

# **NEM Lack of Reserve Framework Report**

**27 July 2018**

**Reporting period 1 April 2018 to 30 June 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 April 2018 to 30 June 2018.

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## VERSION CONTROL

| Version | Release date | Changes         |
|---------|--------------|-----------------|
| 1       | 27 July 2018 | 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 April 2018 to 30 June 2018, AEMO declared a total of 20 Lack of Reserve (LOR) conditions (either forecast or actual). This compares to 16 LOR conditions declared during the previous reporting period (16 January 2018 to 31 March 2018).

The predominant causes of lack of reserve conditions during the reporting period were a combination of transmission network outages and generation outages, due to the scheduling of upgrade projects and maintenance activities in periods of generally lower electricity demand. A number of lack of reserve conditions were cancelled upon re-scheduling of such planned outages. During the reporting period the majority of LOR conditions were declared when the FUM was not setting the LOR level.

The next report on the NEM Lack of Reserve Framework, for the reporting period 1 July 2018 to 30 September 2018, will be published on or before 31 October 2018.

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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 April 2018 to 30 June 2018.

This report is divided into four sections:

- **Reserve Level Declaration Guidelines** – a summary of any changes to the guidelines over the past quarter, and the progress of any consultations under way.
- **Retraining of the Bayesian Belief Network (BBN)** – whether the BBN has been retrained during the past quarter, and a summary of the outcomes of such retraining. Where relevant this will explain, in general terms, how this retraining is likely to impact on the values of the FUM (Forecast Uncertainty Measure) for future periods.
- **Lack of Reserve (LOR) conditions declared** – a list of all LOR conditions declared or revised during the past quarter (based on market notices), including a simple statement as to the primary cause (for example, forecast uncertainty of demand forecasts, intermittent generation, largest credible risk, scheduled generation availability, or a combination).
- **Statistics** – an update of ongoing quarterly statistics, to provide an assessment over time of FUM values, number of LOR declarations and causes of LOR declarations.

For further information, contact AEMO Operational Forecasting: [op.forecasting@aemo.com.au](mailto:op.forecasting@aemo.com.au).

The next report on the NEM Lack of Reserve Framework, for the reporting period 1 July 2018 to 30 September 2018, will be published on or before 31 October 2018.

# 2. Reserve Level Declaration Guidelines

## 2.1 Changes in the reporting period

No changes have been made to the initial version of the guidelines since they became effective.

## 2.2 Planned reviews

AEMO continues to review the performance of the reserve level declaration arrangements on an ongoing basis to analyse how the framework has been operating to date. A number of potential improvement opportunities have been identified, including a change to address an issue with the reasonability limits applied for the intervals from 140 to 144 half-hours ahead. This issue can cause the FUM values for these intervals to exhibit an inflexion, and did result in a small number of LOR declarations over the reporting period that would not otherwise have been made. None of these LORs resulted in actual reserve conditions.

While not all of the changes under investigation will require changes to the guidelines, AEMO has developed an issues paper for consultation with stakeholders. The issues paper was published on 16 July 2018<sup>1</sup>.

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<sup>1</sup> <https://www.aemo.com.au/Stakeholder-Consultation/Consultations/Changes-to-Reserve-Level-Declaration-Guidelines?Convenor=AEMO%20NSP>

# 3. Retraining of the Bayesian Belief Network

The Bayesian Belief Network (BBN) is the algorithm which determines the FUM, which in turn determines the LOR levels. This process is summarised in the Reserve Level Declaration Guidelines.<sup>2</sup>

AEMO commenced retraining of the BBN to update the network to account for performance of the forecasting inputs over summer 2017-18 in April 2018.

The retraining involved a three-stage process:

1. An Extract-Transform-Load (ETL) stage, to extract historical data up to 31 March 2018, 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 completed the retraining process and implemented the retrained BBN on 13 June 2018.

Changes to future Forecast Uncertainty Measure (FUM) values can be expected due to the retrained BBN as follows:

1. NSW – increase to FUM values in the near term (0 to 8 hours ahead), decrease to FUM values from 24 hours ahead to 60 hours ahead.
2. Queensland – immaterial changes to most forecasting horizons, with the exception of a decrease to FUM values at 48 hours ahead.
3. South Australia – decrease to FUM values for all forecasting horizons.
4. Tasmania – immaterial changes to all forecasting horizons.
5. Victoria – decrease to FUM values for all forecasting horizons.

AEMO has published a retraining report which provides further information on the outcomes of retraining the BBN.<sup>3</sup>

Subsequent reporting on the periodic retraining of the BBN will be incorporated into the on-going NEM Lack of Reserve Framework Reports.

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<sup>2</sup> Reserve level declaration guidelines: <http://aemo.com.au/Electricity/National-Electricity-Market-NEM/Security-and-reliability/Power-system-operation>

<sup>3</sup> Retraining report available at <http://aemo.com.au/Electricity/National-Electricity-Market-NEM/Security-and-reliability/Power-system-operation/NEM-Lack-of-Reserve-Framework-Quarterly-Reports>

## 4. Lack of Reserve conditions declared

Table 1 is a list of all forecast and actual LORs declared over the reporting period 1 April 2018 to 30 June 2018.



**Table 1 LOR conditions declared during reporting period 1 April 2018 to 30 June 2018**

| Issue date and time | Effective date        | Period       | Region | Level | Market Notice | Actual, forecast or cancel | Comments   |
|---------------------|-----------------------|--------------|--------|-------|---------------|----------------------------|--|
| 09/04/18 19:25      | 10/04/18              | 1730 to 2000 | SA     | LOR1  | 62181         | Forecast                   | Unseasonably hot weather conditions observed on 10 April, with maximum observed temperatures at Adelaide Kent Town of 36.5 degrees Celsius           |
| 10/04/18 11:12      | 10/04/18              | 1800 to 1930 | SA     | LOR2  | 62196         | Forecast                   | Unseasonably hot weather conditions observed on 10 April, with maximum observed temperatures at Adelaide Kent Town of 36.5 degrees Celsius           |
| 10/04/18 14:22      | 10/04/18              | n/a          | SA     | LOR2  | 62200         | Cancel                     | Cancellation of previously forecast LOR2   |
| 10/04/18 17:48      | 10/04/18              | n/a          | SA     | LOR1  | 62213         | Actual                     | Unseasonably hot weather conditions observed on 10 April, with maximum observed temperatures at Adelaide Kent Town of 36.5 degrees Celsius           |
| 10/04/18 19:08      | 10/04/18              | n/a          | SA     | LOR1  | 62214         | Cancel                     | Cancellation of actual LOR1  |
| 19/04/18 16:33      | 19/04/18              | 1730 to 1900 | NSW    | LOR1  | 62389         | Forecast                   | Unplanned generation outages in NSW reduced available supply.  |
| 19/04/18 17:57      | 19/04/18              | n/a          | NSW    | LOR1  | 62390         | Actual                     | Unplanned generation outages in NSW reduced available supply.  |
| 19/04/18 19:00      | 19/04/18              | n/a          | NSW    | LOR1  | 62397         | Cancel                     | Cancellation of actual LOR1  |
| 24/05/18 17:09      | 31/05/18,<br>01/06/18 | Multiple     | SA     | LOR2  | 62936         | Forecast                   | Network transmission outages affecting the interconnector were planned for the period beginning 31/05/2018, reducing available supply from Victoria. |
| 25/05/18 12:56      | 31/05/18,<br>01/06/18 | n/a          | SA     | LOR2  | 62939         | Cancel                     | Cancellation of previously forecast LOR2   |
| 25/05/18 14:52      | 31/05/18,<br>01/06/18 | Multiple     | SA     | LOR1  | 62944         | Forecast                   | Network transmission outages affecting the interconnector were planned for the period beginning 31/05/2018, reducing available supply from Victoria. |
| 26/05/18 14:44      | 31/05/18,<br>01/06/18 | Multiple     | SA     | LOR1  | 62951         | Forecast                   | Update to previously forecast LOR1   |
| 27/05/18 15:31      | 31/05/18              | Multiple     | SA     | LOR1  | 62961         | Forecast                   | Update to previously forecast LOR1   |
| 28/05/18 11:26      | 31/05/18              | 0830 to 1000 | SA     | LOR2  | 62964         | Forecast                   | Network transmission outages affecting the interconnector were planned for the period beginning 31/05/2018, reducing available supply from Victoria. |
| 28/05/18 14:39      | 31/05/18              | n/a          | SA     | LOR2  | 62970         | Cancel                     | Cancellation of previously forecast LOR2   |
| 28/05/18 14:41      | 31/05/18              | n/a          | SA     | LOR1  | 62971         | Cancel                     | Cancellation of previously forecast LOR1   |
| 28/05/18 14:49      | 04/06/18              | 1800 to 2130 | SA     | LOR1  | 62973         | Forecast                   | Network outages were planned for the period, reducing available supply from Victoria.  |
| 28/05/18 18:22      | 31/05/18              | 1700 to 1800 | SA     | LOR2  | 62975         | Forecast                   | Network outages were planned for the period, reducing available supply from Victoria.  |

| Issue date and time | Effective date | Period       | Region | Level | Market Notice | Actual, forecast or cancel | Comments  |
|---------------------|----------------|--------------|--------|-------|---------------|----------------------------|---|
| 28/05/18 22:48      | 31/05/18       | n/a          | SA     | LOR2  | 62977         | Cancel                     | Cancellation of previously forecast LOR2  |
| 29/05/18 14:36      | 31/05/18       | 0830 to 0900 | SA     | LOR2  | 63015         | Forecast                   | Network outages were planned for the period, reducing available supply from Victoria  |
| 29/05/18 14:45      | 31/05/18       | 0900 to 0930 | SA     | LOR1  | 63016         | Forecast                   | Network outages were planned for the period, reducing available supply from Victoria  |
| 29/05/18 16:20      | 31/05/18       | n/a          | SA     | LOR2  | 63018         | Cancel                     | Cancellation of previously forecast LOR2  |
| 29/05/18 22:55      | 31/05/18       | Multiple     | SA     | LOR2  | 63020         | Forecast                   | Network outages were planned for the period, reducing available supply from Victoria  |
| 30/05/18 14:18      | 31/05/18       | n/a          | SA     | LOR2  | 63022         | Cancel                     | Cancellation of previously forecast LOR2  |
| 30/05/18 14:17      | 31/05/18       | n/a          | SA     | LOR1  | 63023         | Cancel                     | Cancellation of previously forecast LOR1  |
| 31/05/18 14:34      | 04/06/18       | Multiple     | SA     | LOR1  | 63047         | Forecast                   | Update to previously forecast LOR1  |
| 01/06/18 11:15      | 04/06/18       | 0800 to 1000 | SA     | LOR2  | 63051         | Forecast                   | Network outages were planned for the period, reducing available supply from Victoria  |
| 01/06/18 12:37      | 04/06/18       | 1030 to 1200 | SA     | LOR2  | 63052         | Forecast                   | Update to previously forecast LOR2  |
| 01/06/18 14:32      | 04/06/18       | n/a          | SA     | LOR2  | 63053         | Cancel                     | Cancellation of previously forecast LOR2  |
| 01/06/18 14:33      | 04/06/18       | Multiple     | SA     | LOR1  | 63054         | Forecast                   | Update to previously forecast LOR1  |
| 02/06/18 14:45      | 04/06/18       | n/a          | SA     | LOR1  | 63055         | Cancel                     | Cancellation of previously forecast LOR1  |
| 04/06/18 14:34      | 04/06/18       | 1730 to 1900 | NSW    | LOR1  | 63060         | Forecast                   | A combination of planned and unplanned generation outages in NSW, and the delayed return to service of planned transmission network outages reduced available supply. |
| 04/06/18 17:34      | 04/06/18       | n/a          | NSW    | LOR1  | 63061         | Actual                     | A combination of planned and unplanned generation outages in NSW, and the delayed return to service of planned transmission network outages reduced available supply. |
| 04/06/18 19:15      | 04/06/18       | n/a          | NSW    | LOR1  | 63062         | Cancel                     | Cancellation of actual LOR1   |
| 04/06/18 19:26      | 05/06/18       | 1730 to 1900 | NSW    | LOR1  | 63063         | Forecast                   | A combination of planned and unplanned generation outages in NSW, and the delayed return to service of planned transmission network outages reduced available supply. |
| 04/06/18 23:55      | 05/06/18       | n/a          | NSW    | LOR1  | 63064         | Cancel                     | Cancellation of previously forecast LOR1  |
| 05/06/18 13:54      | 05/06/18       | 1630 to 1700 | NSW    | LOR1  | 63066         | Forecast                   | A combination of planned and unplanned generation outages in NSW, and the delayed return to service of planned transmission network outages reduced available supply. |
| 05/06/18 16:26      | 05/06/18       | n/a          | NSW    | LOR1  | 63067         | Actual                     | A combination of planned and unplanned generation outages in NSW, and the delayed return to service of planned transmission network outages reduced available supply. |
| 05/06/18 17:39      | 05/06/18       | 1730 to 1800 | NSW    | LOR2  | 63073         | Forecast                   | A combination of planned and unplanned generation outages in NSW, and the delayed return to service of planned transmission network outages reduced available supply. |

| Issue date and time | Effective date | Period       | Region | Level | Market Notice | Actual, forecast or cancel | Comments  |
|---------------------|----------------|--------------|--------|-------|---------------|----------------------------|---|
| 05/06/18 18:27      | 05/06/18       | n/a          | NSW    | LOR2  | 63084         | Actual                     | A combination of planned and unplanned generation outages in NSW, and the delayed return to service of planned transmission network outages reduced available supply. |
| 05/06/18 18:34      | 05/06/18       | n/a          | QLD    | LOR1  | 63086         | Actual                     | A combination of planned and unplanned generation outages in NSW and QLD reduced available supply to both regions.  |
| 05/06/18 18:41      | 05/06/18       | n/a          | QLD    | LOR1  | 63087         | Cancel                     | Cancellation of actual LOR1   |
| 05/06/18 19:18      | 05/06/18       | n/a          | NSW    | LOR2  | 63088         | Cancel                     | Cancellation of actual LOR2   |
| 05/06/18 19:20      | 05/06/18       | n/a          | NSW    | LOR1  | 63089         | Cancel                     | Cancellation of actual LOR1   |
| 06/06/18 07:55      | 06/06/18       | 1730 to 1930 | NSW    | LOR1  | 63093         | Forecast                   | A combination of planned and unplanned generation outages in NSW reduced available supply.  |
| 06/06/18 10:45      | 06/06/18       | n/a          | NSW    | LOR1  | 63096         | Cancel                     | Cancellation of previously forecast LOR1  |
| 06/06/18 15:49      | 06/06/18       | 1700 to 1800 | NSW    | LOR1  | 63099         | Forecast                   | A combination of planned and unplanned generation outages in NSW reduced available supply.  |
| 06/06/18 17:12      | 06/06/18       | n/a          | NSW    | LOR1  | 63100         | Actual                     | A combination of planned and unplanned generation outages in NSW reduced available supply.  |
| 06/06/18 19:30      | 06/06/18       | n/a          | NSW    | LOR1  | 63101         | Cancel                     | Cancellation of actual LOR1   |
| 07/06/18 10:20      | 07/06/18       | 1730 to 1800 | NSW    | LOR1  | 63103         | Forecast                   | A combination of planned and unplanned generation outages in NSW reduced available supply.  |
| 07/06/18 11:10      | 07/06/18       | n/a          | NSW    | LOR1  | 63116         | Cancel                     | Cancellation of previously forecast LOR1  |
| 07/06/18 11:55      | 07/06/18       | 1730 to 1800 | NSW    | LOR1  | 63117         | Forecast                   | A combination of planned and unplanned generation outages in NSW reduced available supply.  |
| 07/06/18 15:03      | 07/06/18       | 1700 to 1800 | NSW    | LOR1  | 63118         | Forecast                   | Update to previously forecast LOR1  |
| 07/06/18 15:46      | 07/06/18       | 1700 to 1900 | NSW    | LOR1  | 63119         | Forecast                   | Update to previously forecast LOR1  |
| 07/06/18 16:43      | 07/06/18       | 1730 to 1800 | NSW    | LOR2  | 63120         | Forecast                   | A combination of planned and unplanned generation outages in NSW reduced available supply.  |
| 07/06/18 17:11      | 07/06/18       | n/a          | NSW    | LOR1  | 63124         | Actual                     | A combination of planned and unplanned generation outages in NSW reduced available supply.  |
| 07/06/18 17:47      | 07/06/18       | n/a          | NSW    | LOR2  | 63136         | Actual                     | A combination of planned and unplanned generation outages in NSW reduced available supply.  |
| 07/06/18 19:04      | 07/06/18       | n/a          | NSW    | LOR2  | 63137         | Cancel                     | Cancellation of actual LOR2   |

| Issue date and time | Effective date | Period       | Region | Level | Market Notice | Actual, forecast or cancel | Comments   |
|---------------------|----------------|--------------|--------|-------|---------------|----------------------------|--|
| 07/06/18 20:08      | 07/06/18       | n/a          | NSW    | LOR1  | 63138         | Cancel                     | Cancellation of actual LOR1  |
| 08/06/18 09:12      | 08/06/18       | 1000 to 1100 | NSW    | LOR1  | 63140         | Forecast                   | A combination of planned and unplanned generation outages in NSW reduced available supply. |
| 08/06/18 09:49      | 08/06/18       | 1730 to 1800 | NSW    | LOR1  | 63142         | Forecast                   | Update to previously forecast LOR1   |
| 08/06/18 11:40      | 08/06/18       | 1700 to 1930 | NSW    | LOR1  | 63143         | Forecast                   | Update to previously forecast LOR1   |
| 08/06/18 11:46      | 08/06/18       | 1730 to 1800 | NSW    | LOR2  | 63144         | Forecast                   | A combination of planned and unplanned generation outages in NSW reduced available supply. |
| 08/06/18 13:09      | 08/06/18       | n/a          | NSW    | LOR2  | 63145         | Cancel                     | Cancellation of previously forecast LOR2   |
| 08/06/18 13:14      | 08/06/18       | 1630 to 1930 | NSW    | LOR1  | 63146         | Forecast                   | Update to previously forecast LOR1   |
| 08/06/18 13:45      | 08/06/18       | 1730 to 1800 | NSW    | LOR2  | 63148         | Forecast                   | A combination of planned and unplanned generation outages in NSW reduced available supply. |
| 08/06/18 14:11      | 08/06/18       | 1630 to 2100 | NSW    | LOR1  | 63149         | Forecast                   | Update to previously forecast LOR1   |
| 08/06/18 15:42      | 08/06/18       | n/a          | NSW    | LOR2  | 63150         | Cancel                     | Cancellation of previously forecast LOR2   |
| 08/06/18 16:13      | 08/06/18       | 1730 to 1800 | NSW    | LOR2  | 63151         | Forecast                   | A combination of planned and unplanned generation outages in NSW reduced available supply. |
| 08/06/18 16:36      | 08/06/18       | n/a          | NSW    | LOR1  | 63153         | Actual                     | A combination of planned and unplanned generation outages in NSW reduced available supply. |
| 08/06/18 17:44      | 08/06/18       | n/a          | NSW    | LOR2  | 63162         | Actual                     | A combination of planned and unplanned generation outages in NSW reduced available supply. |
| 08/06/18 18:07      | 08/06/18       | n/a          | NSW    | LOR2  | 63163         | Cancel                     | Cancellation of actual LOR2  |
| 08/06/18 21:35      | 08/06/18       | n/a          | NSW    | LOR1  | 63165         | Cancel                     | Cancellation of actual LOR1  |
| 09/06/18 09:20      | 09/06/18       | 1700 to 1830 | NSW    | LOR1  | 63168         | Forecast                   | A combination of planned and unplanned generation outages in NSW reduced available supply. |
| 09/06/18 14:10      | 09/06/18       | 1700 to 1830 | NSW    | LOR1  | 63170         | Forecast                   | Update to previously forecast LOR1   |
| 09/06/18 17:08      | 09/06/18       | n/a          | NSW    | LOR1  | 63171         | Actual                     | A combination of planned and unplanned generation outages in NSW reduced available supply. |
| 09/06/18 19:01      | 09/06/18       | n/a          | NSW    | LOR1  | 63172         | Cancel                     | Cancellation of actual LOR1  |

| Issue date and time | Effective date | Period       | Region | Level | Market Notice | Actual, forecast or cancel | Comments   |
|---------------------|----------------|--------------|--------|-------|---------------|----------------------------|--|
| 11/06/18 15:22      | 18/06/18       | 1800 to 1900 | VIC    | LOR1  | 63177         | Forecast                   | Network outages were planned for the period, reducing available supply from New South Wales. |
| 13/06/18 14:36      | 18/06/18       | n/a          | VIC    | LOR1  | 63186         | Cancel                     | Cancellation of previously forecast LOR1   |

# 5. Quarterly statistics

Quarterly statistics in the accompanying spreadsheet have been updated to include data for the reporting period 1 April 2018 to 30 June 2018.

Average, minimum and maximum FUM values are detailed in the accompanying spreadsheet. The changes in these values, when compared to the previous reporting period, can be summarised as such:

- In general, average FUM values have decreased for NSW, QLD, SA and VIC. Average FUM values for TAS have remained relatively stable.
- In general, minimum FUM values have decreased consistent and in proportion to the decreases to average FUM values in all regions.
- In general, maximum FUM values have decreased consistent with decreases to average FUM values in VIC and QLD. For all other regions the maximum FUM values have remained relatively stable.
- After accounting for seasonal differences due to, for example, reduced temperature induced uncertainty for demand forecasts and scheduled availability, and increased intermittent generation uncertainty due to increased average wind generation forecasts, the FUM values (minimum, average, maximum) have slightly decreased. This is consistent with AEMO's ongoing efforts to improve forecasting system accuracy and reduce forecasting uncertainty, and improved accuracy of scheduled generator availability bidding.

A total of 20 LOR conditions (forecast or actual) were declared during the reporting period. This compares with 16 LOR conditions declared in the prior reporting period. Accounting for the difference in length of the reporting periods (74 days prior period vs 90 days current period), the total number of LOR conditions declared is relatively stable.

The predominant causes of lack of reserve conditions during the reporting period were a combination of transmission network outages and generation outages, due to the scheduling of upgrade projects and maintenance activities in periods of lower electricity demand. A number of lack of reserve conditions were cancelled upon re-scheduling of such planned outages. During the reporting period the majority of LOR conditions were declared when the FUM was not setting the LOR level.

The count of LOR declarations in the accompanying spreadsheet is based on market notice declarations of all forecast or actual LORs during the reporting period, but does not include any market notice declarations which were updates to previously declared forecast or actual LORs. Any forecast LORs which were subsequently updated to actual LORs are only counted once for a given effective date.