SOUTH AUSTRALIAN DEMAND FORECASTS

SOUTH AUSTRALIAN ADVISORY FUNCTIONS

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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 (NEM).

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1. INTRODUCTION AND KEY FINDINGS

This report summarises South Australia's electricity demand forecasts based on the work of the *2016 National Electricity Forecasting Report* (NEFR[1]).

1.1 Key findings

In the medium term (2015–16 to 2025–26), operational consumption in South Australia is forecast to decline, continuing the trend that started in 2010–11. This decline is attributed to projected lower residential consumption and flat business consumption, as a result of forecast high uptake in rooftop photovoltaic[2] (PV) and ongoing energy efficiency improvements.

In the short term (2015–16 to 2018–19), AEMO forecasts flat operational consumption in South Australia, driven by a projected recovery in industrial consumption from assumed stabilising economic conditions in the neutral scenario, offset by rooftop PV uptake, energy efficiency savings, and the exit of the automotive industry.[3]

Maximum demand is expected to continue to decline, driven by rooftop PV, energy storage, and energy efficiency improvements.

AEMO has again 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. By the end of 2026–27, continued uptake of PV is projected to result in negative minimum demand under certain conditions. This leads to net exports from the distribution network to the transmission grid in aggregate, and ultimately from the region during those periods.

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-hour (GWh), where **demand** refers to electrical power needed at a particular point in time (or the average over a short period of time like 5 or 30 minutes) and is measured in megawatt (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 small non-scheduled generation (SNSG).[4] When reporting on a particular NEM region, it includes net interconnector imports.
- 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.
- 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 MD projection is expected to be exceeded, on average,

[1] Available: http://www.aemo.com.au/Electricity/Planning/Forecasting/National-Electricity-Forecasting-Report.
[2] A system comprising one or more photovoltaic panels, installed 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 SNSG generally covers generators smaller than 30 MW.

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 capacity for rooftop PV and battery storage is based on advice from external consultancy Jacobs.[5]

Key changes from previous years are:

- AEMO adapted this advice to assume a westerly shift in rooftop panel orientation, commencing from zero at the start of 2016–17 and resulting in 10% of Jacob's capacity projections having a westerly panel orientation by 2035–36 in response to changing consumer incentives.
- The adapted forecast also addresses the fact PV panels degrade over time. Based on the average age of panels, AEMO has calculated the effective capacity taking into account the projected degradation of rooftop PV over time.
- Unlike the 2015 NEFR, this year's forecast includes Integrated PV and Storage Systems (IPSS). This is based on new combined installations, with the current model not considering rooftop PV being retrofitted with battery storage. Uptake of IPSS is forecast to start slowly and pick up especially after 2020, in both the residential and the commercial sectors.

More details on the approach will be published in the NEFR Methodology Information Paper, due late July 2016.

[5] Jacobs' consultancy report "Projections of uptake of small-scale systems" is available on AEMO's website: http://www.aemo.com.au/Electricity/Planning/Forecasting.

2. OPERATIONAL CONSUMPTION

Annual consumption is forecast to moderately decline, from consumption of 12,635 GWh in 2015–16 to 11,825 GWh in 2025–26, due to:

- Continued high uptake of rooftop PV and energy efficiency savings being projected to be more than offset moderate new connections growth and increasing appliance use by households.
- Flat business sector consumption, caused by the absence of growth in energy intensive manufacturing, little growth in services offset by energy efficiency savings, and the expected closure of the Australian automotive manufacturing sector.
- Projected increases in electricity prices reducing growth in consumption.

Out to 2025–26, operational consumption is forecast to decline in the neutral scenario, at an annual average rate of 0.7%.

In comparison, from 2010–11 to 2015–16 annual operational consumption declined by 1,088 GWh. This is primarily attributed to rising electricity prices, uptake of rooftop PV, and energy efficiency. The combined impact equates to an average decline of 1.6% per year over five years.

2.1 Key differences between 2016 and 2015 NEFR forecasts

The key differences are:

- Current estimate for 2015–16: The current estimate for 2015–16 annual operational consumption is 12,635 GWh, which is 93 GWh (0.7%) below the 2015 NEFR medium forecast.
- Short-term forecast (2015–16 to 2018–19): The 2016 forecast is an average annual decrease of 0.5%, compared to a flat forecast in the 2015 NEFR medium forecast.

2.2 Forecasts

Table 1 Annual operational consumption actual and forecast for South Australia (GWh)

	Actual			Forecast[6]			
Financial Year	GWh	% change	Financial Year	Actual	Strong	Neutral	Weak
2010–11	13,723		(estimate) 2015–16	12,635			
2011–12	13,365	-2.6%	2016–17		12,722	12,627	12,327
2012–13	13,316	-0.4%	2017–18		12,662	12,508	12,111
2013–14	12,868	-3.4%	2018–19		12,647	12,432	11,950
2014–15	12,498	-2.9%	2019–20		12,631	12,359	11,794
(estimate) 2015–16	12,635	1.1%	2020–21		12,665	12,339	11,775
			2021–22		12,608	12,214	11,651
			2022–23		12,565	12,111	11,560
			2023–24		12,518	12,008	11,493
			2024–25		12,483	11,909	11,397
			2025–26		12,480	11,825	11,299

[6] AEMO has updated its scenarios framework for forecasting and planning publications, which represents likely pathways for Australia across weak, neutral, and strong economic and consumer outlooks. The neutral sensitivity is considered the most likely and is the main focus of this report. It is generally comparable with the medium scenario from the 2015 NEFR. The weak and strong sensitivities are not directly comparable with low and high scenarios from 2015 though, due to changes in the scenario logic.

Figure 1 Annual operational consumption actual and forecast for South Australia

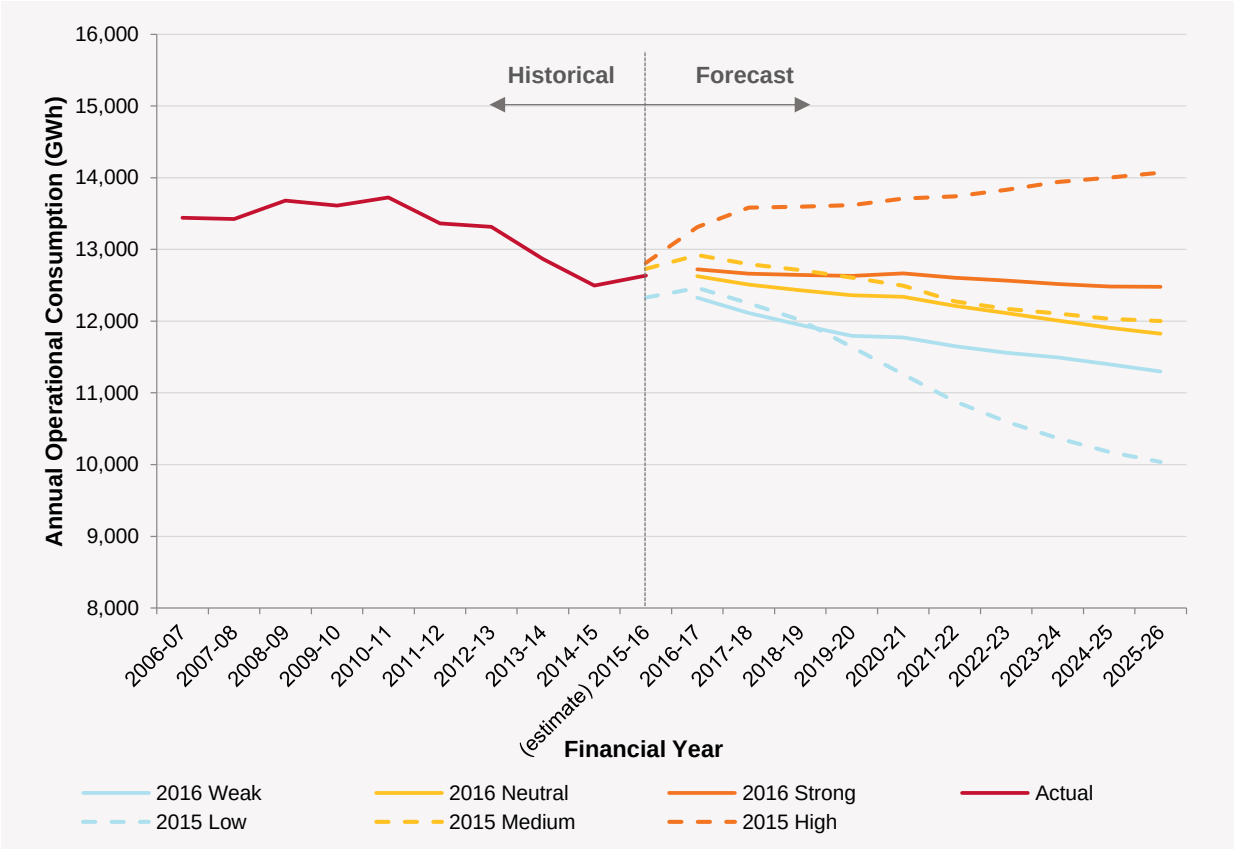
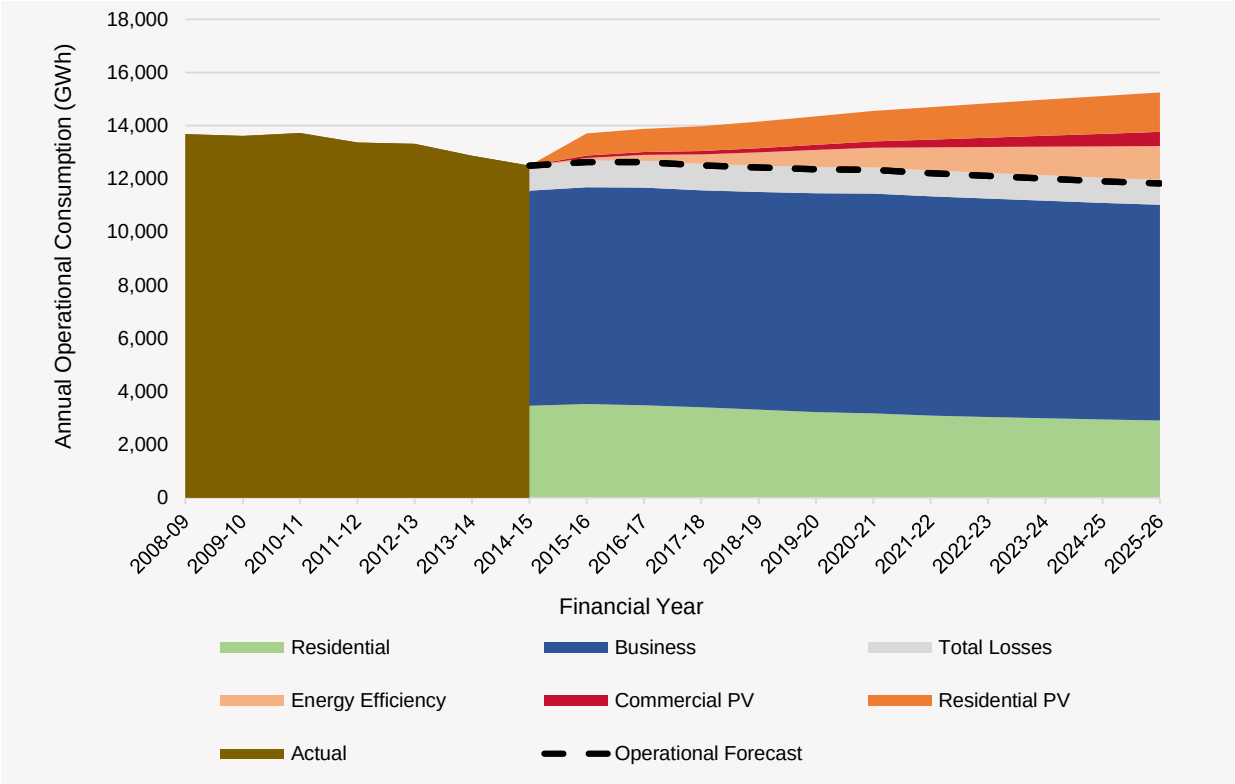


Figure 2 Annual operational consumption forecast by segment for South Australia (Neutral sensitivity)



3. MAXIMUM DEMAND FORECASTS

Maximum demand is expected to continue to decline.

- For summer 2015–16, South Australia's actual maximum demand was 2,895 MW, which occurred on 17 December 2015.
- Over the next 10 years, on average the 10% POE summer maximum demand is forecast to decrease from 3,158 MW to 2,639 MW, under the neutral economic and consumer outlook.
- Trends are similar to those for annual consumption, however the greater contribution of air-conditioning load at peak times adds a greater offset from energy efficiency. South Australia has a large number of aged air conditioning appliances for which the replacement technology is roughly twice as efficient.

3.1 Key differences between 2016 and 2015 NEFR forecasts

The key differences are:

- From the 2016 NEFR, AEMO is forecasting maximum demand on "as sent out" basis, similar to annual consumption.[7]
- The 10% POE maximum demand is forecast to decrease at an annual average rate of 1.3% over the short term (2015–16 to 2018–19) and 1.8% annually over the 10 year horizon under the neutral economic and consumer outlook. In comparison, the medium scenario in the 2015 NEFR forecast a slight increase of 0.1% annual increase.

3.2 Forecasts

Table 2 Summer operational maximum demand forecasts for South Australia (Neutral sensitivity, MW)

Summer	Actual	10% POE	50% POE	90% POE
2015–16	2,895	3,158	2,823	2,534
2016–17		3,081	2,753	2,489
2017–18		3,038	2,714	2,427
2018–19		3,034	2,656	2,421
2019–20		2,928	2,599	2,370
2020–21		2,878	2,569	2,360
2021–22		2,805	2,487	2,294
2022–23		2,756	2,460	2,279
2023–24		2,734	2,435	2,254
2024–25		2,693	2,421	2,202
2025–26		2,639	2,396	2,202

[7] The reason is that auxiliary loads are a function of the generation mix that is market driven and rapidly changing, and consequently attempting to forecast these loads from regression analysis of historical auxiliary load patterns is no longer relevant. Forecasts for auxiliary loads are provided, but should only be used for shorter term (1-3 years) studies.

Figure 3 Summer operational maximum demand forecasts for South Australia (2016 shows neutral and 2015 the medium scenarios)

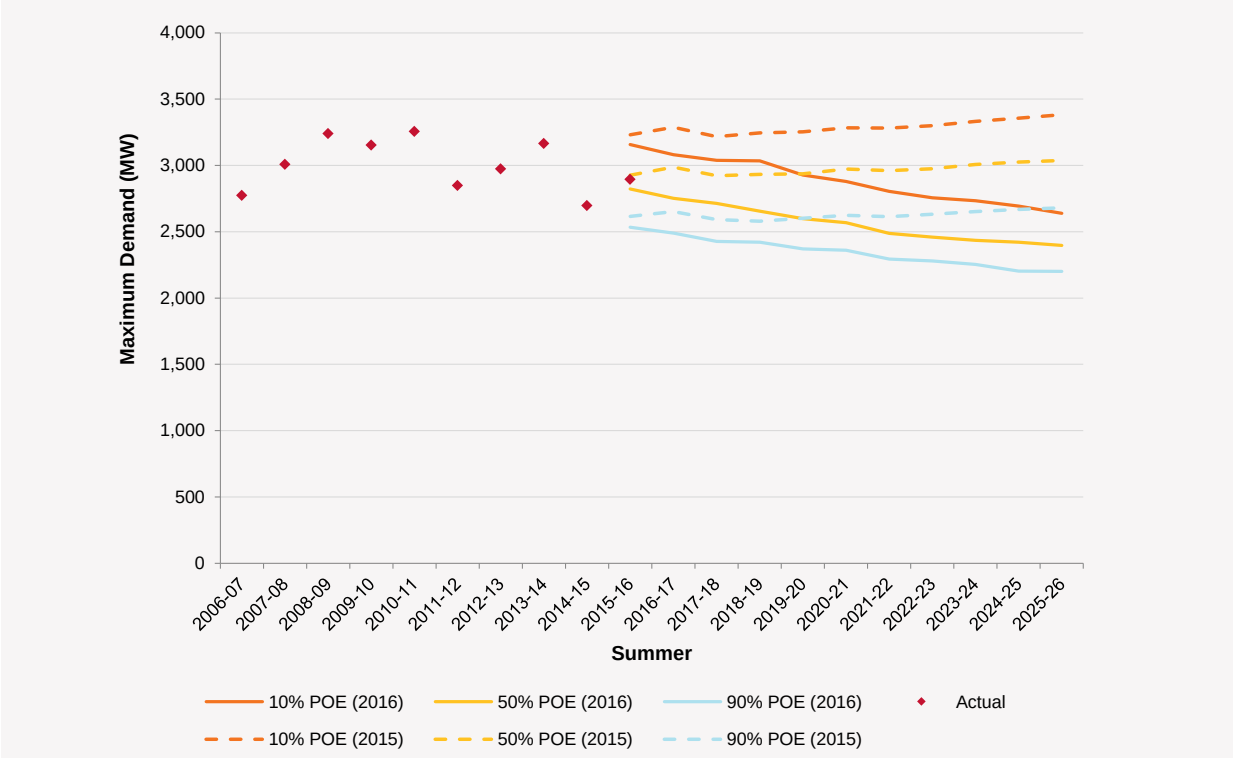
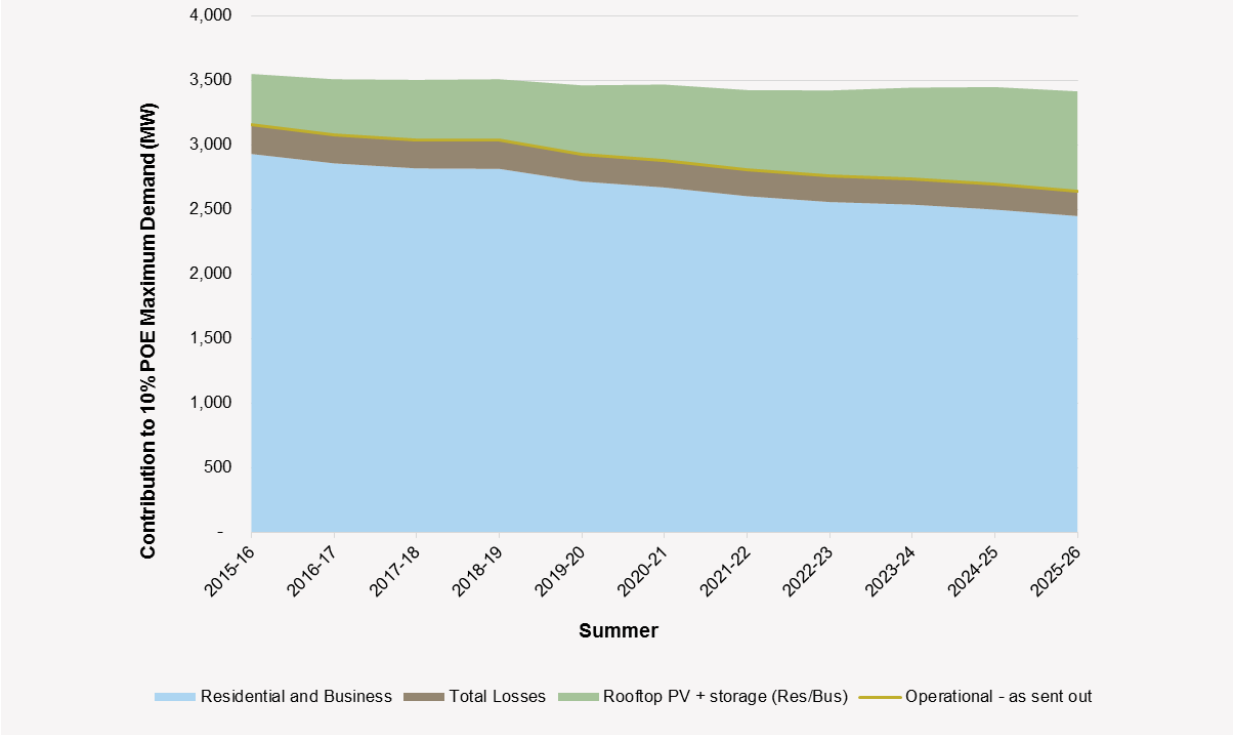


Figure 4 Summer 10% POE maximum demand forecast segments for South Australia (Neutral sensitivity)



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 2015–16 was 834 MW on 25 March 2016. Minimum demand generally happens in summer.
- Towards the end of the medium-term outlook (2026–27), on 90% POE minimum demand days, continued uptake of rooftop PV is forecast to offset 100% of demand in South Australia, during midday periods. From that year, AEMO forecasts negative minimum demand under certain conditions. This results in net exports from the distribution network to the transmission grid in aggregate, and ultimately from the region during those periods.
- South Australia is the first region in the NEM for which high rooftop PV penetration has caused minimum demand to shift from overnight to near midday.

4.1 Key differences between 2016 and 2015 NEFR forecasts

The key differences are:

- Negative operational demand is projected to occur later than forecast in the 2015 NEFR, mainly due to a downward revision of rooftop PV uptake.

4.2 Forecasts

The 90% POE minimum demand is forecast to decline to 499 MW over the short term (2015–16 to 2018–19) under the neutral scenario. Estimated rooftop PV generation is 554 MW by 2018–19 under this sensitivity.

Figure 5 Summer 90% POE minimum demand forecast segments for South Australia (Neutral sensitivity)