

# Summer operations 2017-18

**November 17**

A report for the National Electricity Market

# Important notice

## PURPOSE

AEMO has prepared this document to provide information about its preparations for summer 2017-18. These preparations are designed to minimise, as far as possible, the risk of customer supply disruption in the National Electricity Market during the periods of highest demand for electricity from the grid.

This report is based on information available at 15 November 2017.

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## VERSION CONTROL

Version	Release date	Changes
1	28/11/2017	
2	29/11/2017	Clearer commentary around table on page 6.
3	12/12/2017	Update actuals, forecasts and note in table on page 6.



# Introduction

AEMO is responsible for operating the power grid for the National Electricity Market (NEM) that serves the eastern and south-eastern regions of Australia, and the Western Australian South West Integrated System. Our key responsibility is to oversee the operations of the power system so electricity is supplied safely, securely, and reliably to Australian homes and businesses, and the system operates in the long-term interests of consumers.

Following the statewide blackout in South Australia last September, and the supply interruptions in South Australia and New South Wales last summer, AEMO has worked extensively with government and industry so the NEM power system<sup>1</sup> is now in a much stronger position for the summer ahead.

This report summarises these efforts and the outcomes they are designed to achieve.

The electric power grid combines multiple individual generators and transmission networks as a single synchronised machine, keeping supply and demand in constant balance and delivering electricity to each of us, every moment of every day. It has been described as one of the great engineering achievements of the 20<sup>th</sup> century.

As a society, we have grown used to the power system being dependable and efficient. When it works well, it operates unnoticed.

Consumers in Australia, however, are now thinking a lot about the power system, and are uncertain about its capability to meet their expectations for efficiency and reliability.

This concern about the power system has come from many contributing factors, from supply interruptions to rising power bills.

AEMO is working actively with Commonwealth and State governments and the energy industry, guided by the Finkel Review and now with the newly formed Energy Security Board, on a road map so changes can be made to the design and operations of the power system to resolve these issues.

As well as engaging in these systemic changes, AEMO also has a more immediate task.

Summer, across all of Australia except Tasmania, is the period of highest energy usage. It is also the period when this level of demand, high temperatures, and climatic events like bushfires and storms place the power system at highest stress and make it most prone to failure.

Like all power system operators, AEMO has traditionally prepared carefully for summer periods, working with generators, network owners, and relevant government agencies so all reasonable actions are being taken to secure the system.

Following the rapid closure of the Hazelwood Power Station in Victoria in March 2017 and the events of last summer, AEMO assessed the short-term balance of supply and demand in the NEM in our *Energy Supply Outlook* published in June 2017. In that report, AEMO identified a heightened risk of supply disruptions for the coming summer in Victoria and South Australia if no further steps were taken.

AEMO also recognised that, due to an increasingly tight supply and demand arrangement throughout the NEM,

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<sup>1</sup> Although risks in the Western Australian system are not as high, because the capacity market in Western Australia ensures sufficient supply to meet forecast peak demand, AEMO co-ordinates transmission and generation outage planning, contingency management, and forecasting improvements to reduce risks (noting that, as in the NEM, 100% supply reliability cannot be guaranteed in extreme conditions). This report focuses on the NEM — more information about Western Australia is available from AEMO.

increases in the frequency and duration of summer heatwaves, the rapid changes occurring in the power system through the introduction of new sources of generation and off-grid capabilities, and Australians' expectations for a reliable power system, we needed to place additional emphasis on the system being prepared for the upcoming summer.

AEMO put together a comprehensive plan to ensure all reasonable and necessary actions were pursued to prepare for the coming summer in all NEM regions.

For AEMO, regaining consumer confidence in the reliable operations of the system this summer is a crucial and fundamental first step in regaining confidence in the whole of the NEM.

We are pleased with the collaborative and thoughtful responses we have received from Commonwealth and State governments and public and private energy market participants in the development and pursuit of our summer readiness plan. In South Australia, the State government's Energy Plan will be an important contributor to delivering new generation and energy storage for use in emergency situations during the coming summer, if extreme conditions occur.

Due to this planning, and the actions of many, AEMO is well prepared for the summer.

And while we know unexpected events can happen and do happen to power systems, we have pursued a thorough plan to address most foreseeable events, and undertaken contingency planning to prepare AEMO, governments, and the energy industry to address the unforeseeable quickly and effectively.

This report shares the actions that have been taken across the NEM to deliver reliable and secure power to Australian consumers.

AEMO's summer readiness action plan has focused on:

- Maximising the resources in the system, including reserves for emergencies:
  - The amount of generation operating in the market, and its availability throughout summer.
  - A reserve of off-market generation to be operated in emergencies if needed.
  - The availability of fuel for generators (coal, gas, water, and diesel).
  - The availability and capacity of the transmission network to carry power to where consumers need it.
  - Demand side participation, so more consumers have the opportunity to reduce their usage in a planned way at peak times, helping the system balance in return for incentives.
- Learning from the experiences of last summer.
- Strengthening operational systems and training.
- Contingency planning, so everyone involved in the power system is prepared to respond to unforeseen events.
- Achieving these goals through extensive collaboration and communication.

# Contents

Important notice	
Introduction	1
1. Forecasts for summer 2017-18	4
1.1 Annual preparations for summer	4
1.2 Forecasting for summer	4
1.3 Forecast demand in summer 2017-18	7
1.4 Some historical context on demand and supply	8
1.5 The forecast supply and supply-demand balance in summer 2017-18	11
2. Increasing the resources in the NEM	13
2.1 Additional generation capacity and demand resources in the NEM	13
2.2 Increasing the availability of existing generation	17
2.3 Maximising generator fuel availability	17
2.4 Maximising network availability	18
3. Operational improvements	20
3.1 Generator risk profiling and communication of recall information	20
3.2 Lack of Reserve thresholds	20
3.3 Improving forecasting	21
3.4 Operator training	21
3.5 Actions arising from South Australia black system	21
3.6 Additional jurisdiction actions in South Australia and New South Wales	22
4. Contingency planning	23
5. Collaboration and communication	24
6. Independent review of AEMO's summer plans	25
7. Planning beyond this summer	26
Appendix A	27
Appendix B	28

# 1. Forecasts for summer 2017-18

The power system can only operate when supply and demand are in constant balance, so AEMO forecasts both supply and demand to identify any times when this balance might be at risk. We publish long-term forecasts, to help plan investments in the system, and much more detailed and short-term forecasts to help the system operate securely and efficiently in real time.

Our forecasts for this summer identified risks of supply falling short of demand in some extreme but foreseeable conditions, and also of the system not having enough reserve power to respond to unforeseen emergencies. Although the risk of uncontrollable weather and system events which result in loss of power are always present in a power system, AEMO has worked hard with market participants and Commonwealth and State governments to secure sufficient resources and be summer-ready.

## 1.1 Annual preparations for summer

Each year, AEMO works with Transmission Network Service Providers (TNSPs), generators, governments, and other electricity market participants to prepare for summer, when electricity demand peaks in New South Wales, Queensland, South Australia, and Victoria<sup>2</sup>.

These preparations follow many years of work by AEMO to forecast demand (refining these forecasts as new information becomes available), and undertake continuous, detailed monitoring of sources of supply.

In typical years, AEMO has begun preparations in July and completed them in November. For this summer, we began preparations in February 2017.

This has included a comprehensive review of forecast weather conditions, electricity demand, transmission network preparedness, generator availability, and opportunities to improve operational communications and emergency management arrangements.

AEMO also partnered with the Australian Renewable Energy Agency (ARENA) and Commonwealth and State governments to develop approaches to use demand-based resources, emergency generation, and battery storage to enhance existing supply.

We will continue to monitor and respond to conditions throughout summer 2017-18.

## 1.2 Forecasting for summer

### Reliability – having enough resources in the system to meet demand

In the NEM, the “big picture” standard for reliability is set by the Australian Energy Market Commission (AEMC) Reliability Panel.

This standard is set, not for the whole NEM, but for each individual NEM region.

The standard says each region must have enough resources to meet 99.998% of its consumer demand each year. This can include imports from another region, if that other region is forecast to have enough spare energy at the time.

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<sup>2</sup> All NEM regions have their peak demand in summer except Tasmania, which has its annual peak in winter, driven by electricity use for heating.

The reliability standard accepts that up to 0.002% of demand might not be met in a region each year, because there isn't enough generation capacity, demand-side participation, or network capability. For example, because total energy consumption<sup>3</sup> in New South Wales in 2015-16 was 69,554 gigawatt hours (GWh), the standard would still have been met if up to 1,391 megawatts (MW) had been lost for an hour that year in the New South Wales region (or 696 MW for two hours, or any combination that adds up to 1,391 megawatt hours (MWh)).

Any loss of supply due to multiple or “non-credible” generation or transmission events, network outages in the region, or industrial action, is also not counted in the reliability standard. Because it accepts some interruptions to consumer supply, the reliability standard represents a trade-off between the cost of any such interruption happening and what it would cost to insulate the power system against extreme and rare events.

AEMO is collaborating with the AEMC in a review of the reliability standard, which is expected to be published by 30 April 2018<sup>4</sup>.

AEMO publishes long-term assessments of supply and demand to identify any risk of any region not meeting the reliability standard in any year. These long-term assessments can signal to the market times and places where investment in more resources or transmission capability may be needed.

### How AEMO forecasts summer peak demand

In our long-term, 20-year demand forecasts, AEMO forecasts the maximum demand which could be expected at any one time each year.

We provide 50% probability of exceedance (POE) forecasts for a summer of average weather, based on weather patterns likely to occur one in every two years. Similarly, we also provide 10% POE forecasts, based on a one in 10 year chance of an event occurring.

Weather is important in planning because:

- High temperatures increase customer demand for electricity at those times.
- Extremely hot weather also places additional stress on the plant and infrastructure the system needs to supply consumers with electricity.

It's important to remember that the reliability standard does not relate to balancing supply and demand at peak times, and does not help AEMO assess the operational risks of imbalances between supply and demand in real time.

For more short-term assessments of reliability and risks, AEMO uses Lack of Reserve (LOR)<sup>5</sup> values to identify times when extra reserves may be required to avoid the need for load shedding to maintain or restore power system security.

LOR conditions indicate the system may not have enough spare energy if something major and unexpected happened, like the loss of a generator or interconnector.

Recognising the importance of adequate reserves in reliability, the AEMC has recently begun reporting on both unserved energy and LOR in reporting on reliable system performance<sup>6</sup>. See 1.4 for more historical context on reserve levels.

Unserved energy means energy that cannot be supplied to consumers, resulting in involuntary load shedding (loss of customer supply), because there is not enough generation capacity, demand side participation, or network capability, to meet demand.

- Weather affects how much generation is contributed by weather-dependent resources such as hydro, wind, and solar.

This was highlighted by events in the 2016-17 summer, when supply to customers was disrupted at some times when generation was unavailable at the same time as demand was high.

AEMO only forecasts maximum demands for individual regions. We don't add regional peak demand forecasts together to get a “NEM peak”. Each region must be able to meet its own forecast peak with the resources available to it.

As each summer gets closer, we update our forecasts, based on new information about trends that affect energy demand.

<sup>3</sup> Native consumption, which is operational demand from the grid (energy used by all consumers, and energy lost in transmission) plus small non-scheduled generation (SNSG).

<sup>4</sup> AEMC, 2017. Reliability Standard and Settings Review 2018, available at <http://www.aemc.gov.au/Markets-Reviews-Advice/Reliability-Standardand-Settings-Review-2018#>.

<sup>5</sup> Lack of Reserve (LOR) is described in clause 4.8.4 of the National Electricity Rules.

<sup>6</sup> The AEMC's 2016 Annual Market Performance Review (AMPR) was its first to report on the combination of unserved energy and reserve levels (measured by Lack of Reserve notices) to indicate reliability in the NEM, after previous reports considered unserved energy alone. Available at <http://www.aemc.gov.au/Markets-Reviews-Advice/Annual-market-performance-review-2016>.



The trends that broadly drive changes in long-term maximum demand forecasts are:

- For the large industrial business sector, economic activity, energy prices, and business operations starting up or winding down.
- For small-to-medium businesses and households, levels of energy efficient behaviour, changes in technology, and use of rooftop PV<sup>7</sup> to generate their own energy (and to a lesser extent, batteries to store energy).

Overall, the peak is expected to fall in most NEM regions in the next five to 10 years. In this period, maximum demand is expected to keep occurring during sunlight hours while rooftop PV is generating, so forecast growth in rooftop PV will reduce demand from the grid.

In the longer term, the time of maximum demand is forecast to move later in the day, to close to or after sunset, when rooftop PV from households and businesses won't have the impact it has now and will have in the short to medium term.

The table below shows current figures and 20-year forecasts for maximum demand (MD) in each NEM region, with the installed capacity of rooftop PV, and how much of each region's forecast maximum demand that capacity represents.

It's important to remember that rooftop PV won't contribute its full capacity at the time of maximum demand. Its contribution is projected to decline, even as its capacity rises, as maximum demand gets later in the day and occurs when the sun is weaker.

		NSW summer	Qld summer	SA summer	Tas summer	Vic summer
2016-17 actual	MD MW	13,670	8,930	3,017	1,272	8,230
	Rooftop PV capacity MW	1,383	1,829	781	111	1,138
	PV capacity as % of MD	10	20	26	9	14
2036-37 forecast	MD MW	14,580	9,967	2,915	1,439	9,612
	Rooftop PV capacity MW	7,407	5,496	2,134	237	4,377
	PV capacity as % of MD	51	55	73	16	46

Note: the % is for rooftop PV capacity in that year, not its contribution to maximum demand. The contribution of rooftop PV will decrease as maximum demand gets later in the day. The 2036-37 forecasts are from AEMO's 2017 NEM ESOO (updated from those AEMO published in our June 2017 *Electricity Forecasting Insights*).

AEMO's long-term maximum demand forecasts already use the past 20 years of actual weather data, including very hot years, very cool years, and everything in between, so there is not a significant change to the forecast when we include more recent weather data<sup>8</sup>.

AEMO does, however, monitor weather forecasts closely as each summer approaches. Narrowing down the weeks, days, and hours when hot weather

is expected helps us make more detailed operational forecasts of demand and supply that inform the market in shorter timeframes (within a week).

To create operational forecasts of demand, AEMO uses historic measurements of load (energy supplied to consumers) combined with calendar information (such as public holidays, school holidays, and daylight savings) to develop models to predict the level of demand given an expected weather forecast.

<sup>7</sup> "Rooftop PV" means solar photovoltaic systems installed on consumers' premises, "behind the meter". When consumers draw power from these systems, it reduces how much they consume from the power grid. This has a very different impact on the system to large-scale solar generation, like solar farms, which feeds power into the grid the same way large coal-fired, gas-powered, or hydro generators do.

<sup>8</sup> AEMO applied a warming trend to historical data to adjust the data to 2017 levels. AEMO's warming trend is based on CSIRO's simulated future states of the Earth's climate using Representative Concentration Pathways (the RCP4.5 model). This model predicts that the earth warms at a rate of 0.50 degrees per year.

## How AEMO forecasts supply

AEMO publishes a forecast every year about the likelihood of the market having too much or too little capacity to meet forecast annual consumption and maximum demand at any time in the short to medium term.

That report, the *Electricity Statement of Opportunities* (ESOO), alerts the market, governments, and other stakeholders to any forecast supply-demand challenges over the next 10 years, and gives them the chance to plan a response.

For the ESOO, we look at the total capacity of generation that exists and is expected to be developed or withdrawn, as well as the probability of this generation being available at any point in time.

This is balanced against demand forecasts, including projected maximum demand based on both average and more extreme weather.

AEMO also publishes information which looks at the supply and demand balance in shorter timeframes:

- Day ahead (pre-dispatch forecasts).
- Two to seven days ahead (short-term projected assessment of system adequacy, or ST PASA, published every two hours).
- Two years ahead (medium-term PASA, or MT PASA, published weekly)<sup>9</sup>.

Supply in these assessments measures, not generation capacity, but how much generation we have been told is actually expected to be available – for example, we use advice from generators about any plant they plan to switch off for maintenance.

As each summer gets closer, we use new information to update our forecasts and be prepared. All our forecasting relies on strong collaboration and the sharing of information across the energy industry and its customers.

## 1.3 Forecast demand in summer 2017-18

AEMO's updated long-range forecasts of maximum demand for the coming summer were slightly higher than earlier forecasts, mainly because:

- We refined our modelling, to link the forecast to likely PV generation at the time of peak demand. This resulted in a lower impact from rooftop PV and a higher maximum demand forecast for South Australia than our earlier forecasts.

- The latest trends suggested consumers wouldn't change their behaviour to reduce their energy use, and therefore their demand from the grid, by as much as we had thought.

Short-term operational demand forecasts have not yet been developed, because they rely on weather forecasts at an hourly resolution, which are only available up to 10 days in advance.

### Bureau of Meteorology forecasts

AEMO is working closely with the Bureau of Meteorology to support our operational planning. Its severe weather outlook<sup>10</sup> projects for this summer:

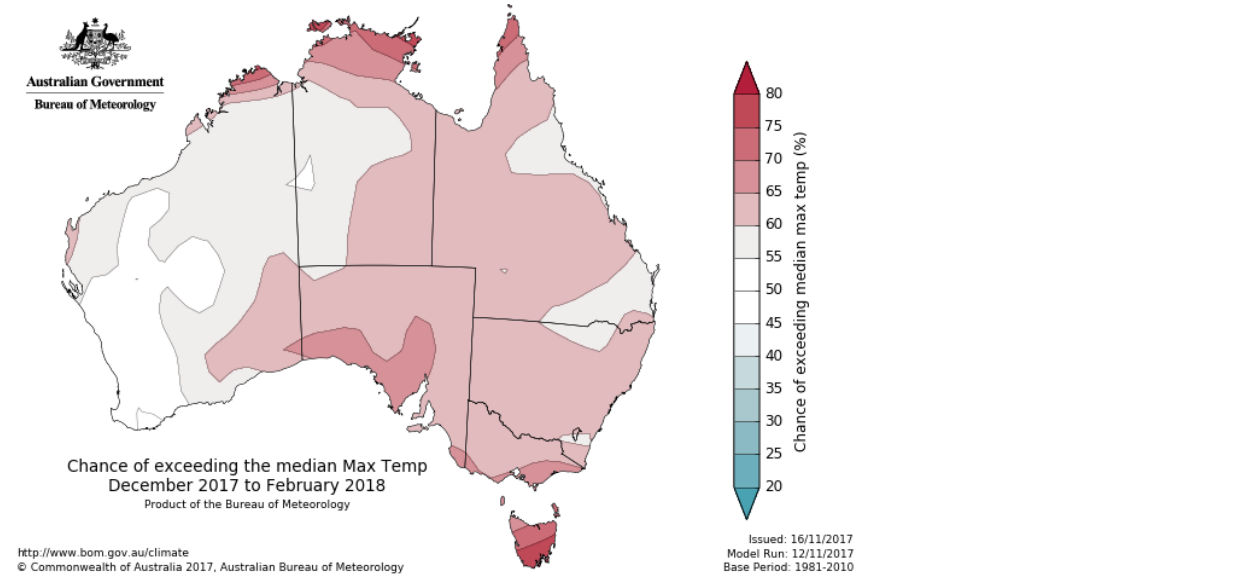
- A higher likelihood of heatwaves than in most years.
- A higher chance of extreme heat in south-eastern Australia.
- Above average maximum temperatures, with the highest chances of warm days in Darwin, Hobart, Melbourne, and Adelaide.
- Victoria and South Australia having the highest likelihood of a greater than normal number of hot days, and a risk of longer (at least five days) heatwaves.

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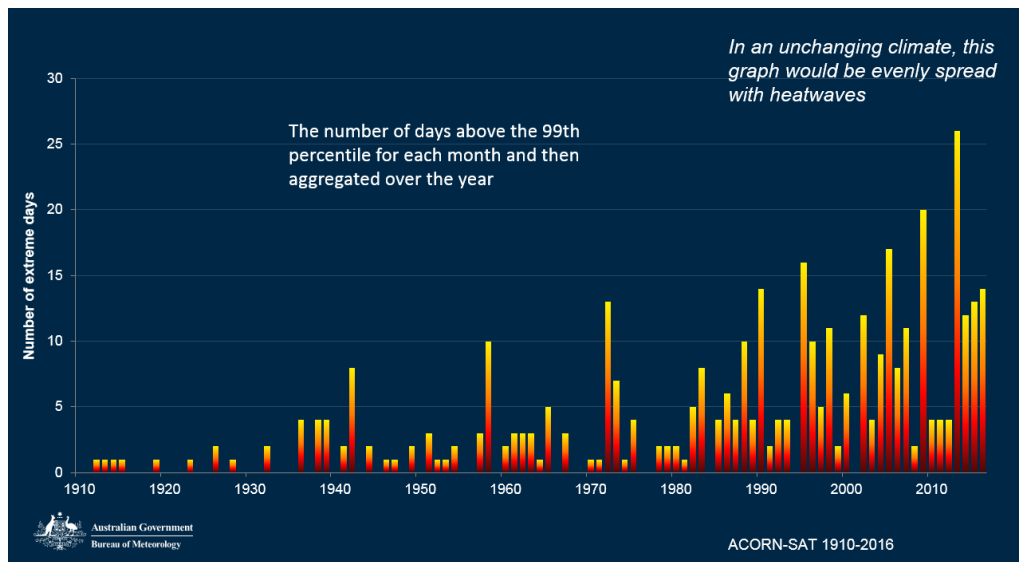
<sup>9</sup> ST PASA and MT PASA reports are published at <http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Data/Market-Management-System-MMS/Projected-Assessment-of-System-Adequacy>.

<sup>10</sup> Longer-range forecasts particularly are subject to change. More information and a video is available at <http://www.bom.gov.au/weather-services/severe-weather-knowledge-centre/>.

**Figure 1 Temperature outlook for December 2017 to February 2018 – chance of exceeding median maximum temperature**



**Figure 2 Trends in Australian heatwaves**



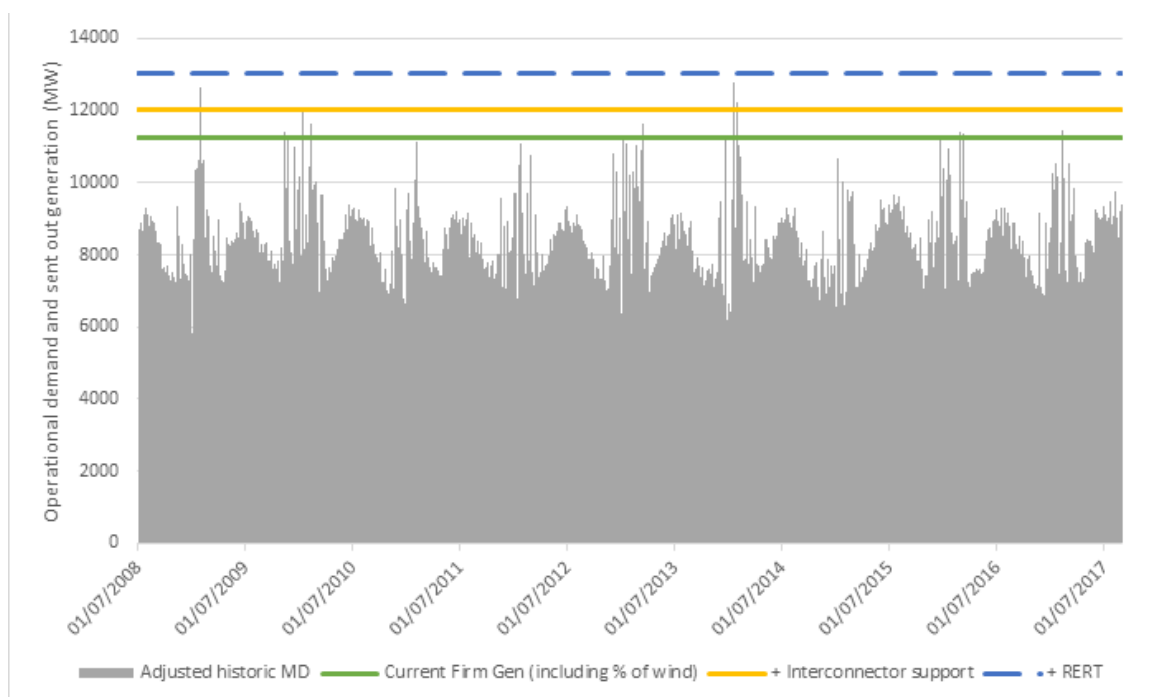
## 1.4 Some historical context on demand and supply

It is worth noting that the forecast peak demand in the summer ahead is not unprecedented. What has changed is the amount and type of supply in the system to respond.

For a broader historical perspective, Figure 3 below shows the combined daily maximum demand in South Australia and Victoria since 2008. It highlights ‘superpeaks’ of demand in 2009 and 2014, which occurred when south-eastern Australia experienced sustained heatwaves.

These two regions are combined because when South Australia’s demand is high, the region (whose power system is connected only to Victoria) relies on Victoria having enough capacity to export to South Australia, above its own need for electricity. If Victoria’s supply-demand balance does not allow these exports, South Australia’s risk of a shortfall increases. Historically, supply across both regions has become tested when temperatures in Victoria exceed 35°C and Victorian demand exceeds 8,000 MW.

**Figure 3 Daily maximum demand in Victoria and South Australia combined, 2008 to 2017, and current combined supply**



Note: The volatile daily demand peaks use historical measurements, but are normalised (adjusted) to 2017 demand levels. The horizontal green line shows current combined firm generation. The yellow line shows current firm generation plus current assumed interconnector support from New South Wales and Tasmania. The dotted blue line adds extra capacity anticipated through the Reliability and Emergency Reserve Trader (RERT) process for the summer ahead (see 2.1).

Figure 3 shows that the combined highest daily maximum demand across South Australia and Victoria in both 2009 and 2014 would exceed the current combined supply capacity across the two states of dispatchable generation (scheduled generation and firm wind output)<sup>11</sup> and interconnector imports (from New South Wales and Tasmania, both of which are connected to Victoria).

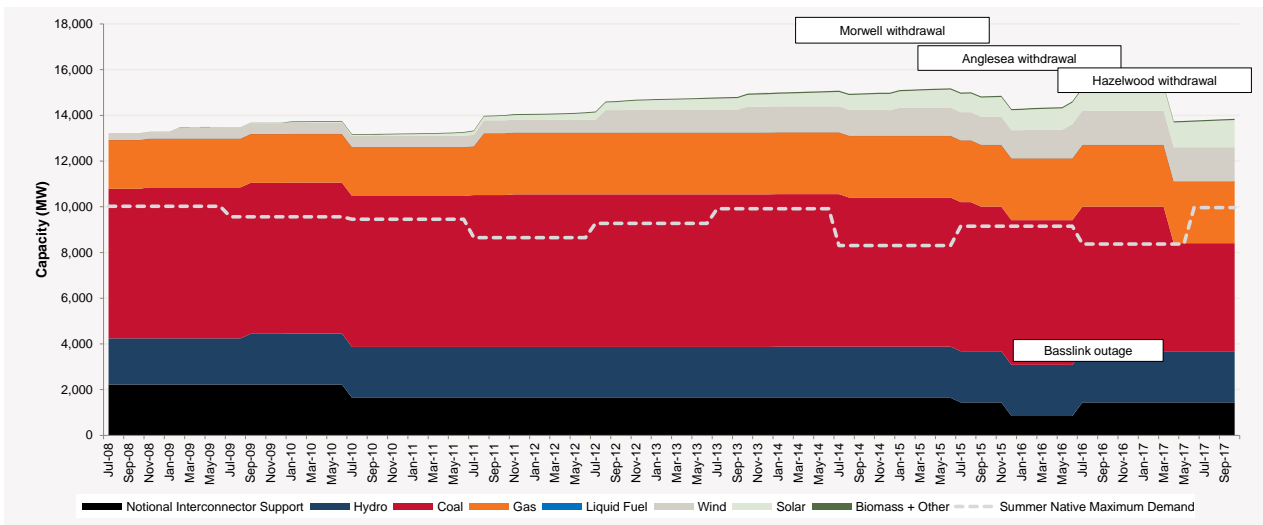
The two charts below show the changes in supply capacity and maximum demand in Victoria (Figure 4) and South Australia (Figure 5) individually since 2008.

Dispatchable generation can be directed to increase or decrease, or to turn on or off, when this flexibility is needed to keep the system operating securely.

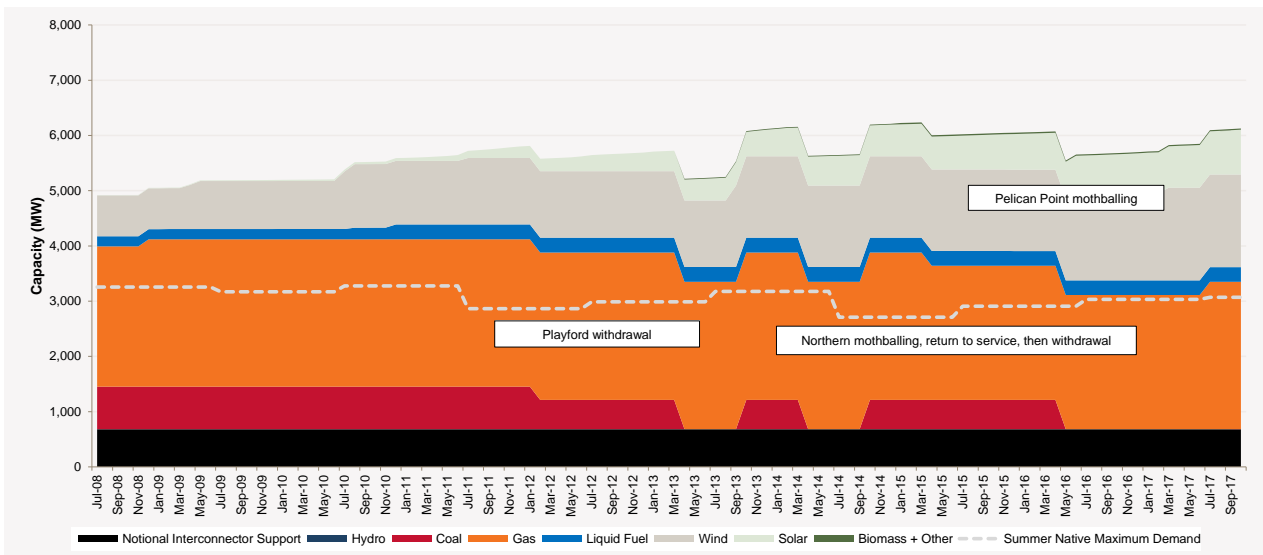
Firm capacity means generation capacity we know will be available at a given time.

<sup>11</sup> The “current firm generation” on the chart includes 69 MW of wind generation in Victoria, which equates to 7.5% of the current installed capacity, and 128 MW of wind generation in South Australia, which equates to 9.4% of current installed capacity.

**Figure 4 Registered capacity and maximum demand in Victoria, 2008-17**



**Figure 5 Registered capacity and maximum demand in South Australia, 2008-17**



These charts highlight:

- The changing supply mix over recent years.
- How the level and type of reserves in the system at any time can vary according to changes in both supply and demand.
- That both regions now rely more on variable supply to meet demand.

The volume of reserves to respond to unexpected events in each region, or to export if needed, is also now more uncertain.

The key challenge now and in the future is that, while demand peaks have always been uncertain, and likely to vary according to the weather, the power system must now also manage increased uncertainty and variability of supply.

Lack of Reserve (LOR) conditions indicate times the system may not have enough reserves to meet demand if there is a large, unexpected event.

AEMO sends LOR1 notices to the market when we assess there is enough energy in reserve to cover one major contingency, but not two at the same time<sup>12</sup>.

<sup>12</sup> AEMO has proposed that LOR definitions are updated to recognise the increased variability and uncertainty now in the power system (see 3.2).

LOR 3, the highest level of alert, indicates the balance is so tight that load shedding is imminent or has begun.

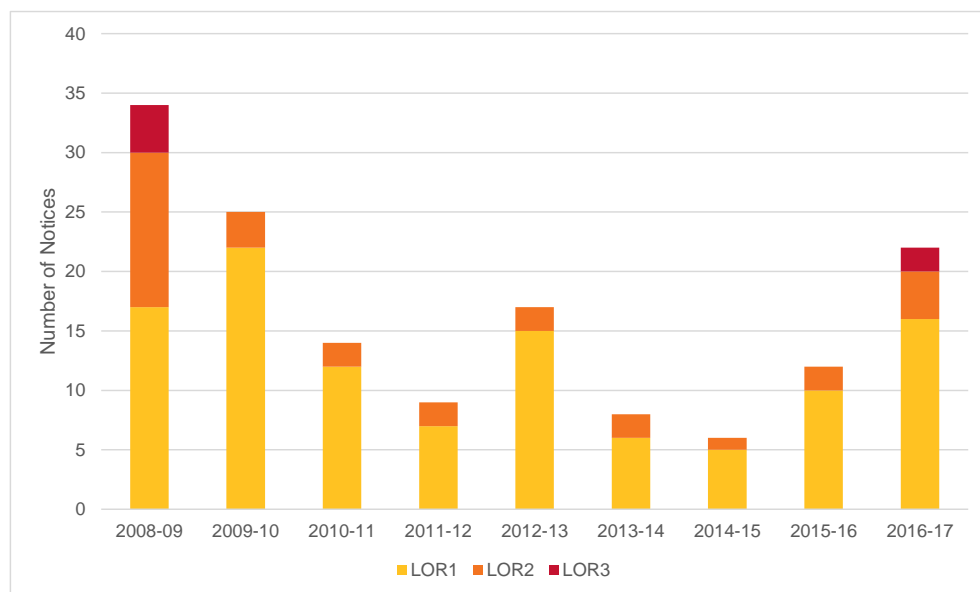
LOR conditions have been created by variations in both supply and demand.

Figure 6 below shows how many times LOR notices were issued, in all NEM regions, from 2008-09 to last summer<sup>13</sup>.

It highlights that, before last summer, LOR3 notices were last issued to the market in the “superpeak” summer of 2008-09.

The LOR3 notices last summer relate to events on 8 February in South Australia and 10 February in New South Wales, when supply was interrupted at times demand was very high and generation capacity was reduced.

**Figure 6 LOR notices issued in the NEM, 2008-09 to 2016-17**



Note: This figure uses the history of Market Notices of LORs being issued, which is similar to how the AEMC has counted LORs in reporting market performance. The count does not exactly match the number of times LOR conditions have existed, but it shows the same trend and also enables us to go as far back as 2008-09.

## 1.5 The forecast supply and supply-demand balance in summer 2017-18

Keeping supply and demand in balance is not only to give consumers uninterrupted power – the physics of the power system mean sudden imbalances between demand and supply can lead to major security problems, up to region-wide blackouts.

When AEMO forecasts the supply-demand balance to identify potential shortfalls (whether or not they mean the reliability standard isn't met), we also need to

focus on there being enough reserves for the system to deal with unexpected events that increase demand or decrease supply.

Since our August 2016 ESOO<sup>14</sup>, AEMO has been highlighting an increased risk in some regions of unserved energy, and the potential for the NEM reliability standard not to be met, at times when peak demand coincided with generation outages, low

<sup>13</sup> The AEMC also highlighted that the NEM experienced instances of both unserved energy and LOR3 conditions in the 2008-09 summer (the year of a demand “superpeak”, as shown in Figure 3), in its 2016 Annual Market Performance Review (AMPR), available at <http://www.aemc.gov.au/Markets-Reviews-Advice/Annual-market-performance-review-2016>.

<sup>14</sup> Available at [http://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning\\_and\\_Forecasting/NEM\\_ESOO/2016/v2/2016-Electricity-Statement-of-Opportunities-Report\\_V2.pdf](http://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/NEM_ESOO/2016/v2/2016-Electricity-Statement-of-Opportunities-Report_V2.pdf).

renewable generation, or low interconnector imports from other regions.

We updated our assessments after ENGIE announced<sup>15</sup> it would close Hazelwood Power Station in Victoria in March 2017, withdrawing 1,600 MW from the NEM.

These assessments found<sup>16</sup> an increased risk of unserved energy in both Victoria and South Australia, at levels that would not meet the NEM reliability standard, in the first peak demand period after the closure – the summer of 2017-18. (The impact on South Australia is due to the energy it would have expected to import from Victoria.)

These projections of the supply-demand balance were based on AEMO expecting no increase in generation from Pelican Point, Swanbank E, or Tamar Valley power stations.

By mid-2017, when AEMO published our *Energy Supply Outlook (ESO)*<sup>17</sup>, the market had responded by reopening some generation, and the South Australian Government<sup>18</sup> had responded with plans for additional emergency diesel generation and battery storage (see 2.1 and 3.6 for more information). The key changes in the NEM that increased these challenges – and the focus of actions to address them – have related to the resources available in the NEM power system to meet demand.

AEMO's most recent modelling, for our September 2017 ESOO<sup>19</sup>, forecast that the reliability standard was likely to be met this summer, but also that the coming summer in South Australia and Victoria represented the highest risk of supply falling short of demand in the 10-year outlook period.

The 2017 ESOO forecasts, based on modelling both average and extreme weather conditions, confirmed that, for summer 2017-18:

- One or both of South Australia and Victoria could potentially not meet the reliability standard if there

was any unforeseen material reduction in generation capacity or increase in demand, or under extreme weather conditions such as high temperatures at the same time as low wind. These assessments highlighted the tightness of the forecast supply-demand balance this summer.

- The targeted actions being taken by the South Australian Government and AEMO (through the Reliability and Emergency Reserve Trader (RERT) provisions discussed in Chapter 2 of this report) would be needed to reduce the risk of supply interruptions.

In both our 2017 ESOO analysis and the more frequent, shorter-term MT PASA outlook<sup>20</sup>, AEMO has identified a potential shortfall in energy reserves in the NEM under extreme conditions.

The power system is finely balanced, and, with reduced reserves available, probable summer events such as heatwaves, lower generation capacity, and/or plant or transmission outages increase the risk of unserved energy.

The directed customer load shedding in the NEM in February 2017 highlighted customers' limited tolerance to supply interruptions, especially during heatwave conditions. This experience, and the potential shortfalls identified by AEMO, reinforce the necessity of actions to secure additional reserves of energy to manage the risk of supply disruptions at times of peak demand in the summer ahead.

Our analysis indicated a reserve of around 1,000 MW would be required this summer to help mitigate the risk of supply shortfalls in South Australia and Victoria<sup>21</sup>. The next chapter outlines how AEMO, governments, and industry have addressed these risks, summarising all the actions that have been taken to increase reserves in the power system this summer.

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<sup>15</sup> ENGIE media release, "Hazelwood power station in Australia to close at the end of March 2017", 3 November 2016, available at <http://www.engie.com/en/journalists/press-releases/hazelwood-power-station-australia/>.

<sup>16</sup> AEMO. 2016 Update to the ESOO, November 2016, available at [http://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning\\_and\\_Forecasting/NEM\\_ESOO/2016/update/2016-ESOO-Update---Hazelwood-Retirement.pdf](http://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/NEM_ESOO/2016/update/2016-ESOO-Update---Hazelwood-Retirement.pdf); and updated Energy Adequacy Assessment Projection (EAAP), November 2016, available at <http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Energy-Adequacy-Assessment-Projection>.

<sup>17</sup> Available at [http://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning\\_and\\_Forecasting/NEM\\_ESOO/2017/2017-Energy-Supply-Outlook.pdf](http://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/NEM_ESOO/2017/2017-Energy-Supply-Outlook.pdf).

<sup>18</sup> Available at <http://ourenergyplan.sa.gov.au/>.

<sup>19</sup> Available at [http://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning\\_and\\_Forecasting/NEM\\_ESOO/2017/2017-Electricity-Statement-of-Opportunities.pdf](http://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/NEM_ESOO/2017/2017-Electricity-Statement-of-Opportunities.pdf).

<sup>20</sup> The MT PASA, or Medium Term Projected Assessment of Supply Adequacy, is updated routinely by AEMO to provide information to the market. See: <http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Data/Market-Management-System-MMS/Projected-Assessment-of-System-Adequacy>.

<sup>21</sup> See AEMO's *Advice to Commonwealth Government on Dispatchable Capability*, released in September 2017 and available at [https://www.aemo.com.au/-/media/Files/Media\\_Centre/2017/Advice-To-Commonwealth-Government-On-Dispatchable-Capability.PDF](https://www.aemo.com.au/-/media/Files/Media_Centre/2017/Advice-To-Commonwealth-Government-On-Dispatchable-Capability.PDF).

# 2. Increasing the resources in the NEM

AEMO has acted, with generation operators and State governments, to bring close to 2,000 MW of additional resources to the NEM in time for summer 2017-18, to meet forecast demand and provide a reserve in case of unforeseen events. These actions have covered:

- Increasing the generation capacity operating in the NEM.
- Adding non-market generation that can be started up in case of emergencies.
- Maximising the availability of operating generation throughout summer.
- Ensuring suppliers have sufficient fuel for generators to keep operating.
- Maximising the availability and capacity of the transmission system (poles and wires) to transport energy to where consumers need it.
- Encouraging demand-side resources, so consumers can choose planned reduction in demand in return for incentives, and AEMO has tools to operate the system securely, reliably, and efficiently at peak times.

## 2.1 Additional generation capacity and demand resources in the NEM

The power system needs to have enough generation available to meet consumers' demand for electricity, and to keep supply and demand in balance so the system keeps operating securely.

In demand-side participation (DSP), demand on the grid can be reduced through pre-agreed consumer

actions and incentives to shift flexible usage to non-peak periods, or meet it with distributed local generation. This is growing as an option that can be delivered relatively quickly, flexibly, and cost-effectively to help address potential issues balancing supply and demand at peak times.

### Market generation resources

The first challenge to supply was that some generation had withdrawn from the NEM (some permanently, and some being temporarily mothballed), and had not yet been replaced.

After AEMO identified potential supply shortfalls in the coming summer, the market responded to increase the capacity of generation available to meet demand at

peak times. A total 833 MW of previously mothballed gas-powered generation (GPG) capacity has been made available through the market:

- The plant operator of Pelican Point Power Station in South Australia advised AEMO the plant reduced capacity by half in April 2015, and returned to full capacity (adding 240 MW) from July 2017.



- The Queensland Government, as asset shareholder, directed Stanwell Corporation to return its 385 MW Swanbank E Power Station to service earlier than initially planned, to be operational from 1 January 2018<sup>22</sup>. Stanwell has advised AEMO that return-to-service testing began in early November.
- Tamar Valley Power Station in Tasmania, which stopped operating its 208 MW combined-cycle gas

turbine (CCGT) plant in May 2017, will have this capacity available.

In addition, Visy Power Generation advises that Smithfield Energy Facility, which closed in July 2017, is now expected to have up to 109 MW of capacity available in early summer 2017-18. At this time, the operator is not able to provide more detail about the timing of its availability.

## Procuring generation and demand resources through Reliability and Emergency Reserve Trader (RERT)

RERT is a function conferred on AEMO under the National Electricity Rules. Under RERT, AEMO can enter into reserve contracts so we can call on resources not available to the market if needed to ensure reliability of supply meets the reliability standard, and to maintain power system security.

It allows AEMO to procure additional generation or load reduction capacity not normally available to the market, and can be offered for short, medium, and long notice periods.

Noting the needs for the upcoming summer, AEMO sought reserves via RERT to leverage existing DSP initiatives, and to be ready in time for summer. We released tenders for RERT in July 2017 and again in

September 2017. A total of 1,150 MW is currently expected to be available via RERT this summer, from both demand (884 MW) and generation (266 MW) resources. AEMO will continue to monitor reserves throughout summer.

The RERT process includes AEMO:

- Negotiating contracts.
- Developing, testing and implementing RERT management systems so we are operationally ready to manage RERT reserves.
- Consulting with jurisdictions (State governments in NEM regions), market participants, and other stakeholders.

### RERT generation resources for this summer

Non-market generation capacity of 266 MW is expected to be available to AEMO through RERT from 10 November 2017 in South Australia, and from 8 January 2018 in Victoria.

The South Australian Government's emergency generators (nameplate 276 MW capacity, with a minimum 170 MW available and potential for up to 225 MW<sup>23</sup>) are now operational. Close coordination

between AEMO, the South Australian Government, and SA Power Networks has made it possible for the units to be available in time for summer to reduce the risk of involuntary load shedding.

In Victoria, 96 MW of emergency diesel generation has been offered to AEMO through the RERT tender process, and the provider is working through the required approval processes<sup>24</sup>.

### RERT demand resources for this summer

For summer 2017-18, AEMO expects a total 884 MW to be available from demand response programs.

Of this total, 789 MW is being delivered in Victoria, 61 MW in New South Wales, and 34 MW in South Australia.

The total includes 143 MW (from Victoria, South Australia, and New South Wales) to be delivered this summer<sup>25</sup> through the joint AEMO/Australian Renewable Energy Agency (ARENA) demand response trial.

<sup>22</sup> Stanwell media release, "Swanbank E Power Station to return to service", 7 June 2017. Available at <http://www.stanwell.com/news/press-releases/swanbank-e-power-station-return-service/>.

<sup>23</sup> AEMO's figures in this report use the minimum 170 MW as the nominal capacity of this generation, as a firm minimum contracted under RERT to allow for one or two units to be unavailable. With all units operational on a heatwave day, the likely maximum is around 225 MW. All generation is "derated" to some degree from its nameplate capacity, to allow for loss of generating capacity when it operates in very hot weather. As the South Australian government's Energy Plan website says, the goal of the temporary energy security measure has been to provide up to 200 MW of emergency generation for this summer. See <http://ourenergyplan.sa.gov.au/gas-power-plant.html>.

<sup>24</sup> AEMO is also discussing an option for an additional 60 MW of emergency generation in Victoria through RERT.

<sup>25</sup> The joint AEMO/ARENA trial will deliver 189 MW of demand response in year two, and 200 MW in year three, across the same three regions.

This three-year initiative, which starts this summer, is to pilot demand response projects, and encourage other market responses to provide firm capacity<sup>26</sup>. The trial's dual aim is to:

- Provide reserves for the upcoming summer as part of RERT.
- Trial a strategic reserve model (referencing international market designs) for reliability or emergency demand response to inform future market design.

Under the trial, ARENA is providing, over a period of three years, up to \$28.6 million of funding for projects, with the New South Wales Government providing \$7 million, for energy users to become demand response enabled. This was run as a competitive funding round, which received 24 applications.

Funding will cover metering, monitoring, storage, distributed generation equipment, and other set up costs. Successful applicants sit on the short notice RERT panel, which enables AEMO to use these resources in periods of tight demand/supply situations.

In October, ARENA and AEMO announced 10 pilot projects involving eight recipients had been successful in the competitive round<sup>27</sup>. Participation ranges across network providers, retailers, aggregators, direct energy users, and technology providers such as smart thermostat developers.

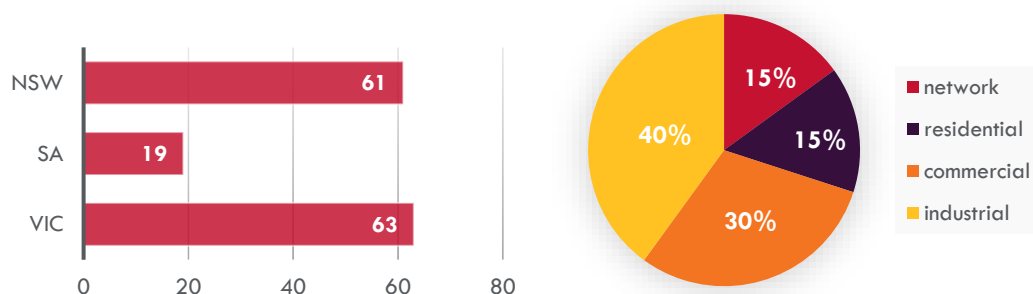
The pilot projects will involve:

- Energy users volunteering to be available to conserve their energy use for short periods during a peak demand event, in exchange for incentives.
- Both commercial and industrial energy users and residential household consumers.

These reserves will be available for dispatch within 10 minutes or within one hour. During a peak demand event, when reserves reach critically low levels, AEMO will be able to call on these pilot projects to dispatch their reserves, and will pay usage charges under the RERT agreements.

The pilot projects will trial a range of different demand response models, technologies, and incentives.

**Figure 7 AEMO/ARENA demand response trial for this summer, by region and sector**



Demand response programs have been used around the world for decades as a cost-effective resource for maintaining a reliable grid.

By reducing load during a limited number of hours each year, its benefits can include deferring the need for new peaking generation capacity, reducing peak period energy costs, and lessening the need for transmission and distribution infrastructure.

Demand response can also provide new capacity on shorter notice than would be required to build new generation and/or transmission infrastructure.

In a range of global examples:

- Texas last year had 3,616 MW of demand available to be called on as part of its response reserve service.
- Other systems, covering groups of US states, can decrease use by between 3% and 7% of peak demand.
- Demand response was used in California in 2012 to ramp up efforts to cover generation shortfalls.

<sup>26</sup> Announcement available at <https://www.aemo.com.au/Media-Centre/ARENA-and-AEMO-join-forces-to-pilot-demand-response-to-manage-extreme-peaks-this-summer>.

<sup>27</sup> See Appendix A for a list of the projects.

- Japan turned to demand response as part of the solution after the Fukushima nuclear disaster.
- Korea introduced laws in 2014 encouraging its use.

Around the world, demand response is typically used during months when temperatures lead to a rise in use of electricity, for example:

- In the summer of 2013, peak demand in New York was reduced by over 1,000 MW in response to reliability concerns.
- In PJM, the market operator used around 1,600 MW of the over 9,000 MW of demand response at its disposal.
- The programs spanned residential, commercial, and

industrial customers, with demand response procured through a centralised wholesale capacity market.

Demand response was also used during the winter of 2013-14 in North America, when ERCOT (Texas) called on more than 600 MW of demand response. Within 45 minutes, these demand resources had reduced load to acceptable levels and the supply and demand balance had been stabilised, avoiding potential rolling brownouts.

While it is growing, much of the potential of demand response has yet to be tapped.

The Paris-based International Energy Agency last year described it as a potential game-changer for electricity markets, estimating it could cut use at peak times by 15%.

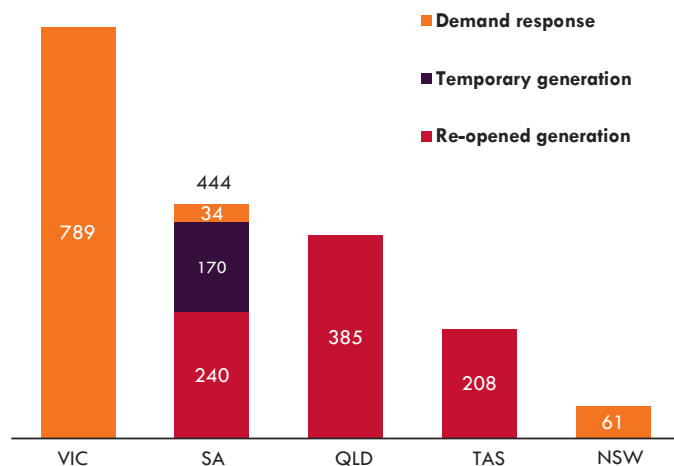
### Total additional resources available in the NEM this summer

This table summarises the total additional resources currently expected to be available this summer, from market responses, government actions, and RERT tenders. Figure 8 on the next page shows these resources by region.

	Source	Capacity
Market generation	Pelican Point Power Station, South Australia	240 MW
Market generation	Swanbank E Power Station, Queensland	385 MW
Market generation	Tamar Valley Power Station CCGT, Tasmania	208 MW
	<b>Total market generation resources</b>	<b>833 MW</b>
RERT demand	AEMO/ARENA trial	143 MW
RERT demand	Other tendered demand resources	741 MW
	<b>Total RERT demand resources</b>	<b>884 MW</b>
RERT generation	South Australia diesel generators	170 MW
	<b>Total RERT generation resources</b>	<b>170 MW</b>
	<b>Total RERT reserves</b>	<b>1,054 MW</b>
	<b>Total additional resources</b>	<b>1,887 MW</b>

In addition, AEMO has been offered 96 MW in emergency diesel generation in Victoria, subject to the necessary approvals.

**Figure 8 Additional resources for summer 2017-18 (in MW)**



## 2.2 Increasing the availability of existing generation

Another critical challenge for this summer was that having any generation in the system unavailable for a planned maintenance outage could leave the balance of supply and demand precariously tight.

As part of planning for summer, generators have co-operated with AEMO to:

- Identify all planned outages for maintenance, and look at whether these can be moved, assessing the risk against cost and reliability.

- Move outages to before or after summer where possible.
- Agree on lead times under which outages that cannot be moved could be cancelled if required under an AEMO direction.
- Identify and mitigate risks to plant availability.

Even given these actions, unplanned forced outages or technical issues, or operating limitations on generation output, can occur under some conditions.

## 2.3 Maximising generator fuel availability

Generators need enough fuel of appropriate quality to operate effectively. Concern about the availability of gas, coal, water, and diesel continues to be raised by governments and market participants, and was highlighted in the New South Wales Energy Security

Taskforce’s initial report, and the Tasmanian Energy Security Taskforce’s final report<sup>28</sup>. More recently, coal supply has also become a focal point for New South Wales Hunter Valley coal generators.

### Monitoring fuel supplies

As part of generators’ ongoing engagement with AEMO, they must update us each week about any energy or fuel limitations, under the MT PASA

process<sup>29</sup>. AEMO has also worked closely with the gas industry and state government energy and resource departments to identify any potential issues for fuel

<sup>28</sup> Available at <http://www.chiefscientist.nsw.gov.au/reports/nsw-energy-security-taskforce> and <http://www.statelibrary.tas.gov.au/tasmanian-energy-security-taskforce/final-report>. AEMO’s March 2017 *Gas Statement of Opportunities* (GSOO) flagged potential shortfalls of supply of gas for GPG in the NEM, beginning in summer 2018-19. Responses from gas producers and government have since led AEMO to downgrade this risk.

<sup>29</sup> These fuel limitations are submitted as weekly energy limits, in megawatt hours (MWh), for each week for the upcoming 24-month period, commencing from the first Sunday after the latest MT PASA run. AEMO publishes MT PASA reports each month. Available at <http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Data/Market-Management-System-MMS/Projected-Assessment-of-System-Adequacy>.

availability, including potential issues with delivery of fuel. To the extent any limits to fuel availability are found that may impact on the security of the power system, we work with industry and governments to

mitigate the risk. Leading into and during this summer, AEMO and State governments will closely monitor fuel availability, and plans are in place for intervention if it is needed.

### Gas supplies for GPG

AEMO has identified gas availability as a risk for Australia's eastern and south-eastern gas markets, including for GPG in the NEM, in a range of reports and advice to governments during 2017. Our most recent published forecast<sup>30</sup> projected a gas shortfall in the domestic eastern and south-eastern gas markets of 54 petajoules (PJ), potentially as high as 107 PJ, in 2018.

AEMO's actions to support availability of gas for GPG this summer include:

- Working with gas producers and LNG consortia, using the latest information available on projections of production, reserves, facility capacity limitations, and demand for gas for export in risk assessments.
- Collaborating with gas production and pipeline businesses to coordinate maintenance of facilities. By minimising outages of gas transmission pipeline and production facilities during critical NEM periods, we aim to maximise the capacity of the gas transmission system to deliver supplies to GPG at these times.

- Collaborating with industry representatives, peak industry associations, market institutions, and state jurisdictions to prepare a high-level design and Guidelines to implement the Gas Supply Guarantee<sup>31</sup> mechanism for peak electricity demand. This measure will inform industry arrangements to make more gas available (including linepack) for GPG during critical NEM demand periods, while not compromising gas supply to southern states during winter.

The Federal Government responded to our advice to government and industry about the risk of shortfalls by implementing the Australian Domestic Gas Security Mechanism (ADGSM)<sup>32</sup>, which allows it to limit gas exports.

This coordinated effort between government and industry, based on independent information to the market which highlighted the risk of potential shortfalls, resulted in guaranteed gas supply for the east coast gas market for 2018.

### Supplies for hydro, diesel, and coal generation

While water storages are lower than this time last year in Queensland and New South Wales, they are expected to be sufficient for hydro generation through summer, particularly during peaks. AEMO will continue to closely monitor the reliability of water supplies for hydro generation, and work with generators to assess risks on water storages.

AEMO will work with generators to monitor supplies of diesel for the additional generation offered under RERT as an emergency reserve for this summer.

AEMO also continues to work with generators and in conjunction with State governments to monitor current and forecast coal stocks, and (at the time of publication) we are not aware of any shortages.

## 2.4 Maximising network availability

AEMO has worked and continues to work actively with Transmission Network Service Providers (TNSPs) to make sure the transmission network is available over the critical summer period.

The transmission network plays a vital role in transporting electricity from generators to consumers. It also requires maintenance, especially to reduce risk during bushfire season.

<sup>30</sup> AEMO. Update to the Gas Statement of Opportunities (GSOO) for eastern and south-eastern Australia, September 2017, available at <http://www.aemo.com.au/Gas/National-planning-and-forecasting/Gas-Statement-of-Opportunities>.

<sup>31</sup> Gas producers and pipeline operators made a commitment to the Commonwealth Government to make gas supply available to electricity generators during peak NEM periods. The Gas Supply Guarantee mechanism has been developed by industry to facilitate the delivery of these commitments. It is directed to short-term deliverability and supply issues for GPG, and as such is most appropriate to address operational risks or major unplanned events, such as an unplanned outage of a major coal-powered generation unit.

<sup>32</sup> The ADGSM provides for the Federal Minister for Resources to consult with a number of parties, including market bodies, government agencies, LNG projects, the Prime Minister, and Ministers, on the potential for a domestic gas shortfall in any calendar year and, following consultation, to determine whether LNG export restrictions should be imposed to avoid such a shortfall. This mechanism is intended to provide means to manage the risks to the annual domestic energy balance.

The actions outlined below have been designed to manage risk for the network and also maximise its

### Keeping the network available through summer

Through the Power System Security Working Group, AEMO and TNSPs have planned and reached agreement so:

- Planned outages for maintenance are moved to before or after summer if possible, and there are agreed lead times under which outages that cannot be moved could be cancelled if required under an AEMO direction.
- Risk management activities for the network, like maintenance and easement clearing to reduce bushfire risk, are completed before summer.
- Planned interconnector and other transmission network upgrades are completed before summer where possible.

On days of high demand during summer, particularly where Lack of Reserve (LOR) shortfalls are identified, AEMO will not allow planned maintenance to occur

### Network upgrades

To support energy transfer as needed between regions, AEMO and TNSPs are working towards interconnector upgrades:

- Commissioning the Heywood Interconnector upgrade, to increase its capacity in both directions.
  - The availability of the full increased capacity depends on the commissioning of two emergency control schemes, which AEMO proposed and ElectraNet is working towards implementing progressively from late 2017.
  - These control schemes will detect high flows on the interconnector and respond by switching on the new battery at Hornsdale and taking any additional actions necessary to reduce imports to safe levels and protect against the risk of the interconnector failing.
- Improving the ability to access the full capacity of the Murraylink interconnector (High Voltage Direct Current (HVDC) cable between South Australia and Victoria) during very high demand conditions. A runback scheme<sup>33</sup>, expected to be commissioned by

availability during summer when its capacity is critical to meeting demand.

unless there is an issue which presents a safety risk, or the outage is already underway and recalling it would increase risk to the power system.

TNSPs have advised AEMO that they:

- Are on track to complete all bushfire mitigation activities before summer starts. These include aerial surveys, fuel load assessment, and easement maintenance.
- Have completed maintenance on key assets, including ElectraNet replacing temporary transmission towers with permanent towers in South Australia, and TransGrid replacing towers in New South Wales.

Interconnectors are expected to operate at full nominal capacity, and there is the potential for an increase in capacity by summer (see below).

the end of December 2017, will reduce the risk of voltage collapse and network issues in southern New South Wales normally associated with high demand conditions, so a stability constraint doesn't limit transfer of power from Victoria to South Australia. AEMO's analysis suggests this upgrade could increase the transfer limit by 100 MW during peak load.

- Fast-acting tripping schemes being enabled at South Australian wind farms to increase the power export capacity from South Australia to Victoria and ensure stable operation of the South Australian network in the unlikely event of the interconnector failing.

AEMO is also working with TNSPs to implement or enhance the existing network through the implementation of other schemes that maximise the transmission capacity, such as short-term and emergency ratings of transmission elements to temporarily increase transfer capability under extreme operating conditions.

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<sup>33</sup> Special protection schemes detect and respond to contingency events so the power system remains in a satisfactory operating state. A runback scheme is a type of special protection scheme which reduces the flow of electricity in a given network element in a controlled way, in response to a specific event.

# 3. Operational improvements

AEMO is working with generators and updating our forecasting tools, to improve the visibility of risks to the power system, triggers for notification and intervention when a risk is identified, and training for control room operators.

We have taken practical, tangible actions on the recommendations from the 2016 black system in South Australia, while some State governments have also taken additional actions in preparation for this summer.

## 3.1 Generator risk profiling and communication of recall information

While generators have specific obligations to provide information to AEMO for operational risk and market needs, AEMO identified some improvements, outside the scope of the existing regulatory arrangements, which would enable us to make more informed decisions under extreme operating conditions.

AEMO is engaging with each scheduled generator in the NEM to better understand restrictions and risks of partial outages that could apply under high summer temperature conditions. This generator risk profiling

will help AEMO better understand the risk of unexpected reductions in the availability of scheduled generating units on days of extreme heat.

We are also implementing a more robust process for generators to communicate the recall capability of their out-of-service generating capacity, to improve decision-making on intervention strategies.

The support of generators throughout this process has been and will continue to be critical.

## 3.2 Lack of Reserve thresholds

Since last summer, AEMO has reviewed how Lack of Reserve (LOR) thresholds are defined, specifically how they take into account risks of unexpected reductions in reserves due to factors not covered in the existing Rule.

The existing LOR definitions were based around the risk of “credible contingencies”, such as the loss of the largest generator, or large load, or interconnection, in any region. AEMO considered that this approach did not adequately consider the range of risks to reliability that now exist, given the changing nature of the electricity system.

The revised LOR definitions will also take into account a measure of reserve forecast uncertainty due to the risk of partial outages of scheduled generating units, and weather-related changes that affect levels of demand and the availability of variable renewable generation.

The measure will be based on an assessment of past inaccuracies in forecasting these quantities, and these estimates of uncertainty will be updated at regular intervals to adjust for changing power system conditions.

After the review, AEMO proposed changes to the National Electricity Rules to update the LOR definitions and therefore the criteria and thresholds for AEMO to intervene in the NEM. The AEMC issued its draft determination on the proposed Rule changes in October 2017, and intends, after consultation on this draft, to release its final determination in December 2017.

In parallel, AEMO will be consulting on the development of the reserve declaration guidelines which will be required under the proposed LOR Rule change.



### 3.3 Improving forecasting

Security of electricity supplies will become much more sensitive to the management of the impacts of daily and within day changes in weather on the power system.

Variations in coal, gas, and hydro generation are typically not dependent on within day weather conditions, except under extreme conditions.

As wind and solar generation take a much higher share of electricity supply, secure and reliable NEM operation will be more sensitive to the ability to balance supply and demand in the power system when the output of this weather-variable generation is low, or varies materially over short timeframes.

AEMO's ability to forecast this variable output accurately, ahead of the day and within each hour of the day, is critically important to keeping the system in balance.

At the same time, the transformation of Australia's energy system, with high penetrations of variable renewable generation sources and a rapid increase in distributed energy resources (DER) installed behind the meter (on customers' premises) is making it increasingly challenging to forecast both supply and demand.

AEMO is continually developing our operational forecasting capabilities, and pursuing new and innovative approaches to forecasting demand and supply. Current initiatives include:

- Updating demand forecasting models to improve modelling of latent heat build-up and the modelling

of micro-climate zones (such as the difference between coastal and inland city temperatures due to the strength of a sea breeze), leading to improved forecasting accuracy during extreme conditions.

- Collaborating with weather forecasting suppliers to obtain detailed alerts on weather-related events that could impact power system operation, such as heatwaves and sudden changes in wind or cloud conditions that affect the output of wind or solar generation.
- Developing tools and systems to provide real-time alerts when weather events cause forecasting uncertainty to increase.
  - This will allow power system controllers to take pre-emptive action, such as reconfiguring the network and/or increasing the availability of reserves, in case actual events differ greatly from the forecasts.
- Engaging a resident meteorologist, seconded from the Bureau of Meteorology, to work out of the AEMO office and provide expert weather forecast advice directly to operational staff.
- Receiving monthly updates from the Bureau of Meteorology on its climate and weather forecasts.
- Proposing a rule change to allow LOR thresholds to account for differing levels of forecasting uncertainty (see 3.2 for more information).

### 3.4 Operator training

As the power system changes and becomes more complex, so do the responsibilities and training needs of AEMO's control room engineers. AEMO recently increased the operating training requirement from four days a year to 120 hours a year.

A key focus of this training is system restart, dealing with complex environmental impacts on the power system, reserve and contingency management, and undertaking directions.

### 3.5 Actions arising from South Australia black system

AEMO has acted, with industry and government, to implement the recommendations it made after investigating the South Australia black system which occurred in September 2016<sup>34</sup>. These actions aim to reduce risk in five key areas:

- Reduce the risk of the South Australia region islanding (separating from the rest of the NEM).
- Improve forecasting of events that could cause islanding.

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<sup>34</sup> AEMO. *Black System in South Australia, 28 September 2016 – Final integrated report*, 28 March 2017, available at <http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Market-notices-and-events/Power-System-Operating-Incident-Reports>.



- Increase the likelihood, in the event of islanding, that a stable electrical island in South Australia can be formed and sustained.
- Improve the system restart process, so supply to customers can resume as quickly as safely possible.
- Improve market and system operations processes during periods of market suspension.

To reduce the energy supply risk to South Australian consumers:

- For this summer, AEMO will have completed its recommended actions to support measures needed to identify, minimise, and manage islanding risks for South Australia.
- Critical improvements to operational tools and processes have been implemented.
- AEMO is working with ElectraNet to complete a range of actions to expand available capacity (including necessary upgrades to hardware and secondary systems)

### 3.6 Additional jurisdiction actions in South Australia and New South Wales

Under the South Australian government's energy plan, as well as the emergency diesel generation under RERT (see 2.1), the connection of the first utility-scale 100 MW/129 MWh battery at Hornsdale Power Reserve to the north of Adelaide is on schedule and is expected to be online by 1 December 2017. The Hornsdale battery is the world's largest lithium ion battery. It will provide valuable system security services by helping to maintain frequency within operational limits and will also be available to provide emergency back-up power.

Given the unprecedented nature of the technology, it has been necessary for AEMO to update a number of its models, processes, and systems to register and connect the battery in the NEM. We have worked closely with the South Australian government, Neoen, and Tesla on delivery, with strong commitment from all parties enabling the project to be progressed to compressed timeframes.

The South Australian government has also updated its powers during an electricity supply emergency.

The New South Wales government is taking a number of steps to prepare for summer. It has created Environmental Protection Authority (EPA) exemptions for generators on hot days, and is monitoring coal

stockpiles and potential coal transport issues, including intervening to ensure the continued operation of the Springvale mine, the only source of coal supply to Mount Piper Power Station.

The New South Wales government is streamlining its emergency management powers via amendment by removing the requirement for the governor to declare an electricity supply emergency. This power will rest with the Premier.

The New South Wales government has also invested in the AEMO/ARENA demand response initiative to secure additional demand response for New South Wales (see 2.1), and updated its voluntary demand management protocols

Like the South Australian moves to update emergency powers, these changes complement the emergency provisions under the National Electricity Rules. AEMO has worked with all State governments in the NEM to refresh and strengthen the communication protocols to be used in the event of a power system emergency.

The Queensland government has directed Swanbank E to return to generating earlier than planned (see 2.1).

The Victorian government has promoted departmental participation in demand response initiatives.

# 4. Contingency planning

As well as preparing for a range of probable scenarios over summer, AEMO has also worked with State governments and electricity and gas market participants to plan rigorously so we are all prepared if something unforeseen happens.

Every September, AEMO and all NEM jurisdictions (State governments) conduct emergency management exercises to test arrangements for the summer ahead.

AEMO and jurisdictions use the Power System Emergency Management Plan (PSEMP) to enable a co-ordinated response to power system incidents and share lessons from any events. This year, AEMO completed a full review and update of the PSEMP, which has been endorsed by all jurisdictions.

AEMO ran a joint national gas and electricity response exercise on 12 September 2017, the first of its kind nationally, to test contingency plans and emergency management arrangements across AEMO, industry participants, and jurisdictions.

The exercise practiced the inter-operability of national gas and electricity emergency management arrangements when managing major energy supply shortfalls in Australia, including:

- Assessing the adequacy of national arrangements to manage a multi-jurisdictional gas and electricity supply shortfall.
- Practicing coordinated communication across emergency management committees, structures,

energy bodies and governments during supply shortfalls.

- Ensuring information flows, sources of information, and protocols are clearly understood by all jurisdictions prior to summer.

The lessons from this exercise have been incorporated into planning for summer.

During 2017, AEMO conducted regular system restart training. Operators from TNSPs and generators in each region attend four days of training each year in Skills Maintenance and Simulation (SMS), which involves a day of presentations and discussion on principles and specific restart plans, then a simulated full black system restart for the region.

We are also providing a training package ahead of this summer for NEM control room and real-time operations staff, which updates mandatory restrictions, RERT (see 2.1), a new lightning reclassification interface, the LOR Rule change (see 3.2), an overview of the east coast gas system, and generation recall, availability, and risk monitoring

# 5. Collaboration and communication

Given heightened public awareness, not only of AEMO but the energy industry collectively, we know our actions leading up to and during this summer will be more highly scrutinised than ever before. We will communicate and engage openly and transparently.

AEMO operates the NEM in constant collaboration with industry participants, Commonwealth and State governments, and other stakeholders. We must work together to plan for and respond to any incident affecting power system operation, and share information, knowledge, and lessons learned.

AEMO also has an obligation, as a public energy communicator, to help inform and educate the public about the work being undertaken by industry in preparation for summer, and to help clarify the roles and responsibilities of organisations over this period.

## Communicating across government and industry about summer preparedness

AEMO has conducted a series of working group meetings, desktop exercises, and one-on-one discussions with governments, TNSPs, and generators to further expand on AEMO's summer preparedness activities and seek similar information from these organisations on their own preparedness for summer.

We set up a working group of federal and state departmental policy managers, with the aim of providing visibility of each other's summer readiness programs, sharing knowledge, identifying gaps, and increasing coordination and cooperation in dealing with a shared issue. The working group convened via national teleconference in September.

AEMO also held a series of briefings and desktop exercises with each NEM jurisdiction. In each session, we and the state government provided an operational and policy briefing on summer readiness activities, and worked through practical desktop scenarios to establish awareness and confidence in the system.

Jurisdictions have provided very positive feedback on the sessions, AEMO's work to prepare for summer, and the openness of our communication with them.

AEMO is also running a series of one-on-one discussions with government, TNSPs, and generators to ensure the NEM is fully prepared for summer.

## Communicating openly with the public about summer

Given the level of public interest in energy, AEMO is taking a more proactive approach to communicating about summer and how the energy sector has prepared for both extreme conditions and unforeseeable events.

We will draw on industry research by consumer advocacy groups and industry at large to communicate with media, consumer groups, and the general public, both directly and in partnership with industry and governments. AEMO has convened a working group of industry organisations, market bodies, and consumer groups, so we can plan together how we will inform

and engage with the energy industry's stakeholders leading up to and during summer. AEMO will also run detailed information sessions for the national media.

Our communication with the broader community will focus mainly on how AEMO and the energy industry have prepared for summer, and demand response.

AEMO's new web portal, *ENERGYLive*, will be our key channel to share information online and on social media with the public. *ENERGYLive* is designed to be an independent, consumer-friendly source of information and news, to encourage everyone to have informed energy conversations.

# 6. Independent review of AEMO's summer plans

In August 2017, AEMO engaged Energy Market Consulting Associates (EMCa) to independently review its plans for summer 2017-18 and recommend any improvements<sup>35</sup>.

EMCa assessed:

- Summer readiness planning and implementation of recommendations from the South Australian black system in September 2016.
- Governance and confidence in these plans and actions being delivered on time and in full.
- Any other actions AEMO could reasonably take to improve its readiness for summer 2017-18.

The assessment was based on the goal of avoiding an event where the NEM would have “insufficient capacity to maintain a secure and reliable power system without the use of load shedding that AEMO could reasonably have avoided”.

EMCa's conclusions are attached as Appendix B.

In summary, this review answered the question “Is AEMO summer ready?” by saying:

- AEMO was where it planned to be, but much work was still needed, and the remaining period to summer would be critical.
- If AEMO completed its summer readiness program as planned by the end of December 2017, it would have done what is in its control to reduce the likelihood of unserved energy at peak demand times in summer.
- Given the fine supply-demand balance, the risk of unserved energy in South Australia and Victoria would remain high.
- As a number of critical initiatives, particularly including demand response programs, become effective, the risk of power outages would fall.

AEMO agreed to and has acted on all eight of EMCa's recommendations.

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<sup>35</sup> This third-party assessment was a recommendation of the Finkel Review: *Independent Review of the Future Security of the National Electricity Market – Blueprint for the Future*, June 2017, available at <http://www.environment.gov.au/system/files/resources/1d6b0464-6162-4223-ac08-3395a6b1c7fa/files/electricity-market-review-final-report.pdf>.

# 7. Planning beyond this summer

Looking past this summer, AEMO will continue to work with industry, regulators, and government to plan longer-term approaches to manage risks.

This summer we will be using some new approaches, particularly the large-scale use of demand response resources, to minimise the risk of supply interruptions for households and businesses across the changing NEM.

After this summer, this form of RERT will not be available to AEMO, so we are investigating and will propose alternative ways to have an appropriate strategic reserve available in the power system to respond to unexpected but plausible events in future.

AEMO has advised<sup>36</sup> that:

- A strategic reserve of dispatchable generation will be required beyond this summer to enable AEMO to respond in emergency periods to reduce to risk of supply disruption.
- The amount of strategic reserve required is expected to decline over the four years to 2021-22 (as peak demand is forecast to be moderated by additional rooftop PV and large-scale renewable generation, and by ongoing improvements in energy efficiency), before being expected to increase again after 2022, when Liddell Power Station in New South Wales has been announced as closing. Any increased need for strategic

reserve is dependent on whether or not the market responds to the announced closure by developing new projects.

- AEMO is working with industry to design new strategic reserve mechanisms, which will progress through the Energy Security Board for endorsement, to deliver:
  - The appropriate level of strategic reserves by mid-2018, to be in place for summer 2018-19.
  - A longer-term solution from summer 2021-22, in time for Liddell's announced closure.

In designing the strategic reserve mechanism, AEMO will learn from this summer's RERT and ARENA initiatives, to develop an approach for delivering peak response that gives consumers reliability, efficiency, and choice.

The NEM keeps changing, as more variable generation capacity is developed, consumers get greater choice and control over their energy, and the power grid becomes more flexible and dynamic.

Through this transition, AEMO is focused on the power system having enough of the type of resources we need – resources that are visible, flexible, predictable, and dispatchable – to be able to act quickly and operate a secure, reliable, and efficient power grid all year round.

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<sup>36</sup> More information, and a copy of AEMO's September 2017 advice to the Federal Government about dispatchable generation in the NEM, is available at <http://www.aemo.com.au/Media-Centre/AEMO-advice-to-the-Commonwealth-government>.

# Appendix A

This table lists participants in the three-year AEMO/ARENA demand response trial.

Name	State	Year 1 (MW)	Year 2 (MW)	Year 3 (MW)	Summary of project
<b>Progressive Green trading as Flow Power</b>	NSW	5.0	15.0	20.0	Flow Power will create a program called Energy Under Control which involves rollout of their own kWatch Intelligent Controller (designed and manufactured in Victoria) to 100 commercial and industrial energy customers across New South Wales, targeting manufacturing, agricultural businesses, and cool storage.
<b>AGL</b>	NSW	18.0	19.0	20.0	AGL will provide 17 MW of capacity from large commercial and industry customers, and 3 MW from 10,000 New South Wales residential households with smart meters, using a combination of behavioural demand response and controllable load/storage.
<b>EnergyAustralia</b>	NSW Vic/SA	18.0 20.0	20.0 30.0	20.0 30.0	Energy Australia will sign up commercial and industrial businesses and residential customers, using WattWatchers' remote monitoring and load curtailment devices and GreenSync's VPP technology for aggregation, along with Redback Technology's smart battery storage systems.
<b>EnerNOC</b>	NSW Vic	20.0 30.0	20.0 30.0	20.0 30.0	EnerNOC will install its own hardware to automatically and remotely control and curtail energy use in 20 large commercial and industrial businesses (approximately 1 MW available per site). Demand response will be 100% generated by curtailment of loads. EnerNOC will also provide frequency control ancillary services (FCAS), demonstrating how customers can receive multiple revenue streams from their reserves.
<b>United Energy Distribution</b>	Vic	12.0	30.0	30.0	United Energy intends to use voltage control devices installed at substations across its Melbourne and Mornington Peninsula distribution network. During a peak event, it will slightly lower the voltage across its whole network of 600,000 households and businesses, using smart meters to ensure the voltage remains at a safe allowable limit.
<b>Planet Innovation (Zen Ecosystems)</b>	Vic/SA	5.0	10.0	15.0	Zen Ecosystems will deploy its smart, connected, and controllable network of Zen thermostats. The demand response capacity will be delivered by controlling air conditioning, heating, and ventilation. Zen Ecosystems will roll this out at business customers, and through a combination of voluntary and load control programs aimed at residential customers, run in partnership with the RACV.
<b>Intercast &amp; Forge</b>	SA	10.0	10.0	10.0	Intercast & Forge is a South Australian metal foundry which manufactures metal castings. This local business has installed sophisticated energy systems that allow it to provide dispatchable demand response by powering down furnaces during peak events.
<b>Powershop</b>	Vic	5.0	5.0	5.0	Powershop will run a behavioural program called Curb Your Power using a mobile notification system for its Victorian retail customers. It will invite customers to reduce energy consumption for 1-4 hours and receive the equivalent of a weekend of free electricity. Powershop will also be able to draw on 1 MW of Reposit enabled batteries installed in its customers' homes, and on a 1 MW co-generation facility at Monash University.

# Appendix B

A copy of the executive summary of the Energy Market Consulting Associates (EMCa) independent review of AEMO's summer planning follows.

# Executive Summary

## Scope and approach

The final report from the Independent Review of the Future Security of the National Electricity Market<sup>1</sup> included a recommendation for a third-party review of AEMO's preparedness for the FY2018 summer. AEMO has asked EMCa to undertake this review. The scope of the review comprises assessments of the following:

1. AEMO's five-point Summer Ready plan to reduce supply risks and to implement the final recommendations from AEMO's review of the South Australian blackout;
2. whether there is appropriate governance and confidence that these plans will be delivered in full and in time; and
3. whether there are other activities or actions that AEMO could reasonably be doing to improve its preparedness for the FY2018 summer.

EMCa undertook the substance of this review in the last two weeks of August 2017 through a desktop assessment of information provided by AEMO and in a series of onsite interviews held at AEMO's Collins Street offices in Melbourne. We sought evidence from AEMO to support the claimed progress and management of its initiatives.

EMCa adopted a risk-based approach in assessing AEMO's initiatives and their expected outcomes. This included a high-level visualisation and

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<sup>1</sup>Independent Review of the Future Security of the National Electricity Market (NEM) to the Council of Australian Government (COAG) on 9 June 2017. Referred to as the 'Finkel Report'.



evaluation of the extent to which AEMO's initiatives are likely to mitigate the threats to South Australia's and Victoria's power supplies in summer 2017-2018<sup>2</sup>.

At the commencement of the review we sought to establish the central undesirable event that AEMO's initiatives were intended to avoid. This became the reference against which we assessed progress and preparedness. Working with AEMO, the undesirable event to be avoided was identified as:

*“Insufficient capacity to maintain a secure and reliable power system without the use of load shedding that AEMO could reasonably have avoided.”*

This review has assessed AEMO's preparedness to manage the risk of this undesirable event occurring in summer 2017-2018.

## The Headlines

### 1. AEMO is continuing to progress summer ready actions

AEMO has implemented a program of actions under its Summer Readiness Program. If completed successfully, the actions will improve AEMO's ability to undertake its role of managing the power system, during high risk periods.

AEMO has completed some Summer Readiness Program actions and is progressing the remainder. A dedicated Program Director is reporting to a steering committee that is monitoring progress towards completion of all actions. AEMO's Summer Readiness Program includes the activities that we would expect in seeking to manage the risk of load shedding in Summer 2017-18. These are:

- Understanding the risks, and supporting the achievement, of maximum available generation capacity including availability of fuel supply;
- Procuring demand-side response to reduce peak demand and provide reserve capacity;
- Supporting measures to ensure transmission network availability and capacity, and contingency planning;
- Monitoring and supporting the implementation of the South Australian Energy Policy;

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<sup>2</sup> AEMO's Summer Ready Program is NEM-wide, with particular focus on the most at risk states, namely SA and VIC.

- Implementing the recommendations from the final Black System South Australia Report<sup>3</sup>;
- Undertaking communication and stakeholder engagement on the FY2018 summer supply situation.

AEMO's objective for its Summer Readiness Program, and for its business-as-usual activities, is to prevent an event where there is insufficient capacity to maintain a secure and reliable power system without use of involuntary load shedding that AEMO could reasonably have avoided.

## 2. The risk of Unserved Energy (USE) for 2017-18 in South Australia and Victoria is higher than in previous years

With the retirement of 1600 MW at Hazelwood in Victoria, no significant change in the forecast peak demands, and only about 500 to 600 MW of firm new capacity being connected to the system in South Australia and Victoria<sup>4</sup>, the situation is finely balanced and the risk of insufficient resources being available to AEMO during the peak summer demand period is higher than in previous years.

We concur with AEMO's current assessment<sup>5</sup> that, without the actions proposed, the risk of USE at peak demand levels is in the range 30% to 40% for the summer period 2017- 2018 in South Australia and Victoria<sup>6</sup>.

The outcome of AEMO's Summer Readiness Program relies on it delivering all the program initiatives. The program is still in progress and some risk remains until these initiatives are fully delivered. Even if all the initiatives are delivered, the risk in Victoria and South Australia of USE through involuntary load shedding will be higher than in recent years.

Some initiatives remain outside AEMO's full control, because other parties provide the resources that AEMO uses to balance supply and demand and to provide backup reserves. While AEMO has taken steps to bring risks

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<sup>3</sup> AEMO AP007 Black System South Australia 28 September 2016 (AEMO, March 2017)

<sup>4</sup> AEMO AI0023, Operations Strategy Guidelines, May 2017 to October 2018: The 500MW to 600MW includes the 200 MW diesel powered gas turbines in South Australia, a possible maximum of 140MW of batteries in South Australia and Victoria, the return of the Pelican Point second 240 MW unit, and a small contribution to firm capacity from the 273 MW of recently commissioned wind generation in Victoria and South Australia.

<sup>5</sup> Electricity Statement of Opportunities – September 2017. AEMO issued this after we had conducted our review and our own assessment of risk.

<sup>6</sup> AEMO has not forecast supply adequacy issues in Queensland, New South Wales or Tasmania

within its control where possible, some risk of USE nevertheless remains attributable to the actions of other parties.

### 3. This is not a one-off event

It is important to recognise, as AEMO has done, that the current situation is due to a transition in the structure of the electricity supply system as traditional large fossil fuel power stations are replaced by more renewable and distributed technologies. The transition will take several years and maybe decades. The initiatives now being undertaken as part of AEMO's preparations for summer 2017-2018, will need to become a business-as-usual activity for AEMO.

### 4. The failure of a single component will increase the likelihood of USE

Even if all the summer ready initiatives are completed successfully and on time, the failure of a single component of the system at a time of peak demand will materially increase the USE risk. The USE risk is high in these circumstances because AEMO will probably have insufficient resources to cover both demand and reserves. Involuntary shedding of load may be required to make the system secure.

### 5. The delivery of several initiatives is critical to mitigation of summer supply risks

No single initiative on its own will resolve the supply/demand risk. The delivery of several initiatives will be critical to reducing the USE risk this coming summer and beyond. AEMO will need to increase its focus on delivering high priority initiatives.

### 6. Time is short, and AEMO is entering the most difficult phase

At the time of drafting this report, four months remain to the end of 2017 and the critical initiatives must be completed by then. Some of the critical Summer Readiness Program actions are dependent on other parties and the timeframes for securing delivery on commitments is compressed. AEMO is working with stakeholders to address their information requirements and to ensure that any network connection, operational constraints and equipment performance issues are expeditiously resolved.

Procurement and operation of critical demand-side participation on the scale being undertaken this year is new to AEMO. The demand-side participation initiatives are entering the most difficult phase where demand-side participation resources will need to become operational. This is not an easy task and four months is a short implementation period to contract, commission, test and establish operating systems for demand-side participation at the scale needed.

## 7. AEMO's governance and management, due diligence and reporting of the initiatives can be improved

In June 2017 AEMO implemented a Summer Readiness Program Steering Committee to reinforce the existing project management framework, to provide executive<sup>7</sup> oversight, and to monitor and report on its summer readiness initiatives. The framework has applied standard project management methods and has developed reporting to the steering committee on progress being made.

Given the urgency and criticality of completion of some initiatives, the steering committee's due diligence and reporting must be stepped up to focus on delivery and operational readiness, as follows.

1. AEMO has business-as-usual initiatives with milestones and deliverables important to summer readiness that are not reported to the Summer Readiness Program Steering Committee. Some of these initiatives may be critical to the Summer Readiness Program, and have been or can be identified and managed as priority projects<sup>8</sup>. Some other initiatives may not be critical but are soaking up resources that could be applied to critical areas.
2. As summer approaches, stress on key people is likely to increase. The availability and application of additional support resources is likely to be needed and should be a key area of continuing vigilance for the steering committee to monitor.
3. Continuous, real-time focus must be applied to the critical initiatives. Bimonthly steering committee and weekly activity coordination team reviews will, on their own, be insufficient to ensure delivery of the critical initiatives. AEMO should ensure that the senior program manager is provided with the necessary resources and is empowered to drive the initiatives forward and to resolve any impediments to their successful deployment. This manager must provide the necessary due diligence and reporting to service a pro-active Summer Readiness Program Steering Committee and to provide the 'big picture' view that will become essential as summer approaches.
4. A master schedule that integrates key program activities and milestones needs to be reported with clear and measurable workstream metrics that reveal program schedule delays, resource constraints and progress shortfalls. Risk assessment should incorporate consideration of any such delivery constraints. The master schedule and status reporting

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<sup>7</sup> Chief Executive and key members of the executive – Figure 2 Section 4.1.1

<sup>8</sup> AI0179 P1267 - Accounting for Reserve Forecasting Uncertainties Project Concept. A process is now being implemented to approve BAU activities as projects.



should be used to ensure that the program is on track to deliver the Summer Readiness Plan and Operation Strategy objectives and that the strategy itself ("the business case") remains valid, effective and deliverable.

5. Reporting to the Summer Readiness Program Steering Committee must include clear measures of program milestones, delivery progress and implementation programs. Any schedule and program milestone amendments should be under formal change processes and approvals.
6. Program metrics should include and benchmark the potential consequences of generation shortfall, including market impacts identified by Electricity Statement of Opportunities 2017, with and without the use of Reliability and Emergency Reserve Trader (known as RERT), and procurement of Australian Renewable Energy Agency (known as ARENA) demand response.

#### 8. Energy conservation campaigns and incentives will be valuable

An energy conservation initiative, targeted at reducing critical peak demand, could provide a valuable contribution to the avoidance of USE events. Incentives provided through critical peak pricing could encourage consumer investment in peak demand reduction and in additional distributed battery storage. Whilst AEMO is not responsible for implementing such programs, given the urgency of the situation, it should consider how it can influence and support their introduction.

## Is AEMO Summer Ready?

At the time of our review AEMO was where it planned to be on the pathway to being ready but there is much left to do. The subsequent four months will be critical and hard work will be required to prevent the Summer Readiness Program slipping behind.

If the Summer Readiness Program is successfully completed by the end of December 2017, AEMO will have done what is in its control to reduce the likelihood of unserved energy at peak demand times in the summer. Some of the activities on the Summer Readiness Program require coordination and actions by third parties and AEMO can only work to manage the power system with resources that are made available by others. The residual unserved energy risk in South Australia and Victoria will remain high as the supply/demand situation is finely balanced and failure of a single component will increase the risk that AEMO will need to shed load to maintain the power system within the requirements of the security standard.

As AEMO states in its Electricity Statement of Opportunities (September 2017), without these actions, in 2017-18:

- *In Victoria, the likelihood of a shortfall is between 39% and 43%. The average shortfall projected is likely to be between 218 MW and 229 MW, but could reach 760 MW. If USE occurs, it is likely to last for four to five hours.*
- *In South Australia, the likelihood of a shortfall is between 26% and 33%. The average shortfall projected is likely to be between 81 MW and 97 MW, but could reach 243 MW. If USE occurs, it is likely to last for two to four hours.*

Absent successful deployment of these initiatives, power outages will be highly probable if extreme weather conditions occur. As the critical initiatives become effective in controlling the threats, this probability will fall. If AEMO or other parties fail to deliver critical initiatives, the probability of power outages will remain high.

Amongst all the initiatives, the most critical to AEMO is delivery of the demand side response programs at expected levels of capacity and capability. As currently presented to us, we consider that there is uncertainty regarding the delivery of this AEMO initiative to the level that AEMO is targeting.

## Recommendations

EMCa's Review Panel recommends that:

1. AEMO focuses its efforts on and increases monitoring of milestones and deliverables that are critical to the management of summer supply reliability and security. Business-as-usual initiatives with milestones and deliverables important to summer readiness should be included in reporting to the Summer Readiness Steering Committee and identified as a project workstream;
2. AEMO continues to apply vigilance to the resourcing and structure of the Summer Readiness Program, given its criticality to management of the summer supply reliability and security risks and its strategic importance to the reputation of the organisation. In particular, the implementation of the demand-side response program is the highest risk element of the current work program. This is an expanded program and the volume target for available megawatts set in April had yet to be updated at the time of undertaking this review;<sup>9</sup>
3. AEMO establishes an integrated master schedule and status reporting with clear and measurable metrics that reveal program schedule delays, resource constraints and progress shortfalls. Metrics should include and benchmark ESOO 2017 forecast market impacts, with and without the

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<sup>9</sup> A 1200 MW target was provided to us in the course of our review. It has subsequently been superseded by a target of 1000 MW referenced in AEMO's letter to the Minister for the Environment and Energy, dated 4th September 2017, published on the AEMO website.

- use of Reliability and Emergency Reserve Trader and procured Australian Renewable Energy Agency demand response;
4. AEMO reviews and revalidates its Summer Readiness Plan and Operation Strategy guideline by 30 October 2017, to ensure that the objectives ("the business case") remain valid, effective and deliverable;
  5. AEMO strengthens the Summer Readiness Program management support and reporting to enable the Summer Readiness Program Steering Committee to exercise due diligence and program oversight to a similar level provided for other major projects, under the Program Management Office;
  6. AEMO ensures that the senior manager responsible for delivery of its Summer Readiness Program is directly empowered and has the resources to drive the initiatives forward and to break down barriers with single point accountability for program delivery and operational success;
  7. AEMO reviews and pursues all reasonable additional opportunities for the use of Reliability and Emergency Reserve Trader provisions to further minimise the risk of unserved energy;
  8. AEMO considers additional ways to provide clear and simple communication material for all parties in the industry, and which can be used to explain to customers the risks to the continuity of their electricity supply. Whilst AEMO is not responsible for customer management during USE events, it does hold information that may be useful for those that do. This information should be used to support the role that customers have in mitigating power cuts such as by using energy conservation and peak demand reduction at critical times.