SOUTH AUSTRALIAN GENERATION FORECASTS

SOUTH AUSTRALIAN ADVISORY FUNCTIONS

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AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

IMPORTANT NOTICE

Purpose

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1. INTRODUCTION

1.1 Purpose and key insights

The purpose of this publication is to provide forecasts of the potential future electricity generation mix in South Australia, over the next ten years.

The projections are based on analysis conducted in the Neutral scenario Base Case for the 2016 *National Transmission Network Development Plan* (2016 NTNDP).[1] Further, the recently announced closure of Hazelwood Power Station has been included from end of March 2017, and Pelican Point Power Station has been assumed to return to full service as a market response.[2] No demand reduction in response to higher projected electricity prices has been modelled.

The key insights based on these assumptions are:

- Wind generation is projected to approximately double in South Australia in the next five years, facilitated by the Large-scale Renewable Energy Target (LRET).
- The generation mix in South Australia is projected to be mostly wind generation and gas-powered generation (GPG). By 2025−26, up to 65% of South Australia's generation is projected to be sourced from wind farms, 21% from GPG, and 13% from rooftop photovoltaic (PV).
- South Australia may become a net energy exporter once the Hazelwood Power Station retires, reversing the historic trend.

1.2 Background

Changes to generation supply

South Australia's electricity landscape has been through major changes in recent times with the withdrawal of inertia-providing coal and gas generators, commissioning of additional wind farms, continuing growth of rooftop PV, and interconnector upgrades.[3] South Australia, and the NEM in general, will continue to see a transformation of the generation mix to meet Australia's state and federal emissions reduction targets, and to meet an increased need for system support services such as frequency and voltage support.

Impact of government policies

This South Australian generation forecast considers government carbon abatement policies that are likely to impact the supply mix in the region.

The Australian Government's LRET incentivises renewable generation across the NEM, and as South Australia has good quality wind resources and the largest installed capacity of wind farms in the NEM, it is expected to contribute notably to the achievement of the LRET.

The LRET incentive impact in South Australia may be lessened by the introduction of the Victorian Renewable Energy Target (VRET). This is because, up to 2020, renewable energy built in Victoria may qualify for both the LRET and the VRET.

In the modelling presented in this report, AEMO has assumed that Australia's commitment to the 21st Conference of Parties agreement in Paris, France in December 2015 (COP21), will be met. Australia's COP21 commitment is to reduce carbon emissions by 26% to 28% below 2005 levels by 2030. For

[1] AEMO. 2016 *National Transmission Network Development Plan*, December 2016. Available at: http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/National-Transmission-Network-Development-Plan.

[2] There are a number of possible market responses; AEMO for this report modelled Pelican Point, as it is most relevant to South Australia.

[3] For more information on recent developments and proposed projects for South Australia's supply mix, refer to Chapter 3 of the 2016 *South Australian Electricity Report* (SAER), August 2016, available at: http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/South-Australian-Advisory-Functions.

energy sector modelling, the Council of Australian Governments (COAG) Energy Council has agreed that the contribution of the electricity sector should be consistent with national emission reduction targets. COAG has stated that a 28% reduction from 2005 levels by 2030 is an appropriate constraint for AEMO to use in its ongoing forecasting and planning processes.

Meeting the COP21 commitment is likely to require both generation withdrawals and investment in low-emission generation capacity. AEMO's modelling assumes Australia's emissions from the electricity sector will decrease significantly, as heavy carbon emitters are expected to reduce generation and be replaced by GPG or renewable energy technologies.

Changes to reporting

The topics covered by this publication previously appeared in the annual *South Australian Electricity Report* (SAER) and *South Australian Electricity Market Economic Trends Report* (SAEMETR).[4] From 2016, the SAEMETR is no longer published, and its content is split into other South Australian Advisory Function (SAAF) reports.

This year's electricity generation mix forecast is taken from the 2016 NTNDP. The 2016 NTNDP considers potential new developments over the next 20 years in response to projected supply shortfalls and other carbon abatement policy objectives. Furthermore, it includes a game-theoretic Nash-Cournot bidding approach to estimate likely generation by fuel type and system inertia.

For these reasons, AEMO believes that the 2016 NTNDP is more appropriate for producing a generation mix forecast than the National Electricity Market *Electricity Statement of Opportunities* (NEM ESOO)[5], which primarily serves to provide information on supply adequacy based on current and committed generation capacity announcements only.

Modelling assumptions

The results presented in this report assume that, over the next ten years[6]:

- There are no changes to existing transmission network infrastructure in South Australia (based on the NTNDP's Base Case). The 2016 NTNDP also explored possible benefits of increased interconnection with other NEM regions enabling more renewable energy development within South Australia than projected in this report.
- There will be available gas supply for GPG. AEMO will analyse the impact of potential GPG growth on supply in the 2017 *Gas Statement of Opportunities* and 2017 *Victorian Gas Planning Report*.
- Pelican Point will return to full service after the retirement of Hazelwood. Engie has informed AEMO that the power station is capable of returning to full output within three months, but has provided no indication that it intends to do so. Alternate market responses in other regions would lead to lower regional GPG forecasts and interconnector exports from South Australia than forecast in this report.
- The expected Rate of Change of Frequency (RoCoF) of the South Australian power system, in relation to the non-credible double circuit trip of the Heywood Interconnector, continues to be maintained at or below 3 Hz per second in accordance with regulation 88A of the *Electricity (General) Regulations 2012* (Provision of limit advice).
- A sufficient number of GPG units are online at all times to ensure fault levels remain at or above the minimum necessary to maintain power system security.[7]

[4] AEMO. *South Australian Electricity Report* and *South Australian Electricity Market Economic Trends Report*. Available at: http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/South-Australian-Advisory-Functions.
[5] AEMO. 2016 National Electricity Market *Electricity Statement of Opportunities*, August 2016. Available at: http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/NEM-Electricity-Statement-of-Opportunities.
[6] For further modelling assumptions, refer to *Market Modelling Methodology and Input Assumptions* and *2016 NTNDP Methodology and Input Assumptions*, December 2016. Available at: http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/National-Transmission-Network-Development-Plan/NTNDP-database
[7] Refer to AEMO Electricity Market Notice 56089, 2 December 2016. Available at: https://www.aemo.com.au/Market-Notices.

2. ELECTRICITY FORECASTS

2.1 Forecast energy supply mix

AEMO's 2016 *National Electricity Forecast Report* (NEFR)[8] modelled three different outlooks for South Australian electricity consumption, based on forecast Weak, Neutral, and Strong economic activity. The generation forecast in this publication is based on meeting demand under the Neutral economic growth scenario.[9]

Table 1 shows South Australian projected generation and net interconnector flow[10] estimates under both the Neutral and Weak scenarios. The Neutral scenario is considered the most likely.

Key supply observations for the Neutral economic growth scenario are:

- The generation mix in South Australia is projected to be mostly GPG and wind generation. By the end of the forecast period, wind is projected to account for approximately 65% of generation and GPG approximately 21%.
- With the announced retirement of Hazelwood from end of March 2017, South Australia is projected to rely less on imports from Victoria and instead generate more locally. Consequently, scheduled South Australian generation (predominantly GPG) is projected to increase initially, but slowly taper off from 2018–19 as new wind generation is built in South Australia.
- Rooftop PV generation is forecast to approximately double over the outlook period to 2,015 GWh by 2025–26.
- Small non-scheduled generation (SNSG) is forecast to increase over the modelling horizon, due to growth in non-scheduled solar PV larger than 100 kW.
- South Australia is expected to be a net energy exporter from July 2017 onwards, reversing the historic trend. This is due to less projected surplus supply in Victoria after the Hazelwood Power Station retires, and the forecast increase in new wind generation in South Australia from 2018–19.

The Weak economic growth scenario is taken from modelling for AEMO's 2016 *National Gas Forecasting Report*[11], and also includes the Hazelwood retirement from the end of March 2017 and a return to full service of Pelican Point.

Comparing the Weak economic growth scenario to the Neutral, it can be seen that:

- The generation mix in South Australia is still projected to be mostly GPG and wind generation. However, by the end of the forecast period, wind is projected to account for approximately 55% of generation and GPG approximately 31%.
- Wind generation is lower from 2018–19 onwards, due to fewer wind farms forecast to be built in South Australia under this scenario.
- SNSG and rooftop PV generation is lower, in line with less forecast growth in rooftop PV and non-scheduled solar PV larger than 100 kW.
- Scheduled generation and interconnector exports are generally lower
- Interconnector imports and net interconnector flows are generally higher; with South Australia becoming a net exporter from 2020–21.

[8] AEMO. 2016 *National Electricity Forecast Report,* June 2016. Available at: http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/National-Electricity-Forecasting-Report.
[9] More details of the 2016 NEFR forecasts for South Australia can be found in Chapter 2 of the 2016 SAER.
[10] Interconnector results in this report are net energy flows over a period of time, and do not highlight any periods of extreme import or extreme export.
[11] AEMO. 2016 *National Gas Forecasting Report*, December 2016. Available at: http://www.aemo.com.au/Gas/National-planning-and-forecasting/National-Gas-Forecasting-Report.

Table 1 Forecast annual energy supply mix (GWh)

Financial year	South Australia generation					Interconnector flows		
	Wind (SS , NS)	SNSG	Rooftop PV	Scheduled (S)	Total generation	Imports (Victoria to South Australia)	Exports (South Australia to Victoria)	Net interchange (positive = imports, negative = exports)
2015–16 (actual)	4,322	52	938	7,147	12,459	2,227	286	1,941
Weak economic growth scenario								
2016–17	5,194	57	953	4,553	10,757	3,226	469	2,757
2017–18	5,286	60	1,019	5,126	11,491	2,293	498	1,795
2018–19	5,618	65	1,088	3,833	10,604	3,089	528	2,560
2019–20	7,237	75	1,170	3,248	11,730	2,230	1,385	845
2020–21	7,223	78	1,268	4,126	12,695	1,471	1,531	- 60
2021–22	7,213	85	1,369	4,242	12,909	1,355	1,611	- 256
2022–23	7,168	91	1,469	4,605	13,333	1,051	1,745	- 694
2023–24	7,144	98	1,565	4,334	13,141	1,183	1,676	- 493
2024–25	7,217	102	1,660	4,111	13,090	1,243	1,693	- 450
2025–26	7,209	107	1,749	4,035	13,100	1,237	1,726	- 490
Neutral economic growth scenario								
2016–17	5,041	54	976	6,469	12,540	1,994	371	1,623
2017–18	5,239	61	1,060	8,422	14,782	539	1,160	- 621
2018–19	8,497	70	1,155	6,301	16,023	490	2,299	- 1,809
2019–20	9,329	90	1,263	5,055	15,737	903	2,343	- 1,440
2020–21	9,996	96	1,384	4,888	16,364	818	2,726	- 1,908
2021–22	9,986	110	1,512	4,869	16,477	795	2,767	- 1,972
2022–23	9,956	122	1,641	5,248	16,967	631	3,015	- 2,384
2023–24	10,006	136	1,770	4,603	16,515	950	2,827	- 1,877
2024–25	9,911	145	1,895	3,640	15,592	1,536	2,438	- 901
2025–26	9,932	155	2,015	3,227	15,330	1,716	2,294	- 578

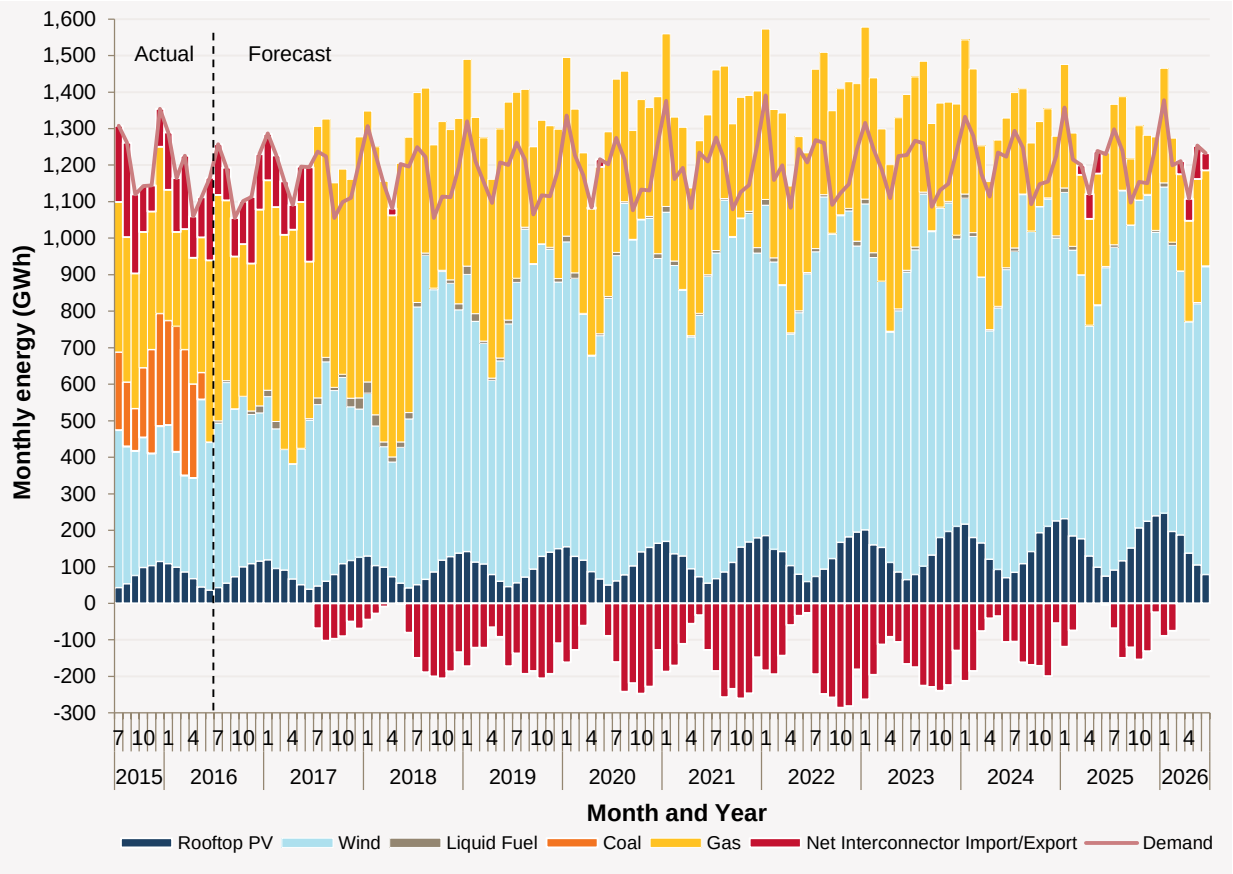
In this table:

- SS stands for Semi-scheduled, NS for Non-scheduled, S for Scheduled, and SNSG for small non-scheduled generation (SNSG are non-scheduled generating units typically less than 30 MW).
- Rooftop PV estimates are based on the 2016 NEFR forecasts. The forecast methodology is available at http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/National-Electricity-Forecasting-Report.
- 2015–16 actual data additionally includes the following notes:
  - Wind generation includes generation that occurred during commissioning of the site.
  - Scheduled includes Angaston power station, including periods when it was registered as non-scheduled.

2.2 Forecast energy generation by fuel type

The figures below present more granular analysis of observed trends in the Neutral economic growth scenario. Figure 1 shows generation by fuel source each month. Seasonal analysis of the data is shown in Figure 2 and Figure 3, which present the summer (defined as 1 November to 31 March) and winter (defined as 1 June to 31 August) forecasts for gas, wind, liquid fuel, rooftop PV generation, and the net interconnector flow.[12]

Figure 1 South Australian forecast energy generation by fuel source (Neutral economic growth scenario)



Note: Net Interconnector Imports are shown above the x-axis (0 GWh line) and Net Interconnector Exports are shown below the x-axis.

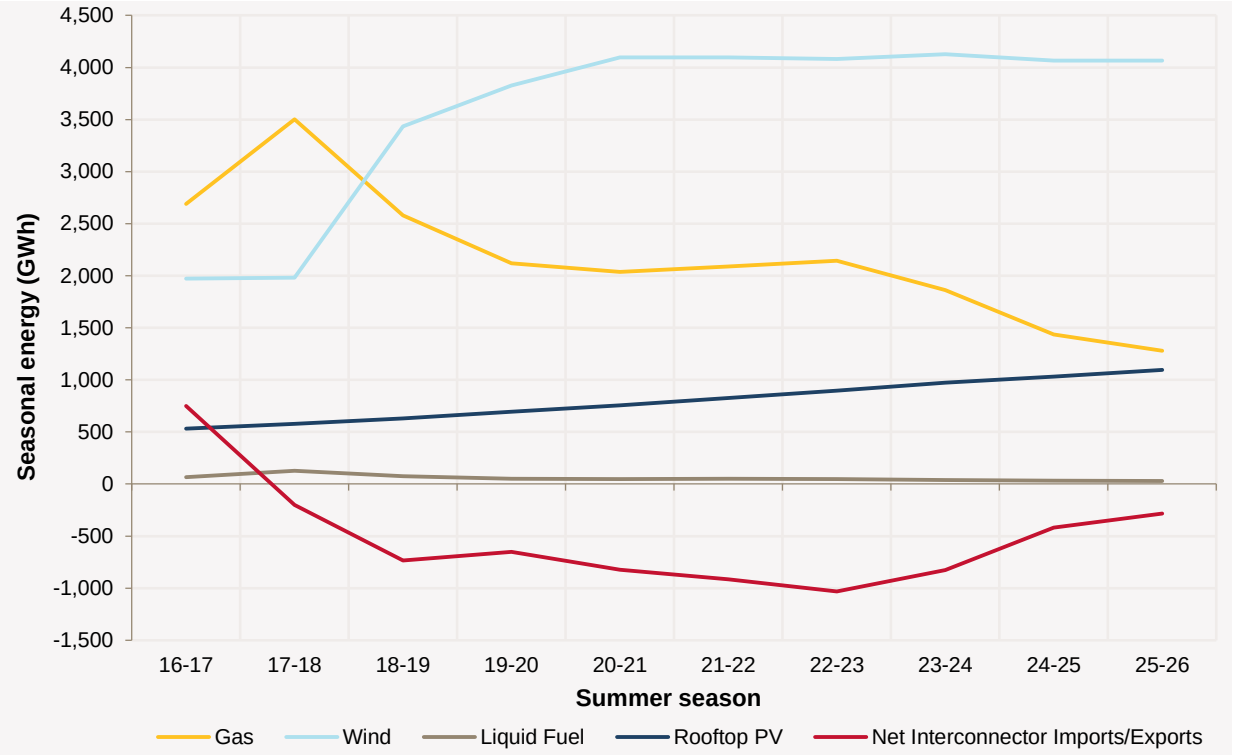
Figure 1, Figure 2, and Figure 3 show:

- With the withdrawal of Hazelwood Power Station in Victoria, GPG is projected to increase from 2016–17 to 2017–18. GPG's market share is projected to trend downward from then until the end of the modelling horizon, due to the projected increase in wind farm installations from 2018–19.
- With a lot of interest to build renewable generation in the region[13] incentivised by the LRET and Australia's commitment to the COP21 agreement, wind generation is forecast to approximately double between 2016–17 and 2020–21. It is projected to remain relatively flat from then on, as the LRET is forecast to have already been met by 2020.
- A reversal of interconnector net flow is forecast following the announced retirement of Hazelwood Power Station in April 2017.

[12] Minor differences between the rooftop PV data in these figures and in the 2016 NEFR are due to variations in the treatment of rooftop PV in the 2016 NTNDP modelling.

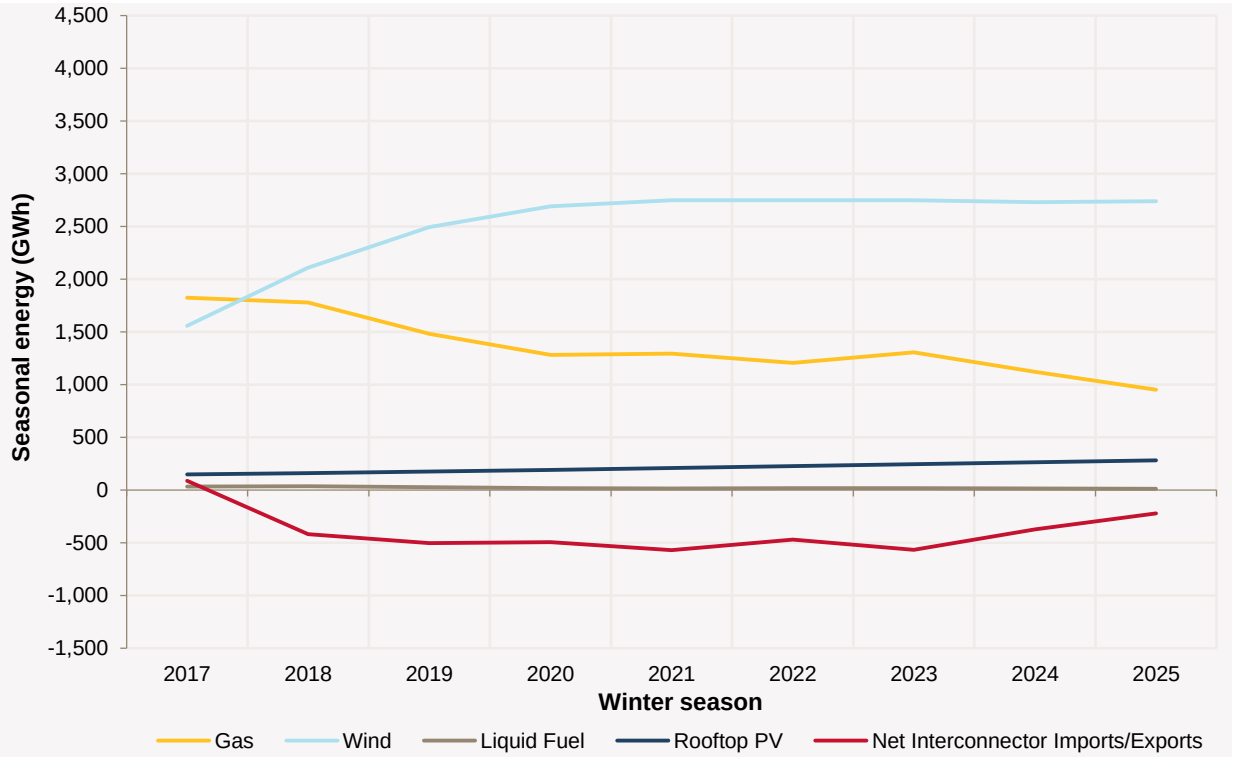
[13] For details of publically announced and committed renewable generation projects in South Australia, refer to Section 1.4 of the 2016 *South Australian Renewable Energy Report*, December 2016. Available at: http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/South-Australian-Advisory-Functions.

Figure 2 Summer − South Australian supply mix and net interconnector flow



Note: Net Interconnector Imports are shown above the x-axis (0 GWh line) and Net Interconnector Exports are shown below the x-axis.

Figure 3 Winter − South Australian supply mix and net interconnector flow



Note: Net Interconnector Imports are shown above the x-axis (0 GWh line) and Net Interconnector Exports are shown below the x-axis.