

ANNUAL MARKET PERFORMANCE UPDATE

JANUARY – JUNE 2020

17 DECEMBER 2020

CURRENT WORK PROGRAM

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The power system is changing with more diversity of equipment and is becoming more complex to operate. It is subject to more frequent extreme events than in the past. A large-scale program of reform is underway to ensure that the power system can continue to operate most effectively in this new environment.

The work program for the Reliability Panel for 2020/2021 includes:

- The Reliability Standard and Settings Review, for the period 2024/2028.
 - This review is important as it will be interdependent with the ESB Post 2025 market design work.
 - It will be important to take an approach to Reliability and Security that is compatible with the future of the NEM and operation of the power system.
- Review of the System Restart Standard & Frequency Operating Standard
- Annual Market Performance Review (AMPR) 2019-20
- Input into rule changes and reforms including ESB post 2025 market design work.

PURPOSE OF ANNUAL MARKET PERFORMANCE REVIEW UPDATES

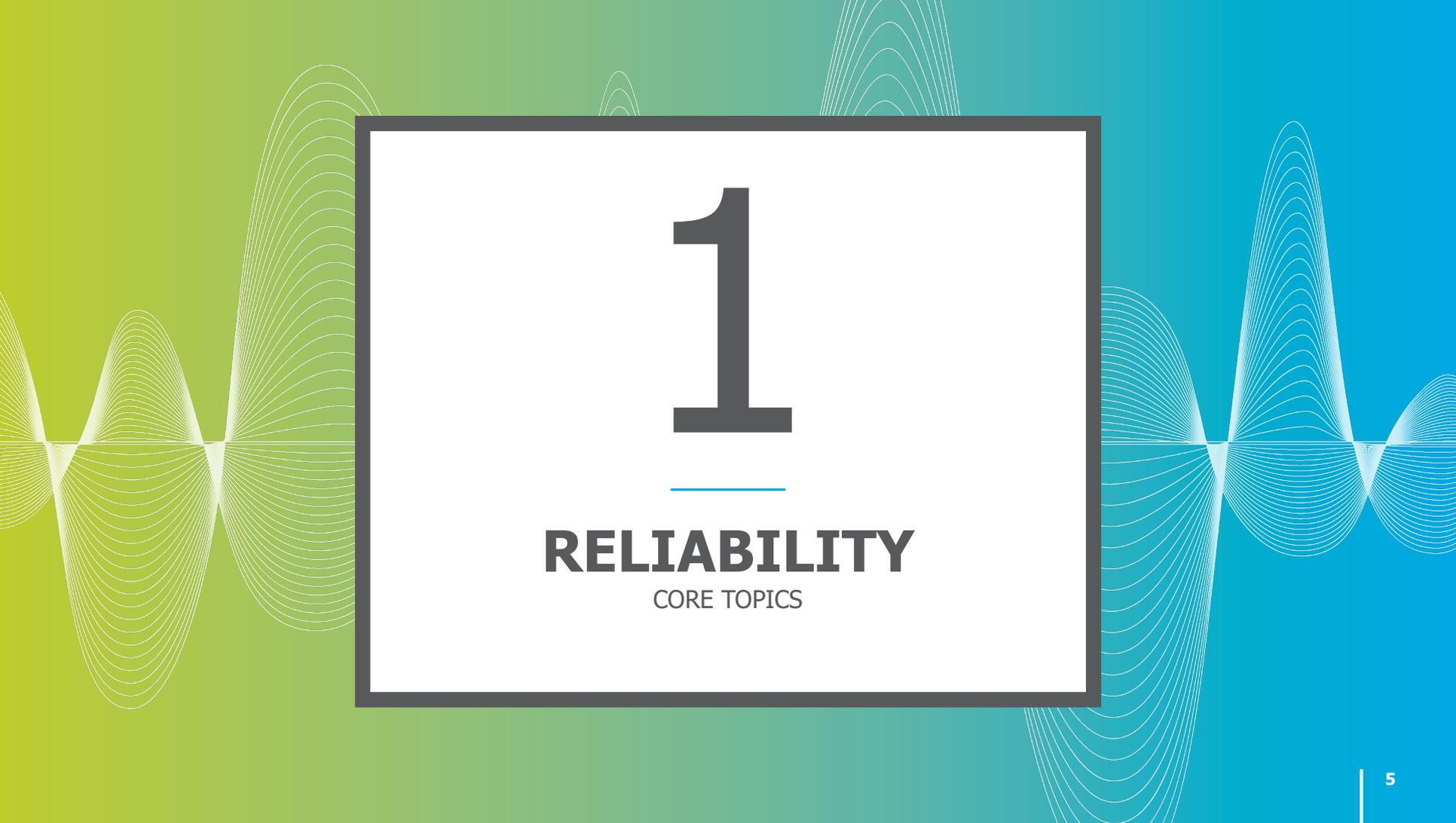
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- The Reliability Panel is required to conduct a review of the performance of the market, and provide advice, in terms of:
 - The reliability of the power system.
 - The security of the power system.
 - The safety of the power system.
- The Panel is now providing two market performance updates each financial year to complement the final report. This is in response to stakeholder feedback to previous reports that this type of update would be helpful and may shorten the time between when changes occur, and when reporting draws them to stakeholder's attention.
- The market performance updates provide an opportunity for the Panel to bring together all relevant information and set the context for the final report.
- This market update will include data for FY 2019-20. Where it is available and appropriate, an in depth look at the first half of 2020 (i.e. January – June) is taken. The next market performance update, scheduled for publication in 2021, will include data from July – December 2020.

AMPR MARKET UPDATE 1: KEY THEMES

1. Reliability	2. Security	3. Emerging issues
Unserved Energy*	Security Events	Power System Resilience
Reliability Events and Directions/Instructions	Directions/Instructions	Wholesale Market: supply and demand COVID lens
Lack of Reserves	Performance Against Frequency Operating Standard	Investment trends and COVID
RERT	System Services (FCAS, NSCAS, SRAS)	
Reliability Price Settings	Network Constraints	
	Market Notices	

* The reliability and security metrics listed are required by the NER and AEMC Terms of Reference for the annual review. Due to data availability, actual USE and power system safety will be reported on in the next market performance update.



1

RELIABILITY

CORE TOPICS

WHAT IS POWER SYSTEM RELIABILITY?

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- Reliability in the electricity sector means that the power system has enough capacity to meet people's needs.
- That is, the system has sufficient capacity, including generation, demand response and interconnectors to produce and transport electricity to meet demand.
- A reliable power system requires the following:
 - Efficient investment, retirement and operational decisions by market participants resulting in an adequate supply of capacity to meet demand
 - Sufficient level of reserve or buffer, so demand and supply can be kept in balance in the face of shocks to the system
 - A reliable transmission and distribution network, and
 - The system being in a secure operating state.*
- The Panel plays an important role in determining the standards to deliver a reliable power system in the most efficient way to minimise costs for consumers.
- This section looks at performance of the power system in the context of key reliability metrics, including directions issued by AEMO, the Reliability and Emergency Reserve Trader, Market Price Cap and Market Price Events.

* Secure operating state: A state where the power system is in, or will return to, the NER requirement of a satisfactory operating state within 30 minutes.

AMPR UPDATE 1: KEY TRENDS – RELIABILITY



- AEMO forecasts no breach of the reliability standard (0.002% USE) until 2029/30.
- AEMO forecasts breach of the interim reliability measure (0.0006% USE) in NSW in 2023/24.
- Spike in unserved energy (USE) in NSW predicted towards 2030, driven by forecast coal retirements.



- AEMO issued 6 reliability directions in 2019/20, all on 1 February 2020.
- Two directions issued in Victoria in response to the VIC-SA islanding event.
- Four directions issued in NSW, unrelated to SA separation event.



- Number of Lack of Reserve (LOR) notices in 2019-20 similar to number in 2018/19.
- No forecast or actual LOR3 conditions in the NEM across the 19/20 period.
- Significantly more LOR2 conditions in 19/20 compared to 18/19.



- Small increase in long notice Reliability and Emergency Reserve Trader (RERT) contracted.
- RERT was used on more days in 2019/20 compared to 2018/19, but the volume activated decreased.
- There was an increase in RERT costs in 19/20 from 18/19 by around \$6 million.

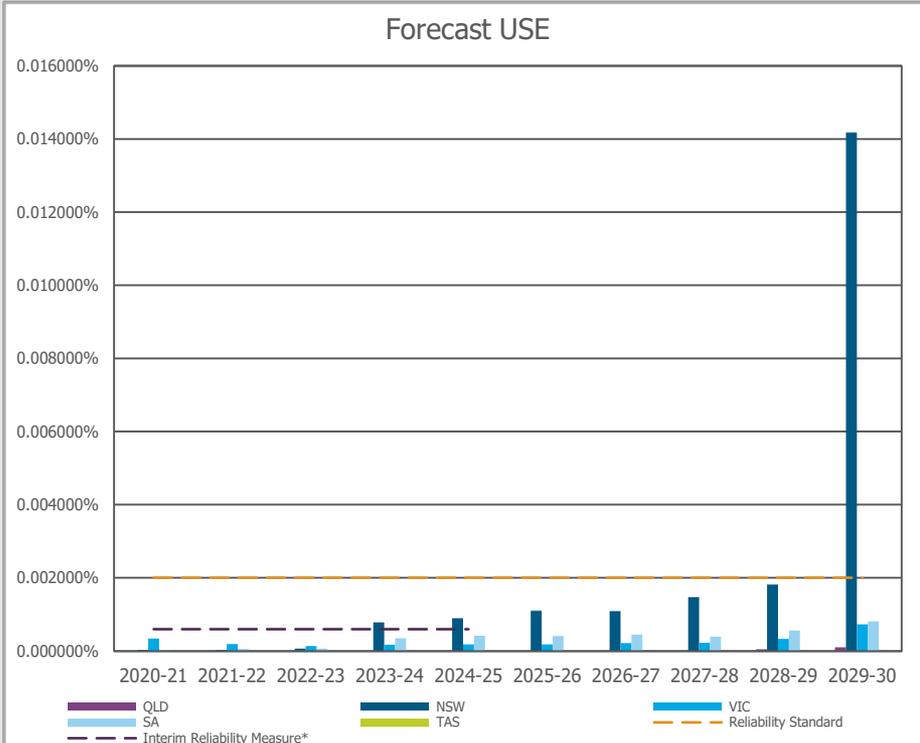


- Market price cap and floor price events are at similar levels to 2018/19, with different states affected.
- Cumulative price threshold not breached for energy in 19/20.
- Cumulative price threshold was breached for FCAS in February 2020 due to SA separation event.



- Reliability Panel will commence Reliability Standard and Settings Review in 2021.
- This review will consider reliability standards and settings for 1 July 2024 – 1 July 2028 and will consider the changing power system and the post 2025 market design work.

1. FORECAST UNSERVED ENERGY



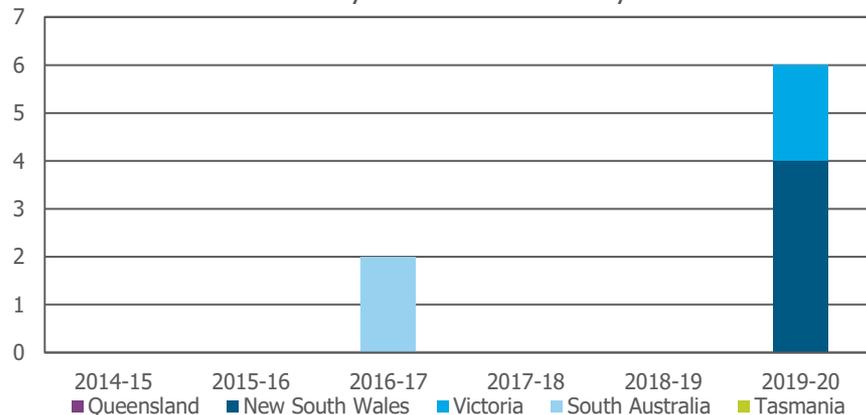
Key points:

- Unserved energy (USE) is a measure of the amount of customer demand that cannot be supplied within a region due to a shortage of generation, demand-side participation or interconnector capacity.
- Forecast USE in NSW expected to surpass the interim reliability measure of 0.0006% USE in 2023/24, when Liddell is expected to retire.
- Reliability gap based on the 0.002% USE reliability standard has been identified in NSW in 2029/30. Expected USE for this period is 8,871 GWh, and the size of the forecast reliability gap is 1480 MW.
- Large spike in forecast USE in NSW due to the assumed increase in forced outages and retirements of coal-fired generators in 2028-2030. Also driving smaller increases in Victoria and South Australia.

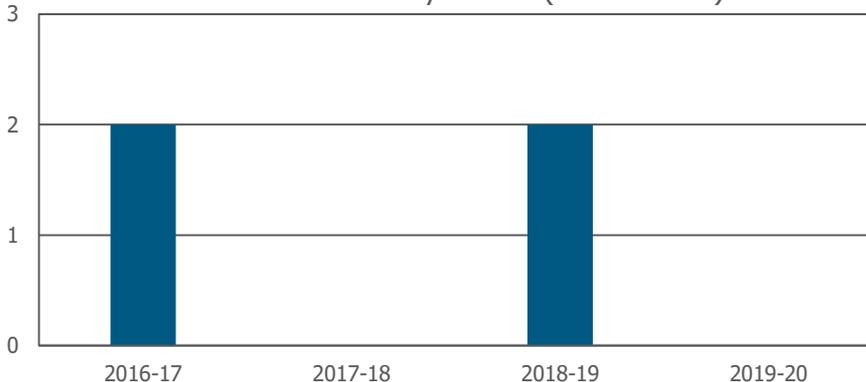
* Note, the Interim Reliability Measure was put in place to take care of immediate reliability concerns, and it will cease in March 2025.

2. RELIABILITY EVENTS AND DIRECTIONS/INSTRUCTIONS

Number of reliability directions issued by AEMO



Number of Reliability Events (Actual LOR3)

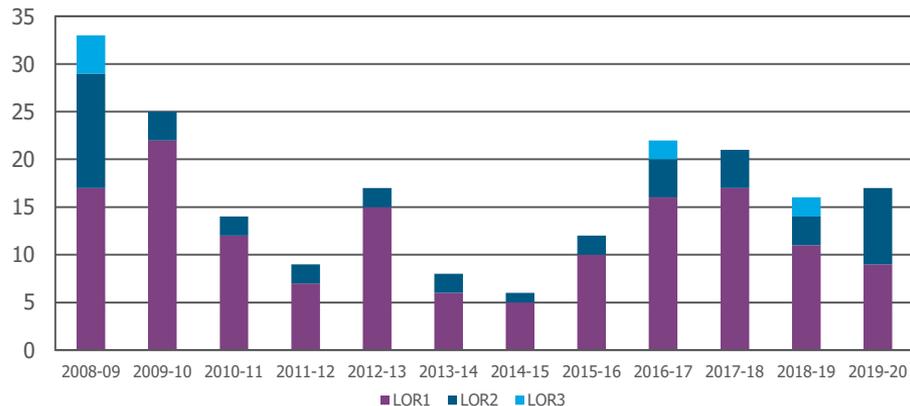


Key points:

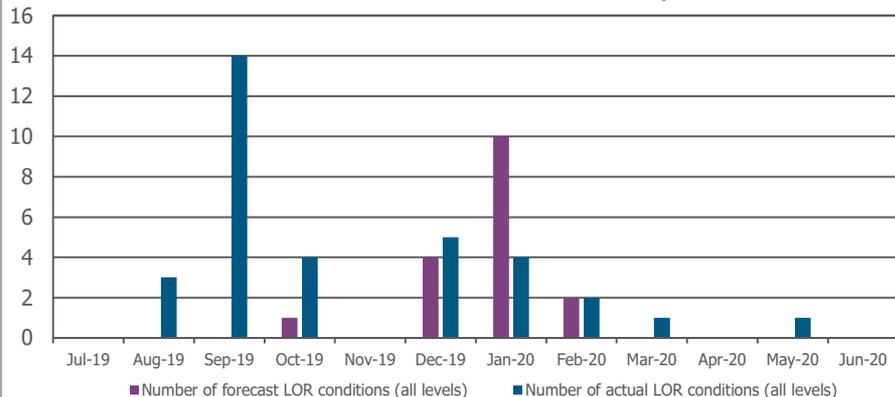
- Reliability directions are issued to maintain the power system in a reliable operating state.
- AEMO issued 6 reliability directions in 2019/20 significantly more than in previous years.
- All directions were issued on 1 February 2020. The two directions issued in Victoria were associated with the South Australian separation event. The four issued in NSW were unrelated to the separation event.
- No reliability events (i.e. actual LOR3 conditions) where supply was interrupted due to shortfall of available capacity reserves in 2019/20.

3. LACK OF RESERVES

Number of actual lack of reserves notices over time



Forecast and actual LOR notices per month

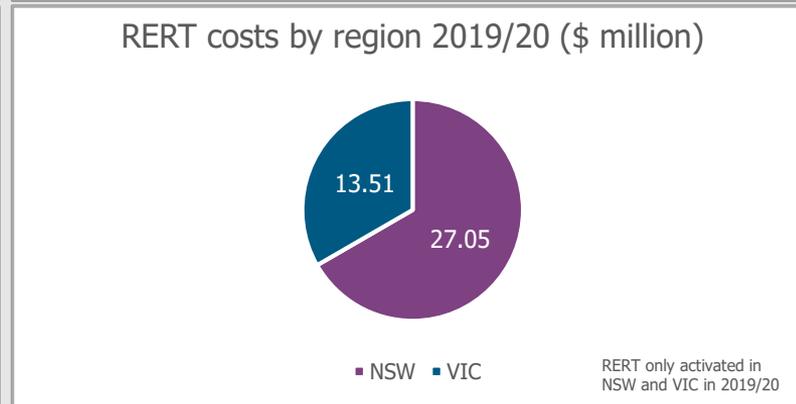
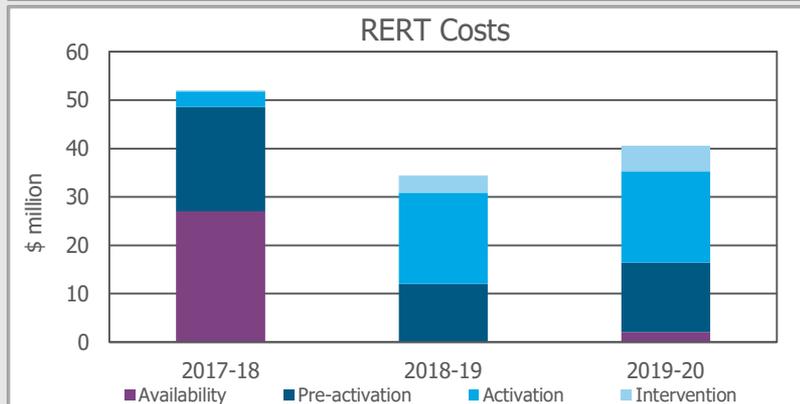
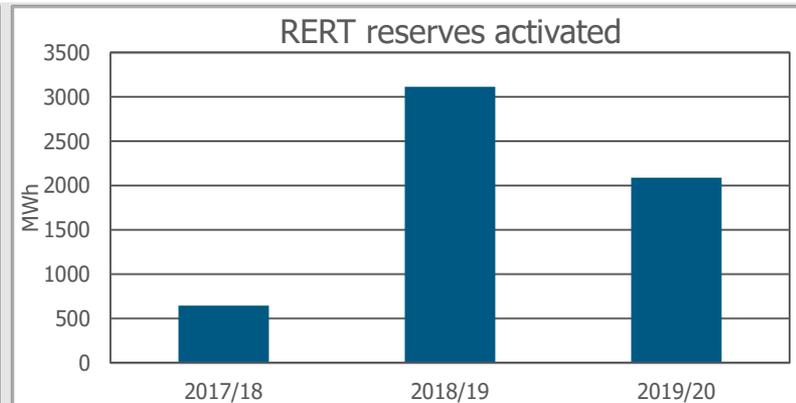
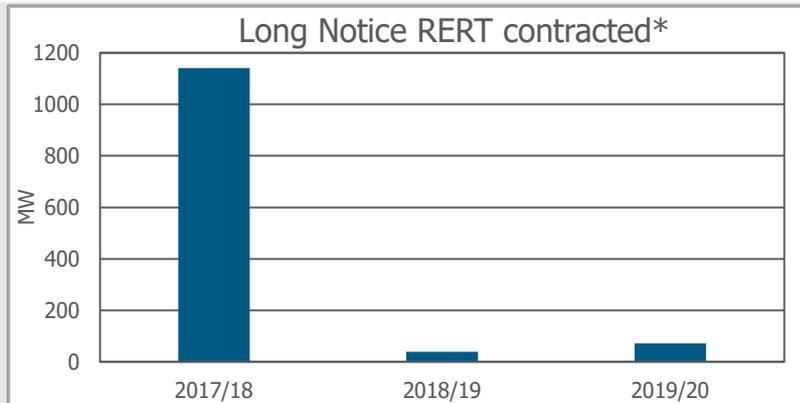


Key points:

- AEMO will declare LOR conditions when there is a non-remote possibility of LOR load shedding due to shortfall of available capacity reserves.
- 17 actual lack of reserve notices issued in 2019/20, an increase of 1 from 2018/19. Number of LOR2 conditions increased significantly compared to historical trends.
- Actual LOR2 is declared when the occurrence of the largest credible contingency event would result in LOR load shedding.
- Summer peak demand drove the majority of LOR notices in 2019/20, due to very high temperatures and extreme weather events, including bushfires, impacting the power system. This includes South Australian separation event in late January and February 2020.

4. RELIABILITY AND EMERGENCY RESERVE TRADER

The RERT is a function conferred to AEMO to maintain power system reliability and security. AEMO maintains a panel of RERT providers for short-notice and medium-notice RERT if required.



* AEMO established a panel of short/medium notice providers for up to 1,698 MW of potential reserve capacity across the NEM, which could be contracted when a revenue shortfall arose.

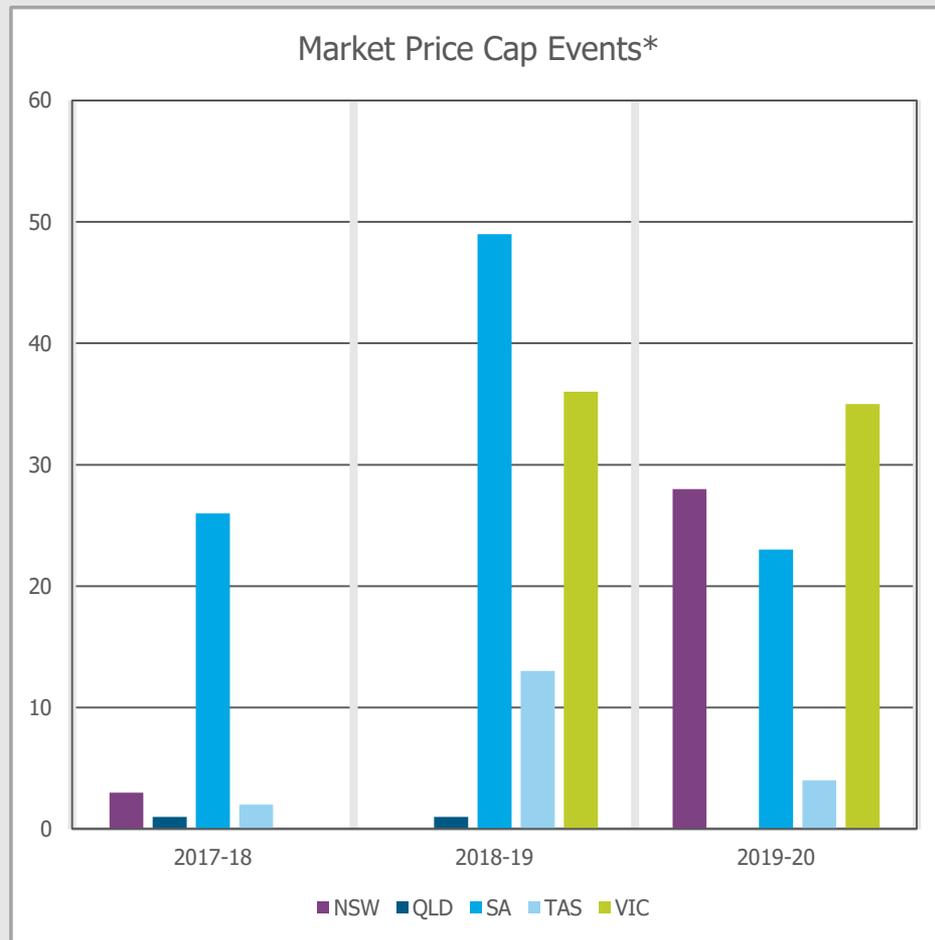
4. RELIABILITY AND EMERGENCY RESERVE TRADER

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- Small increase in amount of long notice RERT contracted in 2019/2020 compared to 2018/19. Short notice RERT was contracted on 6 different occasions in FY 2019/20.
- 2,086.5 MWh of RERT was activated in 2019/20, declining from 3,048 MWh in 2018/19.
- In 2019/20, 1,106.5 MWh of RERT was activated in NSW, and 980 MWh activated in Victoria.
- RERT activated to address reserve shortfalls due to extreme temperatures, high demand, and environmental factors (storms and bushfires) impacting the transmission network.
 - RERT activated in response to extreme external events on multiple occasions. Bushfires impacted performance of the power system on 30 December, 4 January and 23 January leading to the activation of RERT.
 - RERT also activated on 31 January due to transmission outages in Victoria caused by storms, which led to South Australia being islanded.
- For each of these activations, the cost per MWh was less than the average value of customer reliability (VCR), which is \$42,120/MWh in New South Wales and \$41,210/MWh in Victoria. On some occasions, the cost was also less than the MPC.
- The Reliability Panel notes that the Post 2025 work program is considering, in the context of proposed reforms, whether the RERT processes are efficient as possible.

5. RELIABILITY PRICE SETTINGS: MARKET PRICE CAP

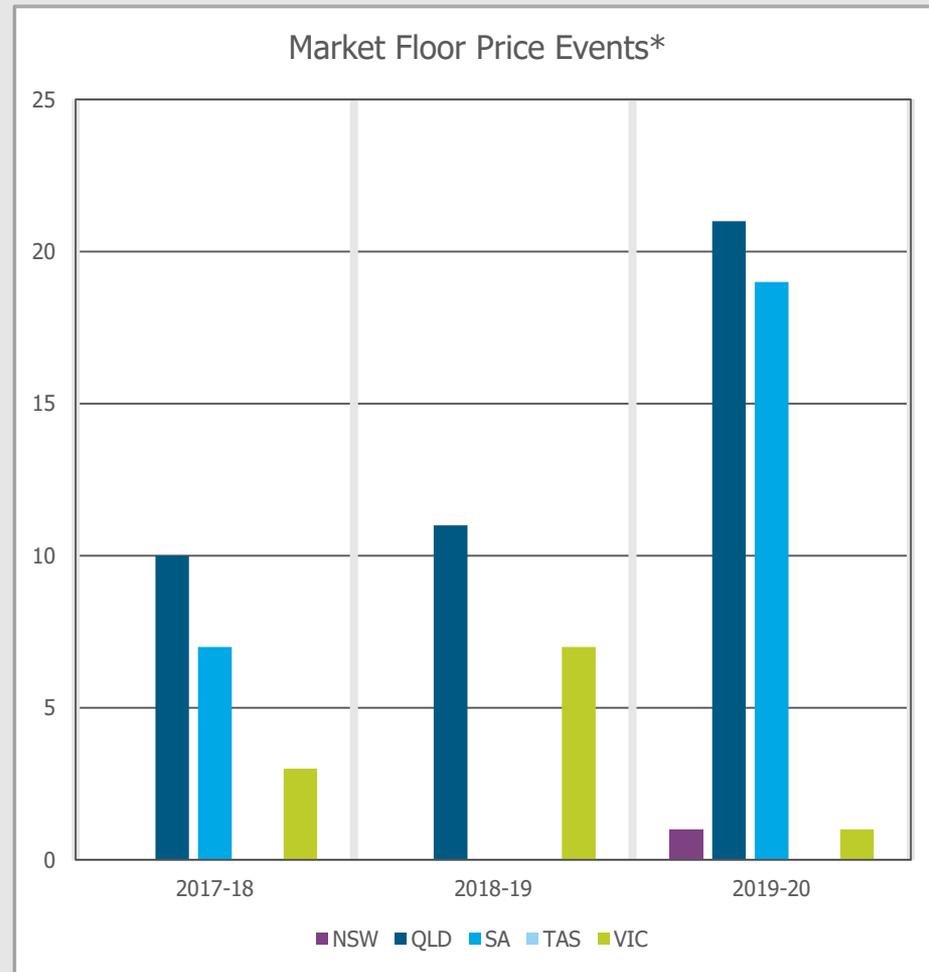
- The market price cap (MPC) is the reliability setting that sets an upper bound on the maximum possible price to which market participants can be exposed in any dispatch interval. The MPC was \$14,700/MWh in 2019-20.
- Increase in MPC events in NSW associated with separation events in January. Long period of MPC prices on 4 Jan during Victoria – NSW separation event.
- No MPC events for QLD in 2019-20.
- South Australia saw significant decrease in market price cap events, but prices are still volatile.
- Tasmania saw a significant decrease in MPC events.
- Victoria MPC events remained stable from last year.
- **The next RSSR review will consider whether the Reliability Standard and Settings are still appropriate given changing power system, generation mix and set of reforms including 2025 market design work.**



* Chart shows dispatch intervals (5 min).

5. RELIABILITY PRICE SETTINGS: MARKET FLOOR PRICE

- The market floor price (MFP) is the minimum settlement price. The MFP was $-\$1,000/\text{MWh}$ in 2019-20.
- Queensland and South Australia saw significant increases in MFP events in 2019-20.
- High penetration of utility-scale renewables and DER could be driving these trends.
- Increase MFP events could be reflecting emerging minimum demand issues present in the NEM, especially in areas with high penetration of intermittent renewables i.e. QLD and SA.
- The Panel notes that there may be implications of negative prices for investment and retirement of coal plant. The Panel will continue to monitor the trends and report on issues in the next update and annual report.



* Chart shows dispatch intervals (5 min).

SUMMARY: POWER SYSTEM RELIABILITY

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- 2019/20 presented more reliability challenges than previous years, reflected by increases in key metrics such as RERT costs, RERT activations, and reliability directions. Complexity and volatility of operating the power system is increasing, reflected by increase in market floor price events.
- The extreme nature of the South Australian separation event required numerous AEMO interventions to maintain power system reliability. Other events such as the Victoria – New South Wales separation event, extreme temperatures and bushfires also required AEMO intervention.
- Six reliability directions were made in 19/20, compared to none in 18/19.
- AEMO forecast a reliability gap of 1480 MW in NSW 2029-30.
- **The Panel considers the challenges presented in 19/20 are important and will consider these and related outcomes in the annual report and 2021 RSSR review.**



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SECURITY

CORE TOPICS

WHAT IS POWER SYSTEM SECURITY?

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- Power system security involves maintaining the different elements that make up the power system within allowable equipment ratings and maintaining the system in a stable condition and within defined technical limits.
- Technical parameters include power flows, voltage and frequency. In practice, the power system is in a secure state if it remains within its technical parameters following a credible contingency event.
- Such events include:
 - Unplanned transmission line outages, and
 - Unplanned generator outages.
- AEMO is responsible for maintaining power system equipment within designed capabilities and ratings. As part of this role, it is responsible for using regulatory tools to intervene to ensure the power system remains secure.
- This section of the market update considers the security performance of the power systems, considering the above and both historical and forecast outcomes.

* Secure operating state: A state where the power system is in, or will return to, the NER requirement of a satisfactory operating state within 30 minutes.

AMPR UPDATE 1: KEY TRENDS – SECURITY

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- Significant increase in reviewable operating incidents in 2019/20 compared to 2018/19.
- 3 events where the power system was not in a secure operating state for more than 30 minutes in 2019/20, down from 4 in 2018/19.



- Upward trend of power system directions continued in 2019/20, almost exclusively in SA.
- Management of SA separation event in January-February 2020 contributed heavily to these.



- Both the mainland and Tasmania had better frequency performance, especially over summer.
- Tasmania suffered a sharp decline in August, due to a Basslink outage.



- Significant spike in FCAS costs and prices in Q1 2020.
- Slight increase in SRAS costs compared to 2018/19.
- AEMO did not procure any NSCAS in 2019/20 in its capacity as system operator.



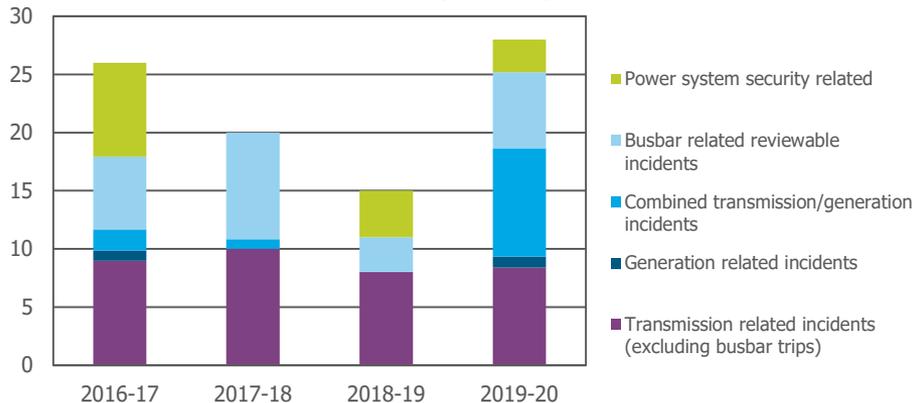
- Number of constraint changes in NEMDE for 2019/20 was less than 2018/19.
- Level of change remains higher than 3-4 years ago, reflecting increasing complexity of NEMDE optimization.



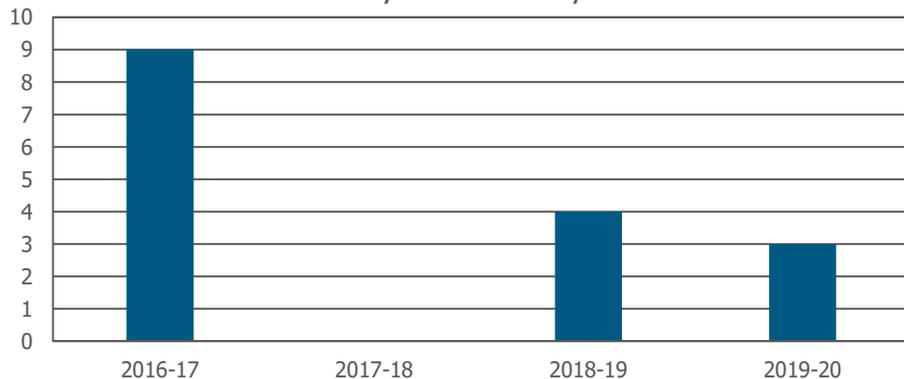
- Increase in the number of market notices issued by AEMO in 2019/20.
- Significant drivers of the increase include market interventions, prices subject to review and prices unchanged.

1. SECURITY EVENTS

Reviewable operating incidents*



Power system security events**



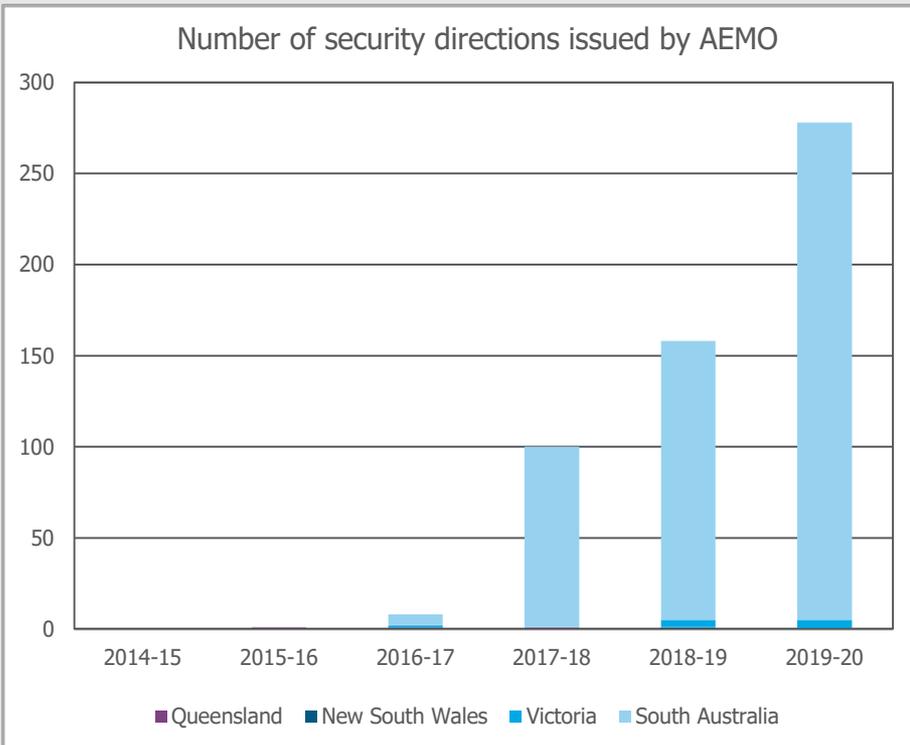
Key points:

- AEMO publishes reports on events considered reviewable under clause 4.8.15 of the NER, and the associated Reliability Panel guidelines.
- Large increase in number of operating incidents in 2019/20 (28) compared to 2018/19 (15), driven by large increase in combined transmission/generation incidents compared to previous years. Number of incidents not unusually high compared to 2017/18 (26).
- Increase in combined transmission/generation incidents partially driven by increases in external power system shocks, including bushfires and storms.
- Three operating incidents in 2019/20 resulted in the power system not being in a secure operating state for more than 30 minutes, categorized as power system security related.
- While there was a significant increase from 2018/19 to 2019/20, magnitude of reviewable incidents does not appear to be unusual given previous years.

*Categories shown as percentages of total events.

** Events when the power system was not in a secure operating state for more than 30 minutes.

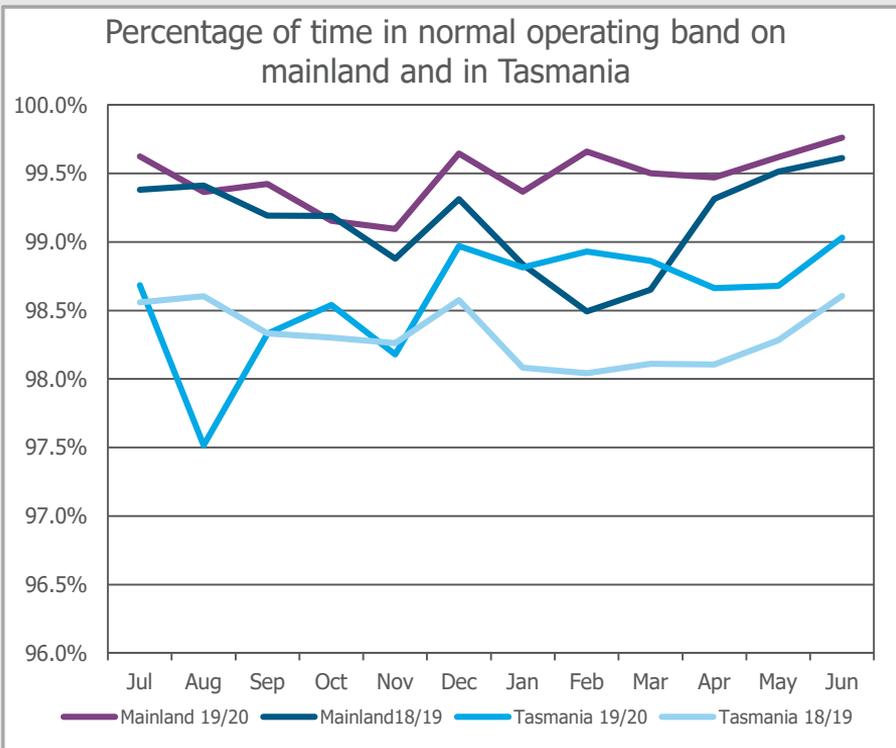
2. SECURITY: DIRECTIONS/INSTRUCTIONS



Key points:

- AEMO may issue directions to participants to maintain or reestablish the power system to a secure operating state.
- Strong upwards trend in security directions continued in 2019/20.
- Most of the security directions issued by AEMO in 2019/20 were in South Australia. Large number of directions issued as a result of the South Australian separation event in January-February 2020. Ongoing system strength directions in South Australia also contributed to these.
- AEMO, in response to the South Australia separation event, had to take a hands-on approach in order to maintain power system security.

3. PERFORMANCE AGAINST THE FREQUENCY OPERATING STANDARD

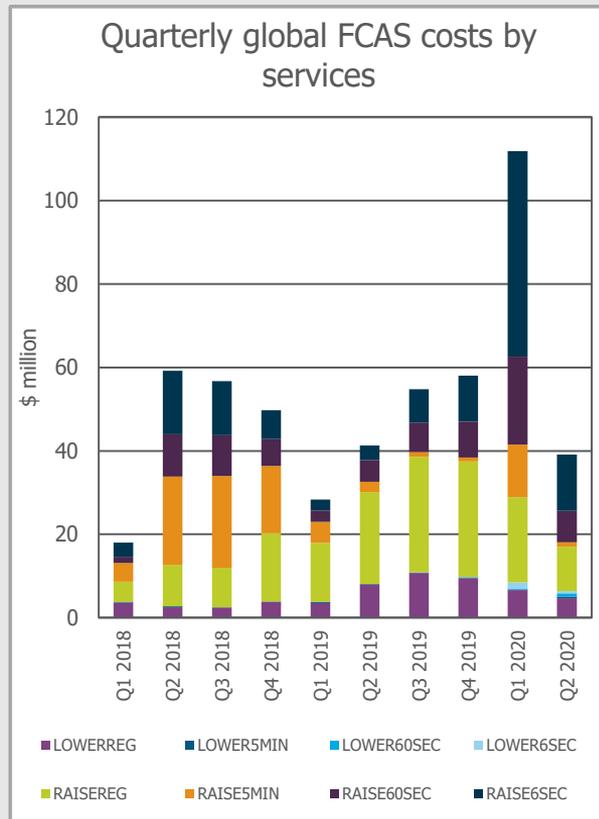
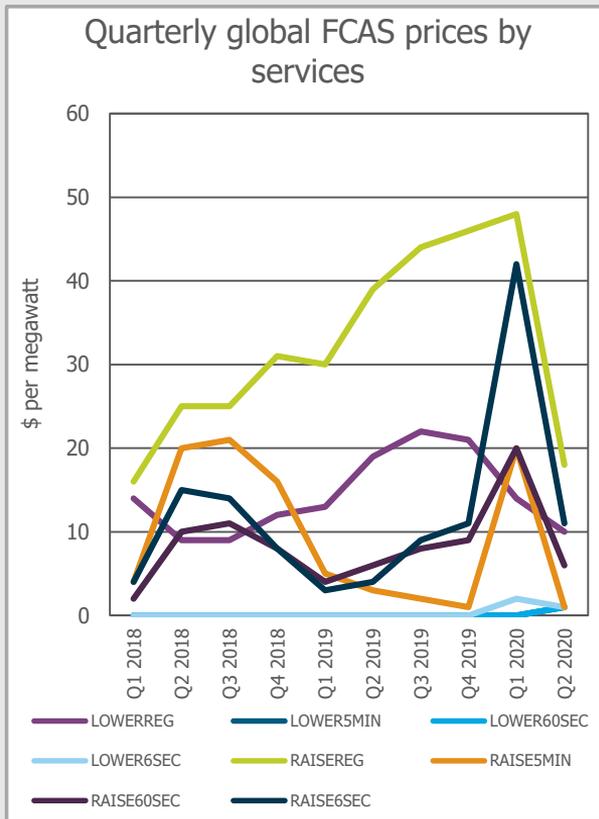
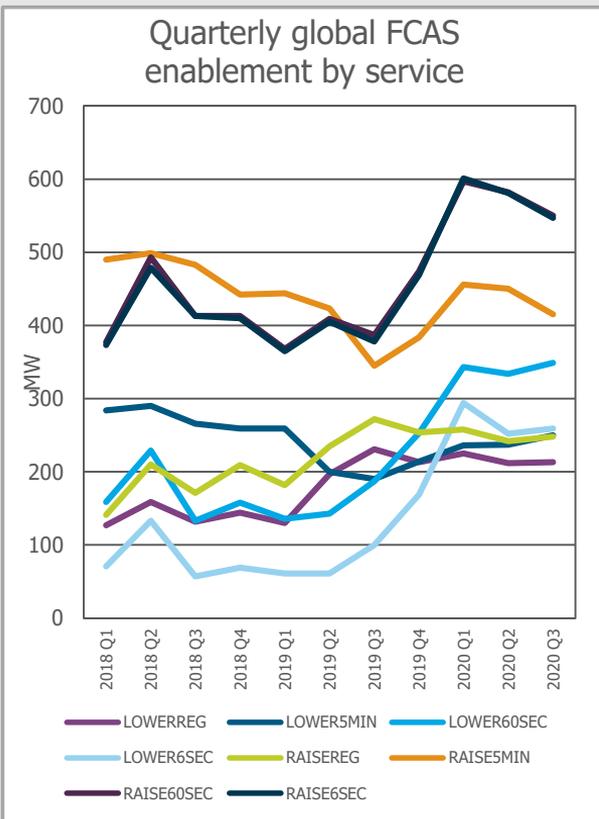


Key points:

- The normal operating frequency band (NOFB) is the range within which the power system should be operating under system normal conditions.
- Mainland had significantly higher percentage of time in NOFB in 2019/20 compared to 18/19, with better performance over summer. Increases to base volume of regulation FCAS and reduction in mainland load relief have improved frequency performance over summer.
- Tasmania performed better over summer and time in NOFB is higher than 2018/19 over the second half of the financial year.
- Unplanned Basslink outage on 24 August 2019 may have led to severe drop.
- Introduction of mandatory primary frequency response is expected to improve performance in 2020/21.

4. FREQUENCY CONTROL ANCILLARY SERVICES

AEMO uses ancillary services to manage the power system safely, securely and reliably.



4. FREQUENCY CONTROL ANCILLARY SERVICES

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Key points:

- Spike in FCAS costs and prices in Q1 2020 associated with South Australian separation event.
- In Q2 2020, FCAS costs declined to normal levels, and were below Q2 cost levels for the previous 2 years.
- FCAS prices decreased significantly in Q2 2020, with services such as regulation raise and regulation lower moving to lowest points in the last 2 years.
- In Q2 2019, AEMO implemented increases to base volume of regulation FCAS procured to help control frequency within the NOFB 99% of the time. AEMO has also reduced mainland load relief from 1.5% to 0.5%, leading to the average volume of contingency FCAS dispatched increasing since Q3 2019.

5. NETWORK SUPPORT AND CONTROL ANCILLARY SERVICES

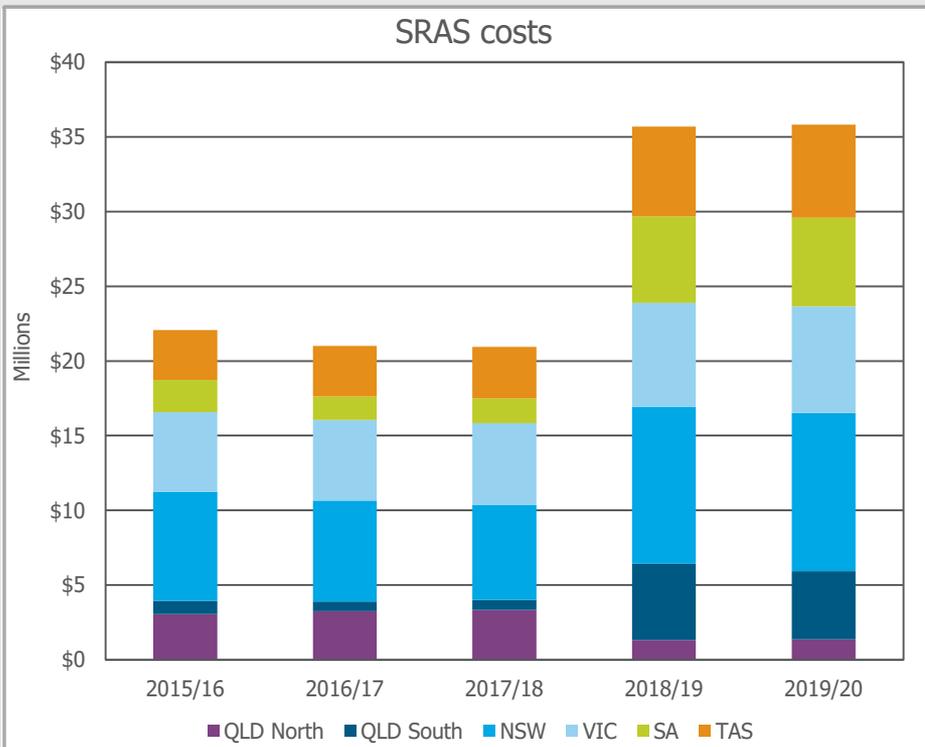
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Key points:

- Network Support and Control Ancillary Services (NSCAS) are a non-market ancillary service that may be procured by AEMO or Transmission Network Services Providers to maintain power system security and reliability, and to maintain or increase the power transfer capability of the transmission network.
- AEMO will be required to acquire NSCAS only to ensure power system security and reliability if the NSCAS gaps remain unmet after TNSP's attempt to procure services.
- AEMO has issued no NSCAS contracts as the market operator for 2019/20 and has not forecast the need for NSCAS contracts in 2020/21.
- AEMO NSCAS costs as the market operator for 2019/20 and 2020/21 are \$0. AEMO has recently updated NSCAS procedures, and this may have an impact on NSCAS procurement in the future.
 - This included changing definition of NSCAS types and changing modelling approaches.*
- This is distinguished from AEMO procuring NMAS contracts under its position as the Victorian Transmission Network Service Provider.

* More information can be found in the final determination report, at: https://aemo.com.au/-/media/files/stakeholder_consultation/consultations/nem-consultations/2020/ncas/nsca-final-report-and-determination.pdf?la=en

6. SYSTEM RESTART ANCILLARY SERVICES

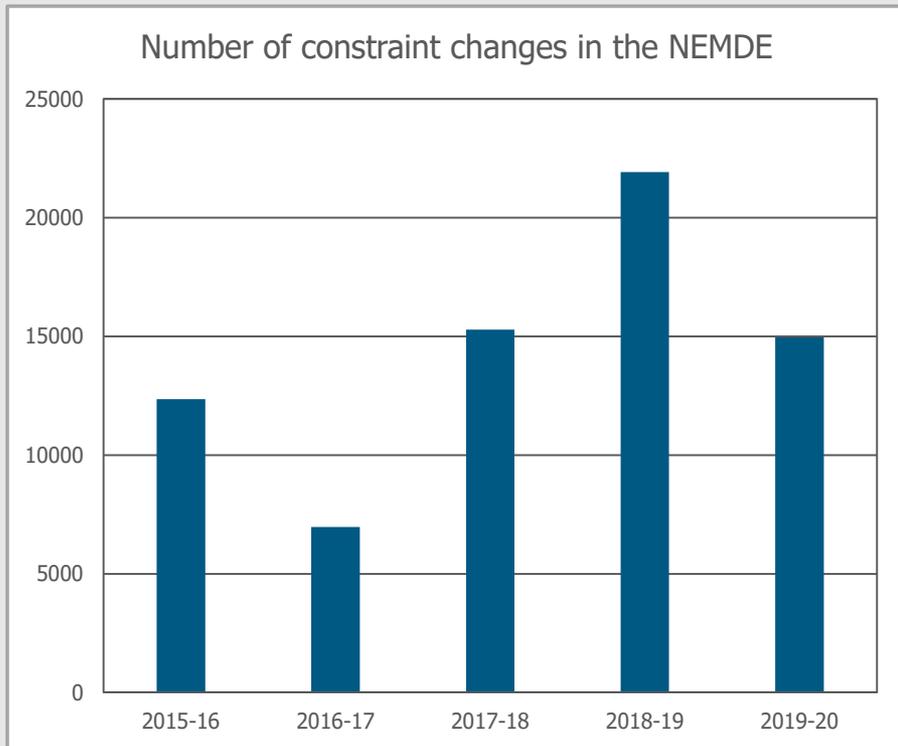


Key points:

- System restart ancillary services (SRAS) contribute to overall resilience of the power system by enabling recovery following a major blackout.
- SRAS costs increased slightly from 2018/19 due to inflation.
- Increase in costs from 2017/18 to 2018/19 can be attributed to the beginning of a new contracting period.
- In April 2020, the AEMC published a final rule determination to enhance the frameworks for system restart and restoration. Following this the Panel is currently reviewing the system restart standard.

7. NETWORK CONSTRAINTS

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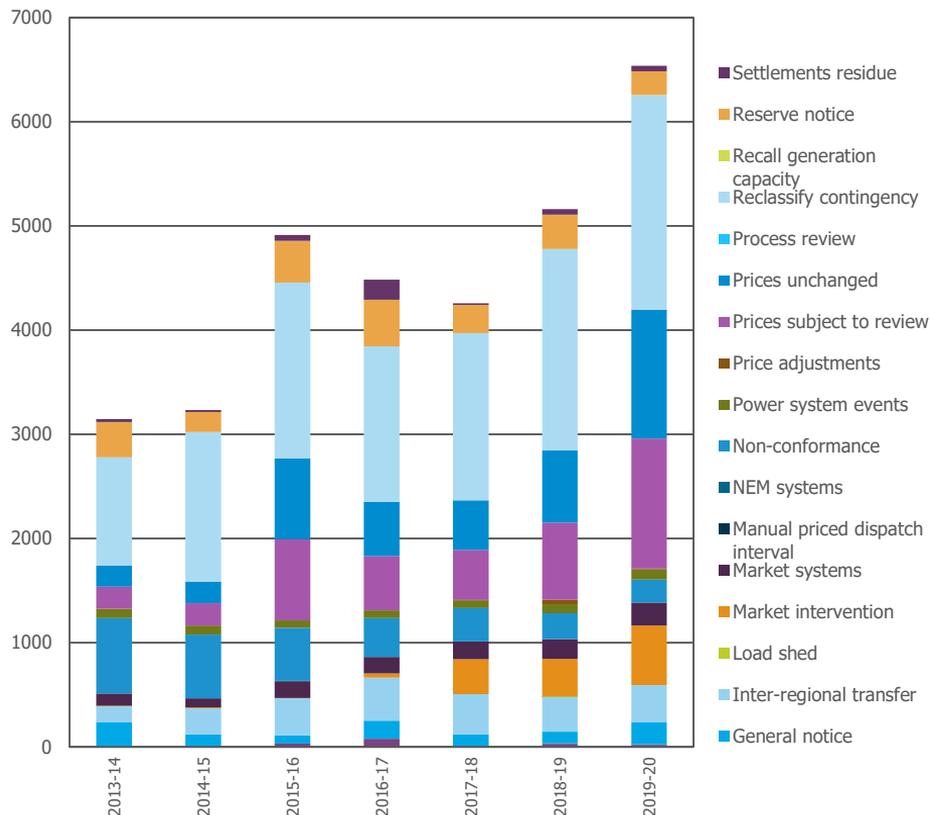


Key points:

- AEMO uses constraint equations to represent the physical limits of the power system, which are used in the NEMDE optimisation.
- AEMO reported approximately 15,000 constraint changes in NEMDE over 2019-20.
- This is a relatively large decrease from 2018-19, but is significantly higher than 2016/17.
- Trend likely driven by several factors, particularly increasing rates of connection of inverter-based generation to weaker parts of the network.
- Ongoing changes in 2019-20 reflects the recent trend of increasing complexity of the optimization process that AEMO is running for dispatch.

8. MARKET NOTICES

Market notices issued per year



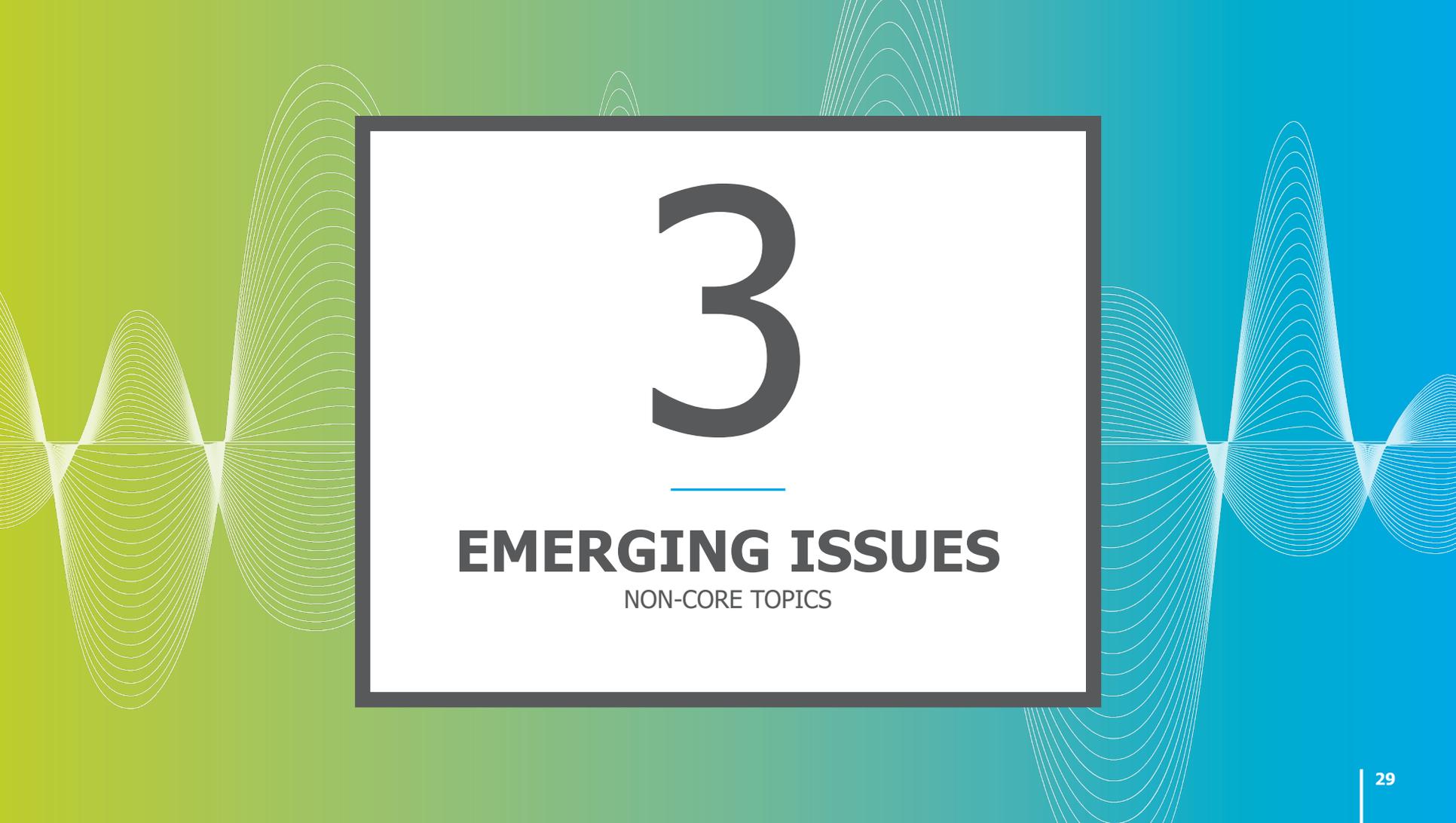
Key points:

- Market notices notify market participants of events that impact on the market.
- Number of market notices issued by AEMO increased in 2019/20.
- The significant drivers of this increase compared to 2018/19 included market intervention (+210), prices subject to review (+510) and prices unchanged (+544).
- Clear upwards trend in total market notices issued by AEMO. Reflective of increased levels of intervention necessary to operate the power system in a secure and reliable state.

SUMMARY: POWER SYSTEM SECURITY

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- 2019/20 saw a trend of increasing challenges and complexity to maintain power system security.
- AEMO issued large amounts of directions, and 210 more intervention notices compared to 2018/19, highlighting the increased attention required to maintain power system security.
- Large number of directions and market notices issued during the South Australia separation event. System strength directions in South Australia are also contributing to total directions issued. Spike in FCAS costs and prices in Q1 2020, coinciding with the South Australian event.
- The ongoing challenge and complexity to maintaining power system security is a key focus of the Panel, particularly in the context of extreme events occurring and how events impact the range of potential solutions required.



3

EMERGING ISSUES

NON-CORE TOPICS

AMPR UPDATE: EMERGING ISSUES - SUMMARY

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- COVID introduced additional uncertainty for investors, however investor uncertainty was already in the market before the advent of COVID.
- Decrease of 1610 MW of capacity publicly announced, and a decrease of 630 MW emerging.*



- Total demand across the NEM down slightly. A trend was underway before COVID.
- COVID 19 has seen the mix of demand changed, with increased residential use as more people work from home.



- AEMO forecasting significant decrease in minimum demand over the next 10 years across all regions except TAS.
- COVID has not appeared to have changed this.



- South Australia and Victoria experiencing significant decreases in demand in the middle of the day.
- Operation of the power system during periods of declining minimum demand will require further consideration.



- AEMO required significant levels of intervention to manage the power system in South Australia during islanding event.
- Markets for fast frequency response could be helpful in managing future events.



- The power system appears to be more reliant on intervention to deal with external events.
- It is important that the right tools are in place for the power system to adapt and maintain power system resilience.

* Emerging: projects that have financing arrangements, but site/planning approvals/construction is uncertain, and development is strongly subject to changes in policy or commercial environment.

1. INVESTMENT TRENDS – COVID AND INVESTMENT UNCERTAINTY

Unit Status	Difference from Jan – Jun 2020 (MW)
Committed	-69.664
Committed*	-31.6
Emerging	-626.56
In Commissioning	346.815
In Service	900.867
Announced Withdrawal	214
Maturing	-481.315
Publicly Announced	-1610.902
Upgrade	20

Key points:

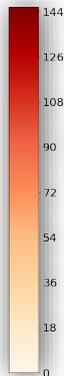
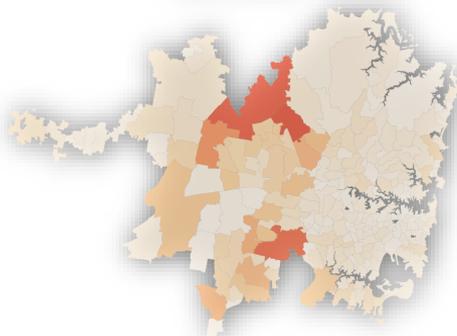
- COVID has introduced investment uncertainty, mainly related to maintenance and constructions delays (workforce shortages), as identified in investment survey of market participants undertaken by AEMC.
- Also reflected in decrease of 1.6GW of publicly announced investment withdrawn from January to June 2020.
- There were pre-existing issues with investment trends including uncertainty related to market design review, system security and grid connection delays as identified by market participants.
- Noting current investment uncertainty, residential PV uptake still strong in most jurisdictions. Major slow down in PV installations during the second COVID lockdown in Melbourne.

1. INVESTMENT TRENDS – PV UPTAKE SYDNEY

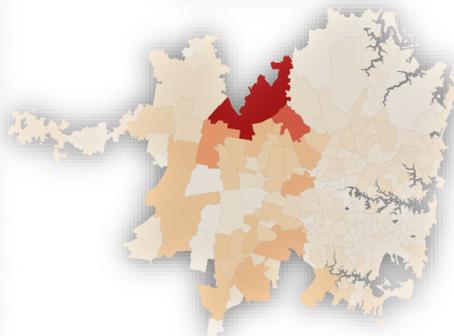
This map shows the number of solar panel installations on houses per month per postcode.

- COVID-19 has not led to a significant slowdown in solar panel installations across Sydney in 2020.

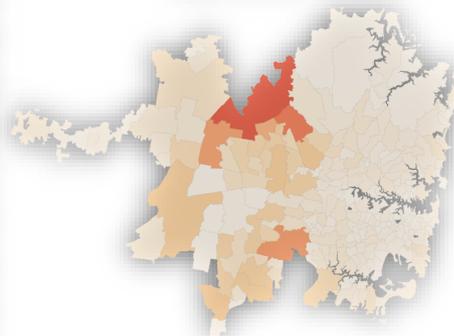
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May 2020



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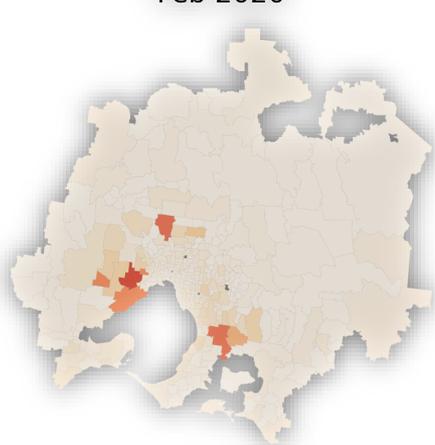


1. INVESTMENT TRENDS – PV UPTAKE MELBOURNE

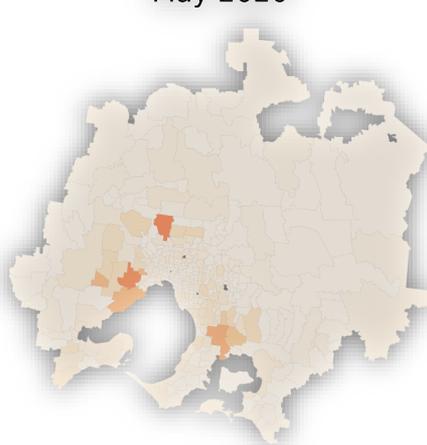
The same cannot be said for Melbourne, which has seen a significant slowdown in PV uptake due to COVID.

- As can be seen, in the depths of the second lockdown there was almost no solar installation.

Feb 2020



May 2020



Sep 2020



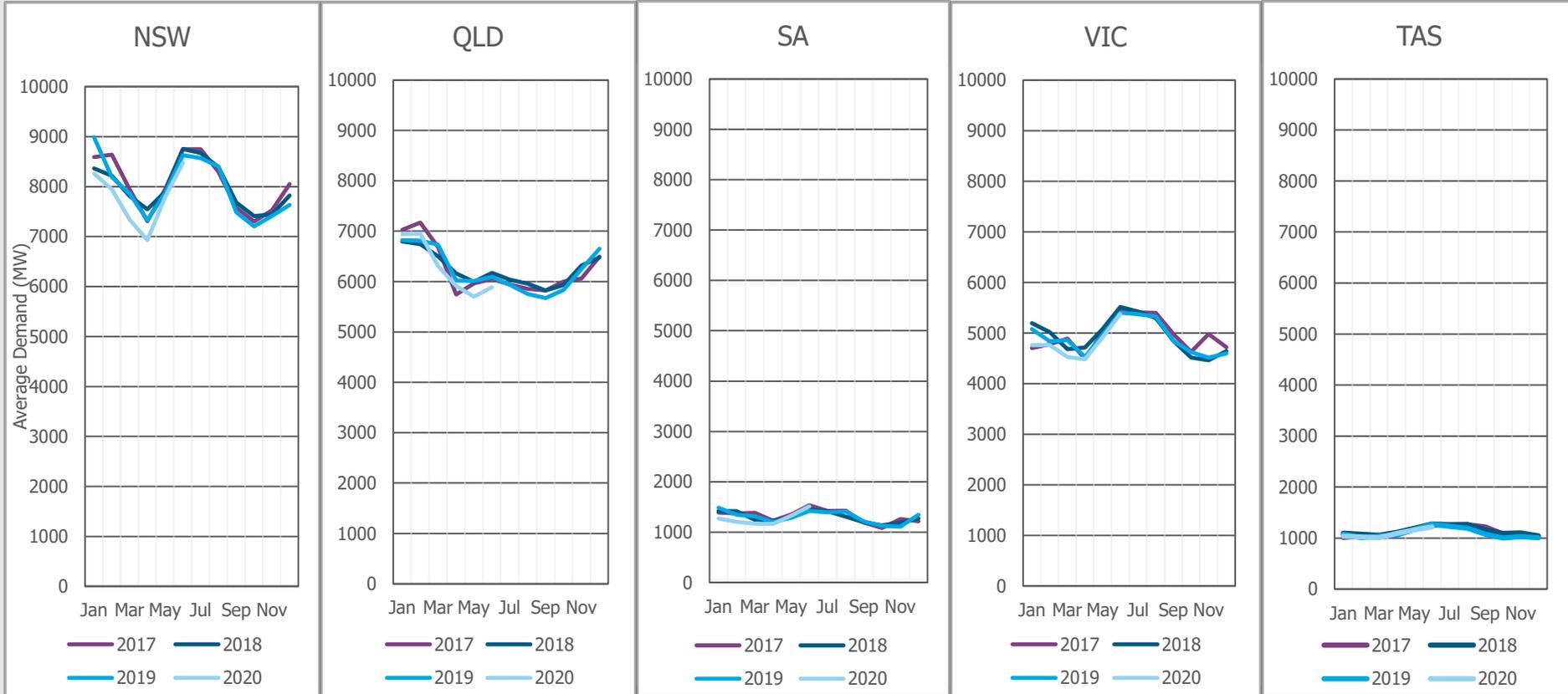
2. WHOLESALE MARKET TRENDS: OVERALL AND CHANGING DEMAND PROFILES

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Key points:

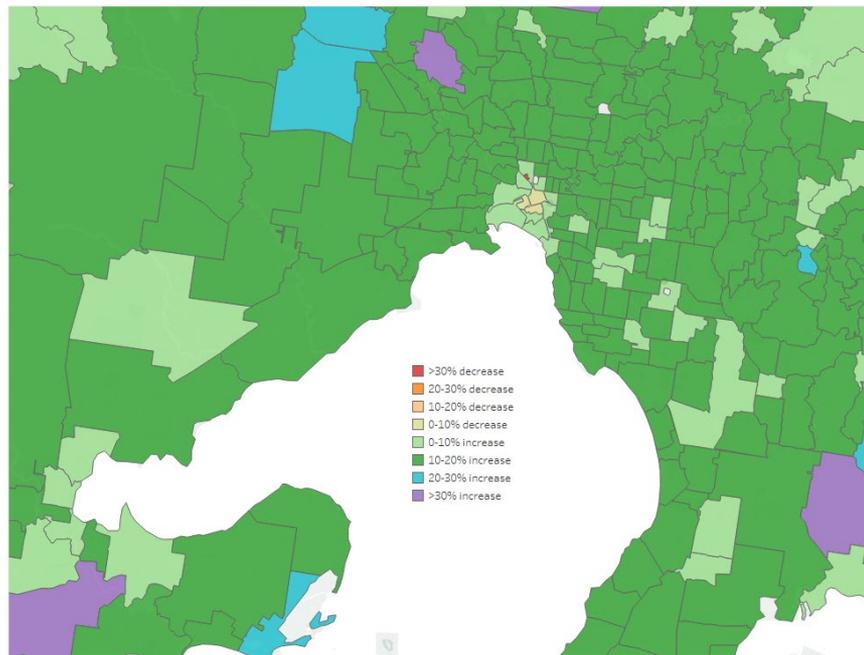
- Overall, total demand dropped slightly in some regions for 2020. This was occurring before COVID.
- During COVID, there has been a change in demand mix – residential up, commercial/industrial down. Trend is clear in DNSP load data from Melbourne comparing 2019 and 2020, as well as from Ausgrid.
- In addition to increased consumption, residential areas have seen a change in load profile, driven by increasing number of people working from home, using more electricity during the day. Rooftop PV is potentially masking some of the load.
- Changing demand profile and increases in residential demand may have implications for the power system, including for how networks are built and are managed going forward. Potential impacts on the system over summer are not yet known, as residential demand may likely increase compared to previous years.

2. WHOLESALE MARKET TRENDS: OVERALL DEMAND

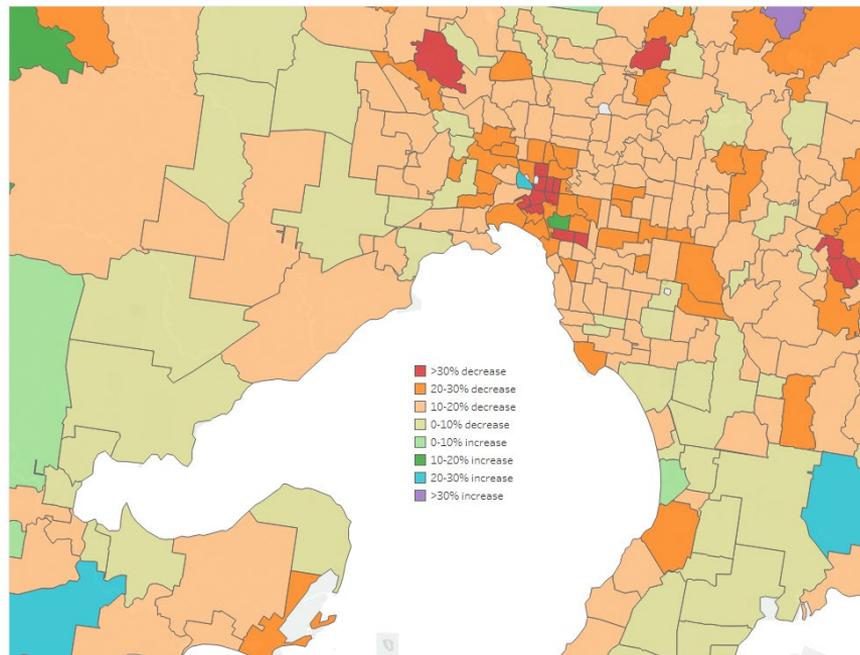


2. WHOLESALE MARKET TRENDS: SHIFTING LOAD PROFILES - MELBOURNE

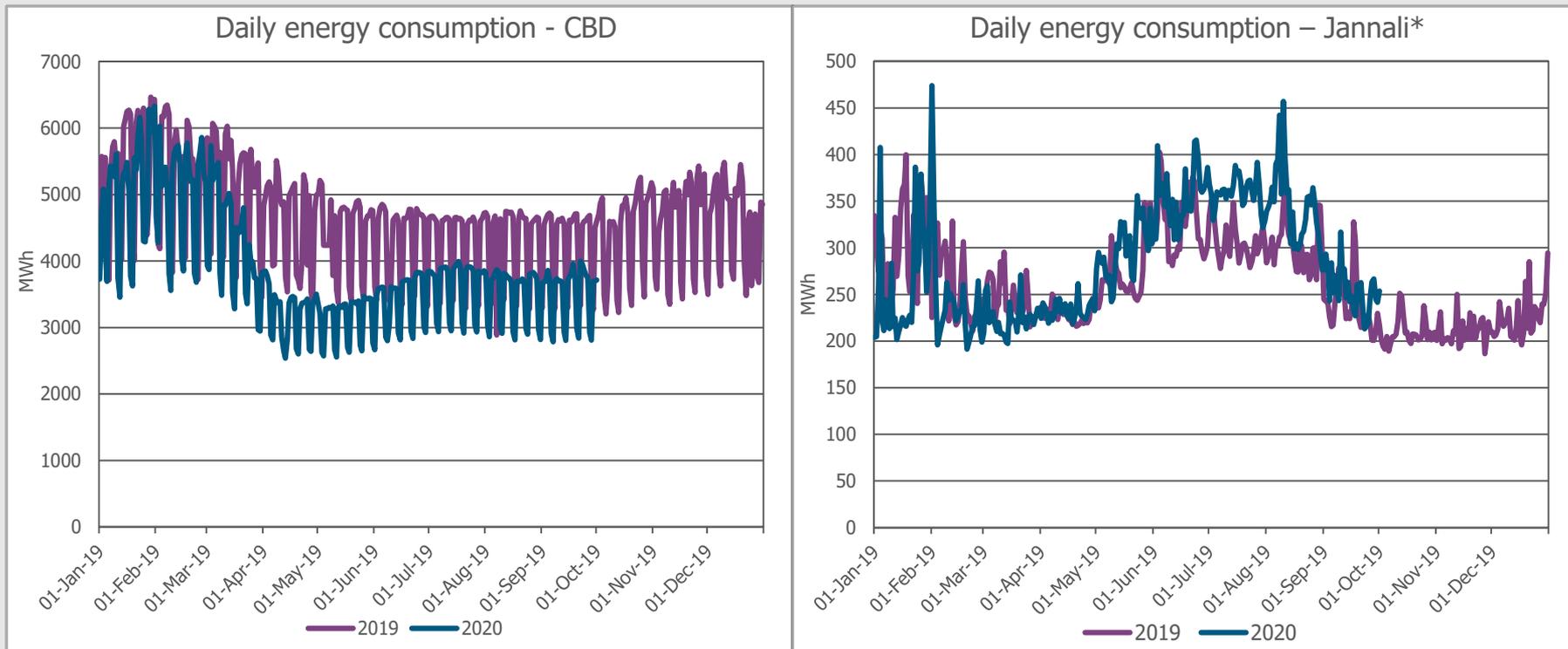
Residential changes in consumption (1 Apr - 23 Oct, 2020 v. 2019, Central)



SME changes in consumption (1 Apr - 23 Oct, 2020 v. 2019, Central)

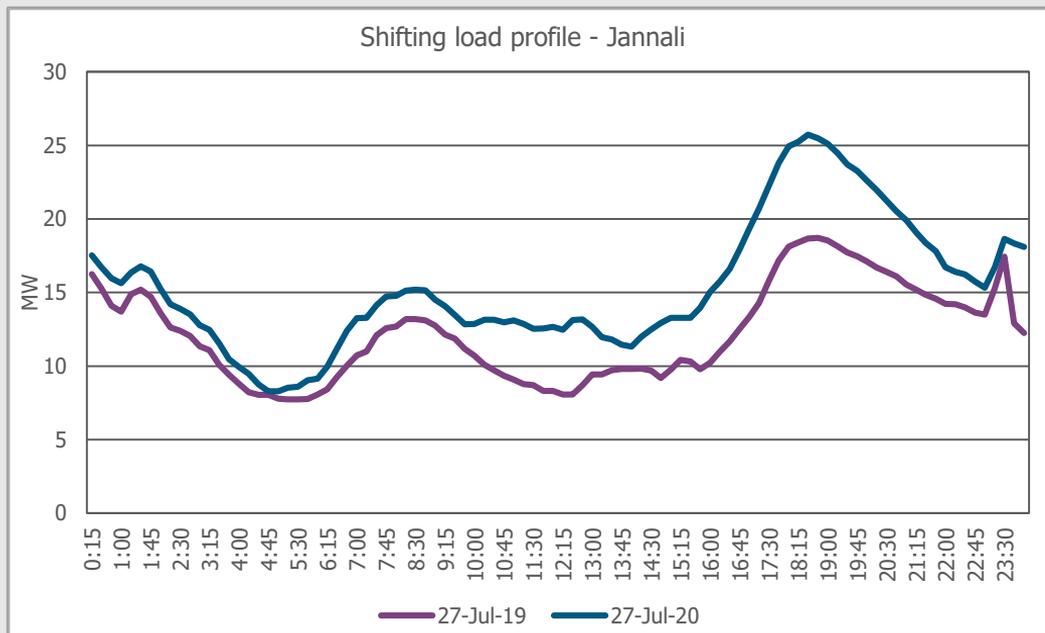


2. WHOLESALE MARKET TRENDS: SHIFTING LOAD PROFILES - SYDNEY



* Jannali is the substation zone with the highest proportion of residential customers in the Ausgrid distribution area. Increase in consumption in high residential areas, and decrease in high business areas, i.e. the CBD.

2. WHOLESALE MARKET TRENDS: SHIFTING LOAD PROFILES - SYDNEY



* Jannali is the substation zone with the highest proportion of residential customers in the Ausgrid distribution area.

2. WHOLESALE MARKET OUTCOMES: DECLINING MINIMUM DEMAND

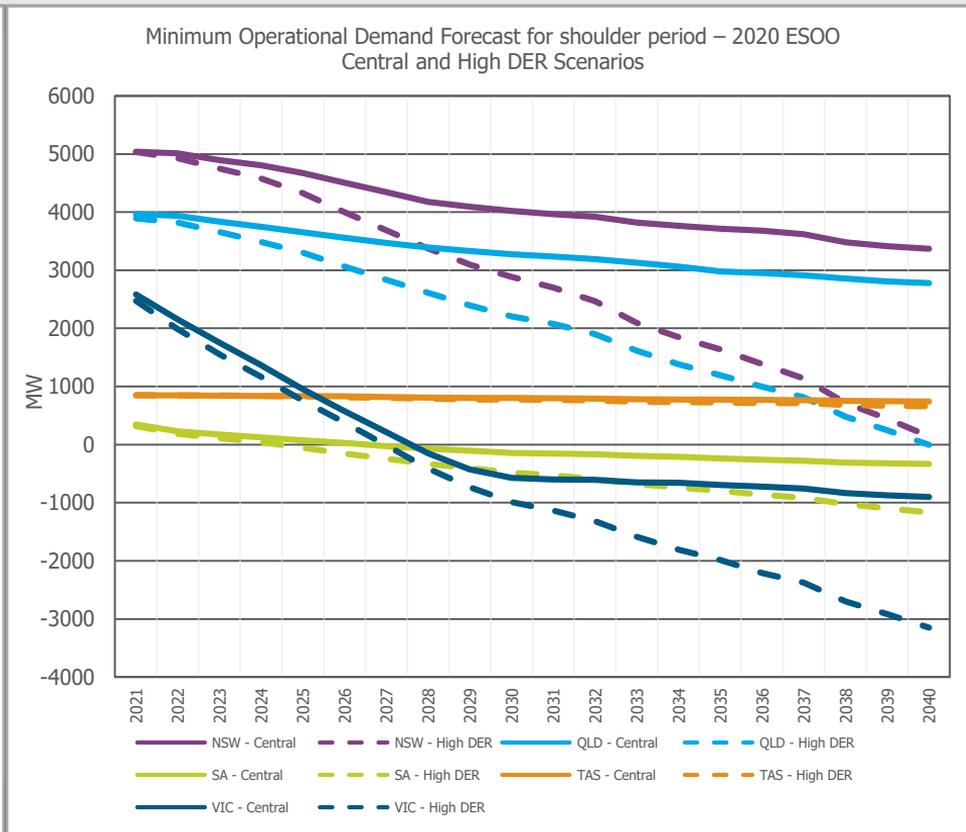
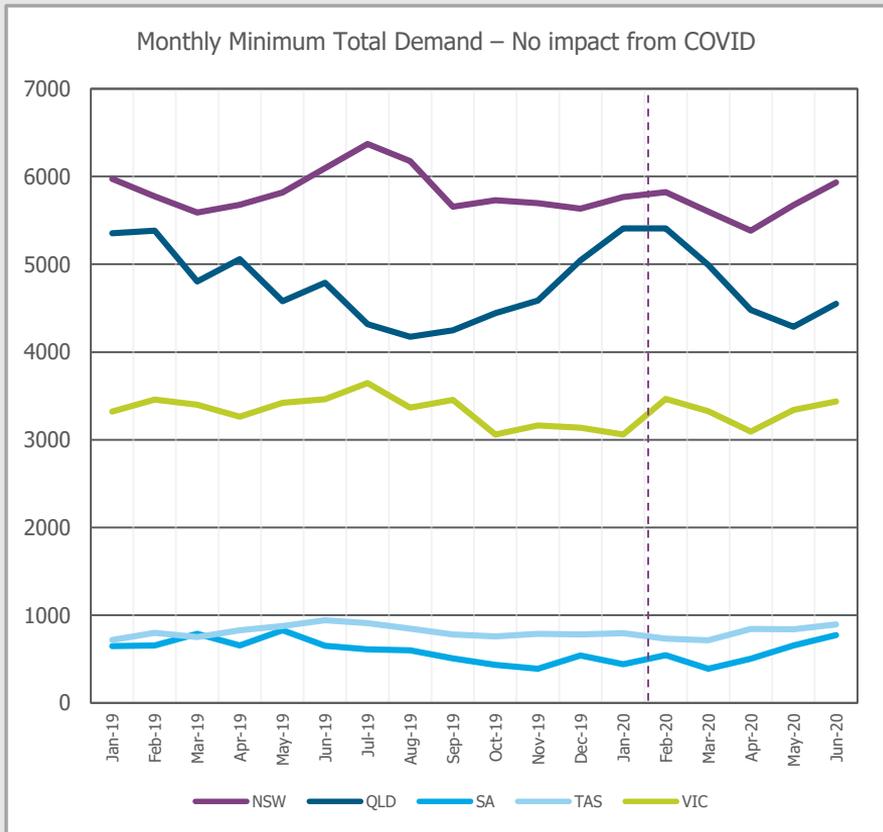
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Key points:

- COVID does not appear to have had a significant impact on monthly absolute minimum demand levels. Absolute minimum demand trends have largely followed seasonal patterns.
- AEMO expect minimum demand levels to continue on a downwards trajectory in all regions. South Australia expected to reach negative minimum demand by 2027, and Victoria by 2028.*
- Intra-day ramping of demand is becoming an increasing issue. Particularly in South Australia and Victoria, and to a lesser extent Queensland, demand levels decreasing significantly over the period from 8am – 3pm.
- There could be system security implications from continued declining demand, such as system inertia and voltage issues, ramp rate changes and need for emergency controls.
- Changes in minimum demand are important for operation of the power system. Important to consider what reliability and security approaches are needed going forward.

* Latest projections are for SA to reach negative minimum demand much sooner.

2. WHOLESALE MARKET TRENDS: DECLINING MINIMUM DEMAND

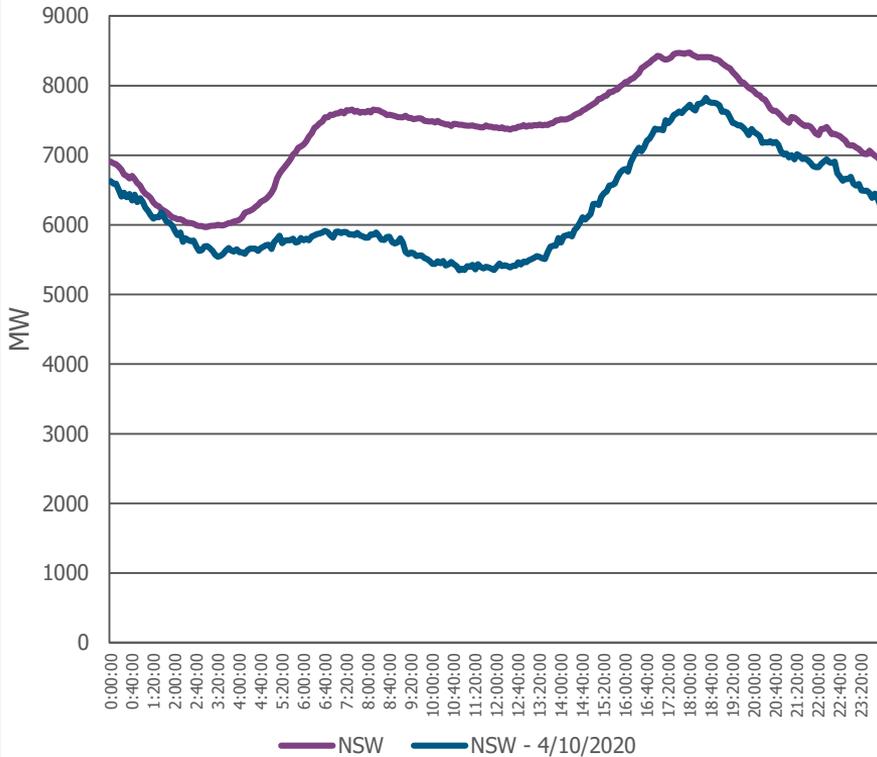


Source: AEMO ESOO 2020. Note: Forecasts do not include auxiliary load or losses.

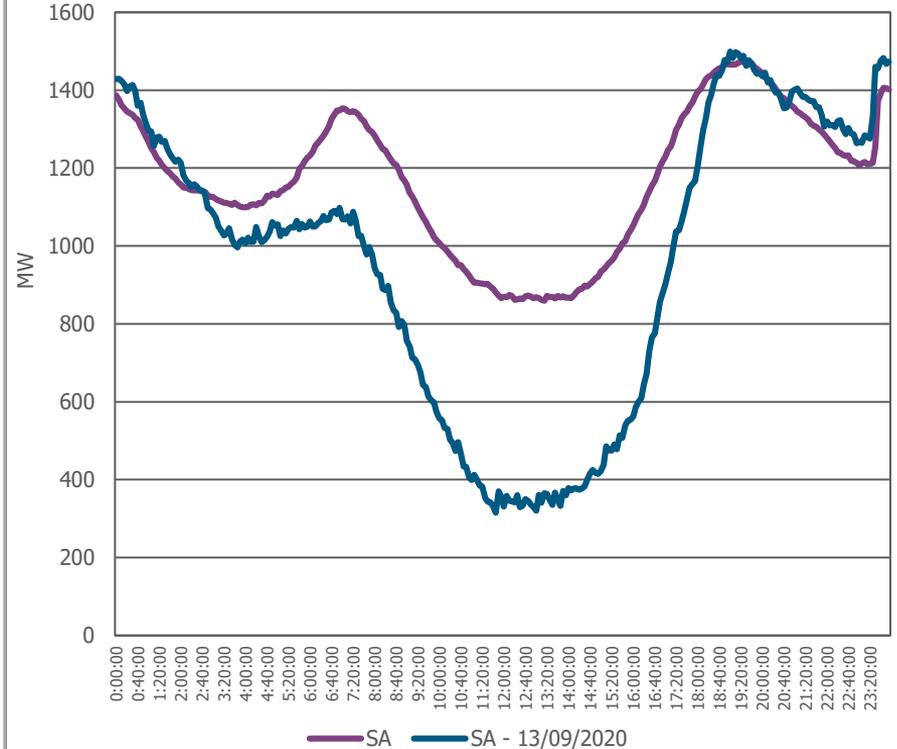
2. INTRA-DAY MINIMUM DEMAND



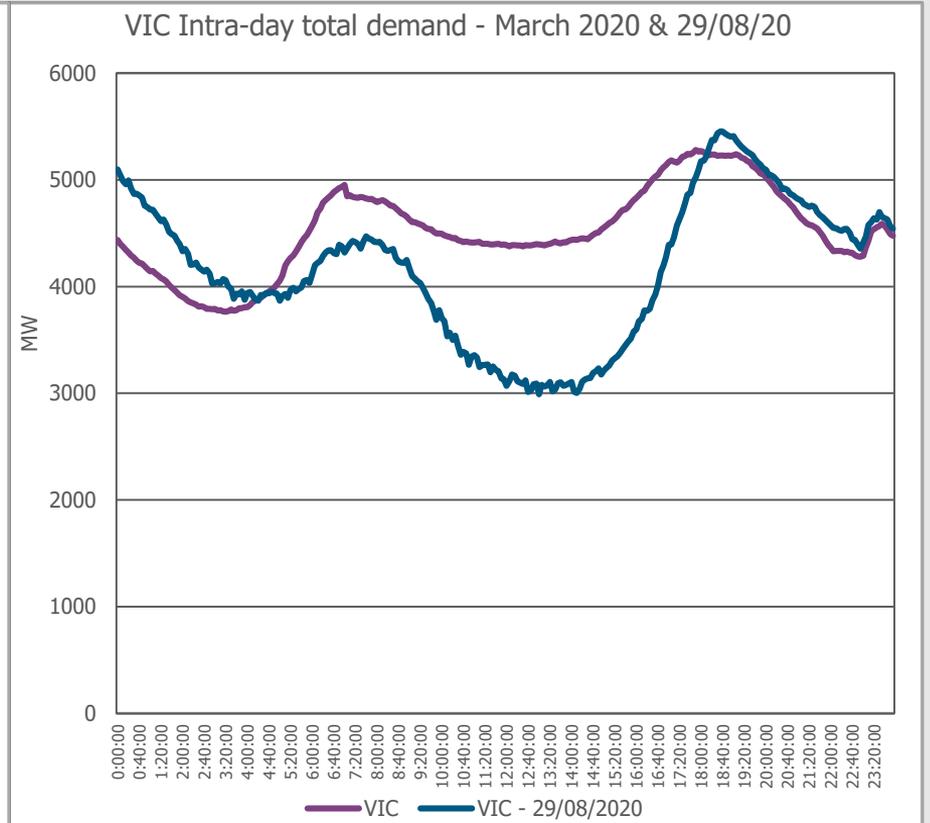
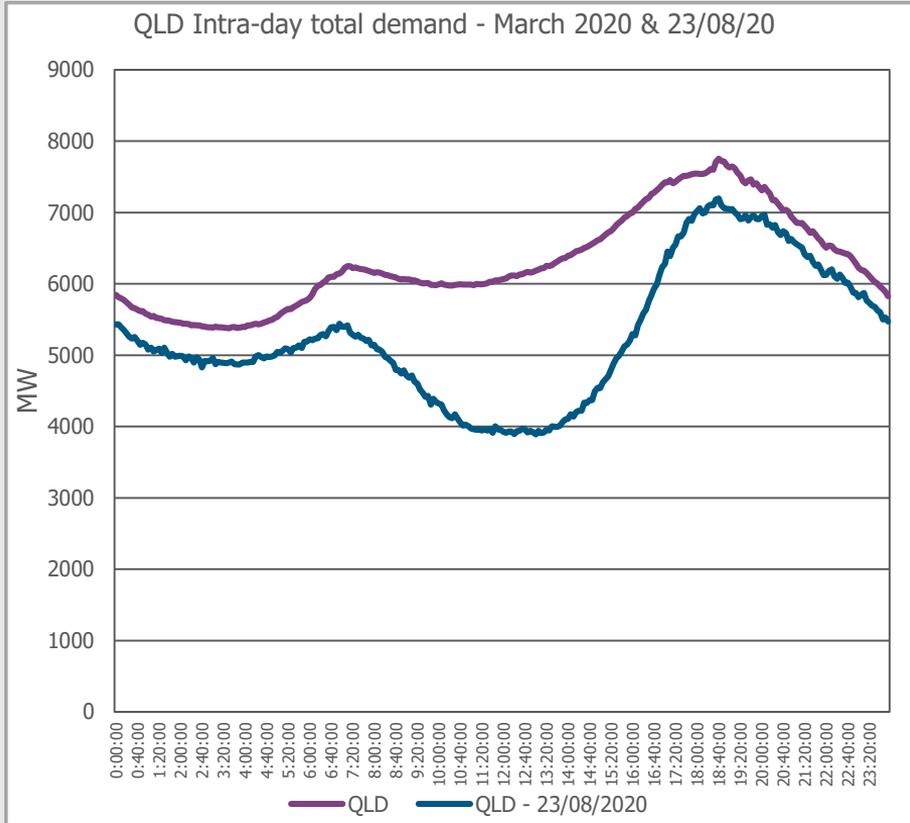
NSW Intra-day total demand - March 2020 & 4/10/2020



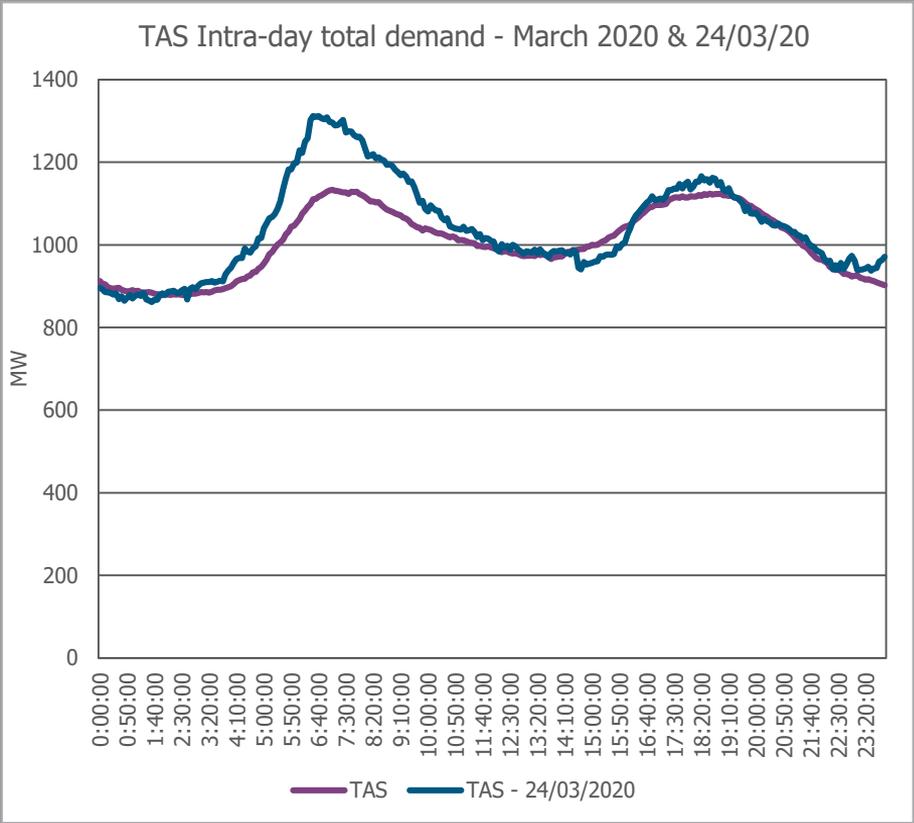
SA Intra-day total demand - March 2020 and 13/08/20



2. INTRA-DAY MINIMUM DEMAND



2. INTRA-DAY MINIMUM DEMAND



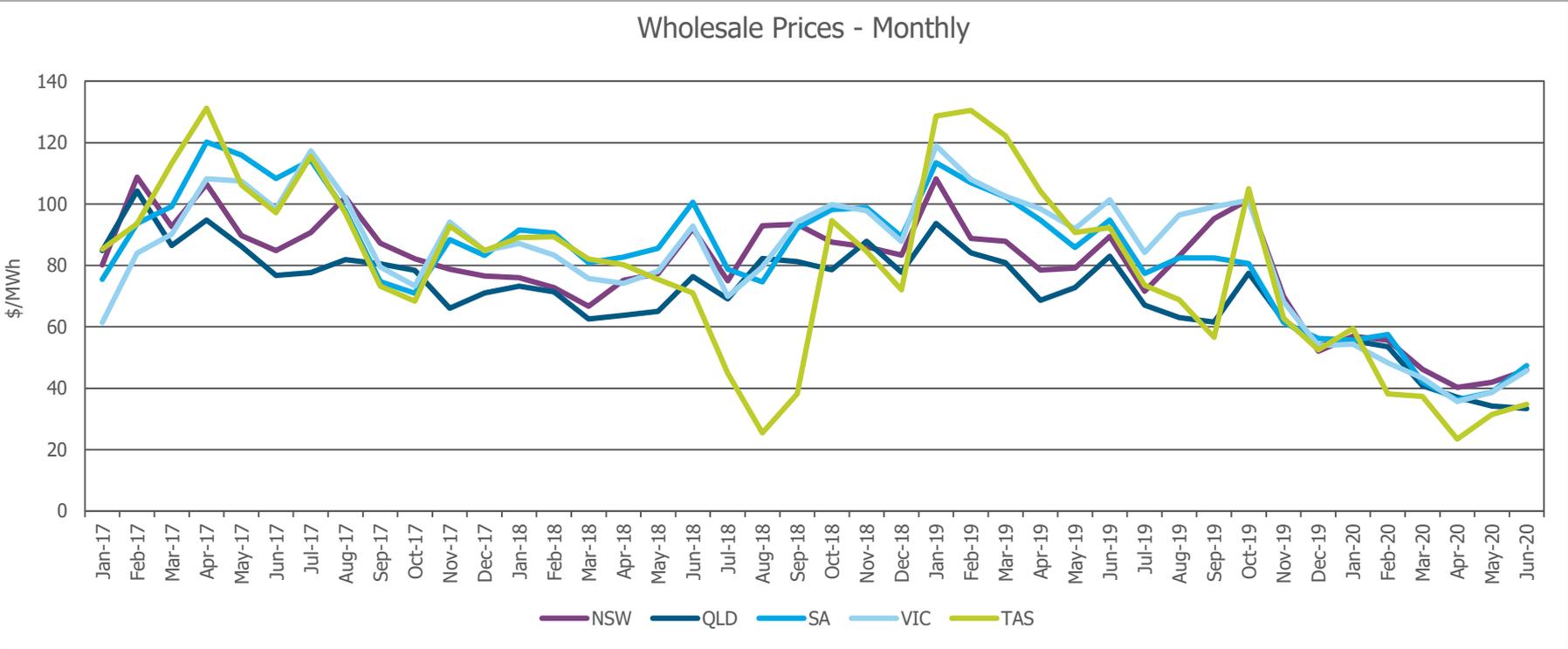
2. WHOLESALE MARKET TRENDS: PRICES

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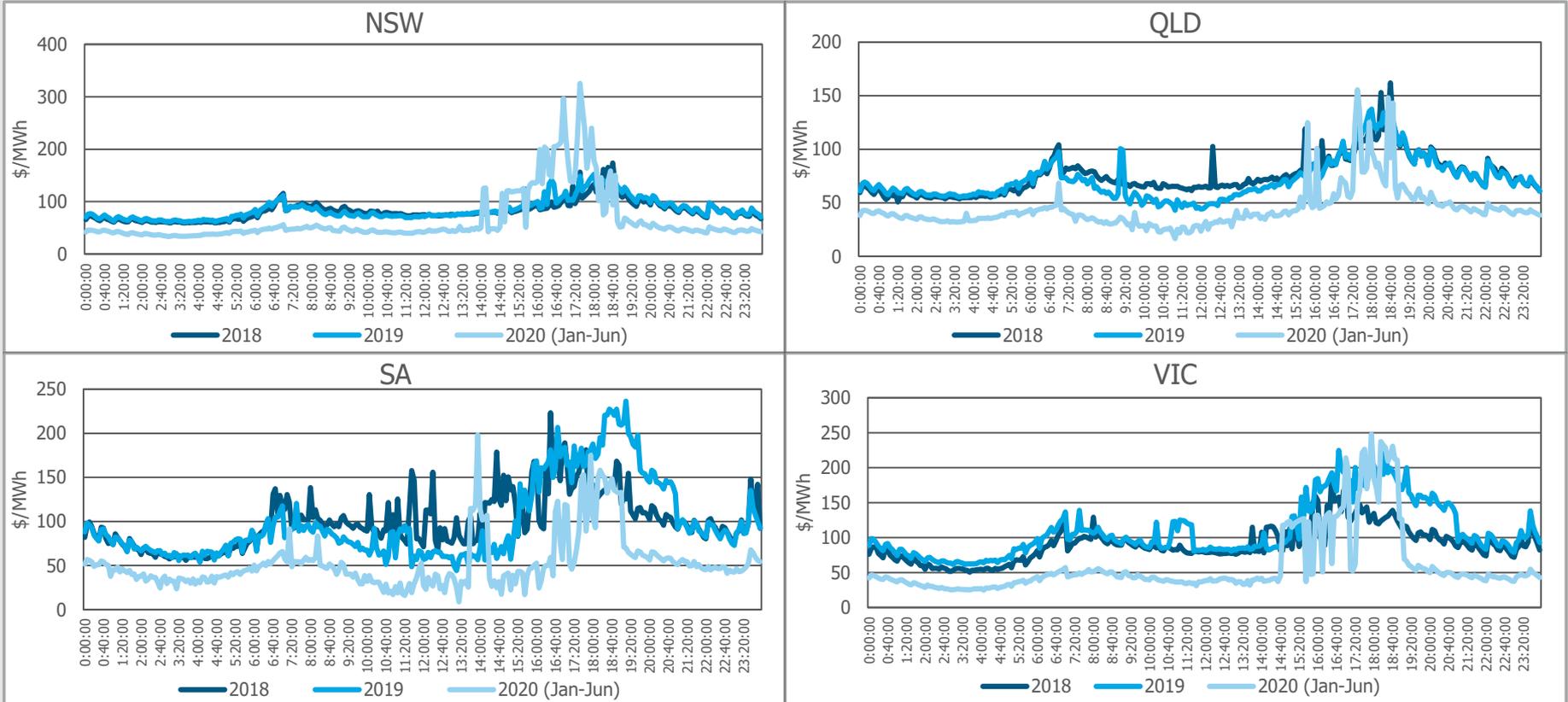
Key points:

- Average wholesale prices have continued to decline from late 2019 but have levelled out towards June 2020.
- Prices in the super peak (4:30 pm to 7 pm) are remaining firm and even rising.
- Afternoon peak becoming steeper across all states in 2020 and appears to be finishing earlier in New South Wales.
- This intra-day demand profile is likely to impact the type of plant entering the market if changes to demand profile are ongoing. For example, faster-response generation such as peaking plant and batteries can react to a shorter peak period compared to less flexible plant.

2. WHOLESALE MARKET TRENDS: PRICES

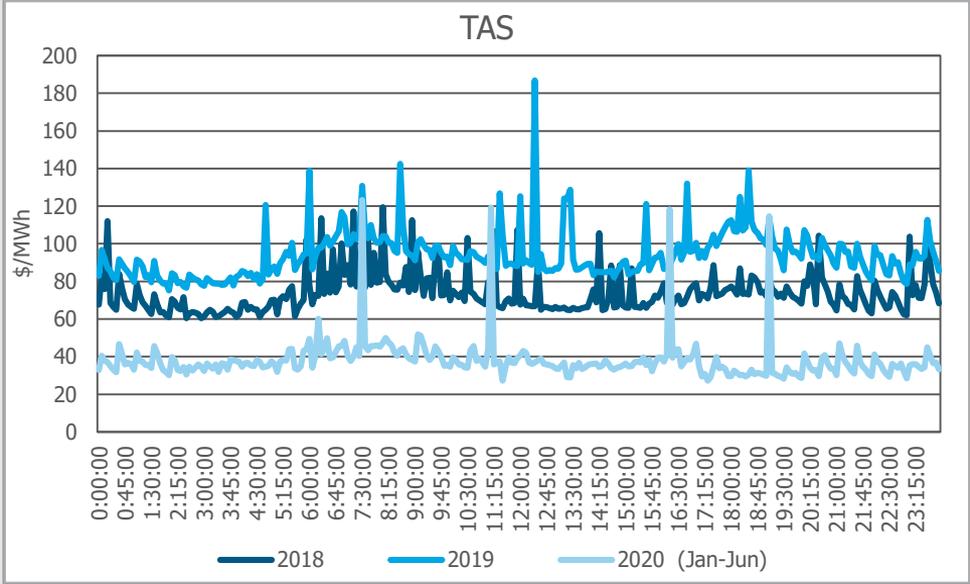


2. WHOLESALE MARKET TRENDS: PRICES



* Note, data for 2020 is only for Jan-Jun, and therefore the results may be influenced by lack of full year environmental conditions.

2. WHOLESALE MARKET TRENDS: PRICES



3. EMERGING ISSUES: POWER SYSTEM RESILIENCE

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- Extreme events, including weather events, appear to be becoming more frequent, exposing the power system to more frequent and extreme external shocks.
- Examples of severe events that have occurred recently include:
 - Bushfires in summer 2019-20[†]
 - Storms, such as extreme wind event in Victoria 31 January 2020
 - COVID-19
- Events on 31 January 2020 led to South Australia being separated from the NEM for 17 days. AEMO forced to intervene extensively to manage the power system, through directions as well as new constraints being created.
- The power system had never operated in this 'extended island' configuration before.

* Climate Council, Weather Gone Wild: Climate Change-Fuelled Extreme Weather in 2018. <https://www.climatecouncil.org.au/wp-content/uploads/2019/02/Climate-council-extreme-weather-report.pdf>

** More details about the Victoria and South Australia Separation Event can be found in the final report, available at https://aemo.com.au/-/media/files/electricity/nem/market_notices_and_events/power_system_incident_reports/2020/final-report-vic-sa-separation-31-jan-2020.pdf?la=en

† <https://naturaldisaster.royalcommission.gov.au/system/files/2020-11/Royal%20Commission%20into%20National%20Natural%20Disaster%20Arrangements%20-%20Report%20%20%5Baccessible%5D.pdf>

3. EMERGING ISSUES: POWER SYSTEM RESILIENCE – SA ISLANDING EVENT

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30 January

High demand forecast for NSW, VIC & SA. Pre-dispatch at MPC for ~4 hours.

31 January

At 13:24, SA region islanded due to transmission towers being destroyed by high winds.

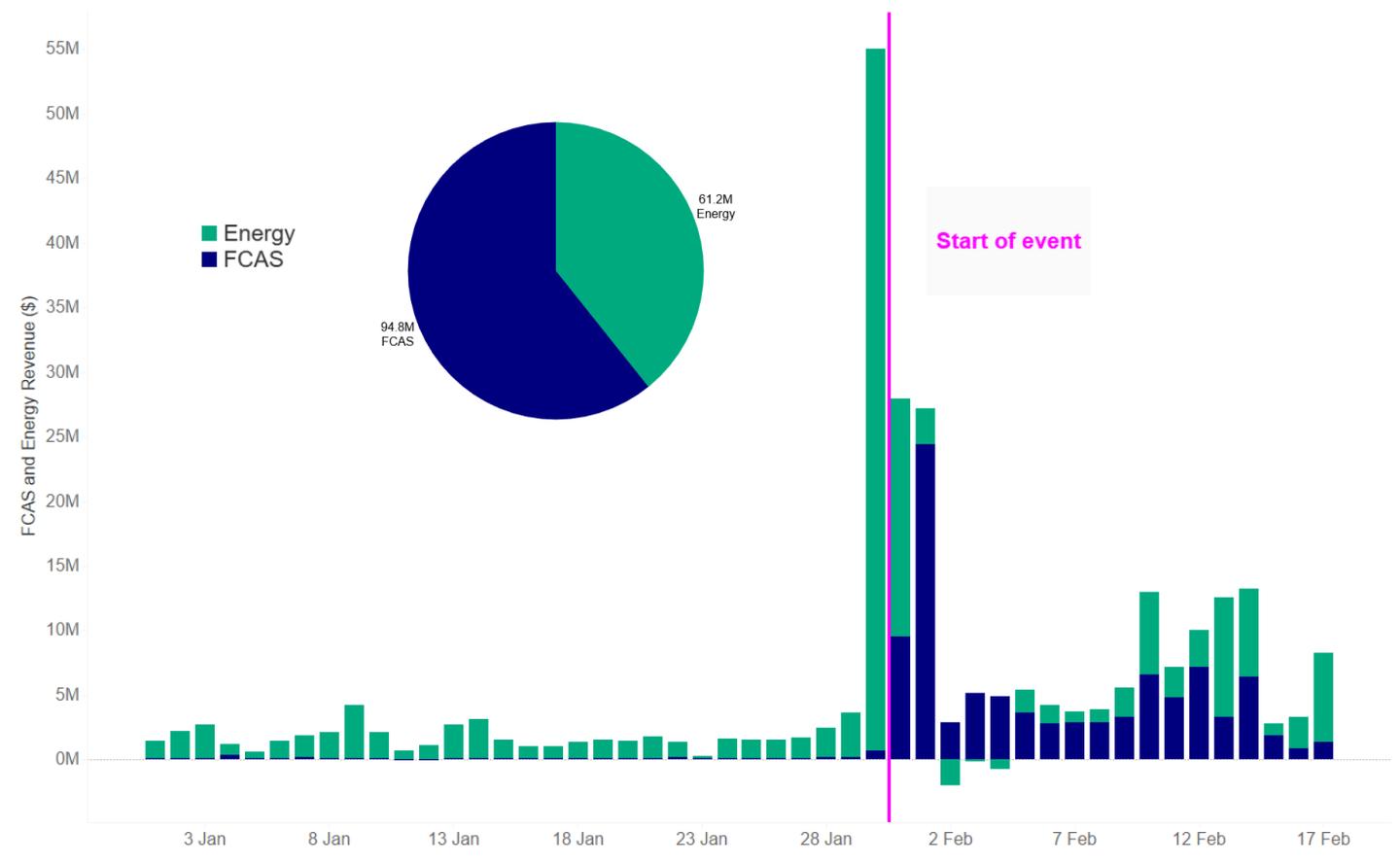
1-16 February

To stabilise the grid during low load periods, AEMO required some semi- and non-scheduled generation to cease during periods of low demand. Mortlake Power Station was operating as base-load. Directions to gas powered generators for system strength.

17 February

At 16:05, South Australia is partially reconnected to the NEM.

3. EMERGING ISSUES: POWER SYSTEM RESILIENCE – SA ISLANDING EVENT



3. EMERGING ISSUES: POWER SYSTEM RESILIENCE – SA ISLANDING EVENT

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- Management of SA event required AEMO to issue more than 50 power system directions in 17 days.
- Total cost of FCAS over the duration of the event was \$94.8 million.
- Situation was able to be managed but required significant operational skill from AEMO, with a high degree of intervention.
- Gas and battery generation played an important role during the event, providing almost 100% of FCAS. The need for such generation was identified following the 2016 black system event. The 2018 South Australian separation event led AEMO to recommend improved primary frequency response.
- AEMC recently completed the Mandatory Primary Frequency Response Rule change in March 2020, requiring scheduled and semi-scheduled generators to support secure operation of the system.
- There are a range of system services projects underway that are expected to help with power system security going forward.
- These reforms could be important to provide the capability for efficiently managing the power system during similar events in the future.

3. EMERGING ISSUES: POWER SYSTEM RESILIENCE

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- The Panel notes that there is a continued need to review power system security and reliability measures in light of the number of events that have been occurring and changes in trends these events bring. Are the right approaches in place, what else may be needed?
- When system security and reliability measures are reviewed in future, it will be equally important to consider the increasing trend of extreme events and ensure that the power system is well equipped to deal with any type of future events.



CONCLUSIONS

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- As noted, 2019/20 presented more challenges in terms of reliability and security than previous years. Operating and maintain reliability and security of the power system continues to be increasingly complex to manage as evidenced by further increases in RERT costs, amount of RERT activations, and reliability/security directions and intervention notices compared to 2018/19.
- The ongoing changes to the system in terms of changing generation mix, sustained and continued extreme events needs to be factored into planning and approaches going forward.
- COVID-19 has not reduced overall total demand but it has changed the demand mix between residential and industrial/commercial consumers. Minimum demand continues to be a focus, particularly the issues it creates for system security including inertia, voltage control, ramp rates and potential use of emergency controls.
- The resilience of the power system is key going forward. Previous trends may not apply post COVID-19 and the recent and ongoing extreme weather events. How should the number of extreme events that the power system has endured in recent times be factored into ongoing planning and approaches to maintaining power system resilience in the future?

REFORMS UNDERWAY

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There are reforms already underway to address power system security and reliability. These include:

- AEMC rules changes, such as:
 - Technical standards for DER
 - Integrating energy storage systems
 - System services, including system strength rule change
 - Primary frequency response requirement
- Panel reviews, including:
 - System restart standard review
 - Frequency operating standard review
 - Annual market performance review.
- ESB Post 2025 work, including workstreams such as:
 - Essential system services and scheduling and ahead markets
 - Valuing demand flexibility and DER integration
 - Resource adequacy mechanisms and ageing thermal generation strategy.

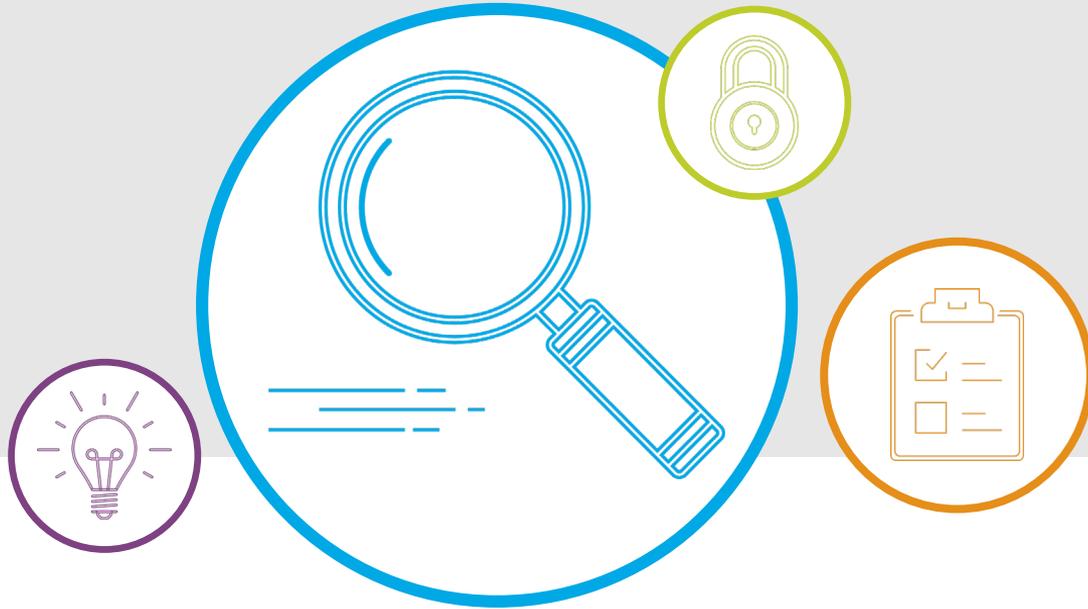
WHAT'S NEXT

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- The Panel will continue to have regard to the key issues highlighted in the update, in particular:
 - Reliability and security matters
 - Overall and decreasing minimum demand
 - Commentary on any further extreme or unusual events, and
 - Power system resilience.
- The next update and annual review will also consider power system safety in more detail, as well as other areas of interest including actual USE and performance of short term PASA.
- The next update and the annual AMPR review will provide useful context to the 2021 Reliability Standard and Settings review, particularly as the market continues to change and the post-2025 market design reforms underway by the Energy Security Board.

WHAT WE DO

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The Reliability Panel, which forms part of the AEMC's institutional arrangements, **reviews and reports** on the safety, security and reliability of the national electricity system.

WHO WE ARE

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The Panel is comprised of members who represent a range of participants in the national electricity market, including:



Consumer groups



Generators



Network businesses



Retailers



Australian Energy Market Operator (AEMO)

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