AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

South Australian Generation Forecasts

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South Australian Advisory Functions

Important notice

PURPOSE

The purpose of this publication is to provide information to the South Australian Minister for Energy and Mining about South Australia's electricity generation forecasts.

AEMO publishes this South Australian Generation Forecasts report in accordance with its additional advisory functions under section 50B of the National Electricity Law. This publication is generally based on information available to AEMO as at 31 December 2020, as modelled for the 2021 Gas Statement of Opportunities (published on 29 March 2021).

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1. Introduction

1.1 Purpose

The purpose of this publication is to provide forecasts of the possible future electricity generation mix in South Australia, over the next 10 years.

The projections are based on analysis conducted for AEMO's 2021 *Gas Statement of Opportunities* (GSOO)[1] for eastern and south-eastern Australia, which modelled future generation and interconnector flows in the National Electricity Market (NEM) under a range of plausible scenarios.

1.2 Scenarios analysed

The data in this report is based on three scenarios that vary the future pace of change in the energy industry – Central, Slow Change and Hydrogen. More detail about the Central and Slow Change scenarios is provided in the *2020 forecasting and planning scenarios, inputs and assumptions* report[2]. The Hydrogen scenario was considered for the first time in the 2021 GSOO[3].

In summary:

- The **Central** scenario reflects the current transition of the energy industry under current policy settings and technology trajectories, where the transition from fossil fuels to renewable generation is generally led by market forces and supported by current Commonwealth and South Australian Government policies.
- The **Slow Change** scenario reflects a general slow-down of the energy transition. It is characterised by slower advancements in technology and reductions in technology costs, low population growth, and low political, commercial and consumer motivation to make the upfront investments required for significant emissions reduction.
- The **Hydrogen** scenario considers a future with stronger economic growth that takes stronger action to address climate risks. In this scenario, aggressive global decarbonisation leads to faster technological improvements, accelerated exit of existing generators, greater electrification of the transport sector with increased infrastructure developments, energy digitalisation, and consumer-led innovation. Hydrogen in this scenario is assumed to be produced from grid-connected electrolysers and is projected to replace up to 20% of domestic natural gas demand by 2040.

[1] At https://www.aemo.com.au/energy-systems/gas/gas-forecasting-and-planning/gas-statement-of-opportunities-gsoo.

[2] At https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/inputs-assumptions-methodologies/2020/2020-forecasting-and-planning-inputs-assumptions-and-scenarios-report-iasr.pdf?la=en.

[3] AEMO consulted on the appropriate scale and timing of the hydrogen sector's development in this scenario with stakeholders in a bespoke hydrogen workshop, as well as in AEMO's monthly Forecasting Reference Group (FRG) open forum. See Presentation 2 in the Forecasting Reference Group (FRG) Meeting pack 35 from September 2020, at https://aemo.com.au/en/consultations/industry-forums-and-working-groups/list-of-industry-forums-and-working-groups/forecasting-reference-group-frg.

2. Electricity forecasts

2.1 Introduction

A summary of forecast electricity generation, interconnection, and loads for South Australia from 2020-21 to 2029-30, across three scenarios, is shown in Table 1.

In Table 1, the following should be noted:

- S stands for Scheduled, SS for semi-scheduled, NS for non-scheduled generation.
- Rooftop PV includes behind-the-meter photovoltaic (PV) systems up to 100 kilowatts (kW).
- PVNSG are distributed systems greater than 100 kW, up to 30 megawatts (MW).
- ONSG is small non-scheduled generation less than 30 MW (a mix of renewable and non-renewable generation).
- Interconnector flows comprise all interconnectors in aggregate, including both existing interconnectors and actionable *Integrated System Plan* (ISP) projects that the 2020 ISP development path assumes will be built between South Australia and other NEM regions (specifically, Project EnergyConnect between South Australia and New South Wales, assumed to be delivered in 2024-25).
- VPP stands for Virtual Power Plant, that is, orchestrated behind-the-meter battery storage systems.

2.2 Modelling assumptions

The following assumptions are consistent across the Central, Slow Change and Hydrogen scenarios.

- Assumed operation of committed[4] generators is based on Generation Information as of July 2020[5].
- Assumed retirement of generators:
  - Torrens Island A Power Station retires progressively from 2020 to 2022.
  - Osborne Power Station retires in 2022-23.
  - Starfish Hill Wind Farm retires in 2027-28.
  - Wattle Point Wind Farm retires in 2029-30.

Assumed new interconnection:

- Project EnergyConnect (South Australia to New South Wales) is assumed to start operation from July 2024 based on 2020 ISP analysis.

Assumed system security constraints[6]:

- A minimum of five synchronous units operating requirement is in place before the synchronous condensers and Project EnergyConnect are delivered.
- A minimum of two synchronous units operating requirement exists once all the synchronous condensers are assumed to be fully operational from July 2022 and prior to Project EnergyConnect.

[4] "Committed" criteria relate to site acquisition, major components, planning and approvals, financing, and construction. Definitions are under the Background Information in each published NEM Generation Information update, at https://www.aemo.com.au/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/forecasting-and-planning-data/generation-information.

[5] NEM Generation Information, July 2020, at https://www.aemo.com.au/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/forecasting-and-planning-data/generation-information.

[6] AEMO, Assumptions for South Australian GPG in the 2018 ISP, at https://www.aer.gov.au/system/files/AEMO%20-%20Assumptions%20for%20South%20Australian%20GPG%20in%20the%202018%20ISP%20-%20August%202019.pdf.

Table 1 Forecast annual energy supply mix for South Australia (gigawatt hours [GWh])

	Generation									Interconnector flow			Load
Financial year	Wind (SS, NS)	ONSG	PVNSG	Rooftop PV	Solar (SS)	Battery (S)	VPP	Gas and diesel (S)	Total	Imports to SA	Exports from SA	Net interchange (+ve import)	Battery (S) and VPP
Central scenario													
2019-20 Actuals	5,798	55	258	1,692	485	47	0	6,286	14,621	922	1335	-413	59
2020-21	6,260	88	442	1,968	574	94	5	3,619	13,050	2,340	1,004	1336	122
2021-22	6,102	89	543	2,077	750	96	9	3,335	13,001	2,356	1081	1,275	129
2022-23	6,691	92	597	2,182	803	94	14	2,455	12,928	2,505	999	1,506	133
2023-24	6,711	92	626	2,274	804	93	19	2,393	13,012	2,548	1025	1,523	137
2024-25	6,833	93	642	2,363	805	95	23	2,062	12,916	2,927	1292	1,635	145
2025-26	6,762	93	666	2,447	799	89	26	1,849	12,731	3,074	1248	1,826	140
2026-27	6,651	94	693	2,526	786	86	31	1,854	12,721	3,059	1191	1,868	143
2027-28	6,525	95	726	2,604	760	86	38	1,841	12,675	3,128	1150	1,977	151
2028-29	6,508	98	766	2,676	742	84	46	1,887	12,807	3,066	1146	1,919	158
2029-30	6,313	98	801	2,725	574	94	56	2,392	13,053	2,731	1133	1,598	167
Slow Change scenario													
2019-20 Actuals	5,798	55	258	1,692	485	47	0	6,286	14,621	922	1335	-413	59
2020-21	6059	88	351	1,948	573	97	2	3263	12,381	2408	871	1537	122
2021-22	5698	87	477	2,005	748	95	4	2922	12,036	2459	798	1661	122
2022-23	6194	89	570	2,048	800	91	7	1902	11,701	2775	738	2038	121
2023-24	6189	89	611	2,084	799	92	8	1878	11,750	2780	744	2037	123
2024-25	6492	88	612	2,115	799	99	11	1563	11,779	3194	1174	2020	135

	Generation									Interconnector flow			Load
Financial year	Wind (SS, NS)	ONSG	PVNSG	Rooftop PV	Solar (SS)	Battery (S)	VPP	Gas and diesel (S)	Total	Imports to SA	Exports from SA	Net interchange (+ve import)	Battery (S) and VPP
2025-26	5506	88	620	2,144	784	79	10	1397	10,628	3480	383	3097	109
2026-27	5391	88	628	2,177	749	76	12	1395	10,516	3538	338	3201	108
2027-28	5224	88	645	2,214	713	75	14	1401	10,374	3653	298	3356	109
2028-29	5162	89	685	2,246	668	75	15	1413	10,353	3671	281	3390	110
2029-30	5086	89	714	2,277	671	74	18	1397	10,326	3714	276	3438	113
Hydrogen scenario													
2019-20 Actuals	5,798	55	258	1,692	485	47	0	6,286	14,621	922	1335	-413	59
2020-21	6,295	89	498	2,015	574	92	12	4080	13,655	2271	963	1308	127
2021-22	6,133	91	588	2,213	751	94	22	3584	13,476	2239	1159	1079	142
2022-23	6,675	94	650	2,407	804	90	41	2673	13,434	2352	1091	1260	160
2023-24	6,651	96	745	2,611	804	88	68	2631	13,694	2274	1185	1089	189
2024-25	6,765	97	827	2,843	803	84	100	2463	13,982	2733	1320	1413	221
2025-26	6,436	99	895	3,039	801	72	111	2825	14,278	2593	738	1855	219
2026-27	9,058	101	957	3,198	998	67	125	3100	17,604	1367	1748	-381	231
2027-28	11,769	103	1036	3,367	3213	65	153	2690	22,396	1053	3024	-1972	260
2028-29	13,994	107	1083	3,547	3206	63	179	2446	24,625	1285	2484	-1199	287
2029-30	15,978	109	1133	3,731	3207	62	220	2312	26,752	1414	2648	-1235	335

In Table 1: S stands for Scheduled, SS for semi-scheduled, NS for non-scheduled generation; Rooftop PV includes behind-the-meter PV systems up to 100 kW; PVNSG are distributed systems greater than 100 kW, up to 30 MW; ONSG is other non-scheduled generation less than 30 MW (a mix of renewable and non-renewable generation not including PVNSG); Interconnector flows comprise all interconnectors in aggregate, including existing interconnectors and interconnection the 2020 Draft ISP development path assumes will be built between South Australia and other NEM regions (Project EnergyConnect between South Australia and New South Wales, assumed to be delivered in 2023-24); VPP stands for Virtual Power Plant, that is, orchestrated behind-the-meter battery storage systems.

2.3 Key supply forecast analysis

Wind

Wind generation in 2019-20 was impacted by the prolonged outage of the Heywood interconnector in January and February 2020, which led to additional curtailment. A further contribution to the increase in output from 2019-20 to 2020-21 is Lincoln Gap Wind Farm, which reached full capacity in the second quarter of 2020.

Across all scenarios, wind generation is forecast to increase in 2022-23 due to the commissioning of Lincoln Gap Wind Farm Stage 2. Announced retirement of existing assets will slightly reduce capacity installed and output from 2027-28 in the Central and Slow Change scenario. In the Hydrogen scenario, new wind farms are projected to be built[7] from 2026-27 driven by increasing demand from electrolysis. Between 2026-27 and 2029-30, the Hydrogen scenario forecasts an uptake of 3 gigawatts (GW) of new wind generation capacity. This development is located across multiple renewable energy zones (REZs), primarily in the Mid-North and South East regions and a small share in Leigh Creek and Yorke Peninsula.

Other Non-Scheduled Generation (ONSG)

This includes generation less than 30 MW and includes a mix of renewable and non-renewable sources. Historically, this category has been seeing growth in technologies such as landfill gas. Modest growth is projected over the forecast period.

PV Non-Scheduled Generation (PVNSG)

PVNSG capacity has been growing rapidly, and this is forecast to continue over the 10-year period. The growth has been driven by commercial decisions in the small to medium commercial sector to reduce energy costs, as well as incentives driven by large-scale generation certificates (LGCs).

Rooftop PV

Rooftop PV generation is forecast to continue increasing over the next decade, with the Hydrogen scenario having the highest growth rate due to its rapid decarbonisation objectives. The Slow Change scenario predicts lower overall capacity and hence lower contribution from rooftop PV.

Large-scale solar

The increase in solar output in 2020-21 relative to 2019-20 is driven by Bungala 2 Solar Farm reaching full capacity in the third quarter of 2020.

Across all scenarios, large-scale solar generation is forecast to increase in 2021-22 due to commissioning of new projects. After that, a flat trajectory is forecast in both the Central and Slow Change scenarios. In the Hydrogen scenario, new solar farms are projected to be built from 2027-28, increasing in total to 1 GW by 2029-30. This additional capacity is all forecast to be built in the Riverland region, driving increased solar generation during this period to also meet demand for electrolysis.

Battery

Across all scenarios, utility-scale battery generation is forecast to follow a relatively steady trajectory over the outlook. However,

Virtual Power Plants (VPPs)

VPP uptake and participation in the energy market in the near term is projected to be slower than previously anticipated. Changing generation levels from VPPs mirror the forecast VPP installed capacity that is modelled

[7] New generator builds in the modelling are not necessarily referring to any particular project that is being tracked by AEMO's Generation Information. Rather, these additions relate to new generation being built to satisfy the modelling scenario's goals, as mentioned in Section 1.2.

in each scenario, with market forces dictating actual usage. While in the Central scenario the uptake is more gradual, in the Hydrogen scenario, the consumer-led growth of storage follows a steep trajectory.

Gas and diesel

The 2020-21 forecast outlines a decrease in gas and diesel generation relative to history. Despite reliance on directions, the forecast projects South Australia to be increasingly importing from Victoria as new variable renewable energy (VRE) capacity connects.

Across all scenarios, the forecast decrease in scheduled gas and diesel generation up to 2024-25 is driven by a combination of factors:

- The retirement of Torrens Island A and Osborne power stations.
- New VRE being commissioned.
- The relaxing of system strength requirements as synchronous condensers are delivered.

The forecast decline after 2024-25 in the Central and Slow Change scenarios is attributed to increasing interconnector imports to South Australia, enabled by Project EnergyConnect which is assumed to be commissioned at the start of that year. With increased interconnection capacity in place, system strength requirements sourced from within South Australia are assumed to be further relaxed, leading to less South Australian gas generation.

More generally, additional VRE across the NEM is forecast to displace gas generation until further coal generation capacity retires, which might temporarily increase reliance on gas generation to meet demand. Gas, however, remains an important source of peaking capacity for the NEM as well as South Australia.

In the Slow Change scenario, after 2024-25, gas generation is forecast to follow a flat trajectory with no material changes expected until the end of the outlook. In this scenario, less VRE is projected to be built in South Australia and across the NEM, so gas generation is not projected to be displaced any further towards the end of the forecast period, and South Australian gas generation is forecast to level off.

In the Hydrogen scenario, temporary increases in South Australian gas generation from 2024-25 can be attributed to the accelerated projected closures of coal generation elsewhere in the NEM assumed under Hydrogen scenario assumptions. From 2027-28 onwards, increased VRE is projected to be built across the NEM (including in South Australia) – this, combined with flexible demand from electrolysis load, is forecast to set South Australian gas generation on a downward trend.

Interconnectors

In 2019-20, exports from South Australia exceeded imports.

In the Central and Slow Change scenarios, however, net interconnector flows into South Australia are forecast to be mostly positive (net import), and generally increase across the forecast period. While South Australian native demand[8] for electricity is relatively flat in the forecast, increased imports are expected to be driven by the projected decline in South Australian gas and diesel generation, and by the retirement of wind generation towards the end of the forecast.

In the Hydrogen scenario, South Australia is projected to become a net exporter on interconnectors from 2026-27, due to forecast strong uptake of VRE in the region from the middle of the forecast period.

[8] Native demand means demand in a region that is met by local scheduled, semi-scheduled, non-scheduled, and generation that is exempt from registration (usually because its capacity or export of energy is small), and by generation imports to the region, excluding the demand of local scheduled loads. It does not include demand met by behind-the-meter distributed generation/storage.