MEIxAEMO Seminar Series

Melbourne Energy Institute

THE UNIVERSITY OF MELBOURNE

Quarterly Energy Dynamics report: Q4 2023

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Presenter

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Moderator

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We acknowledge the Traditional Owners of country throughout Australia and recognise their continuing connection to land, waters and culture.

We pay respect to Elders past and present.

Agenda

Introduction

- East coast electricity and gas highlights

Wholesale electricity demand & prices

- Demand changes
- Quarterly price trends
- Regional prices
- Price setting dynamics and drivers
- Negative prices

Electricity & generation, flows, and FCAS

- Generation supply mix changes
- Black coal-fired &
- gas-fired generation
- Variable Renewable Energy (VRE) changes
- Interconnector flows
- FCAS

East coast gas markets

- East coast gas prices
- Gas demand
- LNG changes
- Gas storage

NEM Electricity demand and wholesale prices

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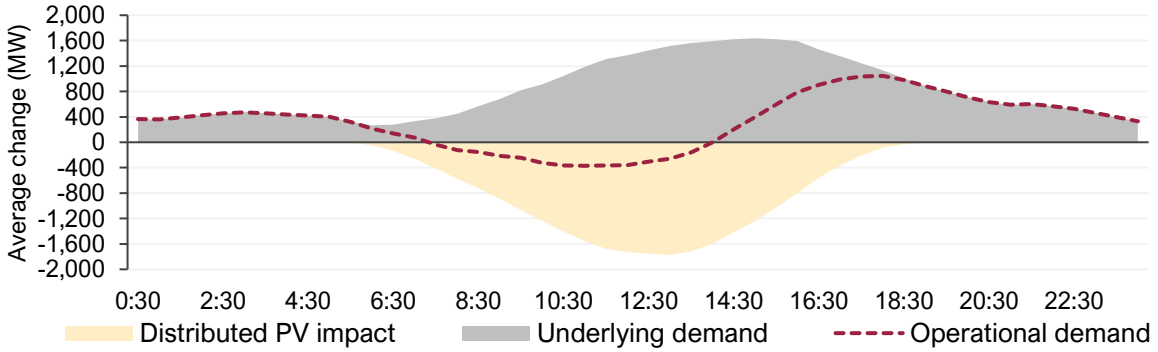
Demand outcomes

❑ **Significant increases in underlying demand during afternoon and overnight hours drove increased operational demand**

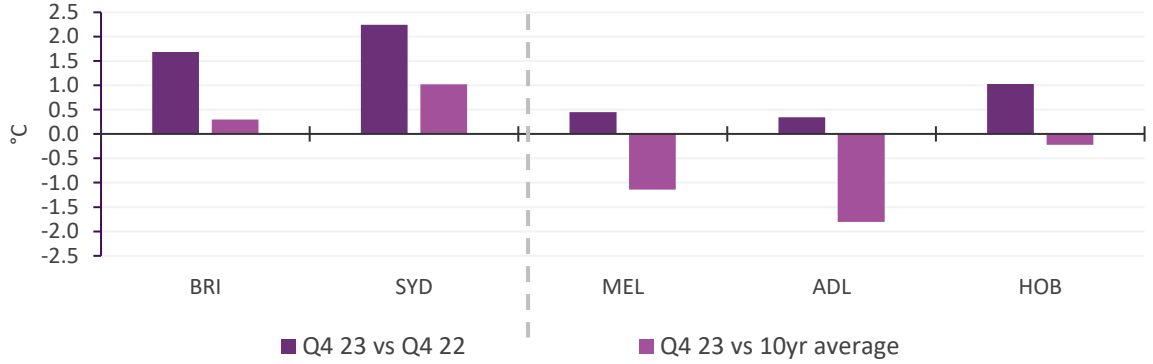
Changes in operational demand – Q4 2023 vs Q4 2022



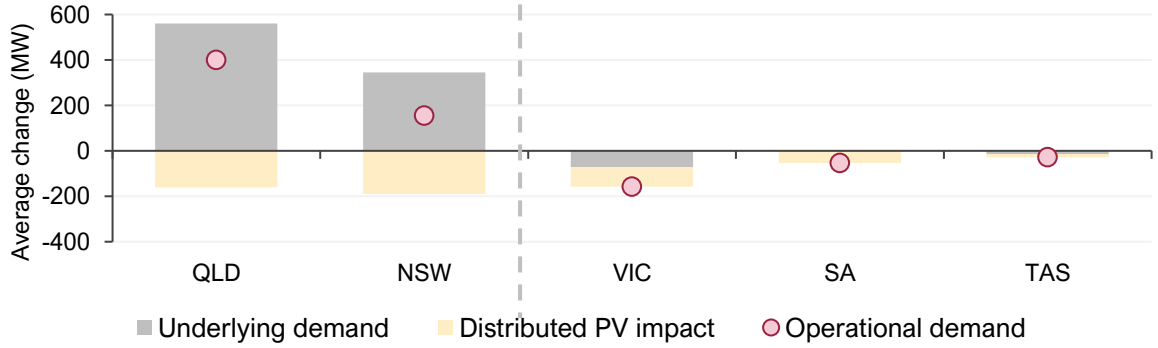
Demand component	Quarterly average	Change y-o-y	Remarks
Operational demand	19,745 MW	+ 315 MW (1.6%) ▲	First year-on-year rise for a Q4 since 2015
Underlying demand	23,718 MW	+ 820 MW (3.7%) ▲	Highest Q4 average since 2009
Distributed PV output	3,433 MW	+ 505 MW (17%) ▲	A new record for any quarter

❑ **Northern regions drove the NEM's operational demand increase with warmer than average temperatures**

Average maximum temperature variance by capital city



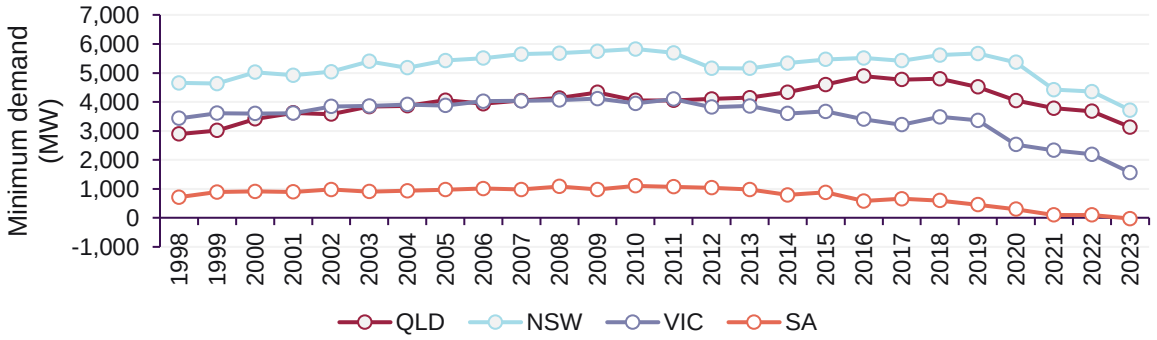
Changes in average demand components by region – Q4 2023 vs Q4 2022



Demand records

❑ **Minimum demands fell to record lows in New South Wales, Victoria and South Australia**

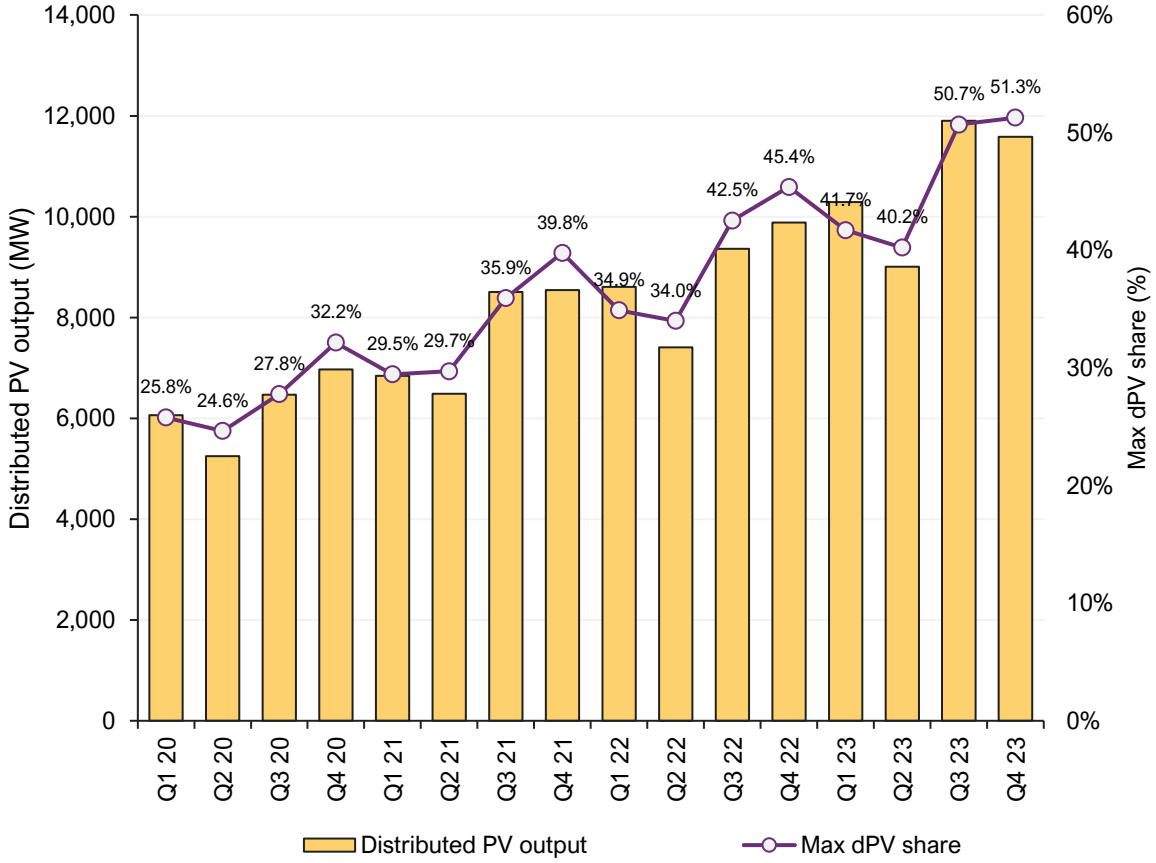
Q4 minimum operational demands for mainland regions



Region	Minimum demand record	Date	Change
NEM	11,009 MW	29/10/2023 1:30:00 PM	384 MW (-3.4%) ▼
NSW	3,719 MW	29/10/2023 12:00:00 PM	382 MW (-9.3%) ▼
VIC	1,564 MW	31/12/2023 1:00:00 PM	504 MW (-24.4%) ▼
SA	-26 MW	31/12/2023 1:30:00 PM	47 MW (-223.8%) ▼
QLD	3,131 MW (Since 2000)	1/10/2023 11:30:00 AM	29 MW (-0.9%) ▼

❑ **Distributed PV supplied a record instantaneous share of underlying NEM demand**

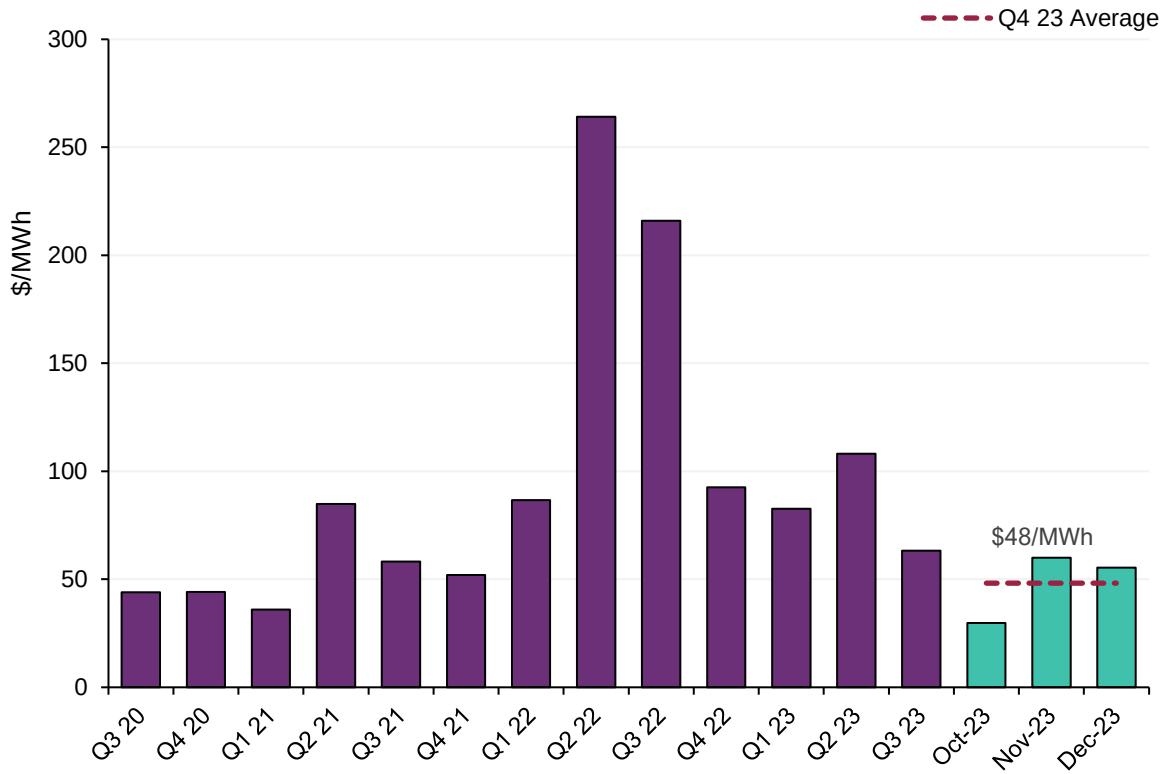
Distributed PV maximum instantaneous supply share (%) of underlying NEM demand and



Wholesale electricity prices

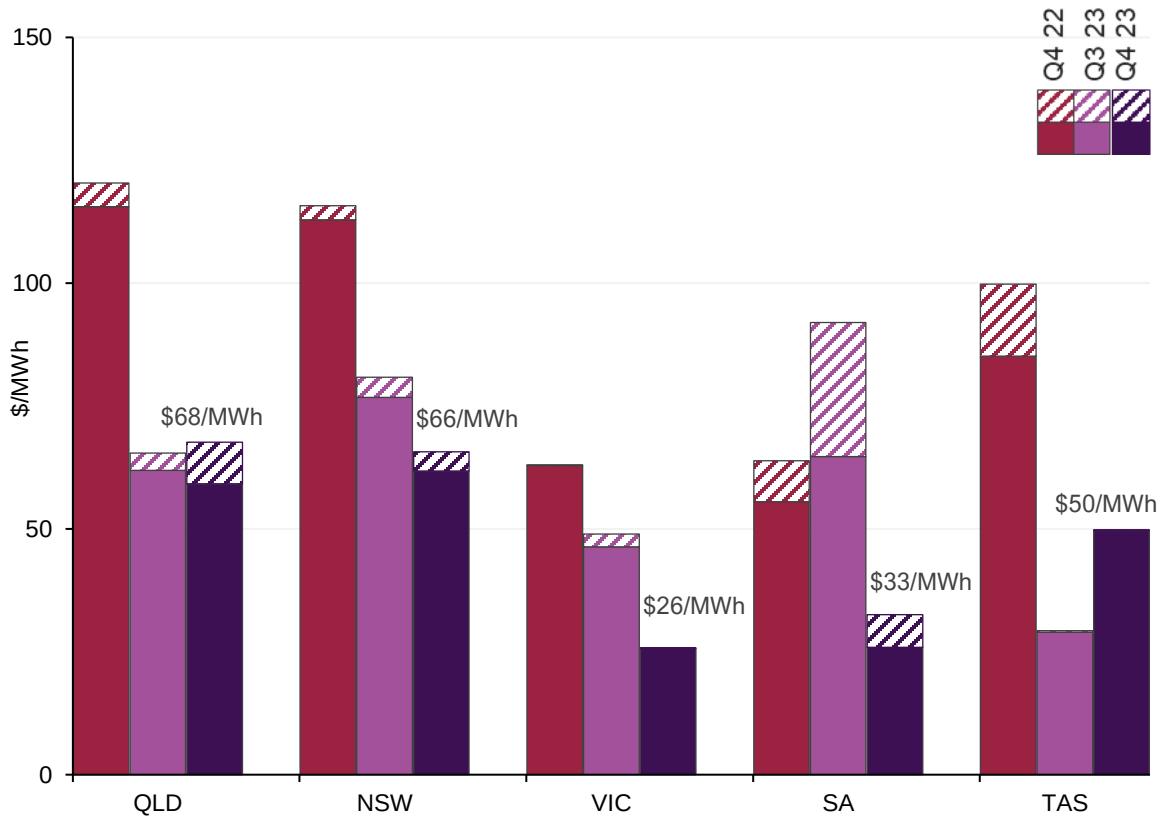
❑ **Average NEM spot prices down by 48% on Q4 2022, and 24% on Q3 2023**

NEM average wholesale electricity prices – quarterly since Q3 2020



❑ **All regions saw price declines on Q4 2022**

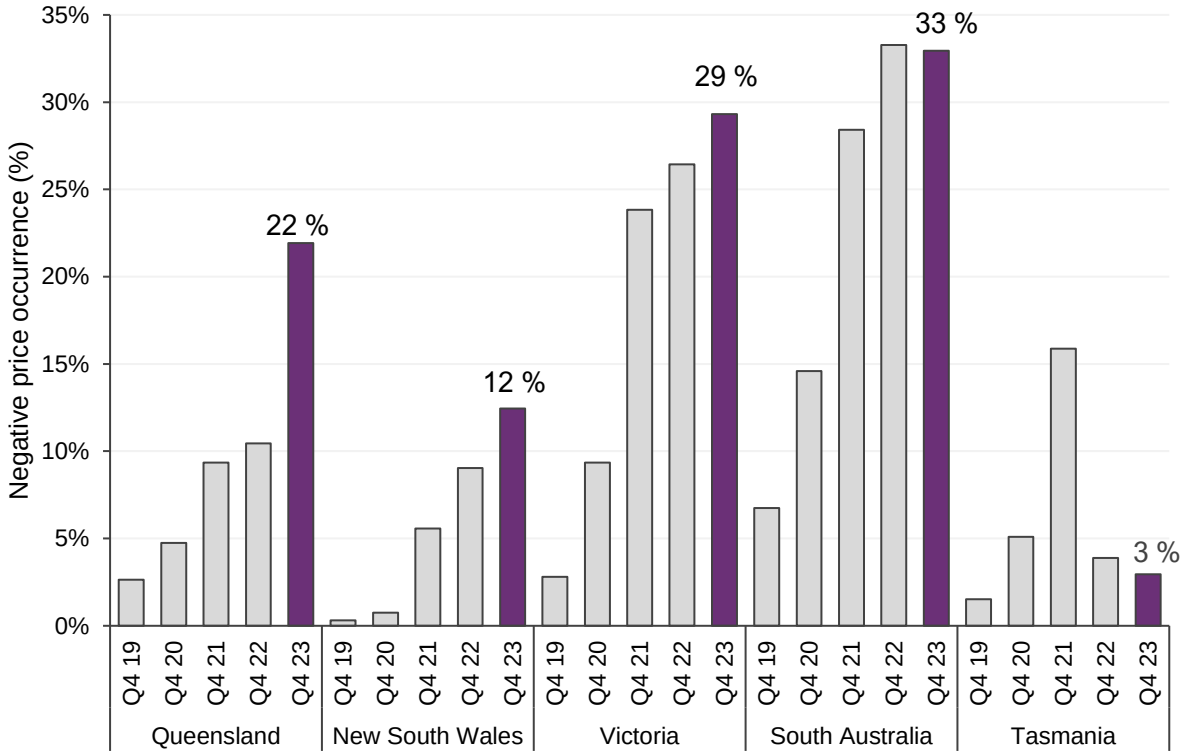
Average wholesale electricity spot price by region – energy and cap return components for



Negative Prices

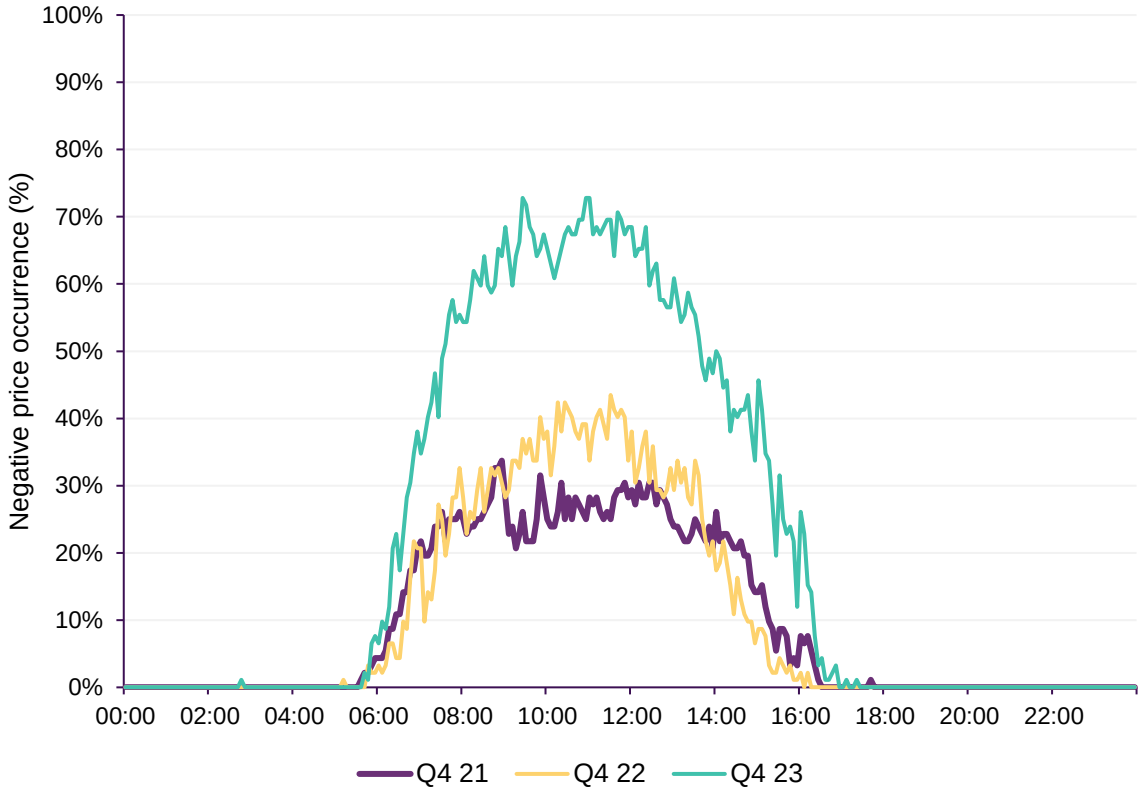
❑ **High Q4 negative price occurrence in all NEM mainland regions, except South Australia**

Negative price occurrence in NEM regions – Q4s



❑ **Record negative price occurrence in Queensland**

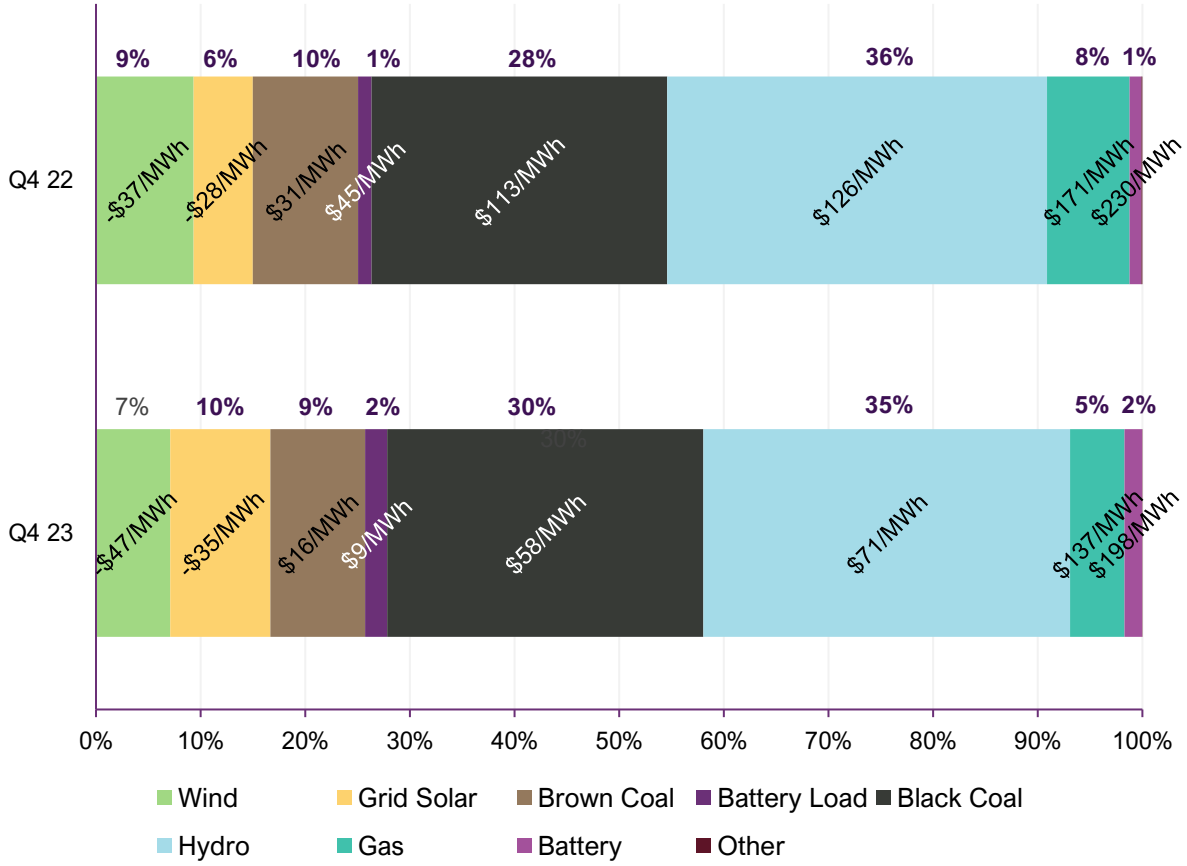
Queensland's negative price occurrence by time of day – Q4s



Price Setting Dynamics

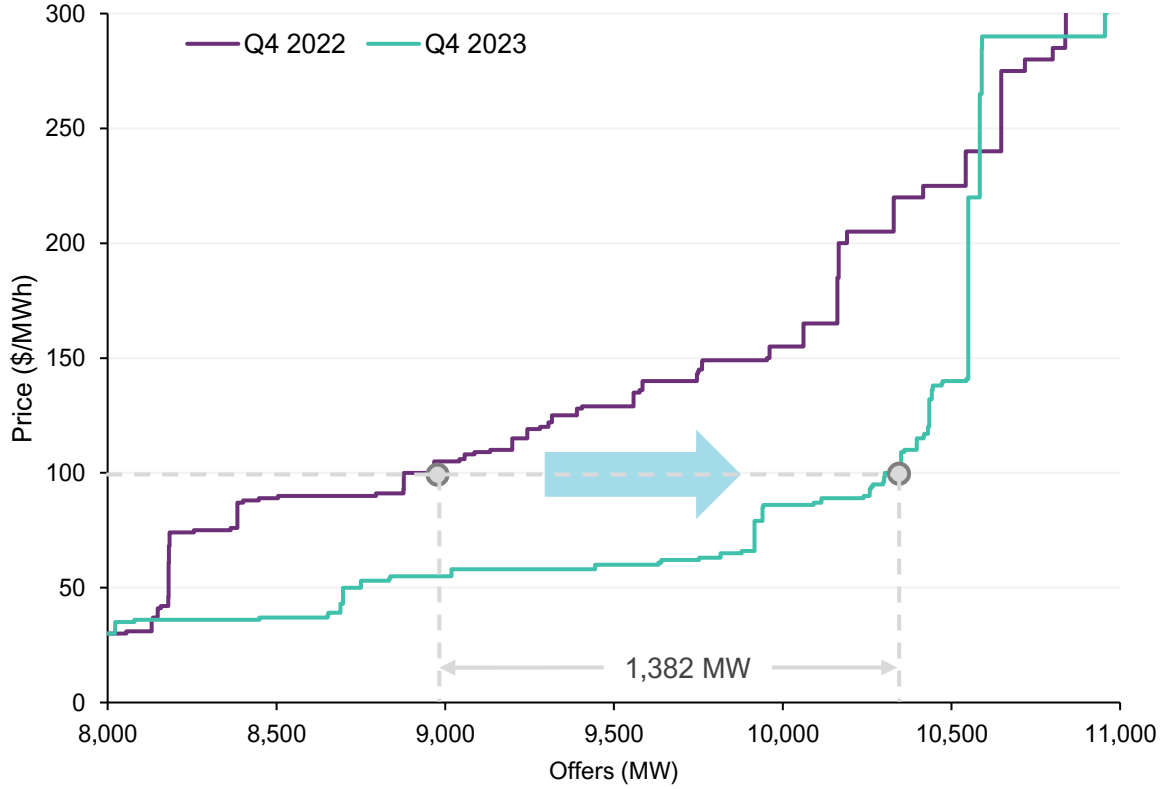
❑ **Large decreases in average prices set by all major fuel types**

NEM price-setting frequency and average price when price-setter by fuel type – Q4 2023 vs Q4 2022



❑ **Increased volumes of black coal-fired generation offered between $50/MWh and $200/MWh**

Black coal generation bid supply curve – Q4 2023 vs Q4 2022



Break for Q&A

NEM Electricity Generation, Interconnector flows and FCAS

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Generation change year-on-year

- Total NEM generation increased from 22,705 MW to **23,511 MW** year-on-year (**+3.5%**)
- Lower price levels and increase in VRE resulted in reduction in coal and gas during the day, and hydro at all times of the day.
- Continued increase in battery capacity saw an uplift in evening battery generation between 1800 hrs and 2100 hrs.
- Emissions reduced to a new all-time lowest record at **25.4 MtCO2-e** and **0.59 tCO2-e/MWh**

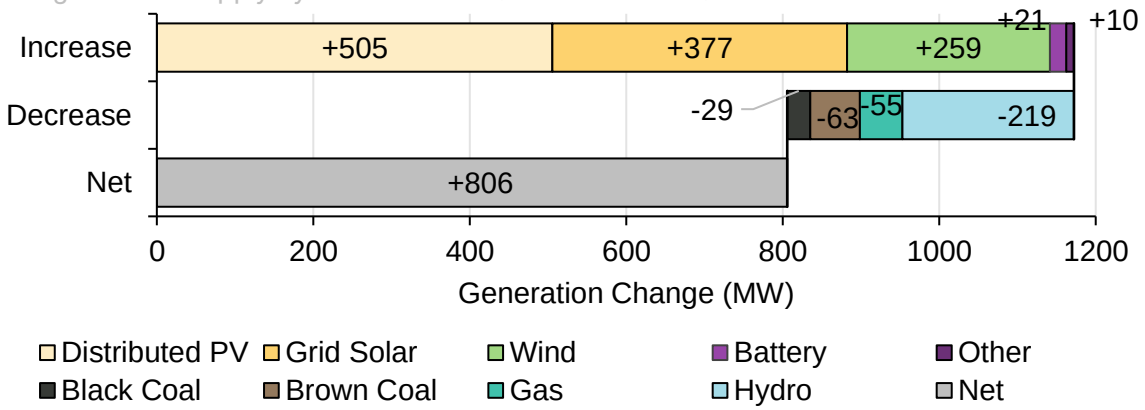
❑ NEM supply mix contribution by fuel type

Quarter	Black coal	Brown coal	Gas	Wind	Grid solar	DPV	Hydro	Battery	Other
Q4 22	40.6%	14.8%	4.0%	12.7%	7.2%	12.9%	7.4%	0.1%	0.15%
Q4 23	39.1%	14.1%	3.6%	13.4%	8.6%	14.6%	6.3%	0.2%	0.19%
Change	-1.5%	-0.8%	-0.4%	0.7%	1.4%	1.7%	-1.2%	0.1%	0.04%

43% renewables

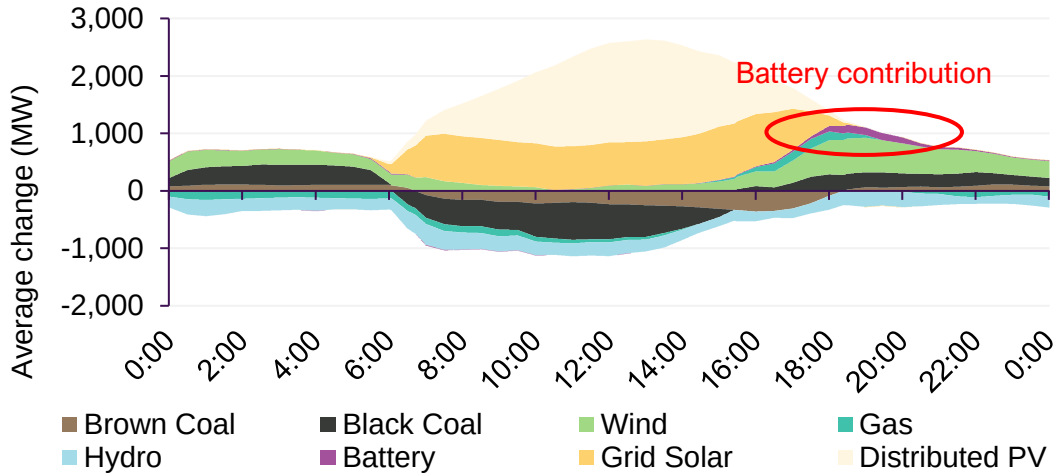
❑ Increased renewable and battery output displaces other major fuel types

Change in NEM supply by fuel source – Q4 2023 versus Q4 2022



❑ VRE output increases during the day, pushing down gas, coal, and hydro

NEM generation changes by time of day – Q4 2023 vs Q4 2022

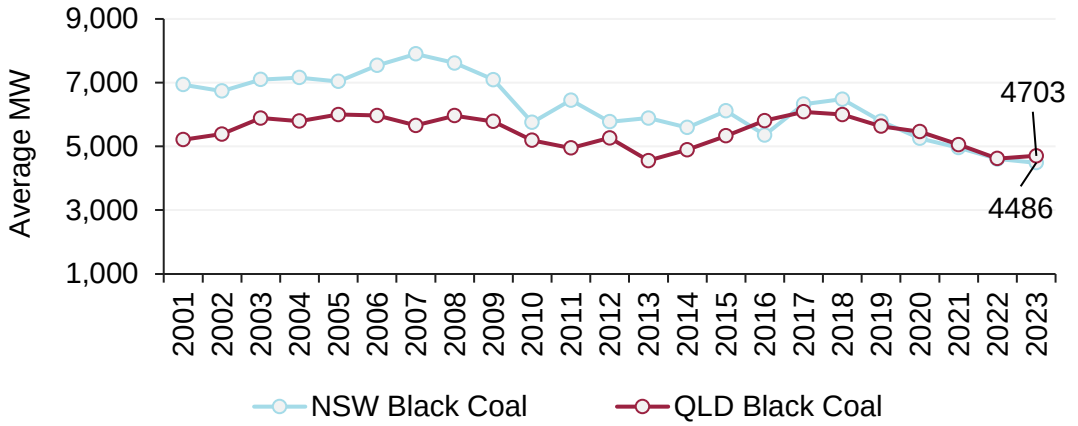


Black coal availability and output

- NEM black coal-fired generation **recorded an all-time lowest** average of 9,189 MW.
- Liddell's lost output was offset by the rest of black coal-fired generation leading to only a net output reduction of 30 MW YOY.
- Overall outages reduced in New South Wales and Queensland. However, Queensland saw more unplanned outages (Tarong and Gladstone).

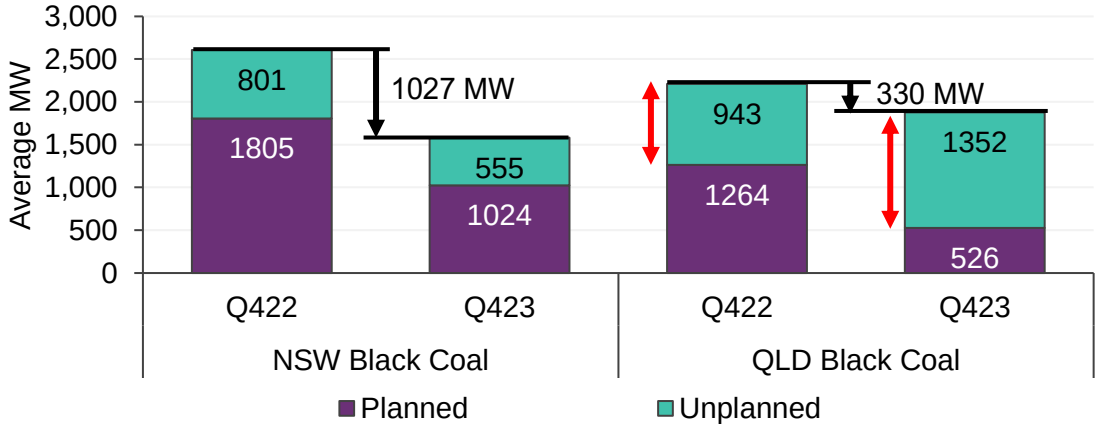
❑ NEM black coal-fired generation reduced to its all-time lowest record

Quarterly average black coal-fired generation by region – Q4s



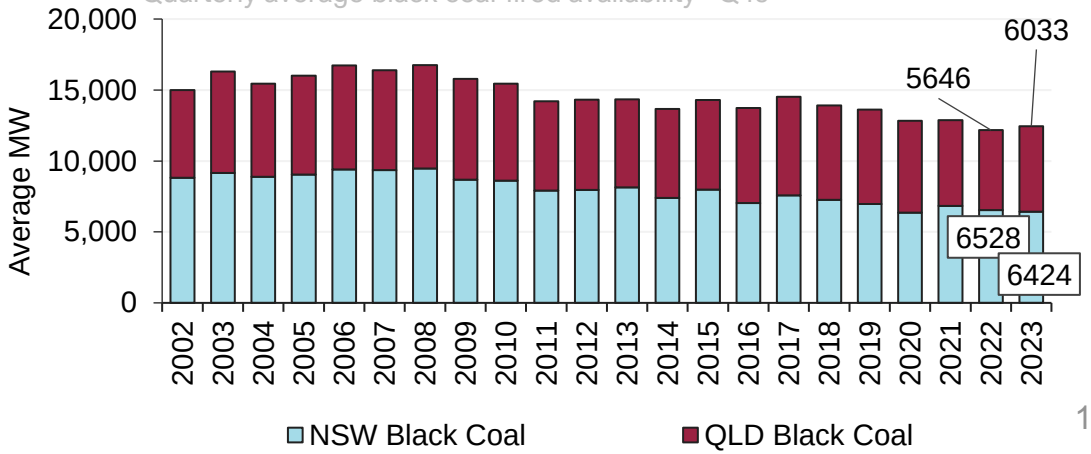
❑ Coal-fired capacity on outage declined

Average coal-fired capacity on outages – Q4 22 vs Q4 23



❑ Higher coal-fired generation availability in Queensland

Quarterly average black coal-fired availability– Q4s



Brown coal output

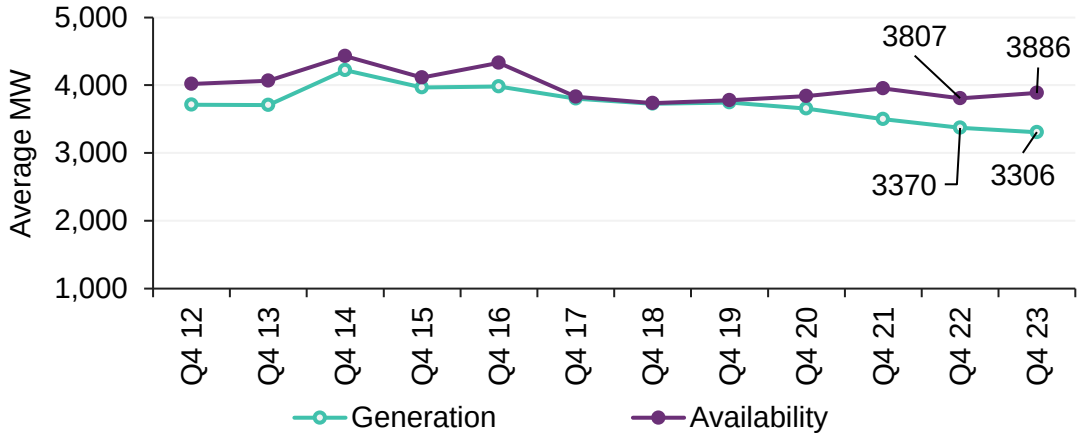
- Brown coal-fired average generation reduced from 3,370 MW to 3,306 MW YOY.
- However, availability increased from 3,807 MW in Q4 2022 to 3,886 MW in Q4 2023.
- Loy Yang A saw a noticeable reduction of 145 MW in outages YOY.
- Output in Victoria continued to reduce during daytime hours and increased during peak and mid-night.
- Brown coal saw 34% increase in intraday swing from 937 MW to 1,251 MW (+315 MW) YoY.

❑ **Brown coal dynamics – Q4 2023 vs Q4 2022**

Generator	Availability (MW)		Output (MW)		Utilisation		Outage (MW)		Intraday swing (MW)	
	Q422	Q423	Q422	Q423	Q422	Q423	Q422	Q423	Q422	Q423
Loy Yang A	1733	1872	1519	1557	88%	83%	457	312	438	659
Loy Yang B	1154	1116	968	927	84%	83%	1	35	394	421
Yallourn W	920	898	883	821	96%	91%	508	544	119	173

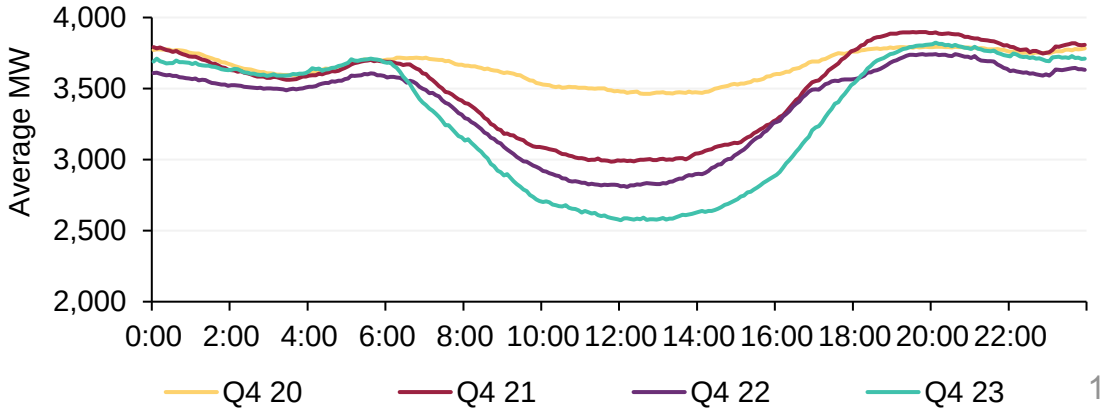
❑ **Increase in brown coal availability but ongoing reductions in output**

Quarterly average generation and availability – Q4s



❑ **Increasing swing in brown coal-fired generation output**

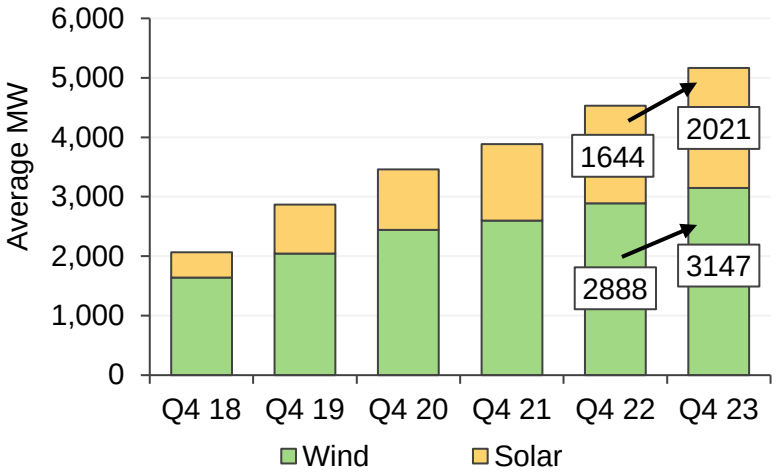
Brown coal-fired output by time of day – Q4s



Wind and solar output

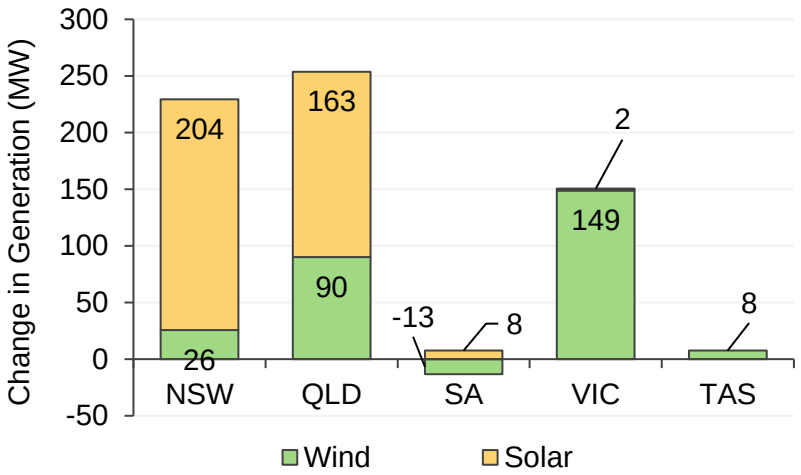
❑ **Steady VRE growth continued**

Average quarterly VRE generation by energy source – Q4s



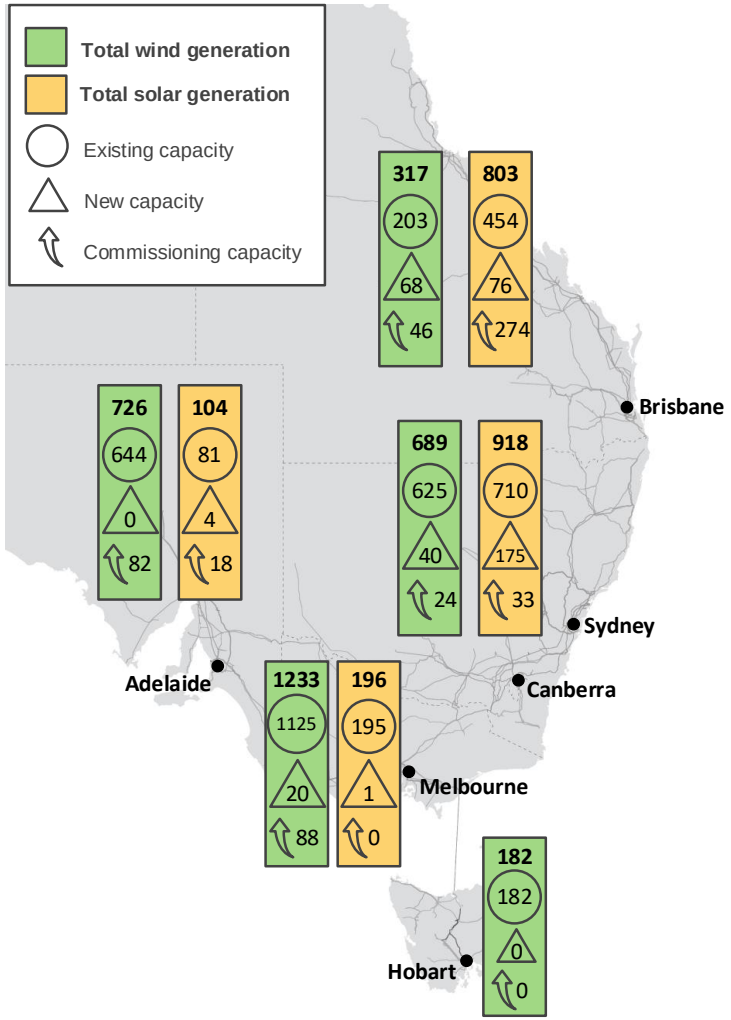
❑ **VRE increases led by solar in QLD and NSW**

Average MW change in output Q4 22 vs Q4 23



❑ **Regional VRE generation summary during Q4 2023**

Quarterly average generation (MW) by fuel type and region



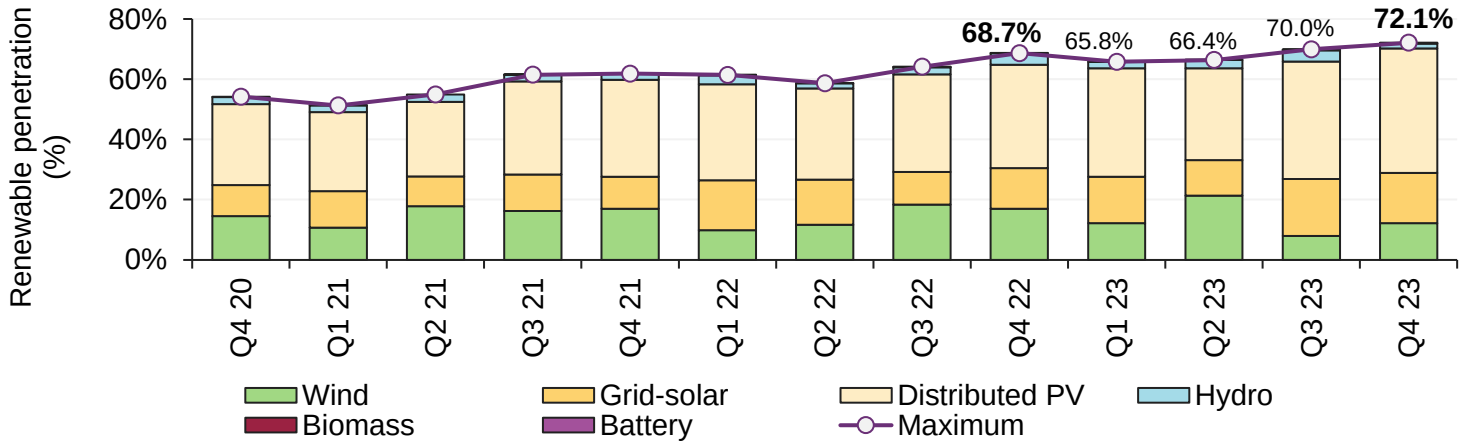
- Grid-scale VRE average output reached an **all-time quarterly record** in Q4 2023 of 5,168 MW.
- Almost all the increase in grid-scale solar was in New South Wales and Queensland.
- Wind increased output was mostly due to the new and commissioning capacity in Victoria.
- Grid solar saw higher capacity factors in all regions while wind saw a marginal reduction.

Renewable output

- The maximum instantaneous share of renewable energy generation in the NEM reached **a new record level of 72.1%.**
- This was during the half-hour ending 1300 hrs on **Tuesday 24 October** 2023.
- The Q4 2023 record included a 41% contribution from distributed PV, 12% from wind, and 17% from grid-scale solar.
- In Q4 2023, the average renewable contribution to daily maximum operational demand **reached a new high of 29.9%**.
- Wind and hydro contributions currently dominate this measure, with increasing contribution from batteries.

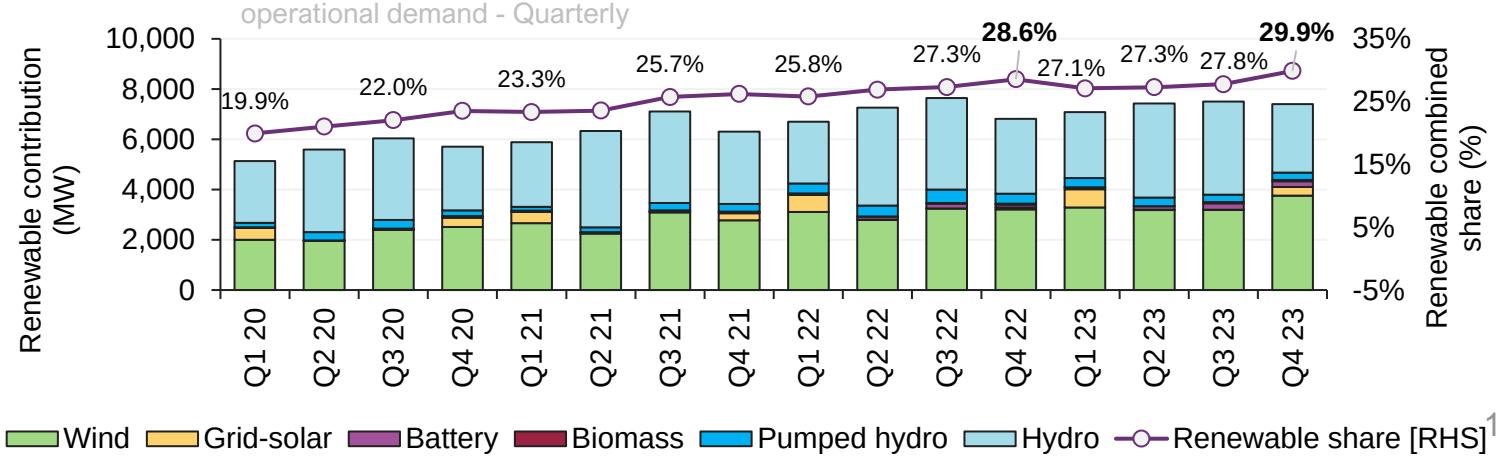
❑ Instantaneous renewable penetration reached a new record level

Percentage of NEM supply from VRE at time of peak instantaneous renewable energy



❑ Growing renewable contribution to meeting daily maximum demand

Average renewable contributions (MW) and combined share (%) at time of daily maximum operational demand - Quarterly

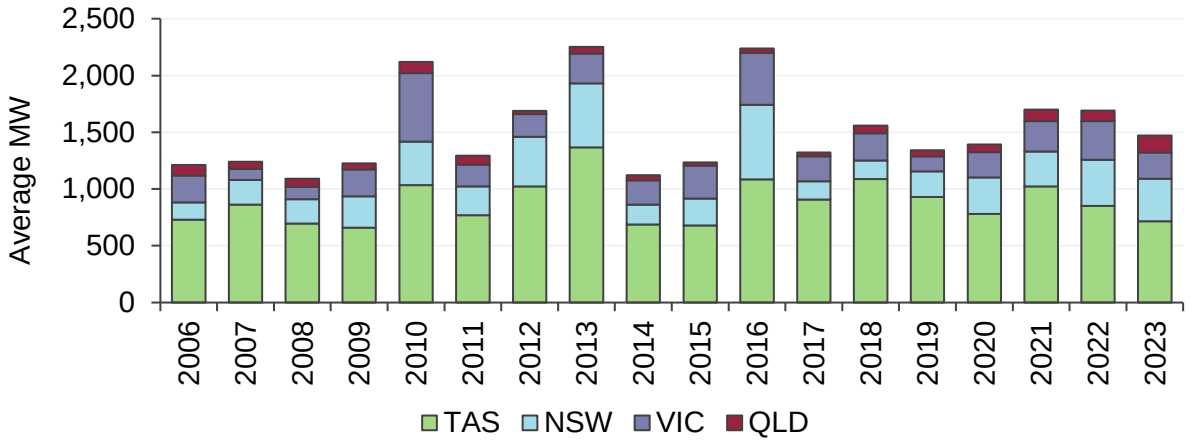


Gas and hydro output

- Gas saw the **lowest average output since 2000**. reaching 851 MW.
- Gas generation followed monthly price dynamics.
- Hydro output dropped from 1,691 MW in Q4 2022 to 1,472 MW this quarter.
- Generation fell in all regions except Queensland.
- The increase in QLD hydro was seen at all times of the day.

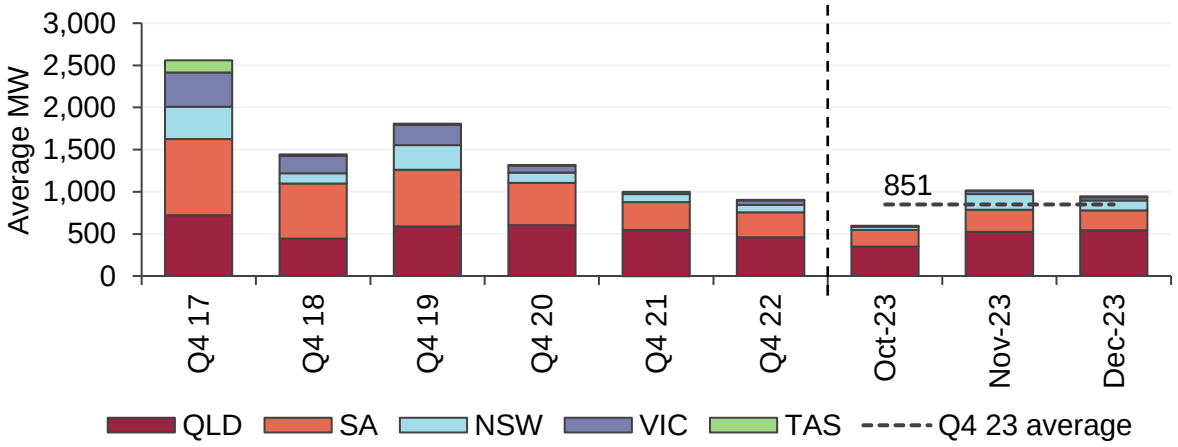
❑ Hydro generation dropped in all regions except Queensland

Average hydro output by region – Q4s



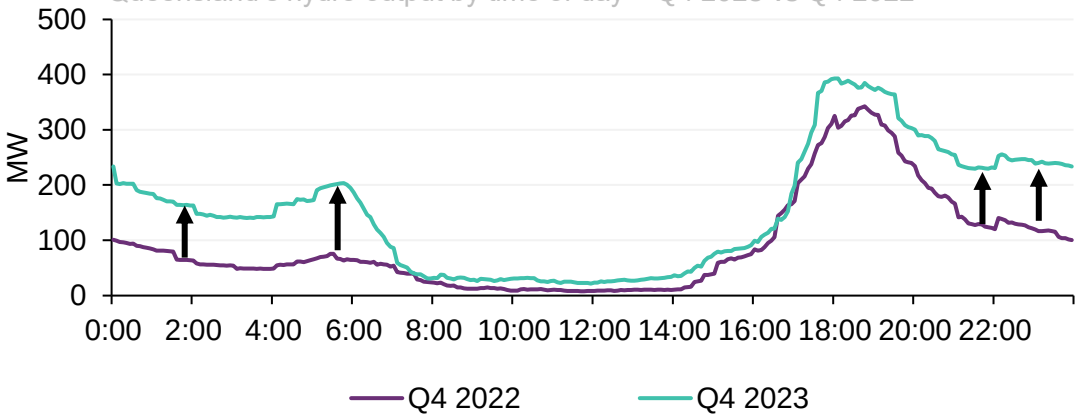
❑ Gas-fired generation reached its lowest quarterly level since 2000

Average gas-fired generation by region – Q4s



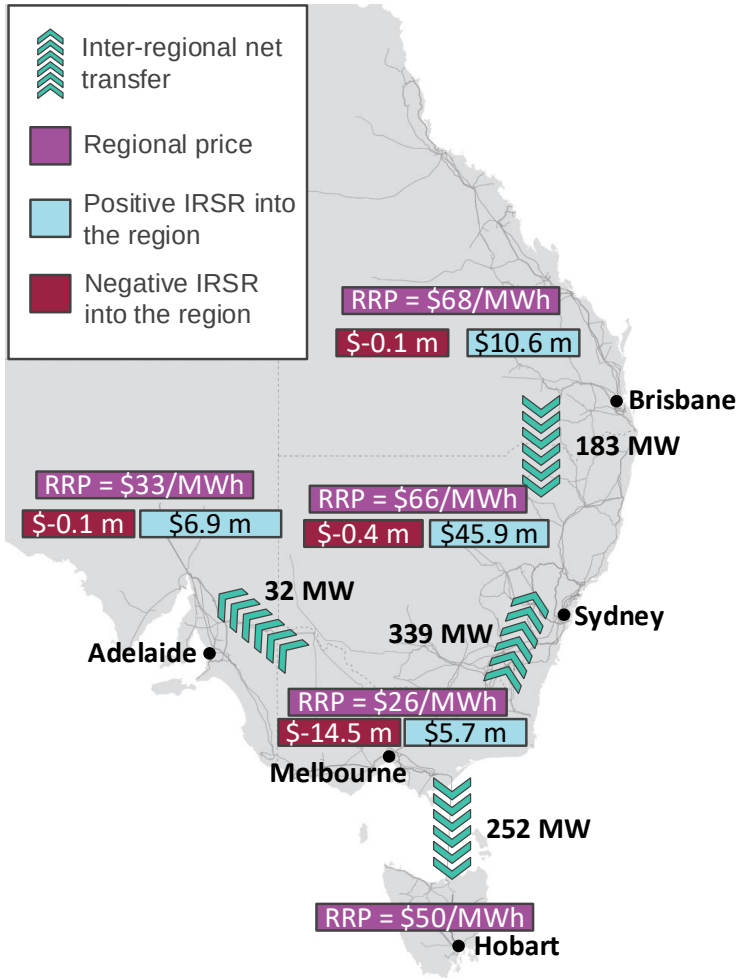
❑ Significant increase in Queensland hydro outside daylight hours

Queensland's hydro output by time of day – Q4 2023 vs Q4 2022



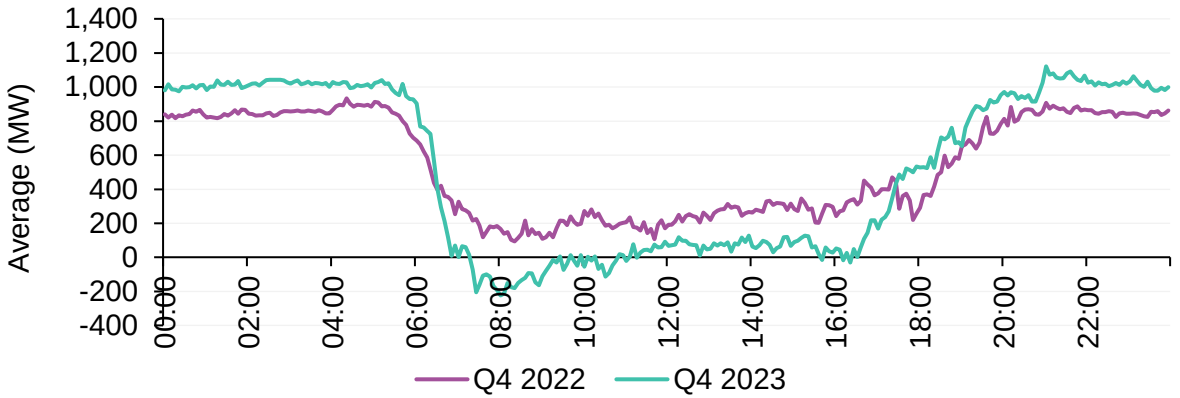
Inter-regional transfers and settlement residues

❑ **Inter-regional transfers, regional reference price, and settlement residues**



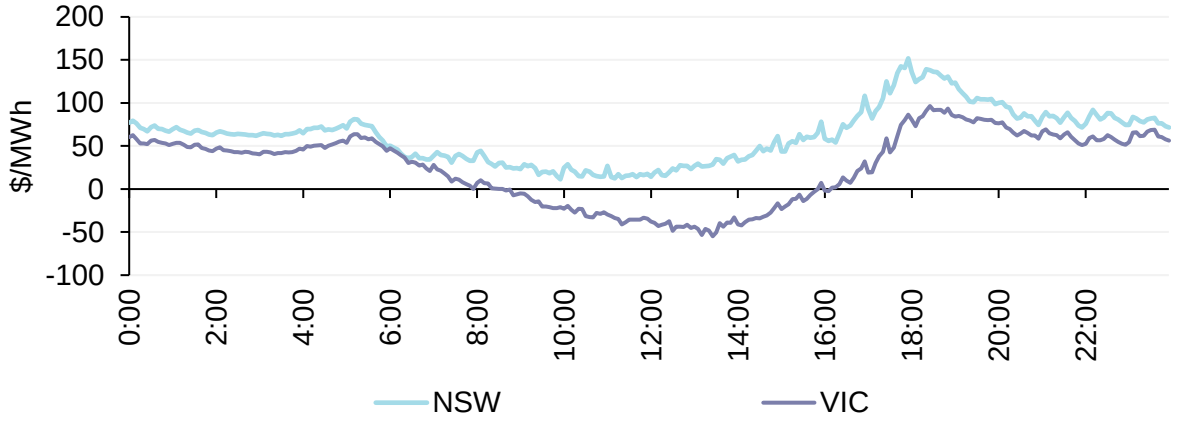
❑ **VNI export limit averaging negative for periods during daylight hours**

Average VNI export limit (Victoria to New South Wales) when binding, by time of day



❑ **Price separation between Victoria and New South Wales**

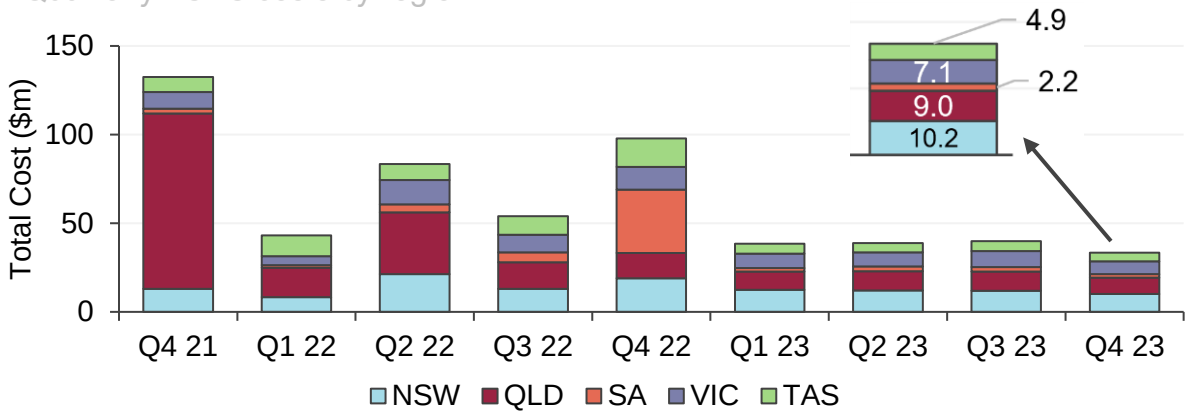
Average regional energy price by time of day – Q4 2023



FCAS market

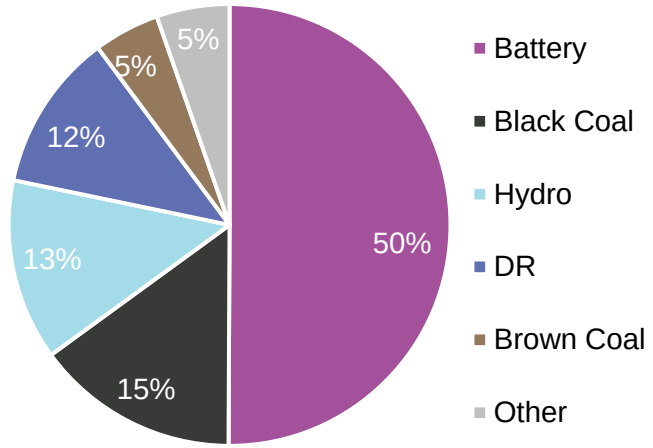
❑ **FCAS costs lower than previous quarters, but significantly reduced from Q4 2022**

Quarterly FCAS costs by region



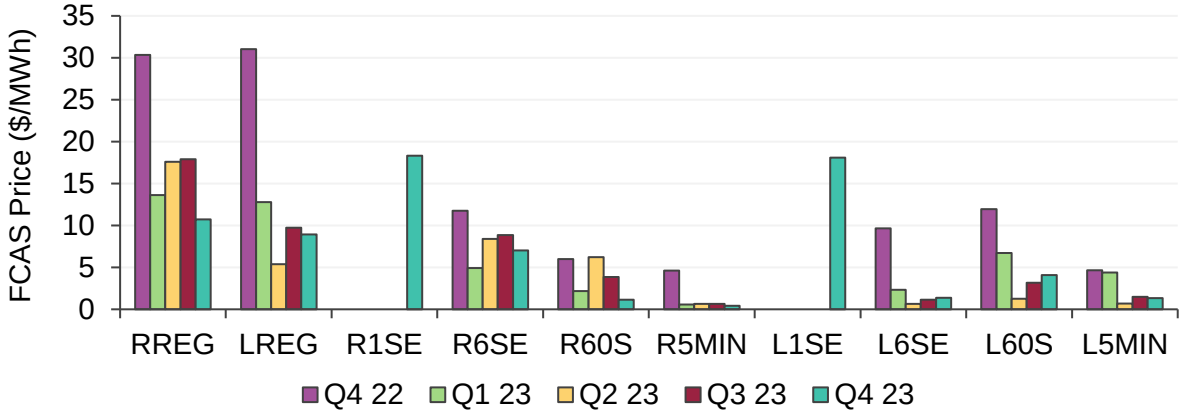
❑ **Batteries FCAS market share increased to 50%**

FCAS volume market share by technology – Q4 2023



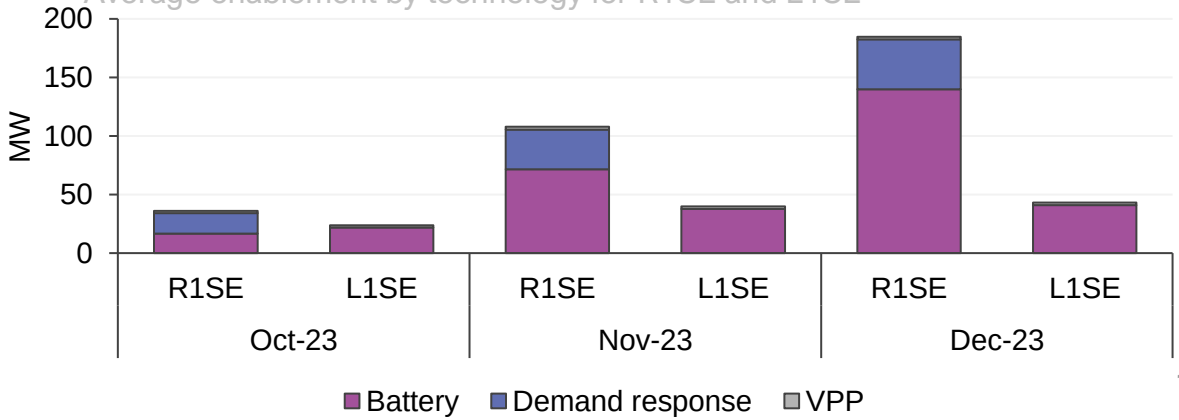
❑ **L1SE and R1SE average NEM prices highest out of all FCAS services in Q4 2023**

NEM average FCAS prices by service – quarterly since Q4 2022



❑ **Batteries and demand response providing majority of the very fast FCAS services**

Average enablement by technology for R1SE and L1SE

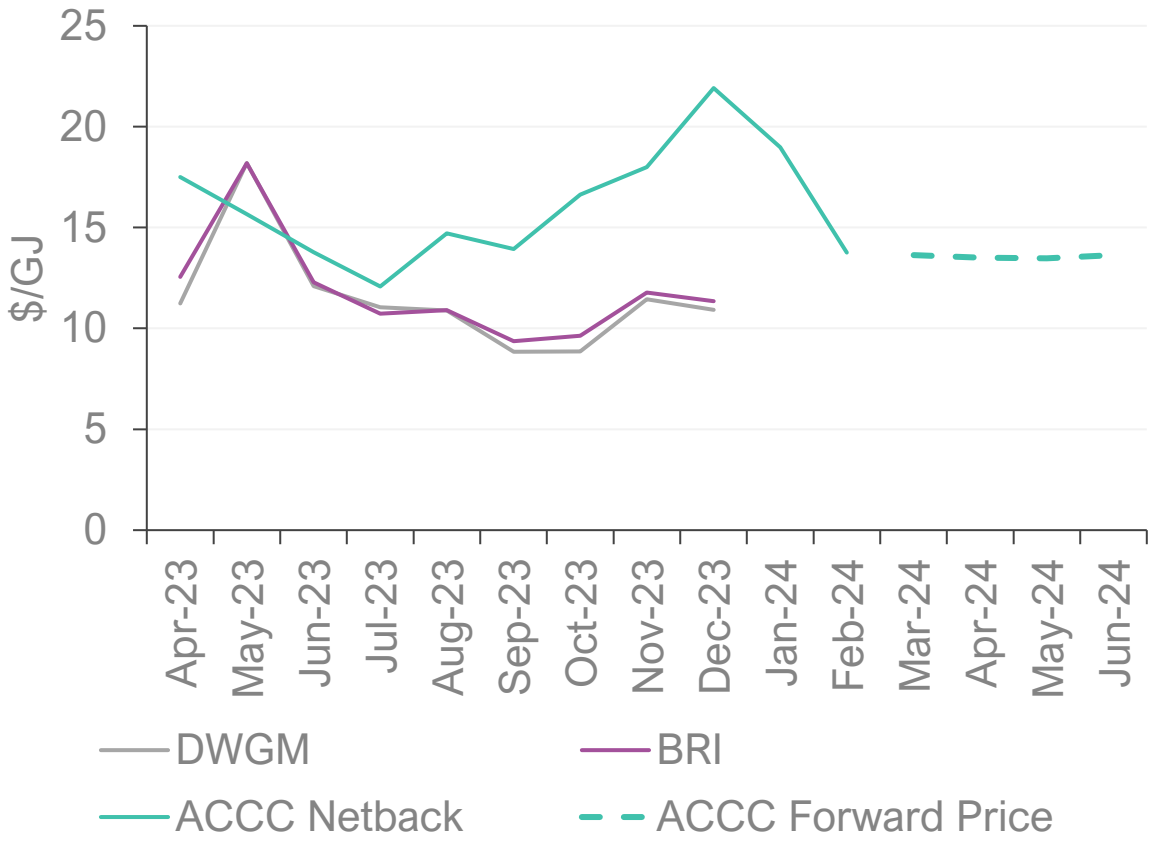


Gas market dynamics

East coast gas prices and demand

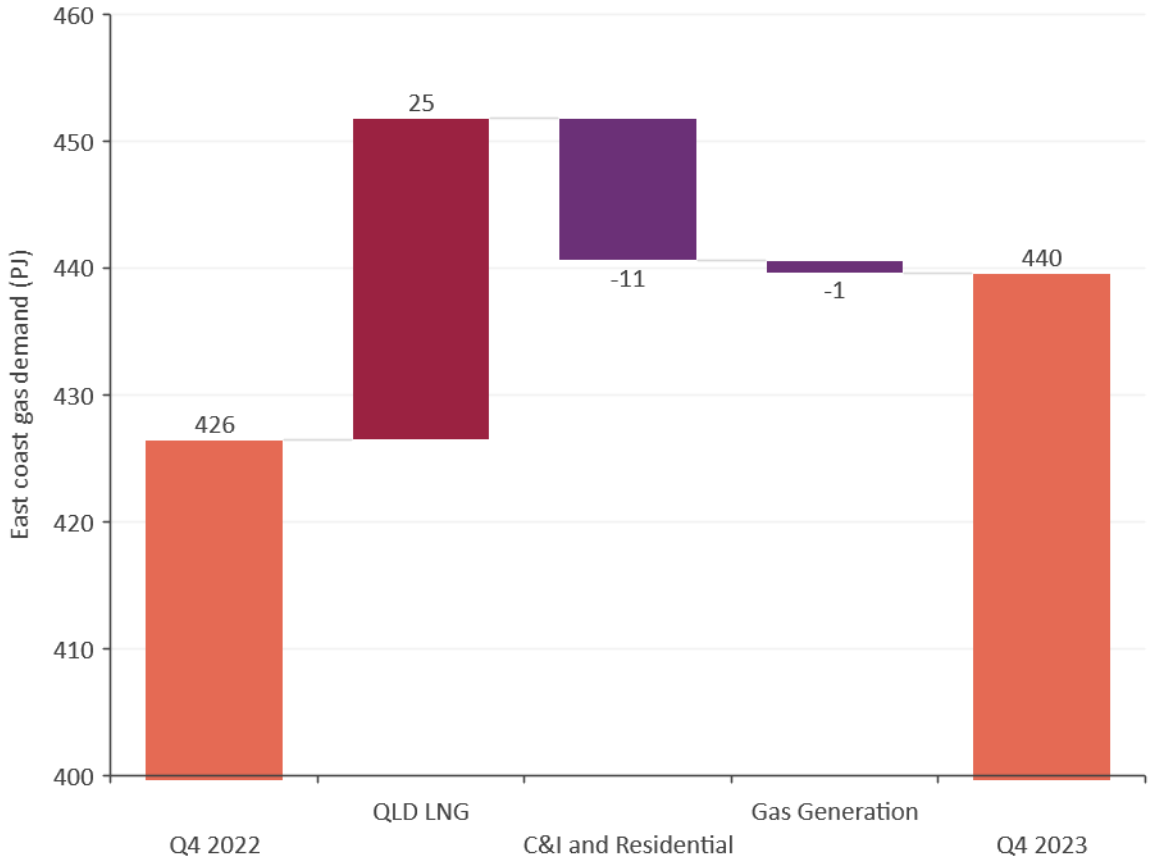
Increase in divergence between domestic gas price and ACCC netback price but forward prices have decreased

DWGM and Brisbane average price compared to ACCC LNG Netback price



QLD LNG demand increases overall east coast demand, with lower domestic gas consumption

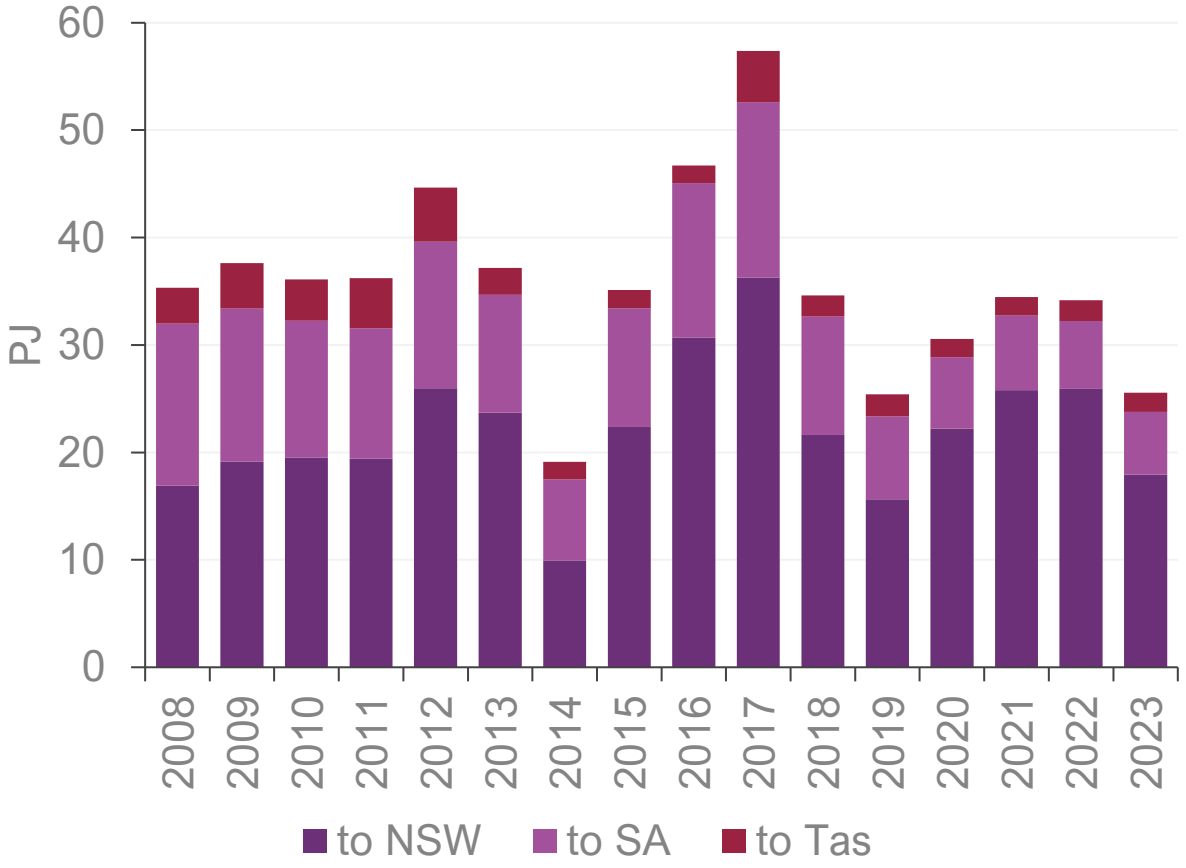
Components of east coast gas demand change – Q4 2022 to Q4 2023



Victorian exports continue to decline while Queensland supply increases

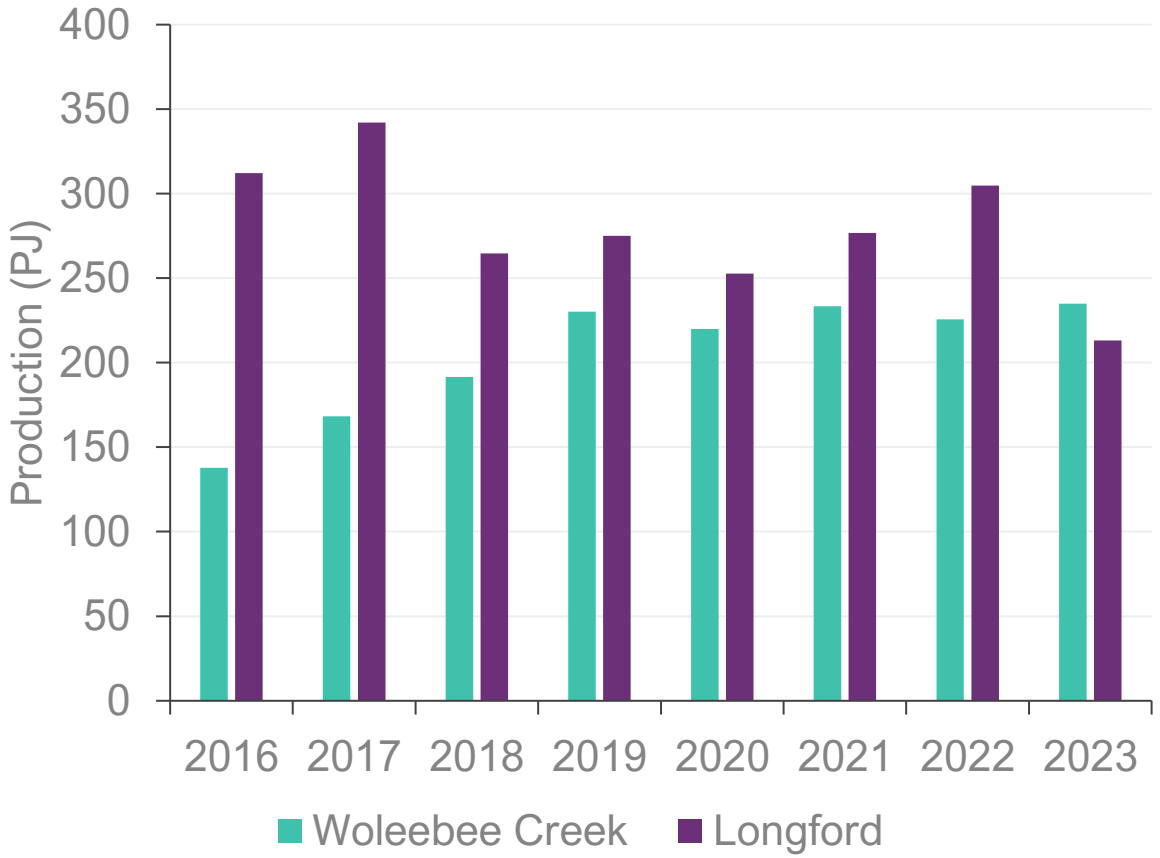
Third lowest Q4 Vic gas exports since data reporting began

Victorian net gas transfers to other regions – Q4s



Woleebee Creek surpassed Longford as the largest production facility on the east coast

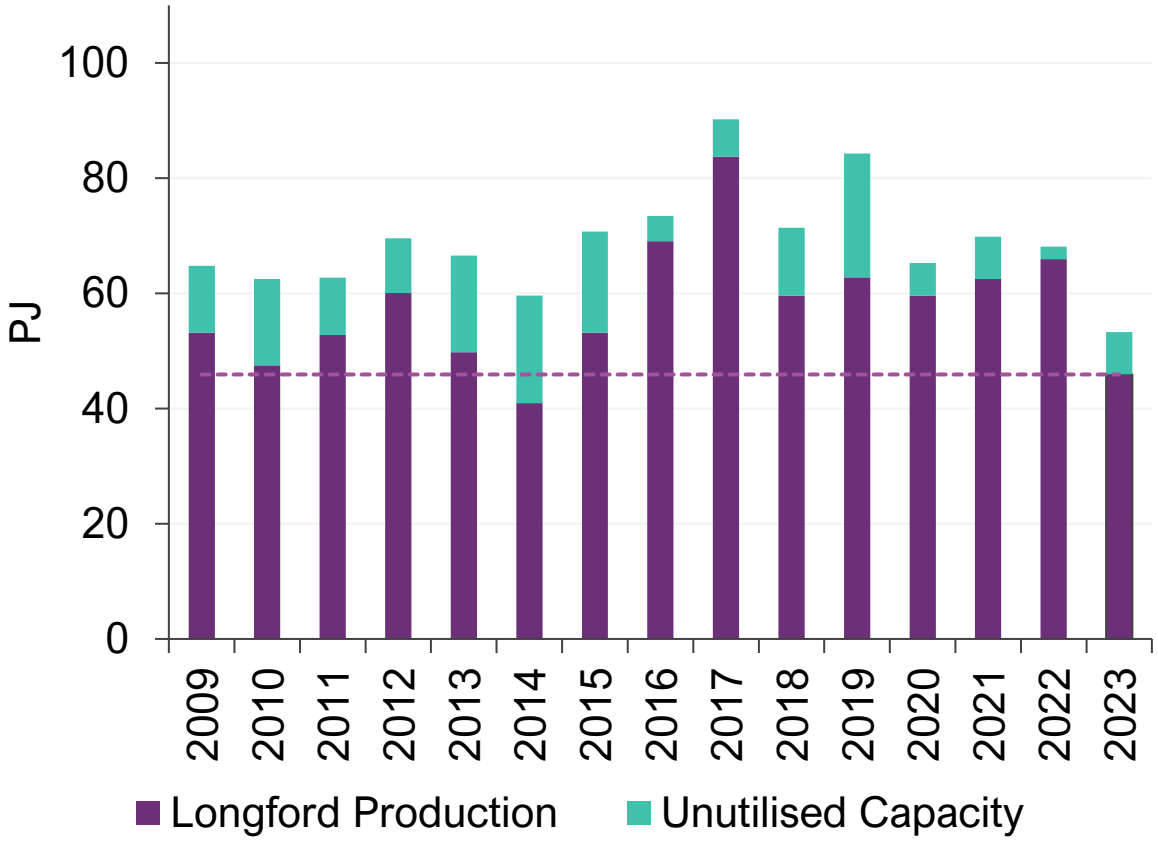
Annual Woleebee Creek vs Longford production



Longford aggregate and daily production continues to decline

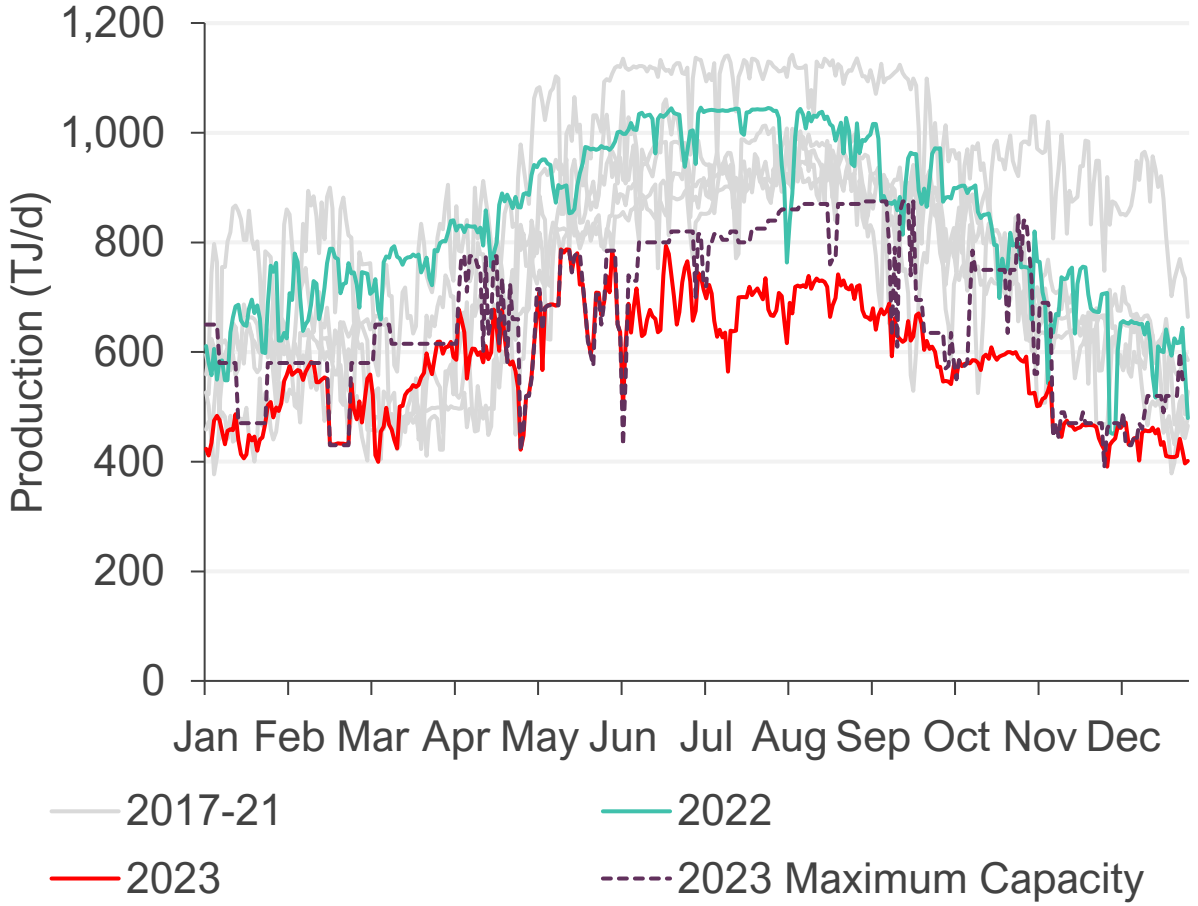
Second lowest Longford Q4 production and lowest capacity since data reporting began

Longford Q4 production versus unutilised capacity



Daily Longford production continued to decline

Daily Longford production 2017-2023, maximum capacity profile 2023



Thank you

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