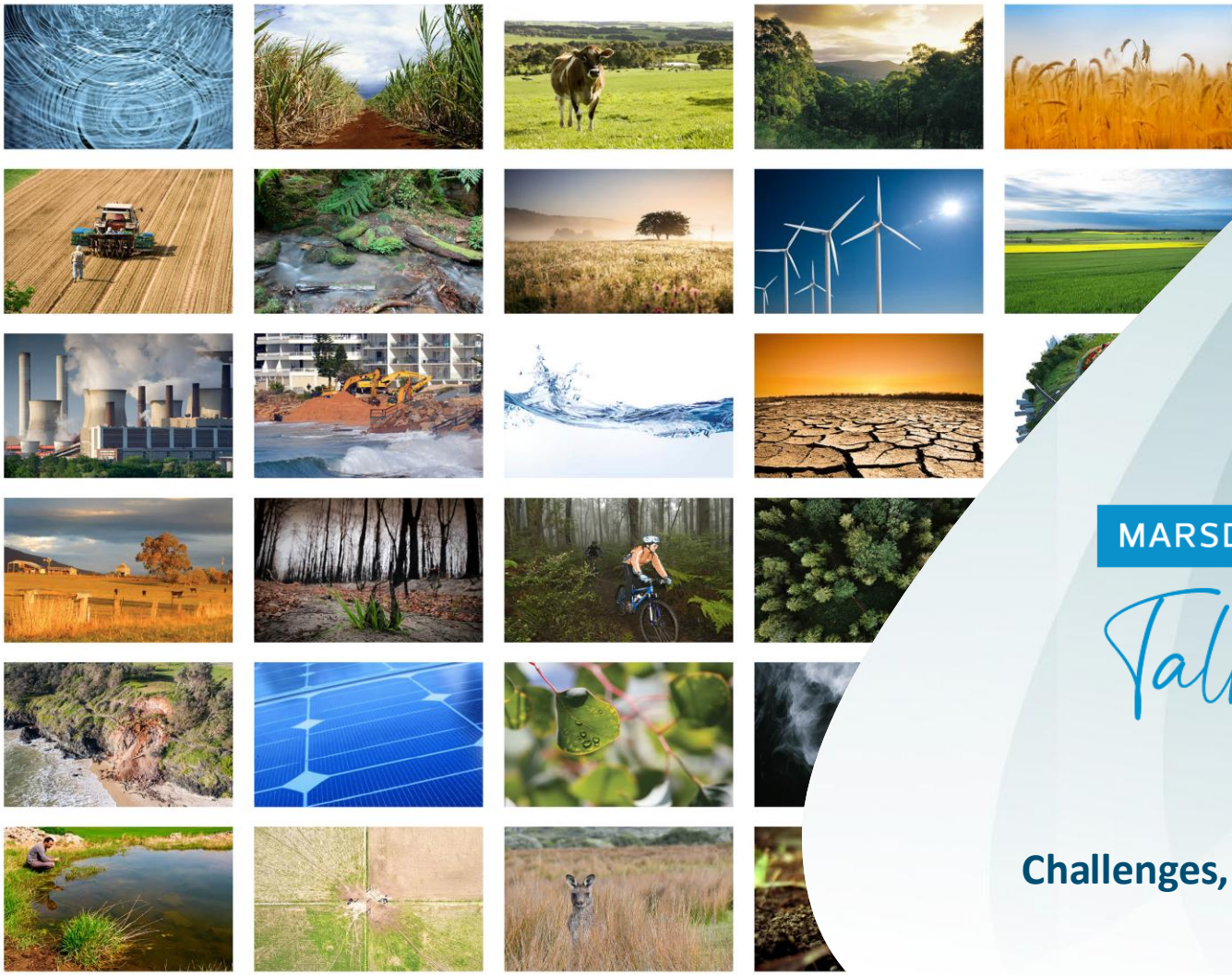

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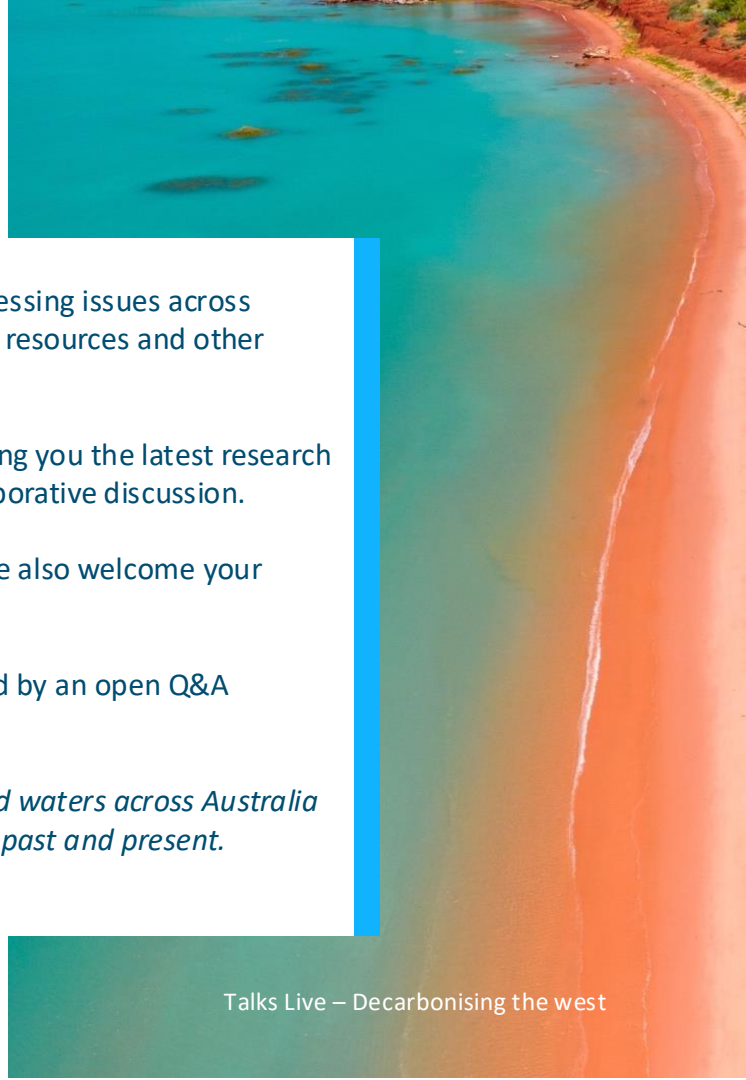
Talks Live

Decarbonising the west

Challenges, choices and taking control

August 2025

Talks Live



The **Marsden Jacob Talks Live** webinar series brings people together to discuss pressing issues across environment, energy, water, circular economy and recycling, agriculture and earth resources and other sectors in Australia and internationally.

These free webinars are open to everyone. We aim to share best practices and bring you the latest research and thinking. Our focus in these events is on encouraging open, positive and collaborative discussion.

We encourage you to share your questions, opinions, experience and interests. We also welcome your thoughts on future topics for our webinar series.

Each live event includes a presentation hosted by Marsden Jacob experts, followed by an open Q&A session.

Marsden Jacob Associates acknowledge the Traditional Custodians of the lands and waters across Australia where we conduct our business. We pay our respects to their Ancestors and Elders past and present.

Who are we?

Grant Draper

Associate Director

MBA (AGSM), MEc (W.Aust.)

- 25 years' experience in Australian electricity and gas sectors.
- Expertise includes modelling wholesale electricity and gas markets, energy market regulation and commercial due diligence assessments.
- Extensive experience modelling the NEM, WEM, Pilbara electricity system (includes NWIS), and the Darwin Katherine Interconnected System (DKIS).

Simon Lang

Principal

BEc(Hons)

- Worked as a Senior Economist for Commonwealth, NSW and WA Treasuries.
- Has worked at Marsden Jacob for two years in wholesale electricity and gas modelling.
- Specialises in market modelling using PROPHET simulation software and developing commercial and financial models using 'R' and Python.

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Why should industry decarbonise operations?

Why this topic? And why now?

Drivers for industry to decarbonise:

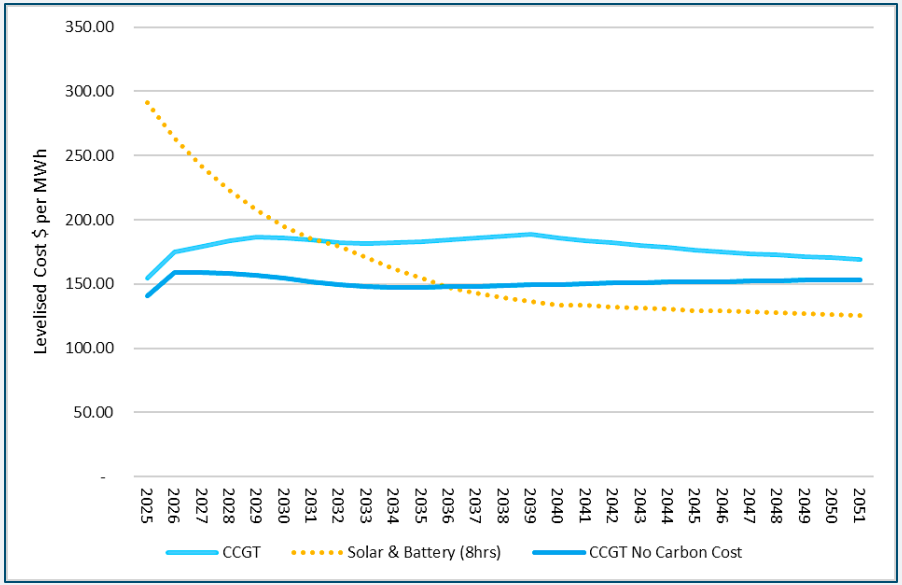
- **Federal and state government commitments to net zero** by 2050.
- **Capital markets/shareholder expectations**.
- **Potential export penalties** for high-carbon products e.g. EU's Carbon Border Adjustment Mechanism.
- **Tightening emissions limits** under the Australian Safeguard Mechanism.
- **Government/agency incentives** for emission reductions.
- **Reduction in cost of renewable energy** due to decreasing capital costs and government subsidies.

Limits of relying on offsets

Relying on carbon offsets to achieve emissions reductions has limitations:

- 'Hard cap' on emissions – rolling 5-year average gross emissions for Safeguard Facilities must decline.
- If ACCU use exceeds 30% of baseline, facilities must explain to the Clean Energy Regulator (CER) why onsite abatement isn't being prioritised.
- Firmed renewables projected to be cheaper than onsite CCGT (or Cogen) plus offsets – especially as gas prices stay high and carbon offset costs rise toward $100/tCO2e by early 2030s.
- By mid-2030s, firmed renewables likely to be the lowest-cost option – even without a carbon price.
- Most cost-effective option for industry expected to be a mix of renewables, storage and gas-powered generation (GPG).

Levelised cost of energy (June 2024 – AUD)

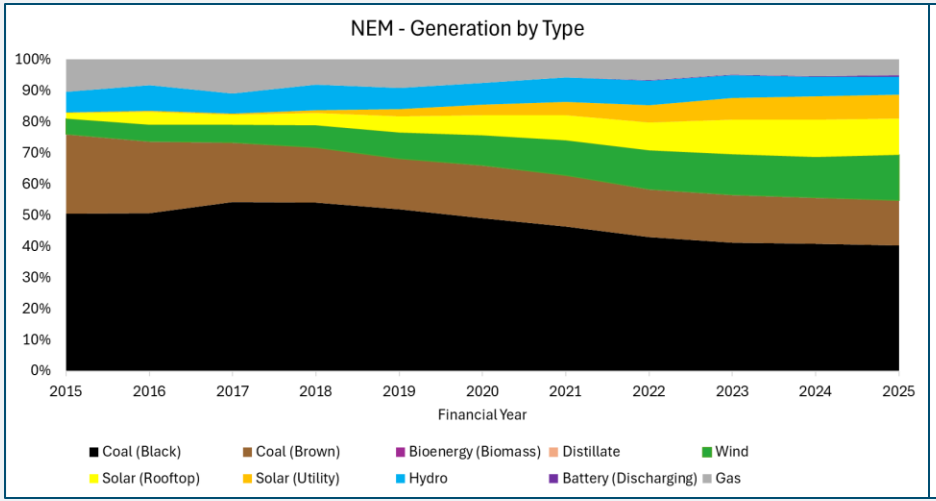


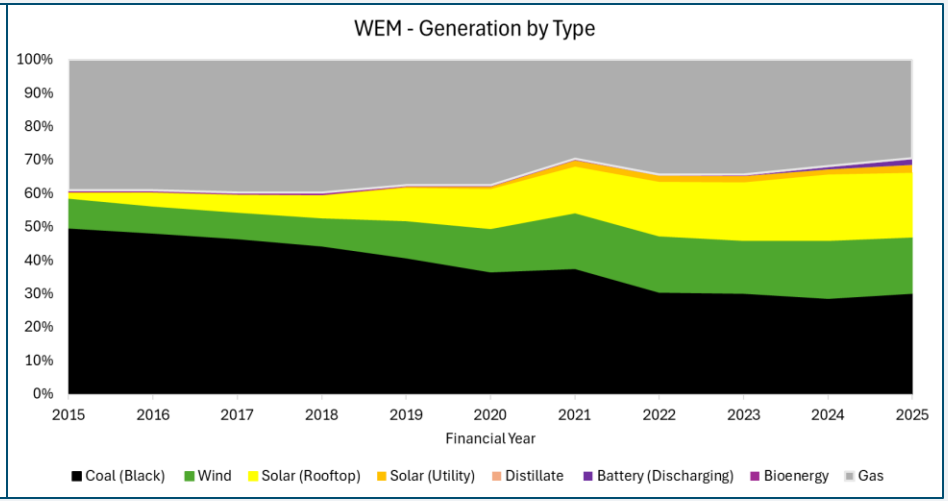
Source: CSIRO GenCost 2025 and MJA Analysis 2025

Electrification pathways to decarbonisation

Electrification of the west

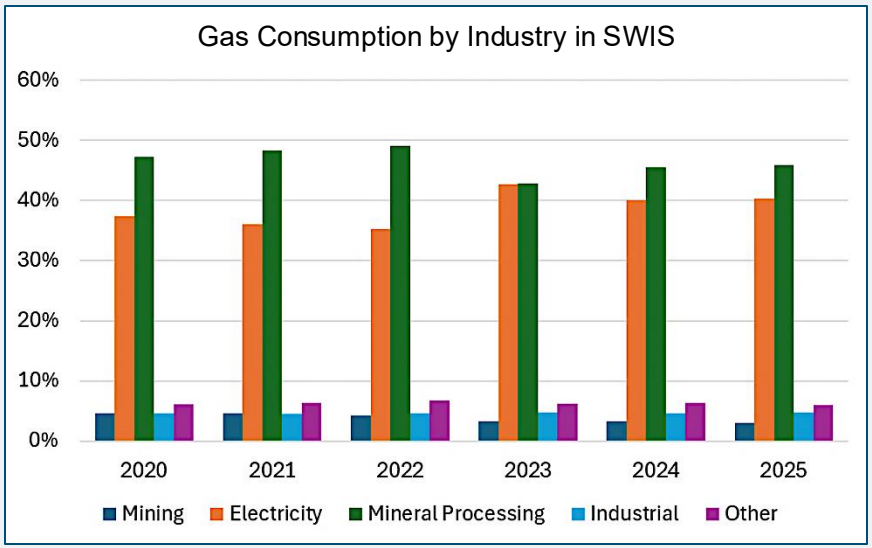
- WA relies heavily on gas, with well-developed gas networks supplying South West, Pilbara and Goldfields.
- Unlike the east coast, WA lacks a statewide interconnected electricity market. Significant transmission investment is needed.





Source: Open Electricity, AEMO

Electrification of the west

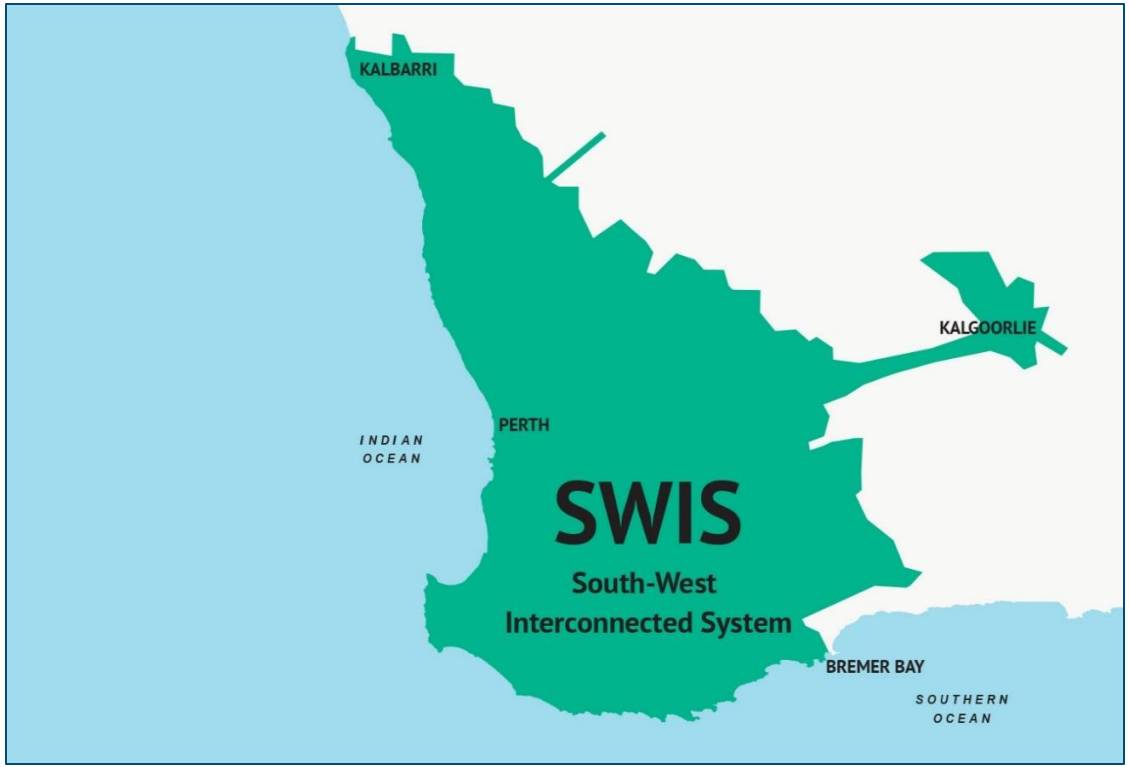


Source: Gas Bulletin Board WA

- South West is home to major energy-intensive industries (mineral processing in graph on right), including: bauxite mining and alumina refining; gold mining and production; mineral sands; lithium mining and refining; and silicon production.
- Challenges for electrifying these industries include:
  - Expanding transmission to connect renewable energy.
  - 'Firming' renewable energy supplies.
  - Bundled electricity costs that maintain industry competitiveness.

Wholesale Electricity Market (WEM)

South West Interconnected System (SWIS)



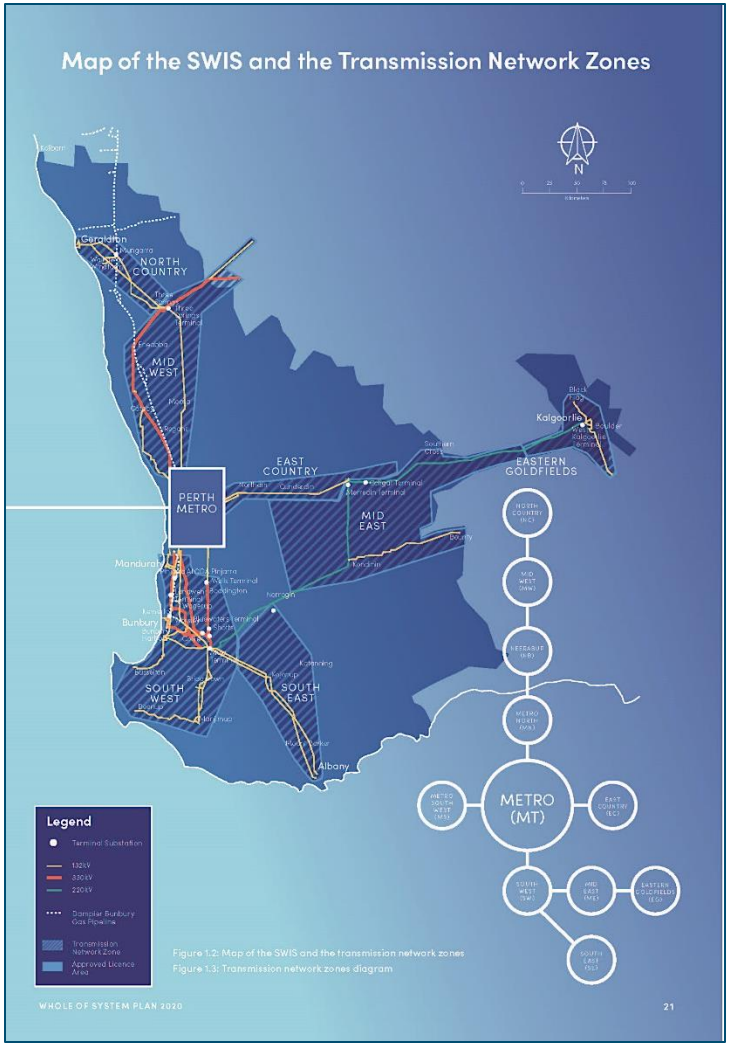
SWIS statistics

- 1.2M customer connections.
- Service area bigger than the UK.
- Operational consumption from grid ~17 TWh p/a, with unscheduled operational consumption (includes rooftop solar) 21 TWh p/a.
- 40% of households have rooftop PV.
- Extreme temperatures in two most recent summers have pushed near-term peak demand forecasts higher.
- Minimum demand has fallen from 1000 MW to 500 MW in 6 years due to rooftop PV.

WA's transmission system

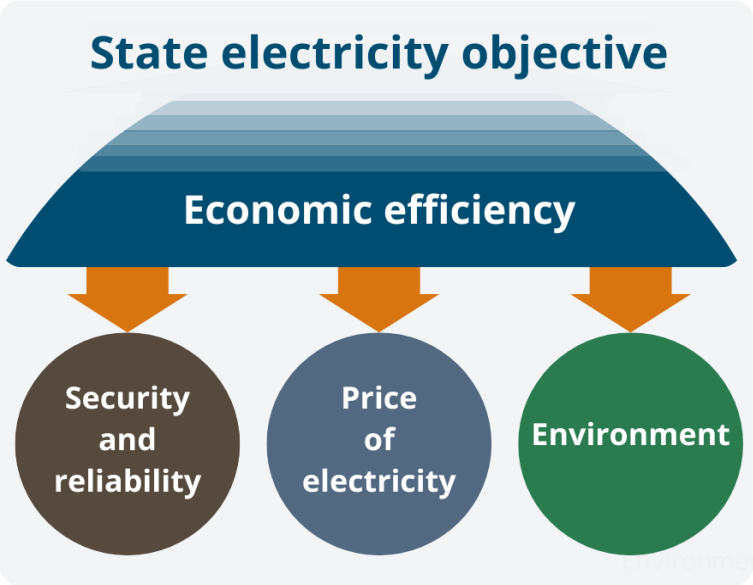
- **North Country and Mid-West:** Wind farms face transmission constraints. Upgrading 132 kV to 330 kV cable will help overcome constraints.
- **East Country:** Large wind and solar farms risk overloading the 220 kV line south to Muja. Clean Energy Link East will unlock more capacity.
- **South East:** Limited capacity due to existing wind farms at Kojonup and Albany. Clean Energy Link South aims to enable a renewable hub at Kojonup.
- **South West:** Capacity for new renewables but is constrained by urban, tourism and industrial demand. Storage facilities growing at Kemerton.
- **Eastern Goldfields:** High mining demand but limited land and short-term outlook hinder long-term renewable Power Purchase Agreements (PPAs).

Source: Energy Transformation Taskforce, Whole of System Plan, August 2020.



Wholesale Electricity Market (WEM)

- **WEM uses an 'energy and capacity' market design**, like the UK, Ireland and PJM (US). The WEM is one of the early adopters of capacity markets (2006).
- **Capacity markets can lead to oversupply and higher costs** – a past issue for the WEM until 2023/24.
- **The new WEM commenced on 1 October 2023** and included:
  - Security constrained economic dispatch.
  - 5-minute generation dispatch and 30-minute market settlement (moving to 5-minute settlement in 2025)
  - Co-optimised energy and ESS.
- **WEM operations are governed by the state electricity objective**, focused on long-term interests of consumers in relation to:
  a) Quality, safety, security and reliability of supply.
  b) Price of electricity.
  c) The environment, including emissions reduction.

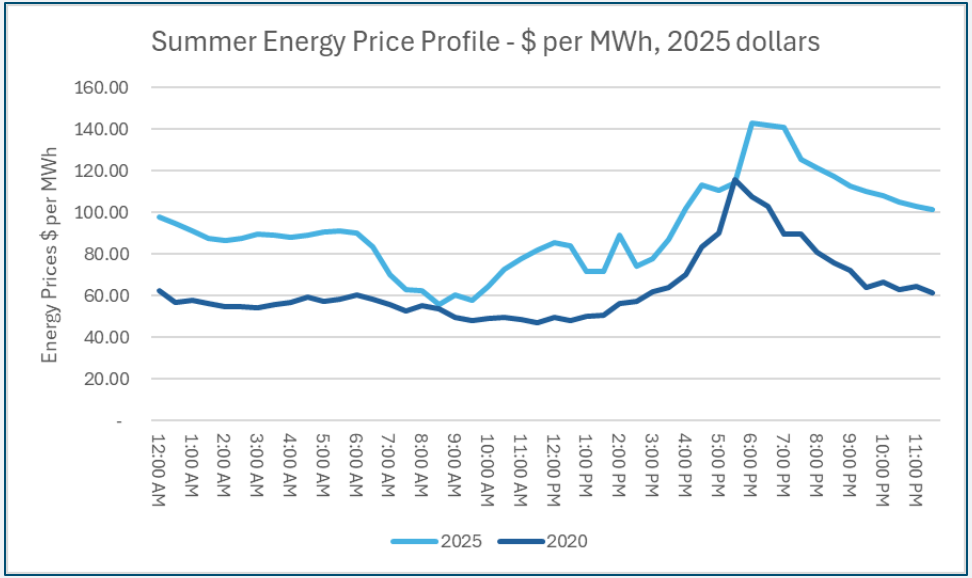


WEM overview

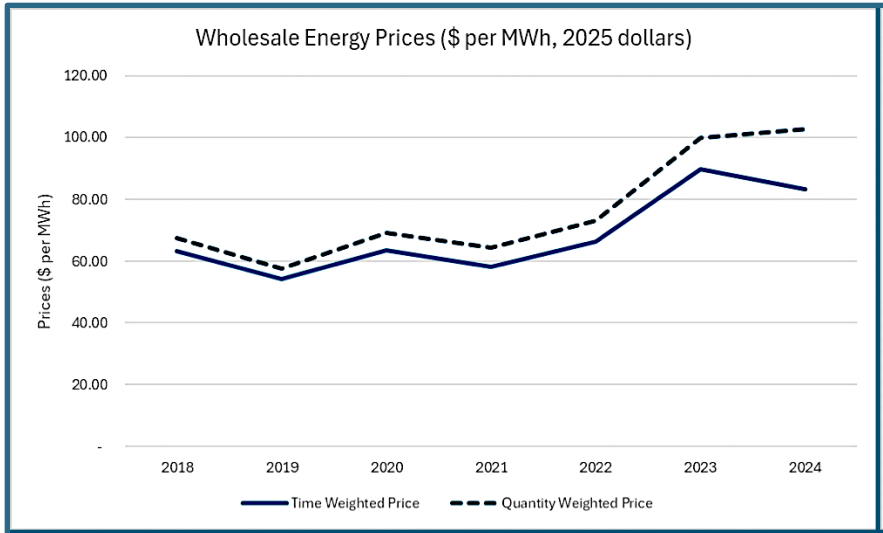
Energy market

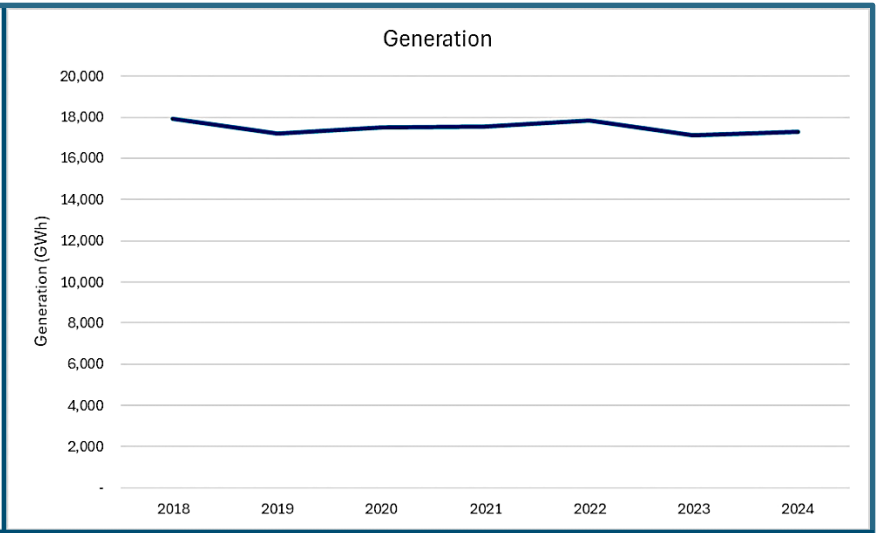
- The WEM was designed as a bilateral contracts market, with imbalances managed through two mechanisms: the day-ahead Short Term Energy Market (STEM) and the Real Time Market (RTM) on the trading day.
- Dispatch follows a merit order, with lowest-cost generation dispatched first, subject to network constraints.

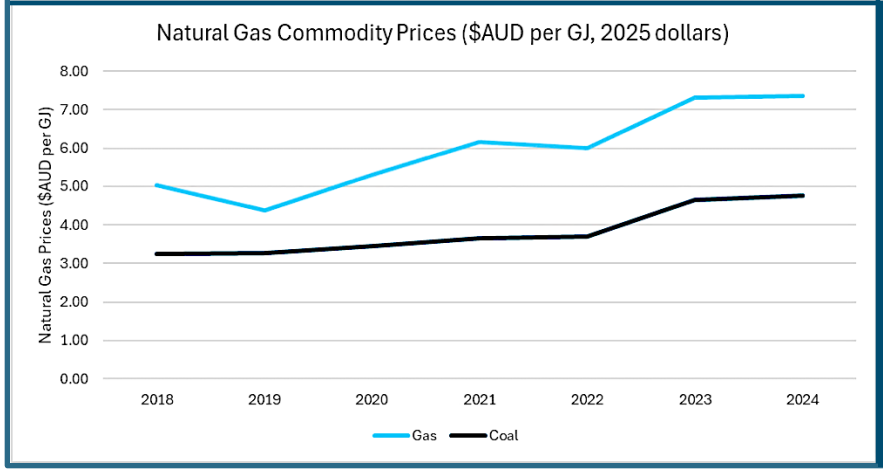
RTM prices (AUD$ per MWh) – 2025



Source: AEMO







- Significant increase in wholesale energy prices overtime primarily due to higher natural gas (commodity) and coal prices.
- Almost no change in Operational Consumption (see Generation above) due to increased penetration of rooftop PV offsetting economic drivers of electricity demand.

Ensuring capacity to meet demand

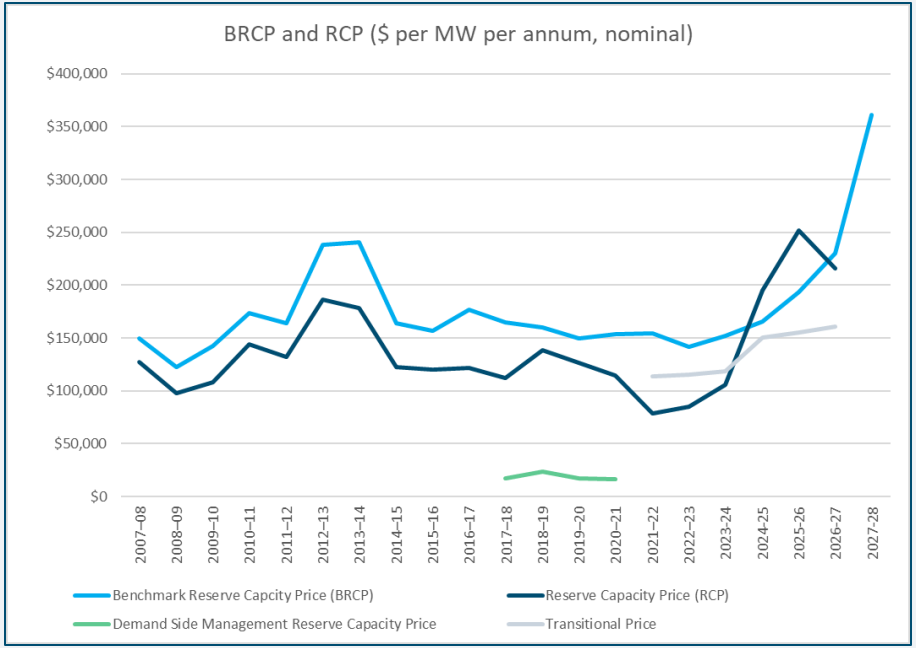
To ensure there is sufficient capacity to meet peak demand, the WEM uses the 'Reserve Capacity Mechanism' (RCM).

Generators and Demand Side Management (DSM) are assigned capacity credits, reflecting their ability to meet peak demand.

The Reserve Capacity Price (RCP) depends on:

- Benchmark Reserve Capacity Price (BRCP) – based on cost of Open Cycle Gas Turbine until 2026-27; switches to 4-hour BESS in 2027-28.
- Excess Capacity – more surplus means lower RCP.

Reserve Capacity Price Forecasts ($ per MW per annum) – nominal dollars



Source: https://aemo.com.au/energy-systems/electricity/wholesale-electricity-market-wem/wa-reserve-capacity-mechanism/reserve-capacity-price

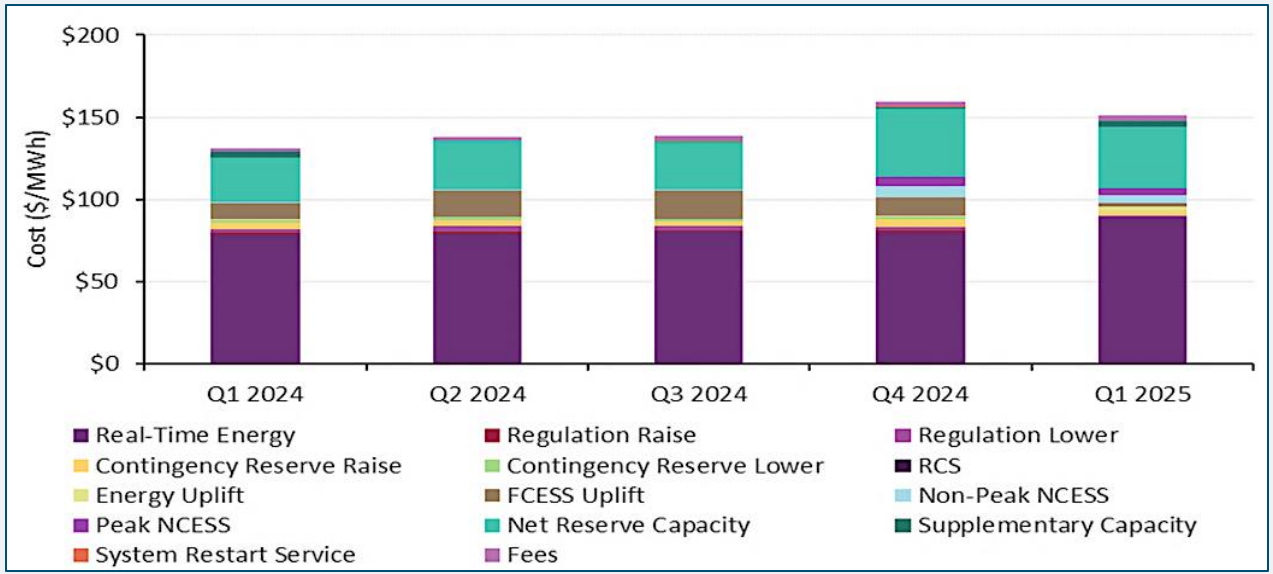
Maintaining system frequency: FCESS

The current Ancillary Services for maintaining system frequency will be replaced by Frequency Control Essential System Services (FCESS), and includes:

- Frequency Regulation Raise (currently referred to as Load Following Ancillary Services Up or LFAS Up).
- Frequency Regulation Lower (currently referred to as LFAS Down).
- Contingency Reserve Raise (currently referred to as Spinning Reserve Ancillary Service or SRAS).
- Contingency Reserve Lower (currently referred to as Load Rejection Reserve or LRR).
- Rate of Change of Frequency (RoCoF) Control Service (no current equivalent service).

Storage facilities will be well suited to providing many of these services.

Wholesale cost stack (nominal)

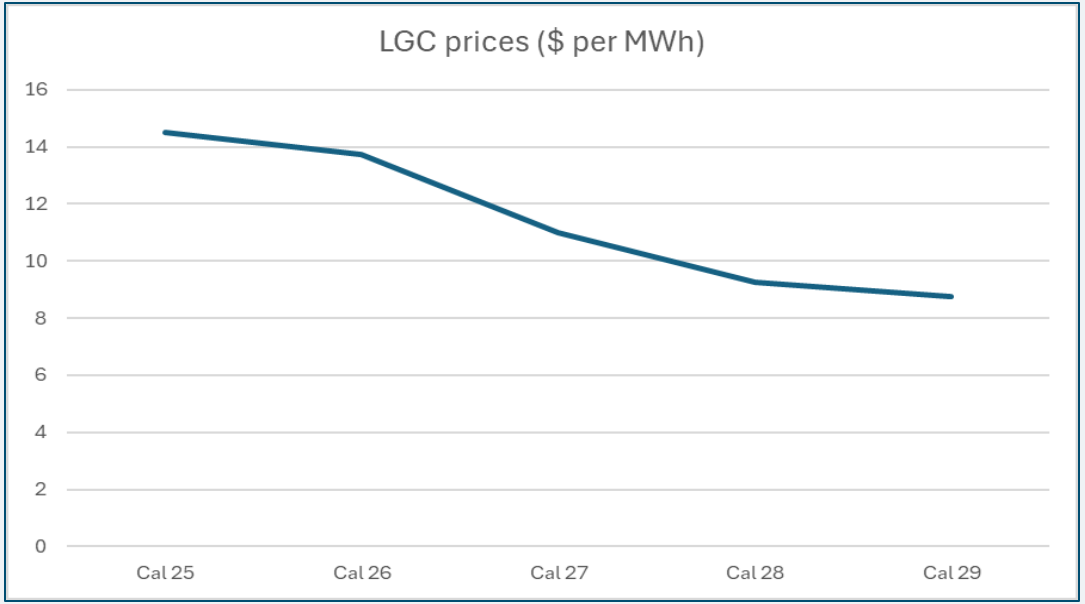


Source: AEMO, Quarterly Energy Dynamics – Q1 2025

- Wholesale cost stack around $150 per MWh in Q1, 2025.
- Energy prices the most significant, followed by capacity prices, and then co-optimised and non-co-optimised ESS.
- Provides a benchmark for future wholesale costs. Adjusting for higher load factor of baseload customer, the relevant benchmark is ~$136 per MWh.

Large-scale generation certificates

Large-Scale Generation Certificate Forward Prices - $ per MWh nominal

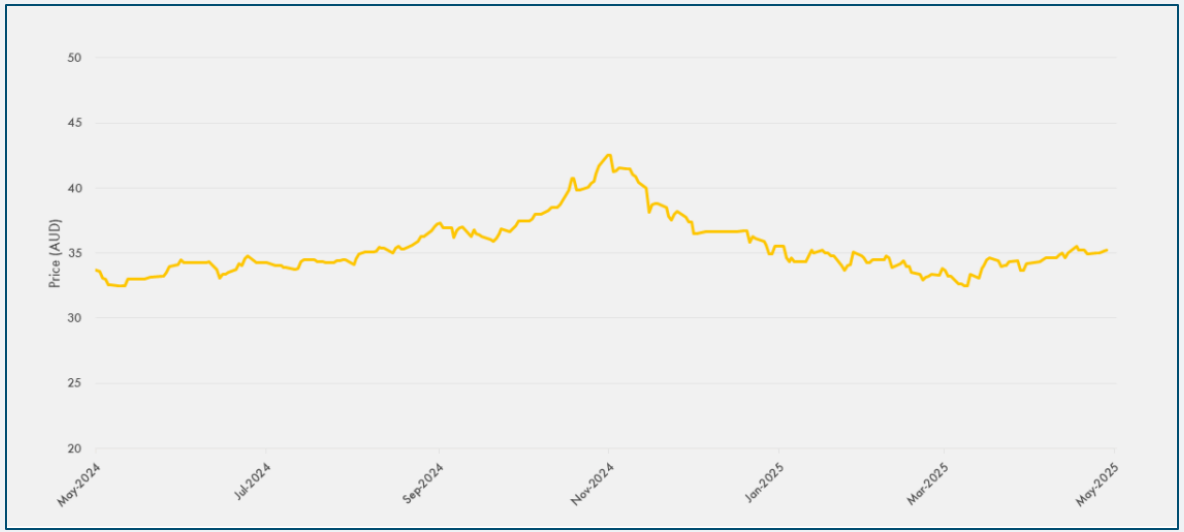


Source: Mercari (17 July 2025)

- The LRET target of 20% renewables by 2020 has been achieved.
- Predicted that forward LGC prices will continue to decline due to growing surplus of certificates from new renewable projects and introduction of the proposed Renewable Energy Guarantee of Origin (REGO) scheme in 2026.
- The REGO scheme will replace the Renewable Energy Target (RET) scheme from 2030.

Carbon credits

Carbon credits – $ per tCO2e (nominal)



Source: Environmental Certificates Market Update: June 2025 | Shell Energy

- Safeguard Mechanism facilities can purchase carbon credits (e.g. ACCUs and Safeguard Mechanism Credits or SMCs) to offset emissions.
- Prices gradually increased in May 2025 influenced by regulatory developments, market demand and integrity of ACCU supply.
- Prices forecast to remain under $100/t through 2035.

Meeting baseload requirements in the SWIS

Meeting baseload requirements in the WEM

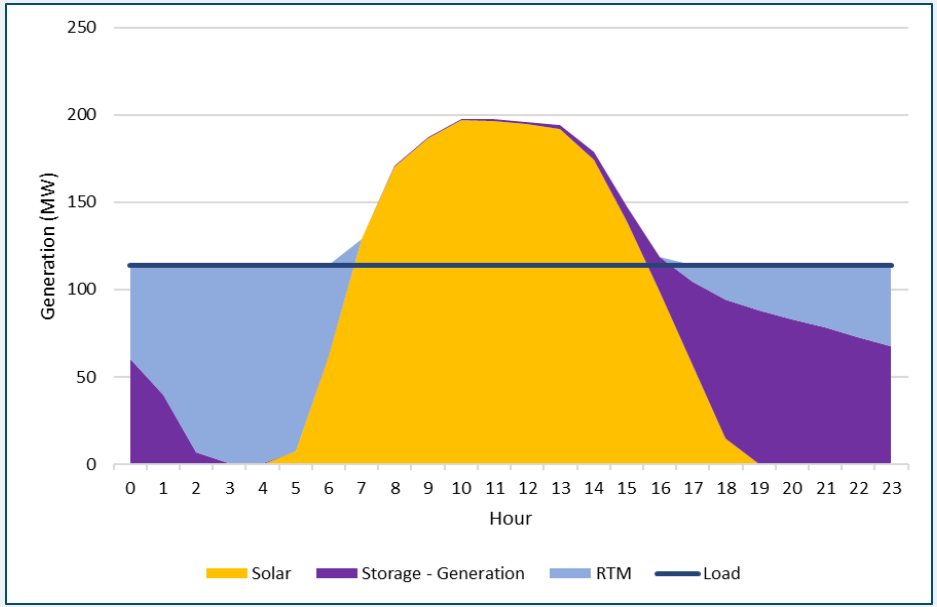
- MJA undertakes initial optimisation to determine right mix of Variable Renewable Energy (VRE) and storage to meet a flat load. Based on Unit CAPEX of each technology and generation traces.
- Excludes carbon costs and transmission charges.
- Used to help determine the right mix of technologies to meet the load's requirements.

Solar and 8hr BTM BESS

- Load is exposed to the RTM for 30% of total energy consumed.
- Solar is oversized to meet load during winter; this results in exports during high solar output months.
- More storage is required in this option to reduce exposure to high price periods.
- Unit cost is $105 per MWh for energy supplies commencing 1 October 2028.
- Optimised solar and BESS capacity to meet the loads' requirements are shown here:

Type	Capacity (MW)
Load	114
Solar	325
BESS (8hr)	114

Average generation/discharge profile (MW)

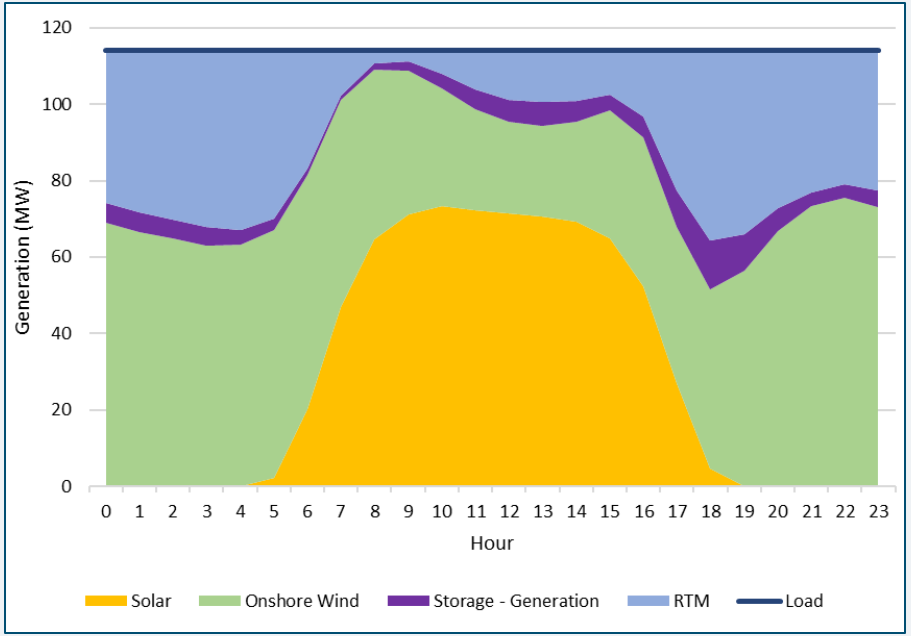


Solar, wind and 4hr BTM BESS

- Load is exposed to the RTM for 25% of total energy consumed.
- Storage requirement is reduced to 4 hours.
- Purchases from the RTM occur more in the evening and morning.
- Unit cost is $110 per MWh for energy supplies commencing 1 October 2028.
- Optimised onshore wind, solar and BESS capacity to meet the loads requirements are shown here:

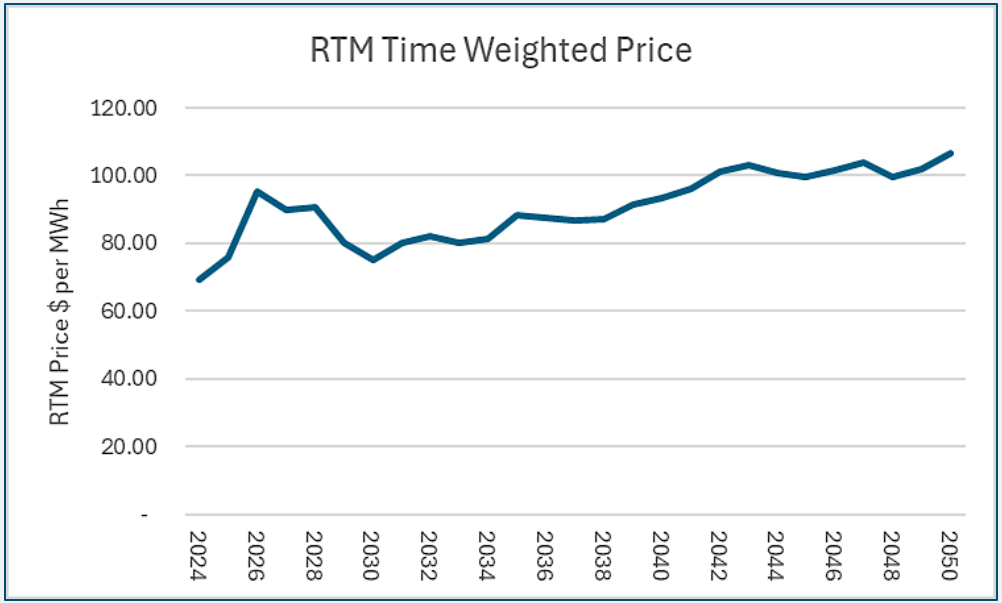
Type	Capacity (MW)
Load	114
Solar	100
Wind	150
BESS (4hr)	114

Average generation/discharge profile (MW)



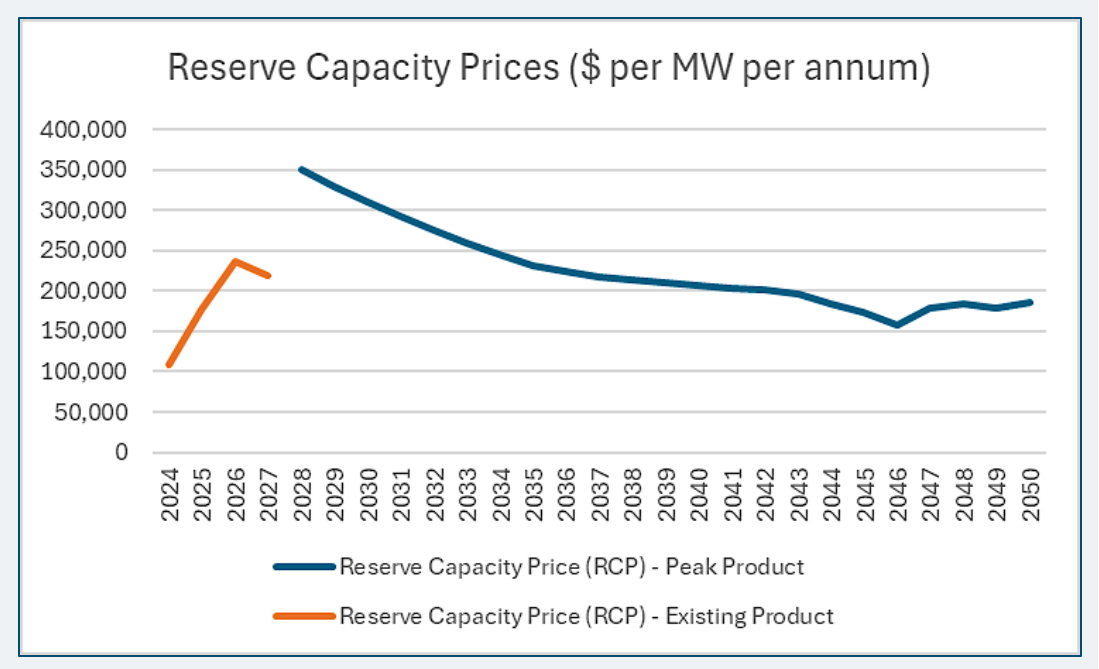
Cost stack for a major industrial customer

Real time prices (June 2025)



- Prices initially increase due to coal plant retirements and rising natural gas prices (2024 to 2026).
- Increase in VRE and BESS help to decrease prices post-2026.
- All coal plant exit the market by 2031 and with rising demand, gas plant, BESS and hydrogen turbines setting higher market prices in many trading intervals.
- BESS is shadow pricing GPG in the SWIS (but at a discount for 50% of its capacity).

Reserve capacity prices



- Variable Reserve Capacity Price (RCP) reflects the annualised fixed costs of dispatchable plant (i.e., OCGT and BESS) and excess capacity.
- BRCP is currently set by 160MW OCGT, however in 2027-28 it will be set by a 4-hour BESS (~50% increase in price).
- Loads purchase capacity credits in relation to their contribution to system peak.

Baseload customer cost stack

(% of total cost, -ve is net expense, +ve is net market revenue)

Cost Stack	Spot Purchases	Grid Connected Solar with BTM BESS	Grid Connected Wind and Solar with BTM BESS
Net Energy Market Revenue	-63.62%	-27.78%	-21.85%
Net Capacity Credit Revenue	-23.09%	14.32%	9.84%
Net ESS Revenue	-4.23%	-6.35%	-4.61%
Net LGC Revenue	-1.51%	0.67%	0.44%
Capital & Connection Cost	0.00%	-27.03%	-21.12%
Renewable PPAs	0.00%	-44.28%	-53.09%
OPEX	0.00%	-2.18%	-2.26%
TUOS	-5.28%	-5.55%	-5.76%
Market Fees	-2.26%	-1.83%	-1.58%

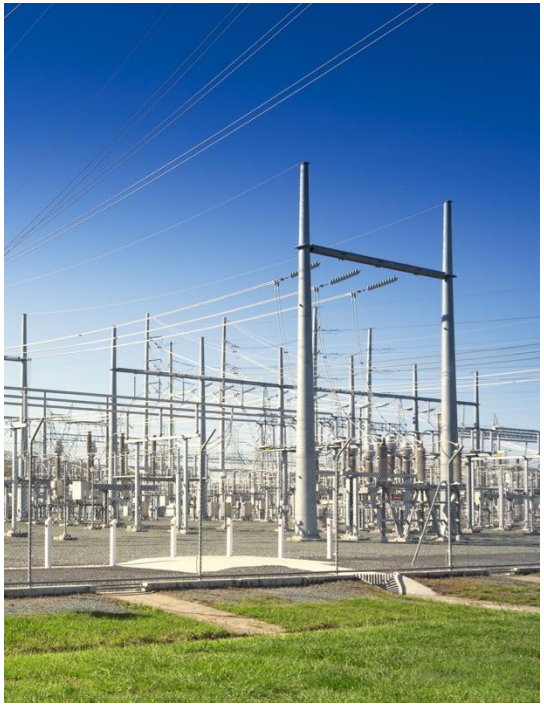
Wholesale cost stack for baseload customer (June 2025)

The bundled cost for meeting a baseload customer's needs in the SWIS (all options have the same emissions profile):

- Around $127 per MWh for spot purchases (i.e., RTM, capacity credits, LGCs etc.).
- Up to $121 per MWh for grid connected solar farm with BTM BESS.
- Up to $117 per MWh for grid connected wind and solar farm with BTM BESS.

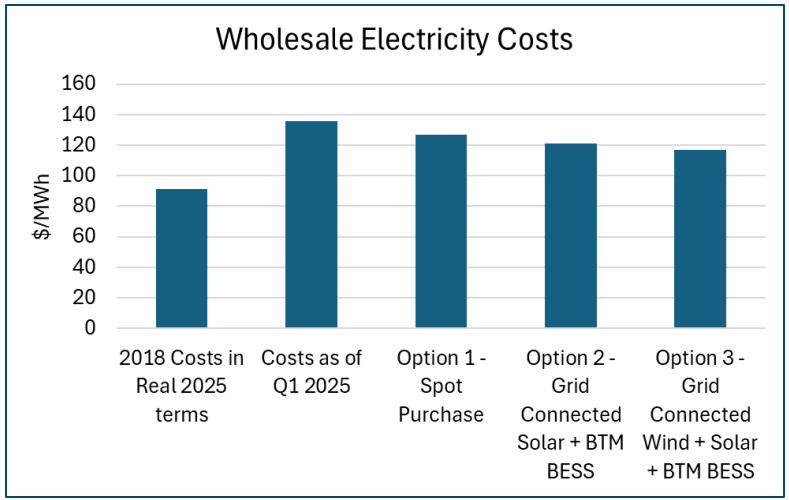
Bundled costs include annualised capital and opex, RTM purchases, capacity credit purchases, ESS, LGCs, PPA prices, TUOS, market fees.

Cheaper than the current cost stack of $136 per MWh for a baseload customer.



Implications for industrial customers in the SWIS

- Wholesale electricity costs have increased substantially from 2018 to 2025.
- Costs will continue to stay high under all options.



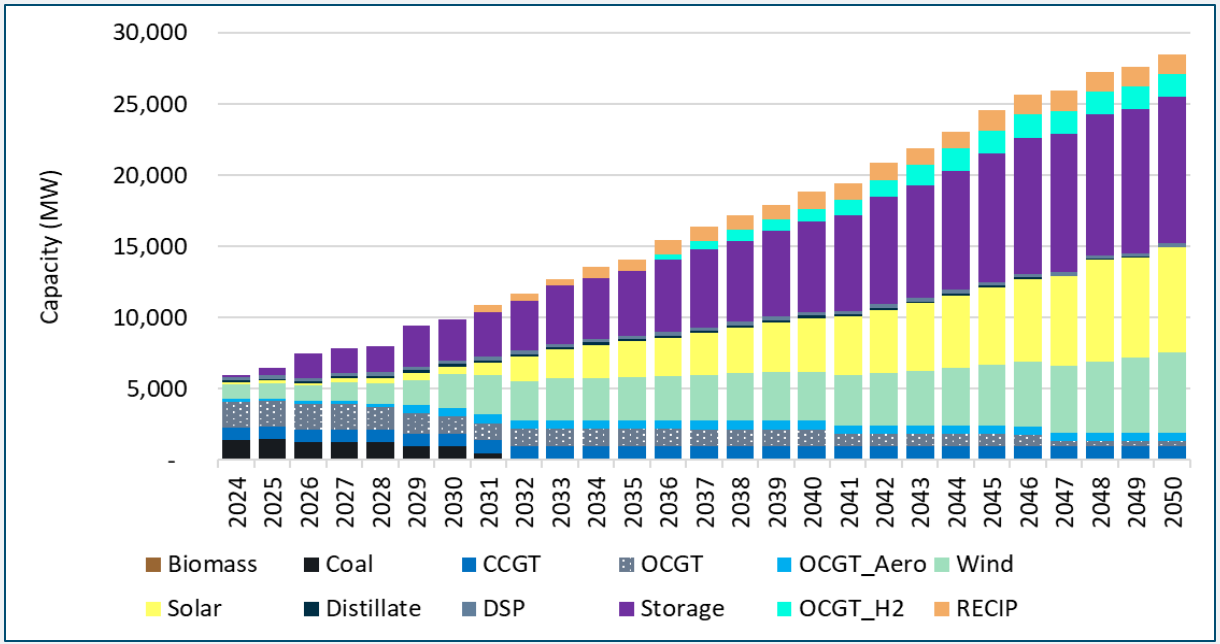
- Additional costs for electrifying industrial processes (i.e. e-boilers) will need to be added onto options 2 and 3.

Implications for industrial customers in the SWIS

- Industry is exposed to commodity prices – if commodity prices fall, margins will be squeezed, potentially resulting in downsizing or closures.

- Changes to Safeguard Mechanism such as reducing emission cap or expanding industries captured would put more pressure on large industry.

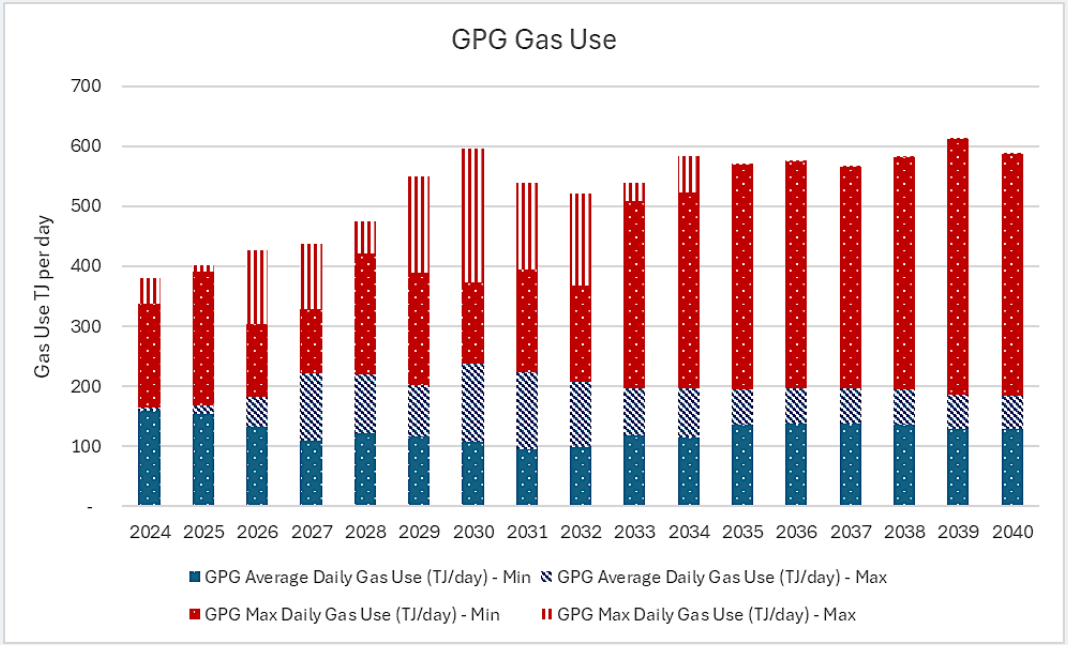
Importance of GPG in the SWIS



Source: MJA 2025

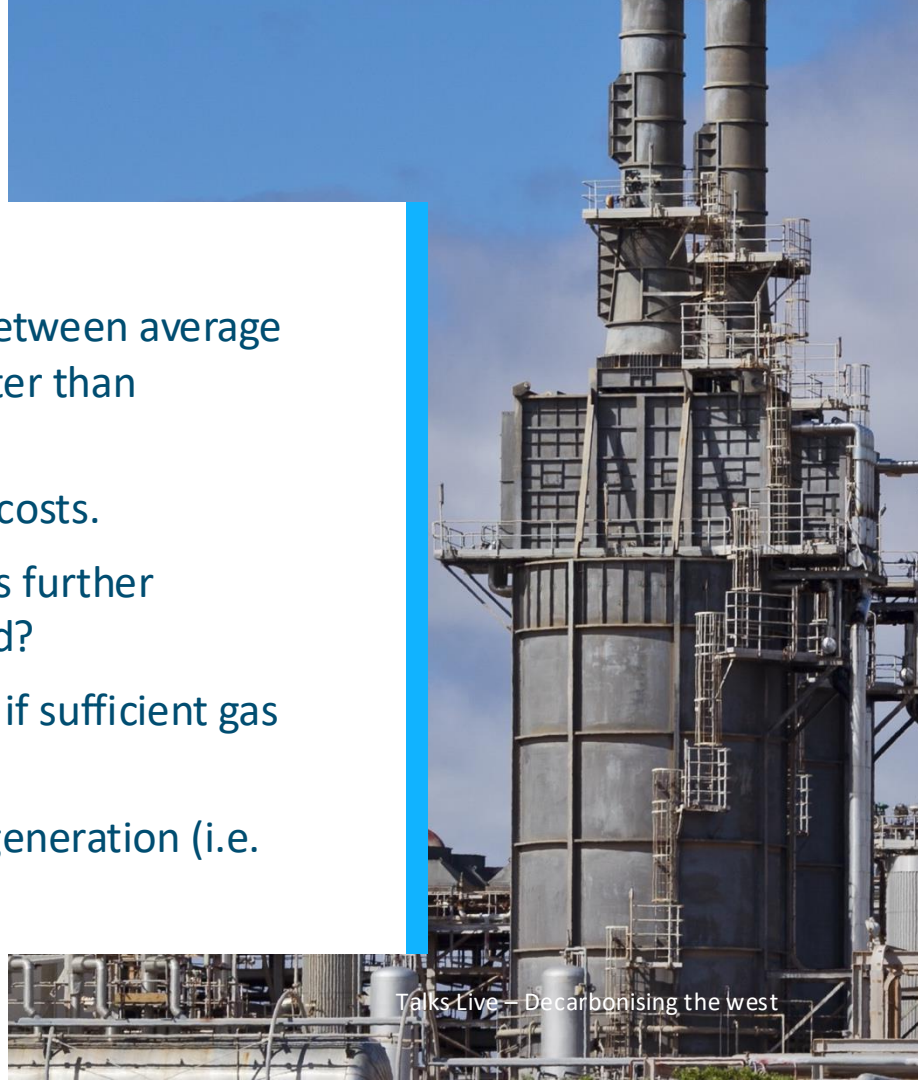
- Economics of long duration storage is yet to be proven in the WEM.
- Market currently only incentivises short term (4hr and now 6hr).
- Lack of long duration means continued reliance on GPG to provide firming and peaking, with our estimates for GPG capacity increasing.
- Reliance on GPG would be even higher if hydrogen turbines are not developed (i.e. OCGT_H2).

GPG gas use



- GPG average gas use (TJ per day) is modest, around 200 TJ per day from 2027 to 2040.
- However, peak GPG increases from 380 TJ/day in 2024 (high case) to over 600 TJ by 2030 (high case) and could remain around this level.

GPG gas use

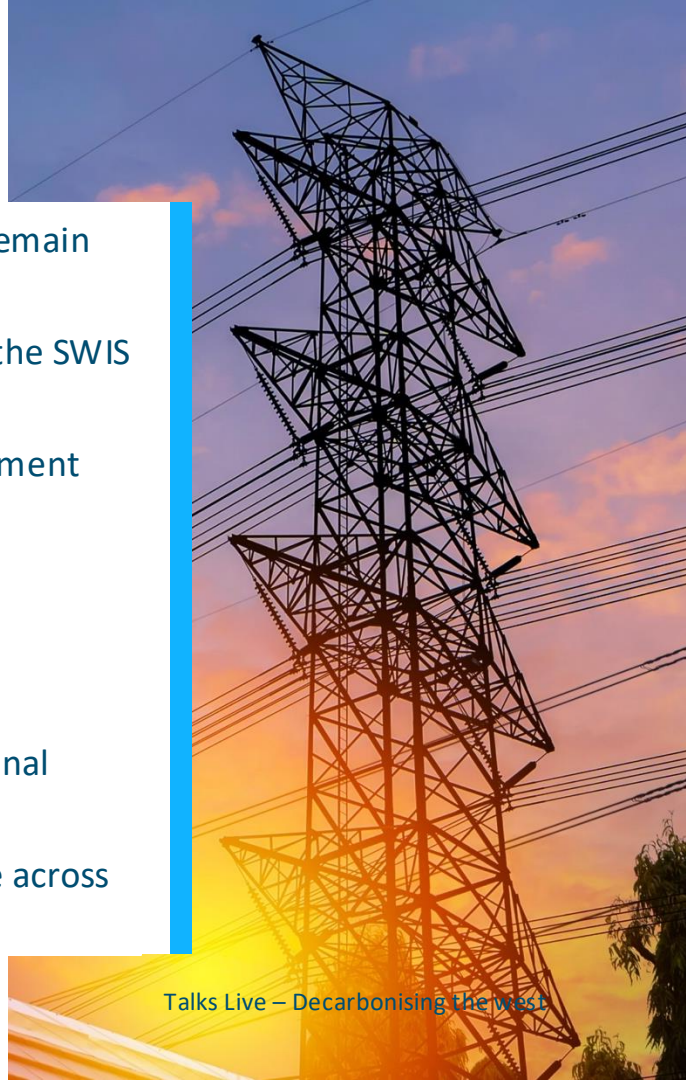


Key challenges for the gas market

- Securing gas supply is difficult given the gap between average and peak demand; portfolios manage this better than standalone plants.
- Low pipeline utilisation may increase haulage costs.
- Can the pipeline meet peak GPG demand, or is further investment in gas looping and storage required?
- Will GPG have to run on distillate (or biofuels) if sufficient gas commodity and haulage is not available?
- Will governments penalise investment in gas generation (i.e. emission penalty scheme, carbon prices)?

Parting insights

- Wholesale electricity prices have risen sharply, and are expected to remain elevated.
- Gas-powered generation (GPG) will continue to play a critical role in the SWIS for peaking and firming, unless there are policy changes.
- Decarbonisation strategies that can support cost certainty and investment include:
  - a carbon price
  - more binding Safeguard Mechanism emission limits
  - policy incentives for long-duration storage.
- Industrial businesses should act now by understanding their operational energy profile and identifying viable transition pathways.
- Marsden Jacob is well placed to support this transition with expertise across energy, water, land use and environmental policy.



Let’s talk

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