AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

NEM Lack of Reserve Framework Report

30 April 2018

Reporting period 16 January 2018 to 31 March 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 16 January 2018 to 31 March 2018.

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VERSION CONTROL

Version	Release date	Changes
1	30/04/2018	Initial version

Executive summary

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

It is the first quarterly report on the new Lack of Reserve Framework in the National Electricity Market (NEM), which came into effect on 16 January 2018. The Reserve Level Declaration Guidelines were not implemented on this date, but during the reporting period, on 15 February 2018.

During the reporting period 16 January 2018 to 31 March 2018, AEMO declared a total of 16 Lack of Reserve (LOR) conditions (either forecast or actual). All 16 LOR conditions:

- Were declared prior to the implementation of the Reserve Level Declaration Guidelines, and thus were declared based on the previous credible contingency declaration guidelines, which applied at the time.
- Coincided with extreme hot weather conditions for the region where the LOR was declared.

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

In June 2018, AEMO will also publish a report summarising outcomes from retraining of the Bayesian Belief Network which determines the Lack of Reserve levels. The retraining will update the network to account for performance of the forecasting inputs over summer 2017-18, by including the recent historical data.

Contents

1. Introduction

This report has been published, in accordance with clause 4.8.4B of the National Electricity Rules (NER), to inform the market about the implementation of the reserve level declaration guidelines and to provide a high-level analysis of how the lack of reserve framework is operating. This report covers the period 16 January 2018 to 31 March 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.

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

2. Reserve Level Declaration Guidelines

2.1 Changes in the reporting period

AEMO developed the initial version of the Reserve Level Declaration Guidelines[1] through consultation between October and December 2017, and published the guidelines on 20 December 2017.

The guidelines implement changes to the NER which allow AEMO to take into account, not only credible contingencies but also forecasting uncertainties, when determining LOR conditions[2].

Under this new approach, the overall uncertainty in reserve forecasts due to forecasting of demand, intermittent generation, and scheduled generation availability is estimated by a quantity known as the Forecast Uncertainty Measure (FUM), measured in megawatts (MW).

Alongside the guidelines, AEMO has also published a set of FUM limits[3] applied for reasonability checks, together with a list of the largest credible contingencies considered in each region for reserve level declarations.

The new arrangements were due to be implemented on 16 January 2018, but implementation was delayed until 15 February 2018 to rectify an issue identified during readiness checks.

No changes have been made to the initial version of the guidelines since they became effective. A revised set of upper reasonability limits for the FUM was issued prior to the implementation date.

2.2 Planned reviews

AEMO continues to review the performance of the new reserve level declaration arrangements on an ongoing basis to analyse how the framework has been operating to date. If potential changes to the guidelines are identified AEMO will initiate a consultation with stakeholders. This is expected to be determined in June 2018.

[1] Refer to https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Security-and-reliability/Power-system-operation.

[2] Refer AEMC Rule Change Declaration of Lack of Reserve Conditions - https://www.aemc.gov.au/rule-changes/declaration-of-lack-of-reserve-conditions.

[3] For further details refer to https://www.aemo.com.au/Stakeholder-Consultation/Consultations/Consultation-on-initial-version-of-Reserve-Level-Declaration-Guidelines.

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.

AEMO has begun retraining of the BBN to update the network to account for performance of the forecasting inputs over summer 2017-18.

The retraining involves 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.

The retraining will update the conditional probabilities in the network based on the recent historical data, and the impact will be minor changes to the FUM for the same given input conditions.

When the retraining is complete, AEMO will publish a report to summarise the outcomes of the retraining and detail the likely impact on the values of FUM determined in the future. AEMO expects to complete the retraining, implement any changes to production, and publish the report in June 2018.

4. Lack of Reserve conditions declared

Table 1 is a list of all forecast and actual LORs declared over the reporting period 16 January 2018 to 31 March 2018.

All LOR conditions declared during the reporting period coincided with extreme hot weather conditions forecast and observed for the effective date of the LOR declaration in the relevant region.

No LOR conditions (forecast or actual) were declared during the reporting period after implementation of the Reserve Level Declaration Guidelines on 15 February 2018[4], therefore all declarations in the table below were based on the previous credible contingency declaration guidelines that were in place at the time.

Because no LOR conditions were declared during the reporting period after the implementation of the Reserve Level Declaration Guidelines, AEMO is not in a position to report on any observed trends in when and why LOR conditions are being declared under the new guidelines.

If sufficient LOR conditions are declared during the next reporting period, AEMO will report on any observed trends in the next quarterly report.

[4] Refer to Market Notice 61250 for notification of implementation of Reserve Level Declaration Guidelines https://www.aemo.com.au/Market-Notices

Table 1 LOR conditions declared during reporting period 16 January 2018 to 31 March 2018

Issue date and time	Effective date	Period	Region	Level	Market Notice	Actual, forecast or cancel	Comments
16/01/18 14:51:11	18/01/18	1800 to 1830	SA	LOR1	60761	Forecast	Extreme hot weather conditions observed on 18 January, with maximum observed temperatures at Adelaide Kent Town of 42.8 degrees Celsius.
16/01/18 14:55:39	18/01/18	1600 to 1800	VIC	LOR1	60762	Forecast	Extreme hot weather conditions observed on 18 January, with maximum observed temperatures at Melbourne Airport of 39.8 degrees Celsius.
16/01/18 14:55:39	19/01/18	1500 to 1700	VIC	LOR1	60762	Forecast	Extreme hot weather conditions observed on 19 January, with maximum observed temperatures at Melbourne Airport of 42.4 degrees Celsius.
17/01/18 15:21:03	18/01/18	1730 to 1830	SA	LOR1	60772	Forecast	Update to prior issued forecast LOR1.
17/01/18 15:21:31	19/01/18	1400 to 1630	VIC	LOR1	60773	Forecast	Update to prior issued forecast LOR1.
17/01/18 15:21:59	18/01/18	1600 to 1730	VIC	LOR1	60774	Forecast	Update to prior issued forecast LOR1.
18/01/18 11:35:02	18/01/18	1600 to 1800	VIC	LOR1	60791	Forecast	Update to prior issued forecast LOR1.
18/01/18 11:35:20	18/01/18	1700 to 1900	SA	LOR1	60792	Forecast	Update to prior issued forecast LOR1.
18/01/18 12:57:53	19/01/18	1430 to 1600	VIC	LOR2	60793	Forecast	Extreme hot weather conditions observed on 19 January, with maximum observed temperatures at Melbourne Airport of 42.4 degrees Celsius.
18/01/18 15:18:19	19/01/18	1430 to 1600	VIC	LOR2	60795	Forecast	Update to prior issued forecast LOR2.
18/01/18 16:05:50	18/01/18	1545 to 1830	VIC	LOR1	60796	Actual	Actual LOR1 declared. Extreme hot weather conditions observed on 18 January, with maximum observed temperatures at Melbourne Airport of 39.8 degrees Celsius.
18/01/18 17:05:50	18/01/18	1635 to 1800	VIC	LOR2	60799	Actual	Actual LOR2 declared. Extreme hot weather conditions observed on 18 January, with maximum observed temperatures at Melbourne Airport of 39.8 degrees Celsius.
18/01/18 17:45:00	18/01/18	n/a	VIC	LOR2	60801	Cancel	Actual LOR2 cancelled.
18/01/18 20:12:06	18/01/18	n/a	VIC	LOR1	60815	Cancel	Actual LOR1 cancelled.
19/01/18 04:51:33	19/01/18	1400 to 1700	VIC	LOR1	60828	Forecast	Update to prior issued forecast LOR1.
19/01/18 08:27:43	19/01/18	1400 to 1700	VIC	LOR2	60833	Forecast	Update to prior issued forecast LOR2.
19/01/18 08:27:34	19/01/18	1530 to 1600	SA	LOR2	60834	Forecast	Extreme hot weather conditions observed on 19 January, with maximum observed temperatures at Adelaide Kent Town of 43.7 degrees Celsius.
19/01/18 08:34:52	19/01/18	1400 to 1730	SA	LOR1	60835	Forecast	Extreme hot weather conditions observed on 19 January, with maximum observed temperatures at Adelaide Kent Town of 43.7 degrees Celsius.

Issue date and time	Effective date	Period	Region	Level	Market Notice	Actual, forecast or cancel	Comments
19/01/18 08:39:21	19/01/18	1300 to 1730	VIC	LOR1	60836	Forecast	Update to prior issued forecast LOR1.
19/01/18 11:10:10	19/01/18	1430 to 1700	VIC	LOR2	60837	Forecast	Update to prior issued forecast LOR2.
19/01/18 11:09:48	19/01/18	1430 to 1630	SA	LOR2	60838	Forecast	Update to prior issued forecast LOR2.
19/01/18 13:48:45	19/01/18	1430 to 1700	VIC	LOR2	60845	Forecast	Update to prior issued forecast LOR2.
19/01/18 13:49:03	19/01/18	1500 to 1630	SA	LOR2	60846	Forecast	Update to prior issued forecast LOR2.
19/01/18 14:02:23	19/01/18	1320 to 1800	VIC	LOR1	60847	Actual	Actual LOR1 declared. Extreme hot weather conditions observed on 19 January, with maximum observed temperatures at Melbourne Airport of 42.4 degrees Celsius.
19/01/18 14:44:35	19/01/18	1320 to 1800	VIC	LOR1	60849	Actual	Actual LOR1 updated. Extreme hot weather conditions observed on 19 January, with maximum observed temperatures at Melbourne Airport of 42.4 degrees Celsius.
19/01/18 15:42:16	19/01/18	n/a	VIC	LOR2	60853	Cancel	Forecast LOR2 cancelled.
19/01/18 15:46:38	19/01/18	n/a	SA	LOR2	60855	Cancel	Forecast LOR2 cancelled.
19/01/18 17:53:10	19/01/18	n/a	VIC	LOR1	60858	Cancel	Actual LOR1 cancelled.
28/01/18 10:43:03	28/01/18	1600 to 1730	VIC	LOR1	61006	Forecast	Extreme hot weather conditions observed on 28 January, with maximum observed temperatures at Melbourne Airport of 38.7 degrees Celsius.
06/02/18 11:24:25	07/02/18	1630 to 1730	VIC	LOR1	61126	Forecast	Extreme hot weather conditions observed on 7 February, with maximum observed temperatures at Melbourne Airport of 37.4 degrees Celsius.
06/02/18 12:59:05	07/02/18	1630 to 1730	VIC	LOR1	61128	Forecast	Update to prior issued forecast LOR1.
07/02/18 07:36:57	07/02/18	1630 to 1800	VIC	LOR1	61130	Forecast	Update to prior issued forecast LOR1.
07/02/18 15:54:59	07/02/18	1530 to 1800	VIC	LOR1	61146	Actual	Actual LOR1 declared. Extreme hot weather conditions observed on 7 February, with maximum observed temperatures at Melbourne Airport of 37.4 degrees Celsius.
07/02/18 17:16:42	07/02/18	1700 to 1730	SA	LOR1	61147	Actual	Actual LOR1 declared. Extreme hot weather conditions observed on 7 February, with maximum observed temperatures at Adelaide Kent Town of 40.7 degrees Celsius.
07/02/18 19:04:33	07/02/18	n/a	VIC	LOR1	61149	Cancel	Actual LOR1 cancelled.
07/02/18 20:03:53	07/02/18	n/a	SA	LOR1	61151	Cancel	Actual LOR1 cancelled.
14/02/18 14:41:27	14/02/18	1530 to 1700	QLD	LOR1	61251	Forecast	Extreme hot weather conditions observed on 14 February, with maximum observed temperatures at Archerfield of 34.6 degrees Celsius.
14/02/18 16:07:39	14/02/18	1600 to 1700	QLD	LOR1	61252	Actual	Actual LOR1 declared. Extreme hot weather conditions observed on 14 February, with maximum observed temperatures at Archerfield of 34.6 degrees Celsius.

Issue date and time	Effective date	Period	Region	Level	Market Notice	Actual, forecast or cancel	Comments
14/02/18 19:32:45	14/02/18	n/a	QLD	LOR1	61272	Cancel	Actual LOR1 cancelled.
15/02/18 10:18:12	15/02/18	1600 to 1800	QLD	LOR1	61283	Forecast	Extreme hot weather conditions observed on 15 February, with maximum observed temperatures at Archerfield of 35.4 degrees Celsius.
15/02/18 17:13:56	15/02/18	n/a	QLD	LOR1	61294	Cancel	Forecast LOR1 cancelled.

5. Quarterly statistics

Quarterly statistics in the accompanying spreadsheet have been updated to include data for the reporting period 16 January 2018 to 31 March 2018.

No LOR conditions (forecast or actual) were declared during the reporting period after implementation of the Reserve Level Declaration Guidelines on 15 February 2018[5], therefore all declarations in the accompanying spreadsheet were based on the previous credible contingency declaration guidelines that were in place at the time.

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.

The implementation of the Reserve Level Declaration Guidelines means that, depending upon the value of the FUM, the Lack of Reserve level 2 (LOR2) trigger value may be greater than the value under the previous credible contingency declaration guidelines.

Tables 2 and 3 provide an indication of the level of impact of the FUM on LOR2 trigger values. Note there is no impact in the Tasmanian region under normal conditions due to the relatively large value of the normal largest credible contingency (loss of Basslink 478 MW).

Table 2 Percentage of Trading Intervals in period 15 February 2018 to 31 March 2018 for which LOR2 trigger level was greater than value that would have applied under previous credible contingency declaration guidelines

Forecasting Horizon (Hrs ahead)	NSW	QLD	SA	TAS	VIC
2	41%	0%	0%	0%	18%
6	100%	93%	31%	0%	100%
12	100%	100%	86%	0%	100%
24	100%	100%	83%	0%	100%
48	100%	100%	100%	0%	100%
60	100%	100%	100%	0%	100%

[5] Refer to Market Notice 61250 for notification of implementation of Reserve Level Declaration Guidelines https://www.aemo.com.au/Market-Notices

Table 3 Average difference (in MW) between LOR2 trigger level and the values that would have applied under the previous credible contingency declaration guidelines for period 15 February 2018 to 31 March 2018

Forecasting Horizon (Hrs ahead)	NSW	QLD	SA	TAS	VIC
2	40	0	0	0	14
6	423	34	16	0	208
12	639	164	42	0	326
24	585	133	60	0	335
48	889	191	172	0	536
60	974	236	196	0	614

As this is the first quarterly report published under the Reserve Level Declaration Guidelines, AEMO intends for future quarterly reports to provide updates to the accompanying spreadsheet, to provide an assessment of:

- Whether FUM levels are rising or falling, taking into account seasonal factors.
- Whether the number of declared LOR conditions are rising or falling, taking into account seasonal factors.
- What the predominant causes of lack of reserve declarations are, and whether these causes are changing over time.