SOUTH AUSTRALIAN DEMAND FORECASTS

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AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

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The purpose of this report is to provide insights into operational consumption and demand forecasts in the South Australian region of the National Electricity Market.

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Version control

Version	Release date	Changes
1	14 July 2017	

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1. INTRODUCTION AND KEY FINDINGS

This report summarises South Australia's electricity demand forecasts, based on the work of the *2017 Electricity Forecasting Insights.*[1]

1.1 Key findings

In the short term (2016–17 to 2019–20), AEMO forecasts a slight decrease in operational consumption in South Australia due to households and businesses managing their use and costs through ongoing investments in rooftop photovoltaic (PV)[2] and energy efficiency, along with a short-term reduction resulting from the announced closure of the automotive industry over the next couple of years.[3]

In the medium term (2019–20 to 2026–27), operational consumption in South Australia is forecast to remain relatively flat, due to forecasts of:

- A slight increase in business consumption driven by projected economic growth in the medium term, moderated by ongoing investments in rooftop PV and energy efficiency.
- A reduction in residential consumption, with growth in population as well as growth in ownership and use of electric appliances expected to be more than offset by continuing high uptake of rooftop PV and ongoing energy efficiency improvements.

Maximum demand is also expected to remain flat, driven by projected increases in rooftop PV and battery storage, and energy efficiency improvements.

The minimum demand forecast highlights the impact of rooftop PV on the daily load profile. This provides useful information on network usage, which can inform further studies to evaluate operational implications. By 2027–28, just outside the 10-year window considered by this report, continued uptake of rooftop PV is projected to result in negative minimum demand in South Australia under certain conditions. This may introduce operational challenges for balancing the power system. The power system and market will need to evolve to address these challenges, including utilising the opportunities from new technologies. For example, South Australia could store this excess generation, or could export it to the rest of the NEM via the interconnectors, provided they are in service.

1.2 Key definitions

This report presents annual operational consumption as well as operational maximum and minimum demand for historical results, estimates, and forecasts.

- **Consumption** refers to electrical energy needed over a period of time and is measured in gigawatt hours (GWh), where **demand** refers to electrical power needed at a particular point in time (or the average over a short period of time like five or 30 minutes) and is measured in megawatts (MW). This report generally considers consumption or demand over particular reporting periods such as a financial year, summer, or winter.
- **Annual operational consumption** includes electricity drawn from the electricity grid, supplied by scheduled, semi-scheduled, and significant non-scheduled generating units, but not generation from rooftop PV and other non-scheduled generation (ONSG).[4] When reporting on a particular NEM region, it includes net interconnector imports from other regions.

1Available at: http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Electricity-Forecasting-Insights.

[2] Rooftop PV means a system comprising one or more PV panels, installed 'behind the meter' on a residential or commercial building rooftop to convert sunlight into electricity.

[3] ABC News, "Toyota to close: Thousands of jobs to go as carmaker closes Australian plants by 2017" (2014). Available at: http://www.abc.net.au/news/2014-02-10/toyota-to-pull-out-of-australia-sources/5250114. Viewed: 27 June 2016.

[4] Rooftop PV and ONSG generally covers generators smaller than 30 MW. In the 2016 report, ONSG was referred to as SNSG (small non-scheduled generation).

  - Underlying consumption or demand means actual electricity used by consumers, as met by any kind of generation, including rooftop PV.
  - Delivered consumption or demand means electricity delivered to consumers from the grid (thus, underlying demand less electricity generated from rooftop PV).
- Annual operational consumption and operational maximum (minimum) demand are both presented on a "**sent out**" basis, measured at the connection point between the generating system and the network, and exclude generator auxiliary loads (electricity used by the generator in its own operations).
- A **probability of exceedance (POE)** refers to the likelihood that a maximum demand or minimum demand forecast will be met or exceeded. The various probabilities (generally 90%, 50%, and 10% POE) provide a range of possibilities for analysts to determine a realistic range of power system and market outcomes.

  For a given period, a 10% POE maximum demand forecast is expected to be exceeded, on average, one year in 10 and a 50% POE projection is expected to be exceeded, on average, five years in 10 (or one year in two).

  Minimum demand forecasts are based on a 90% POE, which are expected to be met or exceeded, on average, nine years in 10 (meaning the actual demand is expected to be below the forecast minimum only, on average, one year in 10).

1.3 Rooftop PV methodology

AEMO's forecast of installed capacity for rooftop PV and battery storage is based on advice from external consultancy Jacobs.[5]

To calculate electricity generation from the installed PV capacity, AEMO then used the following steps:

- Based on the average age of panels in each forecast year, AEMO calculated the effective capacity taking into account the projected degradation of rooftop PV over time.
- AEMO calculated nominal PV generation traces (half-hourly megawatt hour (MWh) generation per MW of effective PV capacity) based on an approach it developed jointly with the University of Melbourne.[6] Two traces were developed, reflecting generation from north-facing panels and west-facing panels. AEMO used these two traces to calculate a blended trace, which captured an assumed westerly shift in rooftop panel orientation, commencing from zero at the start of 2016–17 and resulting in 10% of Jacobs' capacity projections having a westerly panel orientation by 2036–37, in response to changing consumer incentives.

[5] Jacobs' consultancy report "Projections of uptake of small-scale systems" is available on AEMO's website: https://www.aemo.com.au/-/media/Files/Electricity/WEM/Planning_and_Forecasting/ESOO/2017/2017-WEM-ESOO-Methodology-Report---Projections-of-Uptake-of-Small-scale-Systems.pdf.

[6] See University of Melbourne's "Rooftop PV model - technical report", available on AEMO's website: http://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/NEFR/2016/UoM-Rooftop-PV-Model-Technical-Report.pdf.

2. OPERATIONAL CONSUMPTION

Annual consumption is forecast to remain basically flat over the next ten years in the Neutral scenario, increasing slightly from 12,543 GWh in 2016–17 to 12,866 GWh in 2026–27, an annual average increase of 0.26%:

- For residential consumption, households seeking to manage their energy use and costs, with projected continued high uptake of rooftop PV and energy efficiency savings, is forecast to more than offset moderate new connections growth and increasing appliance use by households.
- For the business sector, mild growth in consumption is expected in the longer term, driven largely by industrial investment and increased growth in the 'other business'[7] sector. The growth in business sector delivered demand is forecast to be moderated by businesses managing their use and costs through increased generation from rooftop PV and greater energy efficiency, and, in the short term, by the announced closure of the Australian automotive vehicle manufacturing sector over the next couple of years.

In comparison, from 2011–12 to 2016–17, annual operational consumption declined by 740 GWh, an average annual decline of 1.1% over the five years. This is primarily attributed to increasing uptake of rooftop PV and energy efficiency measures.

2.1 Key differences between 2017 and 2016 forecasts

The key differences are:

- The current estimate for 2016–17 annual operational consumption is 12,543 GWh, which is 84 GWh (0.7%) below the 2016 *National Electricity Forecasting Report* (NEFR) Neutral forecast for 2016–17.
- The 2017 short-term forecast (2016–17 to 2019–20) shows slight growth, compared to the 2016 forecast which projected an average annual decrease of 0.5% in the first two years.

2.2 Forecasts

To address the uncertainty of key drivers behind electricity consumption, AEMO publishes forecasts for three scenarios representing weak, neutral, and strong economic and consumer outlooks.[8] The scenario definitions are consistent with those used in last year's report and are summarised in Table 1.

Table 1 AEMO's 2017 forecasting and planning scenarios

Driver	Weak scenario	Neutral scenario	Strong scenario
Population growth	Weak	Neutral	Strong
Economic growth	Weak	Neutral	Strong
Technology uptake (rooftop PV, energy efficiency, electric vehicles)	Slow – Hesitant consumer in a weak economy	Moderate – Neutral consumer in a neutral economy	Rapid – Confident consumer in a strong economy

Annual consumption forecasts are summarised in Tables 2 and 3, and in Figures 1 and 2.

[7] The 'other business' sector comprises domestic market servicing industries such as education, financial services, IT, infrastructure, and health and aged care. Growth and consumption trends in this sector are driven by population growth and household disposable income.

[8] The three sensitivities all assume Australia achieves its commitment at the 21st Conference of the Parties for the United Nations Framework Convention on Climate Change to reduce greenhouse gas emissions by between 26% and 28% below 2005 levels by 2030. For more see: https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/NTNDP/2017/Draft-2017-Planning-and-Forecasting-scenarios.pdf.

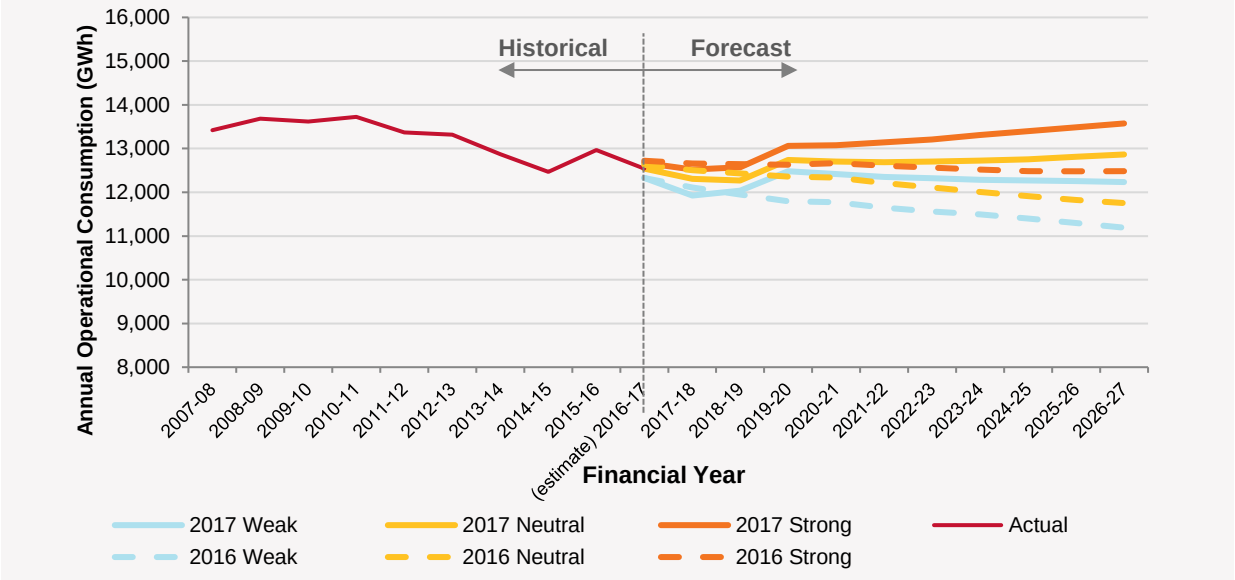
Table 2 Actual annual operational consumption for South Australia, 2011–12 to 2016–17 (GWh)

Financial year	GWh	% change
2011–12	13,367	
2012–13	13,319	-0.4%
2013–14	12,872	-3.4%
2014–15	12,468	-3.1%
2015–16	12,966	4.0%
2016–17 (estimate)	12,543	-3.3%

Table 3 Forecast annual operational consumption for South Australia (all scenarios), 2016–17 to 2026–27 (GWh)

Financial year	Actual	Weak	Neutral	Strong
2016–17 (estimate)	12,543			
2017–18		11,925	12,308	12,521
2018–19		12,035	12,270	12,572
2019–20		12,482	12,739	13,060
2020–21		12,421	12,702	13,079
2021–22		12,348	12,692	13,139
2022–23		12,324	12,704	13,208
2023–24		12,288	12,723	13,309
2024–25		12,270	12,757	13,401
2025–26		12,255	12,814	13,487
2026–27		12,238	12,866	13,575

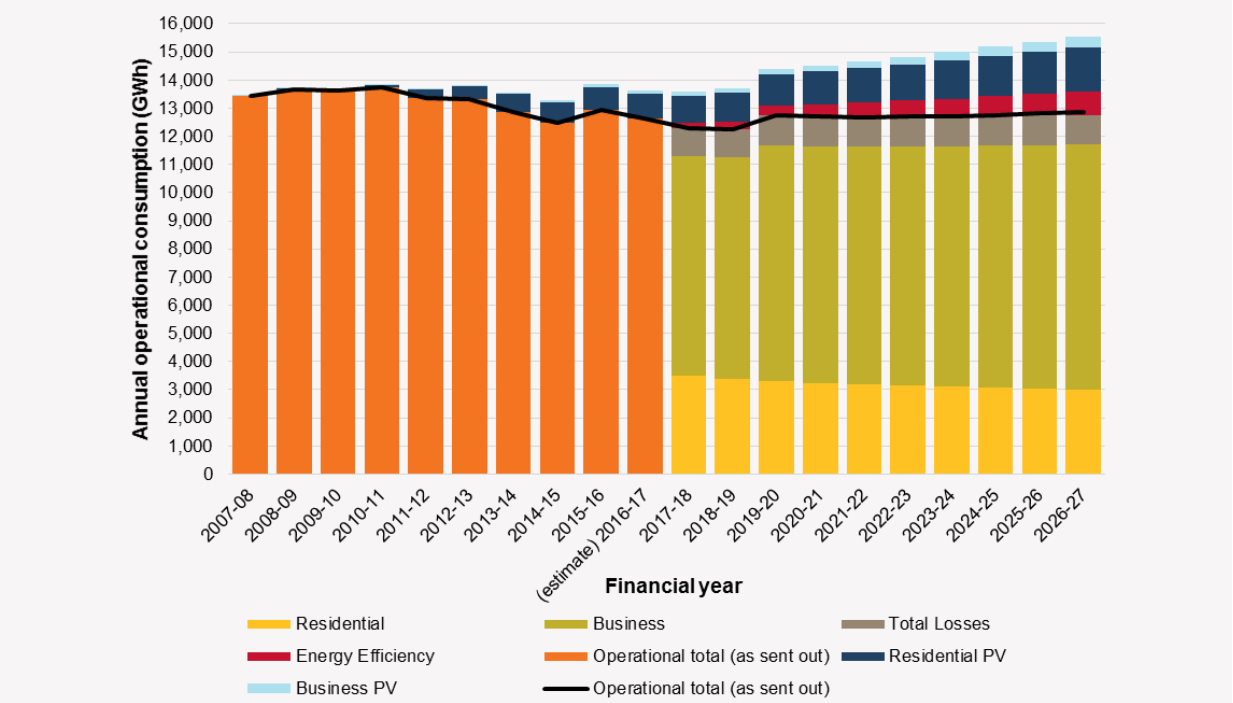
Figure 1 Annual operational consumption actual and forecast for South Australia (all scenarios), 2007–08 to 2026–27



As Figure 1 shows, the forecasts for the three scenarios have a similar spread between the scenarios as forecast in 2016, but are all generally higher, driven by a higher outlook for business consumption.

Figure 2 shows the operational consumption forecasts for the Neutral scenario (black line), broken down by segment (coloured areas). The graph shows how underlying consumption is forecast to increase with population and economic growth. However, the coloured segments above the line represent how business and residential PV and energy efficiencies have reduced the forecast consumption and contribute significantly to the flat outlook for operational consumption for the state.

Figure 2 Annual operational consumption forecast by segment for South Australia (Neutral scenario), 2007–08 to 2026–27



3. MAXIMUM DEMAND FORECASTS

Key insights include:

- Maximum demand is expected to remain flatter, compared to last year's forecast declining trend.
- For summer 2016–17, South Australia's actual maximum operational demand (sent out) was 3,017 MW, which occurred on 8 February 2017.
  - The observed actual is approximately midway between the 10% POE and 50% POE forecasts (see Table 4 below).
  - Prices were very high, and a number of large loads did reduce consumption in the afternoon, by at least 50 MW in total at the time of maximum demand. If it had not been for this demand side participation, the actual observed demand would have been close to a 10% POE event.
  - Just after observed maximum demand AEMO ordered load shedding of 100 MW to ensure system security. Demand had been increasing up to that point, but was levelling off. If load shedding had not been directed, the observed maximum demand could have been slightly higher.
- Over the next 10 years, on average the 10% POE summer maximum demand is forecast to decrease from 3,116 MW to 3,048 MW, under the Neutral economic and consumer outlook.
- Trends are similar to those for annual consumption, with rooftop PV and energy efficiency having a downward pressure on growth, keeping forecasts relatively flat.

3.1 Key differences between 2017 and 2016 NEFR forecasts

The key difference is that the 10% POE maximum demand is forecast to remain relatively flat over the 10-year horizon under the Neutral economic and consumer outlook. In comparison, last year under the Neutral scenario a decrease was projected, at an annual average rate of 1.3% over the short term (2016–17 to 2019–20) and 1.8% over the medium term.

The key reason for this difference is the changed outlook for business consumption.

3.2 Forecasts

Maximum demand forecasts are summarised in Table 4 and Figures 3 and 4.

Table 4 Summer operational maximum demand forecasts for South Australia, 2016–17 to 2026–27 (Neutral scenario, MW)

Summer	Actual	10% POE	50% POE	90% POE
2016–17	3,017	3,116	2,934	2,724
2017–18		3,050	2,848	2,676
2018–19		3,073	2,865	2,663
2019–20		3,110	2,911	2,715
2020–21		3,058	2,860	2,684
2021–22		3,035	2,872	2,699
2022–23		3,055	2,847	2,686
2023–24		3,017	2,820	2,649
2024–25		3,070	2,871	2,684
2025–26		3,082	2,897	2,699
2026–27		3,048	2,892	2,713

Figure 3 Summer operational maximum demand forecasts for South Australia, 2007–08 to 2026–27 (Neutral scenario)

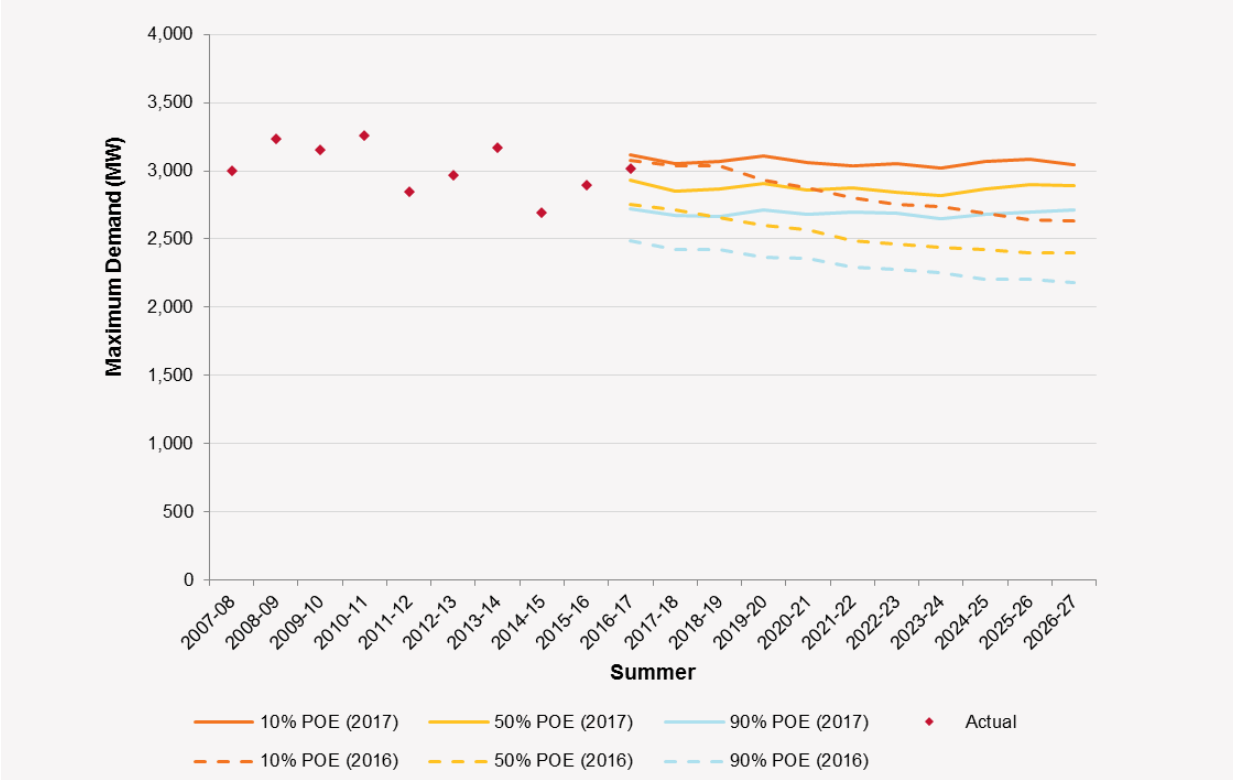
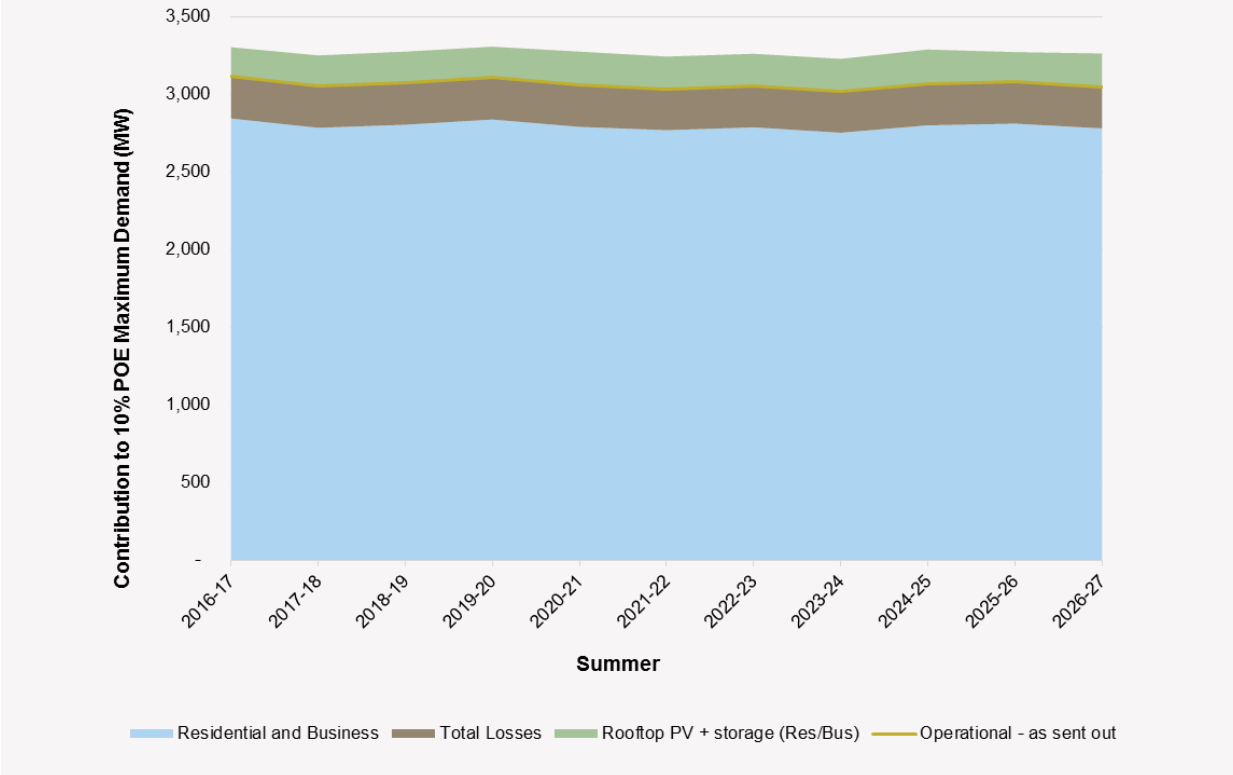


Figure 4 Summer 10% POE maximum demand forecast segments for South Australia, 2016–17 to 2026–27 (Neutral scenario)



4. MINIMUM DEMAND FORECASTS

AEMO has forecast minimum demand to investigate the impact of rooftop PV on the daily load profile. This provides useful information on network usage, which can inform further studies to evaluate operational implications. Key insights include:

- The summer minimum demand in 2016–17 was 800 MW on 6 November 2016. Minimum demand generally happens in summer.
- South Australia is the first NEM region in which high rooftop PV penetration caused minimum demand to shift from overnight to near midday. Since this first occurred in 2012–13, however, South Australia has experienced relatively warm summers. If South Australia was to experience the cold summers it did in 2002 or 2005, the mild temperatures coupled with installed PV capacity could produce quite low minimum demand (reflected in AEMO's minimum demand forecasts).
- AEMO forecasts negative minimum demand for the region under certain conditions, by 2027–28, just after the 10-year horizon of this report. For 90% POE minimum demand days, continued uptake of rooftop PV is forecast to offset 100% of demand in South Australia during the middle of the day. This may introduce operational challenges for balancing the power system. The power system and market will need to evolve to address these challenges, including utilising the opportunities from new technologies. For example, South Australia could store this excess generation, or could export it to the rest of the NEM via the interconnectors, provided they are in service.

4.1 Key differences between 2017 and 2016 NEFR forecasts

The minimum demand forecast is generally consistent with the forecast produced last year.

4.2 Forecasts

The 90% POE minimum demand, shown in Figure 5, is forecast to decline to 354 MW over the short term (2016–17 to 2019–20) under the Neutral scenario. Estimated rooftop PV generation at time of minimum demand is 731 MW by 2019–20 under this scenario. This is projected to be offset by 2.3 MW of battery charging at this time, for a combined impact of 729 MW.

Figure 5 Summer 90% POE minimum demand forecast segments for South Australia, 2016–17 to 2026–27 (Neutral scenario)