ENERGY ADEQUACY ASSESSMENT PROJECTION

FOR EASTERN AND SOUTH EASTERN AUSTRALIA

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IMPORTANT NOTICE

Purpose

AEMO publishes this projection in accordance with rule 3.7C of the National Electricity Rules. This publication is based on information available to AEMO as at 5 August 2016, although AEMO has endeavoured to incorporate more recent information where practical.

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EXECUTIVE SUMMARY

The reliability standard specifies that the level of expected unserved energy (USE), in megawatt hours (MWh), should not exceed 0.002% of the total energy demanded per region, in any financial year

The Energy Adequacy Assessment Projection (EAAP) is published quarterly[1] and assesses the impact of potential energy constraints on the level of expected USE for a range of rainfall scenarios as specified in the EAAP guidelines[2]. 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.[3]
- 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 September 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 since the last quarter (as reported in the June 2016 EAAP) are:

- AEMO has revised the demand forecast for September 2016 EAAP based on the National Electricity Energy Forecasting Report 2016 (NEFR)[4].
- Swanbank E unit (385 MW) is now expected to return to service[5] by summer 2018-2019 rather than winter 2017-2018.
- Tamar Valley CCGT (208 MW) is available[6] over summer 2016-2017.

[1] Due to a Rule Change, from 1 November, the frequency of performing an EAAP will be reduced to at least once in every 12 month period, with additional reporting required if AEMO becomes aware of new information that may materially alter the previously published EAAP

[2]. Available at: http://www.aemo.com.au/Electricity/Resources/Reports-and-Documents/~/media/Files/Other/electricityops/EAAP_Guidelines.ashx. Viewed on 21 September 2016.

[2] Analysis of this period ensures the lowest rainfall for New South Wales is reflected in the low rainfall scenario.

[4] Available at: http://www.aemo.com.au/Eectricity/National-Electricity-Market-EM/~/link.aspx?_id=80D4B633C2C646B388513FD14536623C&_z=z Viewed on 21 September 2016.

[5] Based on written advice received from Stanwell Corporation.

[6] Based on written advice received from Hydro Tasmania.

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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[7] 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 demanded[8], 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 September 2016 EAAP takes into account information provided by participants, through the Generator Energy Limitation Framework (GELF), as at 5 August 2016.

The analysis covers the period from 1 October 2016 to 30 September 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 in 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 the Medium Term Projected Assessment of System Adequacy (MT PASA).
- Demand profiles consistent with the *2016 National Electricity Forecasting Report* (NEFR) energy and demand projections.[10]

[7] Available at: http://www.aemo.com.au/Electricity/Resources/Reports-and-Documents/~/media/Files/Other/electricityops/EAAP_Guidelines.ashx. Viewed on 21 September 2016.
[8] For the purpose of calculating the USE percentage, AEMO assumes that total energy is equivalent to native consumption, defined in AEMO's Forecasting Methodology Information Paper, available at http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/-/media/2221306870FC48EAA20A6AB49526E1D1.ashx Viewed on 25 September 2016.
[9] Analysis of this period ensures the lowest rainfall for New South Wales is reflected in the low rainfall scenario.
[10] Available at: http://www.aemo.com.au/Eectricity/National-Electricity-Market-EM/~/link.aspx?_id=80D4B633C2C646B388513FD14536623C&_z=z Viewed on 21 September 2016.

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:

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

AEMO uses a market model to forecast the next 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 conducts 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 and Queensland

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 summer 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 a breach of the reliability standard 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

[11] Available at : http://www.aemo.com.au/media/Files/Electricity/Consultations/2015/Reliability%20Standard%20Implementation%20Guidelines%20Final%20Report.pdf. Viewed on 21 September 2016.

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. Operational limits have been used in this EAAP to model the capability of the upgraded Heywood Interconnector...

Queensland

Since Stanwell Corporations' announcement to defer the return to service date of its Swanbank E unit (385 MW) to summer 2018-2019, MT PASA has been projecting LRCs in Queensland in January and February 2018.

The EAAP analysis indicates that these LRCs in Queensland are not expected to result in a breach of the reliability standard in the next two years.

1.4 Change in generation capacity

1.4.1 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)	Changes in plant status
Tamar Valley CCGT	Tasmania	208	Expected to be available during summer 2016-2017 (previously offline since 11 May 2016).
Swanbank E	Victoria	385	Expected to return to service in summer 2018-2019 (previously was expected to return in July 2017).

1.4.2 Committed scheduled and semi-scheduled generation capacity

Table 2 lists the committed scheduled and semi-scheduled generating units included in the modelling for September 2016 EAAP. Proponents have advised that these units are expected to be operating within the next two years.

Table 2 Committed[12] scheduled and semi-scheduled generating units

Station	State	Capacity (MW)	Commercial operation date
Ararat Wind Farm	Victoria	240	July 2017
Hornsdale Wind Farm Stage 1	South Australia	102	November 2016

1.5 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.

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

[12] Waterloo expansion windfarm (19.8MW) is now a committed project but is not modelled in September EAAP 2016 due to uncertainties in its registration application and commercial operation date. The impact of this windfarm is unlikely to materially alter the USE projections for SA in the next two years.

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 0.0002% of the state's forecast electricity consumption may not be met. Notably, in January and February 2018, the USE ranging between 9 MWh and 14 MWh is projected (see Appendix A). This USE occurs in approximately 8% of the Monte Carlo simulations, typically at times of high demand, with low wind conditions, or when imports are limited.
- In 2017-18, about 0.0002% of Victoria's forecast electricity consumption may not be met at times of high demand.
- Overall, the projected USE for Victoria and South Australia is lower than June 2016 EAAP due to a drop in the annual consumption forecast for 2016-2017 and variations in GELF data provided by the Scheduled Generators this quarter.
- While some USE may be experienced in New South Wales and Queensland under all rainfall scenarios, the projected levels are well below the reliability standard.

The following tables show the average yearly regional native energy consumption (in MWh) at risk. All regional demand data is from AEMO's 2016 NEFR.

Table 3 Forecast yearly USE in low rainfall scenario

Low rainfall scenario	October 2016 to September 2017 USE (MWh)	October 2016 to September 2017 USE (% of regional demand)	October 2017 to September 2018 USE (MWh)	October 2017 to September 2018 USE (% of regional demand)
New South Wales	6.98	-	1.18	-
Queensland	3.67	-	13.97	-
South Australia	3.26	-	23.44	0.0002%
Tasmania	-	-	-	-
Victoria	0.60	-	67.21	0.0002%

Table 4 Forecast yearly USE in medium rainfall scenario

Medium rainfall scenario	October 2016 to September 2017 USE (MWh)	October 2016 to September 2017 USE (% of regional demand)	October 2017 to September 2018 USE (MWh)	October 2017 to September 2018 USE (% of regional demand)
New South Wales	3.84	-	0.81	-
Queensland	2.62	-	13.90	-
South Australia	3.26	-	3.41	-
Tasmania	-	-	-	-
Victoria	0.46	-	2.39	-

Table 5 Forecast yearly USE in high rainfall scenario

High rainfall scenario	October 2016 to September 2017 USE (MWh)	October 2016 to September 2017 USE (% of regional demand)	October 2017 to September 2018 USE (MWh)	October 2017 to September 2018 USE (% of regional demand)
New South Wales	2.08	-	0.88	-
Queensland	1.45	-	13.96	-
South Australia	3.20	-	3.40	-
Tasmania	-	-	-	-
Victoria	0.50	-	2.48	-

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
October 2016	-	-	-	-	-
November 2016	6.98	3.14	2.96	-	-
December 2016	-	-	-	-	-
January 2017	-	-	0.20	-	0.53
February 2017	-	0.30	0.10	-	0.07
March 2017	-	-	-	-	-
April 2017	-	-	-	-	-
May 2017	-	-	-	-	-
June 2017	-	-	-	-	-
July 2017	-	-	-	-	-
August 2017	-	0.23	-	-	-
September 2017	-	-	-	-	-
October 2017	-	-	-	-	-
November 2017	-	0.13	0.49	-	1.77
December 2017	-	1.09	-	-	-
January 2018	0.77	-	8.71	-	29.32
February 2018	0.41	-	13.86	-	34.77
March 2018	-	-	-	-	-
April 2018	-	-	-	-	-
May 2018	-	1.65	0.38	-	1.36
June 2018	-	1.14	-	-	-
July 2018	-	9.95	-	-	-
August 2018	-	-	-	-	-
September 2018	-	-	-	-	-

A.2 Medium rainfall scenario

Table 7 Forecast USE in medium rainfall scenario, MWh

Month	NSW	QLD	SA	TAS	VIC
October 2016	-	-	-	-	-
November 2016	3.84	2.09	3.04	-	-
December 2016	-	-	-	-	-
January 2017	-	-	0.14	-	0.46
February 2017	-	0.31	0.07	-	-
March 2017	-	-	-	-	-
April 2017	-	-	-	-	-
May 2017	-	-	-	-	-
June 2017	-	-	-	-	-
July 2017	-	-	-	-	-
August 2017	-	0.22	-	-	-
September 2017	-	-	-	-	-
October 2017	-	-	-	-	-
November 2017	-	0.13	0.44	-	1.28
December 2017	-	1.08	-	-	-
January 2018	0.59	-	0.44	-	0.79
February 2018	0.23	-	2.53	-	0.31
March 2018	-	-	-	-	-
April 2018	-	-	-	-	-
May 2018	-	1.65	-	-	-
June 2018	-	1.15	-	-	-
July 2018	-	9.89	-	-	-
August 2018	-	-	-	-	-
September 2018	-	-	-	-	-

A.3 High rainfall scenario

Table 8 Forecast USE in high rainfall scenario, MWh

Month	NSW	QLD	SA	TAS	VIC
October 2016	-	-	-	-	-
November 2016	2.08	0.98	2.99	-	-
December 2016	-	-	-	-	-
January 2017	-	-	0.20	-	0.49
February 2017	-	0.25	0.02	-	0.01
March 2017	-	-	-	-	-
April 2017	-	-	-	-	-
May 2017	-	-	-	-	-
June 2017	-	-	-	-	-
July 2017	-	-	-	-	-
August 2017	-	0.22	-	-	-
September 2017	-	-	-	-	-
October 2017	-	-	-	-	-
November 2017	-	0.13	0.41	-	1.22
December 2017	-	1.08	-	-	-
January 2018	0.59	-	0.48	-	0.94
February 2018	0.30	-	2.51	-	0.32
March 2018	-	-	-	-	-
April 2018	-	-	-	-	-
May 2018	-	1.65	-	-	-
June 2018	-	1.15	-	-	-
July 2018	-	9.96	-	-	-
August 2018	-	-	-	-	-
September 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.