ENERGY ADEQUACY ASSESSMENT PROJECTION

FOR EASTERN AND SOUTH EASTERN AUSTRALIA

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IMPORTANT NOTICE

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EXECUTIVE SUMMARY

The reliability standard specifies that the level of expected unserved energy (USE) should not exceed 0.002% of the operational consumption per region, in any financial year.

The Energy Adequacy Assessment Projection (EAAP) is published quarterly and assesses the impact of potential energy constraints on energy availability for a range of rainfall scenarios as specified in the EAAP guidelines[1]. The scenarios are summarised as follows:

- Scenario 1: Low rainfall – based on rainfall between 1 July 2006 and 30 June 2007 for all regions except New South Wales. New South Wales is based on rainfall between 1 June 2006 and 31 May 2007.[2]
- Scenario 2: Short-term average rainfall – based on the average rainfall recorded over the past 10 years.
- Scenario 3: Long-term average rainfall – based on the average rainfall recorded over the past 50 years, or the longest period for which rainfall data is available, if less than 50 years (depending on the data available to participants).

The key finding of the June 2016 EAAP is that, based on these scenarios, there are no projected breaches of the reliability standard in any of the National Electricity Market (NEM) regions over the next two years.

The notable changes in supply and demand from the previous March 2016 EAAP are:

- 9 May 2016, Northern power station in South Australia ceased operation.
- 6 June 2016, AGL announced the deferral of mothballing the four generating units at its 480 MW Torrens Island A station[3] in Adelaide.
- 10 June[4] 2016, the Basslink Interconnector returned to service following a fault separating Tasmania from the rest of the NEM for a period of approximately six months.
- 27 June 2016, above average rainfall in Tasmania for the month of May 2016 has resulted in hydro dam storage levels reaching 28.5%[5] up from the record low of 12.8%[6] two months earlier.
- As energy supply risks in Tasmania eased, the 222 MW temporary diesel units and 208 MW Tamar Valley combined cycle gas turbine were taken out of service. Bell Bay Aluminium and TEMCO, who were providing voluntary load reductions, returned to normal levels of production[7].

[1] The guidelines were determined following Electricity Rule Consultation Procedures. Available at: http://www.aemo.com.au/Electricity/Resources/Reports-and-Documents/~/media/Files/Other/electricityops/EAAP_Guidelines.ashx. Viewed on 17 June 2016.
[2] Analysis of this period ensures the lowest rainfall for New South Wales is reflected in the low rainfall scenario.
[3] AGL to defer mothballing of South Australian generating units. Available at : https://www.agl.com.au/about-agl/media-centre/article-list/2016/june/agl-to-defer-mothballing-of-south-australian-generating-units. Viewed on 17 June 2016.
[4] Basslink has returned to service – Available at http://www.basslink.com.au/wp-content/uploads/2016/06/Media-statement-13-June-final1.pdf. Viewed on 20 June 2016.
[5] Water levels – Available at http://www.hydro.com.au/. Viewed on 27 June 2016.
[6] Hydro Tasmania's weekly Energy in Storage (GWH) update published on their website on 25 April 2016.
[7] More industrial production, less gas generation. Available at http://www.hydro.com.au/about-us/news/2016-05/more-industrial-production-less-gas-generation. Viewed on 28 June 2016.

CONTENTS

EXECUTIVE SUMMARY **1**

1. ENERGY ADEQUACY ASSESSMENT PROJECTION **2**
1.1 Introduction 2
1.2 Key modelling inputs and methodology 2
1.3 Differences between MT PASA and EAAP 3
1.4 Supply conditions in Tasmania 4
1.5 Change in generation capacity 4
1.6 EAAP results 4

APPENDIX A. DETAILED MONTHLY RESULTS **2**
A.1 Low rainfall scenario 2
A.2 Medium rainfall scenario 3
A.3 High rainfall scenario 4

APPENDIX B. MEASURES AND ABBREVIATIONS **5**
Units of measure 5
Abbreviations 5
Glossary 5

1. ENERGY ADEQUACY ASSESSMENT PROJECTION

1.1 Introduction

The EAAP quantifies the impact of potential energy constraints on energy availability for a range of rainfall scenarios, specified in the EAAP guidelines[8] and described below. AEMO identifies potential periods of USE and quantifies projected annual USE that may breach the reliability standard.

Clause 3.9.3C of the National Electricity Rules (NER) defines:

- The reliability standard, which measures the sufficiency of installed capacity to meet demand. It is defined as the maximum expected USE, as a percentage of total energy (measured in megawatt hours (MWh), allowable in a region over a financial year. It is currently set at 0.002%.
- The USE that contributes to the reliability standard. This excludes USE resulting from power system security events, network outages not associated with inter-regional flows, and industrial action or acts of God.

AEMO's June 2016 EAAP takes into account information provided by participants, through the Generator Energy Limitation Framework (GELF), as at 6 May 2016.

The analysis covers the period from 1 July 2016 to 30 June 2018, and includes anticipated energy constraints under these three specified rainfall scenarios:

- Scenario 1: Low rainfall – based on rainfall between 1 July 2006 and 30 June 2007 for all regions except New South Wales. New South Wales is based on rainfall between 1 June 2006 and 31 May 2007.[9]
- Scenario 2: Short-term average rainfall – based on the average rainfall recorded over the past 10 years.
- Scenario 3: Long-term average rainfall – based on the average rainfall recorded over the past 50 years, or the longest period for which rainfall data is available, if less than 50 years (depending on the data available to participants).

1.2 Key modelling inputs and methodology

The EAAP guidelines also specify modelling inputs and assumptions used in the EAAP analysis.

The EAAP uses the following inputs to its forecasting models:

- Existing scheduled and semi-scheduled generation.
- Committed scheduled and semi-scheduled generation.
- Planned increases in capacities of existing scheduled and semi-scheduled generation used in MT PASA.
- Demand profiles consistent with the *2015 National Electricity Forecasting Report* (NEFR) energy and demand projections.[10]

Participants submit confidential information (specifically MT PASA available capacity offers and GELF parameters) which is used in the EAAP modelling process. The generation capacity and variable GELF parameters are designed to take into account all of the following:

[8] Available at: http://www.aemo.com.au/Electricity/Resources/Reports-and-Documents/~/media/Files/Other/electricityops/EAAP_Guidelines.ashx. Viewed on 20 June 2016.
[9] Analysis of this period ensures the lowest rainfall for New South Wales is reflected in the low rainfall scenario.
[10] AEMO *2015 National Electricity Forecasting Report.* Available at: http://www.aemo.com.au/Electricity/Planning/Forecasting/~/media/Files/Electricity/Planning/Reports/NEFR/2015/Detailed%20summary%20of%202015%20electricity%20forecasts.ashx.

- Hydro storage including pump storage.
- Thermal generation fuel.
- Cooling water availability.
- Gas supply limitations.

AEMO uses a market model to forecast two years at hourly resolution for the three rainfall scenarios. This involves using time-sequential Monte-Carlo market dispatch simulations, accounting for uncertainties in generator availability and weather-sensitive demand. In total, 400 simulations are performed for each rainfall scenario using both 10% and 50% Probability of Exceedance (POE) demand forecasts. The model uses a probability-weighted USE assessment to identify any potential reliability standard breaches.

1.3 Differences between MT PASA and EAAP

AEMO runs two processes to implement the reliability standard over a two year period:

1. EAAP, to forecast USE for *energy* constrained scenarios.
2. MT PASA, to forecast peak *capacity reserve* conditions over a two year projection.

These processes use similar inputs, but the methodologies are different, reflecting their different purposes and frequency of projections. Their similarities and differences are described in more detail in the *Reliability Standard Implementation Guidelines* (RSIG).[11]

The MT PASA is run at least weekly and, as part of a broader process, identifies potential capacity shortfalls known as Low Reserve Conditions (LRCs). An LRC is declared if capacity reserves are projected to be inadequate on any given day. Capacity reserves are the difference between the availability participants have offered and expected demand estimated by AEMO. To assess supply adequacy, these capacity reserves are compared against estimated Minimum Reserve Levels (MRLs). This provides a fast and timely assessment of supply adequacy without needing to compute USE explicitly using a large number of Monte Carlo simulations.

Applying MRL in the MT PASA assists to identify potential reserve shortfalls in the NEM. However, given the approximate nature of the MT PASA process, AEMO applies probabilistic studies such as EAAP to confirm the LRC findings of MT PASA before intervening in response to projected shortfalls.

1.3.1 MT PASA projections for South Australia

Since Alinta Energy's October 2015 announcement about the withdrawal of the Northern and Playford B power stations, MT PASA has been projecting LRCs in South Australia over the summers of 2016–17 and 2017–18. AGL's announcement to defer the previously planned mothballing of Torrens Island A power station has not removed these LRCs in MT PASA.

The EAAP analysis indicates that these LRCs in South Australia are not expected to result in reliability standard breaches in the next two years.

Some supply shortfalls may be experienced in South Australia at times when high demand coincides with low wind generation, plant outages, or low levels of imports. This reflects the changing generation mix in the region. With Northern power station now withdrawn, there is more reliance on intermittent generation and imports to meet demand in South Australia.

The Heywood Interconnector between South Australia and Victoria is currently being upgraded. The upgrade aims to increase capacity from a nominal 460 MW to 650 MW in both directions, but the realised capacity may be lower under certain operating conditions. Indicative limits have been used in this EAAP to model the capability of the upgraded Heywood Interconnector and implications of the

[11] Available at: http://www.aemo.com.au/Consultations/National-Electricity-Market/~/media/Files/Electricity/Consultations/2015/Reliability%20Standard%20Implementation%20Guidelines%20Final%20Report.ashx. Viewed on 20 June 2016.

intended capacity withdrawals. A final set of network limits will be available closer to completion of the upgrade later in 2016, which may impact on assessments of South Australia's supply adequacy.

1.4 Supply conditions in Tasmania

Above average rainfall observed in May 2016 in Tasmania, which resulted in hydro dam storage levels reaching 28%, has eased energy supply risks in Tasmania. As a result, Bell Bay Aluminium and TEMCO are now back to normal production[12] and the combined cycle gas turbine (CCGT) at the Tamar Valley Power Station was taken offline[13] on 11 May 2016.

With the return of Basslink on 10 June 2016, Hydro Tasmania has already commenced round one of demobilising the temporary diesel generators. Four sites are expected to be demobilised in June and July 2016, reducing diesel generation capacity from 222 MW to 135 MW[14].

1.5 Change in generation capacity

1.5.1 Availability changes from existing generation capacity

Table 1 lists future changes to existing generating units' availability that are included in the modelling.

Table 1 Changes in generating plants' availability

Station	State	Capacity (MW)	Outage duration
Torrens Island A	South Australia	480	Mothballing deferred until further notice. Units 1 and 2 have returned to service in June 2016.
Pelican Point (Unit 2)	South Australia	239	Withdrawn until October 2016 but expected to return to service in November 2016. Unit 1 has been withdrawn since March 2015.
Northern	South Australia	546	Withdrawn in May 2016.
Playford	South Australia	240	Withdrawn in May 2016.
Tamar Valley Peaking Plant	Tasmania	58	Returned to service in April 2016.
Tamar Valley CCGT	Tasmania	208	Withdrawn on 11 May 2016.

1.5.2 Committed scheduled and semi-scheduled generation capacity

Table 2 lists the committed scheduled and semi-scheduled generating units included in the modelling.

Table 2 Committed scheduled and semi-scheduled generating units

Station	State	Capacity (MW)	Commercial operation date
Ararat Wind Farm	Victoria	240	July 2017
Hornsdale Wind Farm	South Australia	102	November 2016
Moree Solar Farm	New South Wales	56	March 2016

1.6 EAAP results

No breach of the NEM reliability standard is projected to arise from energy constraints in any region over the next two years.

USE is observed in regions occasionally under all three rainfall scenarios, but supply levels still meet the reliability standard.

[12] Bell Bay Aluminium has returned to its previous demand of 339MW. It previously agreed to reduce its demand by up to 10% during the Basslink outage.
[13] Available at: http://www.hydro.com.au/about-us/news/2016-05/tasmania-currently-completely-renewable. Viewed on 24 June 2016.
[14] Available at: http://www.hydro.com.au/about-us/news/2016-06/basslink-repair-and-diesel-generation-update. Viewed on 24 June 2016.

Appendix A lists average monthly USE results for all regions under all three rainfall scenarios.

Key points from the results are:

- Some USE may occur in South Australia during summer periods under all three rainfall scenarios. In 2017-18, about 0.0004% of the state's forecast electricity consumption may not be met. Notably, in January and February 2018, the USE ranging between 22 MWh and 24 MWh is projected (see Appendix A). This USE occurs in approximately 65% of the Monte Carlo simulations, typically at times of high demand, with low wind conditions, or when imports are limited.
- In 2017-18, about 0.0003% of Victoria's forecast electricity consumption may not be met. This is primarily due to variations in the GELF data provided by the Scheduled Generators this quarter.

The following tables show the average yearly regional energy consumption (in MWh) at risk. All regional demand data is from AEMO's *2015 National Electricity Forecasting Report*.

Table 3 Forecast yearly USE in low rainfall scenario

Low Rainfall Scenario	July 2016 to June 2017 USE (MWh)	July 2016 to June 2017 USE (% of Regional Demand)	July 2017 to June 2018 USE (MWh)	July 2017 to June 2018 USE (% of Regional Demand)
New South Wales	0.27	-	0.84	-
Queensland	-	-	-	-
South Australia	89.68	0.0007%	46.86	0.0004%
Tasmania	-	-	-	-
Victoria	6.32	-	129.47	0.0003%

Table 4 Forecast yearly USE in medium rainfall scenario

Medium Rainfall Scenario	July 2016 to June 2017 USE (MWh)	July 2016 to June 2017 USE (% of Regional Demand)	July 2017 to June 2018 USE (MWh)	July 2017 to June 2018 USE (% of Regional Demand)
New South Wales	0.23	-	0.55	-
Queensland	-	-	-	-
South Australia	88.67	0.0007%	10.75	0.0001%
Tasmania	-	-	-	-
Victoria	4.61	-	5.09	-

Table 5 Forecast yearly USE in high rainfall scenario

High Rainfall Scenario	July 2016 to June 2017 USE (MWh)	July 2016 to June 2017 USE (% of Regional Demand)	July 2017 to June 2018 USE (MWh)	July 2017 to June 2018 USE (% of Regional Demand)
New South Wales	0.34	-	0.57	-
Queensland	-	-	-	-
South Australia	83.16	0.0006%	10.14	0.0001%
Tasmania	-	-	-	-
Victoria	5.23	-	5.07	-

APPENDIX A. DETAILED MONTHLY RESULTS

The following tables show the average monthly regional energy demand (in megawatt hours) at risk.

A.1 Low rainfall scenario

Table 6 Forecast USE in Low rainfall scenario, MWh

Month	NSW	QLD	SA	TAS	VIC
July 2016	-	-	-	-	-
August 2016	-	-	0.12	-	-
September 2016	-	-	-	-	-
October 2016	-	-	-	-	-
November 2016	-	-	29.41	-	-
December 2016	-	-	-	-	-
January 2017	0.27	-	15.22	-	1.64
February 2017	-	-	44.64	-	4.69
March 2017	-	-	-	-	-
April 2017	-	-	-	-	-
May 2017	-	-	0.29	-	-
June 2017	-	-	-	-	-
July 2017	-	-	-	-	-
August 2017	-	-	-	-	-
September 2017	-	-	-	-	-
October 2017	-	-	-	-	-
November 2017	-	-	0.15	-	-
December 2017	-	-	-	-	-
January 2018	-	-	23.90	-	91.68
February 2018	-	-	22.69	-	37.79
March 2018	-	-	-	-	-
April 2018	-	-	-	-	-
May 2018	0.84	-	0.11	-	-
June 2018	-	-	-	-	-

A.2 Medium rainfall scenario

Table 7 Forecast USE in Medium rainfall scenario, MWh

Month	NSW	QLD	SA	TAS	VIC
July 2016	-	-	-	-	-
August 2016	-	-	0.12	-	-
September 2016	-	-	-	-	-
October 2016	-	-	-	-	-
November 2016	-	-	29.51	-	-
December 2016	-	-	-	-	-
January 2017	0.23	-	14.77	-	0.68
February 2017	-	-	43.96	-	3.93
March 2017	-	-	-	-	-
April 2017	-	-	-	-	-
May 2017	-	-	0.32	-	-
June 2017	-	-	-	-	-
July 2017	-	-	-	-	-
August 2017	-	-	-	-	-
September 2017	-	-	-	-	-
October 2017	-	-	-	-	-
November 2017	-	-	0.17	-	-
December 2017	-	-	-	-	-
January 2018	-	-	2.42	-	5.09
February 2018	-	-	8.06	-	-
March 2018	-	-	-	-	-
April 2018	-	-	-	-	-
May 2018	0.55	-	0.09	-	-
June 2018	-	-	-	-	-

A.3 High rainfall scenario

Table 8 Forecast USE in High rainfall scenario, MWh

Month	NSW	QLD	SA	TAS	VIC
July 2016	-	-	-	-	-
August 2016	-	-	0.12	-	-
September 2016	-	-	-	-	-
October 2016	-	-	-	-	-
November 2016	-	-	27.01	-	-
December 2016	-	-	-	-	-
January 2017	0.34	-	13.96	-	0.94
February 2017	-	-	41.78	-	4.29
March 2017	-	-	-	-	-
April 2017	-	-	-	-	-
May 2017	-	-	0.29	-	-
June 2017	-	-	-	-	-
July 2017	-	-	-	-	-
August 2017	-	-	-	-	-
September 2017	-	-	-	-	-
October 2017	-	-	-	-	-
November 2017	-	-	0.20	-	-
December 2017	-	-	-	-	-
January 2018	-	-	2.15	-	5.07
February 2018	-	-	7.70	-	-
March 2018	-	-	-	-	-
April 2018	-	-	-	-	-
May 2018	0.57	-	0.09	-	-
June 2018	-	-	-	-	-

APPENDIX B. MEASURES AND ABBREVIATIONS

Units of measure

Abbreviation	Unit of Measure
GWh	Gigawatt hours
MW	Megawatts
MWh	Megawatt hours

Abbreviations

Abbreviation	Expanded Name
AEMO	Australian Energy Market Operator
CCGT	Combined Cycle Gas Turbine
EAAP	Energy Adequacy Assessment Projection
ESOO	Electricity Statement of Opportunities
GELF	Generator Energy Limitation Framework
LRC	Low Reserve Conditions
MRL	Minimum Reserve Levels
MTPASA	Medium Term Projected Assessment of System Adequacy
NEM	National Electricity Market
NEFR	National Electricity Forecasting Report
NER	National Electricity Rules
POE	Probability of Exceedance
RSIG	Reliability Standard Implementation Guidelines
USE	Unserved energy

Glossary

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

Term	Definition
Low Reserve Conditions (LRC)	When AEMO considers that a region's reserve margin (calculated under 10% Probability of Exceedance (POE) scheduled and semi-scheduled maximum demand (MD) conditions) for the period being assessed is below the Reliability Standard.