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AUSTRALIAN ENERGY MARKET OPERATOR

Western Australia Gas Bulletin Board historical data analysis

A report for the WA gas market

November 2018

Analysis over the period from August 2013 - June 2018

Important notice

PURPOSE

The purpose of this publication is to provide information about the natural gas industry in Western Australia.

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VERSION CONTROL

Version	Release date	Changes
#1	22/11/2018	

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1. Introduction

This paper presents major trends extracted from data on the Gas Bulletin Board Western Australia (GBB WA)[1] since its commencement in August 2013. Key changes in gas consumption, production, and storage are outlined, with all data in financial year ending (FYE) to capture most recent data. Key findings are summarised below[2].

Observed trends in gas consumption:

- Annual gas consumption has increased over the period, from 978 TJ/day to 1035 TJ/day.
  - Compound annual growth rate since FYE14: 1% per year.
  - Compound annual growth rate in FYE18: 2%.
- A clear monthly winter peak in gas consumption each year, between 12 TJ/day and 74 TJ/day higher than peaks in the summer months.
- Across the period from FYE14 to FYE18, gas consumption has increased in the following areas:
  - On a usage category basis, mining sector gas use has increased from 13% to 21% of total gas consumption.
  - On a commodity basis, gas use associated with iron ore has also increased from 6% to 13% of total consumption.
  - On a geographic basis, gas consumption in the geographic zones of East (Goldfields, Kalgoorlie) and North (Dampier, Pilbara, Karratha, Telfer), where several iron ore mines are located, has also increased; gas consumption in the North increased from 24% to 28% of total consumption, and gas consumption in the East increased from 7% to 10% of total consumption.
- Gas consumption for electricity generation (GPG) has fallen from 34% of total consumption in FYE14 to 29% in FYE18. GPG in summer appears to be trending down.

Observed trends in gas production:

- Gorgon has the biggest growth in contribution over the whole period. Since domestic production commenced in FYE17, its production share has grown from 8% in FYE17 to 14% in FYE18.
- While Karratha Gas Plant (KGP) remains the biggest contributor, its production contribution has been trending downwards since FYE16. In FYE16, KGP's share was 48%; in FYE17 it was 40%, and in FYE18 it was 36%.
- From FYE14 to FYE17, Macedon's production share rose 1-3% each year, while Varanus Island's share fell 2-5% each year. In FYE18, this trend reversed, with Macedon's share falling from 20% (in FYE17) to 16% and Varanus Island's share rising from 20% (in FYE17) to 21%.

Observed trends in gas storage:

- No clearly observable correlation or pattern is visible in gas storage injections and withdrawals.

[1] AEMO 2018, *Gas Bulletin Board WA*, Australian Energy Market Operator, https://gbbwa.aemo.com.au/#home.

[2] Please note that the categorisations in this paper include small users and may not reflect the GBB large user categories shown on the GBB website.

2. Gas consumption

2.1 Total consumption

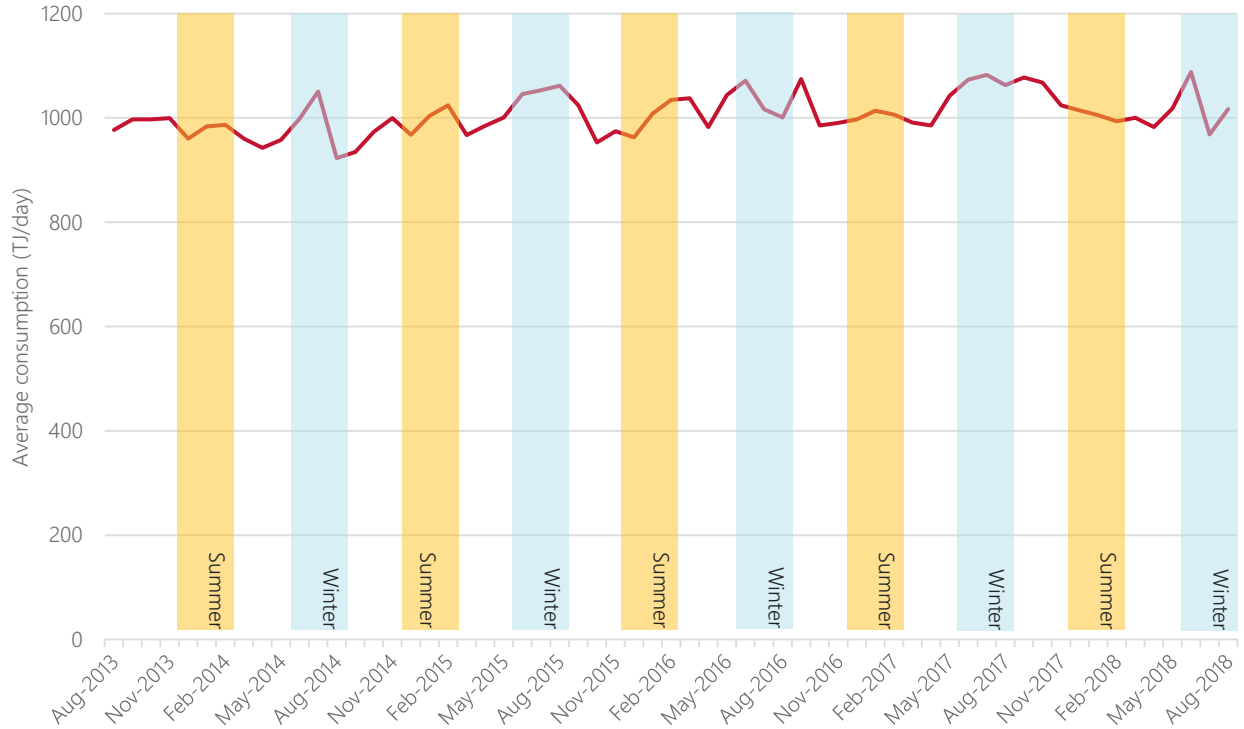
Total consumption includes all domestic sectors in Western Australia.

Figure 1 shows average monthly gas consumption data, and illustrates multiple peaks and troughs in gas consumption since the start of the WA GBB.

Key observations:

- Annual gas consumption has increased over the period, from 978 TJ/day to 1035 TJ/day.
  - Compound annual growth rate since FYE14: 1% per year.
  - Compound annual growth rate in FYE18: 2% over the year.
- There is a clear winter peak in each year, between 12 TJ/day and 74 TJ/day higher than the summer peak. June is the winter peaking month in all years except FYE15, where July 2014 was the winter peaking month.
- June is the only month that shows a consistent year-on-year increase in gas consumption.
- While monthly averages were always higher in the winter months, there were several occurrences of maximum consumption summer days which had higher consumption than the maximum consumption winter day.
  - In FYE15, the highest summer consumption day (28 Jan 2015, with 1,182.7 TJ/day) was 50.4 TJ/day higher than the highest winter consumption day (9 July 2014).
- The highest and second highest consumption days over the entire period occurred on 26 June 2017 and 3 July 2017 (1,190 TJ/day and 1,188 TJ/day, respectively).

Figure 1 Total daily average gas consumption (TJ/day) by month, from GBB WA start



2.2 By usage category

Gas consumers on the GBB were classified into the following usage categories to align with the classifications used in the 2018 WA Gas Statement of Opportunities (GSOO) forecasts[3]:

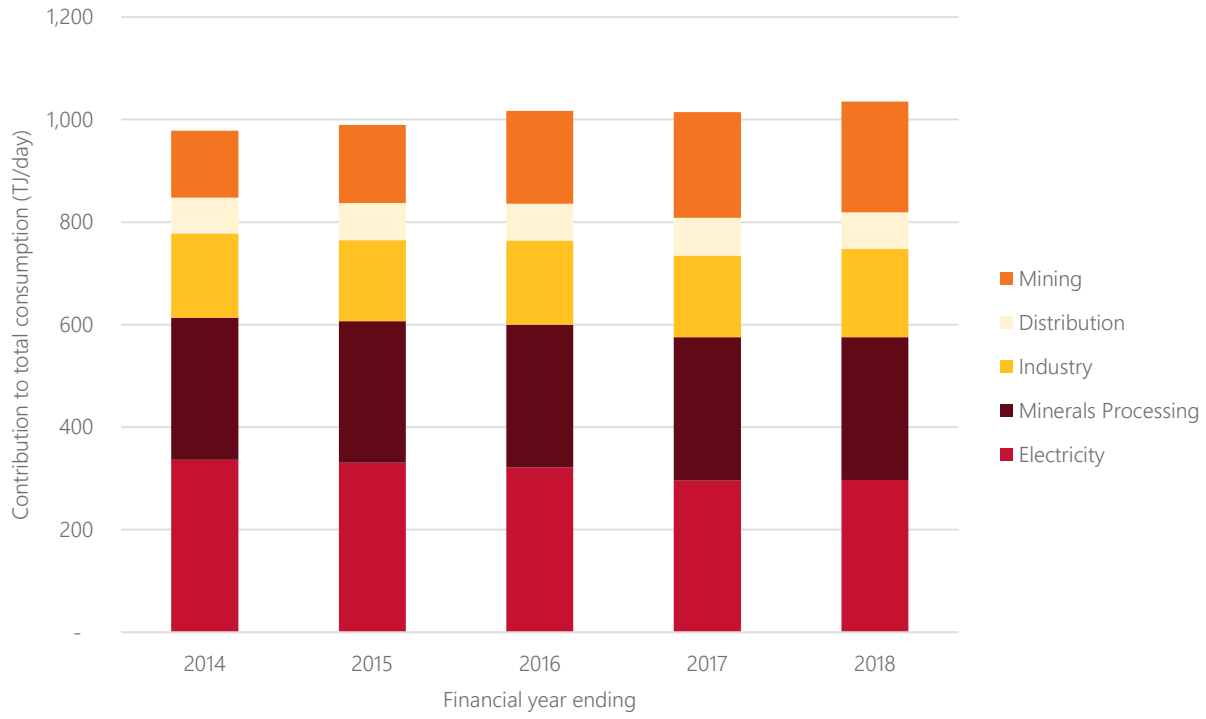
- Electricity
- Distribution
- Industry (includes LNG commissioning)
- Minerals Processing
- Mining.

The major trends in share of total gas consumption were:

- Mining contribution grew from 13% to 21%.
- Electricity contribution fell from 34% to 29%.
- Little change in other sectors (industry, distribution, minerals processing).

Figure 2 and Table 1 summarise the key changes per usage category, and the following sections (2.2.1 to 2.2.3) examine mining, electricity, and industry consumption in more detail.

Figure 2 Gas consumption by usage category contribution (TJ/day)



[3] The classifications shown will be new in the 2018 GSOO.

Table 1 Summary of gas consumption changes across FYE14 – FYE18 by usage category

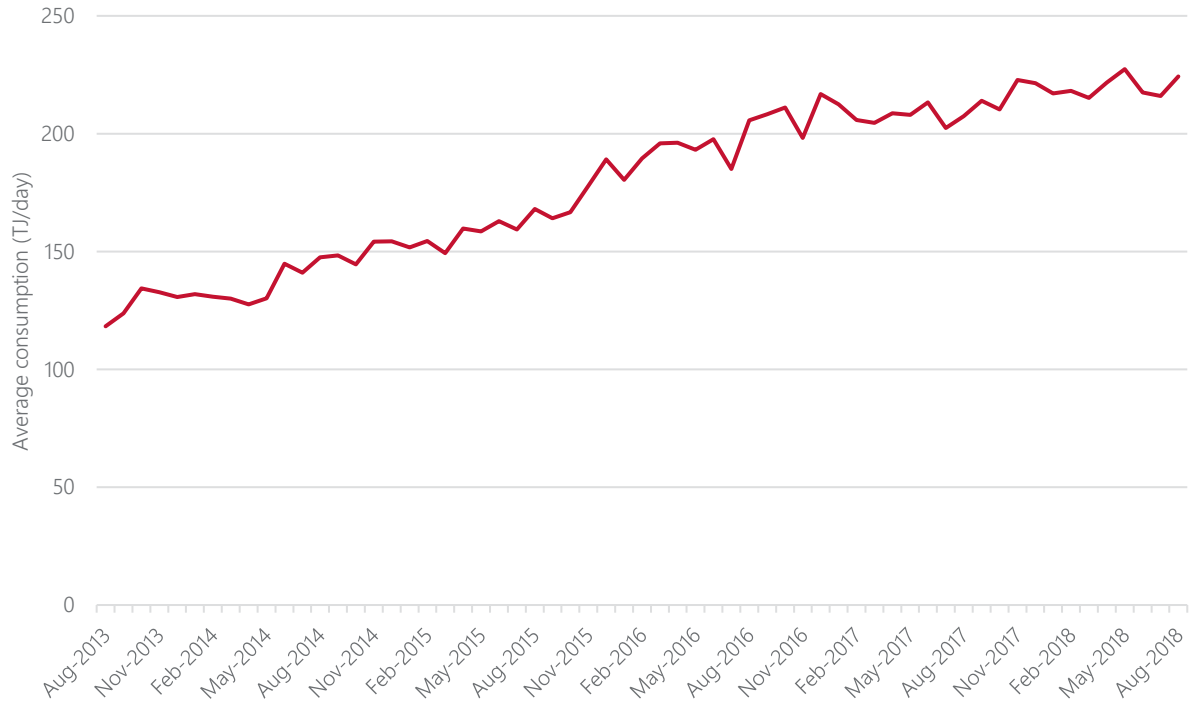
Usage category	% contribution to consumption in FYE18	% contribution to consumption in FYE14	% contribution change (FYE17-FYE18)	TJ/day change (FYE14-FYE18)
Electricity	29%	34%	0%	-39
Minerals Processing	27%	28%	-1%	1
Mining	21%	13%	1%	86
Industry	17%	17%	1%	8
Distribution	7%	7%	0%	1

2.2.1 Mining

Gas consumption for mining has continued to increase over the period since August 2013, as shown in Figure 3.

- Compound annual growth rate since FYE14: 14% per year.
- Compound annual growth rate in FYE18: 7% over the year.
- Over the analysis period, daily average gas consumption over a month has increased from 115 TJ/day to 224 TJ/day (109 TJ/day increase).

Figure 3 Daily average gas consumption (TJ/day) over a month: Mining



2.2.2 Electricity

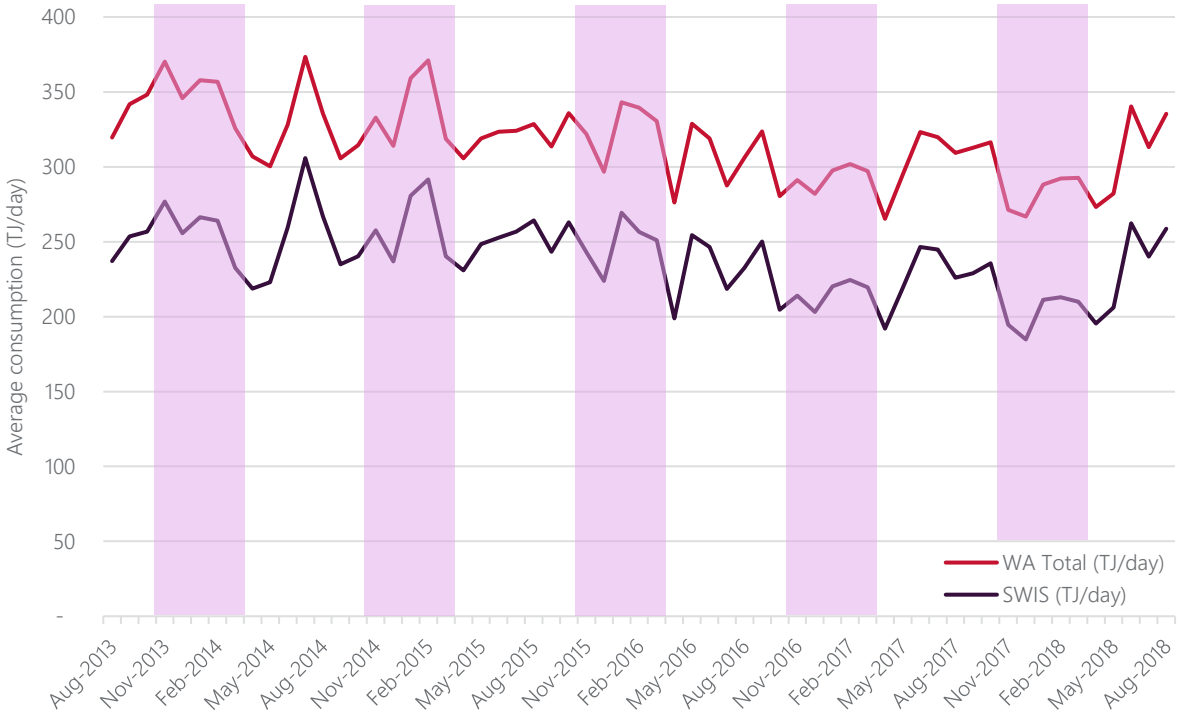
Gas consumption for electricity generation (GPG) has been generally trending downwards since August 2013, although there has been a pickup in GPG since April 2018, as shown in Figure 4.

Key observations:

- Variations in total WA GPG consumption are strongly correlated to variations in SWIS GPG.

- GPG from November to March appears to be decreasing year-to-year.

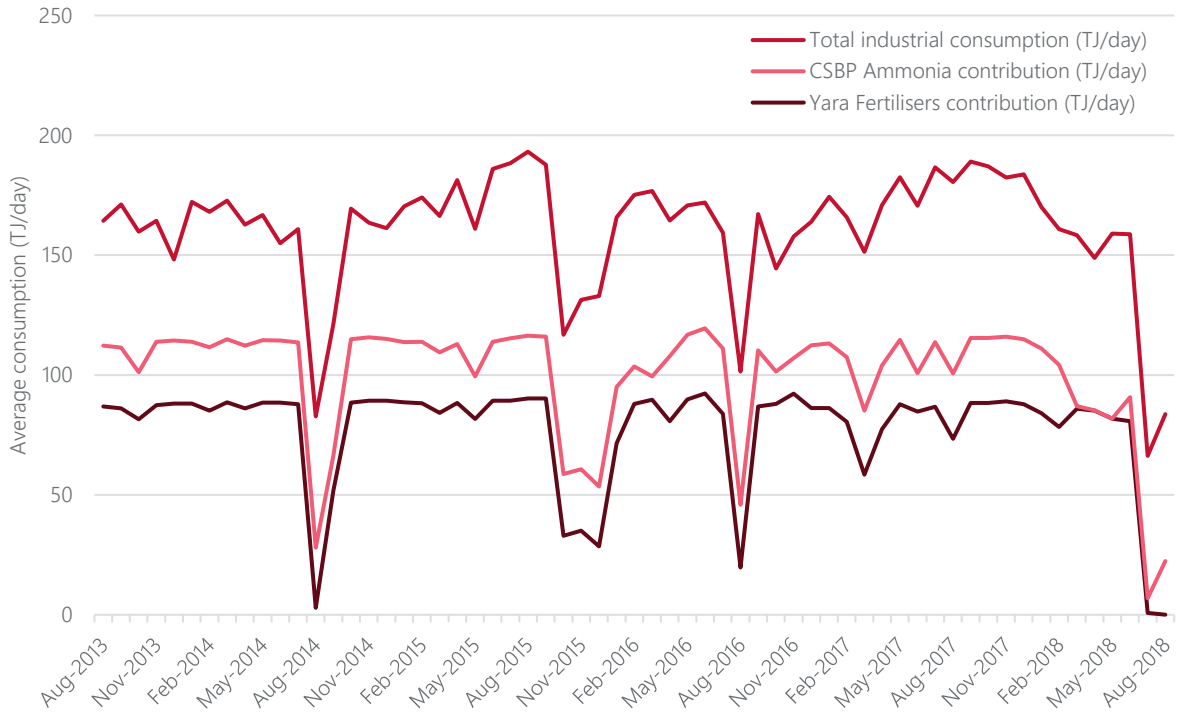
Figure 4 Daily average gas consumption (TJ/day) over a month: Electricity



2.2.3 Industry

Industrial gas use has varied from 66 TJ/day (July 2018) to 193 TJ/day (August 2015) over the analysis period, as illustrated in Figure 5. Changes in industrial gas use reflect changes in consumption patterns of big ammonia producers, with the two biggest users of ammonia having significant impacts on total consumption.

Figure 5 Daily average gas consumption (TJ/day) over a month: Industry



2.3 By commodities

Mining, industrial and minerals processing gas consumers on the GBB were classified into the following categories based on their associated commodities. These four commodities accounted for 47% of total gas consumption in FYE18:

- Alumina
- Gold
- Iron ore
- Nickel.

Major changes in contribution to total consumption over the five years, as shown in Figure 6 and Table 2, were:

- Iron ore contribution grew from 6% to 13%.
- Gold contribution grew from 3% to 5%.
- Alumina contribution fell from 27% to 26%.
- Nickel contribution remained steady.

Figure 6 Average daily gas consumption by commodity type and year (TJ/day)

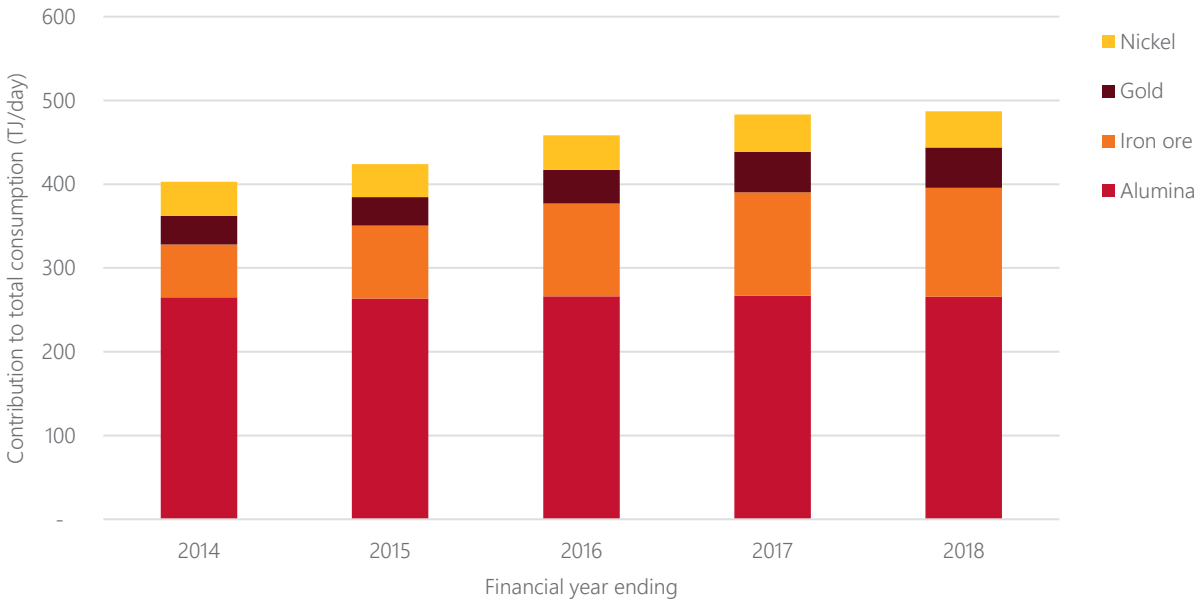


Table 2 Summary of gas consumption changes across FYE14 to FYE18 by commodity

Commodity	% contribution to consumption in FYE18	% contribution to consumption in FYE14	% contribution change (FYE17-FYE18)	TJ/day change (FYE14-FYE18)
Alumina	26%	27%	-1%	1
Gold	5%	3%	0%	14
Iron ore	13%	6%	0%	67
Nickel	4%	4%	0%	2
Total commodities	47%	41%	-1%	84

Recent drives towards incentivising the development of lithium resources in Western Australia could make lithium a significant contributor to gas consumption[4]. Current gas consumption values associated with lithium mining and production are low, but are expected to increase rapidly in the future. As of August 2018, there are two lithium mines using pipeline gas out of seven mines in total. Lithium hydroxide process plants consume a lot of energy and several projects are in the pipeline, including the Tianqi lithium plant in Kwinana[5].

2.4 By geographic zone

Gas consumption data was grouped according to three geographic zones, which are broad categorisations, based on the geographic zones defined in the GSI Rules[6]:

- East (Goldfields, Kalgoorlie).

[4] Regional Development Australia. *Lithium Valley*, May 2018. Available at https://www.rdaperth.org/wp-content/uploads/2018/05/Lithium-Valley-Summary-Document-May-2018.pdf.

[5] Tianqi Lithium. *Construction begins on Stage 2 lithium hydroxide processing plant*, 19 December 2017. Available at http://tianqilithium.com.au/.

[6] Economic Regulation Authority Western Australia. *Gas Services Information Rules,* March 2015. Available at https://www.erawa.com.au/cproot/18030/2/Gas%20Services%20Information%20Rules%2020%20March%202015.pdf.

- North (Dampier, Pilbara, Karratha, Telfer).
- Metro / South West (Metro, South-West, Mid-West, Parmelia).

Figure 7 and Table 3 illustrate that:

- Gas consumption in the Metro / South West zone has fallen from 68% to 62% of total consumption.
- Gas consumption in the North and East zones has grown from 24% to 28% and from 7% to 10% respectively. This increase is largely driven by increased gas consumption due to mining (see Section 2.2).

Figure 7 Average daily gas consumption by geographic zone contribution and year (TJ/day)

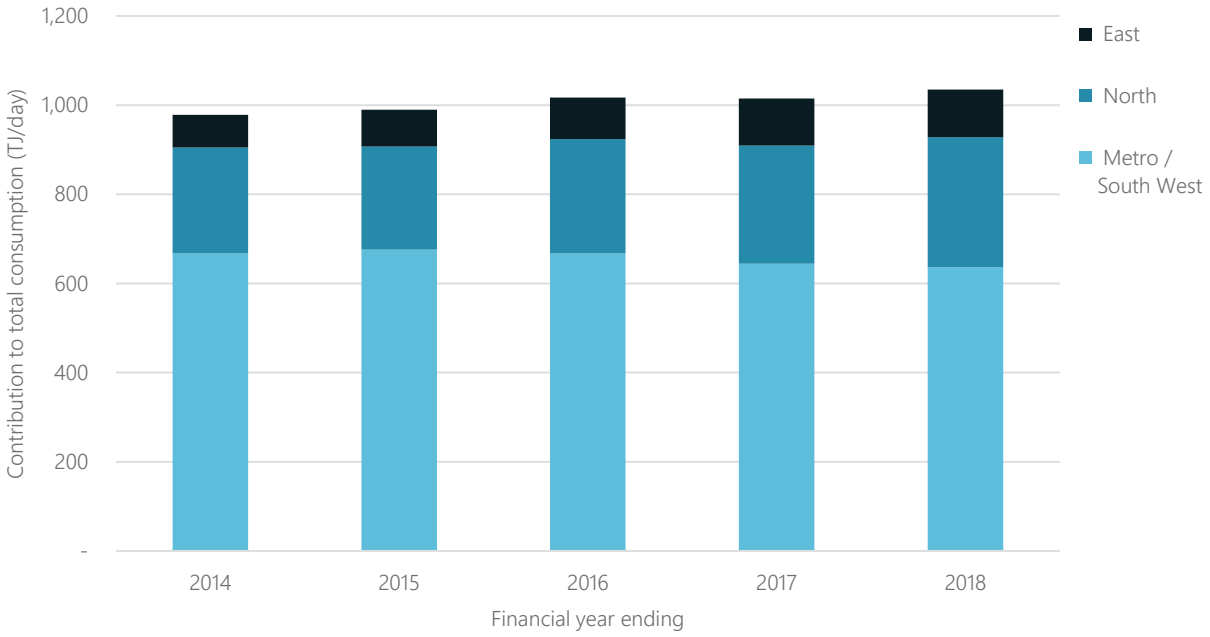


Table 3 Summary of gas consumption changes across FYE14 – FYE18 by geographic region

Region	% contribution to consumption in FYE18	% contribution to consumption in FYE14	% contribution change (FYE14-FYE18)	% contribution change (FYE17-FYE18)	TJ/day change (FYE14-FYE18)
Metro / South West	62%	68%	-6%	-2%	-31
North	28%	24%	4%	2%	54
East	10%	7%	3%	0%	34

Specifically:

- The biggest movers have been the Metro area (-5% contribution), followed by the South-West (-3% contribution), Dampier (+3% contribution), and the Goldfields (+3% contribution).
- The Metro and South-West are tied at equal contributions to gas consumption (29% each) and remain the largest contributors to gas consumption even though their contributions are generally trending downwards.

A further detailed breakdown based on the individual geographic zones defined in the GSI rules is shown in Table 4.

Table 4 Summary of gas consumption changes across FYE14 to FYE18 by GBB zone

Region	% contribution to consumption in FYE18	% contribution to consumption in FYE14	% contribution change (FYE14-FYE18)	% contribution change (FYE17-FYE18)	TJ/day change (FYE14-FYE18)
Metro	29%	34%	-5%	-1%	-27
South-West	29%	32%	-3%	-1%	-10
Dampier	17%	14%	3%	2%	39
Goldfields	8%	5%	3%	0%	34
Pilbara	5%	4%	1%	0%	12
Karratha	4%	4%	0%	0%	2
Kalgoorlie	3%	3%	0%	0%	0
Parmelia	3%	2%	1%	0%	9
Telfer	2%	2%	0%	0%	0
Mid-West	0%	0%	0%	0%	-2

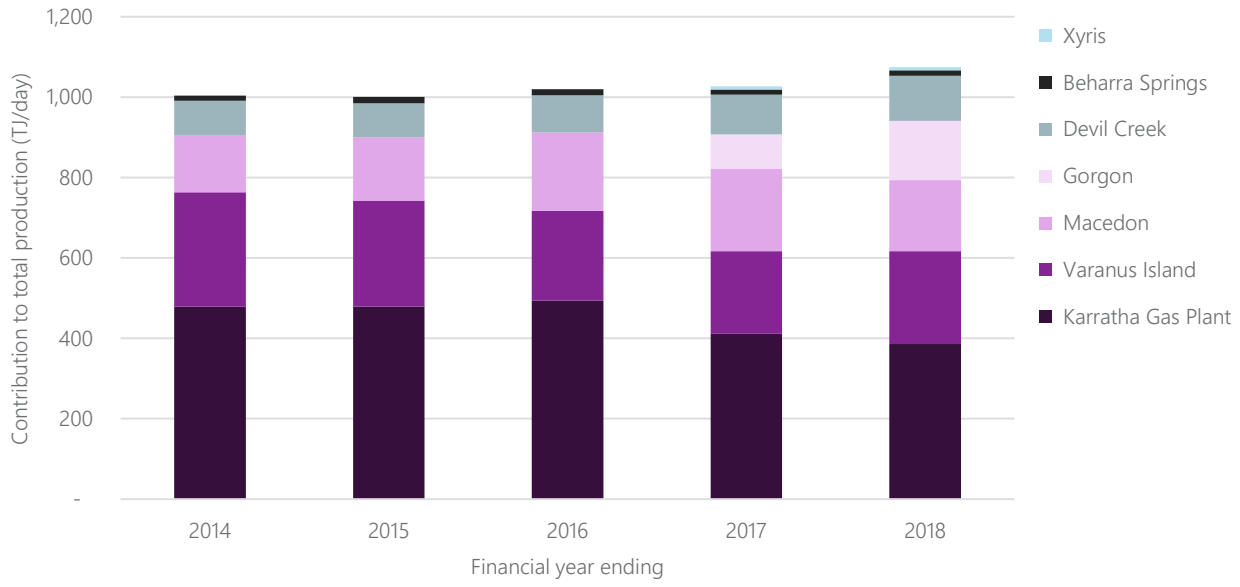
3. Gas production

Gas production data on the GBB was analysed according to production facility, with results shown in Figure 8 and Table 5.

Major changes in production shares since August 2013:

- Gorgon's share of total production stands at 14%, up from 8% in FYE17 and 0% in preceding years[7].
- Karratha Gas Plant (KGP)'s share of production fell from 47% in FYE14 to 36% in FYE18.
  - While KGP remains the biggest contributor to gas production, its contributions have been trending downwards over the last three financial years.
  - Production from KGP was steady or increasing until FYE16. KGP share of total production dropped from 48% in FYE16 to 40% in FYE17 and 36% in FYE18.
- Varanus Island's share of production fell from 28% in FYE14 to 21% in FYE18.
  - From FYE14 to FYE17, Varanus Island's share of total production fell by between 2% and 5% each year.
  - Varanus Island's share of production rose from 20% in FYE17 to 21% in FYE18.
- Macedon's share of production grew from 14% in FYE14 to 16% in FYE18.
  - From FYE14-FYE17, Macedon's share rose consistently each year and its share in FYE17 was 20% of total production. In FYE18, its share fell to 16%.

Figure 8 Production facility contribution to total production (TJ/day)



[7] Supply to the domestic market began in December 2016. Chevron Australia, *Gorgon project*, 2018. Available at https://australia.chevron.com/our-businesses/gorgon-project. Viewed 12 October 2018.

Table 5 Summary of gas production changes across FYE14 to FYE18 by production facility

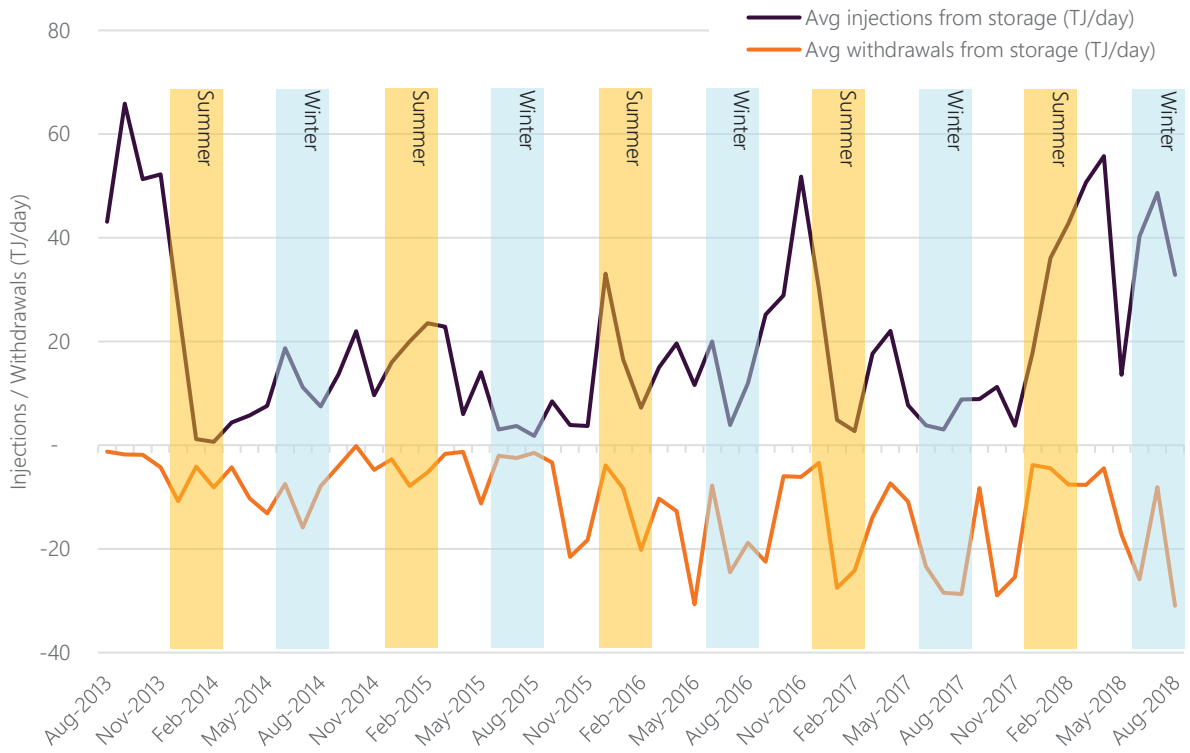
Producer	% contribution to production in FYE18	% contribution to production in FYE14	% contribution change (FYE14-FYE18)	% contribution change (FYE17-FYE18)	TJ/day change (FYE14-FYE18)
Karratha Gas Plant	36%	47%	-11%	-4%	-93
Varanus Island	21%	28%	-7%	2%	-54
Macedon	16%	14%	2%	-3%	36
Gorgon	14%	0%	14%	5%	147
Devil Creek	10%	9%	1%	1%	25
Beharra Springs	1%	1%	0%	0%	1
Xyris	1%	0%	1%	0%	8

4. Storage

As at August 2018, there are two gas storage facilities in Western Australia, Mondarra and Tubridgi[8]. Figure 9 illustrates the variable nature of injections and withdrawals from storage facilities.

While no clear correlation or pattern is visible in gas storage injections and withdrawals, December has the greatest consistency across the period, with generally higher injections into storage facilities and lower withdrawals from storage facilities across all years.

Figure 9 Daily average gas storage injections and withdrawals per month (TJ/day)



To further examine seasonality effects, total monthly maximum and minimum injections and withdrawals are presented in Table 6. No clear seasonal pattern was observed and variations across the period are significant:

- Monthly minimum to maximum withdrawals from storage facilities range from 5 TJ/month (Oct 2014) to 951 TJ/month (May 2016).
- Monthly minimum to maximum injections into storage facilities range from 18 TJ/month (February 2014) to 1,977 TJ/month (September 2013).

[8] While Tubridji commenced operation in late 2017, it was calculated as part of the Ashburton facility, which also contained Wheatstone gas usage data. Separate gas usage data for Tubridgi was only made available in January 2018.

Table 6 Monthly maximum and minimum gas storage withdrawals from and injections into gas storage facilities (TJ/month)

FYE	Withdrawals				Injections			
	Max withdrawn in a month (TJ/month)	Month of occurrence	Min withdrawn in a month (TJ/month)	Month of occurrence	Max stored in a month (TJ/month)	Month of occurrence	Min stored in a month (TJ/month)	Month of occurrence
2014	407.7	May-14	38.1	Aug-13	1,976.5	Sep-13	18.1	Feb-14
2015	492.7	Jul-14	5.1	Oct-14	708.8	Mar-15	91.2	Jun-15
2016	951.3	May-16	45.4	Aug-15	1,026.8	Dec-15	55.9	Aug-15
2017	854.6	Jan-17	104.9	Dec-16	1,554.6	Nov-16	76.7	Feb-17
2018	898.1	Oct-17	118.5	Dec-17	1,672	Apr-18	94.5	Jul-17