Energy Adequacy Assessment Projection

November 2018

Important notice

PURPOSE

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VERSION CONTROL

Version	Release date	Changes
#1	30/11/2018	

Executive summary

The Energy Adequacy Assessment Projection (EAAP) quantifies the impact of potential energy constraints on expected levels of unserved energy (USE) in the National Electricity Market (NEM) over a two-year outlook period. The EAAP complements AEMO's other reliability assessments such as the Medium Term Projected Assessment of System Adequacy (MT PASA) and the Electricity Statement of Opportunities (ESOO) with a primary focus on the impact of energy constraints on reliability in the next two years.

Potential energy constraints include, but are not limited to, water available for hydro generation and as cooling water for thermal generation during drought conditions, and constraints on fuel supply.

For water availability, the EAAP considers a range of rainfall scenarios:

- 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.
- Short-term average rainfall – based on the average rainfall recorded over the past 10 years.
- 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.

This November 2018 EAAP confirms earlier reliability outlooks for this summer, highlighting:

- A heightened risk of USE in Victoria (and South Australia, due to its level of connection with Victoria) in 2018-19, particularly under peak demand conditions. To reduce this risk, AEMO has identified additional reserves which can be made available through the Reliability and Emergency Reserve Trader (RERT) function[1].
- Although some risk of supply shortfalls also exists in New South Wales, the level of USE is within the reliability standard[2].
- No USE is observed in Queensland or Tasmania.
- Based on the information provided by participants, the impact of drought conditions on mainland reservoir levels is unlikely to affect reliability in the coming summer, even if low hydro inflow conditions continue. This is because there remains sufficient flexibility for limited resources to be used effectively to avoid shortfalls at times of high demand.
- The forecast level of USE generally declines by 2019-20, due to the addition of new renewable generation and the Barker Inlet Power Station. However, under low rainfall conditions, if sufficient cooling water for Latrobe Valley generators cannot be accessed from the drought reserve, the forecast expected USE level in Victoria in 2019-20 increases and exceeds the reliability standard:
  - The generator limitations in the low rainfall scenarios are based on current bulk water allocations. There is additional water available in a drought reserve (Blue Rock Lake[3]) that could potentially be made available to mitigate water shortages for brown coal generators that may occur during consecutive years of extreme drought.
- Limitations supplied by thermal generators related to fuel supply have no impact on the level of USE observed in any region.

[1] Further details on AEMO's 2018-19 summer readiness can be found at https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Security-and-reliability/Summer-operations-report.

[2] The reliability standard specifies that expected USE should not exceed 0.002% of total energy consumption in any region in any financial year.

[3] See Southern Rural Water's "Water Plan 3 for 2013-2018", available at http://www.srw.com.au/files/General_publications/WP3_Final.pdf.

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1. Introduction

1.1 Purpose and scope

The Energy Adequacy Assessment Projection (EAAP) report is an energy adequacy assessment that provides information on the impact of potential energy constraints on supply adequacy in the National Electricity Market (NEM) across the two-year study period. Potential energy constraints include, but are not limited to, water storages during drought conditions and constraints on fuel supply for thermal generation.

In this report, AEMO identifies potential periods of unserved energy (USE) under various scenarios and assesses the projected USE against the reliability standard. The reliability standard specifies that expected USE should not exceed 0.002% of total energy consumption in any region in any financial year. Monthly USE forecasts for each of the NEM regions are also presented.

AEMO implements the reliability standard using forecasts and projections over different timeframes. AEMO uses the following processes that each serve a slightly different purpose and therefore use slightly different inputs and approaches:

- Electricity Statement of Opportunities (ESOO) to provide market information over a ten-year projection to assist planning by existing and potential generators and Market Participants.
- Energy Adequacy Assessment Projection (EAAP) to forecast USE for energy constrained scenarios over a two-year projection, published at least once every 12 months.
- Medium Term Projected Assessment of System Adequacy (MT PASA) to forecast USE over a two-year projection, published on a weekly basis based on participant's best expectation of generation availability and outage scheduling at the time.
- Short Term Projected Assessment of System Adequacy (ST PASA) to forecast capacity reserve over a six-day projection.

More details on each of these processes is provided in the Reliability Standard Implementation Guidelines[4] (RSIG).

1.2 Scenarios

For the November 2018 EAAP report, AEMO assessed anticipated energy constraints under three different rainfall scenarios in accordance with the EAAP Guidelines[5]:

- Low rainfall – based on rainfall between 1 July 2006 and 30 June 2007 for all regions except New South Wales. New South Wales was based on rainfall between 1 June 2006 and 31 May 2007.
  - This was categorised into two alternative scenarios:
    - Low rainfall (cooling water restricted) – based on the assumption that there is limited water to supply the cooling systems of Latrobe Valley generators during drought conditions.
    - Low rainfall (cooling water available) – based on the assumption that there is sufficient water to supply the cooling systems of Latrobe Valley generators during drought condition, by accessing drought reserve.
- Short-term average rainfall – based on the average rainfall recorded over the past 10 years.

[4] For more on PASA and the RSIG, see https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Data/Market-Management-System-MMS/Projected-Assessment-of-System-Adequacy.

[5] Available at http://www.aemo.com.au/-/media/Files/Stakeholder_Consultation/Consultations/Electricity_Consultations/2016/EAAP/EAAP_Guidelines.pdf.

- 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).

In each scenario, the level of hydro storage reservoirs at the start of the EAAP modelling horizon is provided by participants through their Generator Energy Limitation Framework (GELF) submissions.

2. Methodology and assumptions

2.1 Methodology

The EAAP is based on a probabilistic, time-sequential model that simulates hourly Monte Carlo simulations to determine potential future supply shortfalls for the three rainfall scenarios, taking account of any other energy limitations provided by participants. This model also accounts for uncertainties in generator availability and weather-sensitive demand. For the November 2018 EAAP modelling, 800 simulations were performed for each rainfall scenario using both 10% and 50% Probability of Exceedance (POE) demand forecasts. For each of the two peak demand forecasts, eight historical reference years were used to represent variable patterns of intermittent generation and demand.

The model uses a probability-weighted USE assessment to identify whether expected USE is likely to exceed the reliability standard in each region of the NEM. Expected USE was derived by applying the following weightings to results from the moderate and extreme demand scenarios:

- 30.4% for 10% POE.
- 39.2% for 50% POE.
- 30.4% for 90% POE[6].

Where the expected USE is above the reliability standard, AEMO flags that the standard is not projected to be met under the relevant scenario.

2.2 Assumptions

2.2.1 Electricity demand

AEMO used the demand forecast under the Neutral scenario from the 2018 Electricity Statement of Opportunities (ESOO) for the NEM[7]. This forecast covered the latest assumptions on:

- Economic drivers.
- Electric vehicle forecasts.
- Rooftop photovoltaic (PV).
- Population growth and connection numbers.
- Energy efficiency.

2.2.2 Generation capacity

Generating units modelled include:

- Existing scheduled and semi-scheduled generation.
- Committed scheduled and semi-scheduled generation.

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[6] Weighting attributed to a 90% POE that is assumed to lead to zero USE and therefore not modelled. Any simulations with USE above zero in the 90% POE case are likely to have so much USE in the 50% and 10% POE cases that it would be expected to be identified as exceeding the reliability standard, regardless of whether or not the 90% POE outcomes were modelled.

[7] Forecasts are available at http://forecasting.aemo.com.au/. Select ESOO 2018 from Publications at pop-up menu.

The capacity of existing generation is sourced from the Medium Term Projected Assessment of System Adequacy (MT PASA) offers, submitted in the week beginning 22 October 2018. If USE is forecast during periods where the MT PASA offer reflects a planned generator outage, this outage will be removed from EAAP, unless specified as inflexible through the participant's GELF submission. The EAAP assessment of USE therefore assumes any planned generation outages that have timing flexibility will be shifted to avoid USE.

The committed generation developments included in the EAAP and MT PASA models are summarised in Appendix A2. Table 1 shows the new generating units that have been added since the May 2018 EAAP. This capacity is not reliant on water for generation, reducing the power system's vulnerability to drought situations to maintain reliability.

Table 1 Additional committed generating units that were not included in May 2018 EAAP

Project	State	Capacity (MW)	Commercial operation date
Ballarat Energy Storage System	Victoria	30	Summer 2018-19
Beryl Solar Farm	New South Wales	98	Winter 2019
Bulgana Green Power Hub – BESS	Victoria	20	Aug 2019
Bulgana Green Power Hub – Wind Farm	Victoria	194	Aug 2019
Childers Solar Farm	Queensland	56	Feb 2019
Clermont Solar Farm	Queensland	92.5	Oct 2018
Coopers Gap Wind Farm	Queensland	350	Jun 2019
Crudine Ridge Wind Farm	New South Wales	135	Summer 2019-20
Emerald Solar Park	Queensland	72	Dec 2018
Gannawarra Energy Storage System	Victoria	25	Summer 2018-19
Haughton Solar Farm	Queensland	100	Summer 2018-19
Karadoc Solar Farm	Victoria	90	Summer 2018-19
Kennedy Energy Park - Phase 1 - Storage	Queensland	2	Oct 2018
Lal Lal Wind Energy Facility- Elaine	Victoria	83.6	Dec 2018
Moorabool Wind Farm	Victoria	320	Apr 2019
Murra Warra Wind Farm – Stage 1	Victoria	226	Winter 2019
Susan River Solar Farm	Queensland	75	Feb 2019
Tailem Bend – Solar	South Australia	108	Winter 2019
Teebar Solar One	Queensland	52.5	Jul 2019
Wemen Solar Farm	Victoria	88	Oct 2018
Wild Cattle Hill Wind Farm	Tasmania	144	Dec 2019
Stockyard Hill Wind Farm	Victoria	532	Dec 2019
Yarranlea Solar	Queensland	103	Aug 2019
Coleambally Solar Farm	New South Wales	150	Operational

2.2.3 Transmission capability

Interconnector information includes, but is not limited to, inter-regional loss factor models and marginal loss factors. Network constraints, which represent technical limits on operating the power system, are expressed as a linear combination of generation and interconnectors, which are constrained to be less than, equal to, or greater than a certain limit. Only network constraints associated with system normal conditions are modelled.

2.2.4 GELF parameters

The GELF parameters are confidential information submitted by Scheduled Generators designed to take into account limitations on resources affecting their ability to supply energy, such as hydro storage (including pump storage), thermal generation fuel, cooling water availability, and gas supply. These parameters are classified into two categories:

- Static GELF parameters:
  - Technical specifications of the power stations, such as power station name, type of power station, number of generating units at the power station, and their capacities.
  - Additional components associated with Hydro Power Schemes such as maximum and minimum active reservoir storage, the reservoirs to which the tunnels are connected, water utilisation factor for generation and pumping for each generating unit or for the power station, and reservoir connections (for example, upstream reservoir and downstream reservoir).
- Variable GELF parameters include:
  - Monthly forecast generation capability and monthly capacity profiles to be submitted by non-hydro power stations.
  - Active reservoir storage at the beginning of the study period, monthly inflows to reservoirs during the study period, minimum reservoir level that can be reached in each month of the study period without violating long-term reservoir management policy, and any other limitations on reservoir capacities or levels that should be considered within the study period to be submitted for hydro power schemes.

Please see EAAP Guidelines[8] for the details of the GELF parameters.

[8] Available at http://www.aemo.com.au/-/media/Files/Stakeholder_Consultation/Consultations/Electricity_Consultations/2016/EAAP/EAAP_Guidelines.pdf.

3. Results

Key outcomes

- The EAAP forecasts a heightened risk of USE in Victoria (and South Australia, due to its level of connection with Victoria) in 2018-19, particularly under peak demand conditions.
- Although some risk of supply shortfalls also exists in New South Wales, the level of USE is within the reliability standard. No USE is observed in Queensland or Tasmania.
- The level of USE in South Australia and Victoria declines over the modelling horizon under short-term and long-term average rainfall scenarios as a result of more renewables coming online and the commissioning of the 210 MW Barker Inlet Power Station.
- Based on the information provided by participants, the impact of drought conditions on mainland reservoir levels is unlikely to affect reliability in the coming summer, even if low hydro inflow conditions continue.
- The level of USE exceeds the 0.002% reliability standard in Victoria in 2019-20 under the low rainfall scenario (with cooling water restrictions) due to constraints on brown coal generation. If sufficient cooling water were available from the drought reserve, the level of USE would be within the reliability standard.
- The limitations on fuel supply that have been provided by participants do not impact on the level of USE in any region. The fuel limitations submitted by participants are generally over longer periods such as annual or monthly limits, and if managed effectively provide sufficient flexibility to allow generation to have fuel available at times of tight supply-demand balance.

3.1 EAAP results

The reliability assessment indicates that, under all rainfall scenarios, there is a risk of supply interruption in New South Wales, South Australia, and Victoria over the next two years, mainly during peak summer periods.

This risk is primarily driven by increased vulnerability to climatic conditions such as extended periods of high temperature, corresponding with low wind or solar availability and unplanned generation outages, as already highlighted in the 2018 ESOO and MT PASA. Drought (and energy constraint more generally) has less impact on reliability in the year ahead due to the ability of generators to schedule limited energy resources for use at times of highest demand.

The levels of USE projected for summer 2018-19 are comparable to those forecast in the 2018 ESOO, which showed a heightened risk of supply shortfalls, particularly in Victoria.

As part of its reserve management strategy and to manage supply shortfalls, AEMO has identified additional reserves which can be made available through the Reliability and Emergency Reserve Trader (RERT) function[9]. This reserve is used only if the market does not respond with enough supply or demand resources to ensure the reliability standard is met, for example at times of very high periods of electricity demand, or to manage power system incidents. These reserves are expected to close the risk of not meeting the reliability standard, identified in the 2018 ESOO and this EAAP Update.

[9] Further details on AEMO's 2018-19 summer readiness and the RERT can be found at https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Security-and-reliability/Summer-operations-report.

The level of USE risk generally declines by 2019-20 primarily due to additional renewable generation and the introduction of the Barker Inlet Power Station in 2019.

Energy limitations over the next two years are projected to have the following impact on supply adequacy:

- Under the low rainfall scenario:
  - USE is observed in New South Wales, South Australia, and Victoria over the next two years.
  - There is a heightened risk of USE in Victoria in 2018-19, with the expected level of USE reaching the maximum reliability standard threshold. This assumes that all planned generation outages with flexible timing can be rescheduled, and the 250 MW of thermal generation currently identified in MT PASA to be unavailable in Victoria/South Australia this summer is made available during peak demand conditions.
  - In 2019-20[10], expected USE in Victoria is projected to exceed the reliability standard due to energy constraints resulting from insufficient cooling water for Latrobe Valley coal generators. This is based on information provided by participants and assumes that additional water cannot be accessed from the drought reserve. If the drought reserve can cover additional needs from the generators following two years of extremely low rainfall, the level of USE falls below the reliability standard.
  - Forecast USE in New South Wales and South Australia is within the reliability standard under both low rainfall cases. This assessment does not consider equitable load shedding that may spread load shedding pro-rata throughout interconnected regions when this would not increase total load shedding. Due to its interconnectedness with Victoria, South Australia may also be at risk of load shedding under both low rainfall cases based on this equitable load shedding principle.
  - Other than the limits related to insufficient cooling water for Latrobe Valley coal generators, there is no deterioration in reliability associated with the low rainfall scenario compared to the short-term and long-term scenarios. This indicates that the relatively low storage levels currently observed at some hydro reservoirs does not increase reliability risks, even when associated with low hydro inflows over the coming months, based on information provided by participants.
- Under short-term, long-term, and low (with cooling water available) average rainfall scenarios:
  - Some USE is observed in New South Wales, South Australia, and Victoria over the next two years.
  - As with the low rainfall scenario, there is a heightened risk of USE in Victoria in 2018-19, with USE reaching the reliability standard of 0.002%, assuming flexibility in the scheduling of planned generation outages.
  - USE in New South Wales and South Australia is below the reliability standard under both scenarios.
  - The level of USE is very similar between the short-term and long-term average scenarios, indicating that energy limitations under average conditions are not likely to affect reliability outcomes.
- No USE is projected in Queensland and Tasmania across all rainfall scenarios over the next two years.

The modelling results[11] show the occurrence of USE in the months of November-December and January-March with a small amount of USE also occurring in June-July in New South Wales.

The monthly forecast USE for all regions under the three rainfall scenarios is provided in Appendix A1. Annual USE outcomes are provided in the following tables and in Figure 1.

[10] Note that 2018-19 and 2019-20 refer to the periods October-September.

[11] Note that each rainfall scenario had different number of simulations that successfully completed. This may cause small deviations in outcomes.

Figure 1 Forecast USE range across all rainfall scenarios

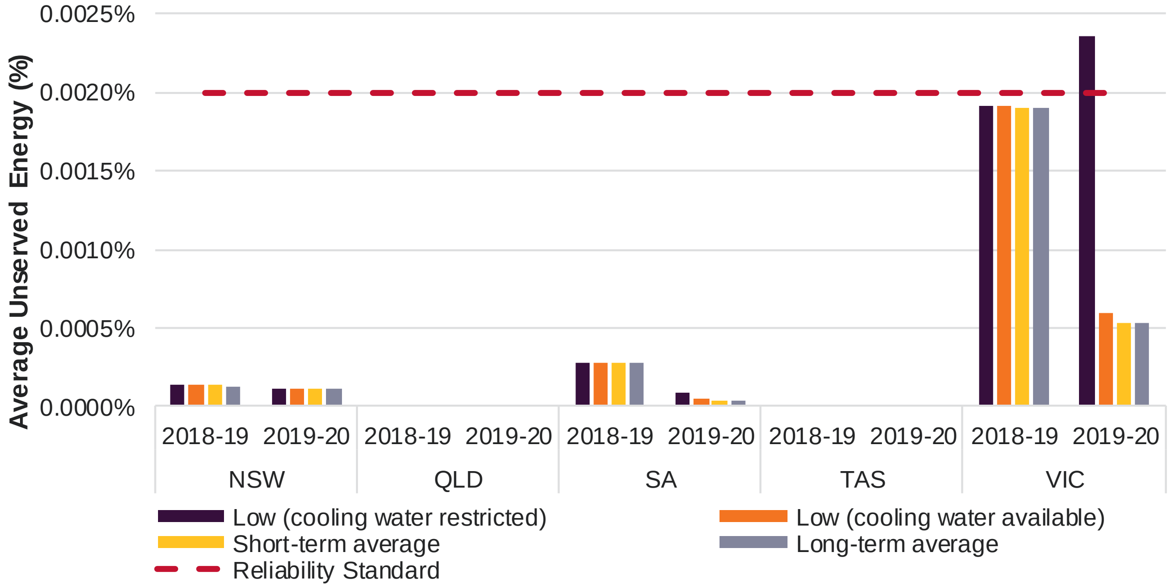

Table 2 Forecast USE in low rainfall scenario (cooling water restricted)

	2018-19 USE		2019-20 USE	
	(MWh)	(% of regional demand)	(MWh)	(% of regional demand)
New South Wales	93	0.0001	76	0.0001
Queensland	0	0	0	0
South Australia	34	0.0003	10	0.0001
Tasmania	0	0	0	0
Victoria	850	0.0019	1,044	0.0024

Table 3 Forecast USE in low rainfall scenario (cooling water available)

	2018-19 USE		**2019-20 USE**	
	(MWh)	(% of regional demand)	(MWh)	(% of regional demand)
New South Wales	92	0.0001	76	0.0001
Queensland	0	0	0	0
South Australia	33	0.0003	6	0.0000
Tasmania	0	0	0	0
Victoria	849*	0.0019	264	0.0006

* For Victoria, any difference in volume of USE in 2018-19 with and without cooling water available is due to random sampling and is not statistically significant. For all intents and purposes, there is no material difference in Victorian USE levels in 2018-19 between rainfall scenarios.

Table 4 Forecast USE in short-term average rainfall scenario

	2018-19 USE		2019-20 USE	
	(MWh)	(% of regional demand)	(MWh)	(% of regional demand)
New South Wales	91	0.0001	76	0.0001
Queensland	0	0	0	0
South Australia	34	0.0003	5	0.0000
Tasmania	0	0	0	0
Victoria	846	0.0019	236	0.0005

Table 5 Forecast USE in long-term average rainfall scenario

	2018-19 USE		2019-20 USE	
	(MWh)	(% of regional demand)	(MWh)	(% of regional demand)
New South Wales	90	0.0001	76	0.0001
Queensland	0	0	0	0
South Australia	34	0.0003	5	0.0000
Tasmania	0	0	0	0
Victoria	846	0.0019	237	0.0005

3.2 Differences between EAAP and MT PASA

AEMO administers two processes to assess NEM reliability against the reliability standard over a two-year planning horizon:

- EAAP, to forecast USE for capacity and energy constrained scenarios, with particular focus on the impact of water shortages during drought conditions, or thermal generation fuel supply limitations.
- MT PASA, to forecast possible capacity shortfalls incorporating scheduled generation and transmission outages.

These processes adopt similar modelling approaches, but use slightly different inputs, reflecting their different purposes and frequency of projections. The main difference between EAAP and MT PASA is that the EAAP is assessed under a range of predefined energy scenarios and is published at least once every 12 months, whereas the MT PASA is based on participants' best expectation of generation availability and is published on a weekly basis.

The MT PASA is an operational planning tool that informs market participants of tight supply conditions and allows them to reschedule planned generation outages to avoid potential supply shortfalls.

The EAAP, on the other hand, assumes that generation and transmission outages will be rescheduled to avoid load shedding unless participants have indicated that the timing of these outages is inflexible.

The similarities and differences of the two processes are described in more detail in the Reliability Standard Implementation Guidelines (RSIG).

3.2.1 MT PASA projections

The most recent MT PASA result (published on 27 November 2018) shows the reliability standard is likely to be exceeded in Victoria for summer 2018-19. The MT PASA result has slightly higher USE than this EAAP Update for the following reasons:

- MT PASA incorporates the impact of transmission outages according to the 13-month Network Outage Scheduled (NOS), while the EAAP model uses system normal, assuming any outage can be rescheduled to avoid capacity shortfalls.
- The MT PASA outcomes include the impact of scheduled generation outages which may be flexible. In EAAP modelling, any flexible outages that occur during periods with observed USE are removed.

MT PASA forecasts higher USE in South Australia than is forecast in EAAP due to differences in available generation capacity based on the information provided by participants under the respective processes.

New South Wales USE outcomes are similar in EAAP and MT PASA.

3.3 Differences between EAAP and ESOO

The NEM ESOO provides information that can help stakeholders plan their operations over a 10-year outlook period, including information about future supply adequacy.

It adopts similar Monte Carlo modelling techniques to EAAP, but uses slightly different inputs to reflect the greater uncertainty inherent in longer-term outlooks. Many of these differences relate to future assumptions on generation availability and capacity, and transmission constraints. Further, in 2018, the ESOO included assumptions on key unplanned transmission line outages or deratings which affect inter-regional transfer capability.

The similarities and differences of the two processes are described in more detail in the RSIG.

The 2018 ESOO results are consistent with the EAAP in all rainfall scenarios in 2018-19. In the EAAP short-term and long-term average rainfall scenarios the 2019-20 USE is marginally lower, largely due to minor changes in generation and transmission capacity information since the 2018 ESOO was published.

In the low rainfall with cooling water restricted scenario, 2019-20 USE is significantly higher in Victoria when compared to the 2018 ESOO, due to the energy and capacity constraints assumed under this scenario.

A1. Detailed results

Table 6 Monthly forecast USE in low rainfall scenario (cooling water restricted), MWh

Month	NSW	QLD	SA	TAS	VIC
Oct-18	0.0	0.0	0.0	0.0	0.0
Nov-18	4.8	0.0	1.0	0.0	38.7
Dec-18	14.9	0.0	0.5	0.0	6.8
Jan-19	51.8	0.0	15.3	0.0	613.2
Feb-19	21.7	0.0	17.1	0.0	183.1
Mar-19	0.0	0.0	0.0	0.0	7.9
Apr-19	0.0	0.0	0.0	0.0	0.0
May-19	0.0	0.0	0.0	0.0	0.0
Jun-19	0.0	0.0	0.0	0.0	0.0
Jul-19	0.3	0.0	0.0	0.0	0.0
Aug-19	0.0	0.0	0.0	0.0	0.0
Sep-19	0.0	0.0	0.0	0.0	0.0
Oct-19	0.0	0.0	0.0	0.0	0.0
Nov-19	7.0	0.0	0.0	0.0	8.1
Dec-19	15.3	0.0	0.0	0.0	0.1
Jan-20	19.8	0.0	3.5	0.0	199.1
Feb-20	32.8	0.0	6.3	0.0	720.8
Mar-20	0.1	0.0	0.1	0.0	115.7
Apr-20	0.0	0.0	0.0	0.0	0.0
May-20	0.0	0.0	0.0	0.0	0.6
Jun-20	0.1	0.0	0.0	0.0	0.0
Jul-20	0.6	0.0	0.0	0.0	0.0
Aug-20	0.0	0.0	0.0	0.0	0.0
Sep-20	0.0	0.0	0.0	0.0	0.0

Table 7 Monthly forecast USE in low rainfall scenario (cooling water available), MWh

Month	NSW	QLD	SA	TAS	VIC
Oct-18	0.0	0.0	0.0	0.0	0.0
Nov-18	4.8	0.0	0.9	0.0	40.1
Dec-18	15.5	0.0	0.5	0.0	8.0
Jan-19	50.9	0.0	15.3	0.0	609.0
Feb-19	20.4	0.0	16.8	0.0	184.7
Mar-19	0.0	0.0	0.0	0.0	7.6
Apr-19	0.0	0.0	0.0	0.0	0.0
May-19	0.0	0.0	0.0	0.0	0.0
Jun-19	0.0	0.0	0.0	0.0	0.0
Jul-19	0.3	0.0	0.0	0.0	0.0
Aug-19	0.0	0.0	0.0	0.0	0.0
Sep-19	0.0	0.0	0.0	0.0	0.0
Oct-19	0.0	0.0	0.0	0.0	0.0
Nov-19	6.7	0.0	0.0	0.0	6.8
Dec-19	14.7	0.0	0.0	0.0	0.1
Jan-20	21.3	0.0	3.5	0.0	194.3
Feb-20	33.4	0.0	2.5	0.0	56.5
Mar-20	0.0	0.0	0.0	0.0	5.6
Apr-20	0.0	0.0	0.0	0.0	0.0
May-20	0.0	0.0	0.0	0.0	0.0
Jun-20	0.1	0.0	0.0	0.0	0.0
Jul-20	0.3	0.0	0.0	0.0	0.0
Aug-20	0.0	0.0	0.0	0.0	0.0
Sep-20	0.0	0.0	0.0	0.0	0.0

Table 8 Monthly forecast USE in short-term average rainfall scenario, MWh

Month	NSW	QLD	SA	TAS	VIC
Oct-18	0.0	0.0	0.0	0.0	0.0
Nov-18	5.0	0.0	0.9	0.0	37.3
Dec-18	16.7	0.0	0.5	0.0	6.2
Jan-19	47.7	0.0	16.2	0.0	608.7
Feb-19	21.2	0.0	16.6	0.0	187.0
Mar-19	0.0	0.0	0.0	0.0	7.1
Apr-19	0.0	0.0	0.0	0.0	0.0
May-19	0.0	0.0	0.0	0.0	0.0
Jun-19	0.0	0.0	0.0	0.0	0.0
Jul-19	0.3	0.0	0.0	0.0	0.0
Aug-19	0.0	0.0	0.0	0.0	0.0
Sep-19	0.0	0.0	0.0	0.0	0.0
Oct-19	0.0	0.0	0.0	0.0	0.0
Nov-19	7.9	0.0	0.0	0.0	5.6
Dec-19	15.4	0.0	0.0	0.0	0.1
Jan-20	19.5	0.0	2.7	0.0	175.4
Feb-20	32.2	0.0	1.8	0.0	51.1
Mar-20	0.0	0.0	0.0	0.0	3.7
Apr-20	0.0	0.0	0.0	0.0	0.0
May-20	0.0	0.0	0.0	0.0	0.0
Jun-20	0.1	0.0	0.0	0.0	0.0
Jul-20	0.5	0.0	0.0	0.0	0.0
Aug-20	0.0	0.0	0.0	0.0	0.0
Sep-20	0.0	0.0	0.0	0.0	0.0

Table 9 Monthly forecast USE in long-term average rainfall scenario, MWh

Month	NSW	QLD	SA	TAS	VIC
Oct-18	0.0	0.0	0.0	0.0	0.0
Nov-18	5.2	0.0	0.6	0.0	39.5
Dec-18	14.8	0.0	0.5	0.0	6.1
Jan-19	47.6	0.0	15.5	0.0	607.6
Feb-19	22.2	0.0	17.5	0.0	184.6
Mar-19	0.0	0.0	0.0	0.0	7.8
Apr-19	0.0	0.0	0.0	0.0	0.0
May-19	0.0	0.0	0.0	0.0	0.0
Jun-19	0.0	0.0	0.0	0.0	0.0
Jul-19	0.3	0.0	0.0	0.0	0.0
Aug-19	0.0	0.0	0.0	0.0	0.0
Sep-19	0.0	0.0	0.0	0.0	0.0
Oct-19	0.0	0.0	0.0	0.0	0.0
Nov-19	8.3	0.0	0.0	0.0	7.1
Dec-19	14.8	0.0	2.7	0.0	0.1
Jan-20	17.4	0.0	1.9	0.0	176.3
Feb-20	34.7	0.0	0.0	0.0	49.8
Mar-20	0.0	0.0	0.0	0.0	3.9
Apr-20	0.0	0.0	0.0	0.0	0.0
May-20	0.0	0.0	0.0	0.0	0.0
Jun-20	0.1	0.0	0.0	0.0	0.0
Jul-20	0.5	0.0	0.0	0.0	0.0
Aug-20	0.0	0.0	0.0	0.0	0.0
Sep-20	0.0	0.0	0.0	0.0	0.0

A2. Generation developments

In this table, Com* identifies projects that are under construction, but AEMO has not been informed that the project meets all five commitment criteria[12].

Table 10 Committed and very advanced generation developments as at 22 October 2018

Project	Technology type	Fuel type	Unit status	Nameplate capacity (MW)	Full commercial use date	Region
Ballarat Energy Storage System	Battery Storage	N/A	Com*	**30**	Summer 2018-19	Victoria
Barker Inlet Power Station	Spark Ignition Reciprocating Engine	Natural Gas Pipeline	Committed	**210**	Aug 2019	South Australia
Beryl Solar Farm	PV-Tracking Flat panel	Solar	Committed	**98**	Winter 2019	New South Wales
Bulgana Green Power Hub – BESS	Battery Storage	N/A	Com*	**20**	Aug 2019	Victoria
Bulgana Green Power Hub – Wind Farm	Wind - Onshore	Wind	Com*	**204**	Aug 2019	Victoria
Childers Solar Farm	PV-Tracking Flat panel	Solar	Com*	**56**	Feb 2019	Queensland
Clermont Solar Farm	PV panels	Solar	Committed	**92.5**	Oct 2018	Queensland
Coopers Gap- Stage 1	Wind - Onshore	Wind	Com*	**100**	Nov 2018	Queensland
Coopers Gap- Stage 2	Wind - Onshore	Wind	Com*	**250**	Jun 2019	Queensland
Crowlands Wind Farm	Wind - Onshore	Wind	Committed	**80**	Winter 2019	Victoria
Crudine Ridge Wind Farm	Wind - Onshore	Wind	Com*	**135**	Summer 2019-20	New South Wales
Gannawarra Energy Storage System	Battery Storage	N/A	Com*	**25**	Summer 2018-19	Victoria
Granville Harbour Wind Farm	Wind - Onshore	Wind	Com*	**112**	Summer 2019-20	Tasmania
Haughton Solar Farm	PV-Tracking Flat panel	Solar	Committed	**100**	Summer 2018-19	Queensland
Kennedy Energy Park - Phase 1 - Solar	PV-Tracking Flat panel	Solar	Com*	**15**	Dec 2018	Queensland
Kennedy Energy Park - Phase 1 - Storage	Battery Storage	N/A	Com*	**2**	Apr 2019	Queensland
Lal Lal Wind Energy Facility- Elaine	Wind - Onshore	Wind	Com*	**70**	Dec 2018	Victoria

[12] Information on AEMO's commitment criteria can be found under the Background Information tab in the Generation Information spreadsheets available at https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Generation-information

Project	Technology type	Fuel type	Unit status	Nameplate capacity (MW)	Full commercial use date	Region
Lincoln Gap Wind Farm - stage 1	Wind - Onshore	Wind	Committed	**126**	Apr 2019	South Australia
Moorabool Wind Farm	Wind - Onshore	Wind	Committed	**320**	Apr 2019	Victoria
Murra Warra Wind Farm – Stage 1	Wind - Onshore	Wind	Committed	**226**	Winter 2019	Victoria
Rugby Run Solar Farm	PV-Tracking Flat panel	Solar	Com*	**65**	Dec 2018	Queensland
Stockyard Hill Wind Farm- Stage 1	Wind - Onshore	Wind	Committed	**400**	Dec 2019	Victoria
Stockyard Hill Wind Farm- Stage 2	Wind - Onshore	Wind	Committed	**132**	Apr 2019	Victoria
Susan River Solar Farm	PV-Tracking Flat panel	Solar	Com*	**75**	Feb 2019	Queensland
Tailem Bend – Solar	PV panels	Solar	Committed	**108**	Winter 2019	South Australia
Teebar Solar One	PV panels	Solar	Com*	**53**	Jul 2019	Queensland
Wild Cattle Hill Wind Farm	Wind - Onshore	Wind	Com*	**144**	Dec 2019	Tasmania
Yarranlea Solar	PV panels	Solar	Com*	**102**	Aug 2019	Queensland
Yatpool Solar Farm	Solar Panels	Solar	Com*	**81**	Winter 2019	Victoria

Measures and abbreviations

Measures

Abbreviation	Unit of measure
MW	Megawatts
MWh	Megawatt hours

Abbreviations

Abbreviation	Expanded name
AEMO	Australian Energy Market Operator
EAAP	Energy Adequacy Assessment Projection
ESOO	Electricity Statement of Opportunities
GELF	Generator Energy Limitation Framework
MT PASA	Medium Term Projected Assessment of System Adequacy
NEM	National Electricity Market
NER	National Electricity Rules
POE	Probability of Exceedance
RSIG	Reliability Standard Implementation Guidelines
USE	Unserved Energy

Glossary

Term	Definition
committed projects	Generation that is considered to be proceeding under AEMO's commitment criteria
electrical energy	Average electrical power over a time period, multiplied by the length of the time period.
electrical power	Instantaneous rate at which electrical energy is consumed, generated, or transmitted.
generating capacity	Amount of capacity (in megawatts (MW)) available for generation.
generating unit	Power stations may be broken down into separate components known as generating units, and may be considered separately in terms (for example) of dispatch, withdrawal, and maintenance.
installed capacity	The generating capacity (in megawatts (MW)) of the following (for example): • A single generating unit. • A number of generating units of a particular type or in a particular area. • All of the generating units in a region. Rooftop PV installed capacity is the total amount of cumulative rooftop PV capacity installed at any given time.
non-scheduled generation	Generation by a generating unit that is not scheduled by AEMO as part of the central dispatch process, and which has been classified as a non-scheduled generating unit in accordance with Chapter 2 of the NER.
operational electrical consumption	The electrical energy supplied by scheduled, semi-scheduled, and significant non-scheduled generating units, less the electrical energy supplied by small non-scheduled generation.
Probability of exceedance (POE)	The probability, as a percentage, that a maximum demand level will be met or exceeded (for example, due to weather conditions) in a particular period of time. For example, a 10% POE maximum demand for a given season means a 10% probability that the projected level will be met or exceeded – in other words, projected maximum demand levels are expected to be met or exceeded, on average, only one year in 10.
Reliability standard	The standard specified in clause 3.9.3C of the National Electricity Rules that measures the sufficiency of installed capacity to meet demand. It is defined as the maximum expected USE, as a percentage of total energy demanded, allowable in a region over a financial year. It is currently set at 0.002%.
Unserved energy	The amount of energy demanded, but not supplied, in a region determined in accordance with clause 3.9.3C(b) expressed as either a GWh total or as a percentage of total energy demanded in that region.