|  |
| --- |
| NEM Lack of Reserve Framework Retraining Report |

21 June 2018

Retraining to include data up to 31 March 2018

Important notice

PURPOSE

AEMO has prepared this document to report on the outcomes of retraining the Bayesian Belief Network which determines the Forecasting Uncertainty Measure as detailed in the NEM Lack of Reserve Framework.

Disclaimer

This document or the information in it may be subsequently updated or amended. This document does not constitute legal or business advice, and should not be relied on as a substitute for obtaining detailed advice about the National Electricity Law, the National Electricity Rules, or any other applicable laws, procedures or policies. AEMO has made every reasonable effort to ensure the quality of the information in this document but cannot guarantee its accuracy or completeness.

Accordingly, to the maximum extent permitted by law, AEMO and its officers, employees and consultants involved in the preparation of this document:

* make no representation or warranty, express or implied, as to the currency, accuracy, reliability or completeness of the information in this document; and

• are not liable (whether by reason of negligence or otherwise) for any statements or representations in this document, or any omissions from it, or for any use or reliance on the information in it.

Version Control

|  |  |  |
| --- | --- | --- |
| Version | Release date | Changes |
| 1 | 21/06/2018 | Initial version |

© 2018 Australian Energy Market Operator Limited. The material in this publication may be used in accordance with the [copyright permissions on AEMO’s website](http://aemo.com.au/Privacy_and_Legal_Notices/Copyright_Permissions_Notice).

Executive summary

This report has been published in accordance with the first NEM Lack of Reserve Framework Report published on 30 April 2018[[1]](#footnote-1), which stated that AEMO will publish a report following retraining of the Bayesian Belief Network. This report summarises the outcomes following the retraining of the Bayesian Belief Network to include data up to and including 31 March 2018.

The retrained Bayesian Belief Network was implemented 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.

The near-term NSW increases noted in this analysis were caused by small sample sizes due to a combination of cold temperatures and moderate to high intermittent generation during the week that this new BBN model was compared to the initial model.

The results from retraining are consistent with the ongoing effort to improve forecasting system accuracy at AEMO.

Subsequent reporting on the periodic retraining of the Bayesian Belief Network will be incorporated into the on-going quarterly NEM Lack of Reserve Framework Reports.

Contents

[Executive summary 3](#_Toc515978783)

[1. Introduction 5](#_Toc515978784)

[2. Retraining of the Bayesian Belief Network 6](#_Toc515978785)

[3. Summary of outcomes from retraining 7](#_Toc515978786)

# Introduction

This report has been published to inform the market about the outcomes following the retraining of the Bayesian Belief Network to include data up to and including 31 March 2018. The retrained Bayesian Belief Network was implemented on 13 June 2018.

The Bayesian Belief Network (BBN) is the algorithm which determines the Forecasting Uncertainty Measure (FUM), which in turn determines the Lack of Reserve (LOR) levels. This process is summarised in the Reserve Level Declaration Guidelines[[2]](#footnote-2).

This report is divided into two sections:

* **Retraining of the Bayesian Belief Network** – high-level outline of the steps involved to retrain the BBN.
* **Summary of outcomes from retraining** – following retraining, an assessment of the changes to the conditional probability distributions within the BBN which determine the FUM, and an estimate of the likely impact on future FUM values.

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

# Retraining of the Bayesian Belief Network

The intention of retraining the BBN is to update the network to include recent historic data since the last retraining. The initial version of the BBN that was deployed during the implementation of the Reserve Level Declaration Guidelines was trained on data from 1 July 2011 to 1 August 2017.

AEMO commenced retraining of the BBN in April 2018 to include data from 1 August 2017 to 31 March 2018. This is the equivalent of adding approximately 10% additional data to the training data set.

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.

AEMO completed the retraining process and implemented the retrained BBN into production on 13 June 2018.

# Summary of outcomes from retraining

AEMO has completed the following assessments to determine outcomes from retraining:

* Inspection of changes to probability distributions – changes to the conditional probability distributions when no input values are selected give an indication of potential FUM values under base-case scenarios.
* Extreme input sensitivity analysis – gives an indication of sensitivity of potential FUM values to extreme input conditions.
* Comparison of FUM values – FUM values from the retrained BBN were compared with the values from the initial BBN to give an indication of changes to FUM values under real-world conditions.

The results from this analysis indicate that changes to future 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. QLD – immaterial changes to most forecasting horizons, with the exception of a decrease to FUM values at 48 hours ahead.
3. SA – decrease to FUM values for all forecasting horizons.
4. TAS – immaterial changes to all forecasting horizons.
5. VIC – decrease to FUM values for all forecasting horizons.

These changes are summarised in Table 1.

The observed trend of general decreases to expected FUM values as a result of the retrained BBN indicates that the forecasting accuracy of the additional historic data introduced into the training set is, on average, more accurate than the existing training set data. The resulting expected decreases to FUM values indicate total forecasting uncertainty has decreased following the retraining. This result is consistent with the ongoing effort to improve forecasting system accuracy at AEMO.

The near-term NSW increases noted in the assessment were caused by small sample sizes due to a combination of cold temperatures and moderate to high intermittent generation during the week over which the retrained BBN and the initial BBN were compared.

Table - estimate of likely changes to future FUM values due to retrained BBN assuming similar input conditions

|  |  |  |  |
| --- | --- | --- | --- |
| Region | Forecasting horizon (hrs) | Previously published average FUM values[[3]](#footnote-3) (MW) | Estimated change to future FUM values (MW) |
| NSW | 6 | 1133 | +65 |
|  | 12 | 1352 | No change |
|  | 24 | 1287 | -25 |
|  | 48 | 1586 | -50 |
|  | 60 | 1663 | -50 |
| QLD | 6 | 729 | No change |
|  | 12 | 874 | No change |
|  | 24 | 840 | No change |
|  | 48 | 899 | -15 |
|  | 60 | 944 | No change |
| SA | 6 | 342 | -15 |
|  | 12 | 389 | -5 |
|  | 24 | 409 | -40 |
|  | 48 | 525 | -45 |
|  | 60 | 552 | -50 |
| TAS | 6 | 180 | No change |
|  | 12 | 199 | No change |
|  | 24 | 175 | No change |
|  | 48 | 199 | No change |
|  | 60 | 209 | No change |
| VIC | 6 | 761 | -30 |
|  | 12 | 881 | -40 |
|  | 24 | 890 | -45 |
|  | 48 | 1093 | -65 |
|  | 60 | 1170 | -60 |

1. Refer to <https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Security-and-reliability/Power-system-operation/NEM-Lack-of-Reserve-Framework-Quarterly-Reports> for NEM Lack of Reserve Framework Quarterly reports [↑](#footnote-ref-1)
2. Refer to <https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Security-and-reliability/Power-system-operation> [↑](#footnote-ref-2)
3. Published in the NEM Lack of Reserve Framework Report – quarter ending 31 March 2018 available at <https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Security-and-reliability/Power-system-operation/NEM-Lack-of-Reserve-Framework-Quarterly-Reports> [↑](#footnote-ref-3)