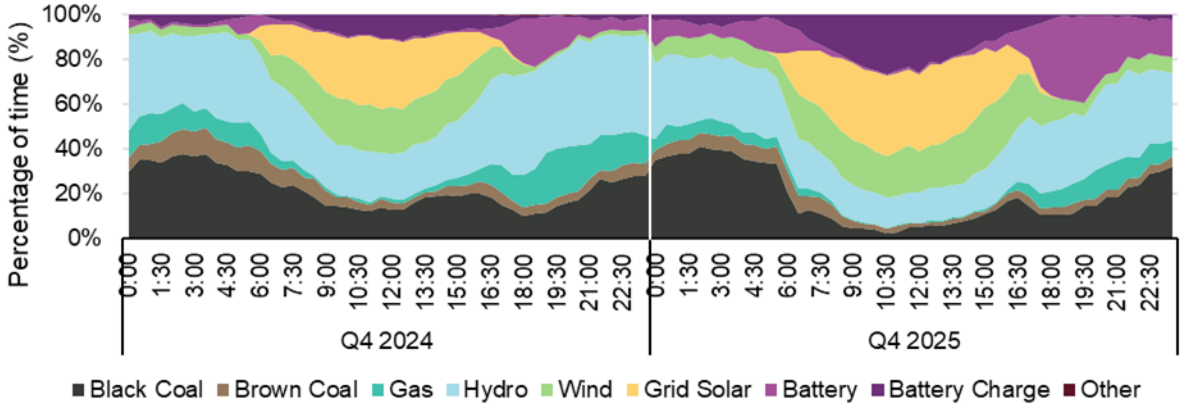
- The NEM is forecast to need ~55 GW of dispatchable storage in 2049-50 (~70% of 80 GW total dispatchable capacity)
- Consumer-owned storage (or distributed or CER storage) are becoming more numerous (to make up 52% share by 2050) as costs decline, reducing the need for utility-scale solutions.



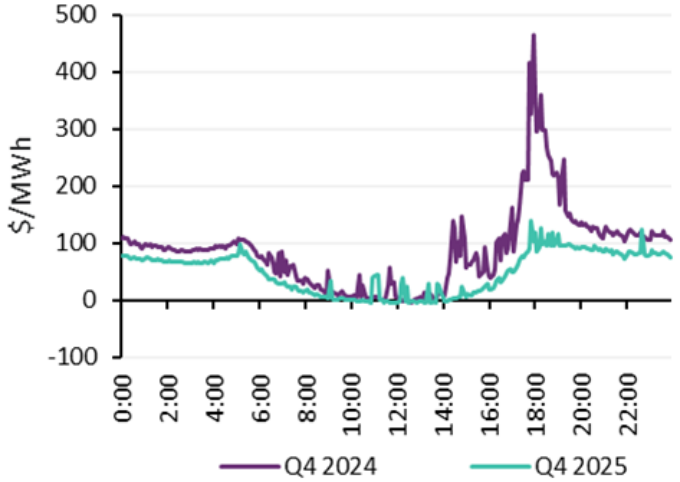
Types of Storage	Capabilities
Passive CER storage	Non-dispatchable home batteries including EVs
Coordinated CER storage	Aggregated & managed as dispatchable VPPs, up to 2-hour discharge
Shallow storage	Up to 4-hour duration, can provide both both their system and energy services
Medium storage	4 to 12 hour BESS or PSH to shift large quantities of electricity to meet morning and evening peaks
Deep storage (Snowy 2.0, Borumba PSH)	Strategic hydro reserves that can dispatch electricity for more than 12 hours, to mitigate long periods of RE droughts and seasonal imbalances

BESS already making impact

Price setting during the evening peak shifted from hydro and gas to battery discharge



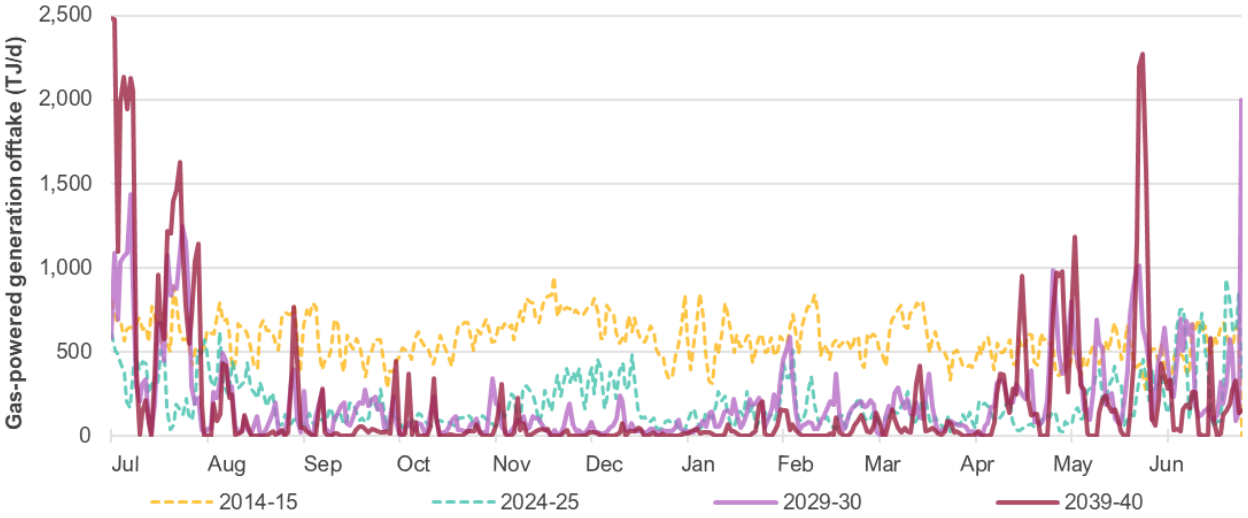
Lower average prices and price volatility



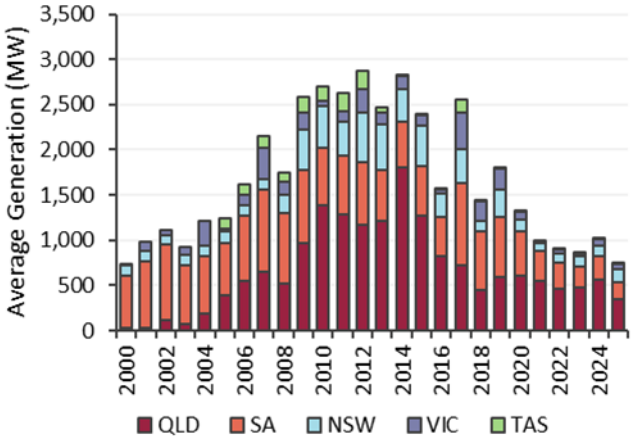
- During the evening peak (16:00 – 20:00), battery discharge was marginal in 25% of pricing intervals, displacing gas and hydro. Battery charging set prices more frequently during the daytime, up from 9% to 20%, reflecting increased charging activity during these periods.
- Batteries are doing what they are supposed to do: contributed to the moderation in the NEM average price across most hours in 2025 (with the largest reductions over the evening peak) and lower price volatility (Diagram 2)

A Changed Role of Gas Power Generation (GPG)

Gas-powered generation offtake monthly variations (2015-2040)



NEM-wide gas-fired generation dropped over the last 10 years



- GPG across the NEM in Q4 2025 was the lowest quarterly average since Q4 2000
- 14 GW of flexible GPG is projected, it's role will change from relatively stable 'mid-merit' (as seen for 2015) to a back-up role, mostly running during winter peaks in 2040 and onward (GPS capacity factor would be just ~5 to 7%).
- Abatement options: switching to green hydrogen (if feasible), carbon capture & storage technologies

Incentives & Drivers for Investment

Spot energy market scarcity pricing (elevated price cap)

- Rewards flexible resources such as gas peaking power plants, BESS
- Other resources (e.g., wind power) can also earn infra-marginal income to compensate fixed costs
- Encourages portfolio risk management by gentailers - invest to hedge against high market prices

Mandatory REC Scheme

- Stable revenue streams for eligible RE projects, household PV and storage installations
- “Cheaper Home Batteries" Program offers a ~30% reduction, launched July 2025

Long term revenue support for wind, solar & storage (BESS/PSH) projects

- Capacity Investment Scheme (CIS) – Australia-wide
- Long-Term Energy Service Agreement (LTESA) – NSW
- Projects selected through regular competitive tenders; Annual revenue cap & floor agreements

Risks & Challenges

Investment challenges

- Huge and rapid investments required in RE generation, storage and transmission assets with closures of coal stations
- Planned projects may not progress as expected, due to delays in approval, investment decision uncertainty, cost pressures, social licence issues, supply chain issues and workforce shortages

Risk that markets and power system operations are not yet ready for 100% renewables

- As renewable generation is being installed rapidly, NEM operations must evolve to be ready for much higher RE penetrations
- AEMO to work on technical requirements for a power system capable of operating at 100% renewables, especially in coordinating CER (as VPP) into grid operations, both technically and commercially
- The latter was one of the key areas examined in the recent “Nelson” Review of the NEM (Dec. 2025)

Implications for Viet Nam

- A comparable table implies potential areas for the evolution of VWEM

Area	NEM	VWEM
Market Structure	Participation is mandatory for all generators and retailers	Market represents a subset of generation, retailers not fully or actively participating
Contracting	Developed derivatives market provides effective hedging instruments & supports competition depth	Contracting remains limited, with quasi-regulated Qc*Pc contracts the only form
Market pricing	Scarcity pricing improves efficient operations and provides signals for investment in flexible resources	Mostly cost containment-driven, inadequate price signals for investment
Mechanisms promoting RE	- Several ongoing financial incentives (REC, CIS), not without pressure on retail prices - Centralised tender process for revenue support	- DPPA mechanism - Financial support much less prevalent due to cost concerns
RE direct market participation	Mandatory, free market entry with no contract requirement	Optional, required a signed PPA in place

Xin cảm ơn!