THE NATIONAL ELECTRICITY MARKET RELIABILITY & SECURITY REPORT

FY2024

26 JUNE 2025

RELIABILITY PANEL AEMC

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About the Reliability Panel
The Reliability Panel (the Panel) is a specialist body within the Australian Energy Market Commission (AEMC), and it comprises the Australian Energy Market Operator (AEMO), industry and consumer representatives. It is responsible for monitoring, reviewing and reporting on the reliability, security and safety of the national electricity system, and advising the AEMC on these matters. The Panel's responsibilities are specified in section 38 of the National Electricity Law.

Acknowledgement of Country
The AEMC acknowledges and shows respect for the traditional custodians of the many different lands across Australia on which we all live and work. We pay respect to all Elders past and present and the continuing connection of Aboriginal and Torres Strait Islander peoples to Country. The AEMC office is located on the land traditionally owned by the Gadigal people of the Eora nation.

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EXECUTIVE SUMMARY

KEY INSIGHTS & IMPLICATIONS

The Reliability Panel's (the Panel) National Electricity Market Reliability & Security Report* (RASR) covers the period from 1 July 2023 to 30 June 2024. The Panel has found that the National Electricity Market (NEM) has continued to maintain adequate levels of reliability, security and safety during this period, and has identified five key insights & implications arising from its analysis.

1. **The NEM has continued to maintain high levels of reliability.**
2. **System security remains a pressing challenge in the energy transition.**
3. **Distributed and utility-scale battery capacity is increasing. Orchestration and appropriate price signals can deliver greater customer and system benefits.**
4. **Patterns in wholesale prices are changing.**
5. **There were no safety incidents for the purposes of this reporting in FY2024.**

*The National Electricity Market Reliability & Security Report was previously known as the Annual Market Performance Review. It fulfils the Panel's obligations under the AEMC's Terms of Reference.

1 The NEM has continued to maintain high levels of reliability.

- The Panel found that the NEM has continued to maintain high levels of reliability. Consistent with previous years, there was no unserved energy (USE) in FY2024.[2]
- At the end of FY2024 there was a total of 16.6 GW of committed and anticipated projects and 259.6 GW of proposed utility-scale wind, solar and battery developments.
- However, more investment in generation beyond currently committed projects is required to meet the reliability standard in future years. Along with ensuring there are sufficient resources for reliability, there must also be sufficient supply of system security services to maximise the benefits of new investment.
- AEMO's 2024 Electricity Statement of Opportunities (ESOO) forecasts reliability gaps in VIC, NSW and SA over the next decade.[3] This is based on projects that are currently committed or anticipated to proceed when factoring in commissioning delays.
    - SA could experience reliability gaps as early as 2026-27 and 2033-34.
    - NSW could experience reliability gaps in 2027-28 and from 2031-32 onwards.
- The Panel notes the NEM review of wholesale market settings underway to promote investment in firmed, renewable generation and storage capacity in the NEM following the conclusion of the Capacity Investment Scheme tenders in 2027.[4]
- For further information, see:
    - Slide 18 on forecast unserved energy.
    - Slide 21 on the investment pipeline.

2. Unserved energy is defined as the amount of wholesale unserved energy that is relevant for the purposes of reporting on the reliability standard. The power outage event in VIC on 13 February 2024 and load shedding in Lismore on 8 July 2024 does not fall under the definition of unserved energy. For more information on the definition, see: The Reliability Panel, Definition of Unserved Energy, August 2019.
3. AEMO, 2024 Electricity Statement of Opportunities, August 2024.
4. For further information, see Department of Climate Change, Energy, the Environment and Water, National Electricity Market wholesale market settings review, May 2025.

2 System security remains a pressing challenge in the energy transition.

- The transition away from a thermal-dominated, synchronous system towards an inverter-based variable renewable energy (VRE) and battery-dominated system is underway and will continue to accelerate. In FY2024, 3.98 GW of utility-scale renewable generation was added to the NEM – increasing installed renewable capacity by 15%.
- Synchronous generation provides essential system security services, such as inertia and system strength. Exiting thermal synchronous generation assets are being replaced primarily with inverter-based resources.
- To keep up with the pace of the energy transition, system security needs must be identified early on to allow sufficient lead time for timely investment. This is critical as security risks, such as minimum system load (MSL), have emerged earlier than expected. Recent AEMC reforms to system strength and inertia frameworks, which are being implemented, are critical to achieving this outcome. Further reforms may be required.
- AEMO forecasts that the ongoing uptake of residential solar PV is expected to drive negative operational demand in most regions within the next decade (already experienced in South Australia). In FY2024, 3.02 GW of distributed solar was installed, the second highest increase behind FY2021. Without adequate security mechanisms, MSL conditions may become more common and costly to manage.
- The National Consumer Energy Resources (CER) Roadmap has identified several opportunities for CER to better support the grid and be visible to the market. These are being addressed through multiple workstreams.[1]
- The Panel emphasises the need for ongoing priority focus on the procurement and supply of essential systems services to ensure the power system remains secure and operates within its technical operating envelope throughout the energy transition.
- For further information, see:
  - Slides 19-20 on the total installed capacity of utility-scale and distributed generation.
  - Slide 30 on MSL.
  - Slides 57-59 on system services procurement.

1. For further information, see Department of Climate Change, Energy, the Environment and Water, Energy Ministers agree to the National Consumer Energy Resources (CER) Roadmap, 19 July 2024.

3 Distributed and utility-scale battery capacity is increasing. Orchestration and appropriate price signals can deliver greater customer and system benefits.

- The amount of distributed and utility-scale battery storage within the NEM is growing rapidly. Out of the total 2,060 MW of distributed battery storage* in the NEM, 1,315 MW (64%) was added in FY2024 alone. Out of the total 1,553 MW of utility-scale battery storage in the NEM, 807 MW (52%) was added in FY2024.
- This trend is expected to continue considering the significant amount of proposed, anticipated and committed utility-scale battery projects in the investment pipeline. At the distribution level, government programs such as the Cheaper Home Batteries Program, are likely to support ongoing growth in small-scale battery deployment.[5]

Distributed batteries

- Orchestration of distributed batteries, when voluntarily part of a virtual power plant, can provide system benefits as well as customer benefits by firming generation alongside other resources such as hydro.
- However, this orchestration must support customer choice and align customer value with system needs.
- While government programs aim to continue the roll-out of distributed batteries, the Panel emphasises the need for technical oversight by AEMO and network service providers (NSPs) to ensure the system benefits that are in the long-term interests of all customers.

Utility-scale batteries

- Appropriate signals are needed to ensure utility-scale batteries can provide value to the system, in relation to both reliability and security.
- For further information, see:
  - Slides 19-20 on the total installed capacity of utility-scale and distributed batteries.
  - Slide 58 on how batteries are already participating in system services (FCAS markets).

*The Panel has used data from AEMO's Distributed Energy Resources (DER) register to inform reporting. The register does not distinguish between community batteries and small-customer batteries if both types of batteries meet the NER definition of a 'small bidirectional unit', which our reporting data does. For the purpose of this report, DER includes CER.

5. The Cheaper Home Batteries Program is funded by the federal government and will be delivered as part of the Small-scale Renewable Energy Scheme.

4 Patterns in wholesale prices are changing.

- In FY2024 the number of negative price periods continued to grow, with one occurring in 14% of all dispatch periods. The proportion of negative pricing periods has grown from 0.34% in FY2018.
- These negative pricing periods typically occur during daylight hours when high rooftop PV output coincides with low demand and high renewable generation.
- While extreme price events declined in FY2024, with fewer market price cap (MPC) and market price floor (MPF) events occurring, the frequency of both negative and high price periods has increased since FY2021.
- The combination of low daytime prices and higher peak-period prices may incentivise investment in storage technologies that can shift energy supply, a trend already reflected in the current shift towards storage project investments.

For more information, see:

- Slide 20 on consumer energy resources.
- Slide 23-25 on diurnal demand curves.
- Slide 40 on the Volume Weighted Average Price.
- Slide 44 on the market price cap and market price floor.
- Slide 45 on negative pricing periods.

5 There were no safety incidents for the purposes of this reporting in FY2024.

- The Panel notes that its safety reporting role extends only to safety incidents arising from actions taken by AEMO to manage the power system within technical and not to safety requirements governed by jurisdictional legislation.[6]
- In this context, there were no safety incidents for the purposes of this reporting.

6. See Part 8 of the *National Electricity (South Australia) Act 1996* and AEMC, Annual Market Performance Review – AEMC Terms of Reference to the Reliability Panel, 26 July 2022.

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1

INTRODUCTION

THE ROLE OF THE PANEL IN ASSESSING SECURITY, RELIABILITY & SAFETY

The functions and powers of the Panel are set out in section 38 of the National Electricity Law (NEL). Among other things, the Reliability Panel (Panel) is required to:

- Monitor, review, and report on, in accordance with the Rules, the safety, security and reliability of the national electricity system
- At the request of the AEMC, provide advice in relation to the safety, security, and reliability of the national electricity system
- Undertake any other functions and powers conferred on it under the NEL and the NER.

Consistent with these functions, clause 8.8.3(b) of the NER requires the Panel to conduct a review of the performance of certain aspects of the market, at least once every financial year and at other times as the AEMC may request.

The Panel must conclude each annual review no later than the financial year following the financial year to which the review relates. The Panel must conduct its annual review in terms of:

- Reliability of the power system
- Power system security and reliability standards
- The system restart standard
- The guidelines referred to in clause 8.8.1(a)(3) of the NER[7]
- The policies and guidelines referred to in clause 8.8.1(a)(4) of the NER[8]
- The guidelines referred to in clause 8.8.1(a)(9) of the NER[9]

The AEMC may provide the Panel with standing terms of reference in relation to the RASR.[10,11]

7. The guidelines referred to in clause 8.8.1(a)(3) of the NER govern how AEMO exercises its power to issue direction in connection with maintaining or re-establishing the power system in a reliable operating state.
8. The policies and guidelines referred to in clause 8.8.1(a)(4) of the NER govern how AEMO exercises its power to enter into contracts for the provision of reserves.
9. The polices and guidelines referred to in clause 8.8.1(a)(9) of the NER identify, or provide for the identification of, operating incidents and other incidents that are of significance for the purposes of the definition of 'reviewable operating incident' in clause 4.8.15 of the NER.
10. The current terms of reference from the AEMC in relation to this review can be found at https://www.aemc.gov.au/market-reviews-advice/annual-market-performance-review-fy2024.
11. Clause 8.8.3(c1) of the NER.

BACKGROUND AND PURPOSE OF THIS REPORT

The Reliability Panel's (the Panel) National Electricity Market Reliability & Security Report (RASR) provides analysis on the reliability, security, and safety performance of the power system across the financial year. This year's report covers the 2023-24 financial year (FY2024).

The Panel also updates a companion document to the RASR final report: "The Reliability, Security and Safety Frameworks in the NEM — an explanatory statement for the 2024 RASR" (explanatory statement). The explanatory statement sets out the:

- Role of the Panel and RASR process
- Frameworks used to deliver power system reliability, security and safety in the NEM
- Set of metrics used by the Panel to monitor and report on reliability, security and safety outcomes in the NEM for the purposes of RASR reporting.

The explanatory statement is intended to be a companion document and should be read in conjunction with the RASR final report. It also serves as an explanatory report for those interested in understanding more about the current frameworks.[12]

12. For more information, see: https://www.aemc.gov.au/market-reviews-advice/annual-market-performance-review-fy2024.

SCOPE OF THE RASR FY2024

As noted, the Panel has undertaken this review in accordance with the requirements in the NER and the terms of reference issued by the AEMC. The AEMC requested that the Panel review the performance of the NEM in terms of reliability, security, and safety of the power system.

In this report, the Panel has considered the following definitions of reliability and security in relation to the power system:

- **Reliability** — There is enough capacity (generation, demand response and networks) to supply customers
- **Security** — It is able to operate within defined technical limits, even if there is an incident such as the loss of a major transmission line or large generator.

For more exhaustive definitions of the above, please refer to the explanatory statement. This report is divided into four main chapters, which consider:

- **Reliability**: The Panel has reviewed the reliability performance of generation and bulk transmission (i.e. interconnection), including:
    - Current and historic NEM reliability performance
    - Forward-looking reliability risks
    - NEM Reserve level events and constraint impacts
    - AEMO interventions for reliability, and Reliability and Emergency Reserve Trader (RERT)
    - Market price signals and investment incentives.
- **Security**: The Panel has reviewed the performance of the power system against the relevant technical standards. In particular, the Panel has had regard to:
    - Power system security incidents/risk management
    - Management of power system security risks
    - Frequency performance
    - AEMO interventions for security
    - System services procurement and use.
- **Safety**: The NEL and NER set out the functions and powers of the Reliability Panel, which include a function to monitor and report on safety in accordance with the Rules. The NER does not specify additional requirements in relation to safety performance monitoring. However, the Panel can provide advice in relation to the safety of the national electricity system at the request of the AEMC.
- **Key market events**: The Panel has considered key events relevant to FY2024.

Taken together, this report provides key insights and observations on the reliability, safety and security of the power system throughout the reporting period.

2

RELIABILITY PERFORMANCE

2.1

INVESTMENT TRENDS AND IMPLICATIONS FOR RELIABILITY

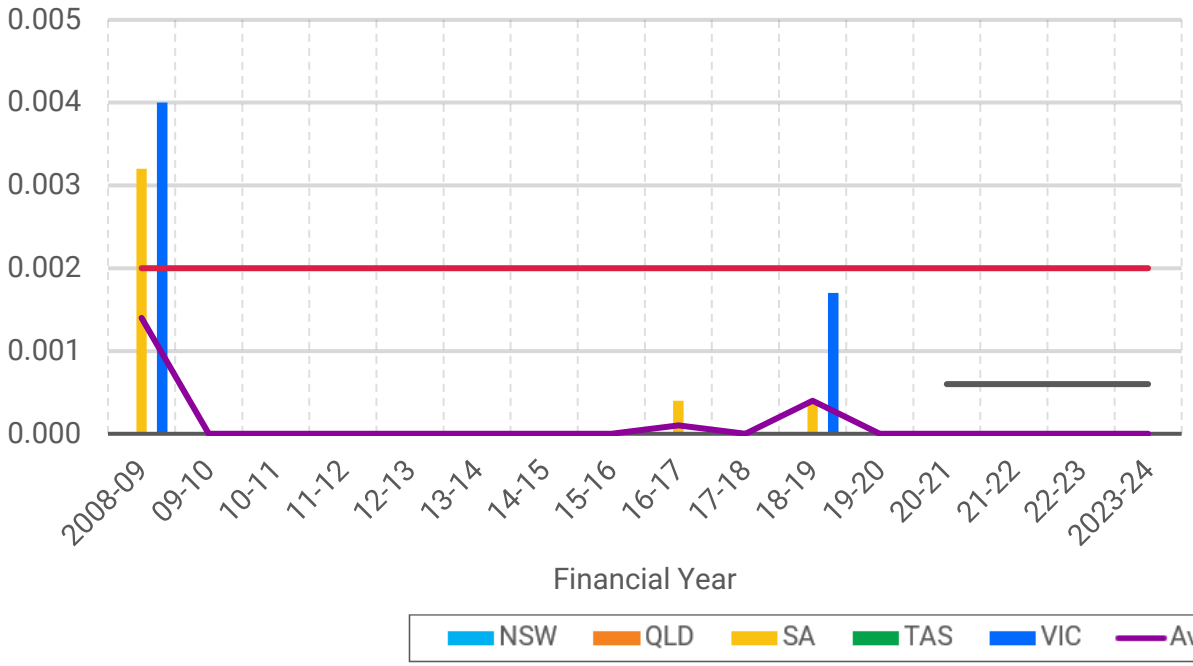
- There was no breach of the reliability standard or interim reliability measure in FY2024.
- FY2024 saw a significant increase in both utility-scale and distributed renewable generation and battery storage.
- Despite the significant amount of proposed generation, the transition of projects from the proposed and anticipated stages to committed is slow, which may impact future reliability.

THERE HAS BEEN NO UNSERVED ENERGY SINCE FY2019

- There was no actual USE in FY2024.[13]
- Modelling from AEMO's 2024 Electricity Statement of Opportunities (ESOO) forecasts the potential for reliability gaps as early as 2026-27 in SA and 2027-28 in NSW.[14] This forecast is based on current committed and anticipated projects while allowing for historically observed commissioning delays. It uses data available at the time of ESOO reporting and should change in response to new investments.
- Reliability gaps are no longer forecast for NSW in 2025-26 and 2026-27 due to the delayed retirement of Eraring Power Station.

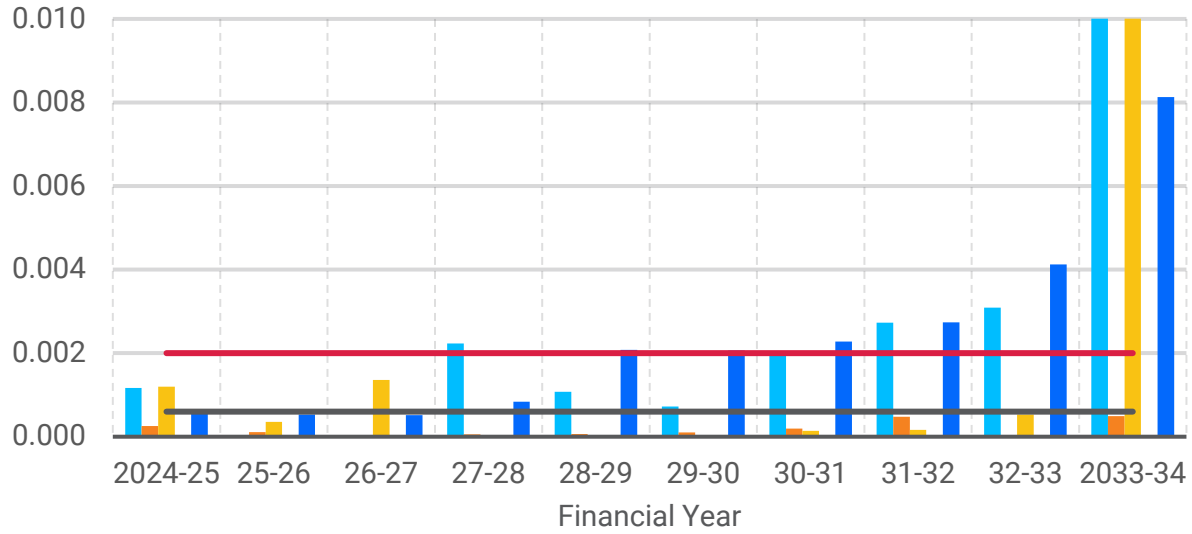
Actual USE

Actual unserved energy (%)



Forecast USE

Expected unserved energy (%)



Source: Panel analysis of AEMO data.

Source: AEMO, 2024 Electricity Statement of Opportunities, August 2024

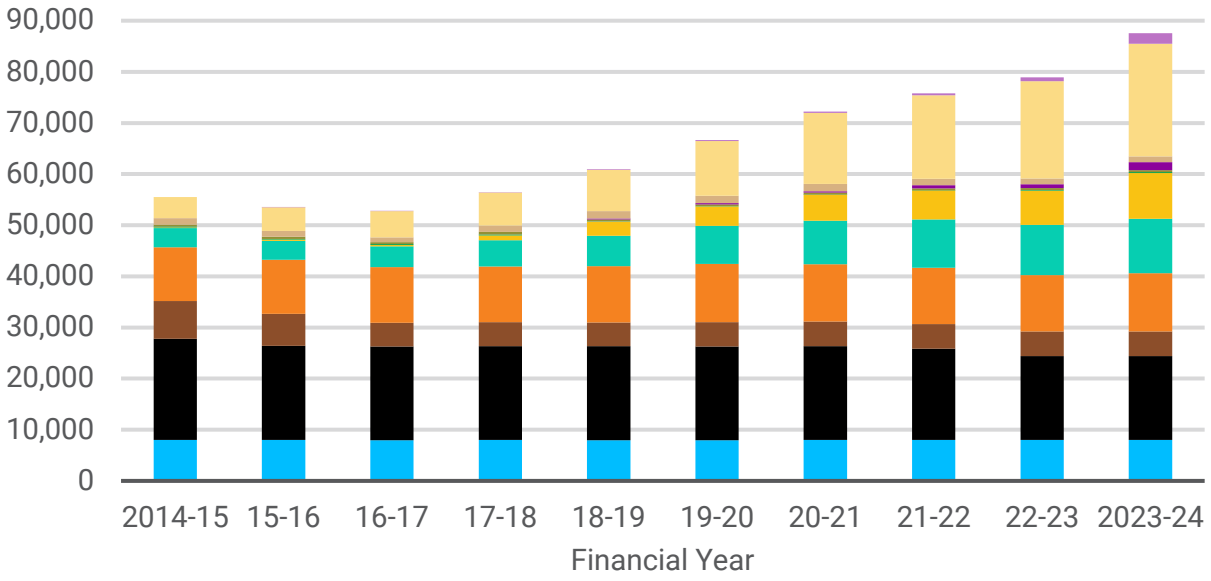
13. Unserved energy is defined as the amount of wholesale unserved energy that is relevant for the purposes of reporting on the reliability standard. The power outage event in VIC on 13 February 2024 and load shedding in Lismore on 8 July 2024 does not fall under the definition of unserved energy. For more information on the definition, see: The Reliability Panel, Definition of Unserved Energy, August 2019.
14. For further information, see AEMO, 2024 Electricity Statement of Opportunities (ESOO), August 2024.

FY2024 SAW A SIGNIFICANT INCREASE IN RENEWABLE GENERATION

- The total capacity in the NEM continued to grow in FY2024 to 87.5 GW, largely driven by a significant increase in utility-scale generation. This represents an increase in total capacity of 10.9% from FY2023.
- 3.98 GW of utility-scale renewable generation was added to the NEM in FY2024. This included 2.26 GW of solar, 0.80 GW of batteries, and 0.88 GW of wind.
- This represents an increase in total renewable utility-scale capacity of 15.5%, above the average of 11.8% over the preceding five financial years.
- At the end of FY2024, renewable energy sources comprised approximately 61% of the total installed capacity in the NEM.

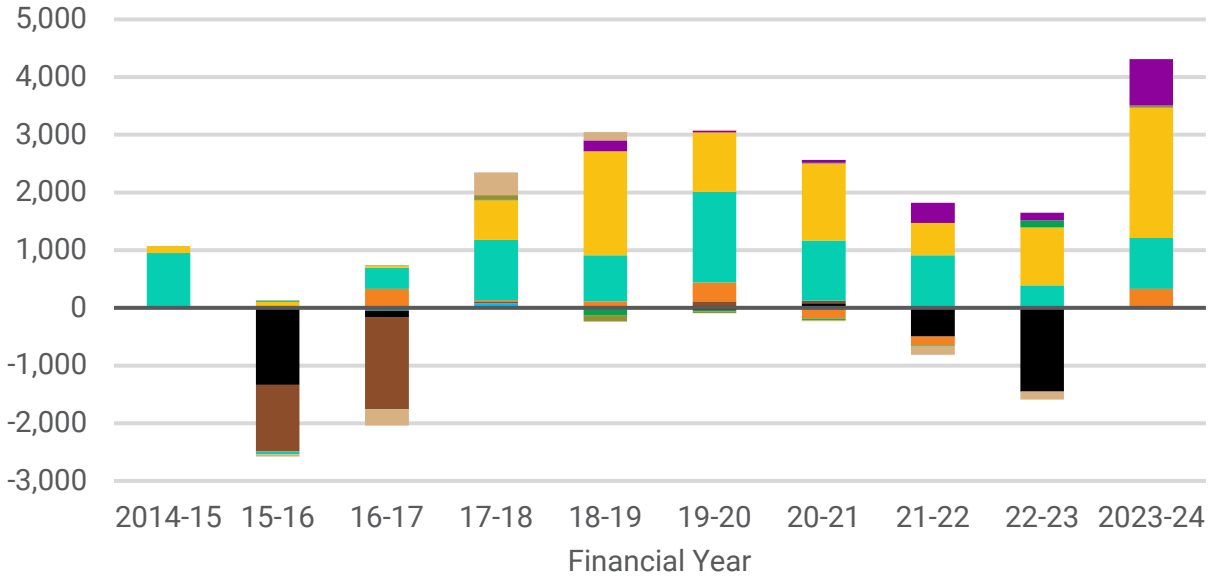
Total capacity by financial year

Total capacity (MW)



Utility-scale generation changes by financial year

Installed capacity (MW)

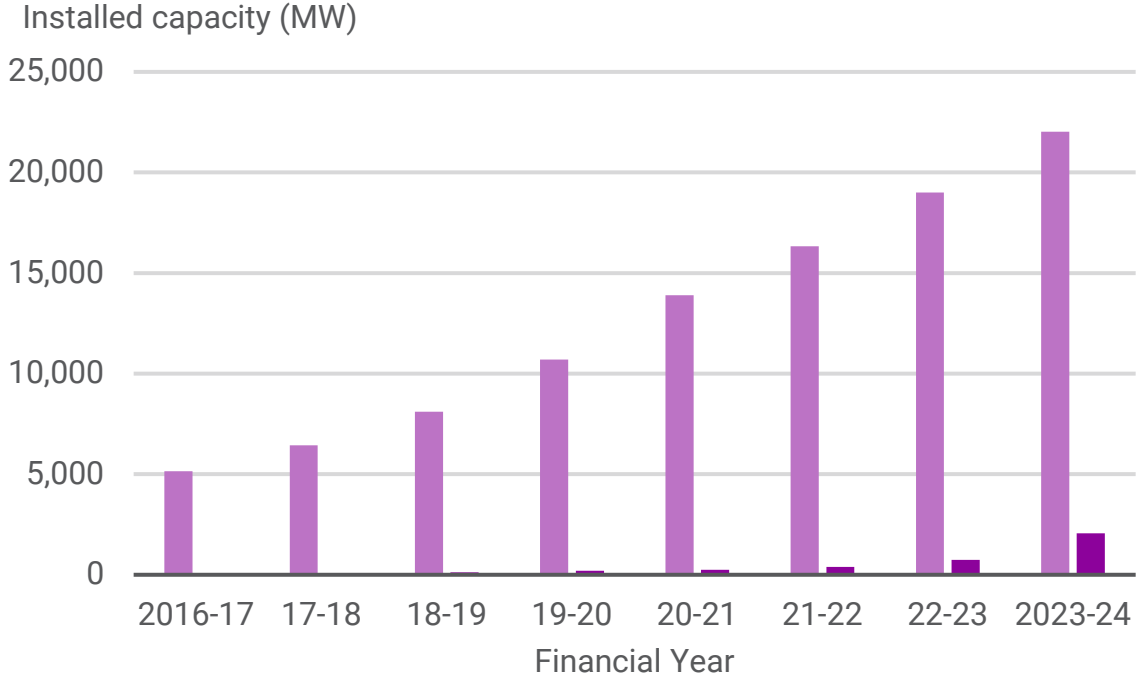


Source: AEMO, NEM Generation Information.

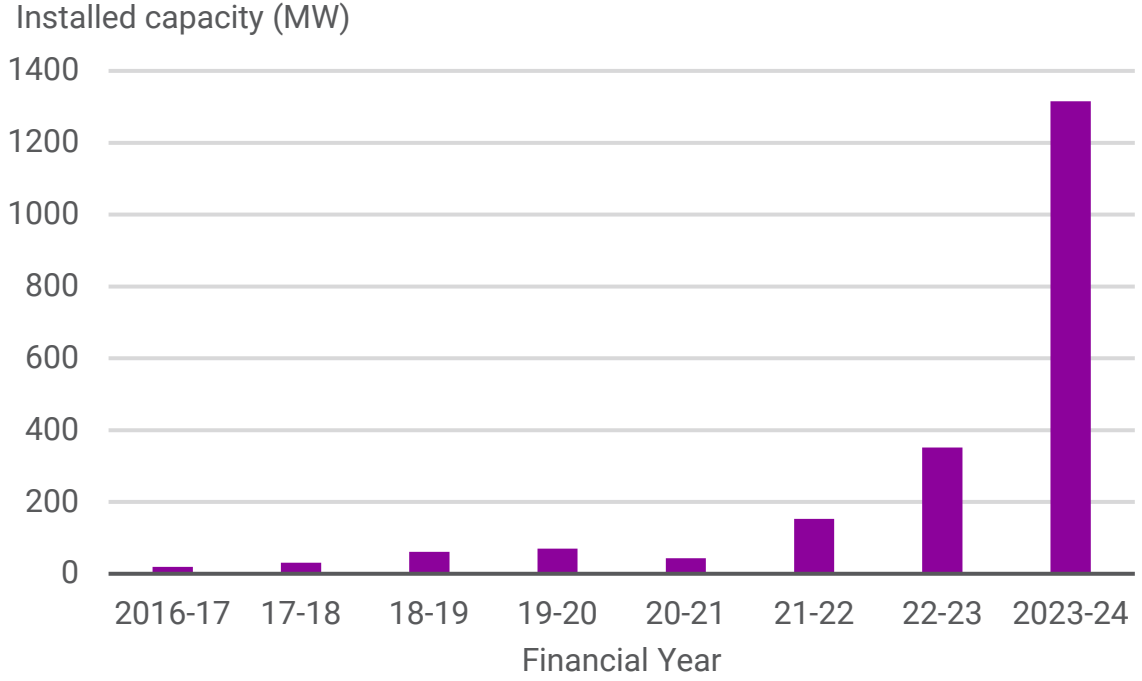
THE NUMBER OF DISTRIBUTED BATTERY INSTALLATIONS TRIPLED FROM FY2023

- 1,315 MW of distributed battery storage was installed in FY2024, up from 352 MW in FY2023.
- The increased number of distributed batteries will reduce strain on the system during times of low operational demand, if these can be managed in a way that is helpful to the system.
- 3,016 MW of distributed solar was installed, the second highest ever increase behind FY2021, with 3,198 MW of new capacity.
- This represents a 15% increase in total installed CER capacity compared to the previous year.

Total installed DER capacity by financial year



New installed distributed battery capacity

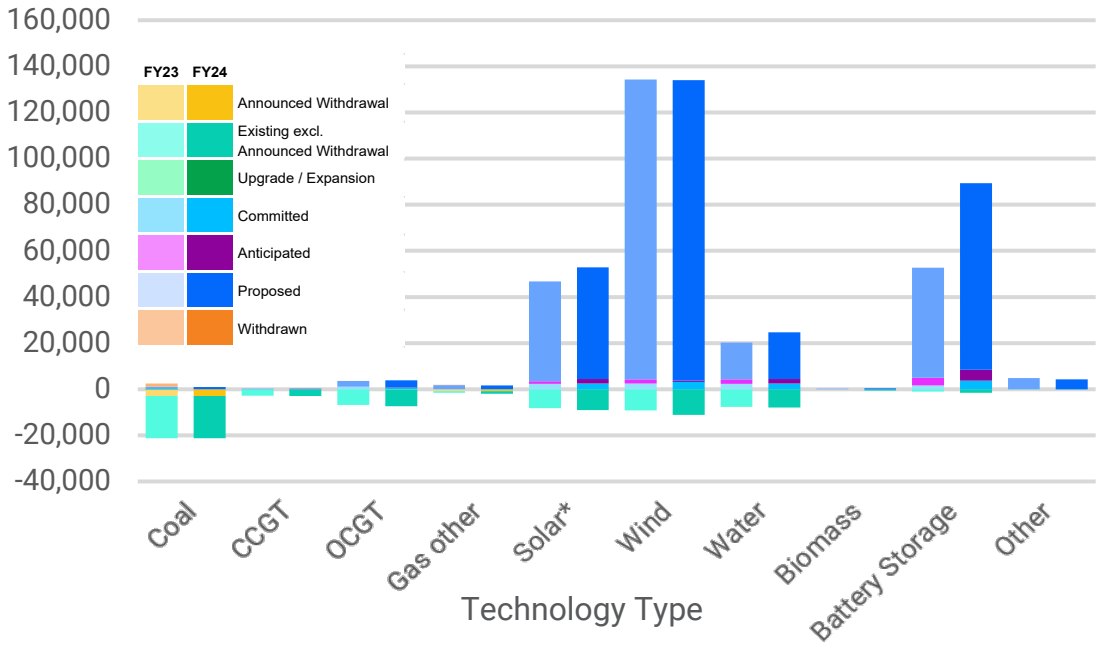


Source: Clean Energy Regulator, Small-scale installation postcode data (distributed solar).
AEMO, DER data (distributed batteries).

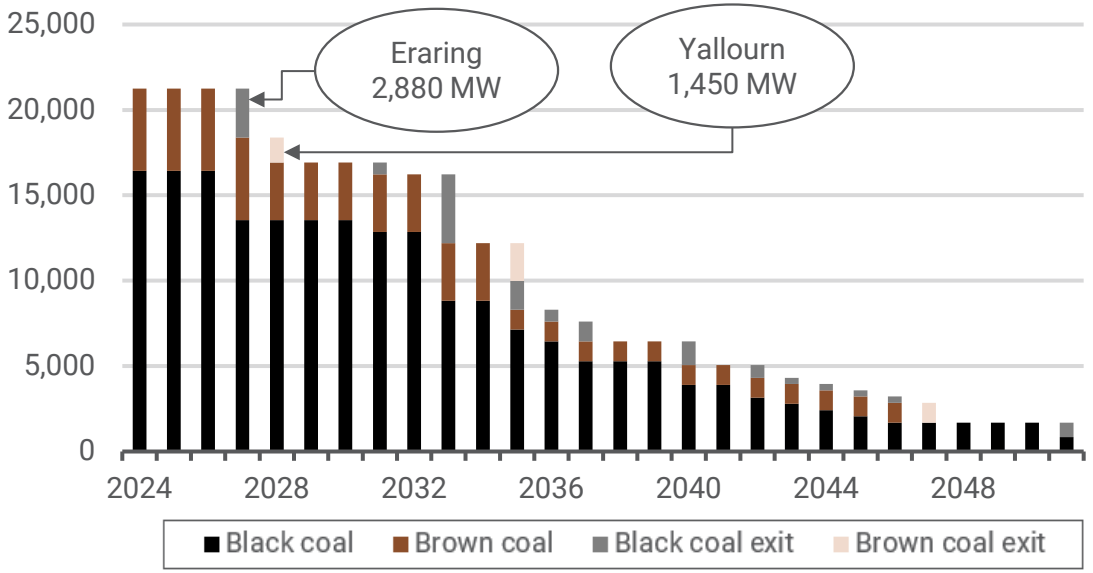
THERE IS A SIGNIFICANT PIPELINE OF GENERATION AND STORAGE PROJECTS

- At the end of FY2024, there was a total of 259.6 GW of proposed utility-scale wind, solar and battery developments.
- FY2024 saw an increase in planned battery storage with an additional 33 GW of proposed and 2 GW of committed projects.
- The Panel notes that 19 projects, representing a total of 6.4 GW, were approved under the first Capacity Investment Scheme (CIS) tender.[15] Furthermore, the Panel acknowledges that the *National Electricity Market wholesale market settings review* is ongoing and will recommend changes for wholesale market settings to promote investment in firm renewable generation and storage following the conclusion of CIS tenders in 2027. The Panel will continue to monitor the progress of the review.

Changes in planned generation
Capacity (MW)



Planned generator exits**
Capacity (MW)



Source: AEMO, NEM Generation Information.
* Solar excludes rooftop photovoltaics (PV).
** The Panel notes that the Queensland government has announced it may delay the closure of Callide B by up to three years past its current forecast closure date of 2028. See, Messenger, A., ' LNP orders review of Queensland's emissions reduction target of 75% by 2035', The Guardian, 8 April 2025.

15. For further information on the Capacity Investment Scheme, see Department of Climate Change, Energy, the Environment and Water, Capacity Investment Scheme, February 2025.

2.2

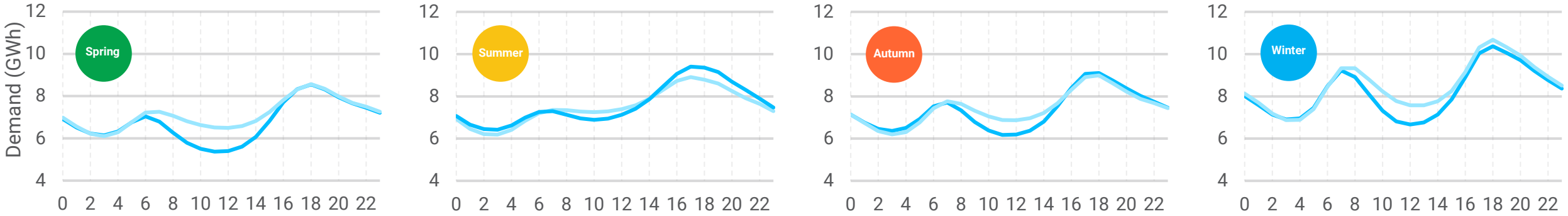
DEMAND SIDE TRENDS

- NSW, VIC and SA are experiencing steepening duck curves as midday demand continues to decrease.
- Morning and evening peaks remain consistent with previous years in all NEM regions.
- NSW continued to be a net importer of energy from QLD and VIC.

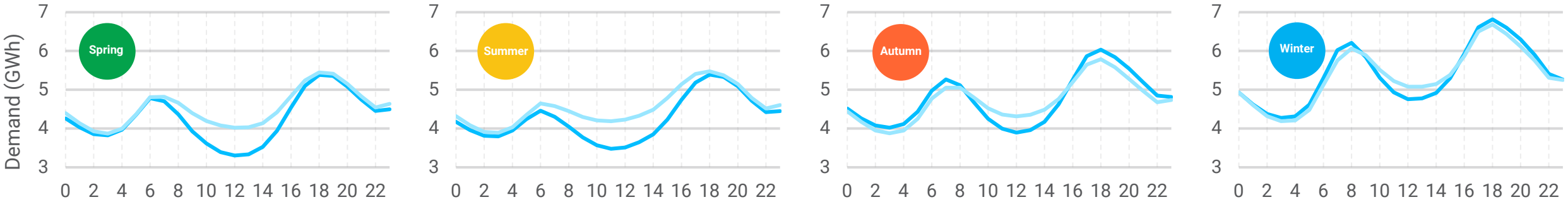
NSW AND VIC ARE EXPERIENCING A STEEPENING DUCK CURVE

- In NSW, demand has fallen between 7 AM and 2 PM across all seasons.
- In VIC, average demand has fallen during the day for all seasons. Average maximum demand during spring and summer has remained consistent with previous years. However, it has slightly increased in autumn and winter.

New South Wales Demand



Victoria Demand

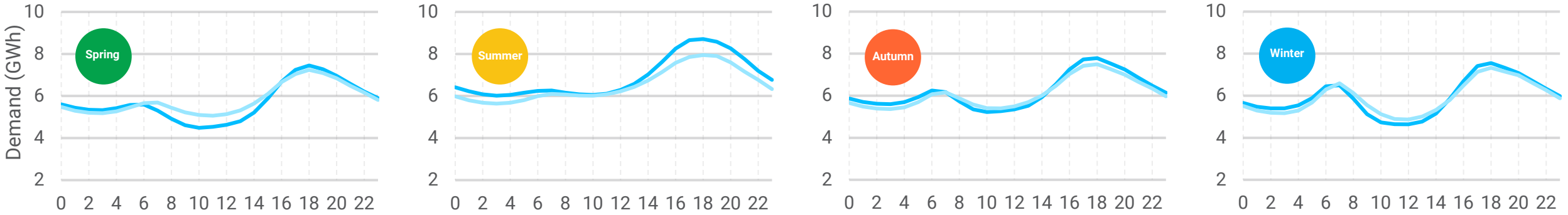


Source: Panel analysis of AEMO MMS data via NEOPoint.

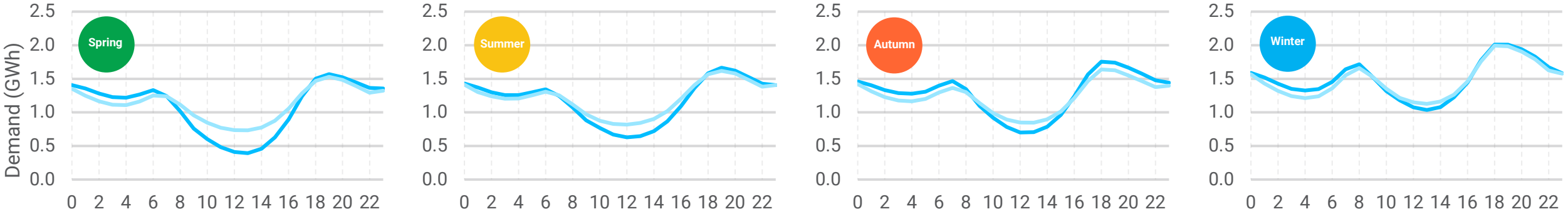
QLD AND SA DEMAND SAW CHANGES IN THE SPRING AND SUMMER SEASONS

- Demand profiles in QLD have remained relatively consistent with previous financial years.
- However, QLD experienced a slight increase in spring midday demand and summer evening peak.
- In SA, there was a slight fall in average demand at midday in summer and autumn, and a greater drop in demand during spring.

Queensland Demand



South Australia Demand

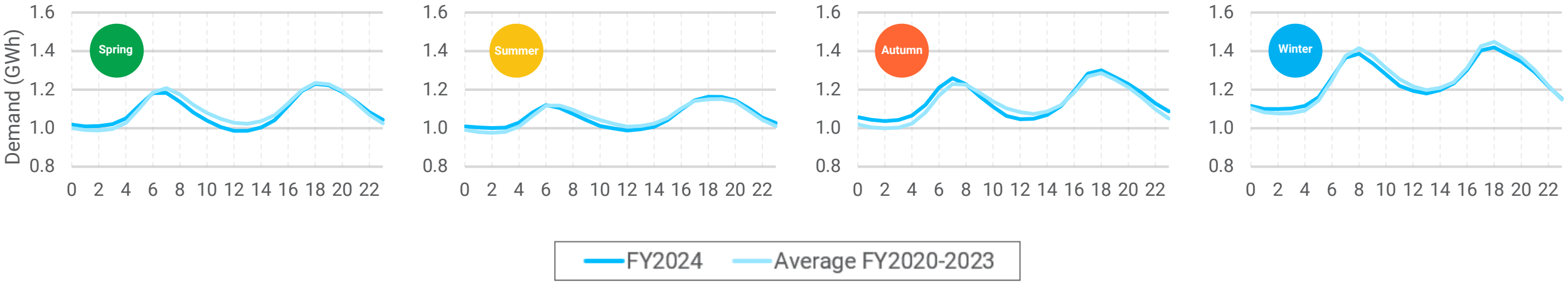


Source: Panel analysis of AEMO MMS data via NEOPoint.

TAS DEMAND REMAINED CONSISTENT WITH PREVIOUS YEARS

- The demand profiles in TAS remained largely consistent with previous years.

Tasmania Demand



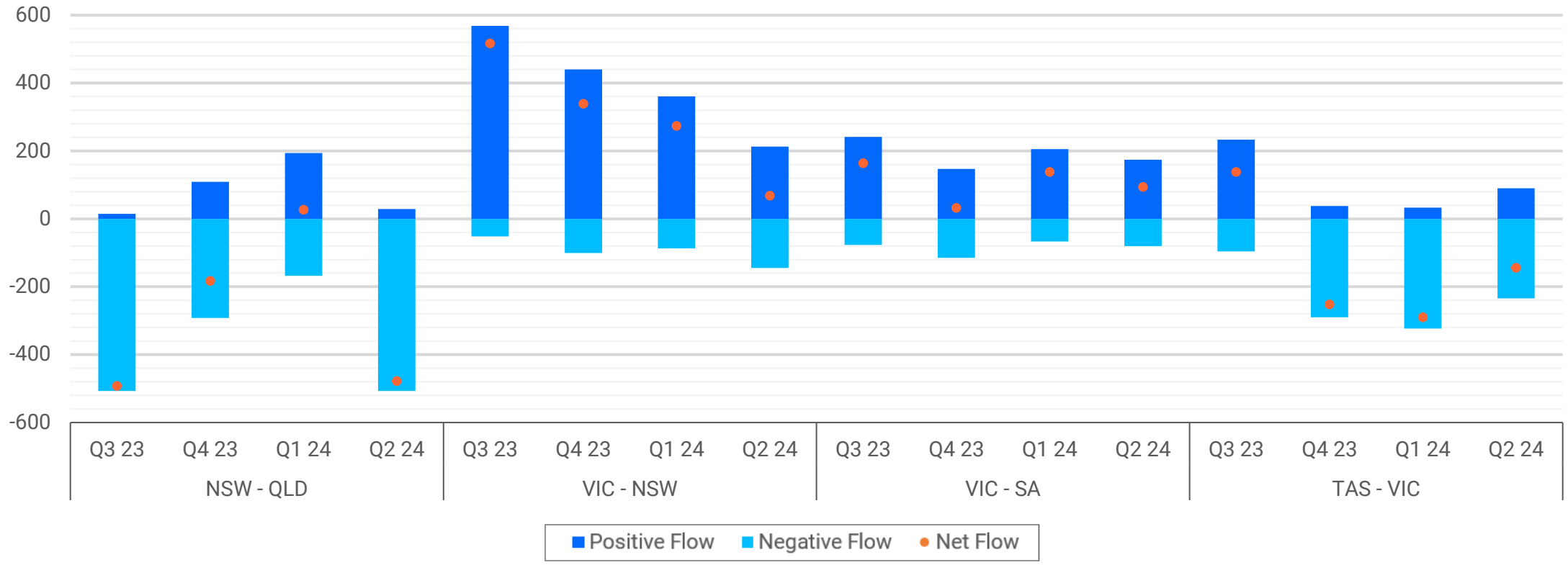
Source: Panel analysis of AEMO MMS data via NEOPoint.

NSW REMAINED A NET IMPORTER OF ENERGY FROM QLD AND VIC IN FY2024

- In FY2024, 10.2% of operational demand within NSW was supplied by imports from QLD and VIC.
- The volume of inter-regional trade is limited (constrained) by the amount and size of interconnectors between regions. Such constraints can lead to higher prices and create reliability risks.
- The Panel notes that, when it becomes operational, the SA-NSW interconnector Project EnergyConnect Stage 2 should encourage inter-regional trade and reduce reliability risks in the medium to long term.

Average daily inter-regional flows

Average flows (MW)



Source: AEMO, Quarterly Energy Dynamics (QED).

2.3

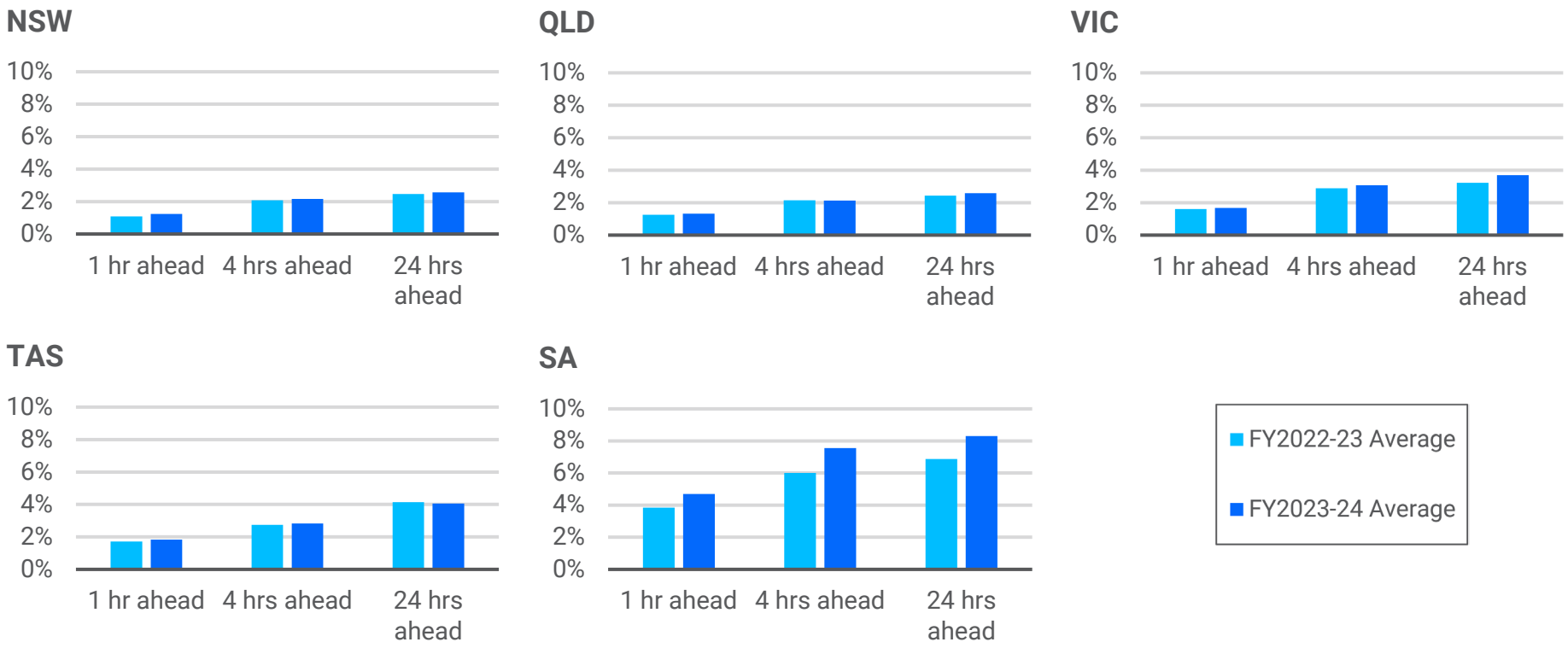
FORECASTING ACCURACY AND FUTURE FORECASTS

- Across FY2024, load forecasting errors were higher in every region compared to FY2023.
- In most NEM regions, solar and wind self-forecasts were more accurate than ASEFS and AWEFS.

LOAD FORECASTING ERRORS INCREASED IN EVERY NEM REGION

- Load forecasting errors were higher in every region in FY2024 compared to FY2023. These errors may be due to significant residuals or unexplained variances that were observed in QLD, SA and VIC.
- In AEMO's *Forecasting Accuracy Report 2024*, they recommend investigating electrification trends, broader weather effects and sectoral responses to economic conditions to enhance understanding of the variances.[16]
- SA continues to have the highest percentage of load forecasting errors. In absolute terms, SA generally experiences larger forecasting errors due to a higher penetration of renewables (including rooftop PV) compared to other NEM regions.

Mean load forecasting errors (%)



16. For further information, see AEMO, Forecasting Accuracy Report, 20 December 2024.

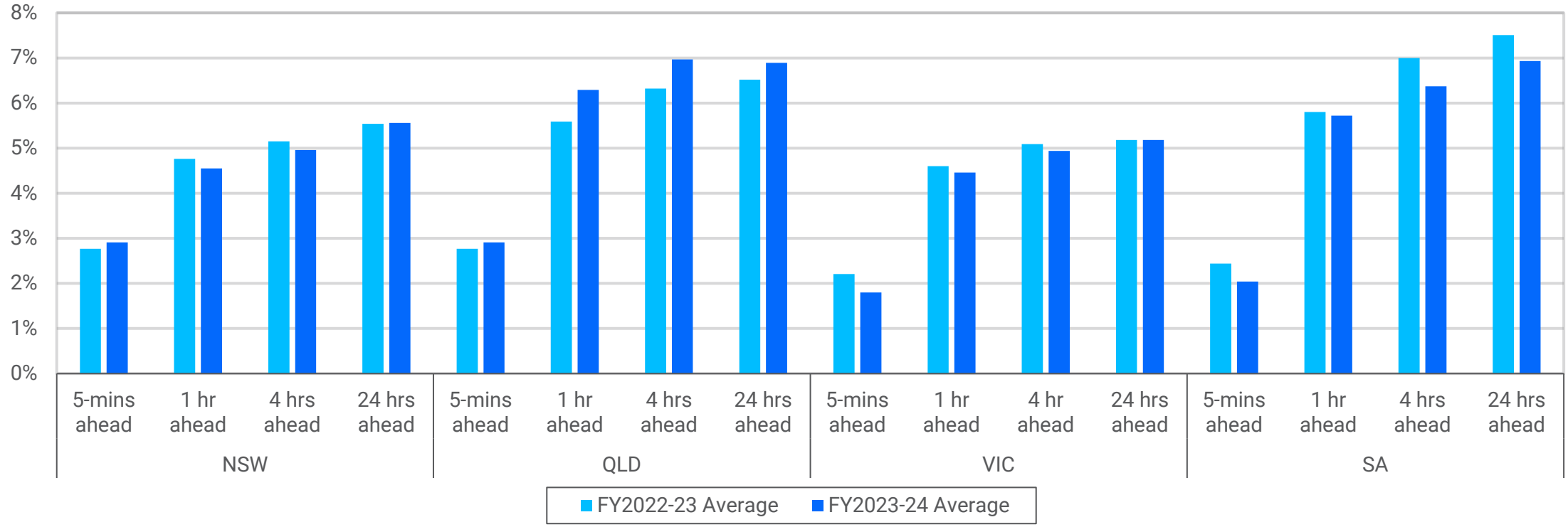
Source: Panel analysis of AEMO data.

SOLAR FORECASTING ACCURACY DECLINED IN QLD

- In FY2024, the Australian Solar Energy Forecasting System (ASEFS) was more accurate in SA across all periods than in FY2023.
- In QLD, forecasting errors increased across all timescales, while in SA, forecasting errors decreased.
- Forecasts that were 1-hour and 4-hour ahead improved in all regions except QLD.
- NSW and VIC forecast errors in FY2024 remain similar to FY2023.

Comparison of FY2023 to FY2024 ASEFS mean errors for solar generation

Normalised mean absolute error (%)



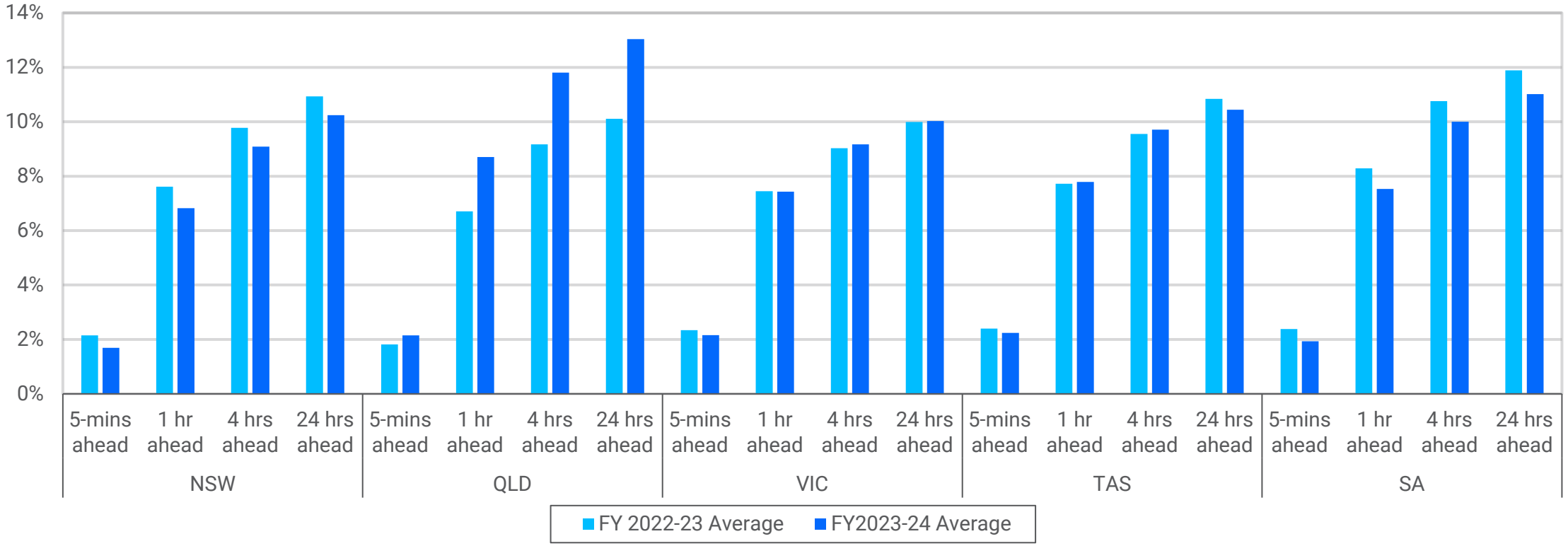
Source: Panel analysis of AEMO data.

WIND FORECASTING ERRORS DECREASED IN ALL REGIONS EXCEPT QLD

- In FY2024, the Australian Wind Energy Forecasting System (AWEFS) was more accurate in NSW and SA than in FY2023.
- The forecasting accuracy in both TAS and VIC was consistent with values in FY2023.
- Wind forecasts in QLD were notably higher in FY2024 across all timescales.

Comparison of FY2023 to FY2024 AWEFS mean errors for wind generation

Normalised mean absolute error (%)



Source: Panel analysis of AEMO data.

WIND SELF FORECASTS OUTPERFORMED THE AWEFS IN ALL REGIONS

- Self-forecasts for wind were, on average, more accurate than AWEFS forecasts in all regions.
- Self-forecasts for solar were similar to ASEFS forecasts, with small discrepancies in NSW and QLD.
- While solar forecasting errors sit around 2% in most periods, QLD experiences slightly above-average forecasting errors at roughly 3%.

Solar self-forecasts

Normalised mean absolute errors (%)

Wind self-forecasts

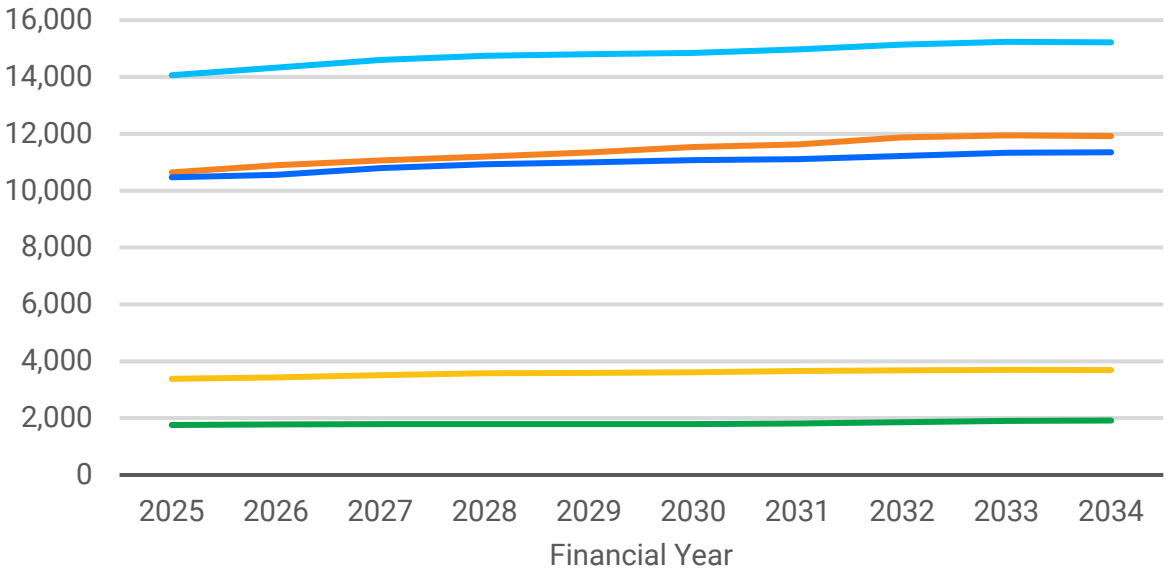
Normalised mean absolute errors (%)

Source: Panel analysis of AEMO data.

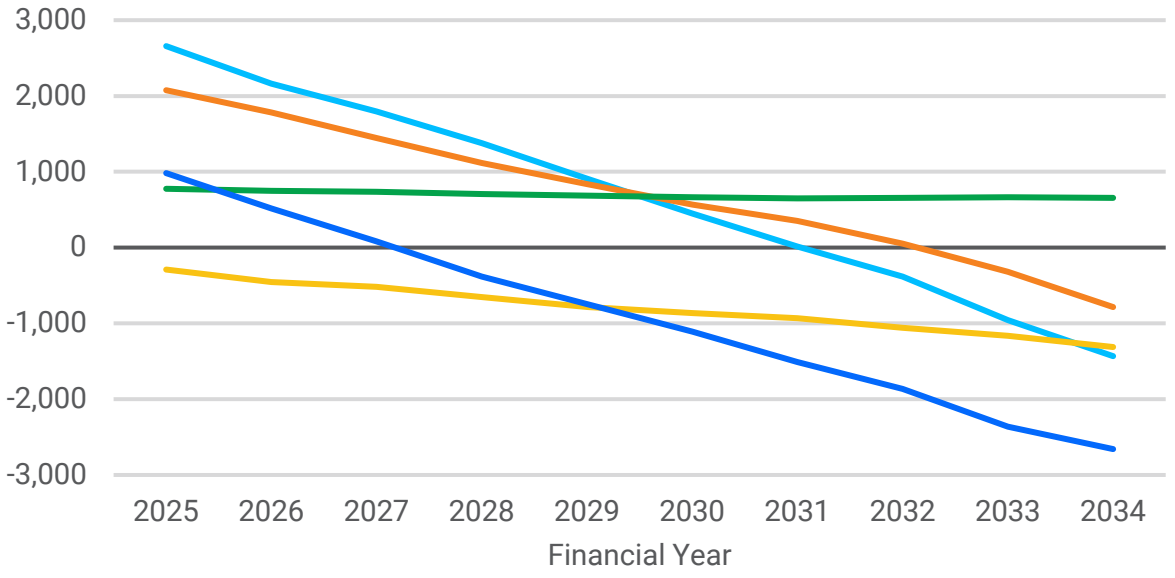
MINIMUM DEMAND IS FORECAST TO DECREASE IN MOST REGIONS

- Minimum operational demand is often measured by a "POE90" forecast – the daily level of demand that would be exceeded 90% of the time.[17] Conversely, a "POE10" forecast measures maximum demand – the daily demand that would be exceeded 10% of the time.
- The charts below show the global maximum and minimum demand forecasts provided in the 2024 ESOO.
- Minimum demand forecasts are expected to fall faster than maximum demand forecasts rise.
- All states except TAS are expected to experience minimum demands below 0 MW earlier than forecast in the 2023 ESOO.
- NSW and QLD minimum demand are now expected to fall below 0 MW around 2031 and 2033, respectively.

ESOO maximum demand forecast POE 10 scenario



ESOO minimum demand forecast POE 90 scenario



Source: AEMO, 2024 Electricity Statement of Opportunities (ESOO), 29 August 2024.

17. POE stands for 'probability of exceedance'.

2.4

RELIABILITY EVENTS AND MARKET INTERVENTIONS

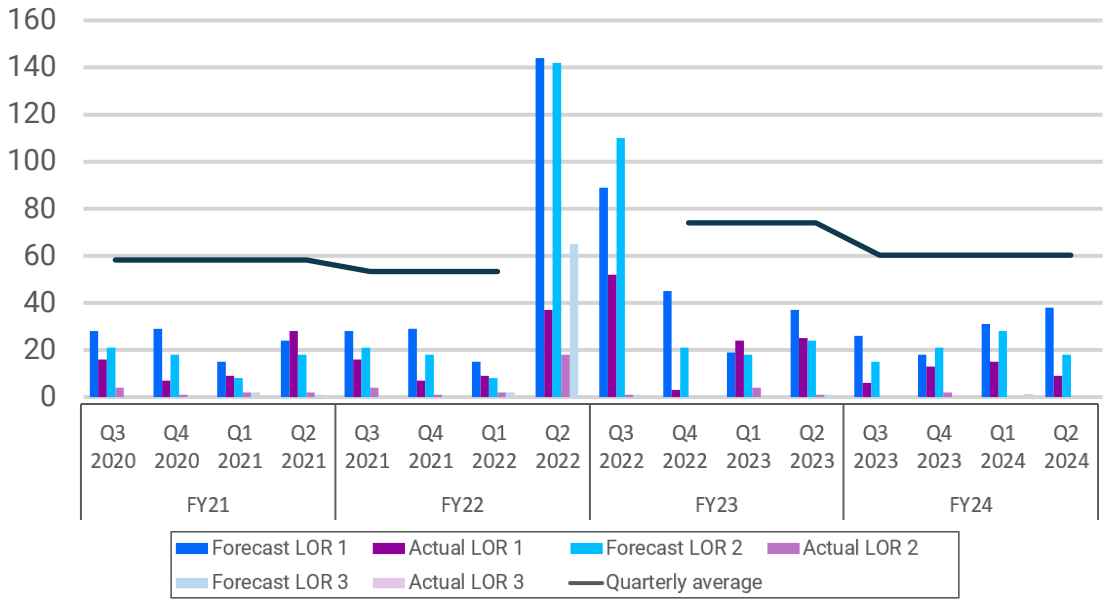
- There was one occasion in FY2024 where AEMO requested a non-scheduled unit to curtail to 0 MW in response to an MSL event.
- RERT was not activated in FY2024, indicating that other market signals were effective in managing reliability risks.
- The NEM experienced a wind drought in April 2024 as average wind capacity factors dropped to 25% across the NEM.

LACK OF RESERVE NOTICES HAVE RETURNED CLOSER TO PRE-2022 LEVELS

- The number of lack of reserve (LOR) notices returned closer to pre-2022 levels, with a quarterly average of 60 LOR notices across FY2024.
- LOR1 and LOR2s are issued if reserve levels fall below the higher of: the largest credible contingency, or the forecast uncertainty measure (FUM).
- Compared to the previous year, a greater proportion of LORs were caused by the FUM in FY2024.
- The Panel notes that the updated Reserve Level Declaration Guidelines came into effect on 26 June 2024. The updated guidelines have changed the FUM model and inputs.[18]

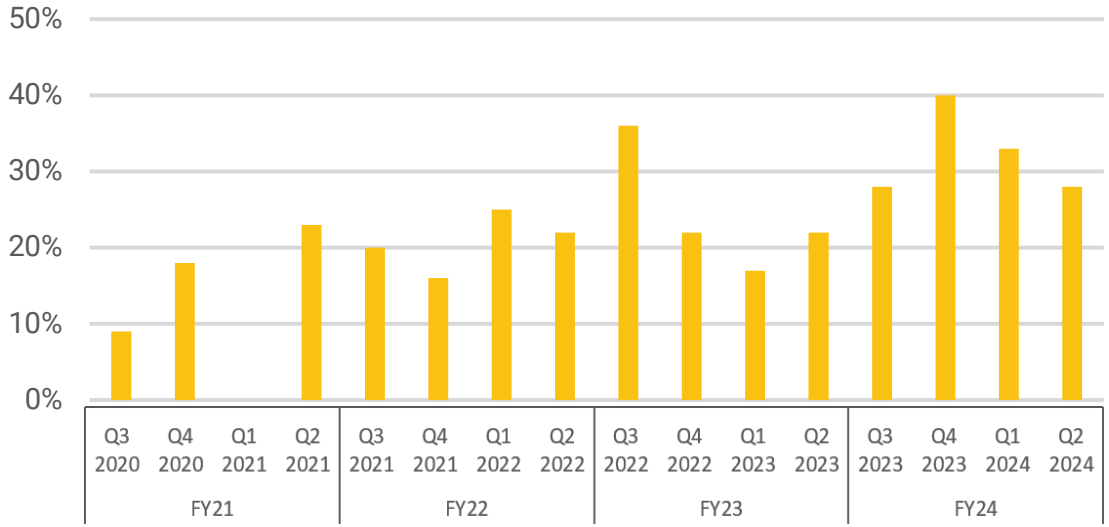
LOR notices by quarter

Number of notices



Percentage of LOR declared by the FUM by quarter

LOR set by the FUM (%)



Source: AEMO, NEM Lack of Reserve Framework Quarterly Reports.

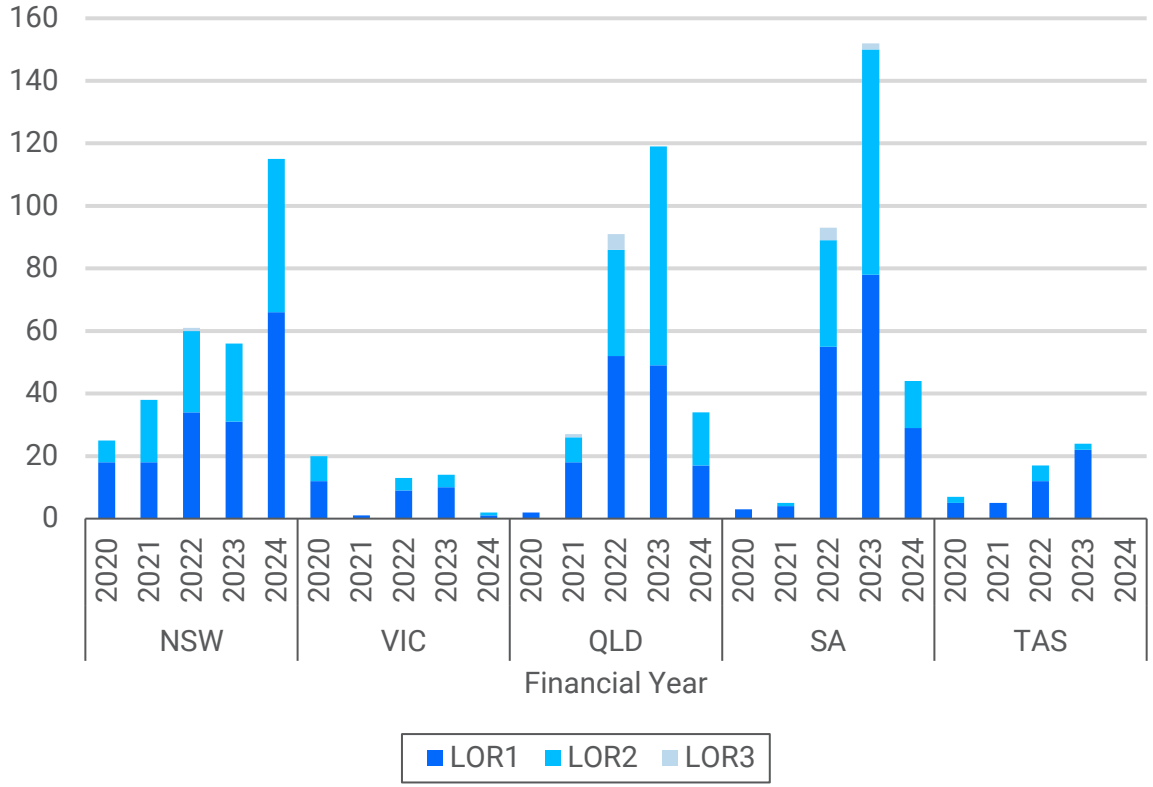
18. The updated Reserve Level Declaration Guidelines included replacing the Bayesian Belief Network model with an alternative in-house Machine Learning mode. The update also included the inclusion of a single input variable (time-of-day) to calculate the FUM. For further information, see AEMO, Reserve Level Declaration Guidelines, 2 May 2024.

MOST NEM REGIONS EXPERIENCED A DECREASE IN LOR EVENTS IN FY2024

- All regions, except NSW, saw a decrease in lack of reserve (LOR) notices from previous years.
- NSW, QLD and SA saw a decrease in actual LOR events compared to FY2023.
- VIC and TAS experienced an LOR3 and LOR1, respectively.
- NSW had the highest number of LOR events, with 25 LOR1 and 1 LOR2 events.

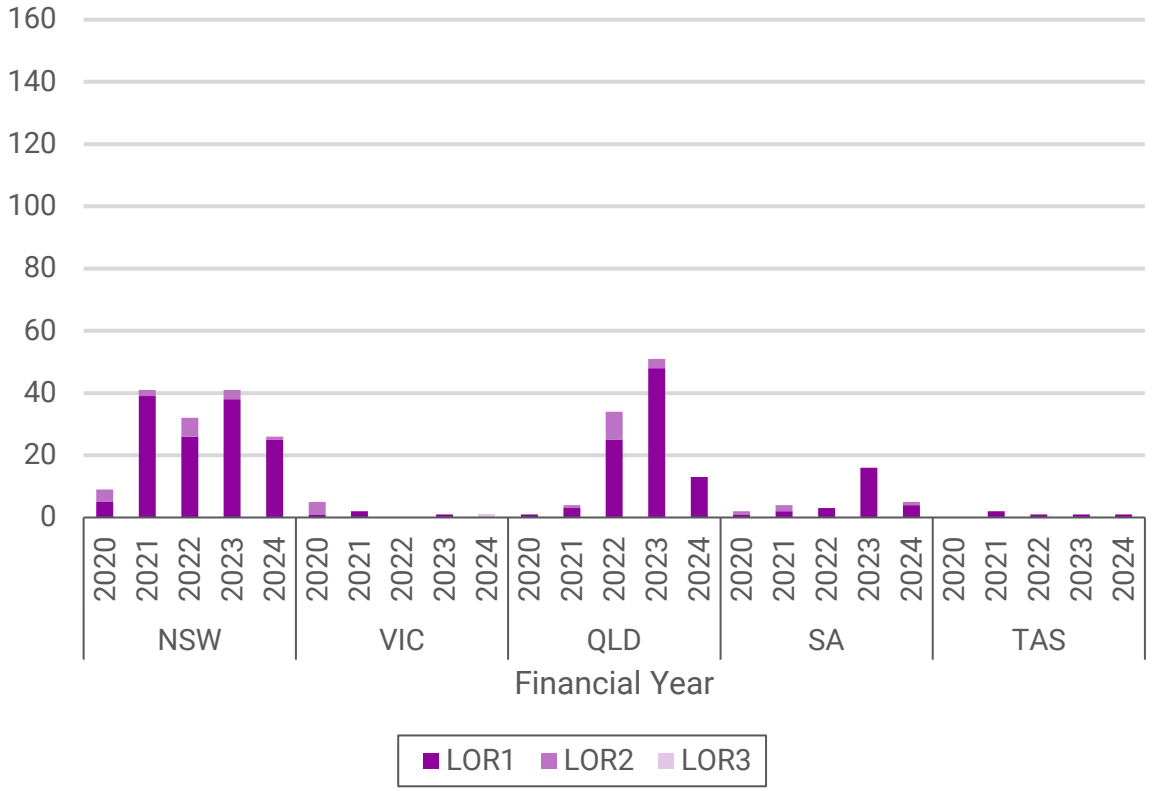
Forecast LOR notices by region

Number of LOR notices



Actual LOR notices by region

Number of actual LOR events



Source: Panel analysis of AEMO data.

THERE WAS ONE MSL DECLARATION IN FY2024

- Minimum system load (MSL) reporting is a new addition to the RASR, which reports on MSL notices outlined in the MSL framework.[19]
- The MSL framework aims to replicate the existing LOR framework and is intended to manage low-demand conditions to maintain system security.
- There was one occasion on 31 December 2023 where AEMO requested a non-scheduled unit to curtail to 0 MW during an MSL event. During that event, AEMO manually set the MW target for a unit to 0 from 1157hrs to 1557hrs. In all other MSL conditions, non-scheduled units have voluntarily responded to price.
- Although FY2025 has seen an increase in MSL notices, more data is required to determine any trends relating to the frequency of MSL occurrences. The Panel will continue to monitor the frequency of MSL notices in future RASRs.

		FY2024				FY2025		
		Q3 2023	Q4 2023	Q1 2024	Q2 2024	Q3 2024*	Q4 2024	Q1 2025
MSL1	Forecast	-	1	-	-	1	10	1
	Actual	-	-	-	-	1	3	1
MSL2	Forecast	-	-	-	-	-	2	-
	Actual	-	-	-	-	-	-	-
MSL3[20]	Forecast	-	-	-	-	-	-	-
	Actual	-	-	-	-	-	-	-
	Total	**-**	**1**	**-**	**-**	**2**	**15**	**2**

* The Panel notes that AEMO only began publishing MSL events in Q3 2024 as part of AEMO's NEM Lack of Reserve Quarterly Reports.

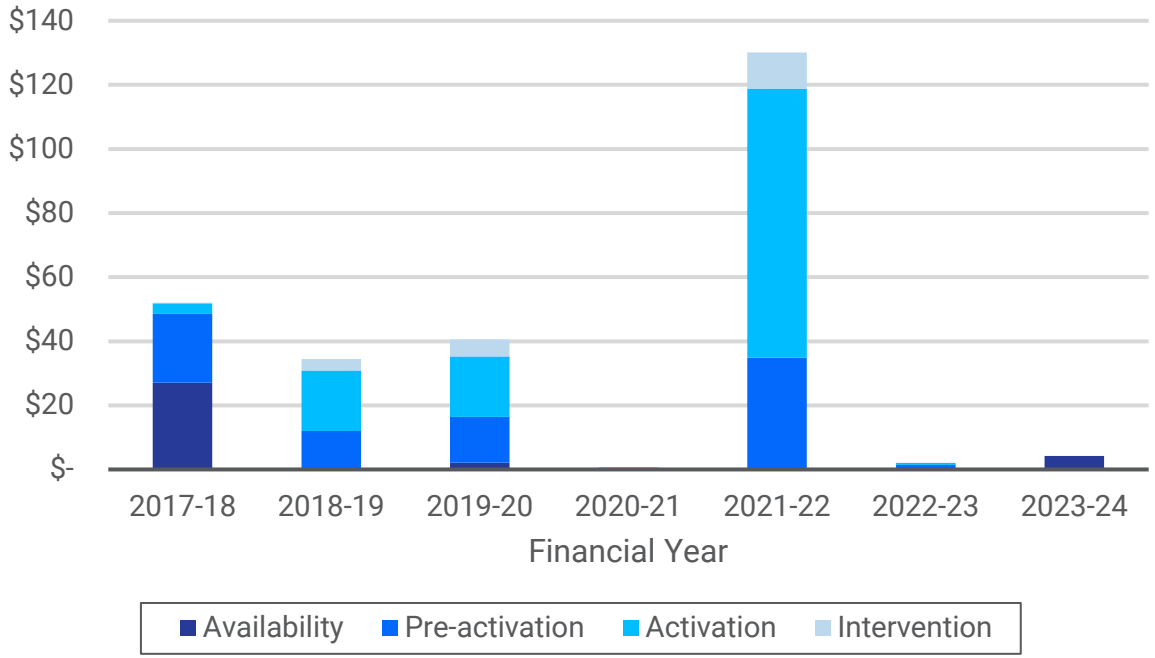
Source: AEMO, NEM Lack of Reserve Framework Quarterly Reports.

19. For further information on the MSL Procedure, see AEMO, Victorian Minimum System Load Procedure Overview, November 2024.
20. An MSL3 event is declared when demand is too low to maintain a secure operating state. MSL2 and MSL1 events occur when the system is one or two credible load contingencies away from reaching MSL3, respectively.

RERT WAS NOT ACTIVATED IN FY2024

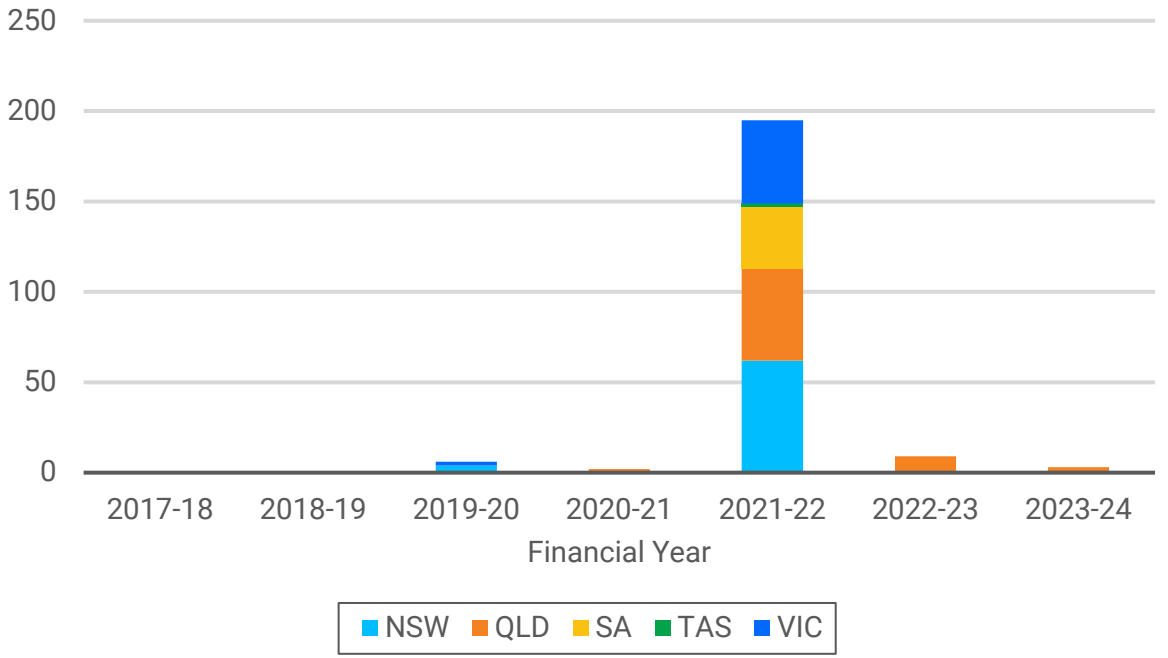
- The total reliability and emergency reserve trader (RERT) cost in FY2024 was $4,252,685. This was higher than in FY2023 due to the contracting of interim reliability reserves.
- RERT was not activated in FY2024. This indicates that other market signals were effective in managing reliability risks.[21]
- The number of reliability directions issued by AEMO continued to decline from a record high in FY2022.
- Only three reliability directions were issued in FY2024, all of which were in QLD. All three directions were issued in January to prevent lack of reserve conditions from deteriorating during hot and humid weather.[22]

RERT costs



Source: AEMO, Reliability and Emergency Reserve Trader (RERT) Report.

Number of reliability directions issued by AEMO



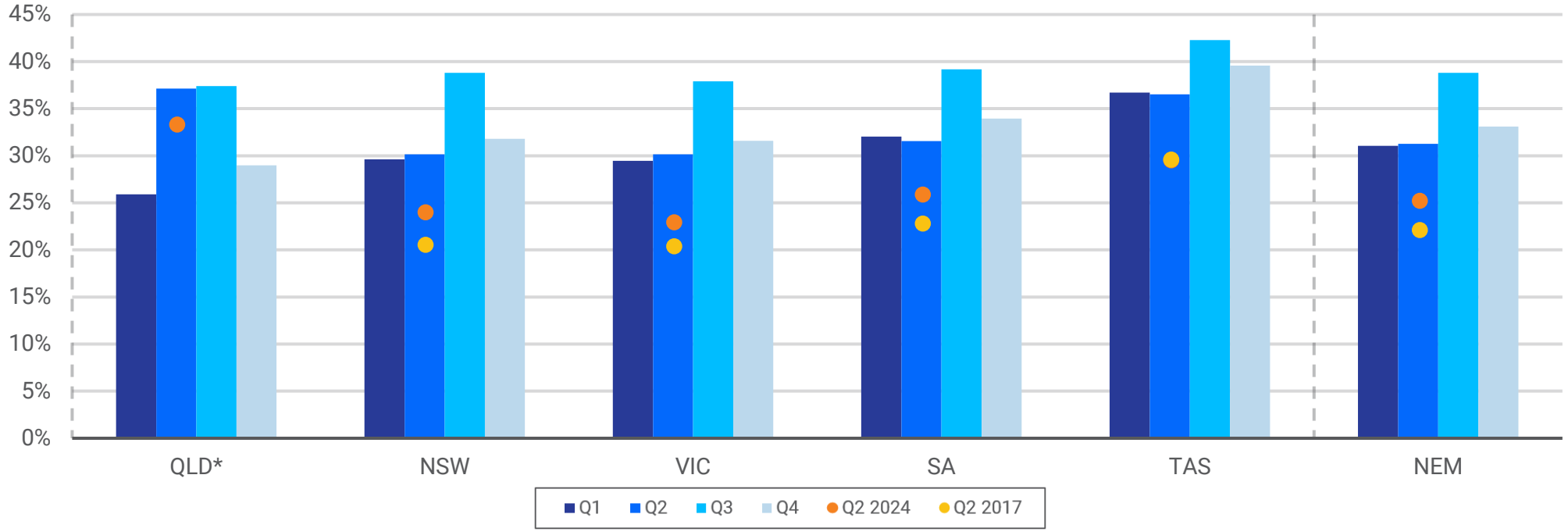
Source: Panel analysis of AEMO data.

21. For further information on RERT activations, see AEMO, Reliability and Emergency Reserve Trader (RERT) End of Financial Year 2023-24 Report, August 2024.
22. For further information on these directions, see AEMO, NEM Event Directions Report 22 and 27 January 2024, March 2024.

THE NEM EXPERIENCED A WIND DROUGHT IN Q2 2024

- In Q2 2024, there was a wind drought in the NEM impacting wind generation.
- The wind drought caused available wind output to fall by 901 MW in Q2 2024 compared to the same quarter in 2023.
- TAS recorded the steepest decline in its wind capacity factor, falling by 13% compared to Q2 2023. QLD was the least impacted, with a modest 3.8% reduction in its wind capacity factor.
- The Q2 2024 wind drought was slightly less severe than that of Q2 2017.[23]

Average quarterly volume weighted wind available capacity factors (averaged over 2011-2024)*



* QLD is averaged over 2019-2024 and does not have data for Q2 2017.

Source: AEMO, Quarterly Energy Dynamics Q2 2024, July 2024.

23. For further information on the wind drought, see AEMO, Quarterly Energy Dynamics Q2 2024, July 2024.

2.5

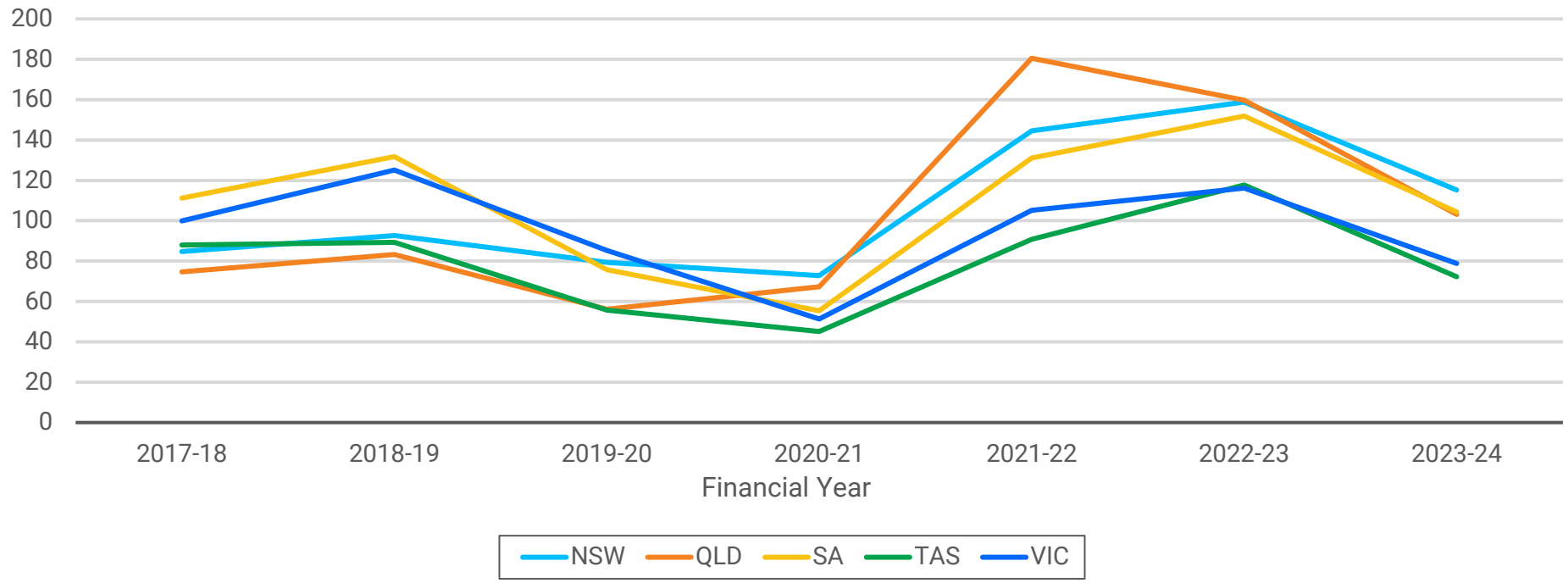
MARKET PRICE SIGNALS AND INVESTMENT INCENTIVES

- Average wholesale prices decreased over FY2024 from a high in FY2023.
- The number of market price floor events fell in FY2024 while the number of market price cap events increased.
- FY2024 saw an increase in the proportion of negative prices in the NEM, driven by an increase in rooftop and utility-scale solar generation.

AVERAGE WHOLESALE PRICES DECLINED FROM A 2023 PEAK

- Volume-weighted average prices (VWAP) fell in FY2024, easing from the record highs seen in FY2023.
- Prices across all regions fell, with the NEM VWAP decreasing by 33% from $140.88/MWh in FY2023 to $94.74/MWh in FY2024.
- FY2023 had the highest average NEM volume weighted average price (VWAP) ever recorded, with NSW, SA and TAS all reaching a record high. This was partly caused by the flow-on impacts of the June 2022 market suspension.
- Despite the downward turn, wholesale prices in FY2024 remain elevated compared to pre-2022 levels – 61% higher than FY2021's average of $58.38/MWh.

Wholesale volume weighted average price (VWAP) by region



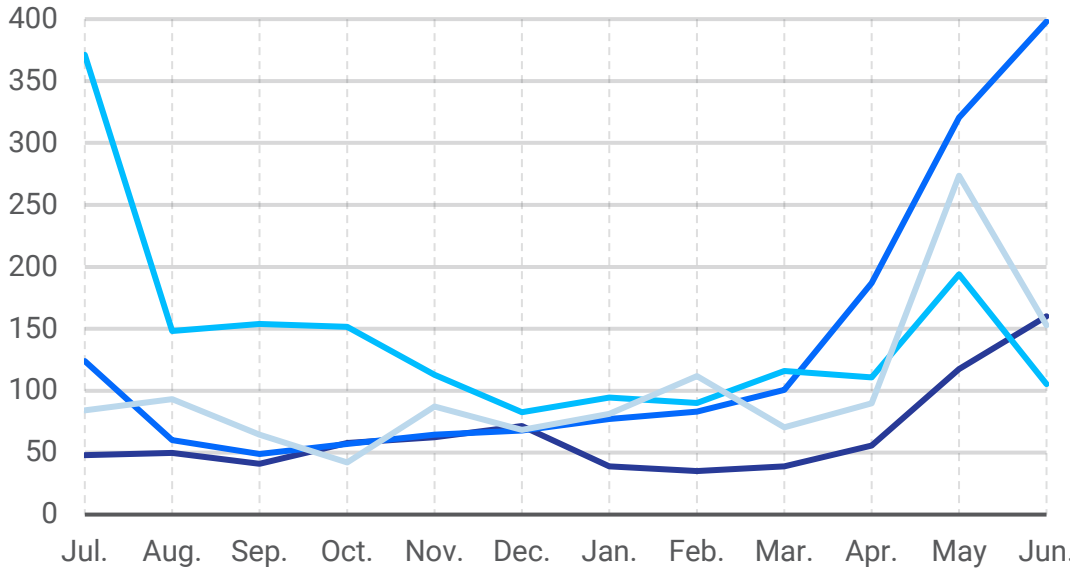
Source: Panel analysis of AEMO MMS data via NEOPoint.

WHOLESALE PRICES IN NSW AND QLD REMAIN HIGHER THAN PRE-2022 LEVELS

- VWAP fell in FY2024 for both states – down 27% in NSW and 35% in QLD – as the market continued to stabilise following the price spikes of 2022.
- While prices are lower, they remain higher than the average prices preceding 2022 - $115.25/MWh (2022) vs. $82.40/MWh (2018-21) in NSW and $103.14/MWh (2022) vs. $70.36/MWh (2018-21) in QLD.
- In NSW, prices peaked during Q2 of FY2024, consistent with seasonal trends across all regions. The price rise was exacerbated by generator and network outages, as well as rebidding by some market participants.[24]
- The 2023–24 summer was Australia's third warmest on record, contributing to increased electricity demand and higher prices. In Queensland, hot and humid weather drove a marked rise in demand from late December through February 2024.

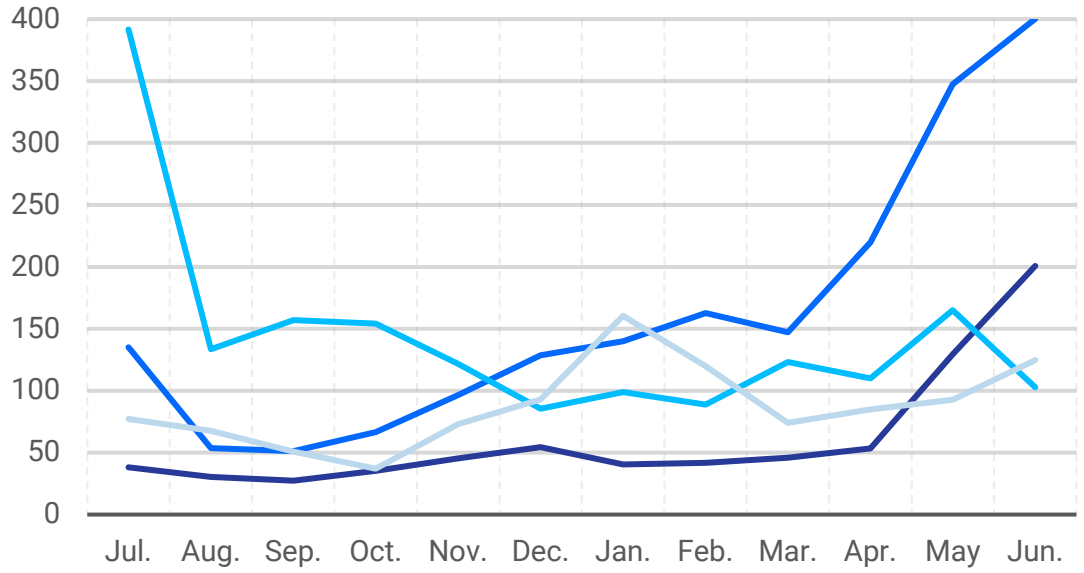
New South Wales monthly average dispatch price

Regional price ($/MWh)



Queensland monthly average dispatch price

Regional price ($/MWh)



Source: Panel analysis of AEMO MMS data via NEOPoint.

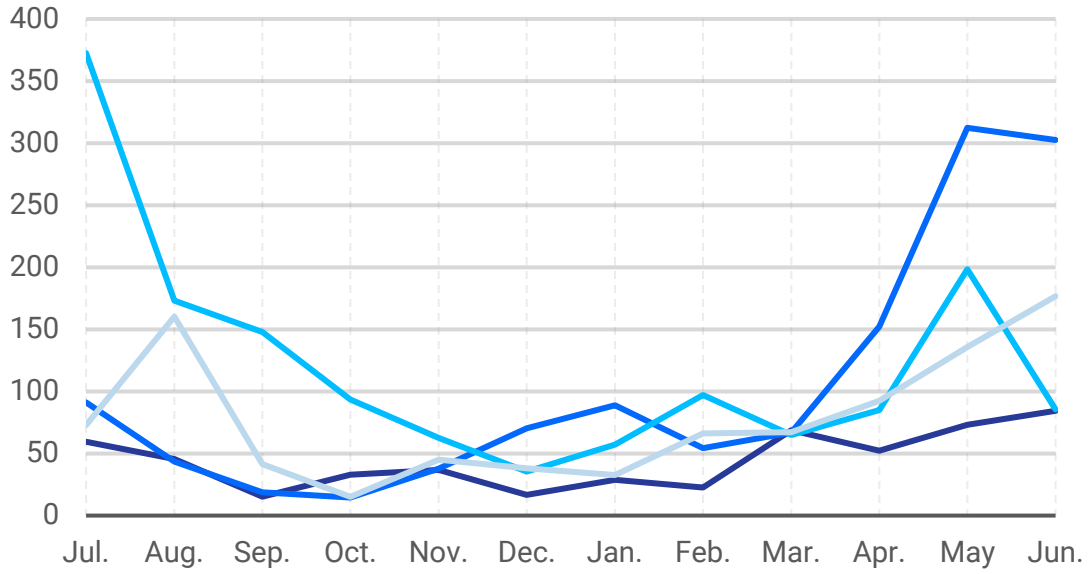
24. AER, Wholesale Electricity Market Performance Report 2024, 20 December 2024.

WHOLESALE PRICES IN SA AND VIC FELL IN FY2024

- VWAP in SA and VIC declined, with the yearly average falling 31% in SA to $104.33/MWh and 32% in VIC to $78.81/MWh.
- SA prices remain above pre-2022 levels, with the FY2024 average exceeding the FY2018–21 average of $93.54/MWh.
- VIC is the only NEM region where prices have fallen below pre-2022 averages, with FY2024 prices $11.59/MWh lower than the FY2018–21 average of $90.40/MWh.
- In Q3 FY2024, SA recorded higher prices than other regions, driven by low wind generation and network constraints that limited lower-cost imports from VIC.
- In Q2 FY2024, VIC prices rose due to cold weather and reduced wind and solar output, increasing demand and reliance on higher-cost generation.

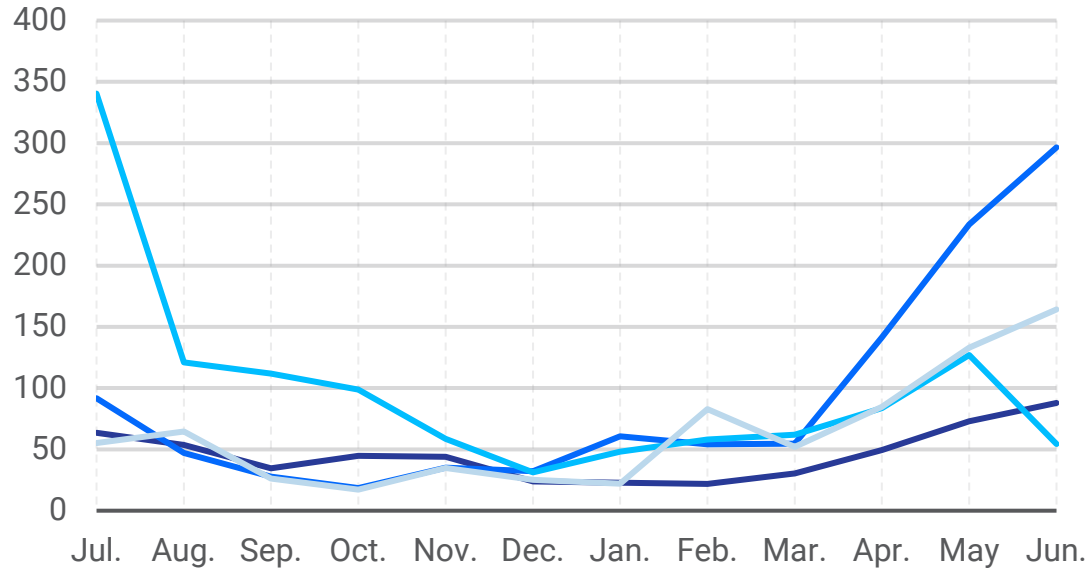
South Australia monthly average dispatch price

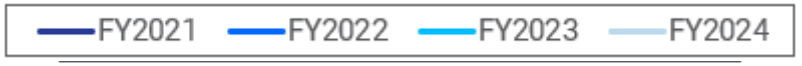
Regional price ($/MWh)



Victoria monthly average dispatch price

Regional price ($/MWh)

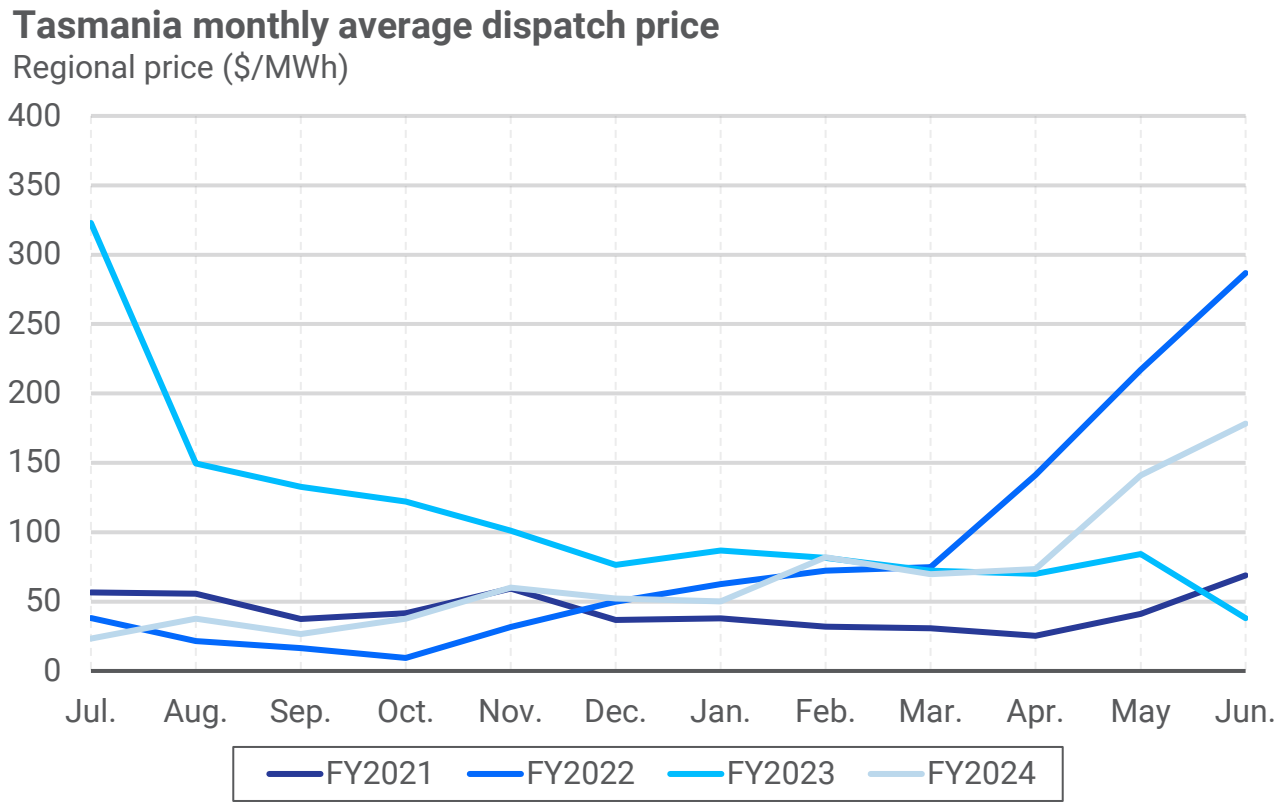




Source: Panel analysis of AEMO MMS data via NEOPoint.

WHOLESALE PRICES IN TAS SAW THE LARGEST DECLINE ACROSS ALL REGIONS

- TAS prices saw the largest regional price decline (after the largest regional price increase in FY2023), falling 39%.
- The VWAP over FY2024 was $72.18/MWh, slightly above the FY19-21 average of $69.57/MWh.

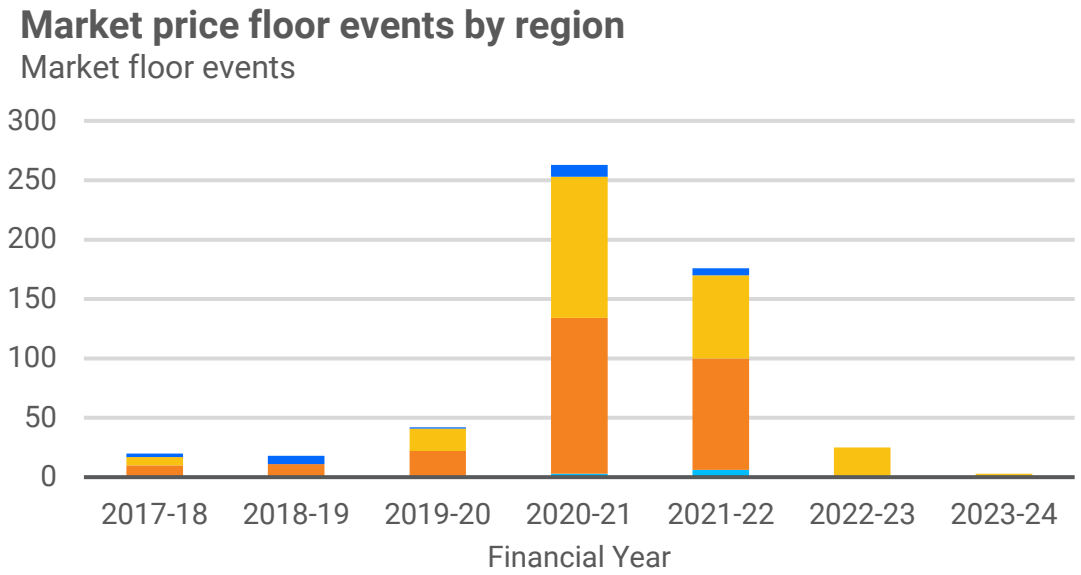


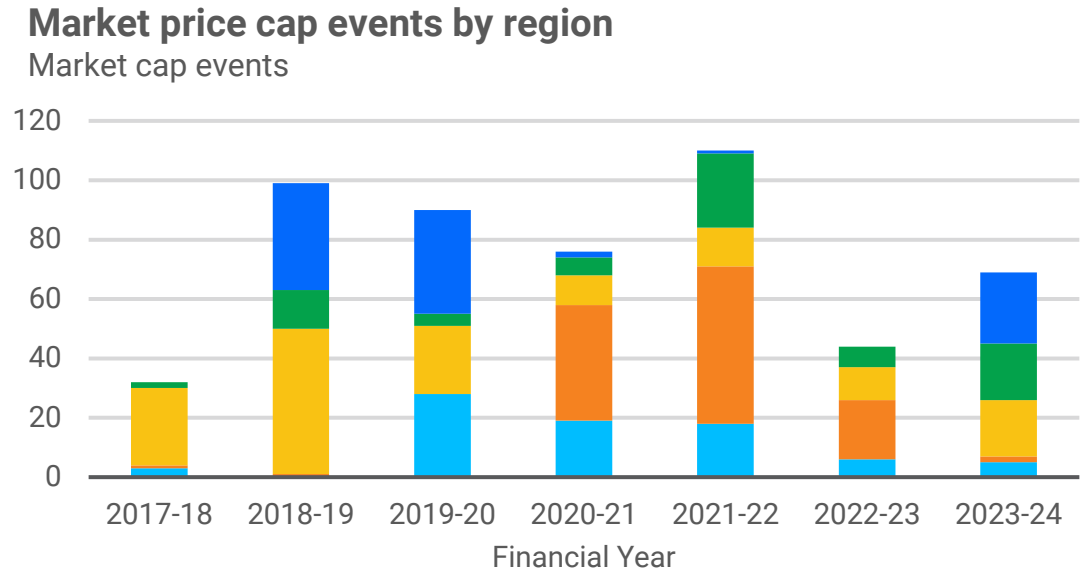
Source: Panel analysis of AEMO MMS data via NEOPoint.

FY2024 SAW A DROP IN MFP EVENTS AND AN INCREASE IN MPC EVENTS

- The increase in market price cap (MPC) events was driven by a non-credible contingency event, which materially affected prices in VIC and TAS.
- Market floor price (MFP) events fell in FY2024, with only three recorded events occurring in South Australia, down from 25 in FY2023.
- MPC events increased to 69 in FY2024 from 44 in FY2023.
- 39 of the 69 MPC events occurred on 13 February 2024, when the Sydenham-Moorabool 500kV No. 1 and No. 2 lines failed during a severe weather event, leading to 2484 MW of generation lost in VIC.[25]

Time Period	Market price floor	Market price cap	Cumulative price threshold	Administered price cap
1 July 2023 - 30 June 2024	- $1,000 / MWh	$16,600 / MWh	$1,490,200 / MWh	$600 / MWh
1 July 2024 - 30 June 2025	- $1,000 / MWh	$17,500 / MWh	$1,573,700 / MWh	$600 / MWh
1 July 2025 – 30 June 2026	- $1,000 / MWh	$20,300 / MWh	$1,674,000 / MWh	$600 / MWh





Source: Panel analysis of AEMO MMS data via NEOPoint.

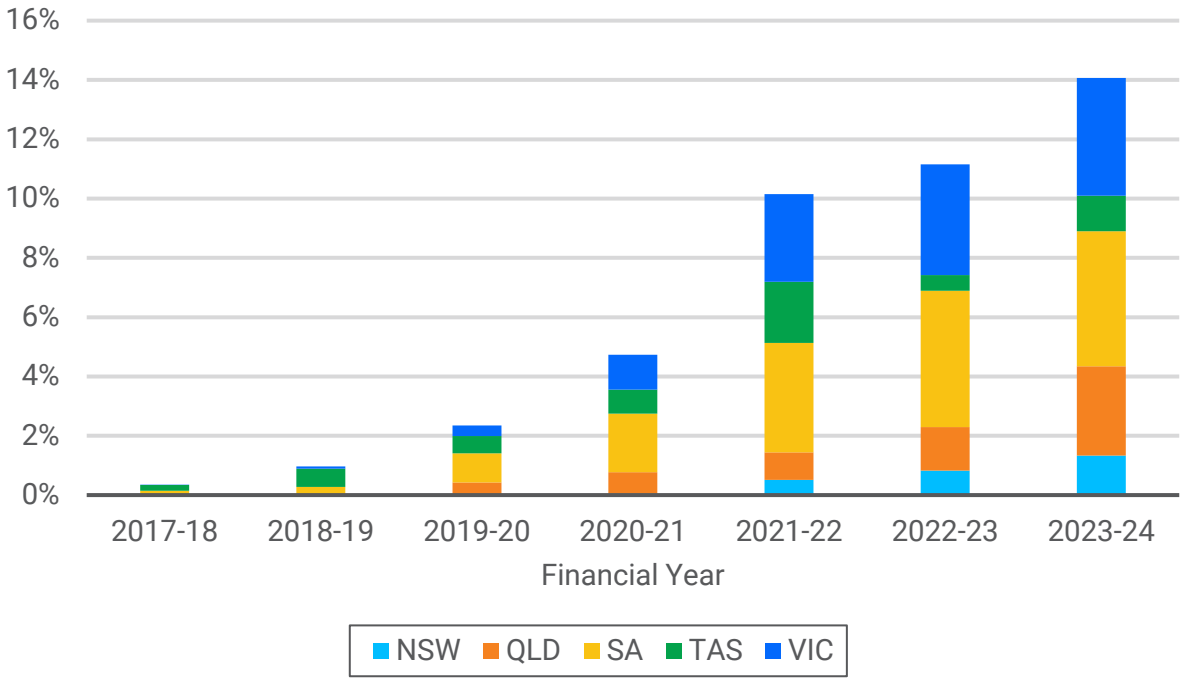
25. For further information on the event, see AEMO, Preliminary Report – Trip of Moorabool-Sydenham 500kV No. 1 and No. 2 lines on 13 February 2024, 15 February 2024.

THE PROPORTION OF NEGATIVE PRICE PERIODS CONTINUED TO INCREASE

- The proportion of negative prices increased in FY2024, with negative prices occurring in 14% of all dispatch periods.
- This is largely driven by an increase in rooftop PV and utility-scale solar generation during low operational demand periods.
- The increase in negative price intervals has come primarily from NSW, QLD and TAS, increasing 61.4%, 105.3% and 127.4%, respectively, from FY2023.
- VIC and SA had changes of 6.5% and -0.4%, respectively. However, these states continue to account for the greatest proportion of negative price periods in the NEM.

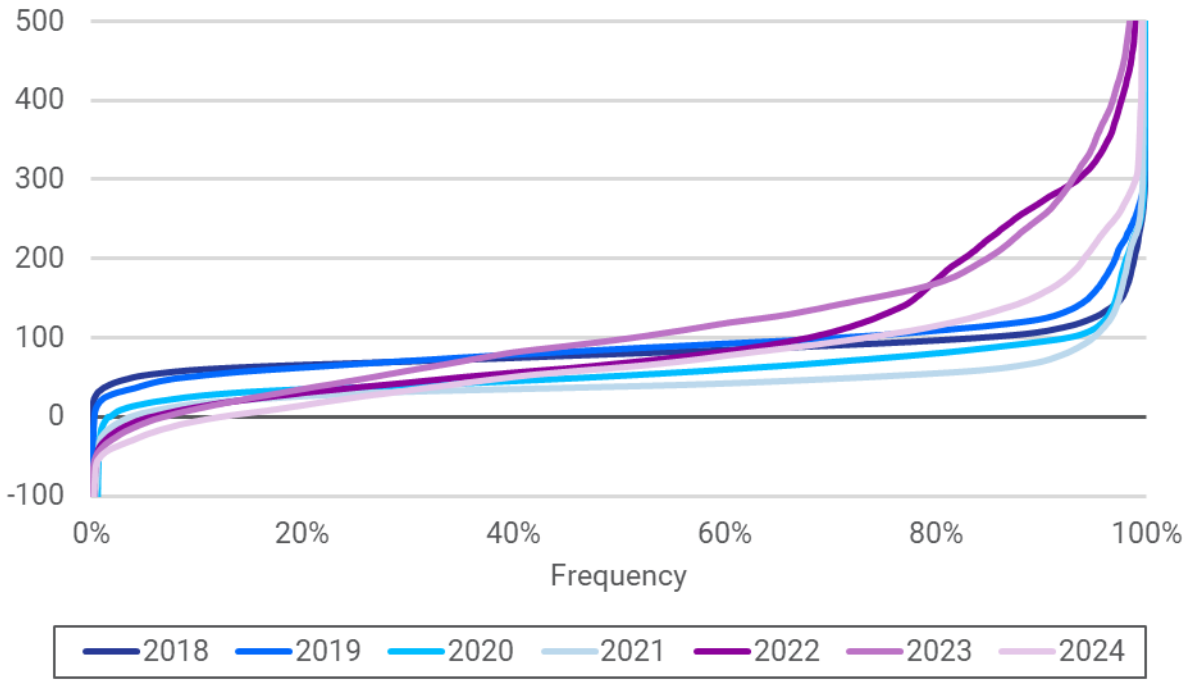
Negative pricing periods

Proportional of intervals at a negative price (%)



Average price duration curve by financial year

Price ($/MWh)



Source: Panel analysis of AEMO MMS data via NEOPoint.

2.6

TRANSMISSION AND NETWORK PERFORMANCE

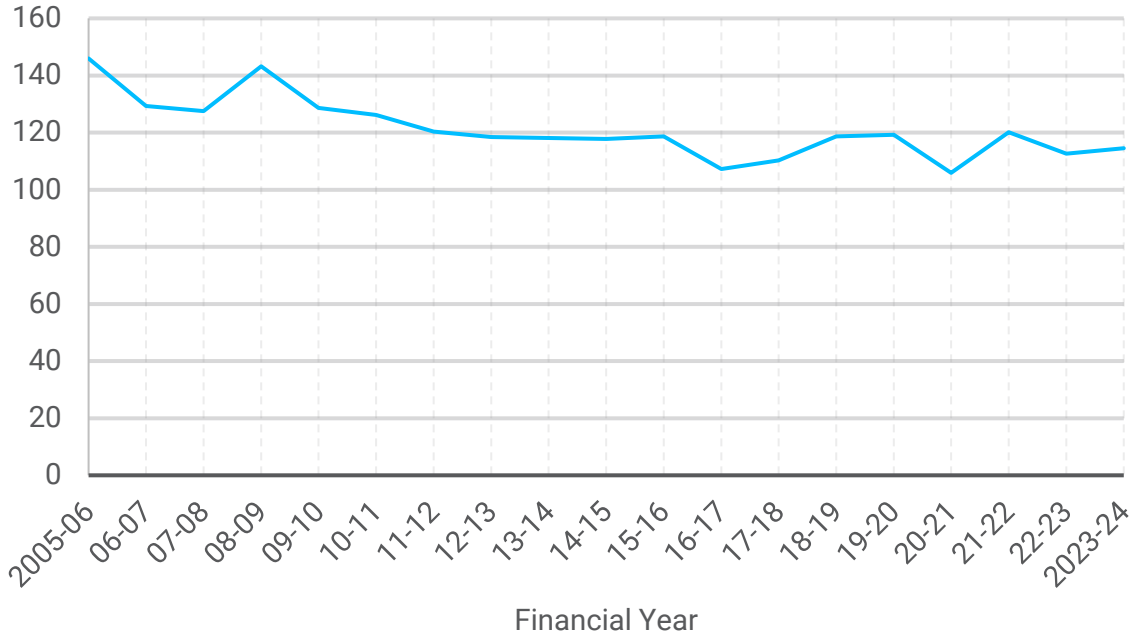
- Distributed Network Service Provider (DNSP) performance remains consistent with previous years.
- Outages in the distribution network continue to account for most of the total supply interruptions in the NEM.
- The total number of constraints increased to 21,790 in FY2024, reflecting an increasingly complex NEM.

SAIDI AND SAIFI REMAIN CONSISTENT WITH PREVIOUS YEARS

- System average interruption duration index (SAIDI) and system average interruption frequency index (SAIFI) are two important indicators of distribution network reliability.[26]
- SAIDI indicates the average number of minutes of outages that each customer served by the DNSP experiences, while SAIFI indicates the average number of outages for each customer served by the DNSP.
- Both SAIDI and SAIFI have remained fairly consistent with FY2023 values. SAIDI only increased slightly to 115 minutes from 113 minutes in FY2023. SAIDI also increased slightly from 0.95 to 0.96 per customer.

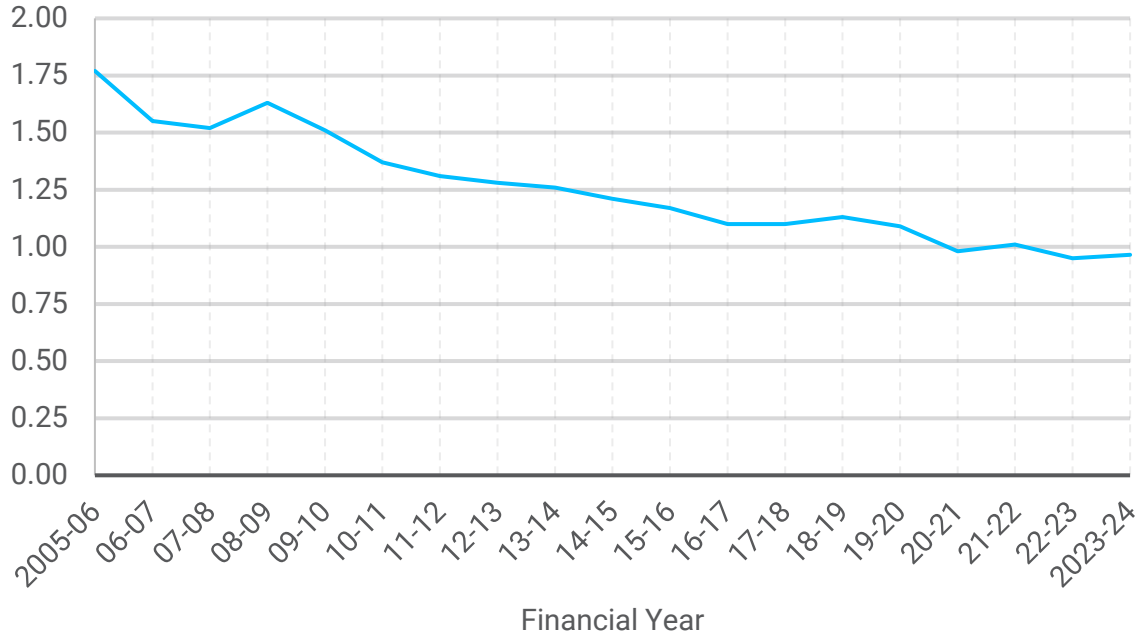
System average interruption duration index (SAIDI)

Weighted average outage duration (minutes)



System average interruption frequency index (SAIFI)

Weighted average number of outages per customer



Source: Panel analysis of AER data.

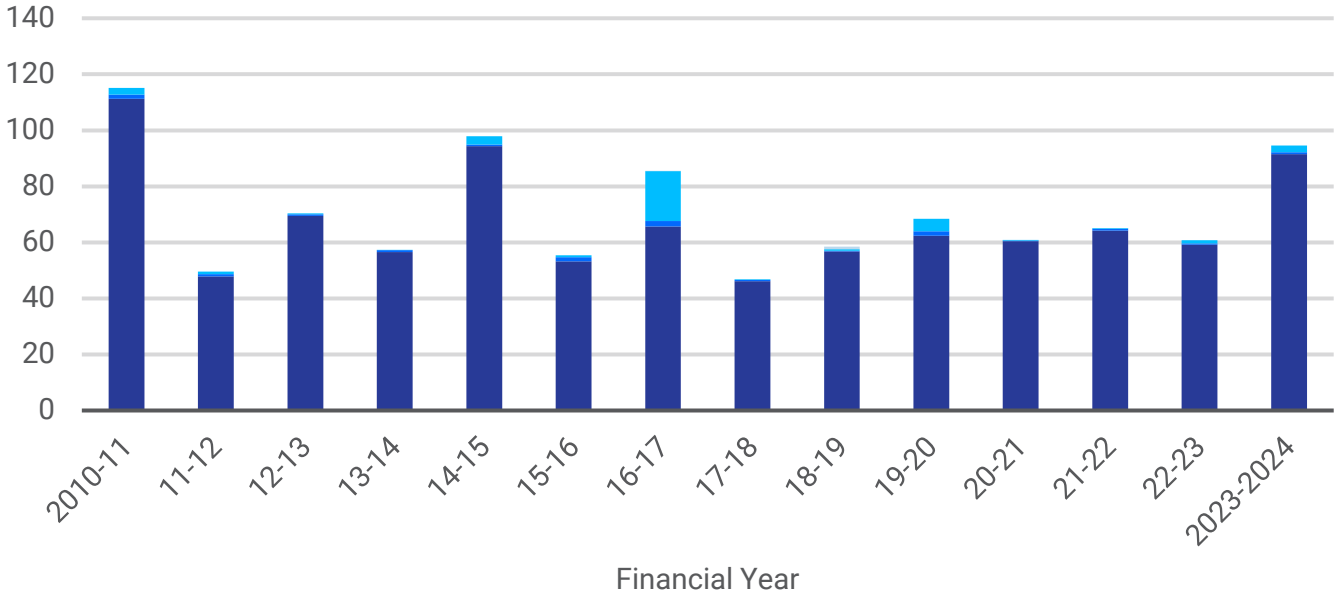
26. The SAIDI and SAIFI data exclude outage events and Major Event Days. The Panel notes that version 6 of the Service target performance incentive scheme was published on 17 April 2025. As this data is from FY2024, version 5 was used to determine exclusions.

SUPPLY INTERRUPTIONS ROSE DUE TO UNPLANNED DISTRIBUTION OUTAGES

- The energy not supplied to customers increased in FY2024 to 94.6 GWh (up from 59.2 GWh in FY2023), following a three-year period of relative stability.
- Distribution-related interruptions remain the dominant cause, accounting for over 96% of total energy interrupted in FY2024 (91.5 GWh).
- Unplanned outages in Queensland (+23 GWh) and Victoria (+8.5 GWh) were the primary contributors to the increase in FY2024 supply interruptions, though Tasmania (+6.5 GWh) also experienced unusually high supply losses from planned and unplanned outages.
- Transmission-related interruptions stayed relatively low, and there was a slight increase in security-related interruptions.
- No reliability-related interruptions were recorded in FY2024, consistent with recent years.

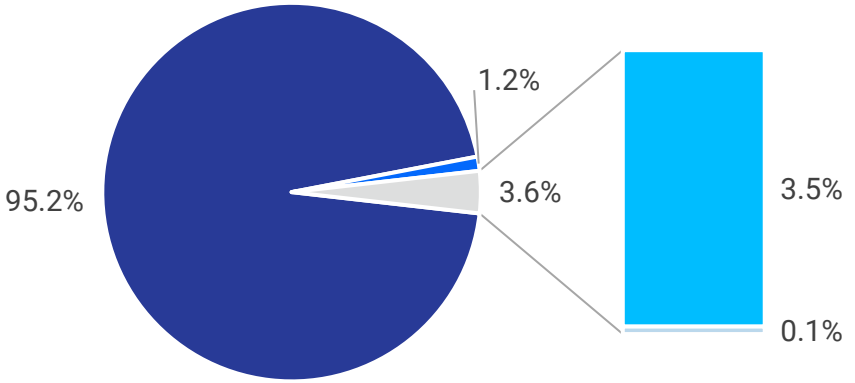
Sources of supply interruptions

Energy not supplied (GWh)



Proportion of energy not supplied by cause

(FY2011 - FY2024)

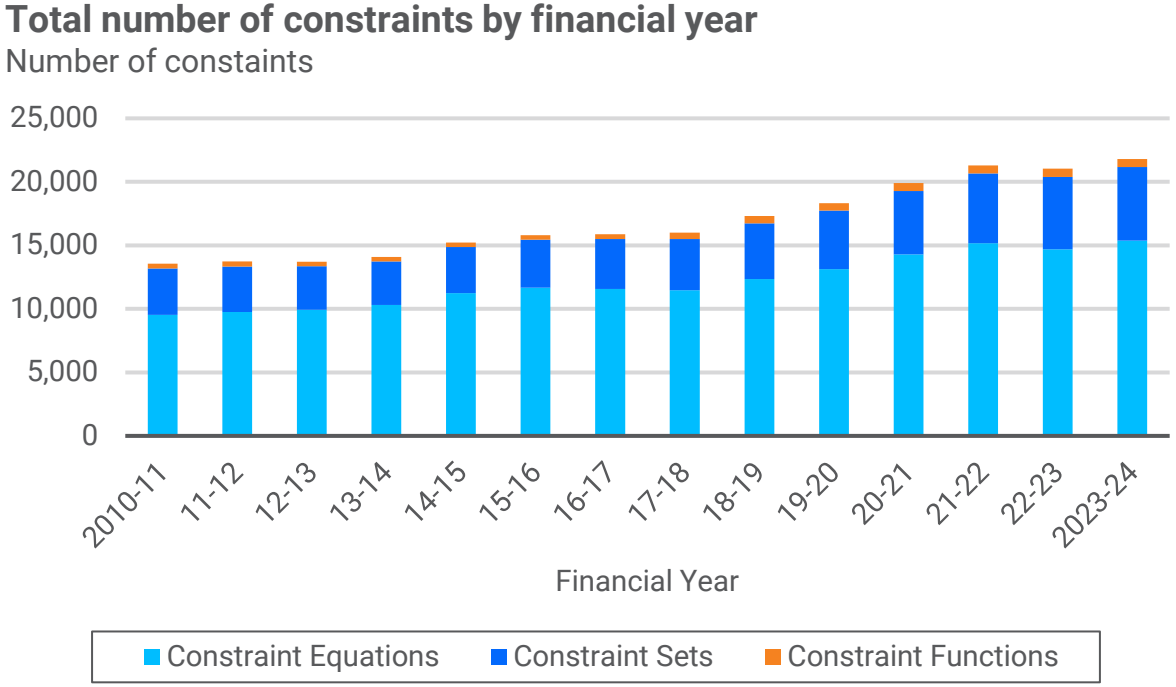


Source: AEMC analysis and estimates based on AEMO's incident operating reports, the AER's RIN economic benchmarking spreadsheets and Transmission Network Service Provider (TNSP) data.

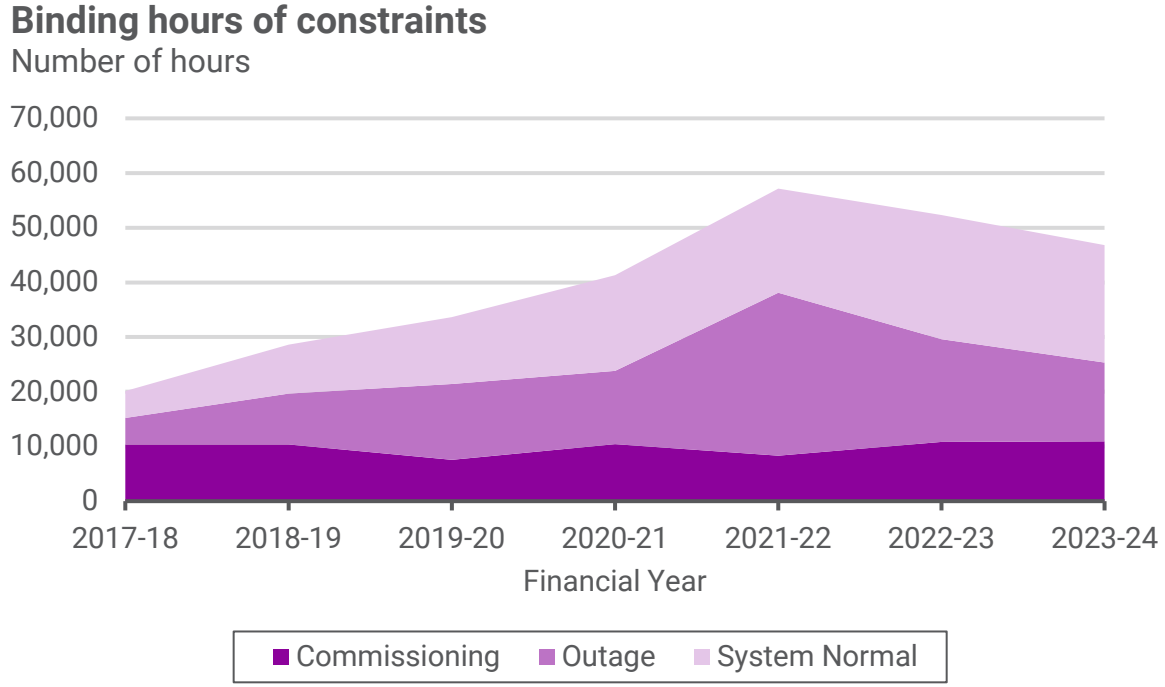
THE NUMBER OF CONSTRAINTS REFLECTS AN INCREASINGLY COMPLEX NEM

- Constraints keep the NEM within the system's physical capabilities and prevent vulnerability to supply disruptions in response to credible contingencies.
- The number of binding constraint hours continued to decline in FY2024 from a peak in FY2022.
- The total number of constraints has been trending upwards over the last decade, with 21,790 constraints in FY2024. This increase reflects an increasingly complex NEM, where the system transitions from one dominated by a small number of large synchronous generators located in areas with strong transmission connections, to one dominated by inverter-based resources connecting in weaker parts of the network.

Total number of constraints by financial year



Binding hours of constraints



Source: Panel analysis of AEMO data.

3

SECURITY PERFORMANCE

3.1

POWER SYSTEM SECURITY INCIDENTS AND RISK MANAGEMENT

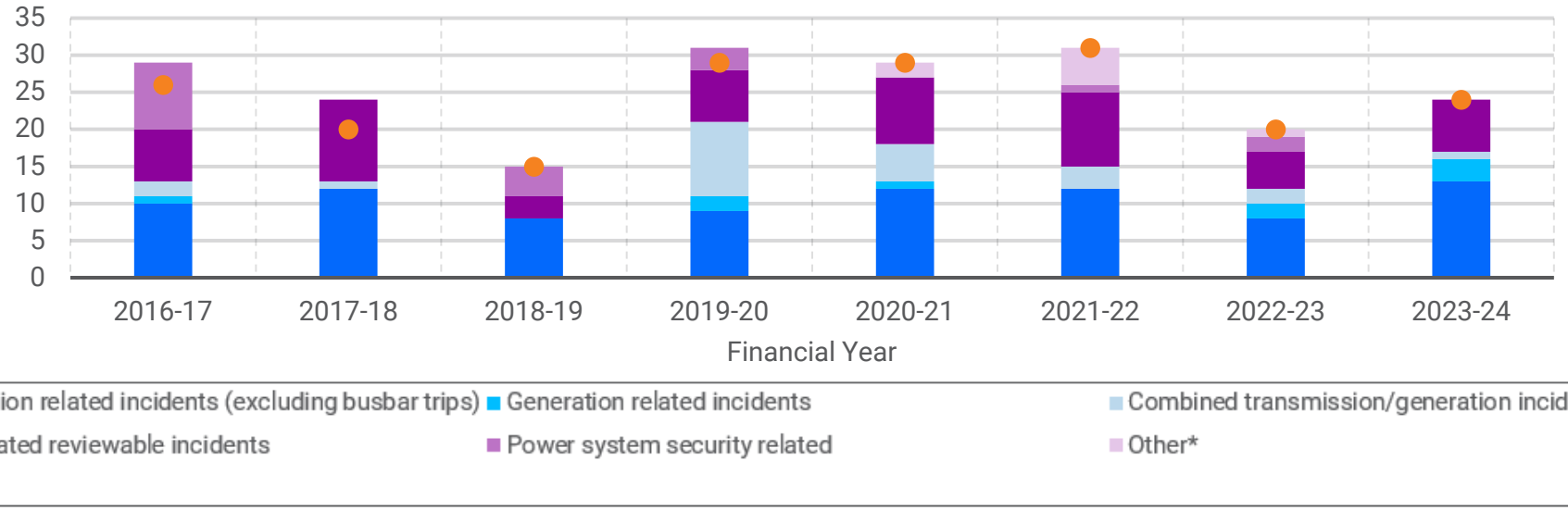
- Like previous years, most reviewable operating incidents in FY2024 were caused by transmission-related incidents.
- There was a spike in the number of reclassification events across the summer of FY2024, which were primarily caused by lightning.
- There were eight scheduling errors in FY2024, representing a decrease from FY2023.

MOST OPERATING INCIDENTS WERE CAUSED BY TRANSMISSION ISSUES

- There were 24 reviewable operating incidents in FY2024, a slight increase from FY2023 where 20 reviewable operating incidents occurred.[27] Most were caused by transmission-related incidents.
- There were more busbar and generation incidents than in FY2023, but fewer combined generation/transmission incidents.
- There were two instances where the power system was not in a secure operating state for greater than 30 minutes – on 8 May 2024 due to the exceedance of the inverter limit at Moree solar farm and on 9 May 2024 due to the exceedance of the inverter limit at New England solar farm. The NEM was in an insecure state for 76 and 40 minutes, respectively.[28]

Reviewable operating incidents by financial year

Number of reviewable operating incidents



*These incidents do not fit in the other categories.
** The power system security category is not mutually exclusive with other categories, a total cannot be derived by summing the number of events in each category.
Note: The Reliability Panel updated the reviewable operating incident guidelines on 29 September 2022.

Source: Panel analysis of AEMO data.

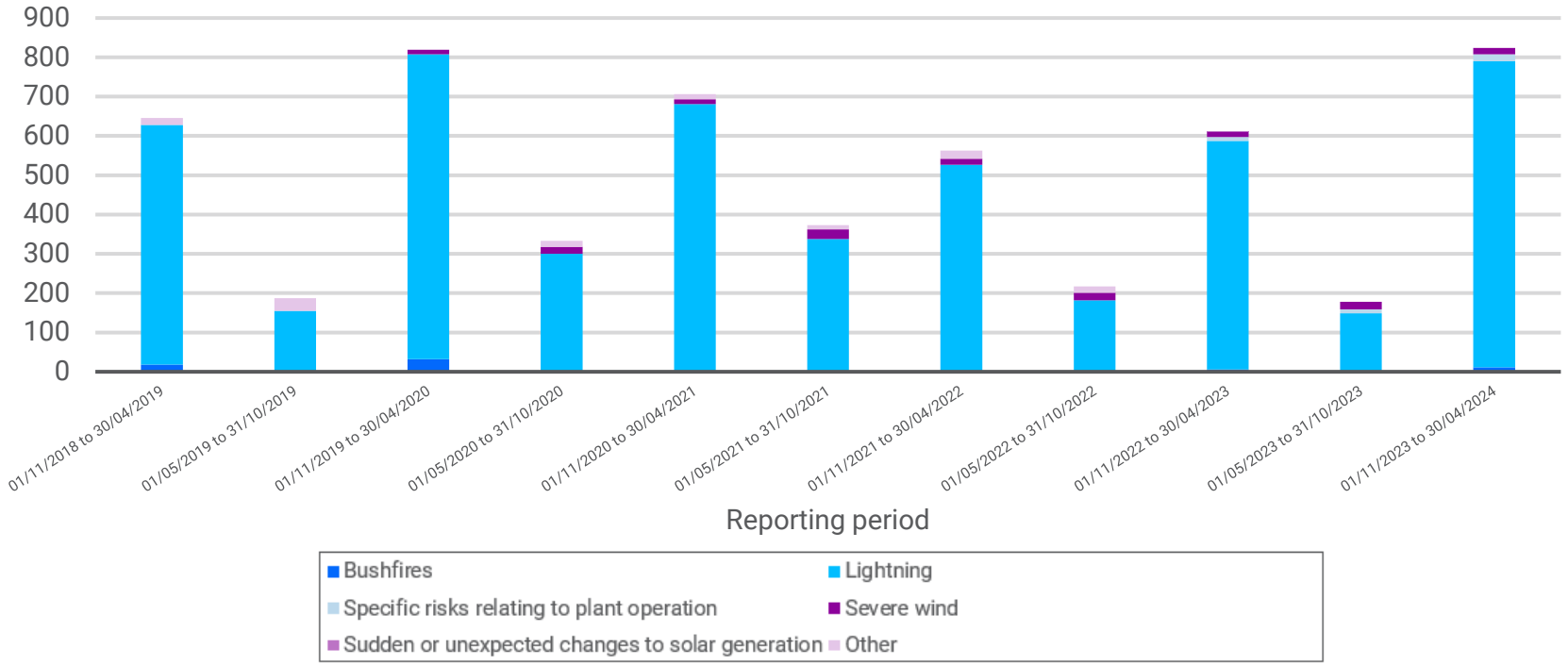
27. AEMO publishes its incident reports on its website, see AEMO, Power system operating incident reports, 2025.
28. For further information, see AEMO, Exceedance of the inverter limit at Moree solar farm on 8 May 2024, November 2024 and AEMO, Exceedance of the inverter limit at New England solar farm on 9 May 2024, October 2024.

SUMMER FY2024 SAW A SPIKE IN RECLASSIFICATION EVENTS

- Between 1 May 2023 and 30 April 2024, there were 1,002 reclassification events.[29]
- 779 of the reclassification events were caused by lightning, followed by specific risks relating to plant operation (18). This is consistent with previous years, where lightning contributed to the highest number of reclassification events.
- Most of the reclassification events occurred in QLD (417), followed by NSW (352).

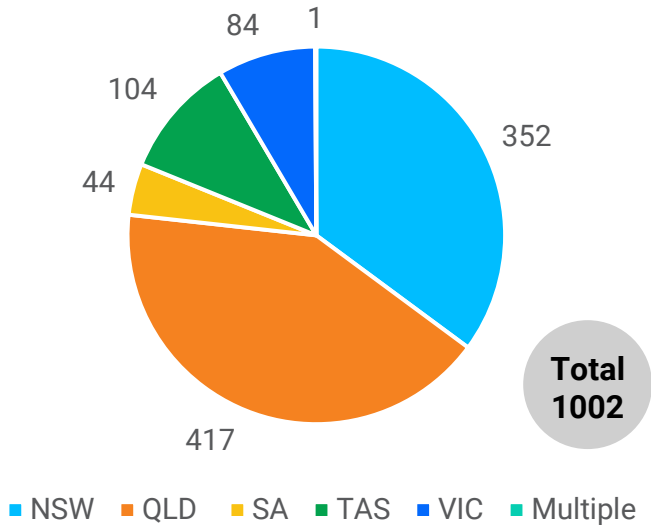
Number of reclassification events by category[30]

Number of reclassification events



Reclassification events in the NEM

(1 May 2024-30 April 2024)

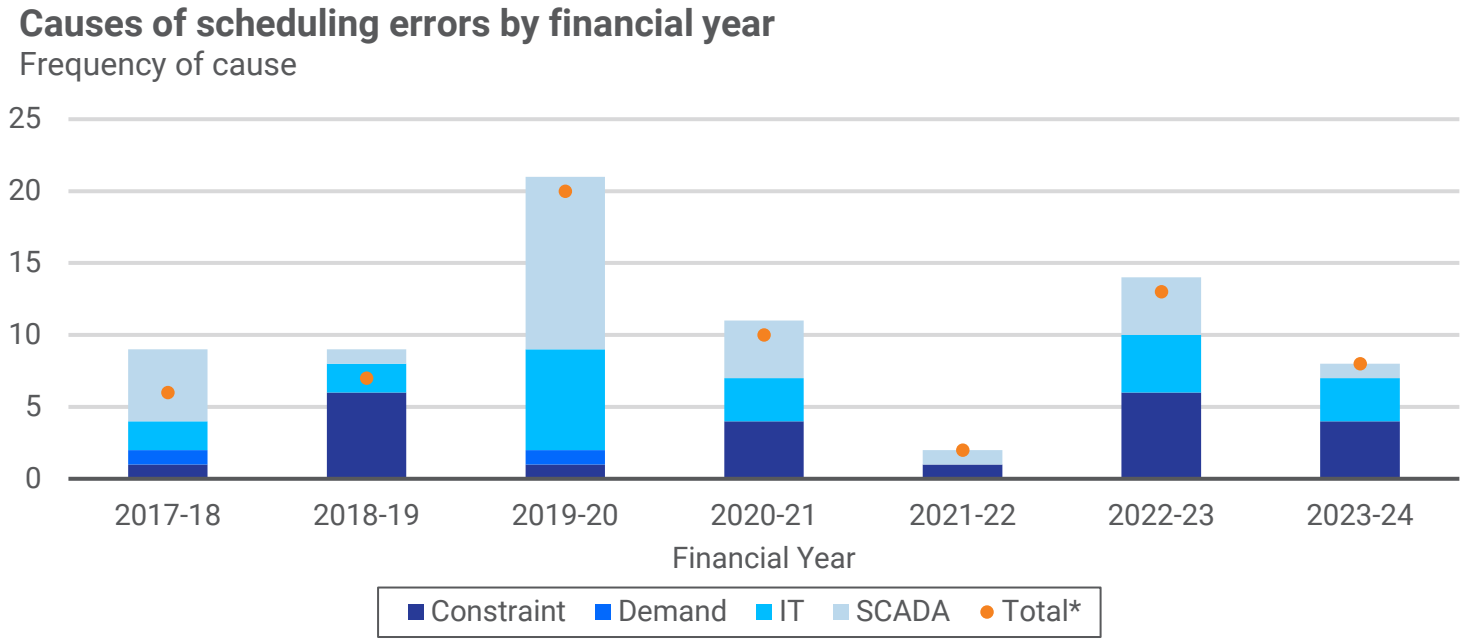


Source: AEMO, Review of Power System Reclassifications.

29. AEMO's reporting period for reclassification events differs from the Panel's review year.
30. There are several categories that have not been included because an event is yet to occur in that category since it has been added. These include: geomagnetic interference, floods, widespread pollutants, landslides, earthquakes, large scale social unrest and cyber attacks.

THE CAUSES OF SCHEDULING ERRORS REMAIN CONSISTENT WITH PRIOR YEARS

- The total number of scheduling errors in FY2024 was slightly below the average of prior years.[31]
- The occurrence of scheduling errors related to constraint, demand and information technology (IT) incidents[32] is in line with the average occurrence in prior years.
- While the number of Supervisory Control and Data Acquisition (SCADA)- related scheduling incidents seems to vary widely between years, in FY2024, there was only 1 SCADA-related event.
- The number of scheduling errors caused by IT is largely consistent with previous years.



* Because some scheduling errors have multiple causes, the total number of scheduling errors will be less than or equal to the total number of causes.

Source: AEMO, Scheduling Error Declaration Report, 2025.

31. AEMO published its Scheduling Errors Declaration Report on its website. For further information, see, AEMO, Scheduling Error reports, 2025.
32. The Panel notes that the market was suspended on 5 September 2024 due to an IT failure. This will be further explored in the next RASR as it falls outside this report's reporting period. For preliminary information, see AEMO, Preliminary Report: NEM Market Suspension on 5 September 2024, 13 September 2024.

3.2

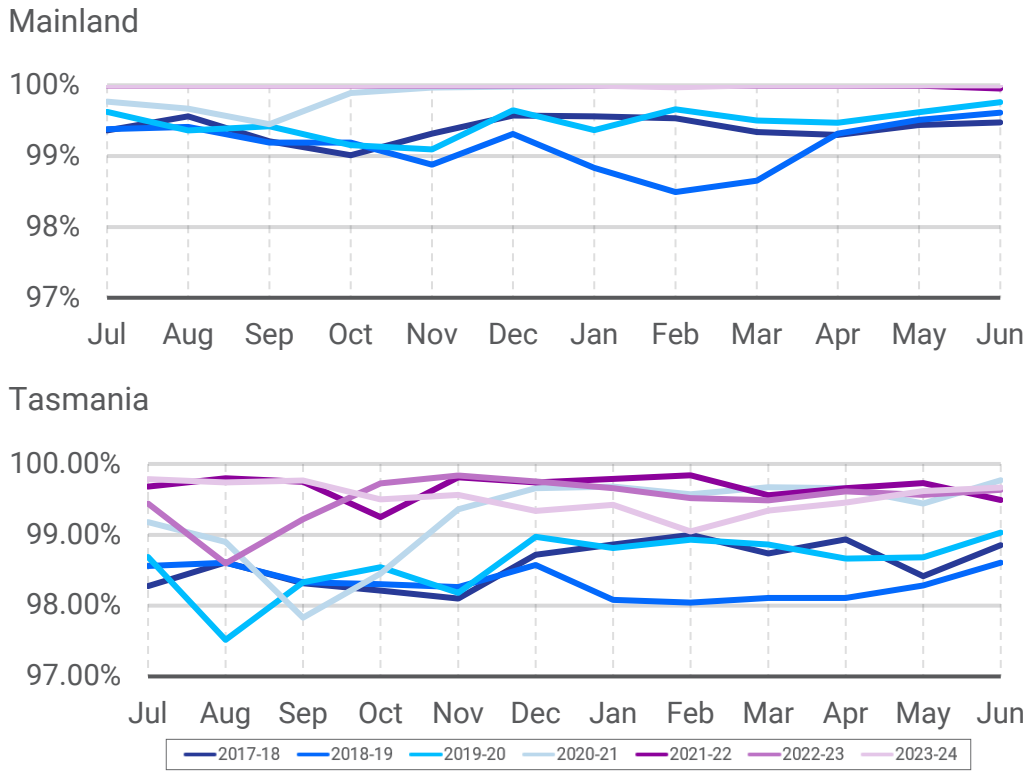
FREQUENCY PERFORMANCE

- Consistent with previous years, frequency on the mainland remained within the NOFB for 99.997% of the time.
- Tasmania experienced 422 frequency operating standard exceedances, which were primarily caused by the Basslink interconnector.

TIME SPENT OUTSIDE THE NOFB IN THE MAINLAND REMAINS LOW

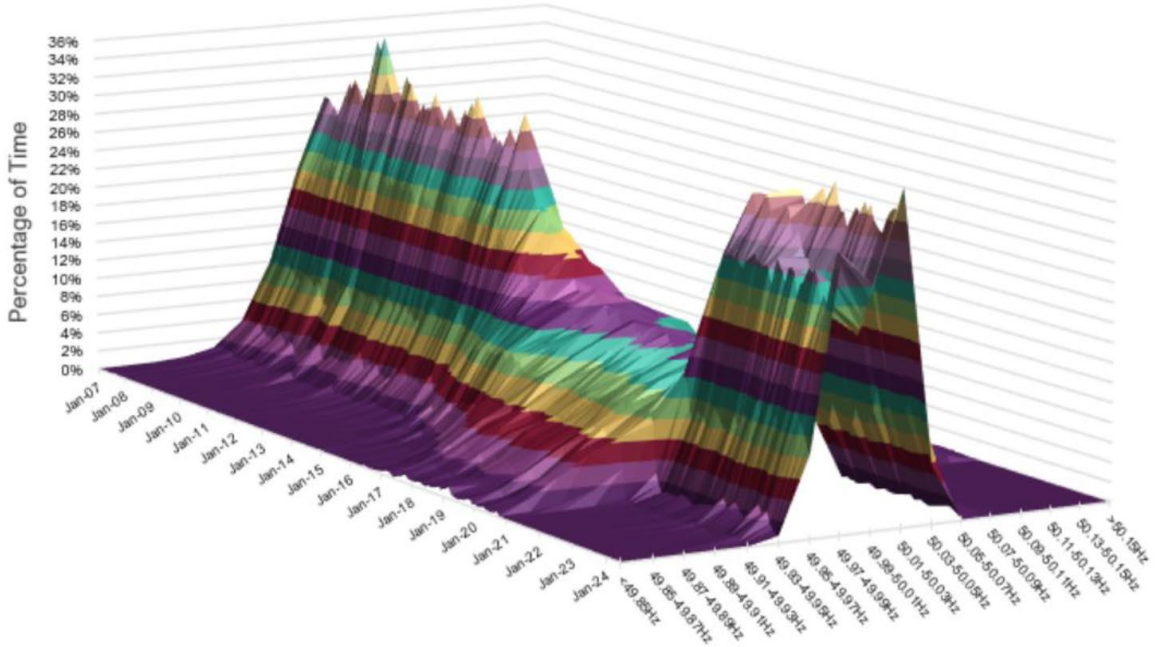
- The mainland operated within the normal operating frequency band (NOFB) for 99.997% of the time, a similar result to FY2023 and FY2022.
- Tasmania's frequency remained outside the NOFB for approximately 0.48% of FY2024, consistent with FY2023 performance.
- There were 422 frequency operating standard (FOS) exceedances in Tasmania in FY2024, up from 235 in FY2023.
- Basslink interconnector operations continued to be the primary cause of extended frequency excursions in Tasmania, with events attributed to flow reversals, import limitations, or scheduled maintenance outages.[33]
- The Panel notes the persistence of bimodal peaks within the mainland frequency distribution and will continue to monitor the trend.

Average time spent within the NOFB by month



Source: Panel analysis of AEMO data.

Monthly mainland frequency distribution



Source: AEMO, Frequency Monitoring – Quarter 2 2024, August 2024.

33. For further information, see AEMO, Frequency and time deviation monitoring – quarterly reports, 2025.

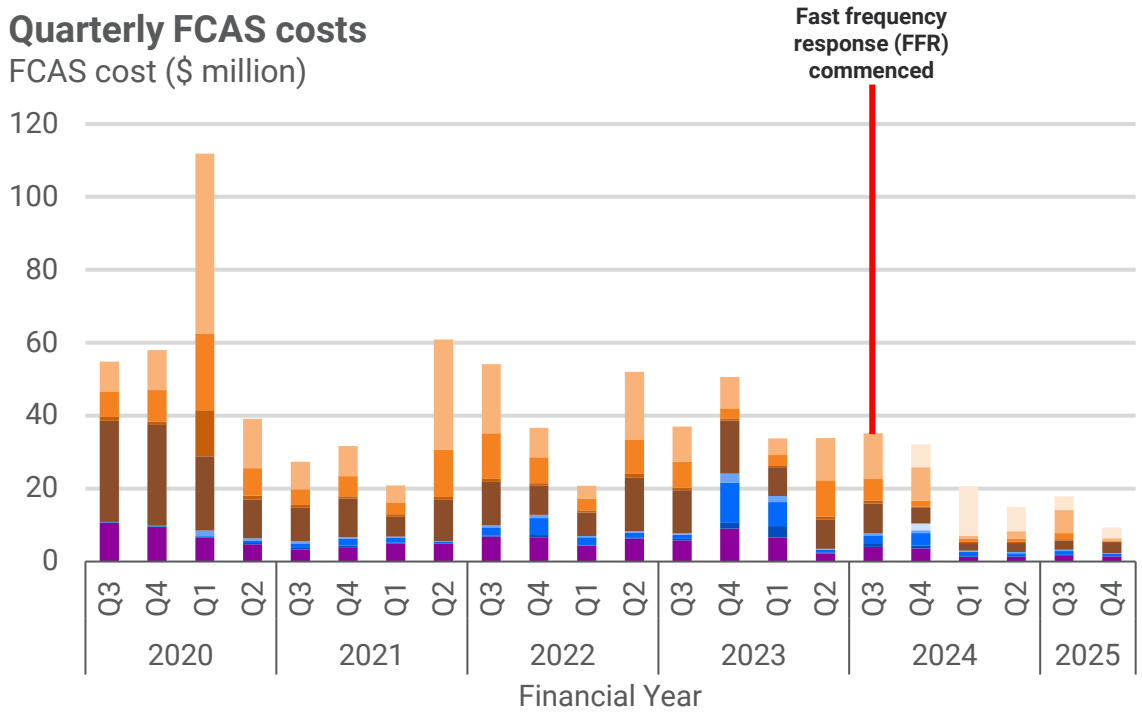
3.3

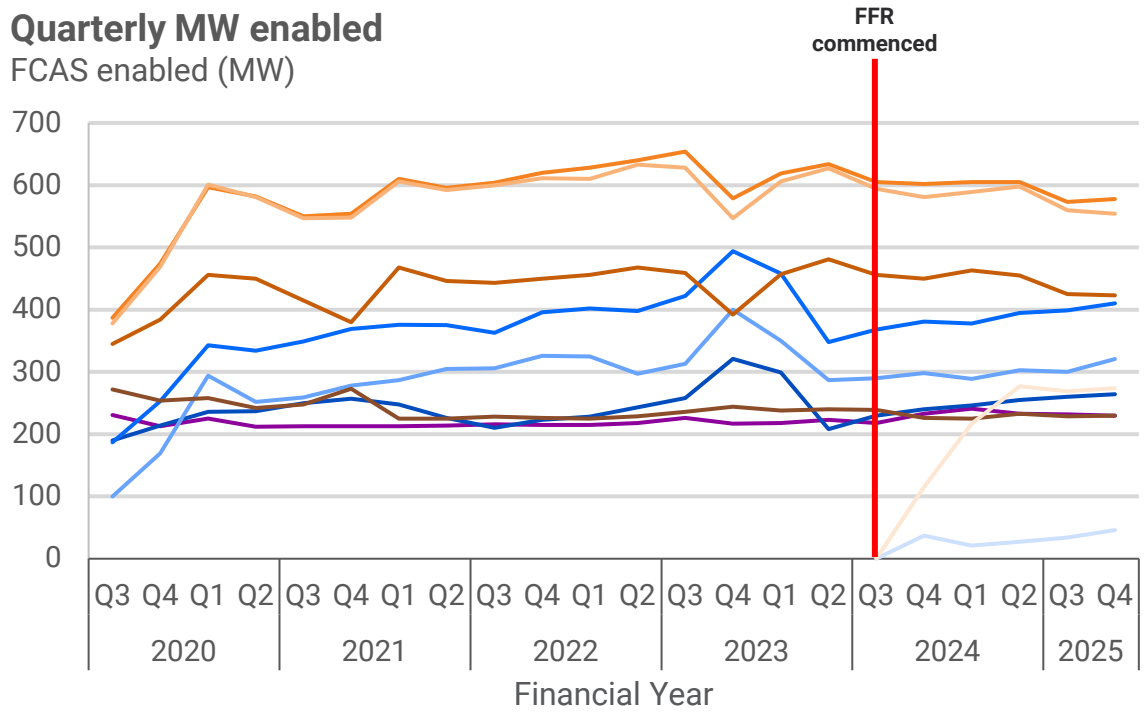
SYSTEM SERVICES PROCUREMENT AND UTILISATION

- FCAS costs have fallen since increased entry of batteries and the commencement of the 1 second FCAS markets.
- This decrease in FCAS costs was the largest contributor to a decrease in system operating costs in FY2024.
- The overall system operating cost structure is shifting, with AEMO revenue requirements comprising a larger share of total costs.

FCAS COSTS HAVE FALLEN SINCE THE START OF 1-SECOND FCAS MARKETS

- Since the commencement of the 1-second raise and lower FCAS markets as well as the increased penetration of batteries, FCAS costs have continued to fall. As the quantity of FCAS enabled is consistent with previous years, the falling costs are likely driven by a decrease in prices.
- In Q1 2024, the 1-second raise market contributed to nearly half of the quarter's total FCAS costs.
- Batteries continued to dominate the FCAS market share, providing 52% of the total FCAS at the end of Q2 2024.[34]
- Batteries accounted for 68% of the combined enablement for 1-second raise and lower services in Q2 2024.





Source: AER, FCAS Quarterly global FCAS costs by services.

Source: AER, FCAS Quarterly average FCAS enablement by services.

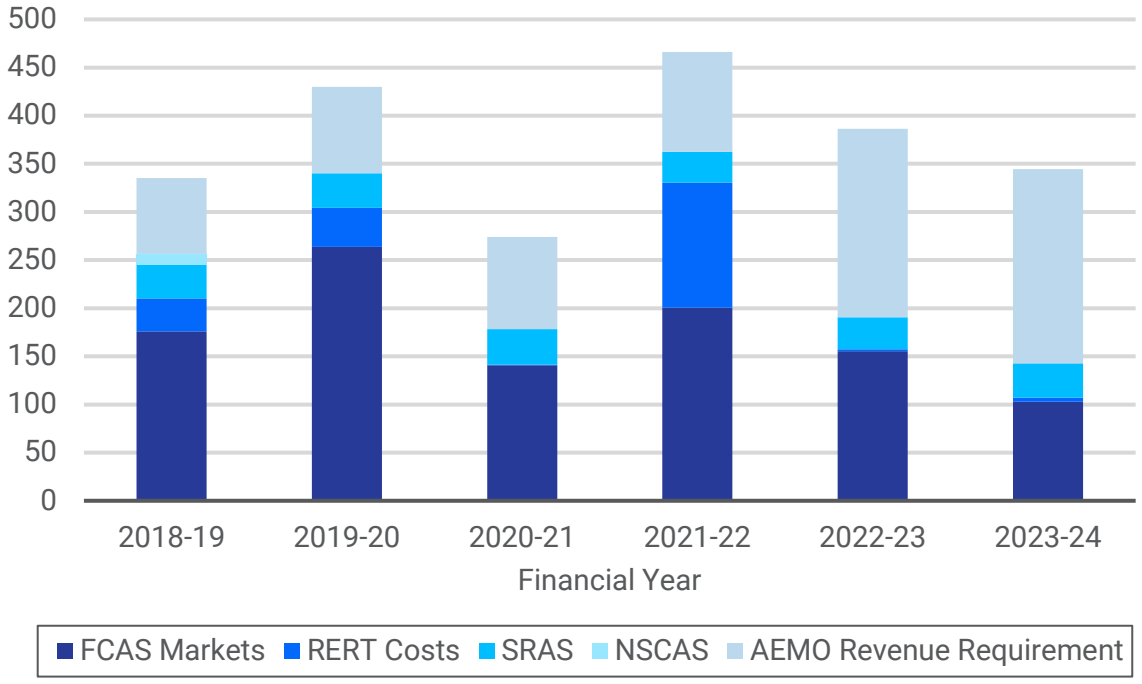
34. For further information, see AEMO, Quarterly Energy Dynamics Q2 2024.

SYSTEM OPERATING COSTS DECLINED IN FY2024

- Total system operating costs decreased by 10.9% from $386.5m in FY2023 to $344.5m in FY2024.
- The primary driver of cost reductions was FCAS market costs, which fell by $52.4m (33.7%), from $155.3m to $102.9m in FY2024.
- AEMO revenue requirements increased modestly by 3% from $195.8m to $201.7m in FY2024.
- System Restart Ancillary Service (SRAS) costs remained stable at $35.6m in FY2024, consistent with the five-year historical average.
- AEMO did not acquire any NSCAS in FY2024.[35]
- The overall cost structure is shifting, with AEMO revenue requirements making up a larger share and FCAS market costs a smaller share.

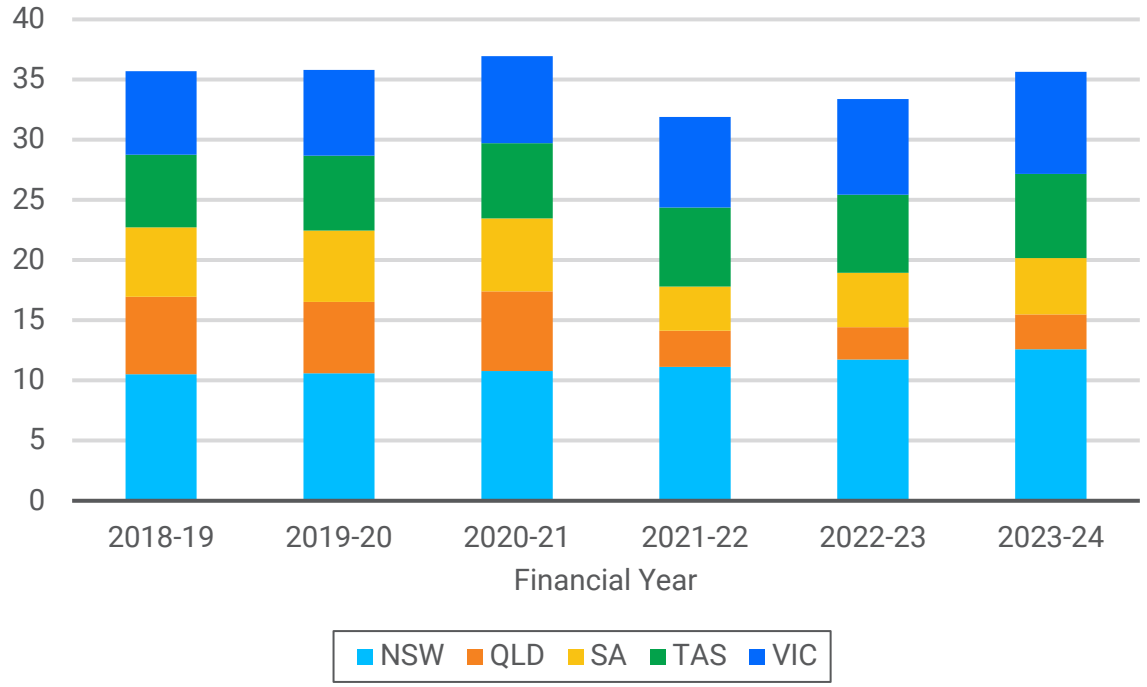
System operating costs

Cost ($ million)



SRAS costs

Cost ($ million)



Source: Panel analysis of AEMO data.

35. AEMO, Non Market Ancillary Services (NMAS) report 2023-24, October 2024.

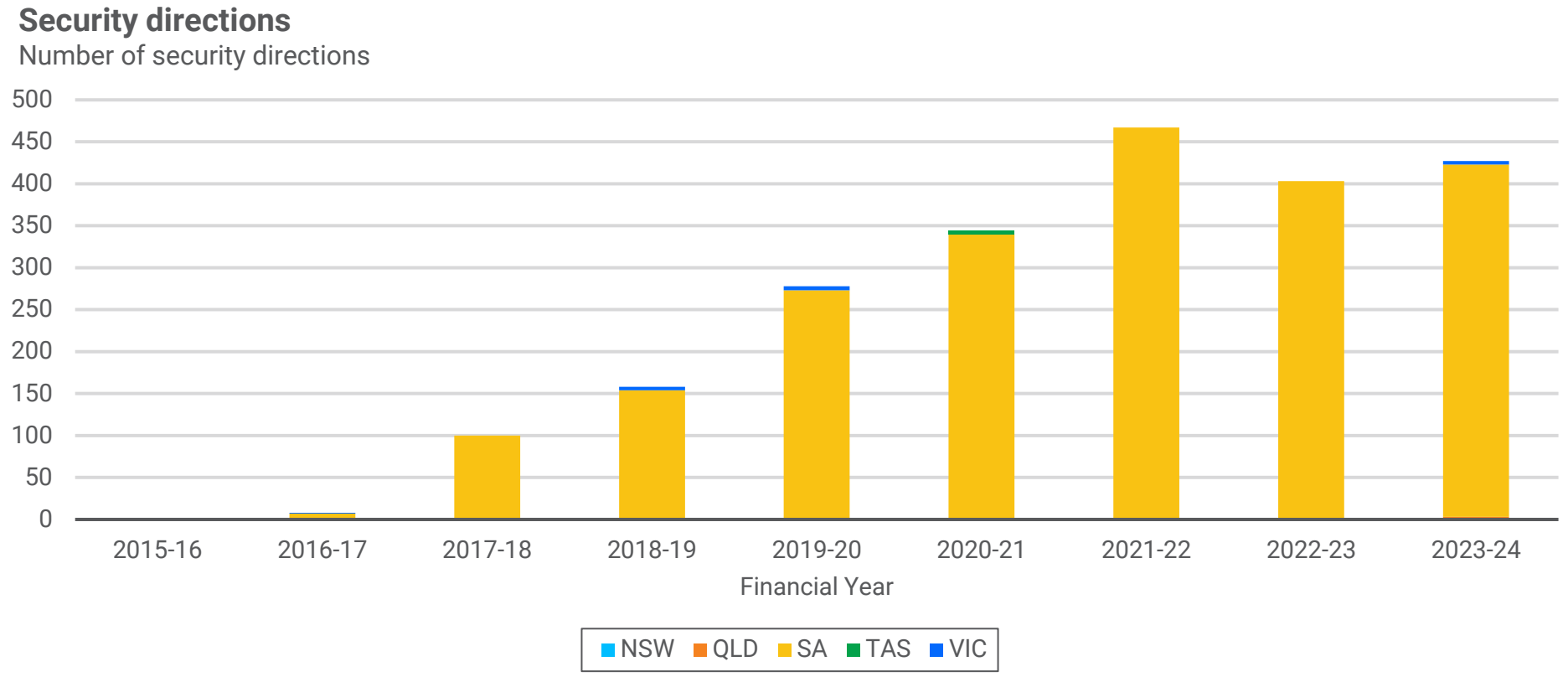
3.4

AEMO INTERVENTIONS FOR SECURITY

- The number of security directions increased slightly from FY2023, with most being issued in SA.
- There were seven security directions issued outside of SA, with one in NSW, two in QLD and four in VIC.

SECURITY DIRECTIONS INCREASED SLIGHTLY FROM FY2023

- In FY2024, a total of 427 security directions were issued, up from 402 in FY2023.
- Consistent with previous financial years, most security directions issued in FY2024 were for SA (420).
- 1 security direction was issued for NSW, 2 for QLD and 4 for VIC. This is above-average for non-SA regions in a single financial year, but more data is required to determine whether this is a trend. The Panel will continue to monitor security directions in future RASRs.
- 57% of security directions were issued in the first half of the financial year (1 July 2023 – 31 December 2023).



Source: Panel analysis of AEMO data.

4

SAFETY PERFORMANCE

THERE WERE NO SAFETY INCIDENTS FOR THE PURPOSES OF THIS REPORTING IN FY2024

Overview of safety

The safety of the power system and associated equipment, power system personnel and the public is covered in general terms under the NEL.

However, there is no national safety regulator specifically for electricity. Instead, state and territory legislation governs safety generally, which includes the safe supply of electricity and the broader safety requirements associated with electricity use in households and businesses.

As discussed in the accompanying explanatory statement, the Panel's role in relation to safety for the purposes of the RASR is narrow and relates primarily to the operation of assets and equipment within their technical limits and not to the broader safety requirements governed by jurisdictional legislation.

Safety performance of the power system in FY2024

The Panel has reviewed AEMO's power system incident reports and consulted with AEMO to understand if there were any instances where actions to maintain the power system within relevant standards and technical limits resulted in technical safety issues.

The Panel understands there were no safety incidents during FY2024 where AEMO's management of power system security resulted in a safety issue.

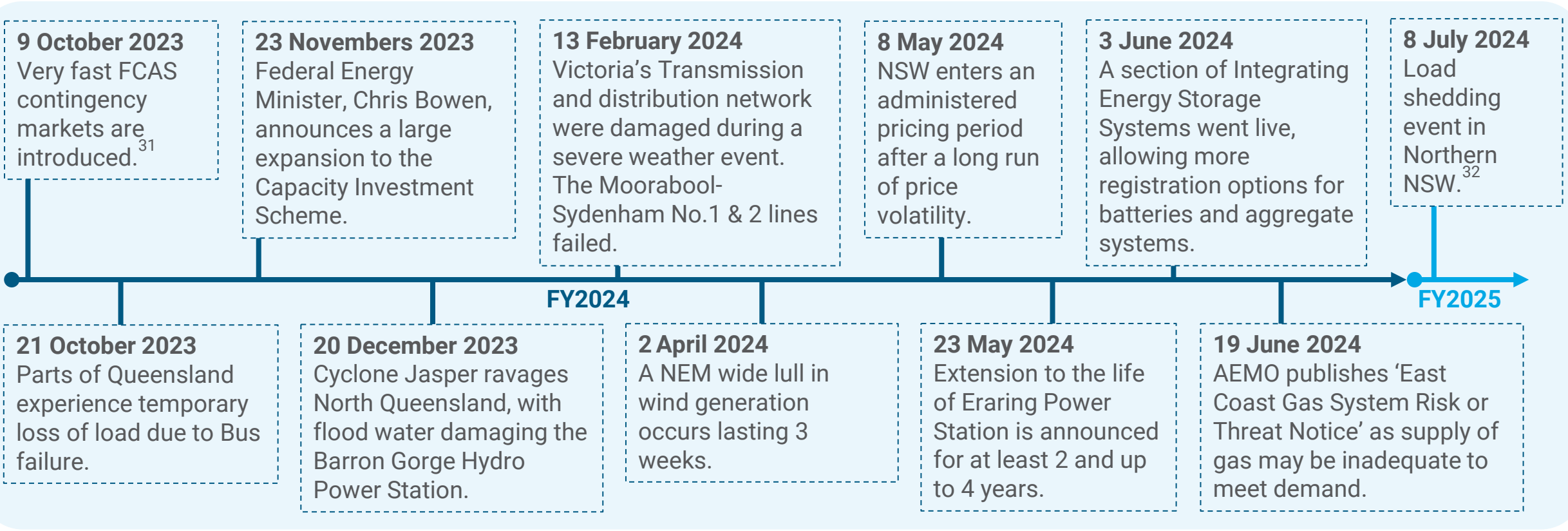
The Panel also notes that there were no instances in FY2024 where AEMO issued a direction and the directed participant did not comply on the grounds that complying with the direction would be a hazard to public safety, or materially risk damaging equipment or contravene any other law.

5

KEY MARKET EVENTS

TIMELINE OF KEY NEM EVENTS IN FY2024

- This section provides an overview of key events in the NEM across FY2024.
- The timeline below provides a broad overview of these events, ranging from reviewable operating incidents to federal and state energy policies.
- The following pages provide a summary of three events the Panel sees as significant: (1) NSW administered pricing period; (2) Trip of the Moorabool – Sydenham lines; and (3) Load shedding in Lismore, Northern NSW.



36. The introduction of new FCAS markets on 9 October 2023 was reported on in FY2023 AMPR. See the AEMC, FY2023 Annual Market Performance Review – Final Report, 27 June 2024.
37. Whilst this event occurred outside of the reporting period, the Panel considered it an important market event worthwhile discussing in the FY2024 RASR.

NSW ADMINISTERED PRICING PERIOD – MAY 2024

Overview

- Following a number of high price events between 7 and 8 May 2024, the cumulative price threshold (CPT) was breached on the evening of Wednesday 8 May 2024 at 7:45pm. Immediately after, a period of administered prices started during which wholesale electricity and FCAS prices were capped at the administered price cap (APC) ($600/MWh). This was the first administered pricing period where the APC was $600/MWh.

NSW market conditions

- **Transmission outages:** a number of planned outages to 330kV transmission lines across NSW limited the amount of low-priced generation that could reach Sydney from southern NSW, Victoria and Queensland. This is significant as NSW is a net importer of energy to meet demand.
- **Unplanned generator outages:** Coal generator capacity in NSW was reduced by 2,500 MW due to unplanned generator outages and plant issues in May 2024, including one unit in Vales Point that unexpectedly tripped off in the early morning of 8 May 2024. The combination of the planned transmission outages and unplanned generator outages significantly reduced available generation and network capacity.

Breaching the CPT

- After the CPT was breached on the evening of Wednesday 8 May, NSW entered a period of administered pricing. This period went from 7:55pm on 8 May to 15 May.
- Two of the coal generator units affected by planned outages (Eraring Unit 3 and Vales Point Unit 5) returned to normal operation on 10 and 11 May 2024, respectively.
- As prices stabilised and returned to normal levels, the cumulative price fell back below the CPT at 5:35 p.m. on Tuesday May 14.
- The high price periods that led to breaching the CPT contributed to an average May price of $297/MWh. This is $202/MWh higher than the previous month and $87/MWh higher than May 2023.

38. For further information, see AER, Electricity prices above $5,000 per MWh – April to June 2024, July 2024.

TRIP OF THE MOORABOOL – SYDENHAM LINES – 13 FEBRUARY 2024

Overview

- On 13 February 2024, the Moorabool – Sydenham No. 1 and No. 2 500 kV lines failed during a severe weather event. As a result of the transmission line failures, 2484 MW of generation was lost in Victoria.

Sequence of events

- **Pre-event conditions:** Prior to the main incident, at 11:35am on 13 February 2024, there was a loss of 500 MW of generation from the Stockyard Hill Wind farm. Overall, Victoria had an operational demand of 7,724 MW and 9,926 MW of scheduled, semi-scheduled and distributed PV generation.
- **Main incident:** At 1:08pm, six 500kV towers collapsed during a severe weather event, leading to the trip of both Moorabool – Sydenham 500 kV lines. Subsequently, all four Loy Yang A generator units and the Dundonnell and Yaloak South wind farms disconnected – amounting to around 2,690 MW of generation lost. At this time, approximately 1,000 MW of load was shaken off.

Impact on the market & immediate responses

- Despite being 2.2 GW higher than operational demand, generation was not able to supply the load due to network constraints.
- At 2:20pm, an actual lack of reserve 3 condition (LOR3) was declared. To keep the system in a secure operating state, AusNet, United Energy, and Jemena shed 324 MW of load after instruction by AEMO.
- Simultaneously, the market price cap was set in Victoria for trading intervals (TI) 1425 onwards. This was removed at TI 1515.
- Load was gradually restored from 2:50pm with 150 MW at this time, and a subsequent 150 MW at 3:10pm. Loy Yang A commenced restoring its units at 4:09pm on 13 February 2024.
- Following load restoration, the actual LOR3 was cancelled.

39. For further information, see AEMO, Preliminary Report – Trip of Moorabool-Sydenham 500 kV No. 1 and No. 2 lines on 13 February 2024, February 2024 and AEMO, Victorian Network performance & Insights Report, October 2024.

LOAD SHEDDING IN LISMORE, NORTHERN NSW – 8 JULY 2024

Overview

- AEMO instructed 40 MW of load shedding to restore system security, affecting approximately 28,000 customers in the Lismore area over a 3-hour period.
- The power system was not operating in a secure state for two distinct periods of 30 minutes and 48 minutes.
- To return the power system to a secure operating state, AEMO directed a total of 40 MW of load shedding.

Event summary

1
- **Pre-event:** Coffs-Lismore 330kV line tripped, limiting flow from other NSW areas to Lismore.
- **Event:** The Terranora Interconnector (QLD-NSW) failed to meet its dispatch target due to computer communication failures. This resulted in the power flowing from Queensland to the Lismore area falling to approximately 0 MW.
- These outages resulted in power flows to Lismore being largely supplied by the Armidale – Lismore 132 kV subsystem. During evening peak, AEMO's EMS flagged contingency analysis (CA) violations.

2
- AEMO instructs Transgrid to radialise Lismore to resolve CA violations. The CA violations resolve but new CA violations appear.
- AEMO instructs Transgrid to shed 30 MW of load to resolve CA violations.

3
- Subsequent busbar splitting operations triggered the Armidale-Metz-Koolkhan 132kV line to trip (auto-reclosing after four seconds).
- This disrupted AC reference signals, causing all Directlink DC systems to trip and the 27 MW Broadwater Cogeneration plant to trip on anti-islanding.
- To restore the system to a secure state, AEMO ordered an additional 10 MW of load shedding before progressive restoration.

Causes

Insulator flashover due to degraded polymer sheds allowing moisture ingress.

Communication failure between Directlink's control computers impacted its ability to receive dispatch targets.

Busbar trip is currently under investigation.

40. For further information, see AEMO, Final Report – Load Shedding Event in Northern New South Wales on 8 July 2024, March 2025.

Abbreviations

TABLE OF ABBREVIATIONS (SLIDE 1 OF 3)

AUD	Australian dollars
AC	Alternating Current
ACT	Australian Capital Territory
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
APC	Administered Price Cap
APP	Administered Price Period
ARENA	Australian Renewable Energy Agency
ASEFS	Australian Solar Energy Forecasting System
ASX	Australian Securities Exchange
AWEFS	Australian Wind Energy Forecasting System
CA	Contingency Analysis
CCGT	Comibend Cycle Gas Turbine
CEC	Clean Energy Council
CER	Consumer Energy Resources

CIS	Capacity Investment Scheme
Commission	See AEMC
CPT	Cumulative Price Threshold
DC	Direct Current
DER	Distributed Energy Resources
DNSP	Distribution Network Service Provider
DPV	Distributed PV
ESOO	Electricity Statement of Opportunities
FCAS	Frequency Control Ancillary Services
FFR	Fast Frequency Response
FOS	Frequency Operating Standard
FUM	Forecast Uncertainty Measure
FY	Financial Year
GW	gigawatt
GWh	gigawatt-hour
GPSRR	General Power System Risk Review

TABLE OF ABBREVIATIONS (SLIDE 2 OF 3)

IBR	Inverter Based Resources
ICCP	Inter-control centre communications protocol
IT	Information Technology
IRM	Interim Reliability Measure
ISP	Integrated System Plan
LNG	Liquified Natural Gas
LOR	Lack of Reserve
MFP	Market Floor Price
MMS	Market Management System
MPC	Market Price Cap
MPFR	Mandatory Primary Frequency Response
MSL	Minimum System Load
MSPS	Market Suspension Pricing Schedule
MT-PASA	Medium Term-Projected Assessment of System Adequacy
MW	megawatt
MWh	megawatt-hour

NEL	National Electricity Law
NEM	National Electricity Market
NEMDE	National Electricity Market Dispatch Engine
NEO	National Electricity Objective
NER	National Energy Rules
NERL	National Energy Retail Law
NERO	National Energy Retail Pbjective
NGL	National Gas Law
NGO	National Gas Objective
NOFB	Normal Operating Frequency Band
NSCAS	Network Support and Control Ancillary Services
NSP	Network Service Provider
NSW	New South Wales
NT	Northern Territory
OCGT	Open Cycle Gas Turbine
The Panel	The Reliability Panel

TABLE OF ABBREVIATIONS (SLIDE 3 OF 3)

PEC	Project Energy Connect
PFR	Primary Frequency Response
POE	Probability of Exceedance
PSFRR	Power System Frequency Risk Review
PSSWG	Power System Security Working Group
PV	Photovoltaics
Q	Quarter
QED	Quarterly Energy Dynamics
QLD	Queensland
QNI	Queensland - New South Wales Interconnector
RASR	Reliability & Security Report
RERT	Reliability and Emergency Reserve Trader
RET	Renewable Energy Target
REZ	Renewable Energy Zone
The rules	National Electricity Rules
SA	South Australia
SAIDI	System Average Interruption Duration Index
SAIFI	System Average Interruption Frequency Index
SCADA	Supervisory Control and Data Acquisition
SF	Self-forecasting
SRAS	System Restart Ancillary Services
ST-PASA	Short Term-Projected Assessment of System Adequacy
TAS	Tasmania
TI	Trading Interval
TNSP	Transmission Network Service Provider
USE	Unserved Energy
VCR	Value of Customer Reliability
VIC	Victoria
VNI	Victoria - New South Wales Interconnector
VPP	Virtual Power Plant
VRE	Variable Renewable Energy
VWAP	Volume Weighted Average Price
WA	Western Australia

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