AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

NEM Lack of Reserve Framework Report

31 July 2019

Reporting period 1 April 2019 to 30 June 2019

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 April 2019 to 30 June 2019.

DISCLAIMER

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VERSION CONTROL

Version	Release date	Changes
1	31 July 2019	Initial version

Executive summary

In the reporting period 1 April to 30 June 2019 (Quarter 2 2019), AEMO declared one Lack of Reserve (LOR) condition[1], compared with 27 in the previous reporting period (Quarter 1 2019). Twenty LOR conditions were declared for the same period last year (Quarter 2 2018)[2]. The declared condition was a forecast LOR1.

Quarter 2 2019 covered the shoulder autumn months, with a low number of high demand periods, relative to the prior quarter. The main reason for the low number of LOR conditions compared to the prior quarter was predominantly due to reduced demand. The main reason for the low number of LOR conditions compared to the same period in previous years is predominantly due to the increased generation availability during this reporting period.

The one forecast LOR condition in Quarter 2 2019 was not set by the FUM. In Quarter 1 2019, ten of the 27 forecast LOR conditions (37%) were set by the FUM.

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

[1] Forecast or actual LOR1, LOR2, or LOR3.

[2] Published 27 July 2018, available on AEMO's website at https://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Power_System_Ops/LOR-Framework-Quarterly-Reports/2018/NEM-Lack-of-Reserve-Framework-Report-qtr-ending-30-June-2018.pdf.

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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 from 1 April 2019 to 30 June 2019.

This report is divided into three sections:

- **Reserve Level Declaration Guidelines** – a summary of changes to the Guidelines over the past quarter, and the retraining of the Bayesian Belief Network.
- **Lack of Reserve (LOR) conditions declared** – details 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 (LCR) 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 leading factors or causes of LOR declarations.

Please direct all LOR inquiries to www.aemo.com.au/Contact-us. In the inquiry form field '*What is your enquiry regarding?* write "**LOR Framework Report**".

The next LOR Framework report, for the period 1 July 2019 to 30 September 2019, will be published by 31 October 2019.

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

Effective date*	Region	LOR1		LOR2		LOR3		Cause
		Actual	Forecast	Actual	Forecast	Actual	Forecast	
08/6/2019	NSW		1					Reduced generation availability
Total		0	1	0	0	0	0	1

* Effective date is the date on which the condition has or is expected to occur, and may differ from the date on which a market notice advising of the (forecast) condition is issued.

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, there were no changes to the Guidelines[3].

2.2 Retraining of the Bayesian Belief Network

The Bayesian Belief Network (BBN) is the algorithm which determines the Forecasting Uncertainty Measure (FUM), which in turn can determine Lack of Reserve (LOR) levels. This process is summarised in the Guidelines.

The intention of retraining the BBN is to update the network to include recent historical data since the last retraining. AEMO commenced retraining of the BBN in July 2019 to include data up to 30 June 2019. The retraining involves a three-stage process:

1. An Extract-Transform-Load (ETL) stage, to extract historical data up to 30 June 2019, perform data validation and cleansing, and compile the data into the structured format required to incorporate into the network.
2. An analysis and modelling stage, to update the network and compile the network nodes.
3. A test and verification stage, to ensure the retrained network is suitable for production implementation.

AEMO is in the final stage of the retraining process and plans to implement the retrained BBN into production in July 2019, pending final verification and readiness checks in the pre-production environment.

2.2.1 Results from retraining

To verify the retraining AEMO completed a backcast of all forecast intervals from April 2018 to March 2019 using the existing BBN and the retrained BBN.

The results of this comparison indicate that changes to future FUM values can be expected due to the retrained BBN as follows:

- New South Wales – a minor decrease in mean FUM values of approximately 15 MW for all forecast horizons. Minor changes (+/- 5 MW) to minimum FUM values for all forecast horizons. An increase in maximum FUM values of approximately 40 MW for forecast horizons beyond 36 hours ahead; maximum FUM values unchanged for other forecast horizons.
- Queensland – a minor increase in mean FUM values of approximately 10 MW for all forecast horizons. A minor increase in minimum FUM values of approximately 15 MW for forecast horizons up to 12 hours ahead; a minor decrease of approximately 10 MW in minimum FUM values for all forecast horizons beyond 12 hours ahead. An increase in maximum FUM values of approximately 35 MW for forecast horizons beyond 36 hours ahead; maximum FUM values unchanged for other forecast horizons.
- South Australia – a minor increase in mean FUM values of approximately 15 MW for forecast horizons beyond 24 hours ahead; mean FUM values unchanged for other forecast horizons. An increase in minimum FUM values of approximately 15 MW for forecast horizons beyond 24 hours ahead; minimum FUM values unchanged for other forecast horizons. Maximum FUM values are expected to be relatively unchanged across all forecast horizons.

[3] The Guidelines are published on AEMOs website at http://aemo.com.au/Electricity/National-Electricity-Market-NEM/Security-and-reliability/Power-system-operation.

- Tasmania – mean, minimum and maximum FUM values are expected to be relatively unchanged across all forecast horizons.
- Victoria – a minor decrease in mean FUM values of approximately 15 MW for all forecast horizons. Minimum and maximum FUM values are expected to be relatively unchanged across all forecast horizons.

3. Lack of Reserve conditions declared

Table 2 lists the declarations of forecast and actual LOR conditions over the reporting period from 1 April 2019 to 30 June 2019. Table 2 also identifies the market notices that communicated updates to, and cancellation of, either forecast or actual LOR conditions.

Declaration count principles

For each reporting period, AEMO determines the total count for LOR conditions based on the following principles:

- All market notices making the initial declaration of a forecast or actual LOR condition with an effective date 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 a continuing condition.
- 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.

For example, where a forecast LOR1 was issued and later an actual LOR1 was declared for a similar period, only the actual LOR1 is counted. But if the initial forecast was for a forecast LOR2 condition and this was later declared as an actual LOR1 then this would be counted as two LOR conditions due to the differing LOR levels.

Table 2 LOR notices declared during the reporting period 1 April 2019 and 30 June 2019

Effective date & time	Market Notice ID	Issue date and time	Level	Actual, forecast, update or cancel	Comments	Reserve requirement (MW)[A]		FUM value (MW)[B]	Reserve require-ment set by
						Required	Available		
New South Wales Region									
8/6/2019 1730 - 1800	68695 68696	8/6/2019 15:36	LOR1	Forecast	Forecast LOR1 due to reduced generation availability.	1,370	1,215	421	LCR2
8/6/2019	68699	8/6/2019 17:28	LOR1	Cancelled	Cancellation of MN 68696. LOR1 condition was cancelled mainly due to a reduction of forecast demand and an increase in generation availability.	1400	1462	219	LCR2
Queensland Region									
Nil									
South Australia Region									
Nil									
Tasmania Region									
Nil									
Victoria Region									
Nil									

A. Reserve Required and Reserve Available are the values that correspond to the trading interval in the effective period with the lowest reserve available.
B. The value in this field represents the FUM value for the trading interval during which the minimum available reserve occurred (see Reserve Requirement (MW) – Available field).

4. Review of performance

4.1 Forecast Uncertainty Measure values

This section details the average, minimum and maximum FUM values for this reporting period, as compared with the period quarter 2 2018 through quarter 1 2019. The relative changes in the FUM value distributions for this reporting period when compared to previous reporting periods can be seen in Figure 1 to Figure 5 below, and are summarised as follows:

- For New South Wales, the largest changes relative to quarter 1 2019 are the decreases in maximum FUM values for 2 hours ahead, 24 hours ahead and 48 hours ahead. Other changes to FUM values relative to quarter 1 2019 are minor.
- For Queensland, the changes to FUM values relative to quarter 1 2019 are minor.
- For South Australia, the largest changes relative to quarter 1 2019 are the decrease in average FUM values for 24 hours ahead, offset by a minor increase in average FUM values for 60 hours ahead. Other changes to FUM values relative to quarter 1 2019 are minor.
- For Tasmania, the largest changes relative to quarter 1 2019 are the decreases in maximum FUM values for 2 hours ahead and 6 hours ahead, offset by a minor increase in maximum FUM values for 24 hours ahead and 48 hours ahead. Other changes to FUM values relative to quarter 1 2019 are minor.
- For Victoria, the largest changes relative to quarter 1 2019 are the decreases in maximum FUM values for 2 hours ahead, 6 hours ahead, 12 hours ahead and 24 hours ahead. Other changes to FUM values relative to quarter 1 2019 are minor.

For completeness, it should be noted that the FUM remained off for a period of 11 days between 6 June and 17 June 2019, after one of the parameters used by PASA was adjusted to improve reserve reporting. After this was identified and rectified, AEMO reviewed the PASA results and concluded that, if the FUM had been in operation, it would not have impacted on the number of LOR conditions in this 11 day period, the single forecast LOR condition on 8 June 2019 would be unaffected as the reserve requirement was set by LCR2 not by FUM.

The large changes to FUM values for this reporting period relative to the corresponding period in 2018 are consistent with the expected changes published in the 2018 consultation on changes to the Reserve Level Declaration Guidelines[4].

[4] Refer to the Update Paper published during the Consultation, at http://aemo.com.au/Stakeholder-Consultation/Consultations/Changes-to-Reserve-Level-Declaration-Guidelines?Convenor=AEMO%20NEM. Effective: 10 December 2018.

Figure 1 New South Wales region: maximum, minimum and average FUM values for the reporting period

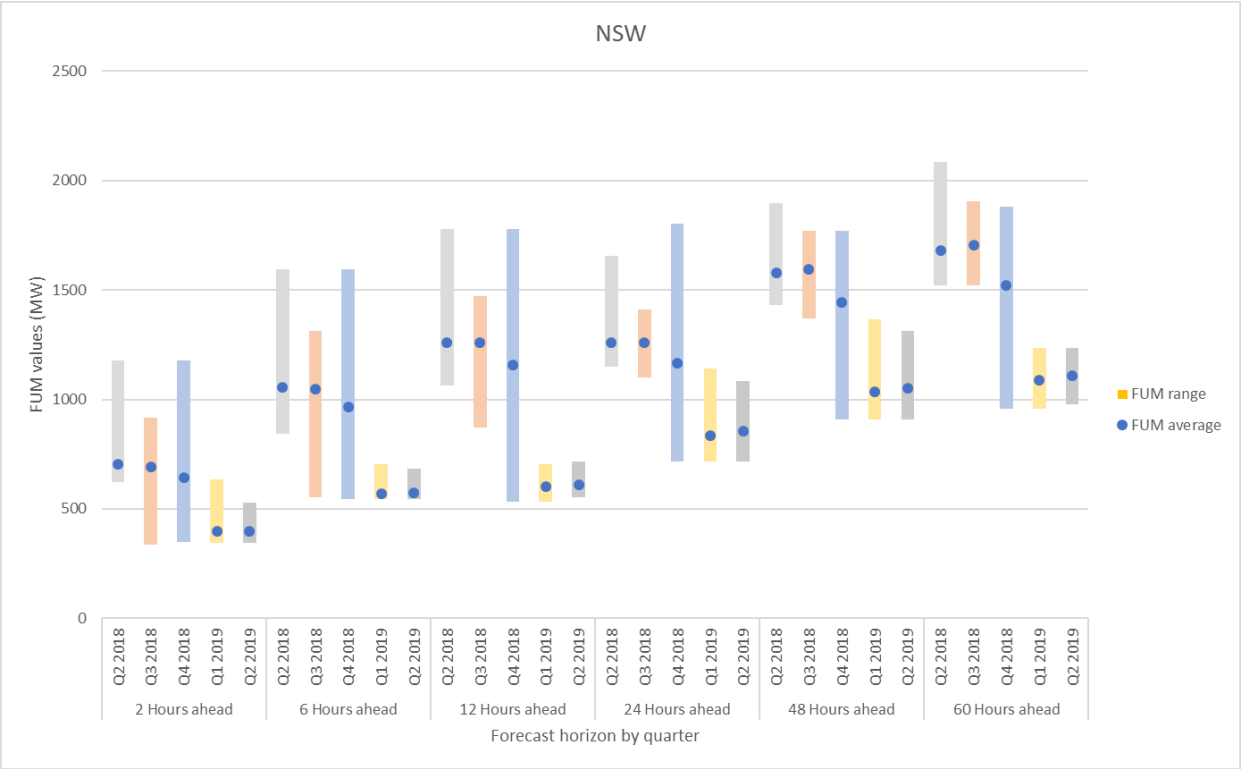


Figure 2 Queensland region: maximum, minimum and average FUM values for the reporting period

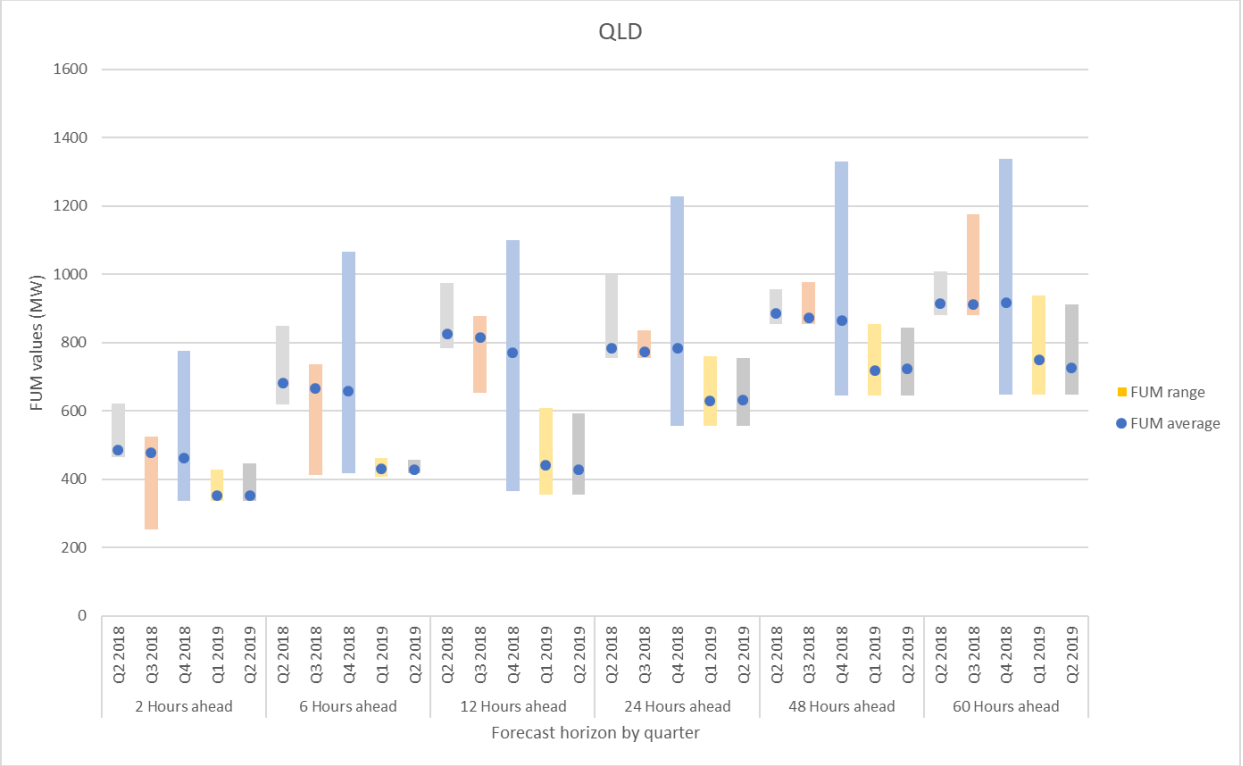


Figure 3 South Australia region: maximum, minimum and average FUM values for the reporting period

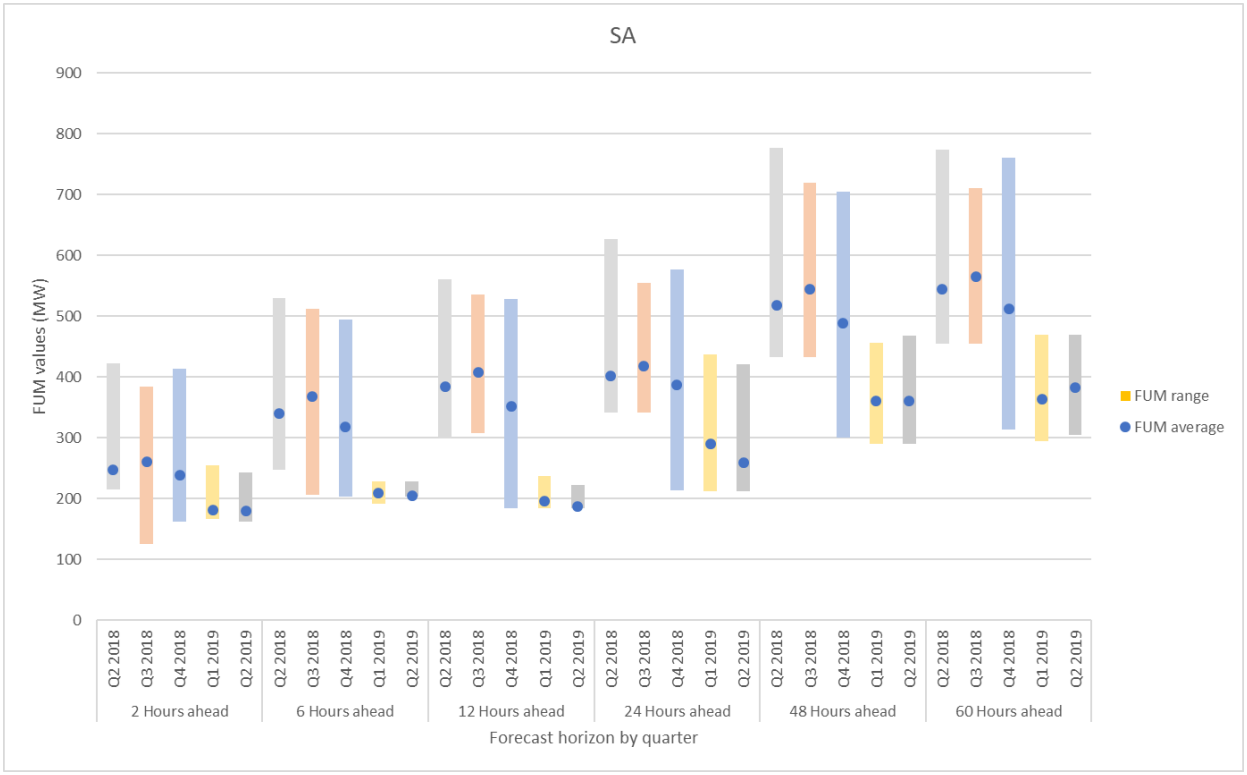


Figure 4 TAS region: maximum, minimum and average FUM values for the reporting period.

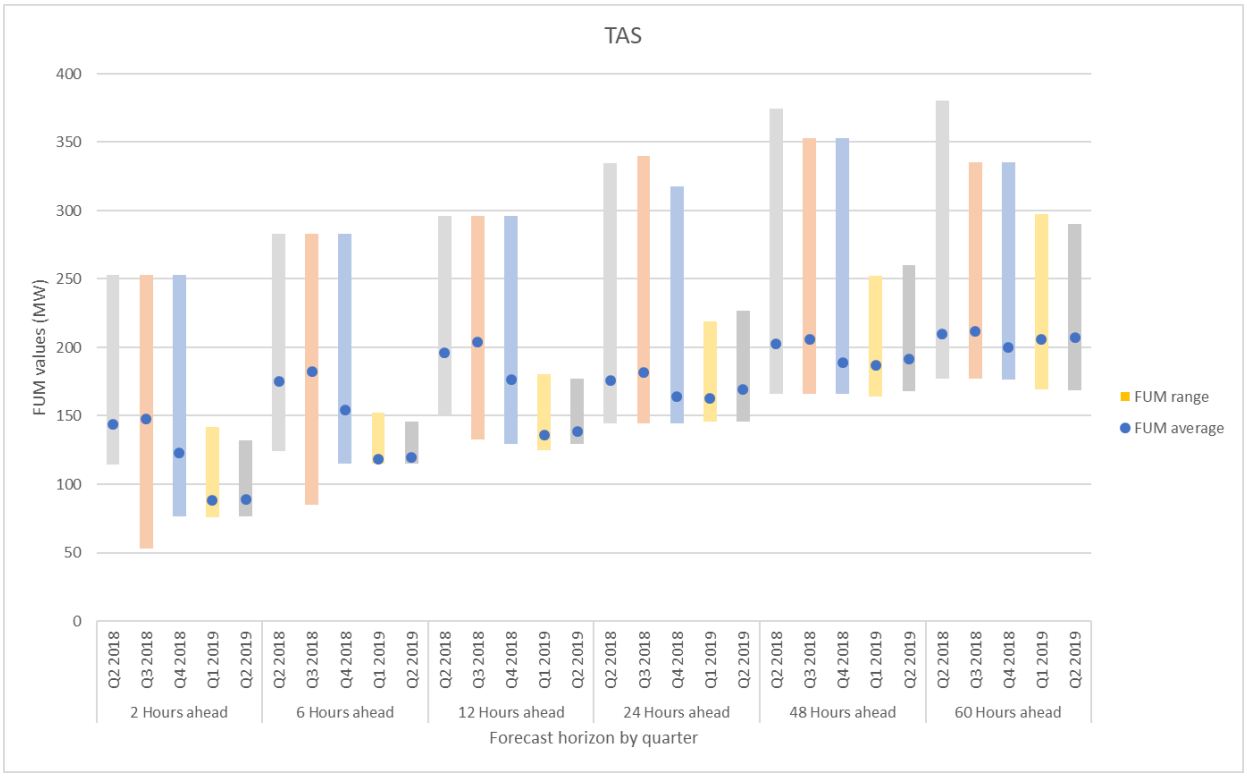
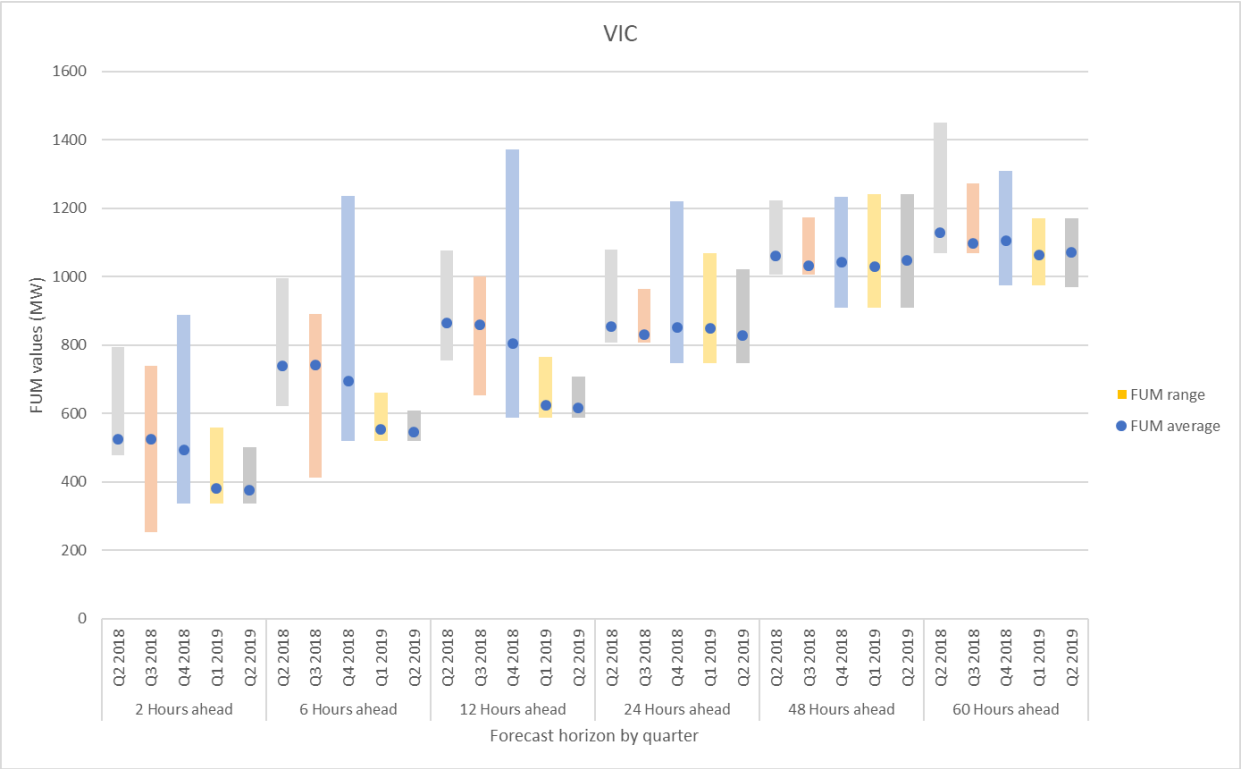


Figure 5 Victoria region: maximum, minimum and average FUM values for the reporting period.



4.2 LOR declaration reserve requirements

One forecast LOR condition was declared for the current reporting period (refer to Table 1). The reserve requirement was a forecast LOR1 condition, and was set by LCR2.

As there was only one declaration in the reporting period, and it was not set by the FUM, the percentage of LOR conditions where the FUM set the reserve requirement is zero. In quarter 1 2019 the percentage was approximately 37%, and 20% in quarter 2 2018.

There were no forecast or actual LOR2 or LOR3 conditions declared during the current reporting period. This outcome indicates that there was sufficient generation to meet demand during Q2 2019.

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

Effective period	LOR1	LOR2	LOR3
New South Wales (NSW)			
8/06/2019	Forecast		
Queensland (QLD), Victoria (VIC), South Australia (SA), Tasmania (TAS)			
Nil			

Note. Yellow shading indicates the requirement was set by the LCR, and orange indicates the requirement was set by the FUM.

4.3 Forecast and actual LOR declarations

No forecast or actual LOR3 conditions were declared.

No forecast or actual LOR2 conditions were declared.

One forecast LOR1 condition was declared, it did not result in an actual LOR1 condition.

The forecast LOR1 condition did not develop into an actual LOR condition on this occasion due to a combination of a reduction in forecast demand as well as a market response following the issue of the forecast market notice. The market response generally took the form of increased available generation.

4.4 Number and cause of LOR declarations

One forecast and no actual LOR conditions were declared during the current reporting period. This is significantly lower than the 27 recorded in the previous reporting period (01 January – 31 March 2019) and the 20 recorded in the corresponding quarter of 2018. The predominant factors contributing to reduced LOR conditions during this period were increased generation availability, or capacity increase, coincident with lower demand due to comfortable temperatures, please refer to Figure 6.

The low number of LOR conditions may be attributed to operational demand being relatively static. The operational demand has been relatively similar compared with the past three years for most regions. There were no extreme weather events during the reporting period Q2 2019, please refer to Appendix A.

Appendix A

Figure 6 New South Wales region: Operational demand for reporting period compared with past years

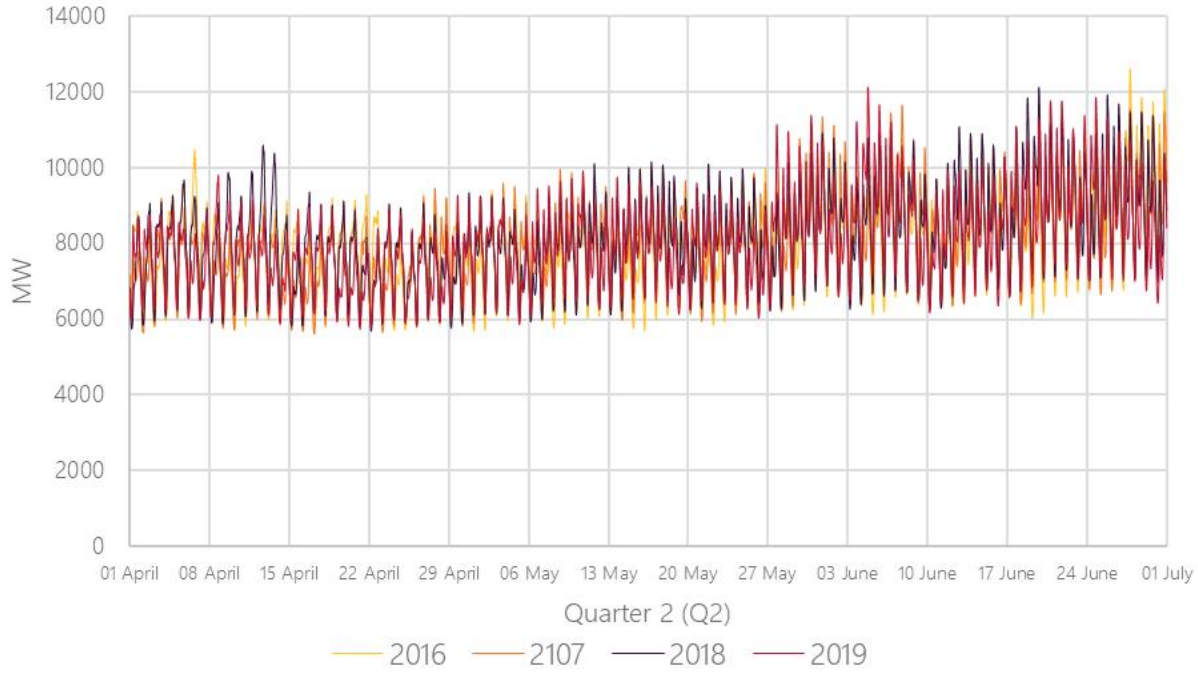


Figure 7 Queensland region: Operational demand for reporting period compared with past years

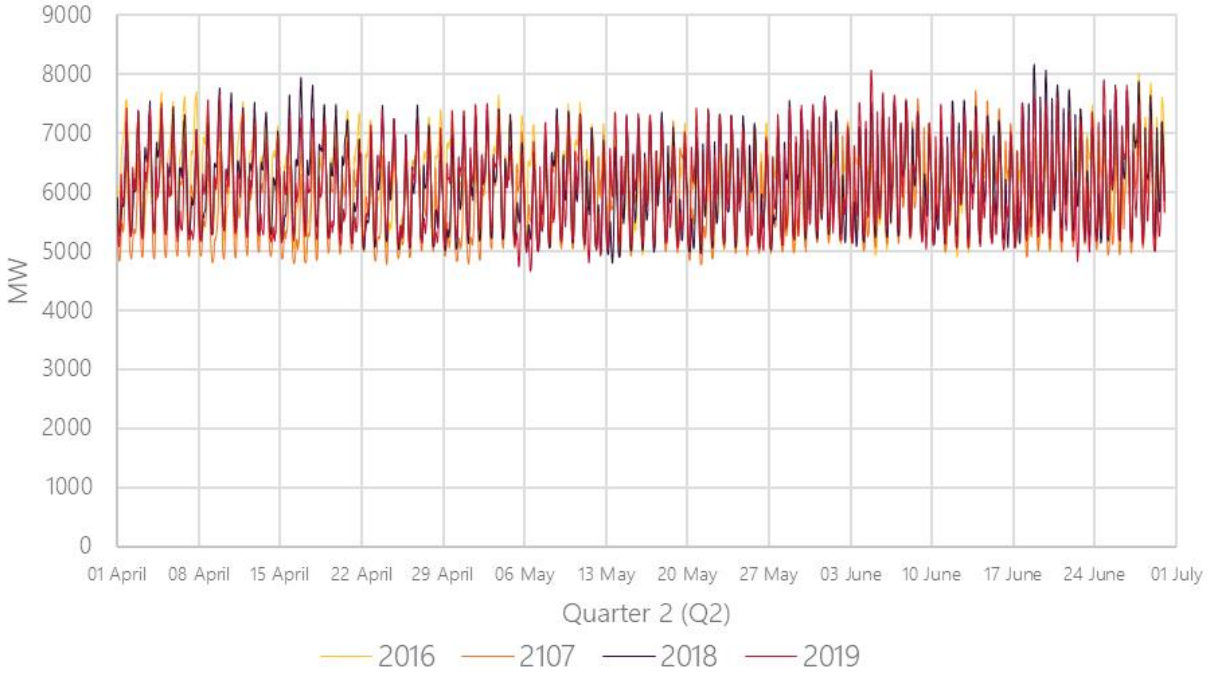


Figure 8 South Australia region: Operational demand for reporting period compared with past year

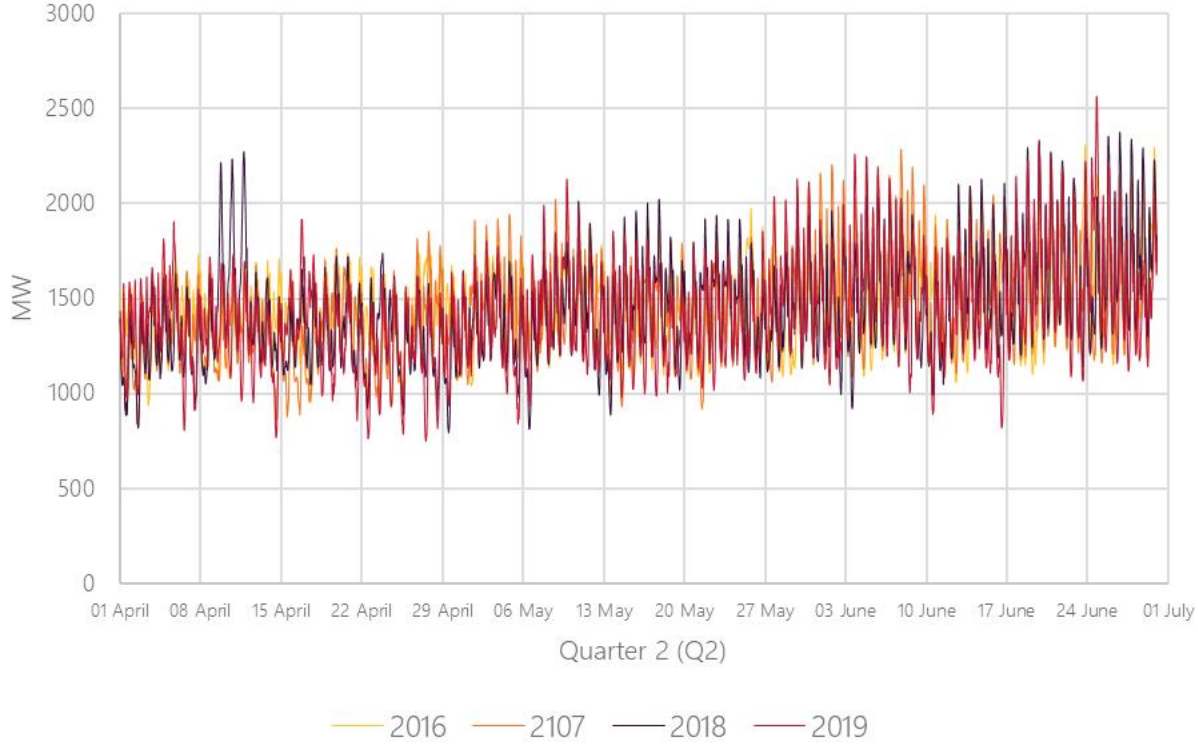


Figure 9 Tasmania region: Operational demand for reporting period compared with past years

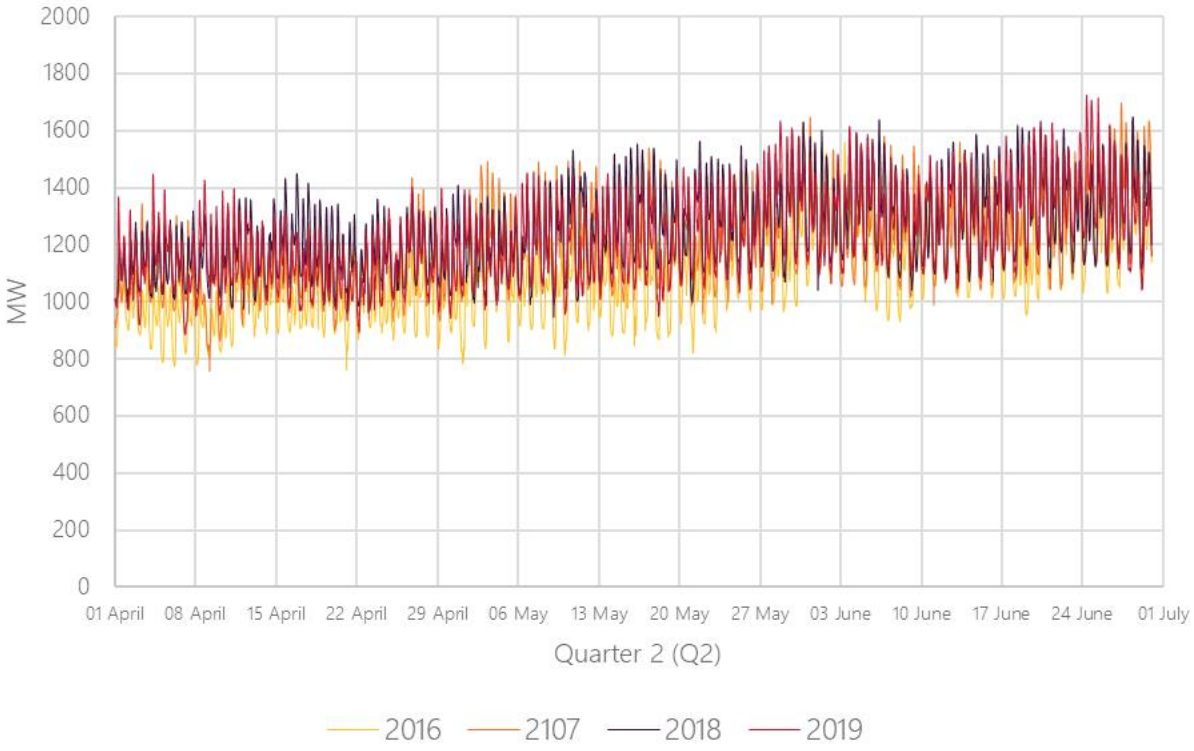
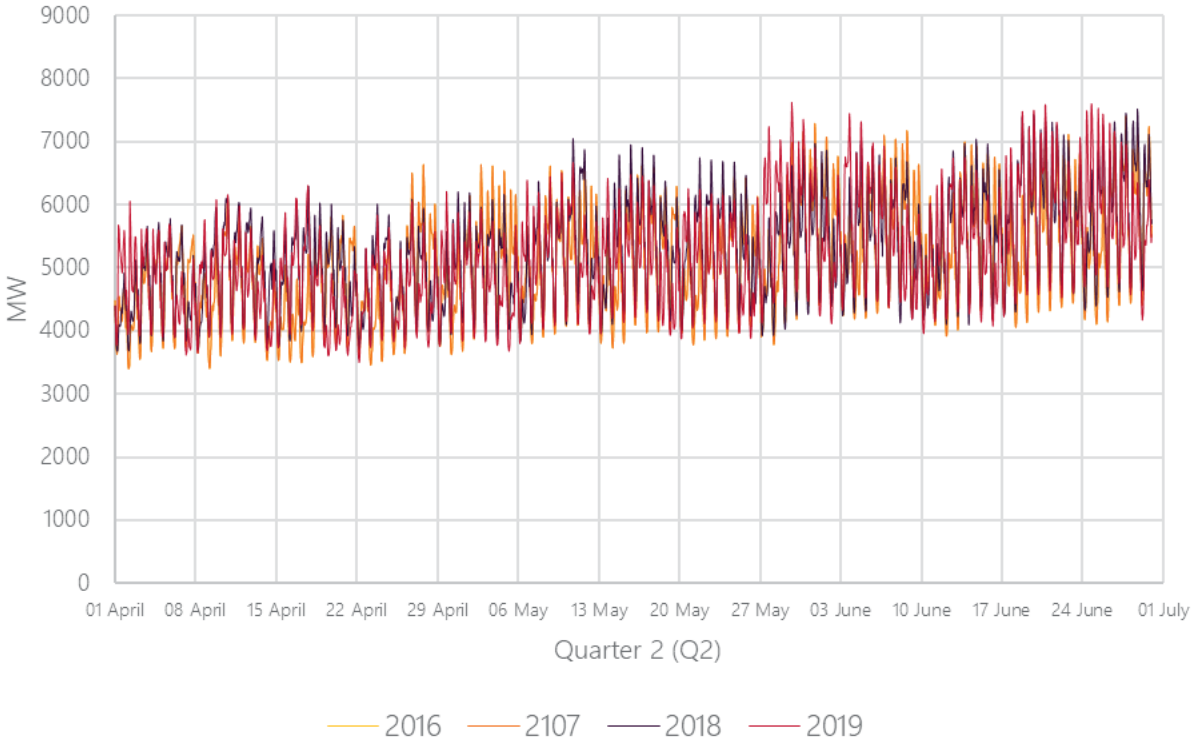


Figure 10 Victoria region: Operational demand for reporting period compared with past years



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 level 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 level 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 level 3. The threshold for an LOR3 condition is when the forecast reserve for a region is at or below zero.