ENERGY ADEQUACY ASSESSMENT PROJECTION

FOR EASTERN AND SOUTH EASTERN AUSTRALIA

Published: **December 2015**

AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

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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 7 November 2015, although AEMO has endeavoured to incorporate more recent information where practical.

EXECUTIVE SUMMARY

The Energy Adequacy Assessment Projection (EAAP) makes available to the market an analysis that quantifies the impact of potential energy constraints on energy availability for a range of rainfall scenarios, specified in the EAAP guidelines[1]:

- 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).

Despite low hydro storage levels across the National Electricity Market (NEM), this December 2015 EAAP does not project any breach of the reliability standard arising from drought conditions over the next two years. The reliability standard prescribes a maximum of 0.002% of all operational consumption can go unserved for any region in any financial year.

The December 2015 EAAP highlights:

- Current hydro storage levels in Tasmania are low (26%[3] as at December 2015). Despite this, there is enough storage, local wind generation and import capacity available from Victoria to cover forecast electricity consumption if the current El Niño conditions do not dissipate over the first quarter of 2016.
- Hydro inflows used in the EAAP cover drought conditions until the onset of anticipated seasonal rainfall. This is consistent with Bureau of Meteorology (BoM) predictions that the current El Niño event that has lowered hydro storage, is expected to peak January 2016, and is then forecast to decline through the first quarter of 2016[4].
- As a response to the El Niño, Hydro Tasmania is conserving its hydro storage, and so the state has been relying more on imported energy via Basslink to meet its electricity needs[5]. On 17 December, Hydro Tasmania committed to returning 208 MW of gas-fired generation to service in Tasmania in January 2016, providing alternative energy supplies for the state.
- On 20 December 2015, a fault on Basslink resulted in the separation of Tasmania from the rest of the NEM. At the time this report was published, the expected return to service date for Basslink was unknown. AEMO has assessed energy supply adequacy (including a scenario where Basslink remains out of service for the entire summer 2016 period) and projects sufficient energy supplies in both Tasmania and Victoria.

The EAAP also serves as a more detailed assessment of the likely impact of Low Reserve Conditions (LRCs) flagged in AEMO's weekly Medium Term Projected Assessment of System Adequacy (MTPASA) process. The LRCs in South Australia, currently reported in MTPASA, are not expected to result in reliability standard breaches in the next two years. Nonetheless, there is a likelihood of some unserved energy (USE) (about 0.001%) in South Australia in summer 2017 and summer 2018. This USE typically occurs at times of high demand, with low wind conditions, or when imports are limited.

[1] 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: 22 December 2015.
[2] Analysis of this period ensures the lowest rainfall for New South Wales is reflected in the low rainfall scenario.
[3] http://www.hydro.com.au/water/water-levels-and-flows-map. Viewed: 22 December 2015
[4] http://www.bom.gov.au/climate/enso/. Viewed: 22 December 2015
[5] http://www.hydro.com.au/about-us/news/2015-12/clarification-tasmania-not-importing-50-its-energy-requirements. Viewed: 22 December 2015

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1. ENERGY ADEQUACY ASSESSMENT PROJECTION

1.1 Introduction

The EAAP makes available to the market an analysis that quantifies the impact of potential energy constraints on energy availability for a range of rainfall scenarios, specified in the EAAP guidelines. AEMO identifies potential periods of USE and quantifies projected annual USE that may breach the reliability standard.

The reliability standard is a measure of the effectiveness, or sufficiency, of installed capacity to meet demand. It is defined in clause 3.9.3C of the NER as the maximum USE, as a percentage of total energy, in a region over a financial year, and is currently set at 0.002%. Energy is measured in megawatt hours (MWh).

The USE that contributes to the reliability standard is defined in clause 3.9.3C (b) of the NER and excludes power system security events, network outages not associated with inter-regional flows and industrial action or acts of God.

AEMO's December 2015 EAAP takes into account information provided by participants, through the Generator Energy Limitation Framework (GELF) as at 7 November 2015. The analysis covers the period from 1 January 2016 to 31 December 2017. This information includes anticipated energy constraints under three rainfall scenarios.

The following three rainfall scenarios were considered:

- 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.[6]
- 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

The guidelines for modelling inputs and assumptions used in the EAAP analysis are provided in the EAAP guidelines.

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 MTPASA.
- Demand profiles consistent with the 2015 National Electricity Forecasting Report's (NEFR's) energy and demand projections.[7]

Participants submit confidential information, specifically MT PASA available capacity offers and GELF parameters, which are used in the EAAP modelling process. The generation capacity and variable

[6] Analysis of this period ensures the lowest rainfall for New South Wales is reflected in the low rainfall scenario.
[7] http://www.aemo.com.au/Electricity/Planning/Forecasting/~/media/Files/Electricity/Planning/Reports/NEFR/2015/Detailed%20summary%20of%202015%20electricity%20forecasts.ashx

GELF parameters are designed to reflect the current environment of constrained energy by taking into account:

1. hydro storage including pump storage;
2. thermal generation fuel;
3. cooling water availability; and
4. 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. It uses a probability-weighted USE assessment to identify any potential reliability standard breaches.

1.2.1 Differences between MTPASA and EAAP

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

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

These processes use similar inputs but the two 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[8].

The MTPASA is run at least weekly and, as part of a broader process, identifies potential capacity shortfalls known as 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 MTPASA assists to identify potential reserve shortfalls in the NEM. However, given the approximate nature of the MTPASA process, AEMO applies probabilistic studies such as EAAP to confirm the LRC findings of MTPASA before intervening in response to projected shortfalls.

Since Alinta Energy's October 2015 announcement about the withdrawal of the Northern and Playford B power stations, MTPASA has been projecting LRC in South Australia over summer 2016 − 17.

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

1.3 Current Landscape

The EAAP is not projecting any breaches of the reliability standard across the next two years, provided seasonal rainfall returns in autumn. This conclusion is based on historical rainfall scenarios, and current GELF assumptions provided by participants, rather than projections of future energy constraints. However, external factors support this conclusion:

- The current El Niño is not forecast to persist far into 2016[9], with the BOM predicting that the event may steadily decline from the start of 2016 once peak values are reached.
- Hydro Tasmania announced that even if there are below average inflows to hydro storages through until next winter (2016), there is enough energy to meet Tasmanian demand. As well

[8] http://www.aemo.com.au/Consultations/National-Electricity-Market/~/media/Files/Electricity/Consultations/2015/Reliability%20Standard%20Implementation%20Guidelines%20Final%20Report.ashx

[9] http://www.bom.gov.au/climate/enso/

as water currently in storage, there will be additional inflows, wind generation and the import capacity of Basslink[10].

- As a response to the El Niño, Hydro Tasmania has been conserving water. AEMO has recently observed Basslink binding on electricity flow from Victoria to Tasmania and providing between 30-40% of Tasmania's electricity needs to meet demand in preparation for the coming summer. This dependence on imports is consistent with the EAAP modelling outcomes.
- Hydro Tasmania has committed to returning its Tamar Valley Peaking Plant (58 MW) to service from June 2016[11], to help meet Tasmania's electricity needs. This has been included in this EAAP modelling.
- On 17 December 2015, Hydro Tasmania announced that the Tamar Valley Combined Cycle gas turbine (208 MW) will return to service in early 2016[12] to generate extra power given the low dam storage levels. This power station has been withdrawn since June 2014. The return to service has not been included in this EAAP's modelling due to the timing of the announcement, but will provide an additional energy supply source that is an alternative to imports from Victoria.
- On 20 December 2015, a fault occurred on the Basslink direct current cable, separating Tasmania from the rest of the NEM. At the time this report was published, the cause of the fault was yet to be identified and Basslink was still offline, with no return to service date specified. In the event of a prolonged outage, extending over the coming summer, there is sufficient capacity and energy supplies within Tasmania to meet the state's electricity needs under all modelled rainfall scenarios. This assumes the Tamar Valley Combined Cycle gas turbine is returned to service in January 2016.

1.4 Change in generation capacity

1.4.1 Availability changes from existing generation capacity

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

Table 1 Changes in generating plants' availability

Station	State	Capacity (MW)	Outage duration
Torrens Island A	South Australia	480	To withdraw from July 2017
Pelican Point (Unit 2)	South Australia	239	To withdraw from April 2016 and return to service in October 2016. Unit 1 has been withdrawn since March 2015.
Northern	South Australia	546	To withdraw from May 2016
Tamar Valley Peaking	Tasmania	58	Returning to service in June 2016

1.4.2 Committed scheduled and semi-scheduled generation capacity

The committed scheduled and semi-scheduled generating units included in the modelling are listed in Table 2.

[10] http://www.hydro.com.au/about-us/news/2015-12/clarification-tasmania-not-importing-50-its-energy-requirements
[11] http://www.aemo.com.au/Electricity/Planning/Related-Information/~/media/Files/Electricity/Planning/Related%20Information/Generation%20Information/2015/Generation_Information_TAS_20151026.ashx
[12] http://www.hydro.com.au/about-us/news/2015-12/hydro-tasmania-restart-combined-cycle-gas-turbine

Table 2 Committed scheduled and semi-scheduled generating units

Station	State	Capacity (MW)	Commercial operation date
Ararat Wind Farm	Victoria	240	Winter 2017
Hornsdale Wind Farm	South Australia	102	Summer 2016-17
Moree Solar Farm	New South Wales	56	February 2016

1.5 EAAP results

AEMO's December 2015 EAAP does not project any breach of the NEM reliability standard arising from energy constraints in any region over the next two years.

As the studies are probabilistic in nature, AEMO performed 400 simulations for each rainfall scenario using both 10% and 50% probability of exceedance (POE) demand forecasts. Occasionally, USE is observed in regions under all three rainfall scenarios, but supply levels still meet the reliability standard.

The following tables show the average yearly regional energy consumption (in MWh) at risk. The results show that:

- Some USE may occur in South Australia during summer periods under all three rainfall scenarios. In 2017, about 0.001% of the state's forecast electricity consumption may not be met. Notably in November 2017, once Torren Island A is withdrawn, USE ranging between 70 to 81MWh is projected (See Appendix A). This USE typically occurs at times of high demand, with low wind conditions, or when imports are limited.
- No USE is projected in Tasmania under any rainfall scenario.

Table 3 Forecast yearly USE in low rainfall scenario

Low Rainfall Scenario	Year 2016 USE (MWh)	Year 2016 USE (% of Regional Demand[13])	Year 2017 USE (MWh)	Year 2017 USE (% of Regional Demand[13])
New South Wales	-	-	3.30	-
Queensland	0.60	-	1.01	-
South Australia	0.87	-	151.24	0.00117%
Tasmania	-	-	-	-
Victoria	-	-	8.80	-

Table 4 Forecast yearly USE in medium rainfall scenario

Medium Rainfall Scenario	Year 2016 USE (MWh)	Year 2016 USE (% of Regional Demand[13])	Year 2017 USE (MWh)	Year 2017 USE (% of Regional Demand[13])
New South Wales	-	-	3.24	-
Queensland	0.60	-	0.99	-
South Australia	0.84	-	136.74	0.00106%
Tasmania	-	-	-	-
Victoria	-	-	7.29	-

[13] NEFR 2015, Operational Annual Consumption, available at: http://forecasting.aemo.com.au/Electricity/AnnualConsumption/Operational (version 26/06/2015) Viewed: 10 December 2015.

Table 5 Forecast yearly USE in high rainfall scenario

High Rainfall Scenario	Year 2016 USE (MWh)	Year 2016 USE (% of Regional Demand[13])	Year 2017 USE (MWh)	Year 2017 USE (% of Regional Demand[13])
New South Wales	-	-	3.23	-
Queensland	0.60	-	1.00	-
South Australia	0.46	-	137.34	0.00106%
Tasmania	-	-	-	-
Victoria	-	-	7.29	-

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
January 2016	-	0.60	-	-	-
February 2016	-	-	-	-	-
March 2016	-	-	-	-	-
April 2016	-	-	-	-	-
May 2016	-	-	0.08	-	-
June 2016	-	-	-	-	-
July 2016	-	-	-	-	-
August 2016	-	-	-	-	-
September 2016	-	-	-	-	-
October 2016	-	-	-	-	-
November 2016	-	-	0.60	-	-
December 2016	-	-	-	-	-
January 2017	0.18	-	33.59	-	6.60
February 2017	-	-	30.22	-	-
March 2017	-	-	-	-	-
April 2017	-	-	-	-	-
May 2017	0.26	-	0.31	-	-
June 2017	-	-	-	-	-
July 2017	-	1.01	0.50	-	-
August 2017	-	-	-	-	-
September 2017	-	-	-	-	-
October 2017	-	-	-	-	-
November 2017	0.69	-	81.80	-	-
December 2017	2.17	-	7.20	-	-

A.2 Medium rainfall scenario

Table 7 Forecast USE in Medium rainfall scenario, MWh

Month	NSW	QLD	SA	TAS	VIC
January 2016	-	0.60	-	-	-
February 2016	-	-	-	-	-
March 2016	-	-	-	-	-
April 2016	-	-	-	-	-
May 2016	-	-	0.18	-	-
June 2016	-	-	-	-	-
July 2016	-	-	-	-	-
August 2016	-	-	-	-	-
September 2016	-	-	-	-	-
October 2016	-	-	-	-	-
November 2016	-	-	0.52	-	-
December 2016	-	-	-	-	-
January 2017	0.20	-	34.05	-	2.67
February 2017	-	-	29.70	-	-
March 2017	-	-	-	-	-
April 2017	-	-	-	-	-
May 2017	0.22	-	0.35	-	-
June 2017	-	-	-	-	-
July 2017	-	0.99	0.29	-	-
August 2017	-	-	-	-	-
September 2017	-	-	-	-	-
October 2017	-	-	-	-	-
November 2017	0.65	-	70.09	-	-
December 2017	2.17	-	7.03	-	-

A.3 High rainfall scenario

Table 8 Forecast USE in High rainfall scenario, MWh

Month	NSW	QLD	SA	TAS	VIC
January 2016	-	0.60	-	-	-
February 2016	-	-	-	-	-
March 2016	-	-	-	-	-
April 2016	-	-	-	-	-
May 2016	-	-	0.08	-	-
June 2016	-	-	-	-	-
July 2016	-	-	-	-	-
August 2016	-	-	-	-	-
September 2016	-	-	-	-	-
October 2016	-	-	-	-	-
November 2016	-	-	0.25	-	-
December 2016	-	-	-	-	-
January 2017	0.17	-	33.22	-	2.72
February 2017	-	-	28.37	-	-
March 2017	-	-	-	-	-
April 2017	-	-	-	-	-
May 2017	0.19	-	0.37	-	-
June 2017	-	-	-	-	-
July 2017	-	1.00	0.33	-	-
August 2017	-	-	-	-	-
September 2017	-	-	-	-	-
October 2017	-	-	-	-	-
November 2017	0.68	-	72.28	-	-
December 2017	2.18	-	72.28	-	-

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
EAAP	Energy Adequacy Assessment Projection
GELF	Generator Energy Limitation Framework
LRC	Low Reserve Conditions
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 December 2015 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.
Reliability Standard	The power system reliability benchmark set by the Reliability Panel. The maximum permissible unserved energy (USE), or the maximum allowable level of electricity at risk of not being supplied to consumers, due to insufficient generation, bulk transmission or demand-side participation (DSP) capacity, is 0.002% of the annual energy consumption for the associated region, or regions, per financial year.