AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

NEM Lack of Reserve Framework Report

31 January 2019

Reporting period 1 October 2018 to 31 December 2018

A report for the National Electricity Market on the operation of the Lack of Reserve Framework

Important notice

PURPOSE

AEMO has prepared this document under clause 4.8.4B of the National Electricity Rules to report on the operation of the NEM Lack of Reserve Framework for the period 1 October 2018 to 31 December 2018.

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VERSION CONTROL

Version	Release date	Changes
1	31 January 2019	Initial version

Executive summary

This report has been published in accordance with clause 4.8.4B of the National Electricity Rules.

During the reporting period 1 October 2018 to 31 December 2018, AEMO declared a total of 9 Lack of Reserve (LOR) conditions, either forecast or actual. This is compared to a total of 17 LOR conditions declared during the previous reporting period (1 July 2018 to 30 September 2018).

During the reporting period the predominant cause of LOR conditions were planned network and generator outages, reducing availability of supply, with some instances occurring during periods of moderately high demand. Of the 9 forecast LOR conditions initially declared, 1 resulted in an actual LOR1 declaration.

The next report on the NEM Lack of Reserve Framework, for the reporting period 1 January 2019 to 31 March 2019, will be published by 30 April 2019.

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1. Introduction

This report has been published in accordance with clause 4.8.4B of the National Electricity Rules (NER), to provide a high-level analysis of how the lack of reserve framework is operating. This report covers the period 1 October 2018 to 31 December 2018.

This report is divided into three sections:

- Reserve Level Declaration Guidelines – a summary of changes to the Guidelines over the past quarter, and an update on the progress of the consultation that is under way.
- Lack of Reserve (LOR) conditions declared – a list of all LOR conditions declared or revised during the past quarter (based on market notices), including an indication of the required reserve level and if the requirement was set by the Forecast Uncertainty Measure (FUM) or the largest credible risk/s in the region. The FUM value for the respective period is also provided. Table 1 below provides a high-level summary of the LOR declarations and their causes.
- Review of Performance – a review of the performance of the lack of reserve framework and any observed trends, providing an assessment of FUM values compared to previous quarters, determinants of reserve level requirements, number of LOR declarations and causes of LOR declarations.

For further information, contact AEMO Operational Planning: op.forecasting@aemo.com.au.

The next report on the NEM Lack of Reserve Framework, for the reporting period 1 January 2019 to 31 March 2019, will be published by 30 April 2019.

Table 1 Summary of forecast and actual LOR conditions, with causing factors.

Effective day	Region	LOR1		LOR2		Cause
		Actual	Forecast	Actual	Forecast	
02/11/2018	NSW				1	This forecast LOR2 was due to relatively high demand and reduced generation availability. It was later cancelled due to an increase in generation availability.
05/11/2018	QLD		1		1	A LOR2 forecast (17:00-18:00) was due to reduction in generational capability), later being cancelled due to increasing generation availability The forecast LOR2 was then re-issued due to an increase in the FUM, later being cancelled due to a decrease in forecast demand and an increase in generation availability. A third forecast LOR2 was issued due to an increase in forecast demand. The forecast LOR2 events were later cancelled due to an increase in generation availability. A forecast LOR1 condition was attributed to increase in generation availability; resulting in reserve level increasing above LOR2 trigger level; however, less than LOR1 trigger level. Attributed to an increase in generation availability. The

Effective day	Region	LOR1		LOR2		Cause
		Actual	Forecast	Actual	Forecast	
						forecast LOR1 was cancelled due to increasing generation availability.
06/11/2018	QLD	1			1	A forecast LOR1 (17:00–19:00) was due to relatively high demand and reduced generation availability. A forecast LOR1 was then increased to a forecast LOR2 due to an increase in forecast demand and a reduction in generation availability. The forecast LOR2 was later cancelled due to an increase in interconnector imports combined with an increase in generation availability. The forecast LOR2 was then re-issued due to an increase in the FUM, later cancelled due to an increase in generation availability. A third LOR2 was forecast (17:00-19:30) due to a reduction in generation availability. The forecast LOR2 event was cancelled and revised to LOR1 due to increase in generation availability. The LOR1 forecast was cancelled due to increasing generation availability. An LOR1 forecast event (17:00-19:00) was due to an increase in demand. A forecast LOR2 was due to a reduction in generation availability. The fourth forecast LOR2 was due to a decrease in generation availability. LOR2 forecast event was cancelled due to a both a slight decrease in demand and an increase in generation availability. These changes led to reassessment as a forecast LOR1. The initially forecast LOR1 was later declared an actual LOR1 due to a combination of generation plant outages and moderate demand.
21/11/2018	QLD		1		1	A forecast LOR1 condition resulted from a planned outage reducing generation availability. The forecast LOR2 condition was due to the FUM setting the reserve requirement. LOR conditions were later cancelled due to an increase in generation availability.
07/12/2018	VIC				1	The forecast LOR2 condition was predominantly due to relatively high demand and reduced generator availability. It was later cancelled due to an increase in generation availability.
12/12/2018	VIC				1	An LOR2 condition was forecast due to moderately high demand and reduced generation availability. It was later cancelled due to an increase in generation availability.
Total		1	2	0	6	**9**

The count of LOR conditions uses the methodology defined in section 3.

2. Reserve Level Declaration Guidelines

2.1 Changes in the reporting period

During the reporting period AEMO implemented changes to the Guidelines designed to further develop and improve the performance of the framework. The changes to the Guidelines were primarily focused on updating the methodology to account for other sources of potential forecasting error, driven by operational experience and learnings gained since implementation of the Guidelines in February 2018.

AEMO launched a consultation to update the Guidelines on 16 July 2018. For detailed information on the changes to the Guidelines refer to the consultation webpage [1]. The consultation was completed on 14 November 2018 with the publishing of the Final Report and the updated Reserve Level Declaration Guidelines. The changes to the Guidelines became effective on 12 December 2018, and the IT system changes were implemented on 13 December 2018[2].

[1] http://aemo.com.au/Stakeholder-Consultation/Consultations/Changes-to-Reserve-Level-Declaration-Guidelines?Convenor=AEMO%20NEM

[2] Refer to Market Notice 65921 issued on 13 December 2018 at 13:31.

3. Lack of Reserve Conditions Declared

Table 2 lists all forecast and actual LORs declarations over the reporting period 1 October 2018 to 31 December 2018. Table 2 also identifies the market notices that communicated updates to, and cancellation of either forecast or actual LOR conditions.

The total count for LOR conditions is based on the following principles:

- All market notices making the initial declaration of a forecast or actual LOR condition during the reporting period were counted.
- Any market notices which updated previously issued forecast or actual LORs for a given effective date (in relation to the reserve requirement, reserve capacity available or effective period) were not counted to prevent double counting of update notices.
- In cases where forecast LORs were cancelled but subsequently re-issued with approximately the same effective period, re-issues were not counted to prevent double counting of effective periods.
- Updates to existing LOR conditions where the LOR level changed were counted as separate LOR conditions.
- Any forecast LORs which were subsequently declared as actual LORs at the same LOR level are counted once. In the summary table in section 1 these are shown as actual conditions only.

Table 2 LOR notices declared during reporting period 1 October 2018 and 31 December 2018

Effective date	Market Notice ID	Issue date and time	Effective time	Level	Actual, forecast, update or cancel	Comments	Reserve requirement (MW)[3]		FUM value (MW)[4]	Reserve requirement set by[5]
							Required	Available		
NSW Region										
2/11/2018	65254	2/11/2018 7:15	15:30-17:30	LOR2	Forecast	LOR2 condition forecast due to relatively high demand and reduced generation availability. The forecast demand peak was 11,357 MW and the actual demand for the corresponding interval was 11,188 MW.	1,664	1,419	1,664	FUM
	65263	2/11/2018 10:48	n/a	LOR2	Cancelled	LOR2 condition cancelled predominantly due to an increase in generation availability.	1,595	1,855	1,595	FUM
QLD Region										
5/11/2018	65275	2/11/2018 19:34	17:00-1800	LOR2	Forecast	LOR2 condition forecast due a combination of generation plant outages and moderately high demand. The forecast demand peak was 8,336 MW and the actual demand for the corresponding interval was 8,432 MW.	1,067	901	1,067	FUM
	65279	2/11/2018 20:30	16:30-19:30	LOR2	Update	Update to existing LOR2 with changes in reserve requirements and effective period.	1,140	874	1,140	FUM
	65289	3/11/2018 9:08	16:30-19:30	LOR2	Update	Update to existing LOR2 with changes in reserve requirements and effective period.	1,003	758	1,003	FUM
	65294	3/11/2018 18:53	n/a	LOR2	Cancelled	The forecast LOR2 condition was cancelled due to an increase in generation availability.	922	1,148	922	FUM

[3] Reserve levels required and available are the values as stated in the market notice and correspond to the interval with the lowest reserve available.

[4] This column represents the FUM value of the intervals which correspond to the reserve requirement stated in the market notice.

[5] LCR refers to Largest Credible Risk, this is the single largest credible risk in the region. LCR2 refers to the sum of the two largest credible risks in the region.

Effective date	Market Notice ID	Issue date and time	Effective time	Level	Actual, forecast, update or cancel	Comments	Reserve requirement (MW)[3]		FUM value (MW)[4]	Reserve requirement set by[5]
							Required	Available		
	65299	4/11/2018 13:00	17:00-19:00	LOR2	Forecast	Forecast LOR2 condition re-issued predominantly due to an increase in FUM.	1,124	1,058	1,124	FUM
	65301	4/11/2018 20:44	n/a	LOR2	Cancelled	Forecast LOR2 condition cancelled due to a slight decrease in demand and an increase in generation availability.	907	977	907	FUM
	65302	4/11/2018 20:44	17:00-19:30	LOR1	Forecast	LOR1 condition forecast due to relatively high demand and reduced generator availability.	1,164	977	907	LCR2
	65305	5/11/2018 6:01	16:30-19:00	LOR2	Forecast	Forecast LOR2 condition re-issued predominantly due to an increase in the forecast demand peak to 8,551 MW. The actual demand for the corresponding interval was 8,475 MW.	952	809	952	FUM
	65308	5/11/2018 9:49	n/a	LOR2	Cancelled	Forecast LOR2 condition cancelled predominantly due to an increase in generation availability.	929	964	929	FUM
	65309	5/11/2018 10:02	17:00-19:30	LOR1	Update	Update to existing LOR1 forecast with changes to reserve requirements and effective period.	1,130	972	905	LCR2
	65311	5/11/2018 12:48	n/a	LOR1	Cancelled	LOR1 forecast cancelled due to reduction in the level of LCR2.	964	965	829	LCR2
6/11/2018	65268	2/11/2018 14:45	17:00-19:00	LOR1	Forecast	LOR1 condition forecast due to relatively high demand and reduced generator availability. The forecast demand peak was 8,317 MW and the actual demand for the corresponding interval was 8,390 MW.	1,193	1,079	n/a as forecast period beyond 72hrs ahead	LCR2
	65290	3/11/2018 9:09	17:00-19:30	LOR2	Forecast	LOR2 condition forecast due to an increase in the forecast demand peak to 8,664 MW combined with a reduction of approximately 200 MW in generation availability. The actual demand for the corresponding interval was 8,390 MW.	725	672	n/a as forecast period beyond 72hrs ahead	LCR

Effective date	Market Notice ID	Issue date and time	Effective time	Level	Actual, forecast, update or cancel	Comments	Reserve requirement (MW)[3]		FUM value (MW)[4]	Reserve requirement set by[5]
							Required	Available		
	65291	3/11/2018 15:13	13:00-20:00	LOR1	Update	Update to existing LOR1 forecast with changes to reserve requirement and effective period.	1,192	725	n/a as forecast period beyond 72hrs ahead	LCR2
	65293	3/11/2018 15:13	n/a	LOR2	Cancelled	Forecast LOR2 condition cancelled predominantly due to an increase in interconnector imports combined with an increase in generation availability.	725	725	n/a as forecast period beyond 72hrs ahead	LCR2
	65295	3/11/2018 19:05	16:30-18:30	LOR2	Forecast	Forecast LOR2 condition re-issued predominantly due to the FUM setting the reserve requirement.	1,080	890	1,080	FUM
	65303	4/11/2018 20:46	n/a	LOR2	Cancelled	Forecast LOR2 condition cancelled due to an increase in generation availability.	1,122	1,131	1,122	FUM
	65304	4/11/2018 20:46	17:00-17:30	LOR1	Forecast	A LOR1 is forecast directly after the cancellation of LOR2; as remaining generation availability still warranted a LOR1.	1,163	1,131	1,122	LCR2
	65307	5/11/2018 9:30	16:30-19:00	LOR2	Forecast	Forecast LOR2 condition re-issued predominantly due to an increase in the level of the FUM.	1,216	1,051	1,216	FUM
	65310	5/11/2018 10:49	n/a	LOR2	Cancelled	Forecast LOR2 condition cancelled due to an increase in generation availability.	1,120	1,298	1,120	FUM
	65312	5/11/2018 12:51	n/a	LOR1	Cancelled	Forecast LOR1 condition cancelled due to an increase in generation availability.	1,168	1,298	1,120	LCR2
	65313	5/11/2018 19:23	17:00-19:00	LOR1	Forecast	Forecast LOR1 condition re-issued due to a decrease in generation availability.	1,069	996	922	LCR2

Effective date	Market Notice ID	Issue date and time	Effective time	Level	Actual, forecast, update or cancel	Comments	Reserve requirement (MW)[3]		FUM value (MW)[4]	Reserve requirement set by[5]
							Required	Available		
	65318	6/11/2018 7:05	17:00-1900	LOR2	Forecast	Forecast LOR2 condition re-issued due predominantly to a decrease in generation availability and an increase in FUM.	1,028	935	1,028	FUM
	65331	6/11/2018 8:42	17:00-20:00	LOR2	Update	Update to existing LOR2 forecast with changes to reserve requirement and effective period.	918	689	918	FUM
	65337	6/11/2018 14:26	n/a	LOR2	Cancelled	Forecast LOR2 condition cancelled predominantly due to a decrease in the FUM and a decrease in the forecast demand peak to 8,470MW. The actual demand for the corresponding interval was 8,390MW.	697	722	697	FUM
	65338	6/11/2018 14:33	16:30-19:30	LOR1	Update	Update to existing LOR1 forecast with changes to reserve requirements and effective period.	1,024	781	709	LCR2
	65340	6/11/2018 16:41	16:30-19:30	LOR1	Actual	Actual LOR1 declared.	1,024	784	534	LCR2
	65353	6/11/2018 19:43	n/a	LOR1	Cancelled	Cancellation of actual LOR1 condition.	n/a	n/a	n/a	LCR2
	65354	6/11/2018 19:48	n/a	LOR1	Cancelled	Cancellation of forecast LOR1 condition.	n/a	n/a	n/a	LCR2
21/11/2018	65446	18/11/2018 14:32	17:00	LOR1	Forecast	Forecast LOR1 condition due to a planned outage reducing generation availability. Note: the reserve requirement published in the market notice was incorrect and corrected in market notice 65447.	630	911	n/a as forecast period beyond 72hrs ahead	LCR2
	65447	18/11/2018 14:35	17:00	LOR1	Forecast	Update to correct reserve requirement amount for the forecast LOR1 condition published in market notice 65446.	930	911	n/a as forecast period beyond 72hrs ahead	LCR2
	65452	18/11/2018 18:55	16:30-17:00	LOR2	Forecast	Forecast LOR2 condition due to the FUM setting the reserve requirement.	1,000	888	1,000	FUM

Effective date	Market Notice ID	Issue date and time	Effective time	Level	Actual, forecast, update or cancel	Comments	Reserve requirement (MW)[3]		FUM value (MW)[4]	Reserve requirement set by[5]
							Required	Available		
	65453	18/11/2018 18:54	n/a	LOR1	Cancelled	Forecast LOR1 condition cancelled following the forecast of LOR2.	1,000	888	1,000	LCR2
	65455	18/11/2018 19:57	n/a	LOR1	Cancelled	Cancels notice 65446.	1,000	888	1,000	LCR2
	65459	19/11/2018 6:33	15:30-17:00	LOR2	Update	Update to existing LOR2 forecast with changes to reserve requirement and effective period.	1,015	684	1,015	FUM
	65460	19/11/2018 12:51	n/a	LOR2	Cancelled	Cancellation of forecast LOR2 condition due to an increase in generation availability.	954	1,406	954	FUM
VIC Region										
7/12/2018	65791	6/12/2018 18:50	17:00	LOR2	Forecast	Forecast LOR2 condition predominantly due to relatively high demand and reduced generator availability.	1,234	1,197	1,234	FUM
	65820	7/12/2018 5:28	16:00-17:30	LOR2	Update	Update to existing LOR2 forecast with changes to reserve requirement and effective period.	1,290	1,175	1,290	FUM
	65821	7/12/2018 11:13	n/a	LOR2	Cancelled	Cancellation of forecast LOR2 condition due to an increase in generation availability.	1,236	1,250	1,236	FUM
12/12/2018	65877	10/12/2018 16:44	16:00-17:00	LOR2	Forecast	LOR2 condition forecast due moderately high demand and reduced generation availability. The forecast demand peak was 7,481 MW and the actual demand for the corresponding interval was 7,336 MW.	1,175	1,087	1,175	FUM
	65879	10/12/2018 19:02	n/a	LOR2	Cancelled	Cancellation of forecast LOR2 condition due to an increase in generation availability.	1,275	1,661	1,275	FUM

4. Review of Performance

4.1 Forecast Uncertainty Measure values

The following section details the average, minimum and maximum FUM values for this reporting period, as compared with Q1 (January to March 2018), Q2 (April to June 2018) and Q3 (July to September 2018). These values can be seen in Figure 1 to Figure 5 below for each region, and are summarised as follows:

- For NSW, average FUM values decreased compared to the previous reporting period. Maximum FUM values increased for the horizon up to 24 hours ahead and remained relatively stable beyond 24 hours ahead. Minimum FUM values have remained relatively stable up to 6 hours ahead and significantly decreased beyond 6 hours ahead.
- For QLD, average FUM values generally remained stable and, in some cases, decreased minimally. Maximum FUM values increased but this has generally been offset by a corresponding decrease in minimum FUM values.
- For SA, average FUM values decreased compared to the previous reporting period. Maximum FUM values are generally similar to values from the previous reporting period. Minimum FUM values generally decreased.
- For TAS, average FUM values decreased compared to the previous reporting period. In general, both maximum and minimum FUM values are generally similar to corresponding values from the previous reporting period.
- For VIC, average FUM values decreased for the horizon up to 12 hours ahead and have remained relatively stable beyond 12 hours ahead. Maximum FUM values increased. Minimum FUM values increased for the horizon up to 6 hours ahead but decreased beyond 6 hours ahead.

Figure 1 NSW region: maximum, minimum and average FUM values for the reporting period.

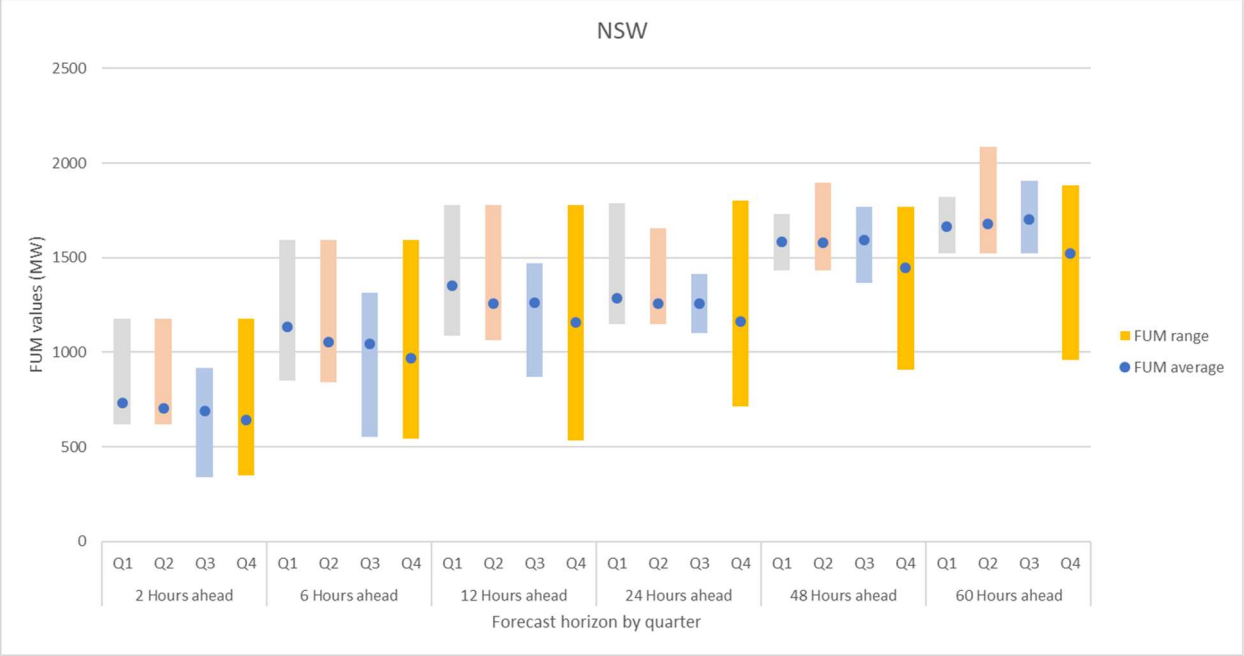


Figure 2 QLD region: maximum, minimum and average FUM values for the reporting period.

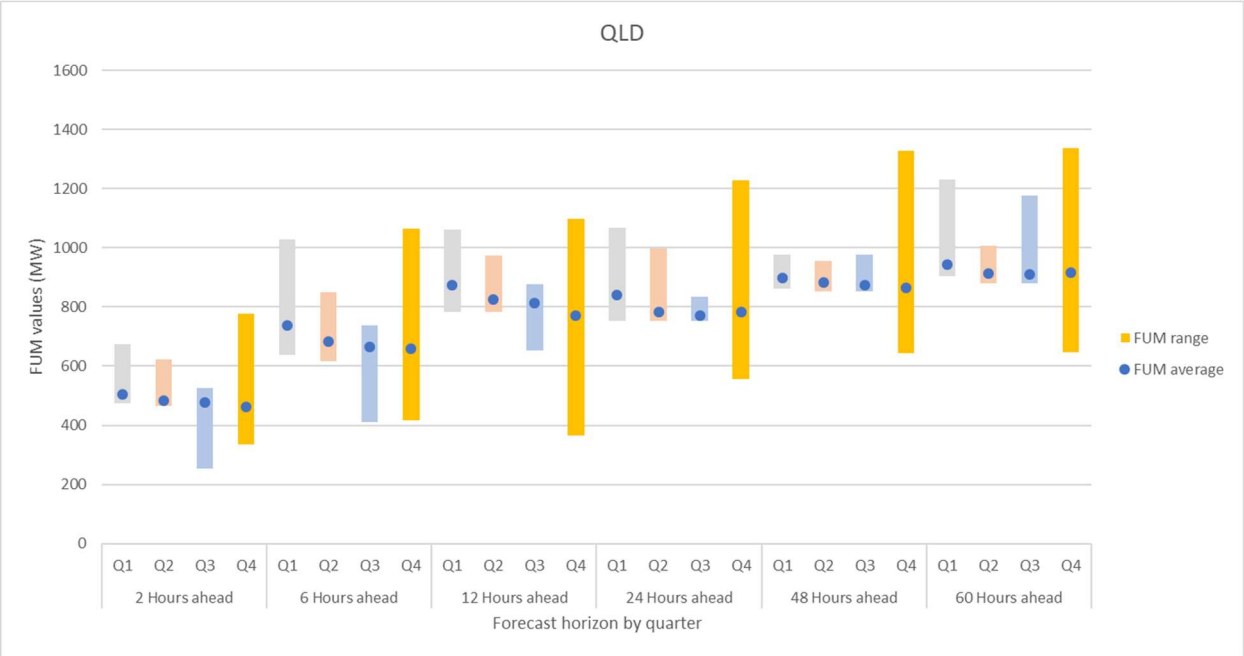


Figure 3 SA region: maximum, minimum and average FUM values for the reporting period.

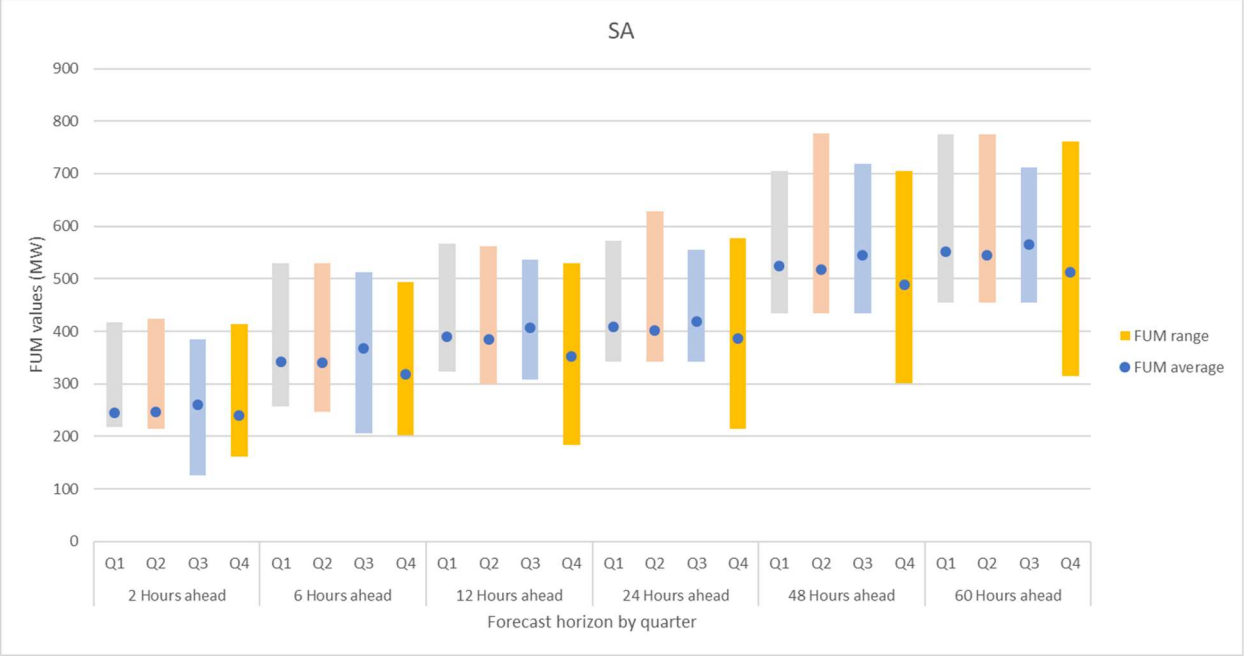


Figure 4 TAS region: maximum, minimum and average FUM values for the reporting period.

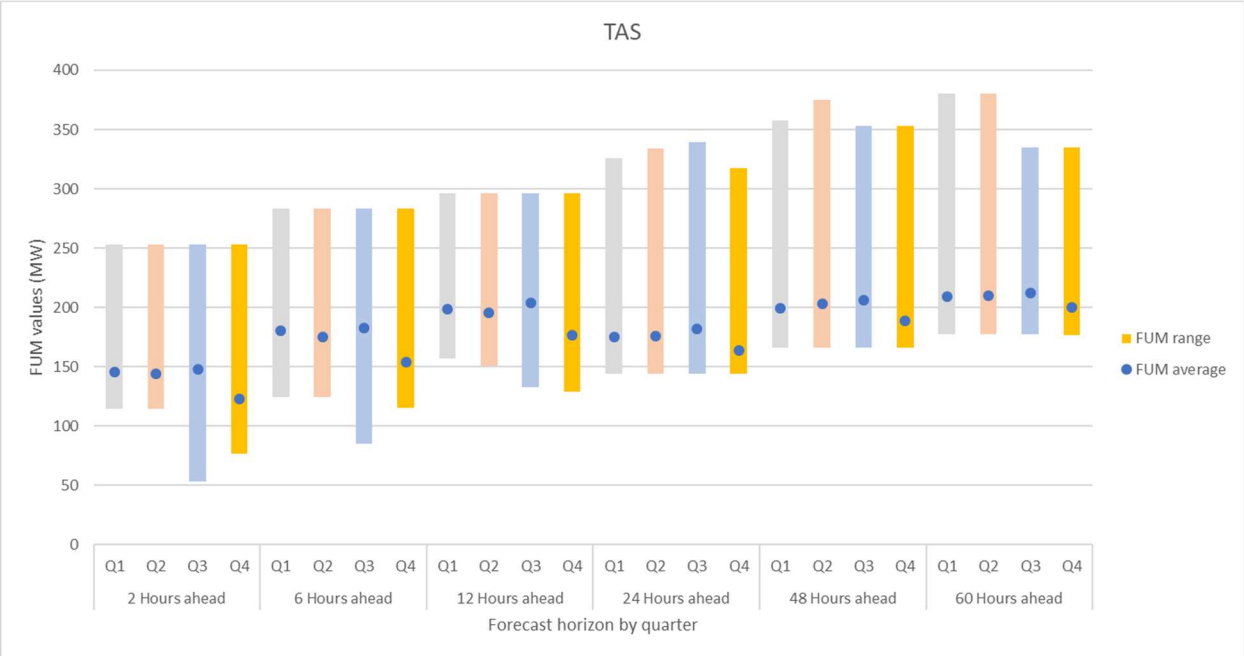
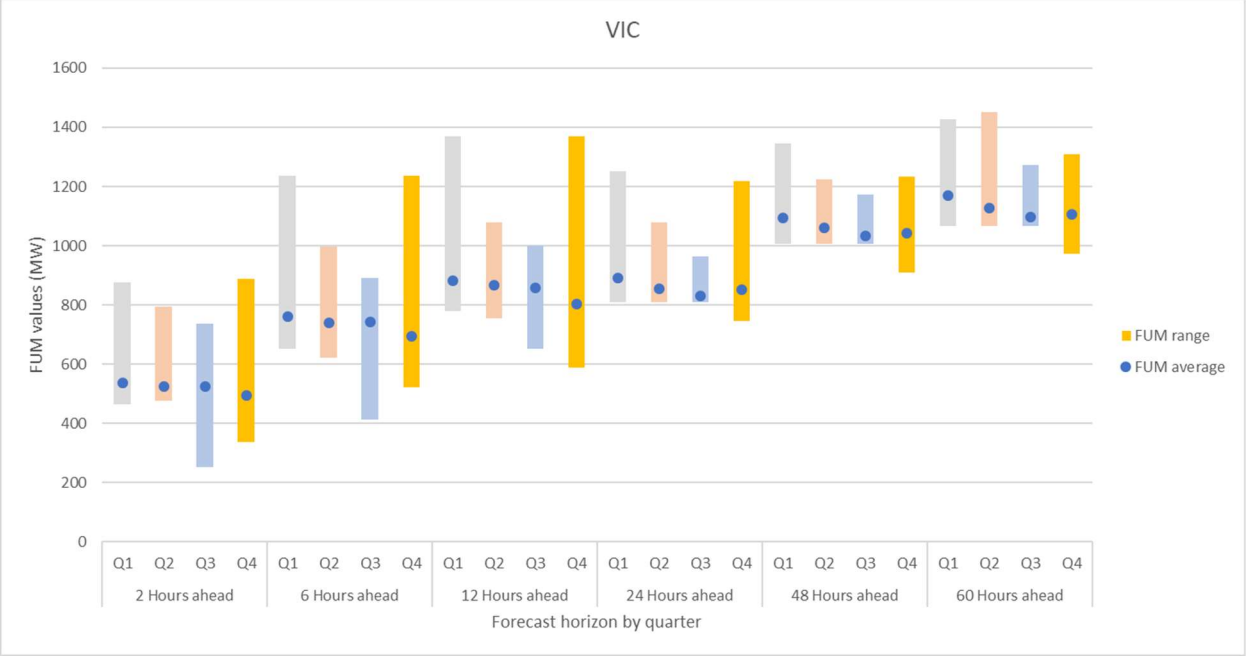


Figure 5 VIC region: maximum, minimum and average FUM values for the reporting period.



4.2 LOR declaration reserve requirements

This section summarises how the reserve requirements were set during any LOR periods. Of the total nine LOR declarations, in six instances the reserve requirements were set by the FUM and in the other three instances the reserve requirements were set by the LCR or LCR2.

In one out of the six cases where the FUM set the reserve requirement, the FUM value acted to raise the reserve requirement of an existing LOR1 condition (where the reserve requirement was set by the LCR2) and resulted in a forecast LOR2. In this case an actual LOR1 was subsequently declared (with the reserve requirement being set by the LCR2) indicating genuine lack of reserve conditions.

All six forecast LOR2 conditions, were declared with the FUM setting the reserve requirement, although both the FUM and the LCR set the reserve requirement for the forecast LOR2 in QLD on 6 November 2018[6]. All LOR1 conditions were declared with the LCR2 setting the reserve requirement.

Table 3 below shows which values set the reserve requirement for the forecast and actual LORs in the reporting period.

Table 3 LORs declared during the reporting period by trigger (FUM or LCR).

Yellow indicates the requirement was set by the LCR, and Orange indicates the requirement was set by the FUM.

Effective period	LOR1	LOR2
New South Wales (NSW)		
02/11/2018		Forecast
Queensland (QLD)		
05/11/2018	Forecast	Forecast

[6] For the forecast LOR2 declaration in QLD on 6 November 2018, the reserve requirement was set by both LCR and FUM due to the different component setting the reserve requirement at the time of the respective market notice being issued.

Effective period	LOR1	LOR2	
06/11/2018	Forecast then Actual	Forecast	Forecast
21/11/2018	Forecast	Forecast	
Victoria (VIC)			
7/12/2018		Forecast	
12/12/2018		Forecast	

4.3 Forecast and actual LOR declarations

During the reporting period there were six forecast LOR2s. None of these forecast LOR2s were subsequently declared as actual LOR2 conditions, but. three of the six were subsequently declared as forecast LOR1s, with one resulting in an actual LOR1. To summarise, during the reporting period there were six separate effective periods forecast as LOR conditions, and of these six, one progressed from a forecast condition to an actual condition. This is best reflected in Table 3 above, which shows the days affected by various LOR conditions, either forecast or actual.

During the reporting period there were three forecast LOR1s with one of the three subsequently being declared as an actual LOR1. The actual LOR1 was flagged earlier (with additional lead time), as a forecast LOR2 condition.

Where a forecast LOR did not result in an actual LOR condition, the predominant cause of the cancellations was market response resulting in increased available generation, and in some cases a reduction in the FUM value.

4.4 Number and cause of LOR declarations

A total of nine LOR conditions (forecast or actual) were declared during the reporting period, less than for the previous reporting period, which saw 17 LOR declarations.

During this period LOR conditions were predominantly caused by reduced generator availability, moderate to high demand, and planned transmission network outages. The trends in the causes for LORs for this reporting period have not changed significantly since the previous reporting period.

Of the nine forecast LOR conditions initially declared, one resulted in an actual LOR1 condition. In cases where forecast conditions did not eventuate in actual LORs, this was predominantly the result of increases in generation availability after the publication of the LOR forecast.

Glossary

This document uses many terms that have meanings defined in the National Electricity Rules (NER). The NER meanings are adopted unless otherwise specified.

For each of the terms below, refer to the Guidelines for further information.

Term	Definition
FUM	Forecast Uncertainty Measure. The number of MWs representing the level of forecasting uncertainty.
Guidelines	The Reserve Level Declaration Guidelines published by AEMO under clause 4.8.4A of the NER
LCR	Largest Credible Risk. This is the single largest credible risk in the region.
LCR2	Largest Credible Risk 2. This is the sum of the two largest credible risks in the region.
LOR1	Lack of Reserve 1. The threshold for an LOR1 is determined by the larger value of either the Forecast Uncertainty Measure or the sum of the two largest credible risks in the region (i.e. LCR2).
LOR2	Lack of Reserve 2. The threshold for an LOR2 is determined by the larger value of either the Forecast Uncertainty Measure or the largest credible risk in the region (i.e. LCR).
LOR3	Lack of Reserve 3. The threshold for an LOR3 condition is when the forecast reserve for a region is at or below zero.