NATIONAL GAS FORECASTING REPORT

FOR EASTERN AND SOUTH-EASTERN AUSTRALIA

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AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

IMPORTANT NOTICE

Purpose

AEMO has prepared this document under clause 91D of the National Gas Law, to provide information about gas annual consumption and maximum demand in eastern and south-eastern Australia over a 20-year outlook period. This report is published in connection with AEMO's gas planning and operational functions, and is based on information available to 31 October 2015 unless otherwise specified.

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Revised version

Version	Release date	Changes[a]	
1	10/12/2015		
2	02/03/2016	Table 6 updated (page 15, Section 2.1) Figure in text updated (page 33, Chapter 3) Table 24 header updated (page 36, Chapter 3) Figure in text updated (page 37, section A.1) Figure in text updated (page 38, section A.2.1) Table 27 updated (page 41, section A.2.2) Figure in text updated (page 42, section A.2.4) Text updated (page 48, section B.1) Table 35 updated (page 49, Section B.2.1) Table 36 updated (page 51, Section B.2.2)	Table 37 updated (page 52, Section B.2.2) Table 56 and figures in text updated (page 74, Section D.2.2) Table 57 updated (page 75, Section D.2.2) Table 58 updated (page 76, Section D.2.3) Table 60 updated (page 78, Section D.2.5) Figure in text updated (page 82, Section E.1) Table 65 updated (page 83, Section E.1.1) Table 66 updated (page 84, Section E.1.2) Table 74 updated (page 91, Appendix F)

[a] Material changes after initial publication. Non-material changes, or typographical or formatting corrections, are not listed.

EXECUTIVE SUMMARY

The National Gas Forecasting Report (NGFR) provides forecasts of annual gas consumption and maximum gas demand across eastern and south-eastern Australia's interconnected gas markets over a 20-year outlook period.

Annual gas consumption forecast

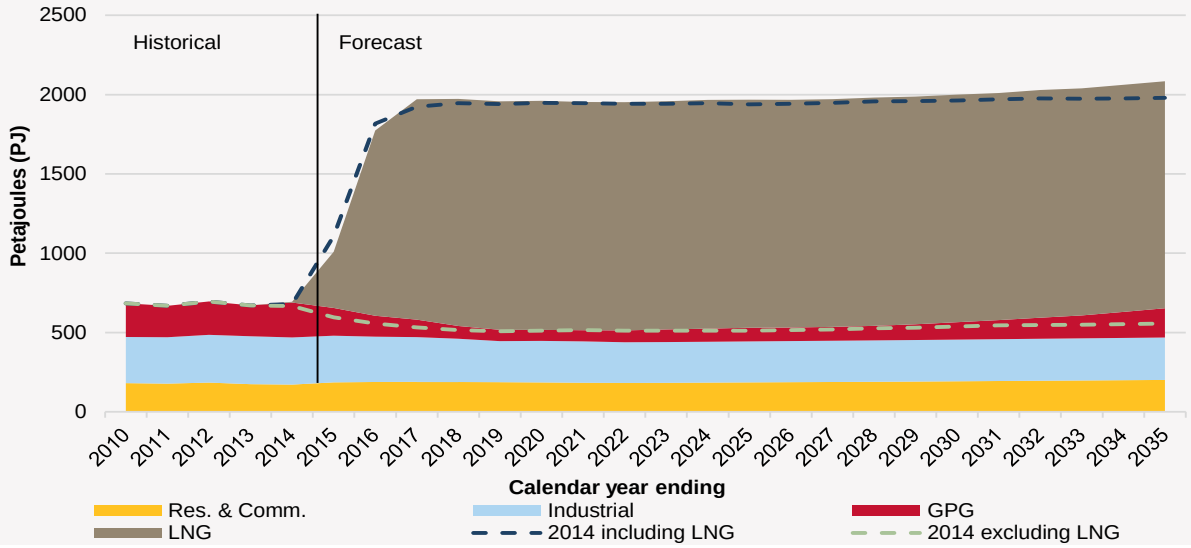
- In the five years 2016–20, the total annual gas consumption in Australia is forecast to rise rapidly as Queensland's liquefied natural gas (LNG) export facilities ramp up production.
- Annual gas consumption is then projected to remain relatively flat over the rest of the 20-year outlook period to 2035.[1]

Table 1 Total annual gas consumption by sector

Sector	2015[2]	2020	2035
Residential and commercial	185.5 PJ	185.1PJ	200.9 PJ
Industrial	294.3 PJ	261.9 PJ	267.4 PJ
Gas Power Generation (GPG)	175.0 PJ	69.3 PJ	184.5 PJ
LNG	353.8 PJ	1444.3 PJ	1431.3 PJ
Total	**1008.6 PJ**	**1960.7 PJ**	**2084.1 PJ**

Figure 1 highlights the transformation of the market expected in the short term during the ramp-up of the LNG facilities.

Figure 1 Total annual gas consumption



[1] The NGFR includes forecasts for low, medium and high demand scenarios. This executive summary focuses on the medium demand scenario.

[2] For 2015 data: residential, commercial and industrial consumption data is estimated on a weather-normalised basis, assuming long-run median weather outcomes; GPG data is calculated using actual metering data until October 2015, estimated thereafter; LNG data uses projections based on publicly available data (Lewis Grey Advisory: Updated Projections of Gas and Electricity Used in LNG; 26 October 2015).

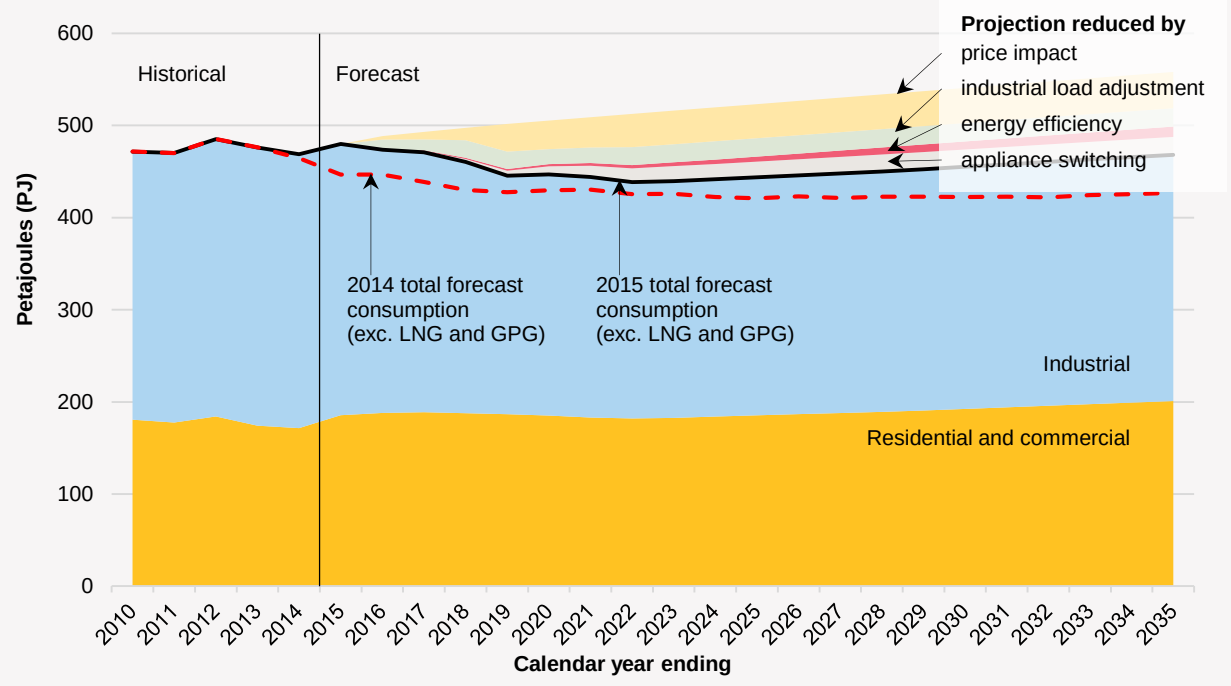
Key insights for annual gas consumption changes

The eastern and south-eastern Australian gas industry is experiencing a period of transformation over the next five years, and annual gas consumption is expected to change in the following ways:

- The start-up of Queensland's LNG facilities is expected to more than double total gas consumption in eastern and south-eastern Australia[3], linking domestic wholesale gas prices to international markets that results in increased gas prices for domestic gas supplies.
- In the short term, growth in gas consumption from food, dairy and services, and expected generally improved business conditions for manufacturing, are forecast to be offset by continued restructuring of industry away from gas-intensive manufacturing such as the automotive industry, ahead of a longer-term improved outlook.
- Gas consumption (and electricity production) by gas-powered generation (GPG) is forecast to reduce in the short term. Beyond five years, GPG gas consumption is forecast to rise to support electricity consumption and to replace over 2,000 MW of coal-fired generation withdrawals.
- Projected improvements in energy efficiency of buildings and appliances, including gas to electric appliance switching and a growing preference for living in apartments and multi-unit dwellings, are expected to contribute to residential and commercial consumption remaining flat, despite projected population increases.

Figure 2 shows forecast annual gas consumption (excluding consumption by LNG and GPG), to demonstrate what gas consumption would have been forecast without the impact of each driver (price increases, industrial load closures, energy efficiency savings, and customers switching from gas to electric appliances), above the total 2014 NGFR and 2015 NGFR forecasts.

Figure 2 Residential, commercial and industrial gas consumption



[3] Compared to aggregated consumption in 2014, before the Queensland LNG facilities started consuming gas.

Forecast uncertainties

There are four key areas of uncertainty in the forecasts (see Section 1.3 for more detail on the uncertainties):

- **LNG** – forecasts of total gas consumption are sensitive to assumptions for LNG facilities, due to the scale of gas consumption by these facilities relative to domestic gas consumption, and there is as yet little operational data available to validate assumptions.
- **GPG** – forecasts of gas consumption by GPG are sensitive to a range of assumptions and inputs, including climate policy, wholesale gas prices, weather, and coal-fired generation.
- **Price** – forecasts of domestic gas consumption are sensitive to projections of wholesale gas prices which contribute significantly to assumptions on structural and behavioural change and forecasts of domestic gas consumption. Projected wholesale gas prices are lower than forecast in the 2014 NGFR.
- **Residential, commercial and industrial** – forecasts of residential, commercial and industrial gas consumption are sensitive to long-range climate assumptions, and the data shows multi-year cycles of climate warming and cooling within a longer-term trend of climate warming.

Comparison with 2014 NGFR forecasts

The total gas consumption forecast in the 2015 NGFR is similar to that forecast in the 2014 NGFR (as shown in Figures 1 and 2), with differences at a state and sector level, explained in more detail in the full report.

Regional outlook for annual gas consumption

In the five-year outlook, different trends are projected:

- Annual gas consumption in Queensland is forecast to grow rapidly until 2019 during the ramp-up at the Gladstone LNG (GLNG), Queensland Curtis LNG (QCLNG), and Australia Pacific LNG (APLNG) projects.
- Annual consumption in the domestic markets is generally forecast to decline ahead of an improved long-term outlook. The initial decline is due to forecast short-term reductions in gas consumption by GPG and large industrial users.

Table 2 compares forecast annual growth rates for each state by market sector.

Table 2 Gas consumption annual change rates in states to 2020

State	Total	Residential & Commercial	Industrial	GPG	LNG
Queensland (incl. LNG)	22.3%	-0.2%	-3.7%	-22.0%	32.5%
Queensland (excl. LNG)	-9.2%	-0.2%	-3.7%	-22.0%	-
New South Wales	-3.1%	0.6%	<0.1%	-18.8%	-
Victoria	-1.1%	-0.3%	-2.6%	1.0%	-
Tasmania	0.4%	5.7%	0.2%	-100%	-
South Australia	-6.4%	-0.4%	-0.5%	-12.6%	-

Changing technologies

Total residential and commercial gas consumption is expected to remain flat over the next five years, with projected growth from population increase (forecast by ABS to increase by 7.8% by 2020[4]) offset by the effects of changes in residential dwelling preferences, energy efficiency savings, price changes, and switching from gas to electric appliances.

- With the exception of New South Wales and Tasmania, residential and commercial consumption is forecast to remain flat for the next five years. Growth in new connections is projected to be offset by a fall in consumption per dwelling.
- Gas penetration, or the proportion of total dwellings with a gas installation, is expected to increase. This is an established trend, with newer detached homes showing a greater propensity for a gas connection than older, established homes. The gas penetration rate is currently 46% for eastern and south-eastern Australia, compared to 45% in 2010. This NGFR forecasts a modest increase to 48% by 2035. Gas penetration varies widely, ranging from 10% in Queensland to 80% in Victoria.
- As dwelling preferences shift in favour of apartments and multi-unit developments, lower gas consumption and fewer gas appliance purchases are expected. This shift has been observed to slow gas penetration rates over the past five years. Inner-city apartments are increasingly all-electric, and have a smaller footprint.

  While new homes on the edge of Australian cities in growth corridors are often larger than typical older homes, six-star building standards are forecast to drive energy efficiency savings that offset some gas consumption increases. Energy efficiency savings from building and appliance improvements are forecast to reduce gas consumption projections by 0.3% (0.5 PJ) per annum on average to 2020.
- Gas to electric appliance switching is forecast to increase. Uptake of, and conversions to, solar hot water, and use of electric heat-pumps instead of gas heating, is expected to reduce consumption projections by 0.9% (1.7 PJ) per annum on average to 2020.

Restructuring of industry

State economies are expected to grow, and expected areas of growth for gas consumption include services and food/beverage manufacturing, especially food and dairy, driven by domestic population increases and anticipated North Asian and ASEAN free trade agreements.[5] These industries are currently assisted by the recent reduction in the AUD/USD exchange rate. Over the next five years, this growth is expected to offset continued restructuring of industry away from gas-intensive manufacturing.

[4] Australian Bureau of Statistics 2013, Population Projections, Australia, 2012 (base) to 2101, cat. No. 3222.0. The reference scenario used by AEMO corresponds to the Scenario B of the ABS projections.

[5] General: https://www.austrade.gov.au/Australian/Export/Free-Trade-Agreements/MAFTA;
The Centre for International Economics, "Economic Benefits of Australia's FTAs"; 2015; Prepared for Department of Foreign Affairs and Trade; https://dfat.gov.au/about-us/publications/Documents/economic-modelling-of-australias-north-asia-ftas.pdf;
Dairy Australia, "Trade Liberalisation"; http://www.dairyaustralia.com.au/Markets-and-statistics/Exports-and-trade/Trade-liberalisation.aspx
Pricewaterhouse Coopers, "The Australian Dairy Industry – the basics", 2011; prepared for The Australian Dairy Industry; http://www.pwc.com.au/industry/agribusiness/assets/australian-dairy-industry-nov11.pdf. Viewed 2 November 2015.

Maximum demand

- In the five years 2016–20, maximum daily demand in Australia is forecast to rise rapidly as Queensland's LNG facilities ramp up production.
- After 2020, maximum demand from the LNG, residential, commercial and industrial sectors is forecast to remain flat, and maximum demand for GPG is forecast to increase to supply electricity as supply from coal-fired generation is forecast to reduce.

Variations in domestic gas demand are mostly driven by heating and GPG. Forecasts of maximum demand for GPG are sensitive to assumptions on policy, environment, and market conditions. For most states, maximum daily demand occurs during the winter heating season. However, large variations in GPG output, driven by weather conditions or outages of coal-fired generation, can create a summer 'peak'.

Table 3 summarises maximum demand for each state, for each year from 2015 (forecast) to 2020, and then for 2035. All forecasts assume a winter peak. The table shows data for 1-in-2 year and 1-in-20 year peak day forecasts.[6]

Table 3 Maximum demand – total, all sectors (TJ/day)

	QLD (incl LNG)		QLD (excl LNG)		NSW		VIC		TAS		SA	
	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20
2015	1829.4	1836.7	491.4	498.6	570.5	601.5	1233.2	1341.9	20.1	25.0	241.9	248.3
2016	4325.8	4332.6	518.9	525.7	576.4	608.2	1245.5	1355.6	20.4	25.4	325.3	331.7
2017	4638.1	4644.8	487.2	493.9	574.7	607.2	1233.7	1344.0	20.8	25.8	292.7	299.2
2018	4735.1	4741.7	449.4	456.1	559.7	592.6	1192.3	1300.8	20.9	26.0	255.3	261.8
2019	4694.8	4700.8	409.1	415.1	547.8	581.3	1196.6	1305.2	21.2	26.4	233.1	239.5
2020	4704.8	4710.9	419.1	425.3	547.1	581.1	1192.3	1301.4	21.4	26.6	226.0	232.4
2035	4856.1	4862.7	597.0	603.6	723.2	763.9	1274.5	1391.7	22.6	28.0	310.3	317.1

[6] 1-in-2 year is equivalent to a 50% Probability of Exceedance (POE) forecast, and a 1-in-20 year forecast is equivalent to a 5% POE forecast.

CONTENTS

CHAPTER 1. ABOUT THE 2015 NGFR

1.1 National gas forecasts

The National Gas Forecasting Report (NGFR) provides independent gas consumption forecasts over a 20-year outlook period for each state in Australia's eastern and south-eastern interconnected gas markets.

These forecasts are a key input into AEMO's Gas Statement of Opportunities (GSOO), published in March each year. The GSOO uses gas consumption and LNG export forecasts in determining the adequacy of gas supplies and infrastructure in eastern and south-eastern Australia.

The forecasts explore three scenarios that reflect high, medium, and low gas consumption outlooks. The NGFR focuses mainly on the medium scenario, short-term outlook (2015–20). Data, trends, and drivers are also provided for the high and low scenarios, and across the medium-term (2020–25) and long-term (2025–35) outlook periods.

1.2 Scope and structure of report

This 2015 NGFR is structured to provide:

- Annual consumption forecasts – aggregated across all states, and summarised for each state. These forecasts are also broken down by sector – residential and commercial customers, industrial customers, gas consumption by gas-powered generation (GPG), and the gas demand from Queensland's liquefied natural gas (LNG) industry, domestically and for export markets.
- Maximum demand forecasts – presented on a similar basis to the annual consumption forecasts. Maximum demand forecasts provide a measure of peak daily consumption for each year in the 20-year outlook period.

The main sections of this report summarise aggregated forecasts with a discussion of the drivers of these forecasts and some key regional observations. More detailed state annual consumption and maximum demand forecasts are provided in the appendices of this report.

The full set of data and charts, including a complete set of results for the high, medium, and low scenarios, is provided on AEMO's website (see Table 4). This includes historical and forecast data, by market segment and for each state, so interested parties can undertake their own comparative analysis.

The following suite of NGFR resources is available on AEMO's web site:

http://www.aemo.com.au/Gas/Planning/Forecasting/National-Gas-Forecasting-Report

Table 4 Suite of 2015 NGFR resources

Resource	Description
National Gas Forecasting Report	This report.
NGFR Methodology Information Paper	Detail of forecasting approach.
NGFR Datafile	Input and output data, scenario detail and key assumptions.
Forecasting Dynamic Interface http://forecasting.aemo.com.au/	A web-based portal where users can view graphs and key results, apply their own filters and download the NGFR data.
Gas Price Consultancy	Forecast of wholesale gas prices prepared by Core Energy Group for AEMO.
Projections of Gas and Electricity Used in LNG	Forecast of electricity and gas consumption used by the LNG projects in Queensland. Prepared by Lewis Grey Advisory for AEMO.

1.3 Forecast scenarios

The forecasts are based on scenarios representing high, medium and low energy (gas and electricity) consumption from a centralised source (natural gas transmission pipelines and power system assets of the National Electricity Market (NEM)).[7]

The scenarios reflect differing economic and policy assumptions that affect residential and commercial consumption, large industrial consumption, LNG domestic and export consumption, and use of GPG in the NEM.

In addition, AEMO has consulted with most large industrial gas users on future consumption patterns, including risks to this consumption that are relevant to the modelled scenarios. This information includes major changes to industrial production methods, load closures, such as 'end-of-life' business operations, and major sectoral changes such as the closure of Australia's automotive manufacturing industry.

The terms high, medium, and low are used throughout the report to identify the scenarios (see Table 5).

Table 5 2015 NGFR modelling scenarios

Scenario name	Consumption from centralised sources	Type of consumer	Gas prices	Population	Business conditions for industrial consumption
High consumption	High	Low engagement	Low	ABS Series A	Good
Medium consumption	Medium	Highly engaged	Medium	ABS Series B	Medium
Low consumption	Low	Highly engaged	High	ABS Series C	Poor

Forecast uncertainties

There are four key areas of uncertainty in the forecasts[8]:

- **LNG** – forecasts of total gas consumption are sensitive to assumptions for LNG facilities, due to the scale of gas consumption by these facilities relative to domestic gas consumption, and there is as yet little operational data available to validate assumptions. AEMO is monitoring available data and engaging with LNG producers, and will update the forecasts if material changes are identified.
- **GPG** – forecasts of gas consumption by GPG are sensitive to a range of assumptions and inputs, including climate policy, wholesale gas prices, weather, electricity consumption and coal-fired generation. This has caused significant change in the GPG forecasts for this NGFR relative to 2014. AEMO will work with industry in 2016 to review this volatility and the methodology and scenario assumptions for GPG, with a view to updating the approach for the 2016 NGFR.
- **Price** – forecasts of domestic gas consumption are sensitive to projections of wholesale gas prices which contribute significantly to assumptions on structural and behavioural change leading to forecast short-term declines in domestic gas consumption. AEMO used pricing projections developed from published tariffs, public information, and advice on contract prices from expert advisors and industry stakeholders. Projected wholesale gas prices are lower than prices used for the 2014 NGFR.
- **Residential, commercial and industrial** – forecasts of gas consumption by residential, commercial and industrial are sensitive to long-range climate assumptions, and the data shows multi-year cycles of climate warming and cooling within a longer-term trend of climate warming. As an interim measure for the 2015 NGFR, AEMO has adopted a conservative assumption of a

[7] Available at:http://www.aemo.com.au/Electricity/Planning/~/media/Files/Other/forecasting/2014_Planning_and_Forecasting_Scenarios.ashx.
[8] Refer 2015 NGFR Methodology Information Paper for more information on how these factors have been used in modelling, and how AEMO has managed the risk of these uncertainties in its forecasts.

stable 'warm-year' trend based on climate data from 2000. In 2016, AEMO will complete a long-range climate study, validated by advice from the Bureau of Meteorology or similar agency, and will update long-run assumptions for the 2016 NGFR.

1.4 Key definitions

This section provides definitions of the most important commonly-used terms in this report.

Annual gas consumption refers to gas consumed over a calendar year, and can include residential and commercial consumption, industrial consumption, GPG consumption, or transmission and distribution losses. Gas used for LNG processing and exports is considered separately. Unless otherwise specified, annual consumption data excludes transmission losses.

Distribution losses refers to gas leakage and metering uncertainties in the distribution network. This is calculated as a percentage of total residential and commercial consumption and industrial consumption connected to the distribution networks.

Effective degree days (EDD) is a measure that combines a range of weather factors that affect energy demand.

Gas-powered generation (GPG) refers to generation plant producing electricity by using gas as a fuel for turbines, boilers, or engines. In the NGFR forecasts, this only includes GPG that is connected to the NEM. The GPG forecasts are based on AEMO's electricity market modelling results from the National Transmission Network Development Plan (NTNDP).

Industrial, also known as Tariff D, refers to users that generally consume more than 10 terajoules (TJ) of gas per year. Industrial consumption includes gas usage by industrial and large commercial users, and some GPG that is not connected to the NEM, for example, GPG around Mt Isa.

Liquefied natural gas (LNG) refers to natural gas that has been converted to liquid form.

Maximum demand (MD) refers to the highest daily demand occurring during the year. This can include residential and commercial demand, industrial demand, GPG demand, or distribution losses. Gas used for LNG production is considered separately. Unless otherwise specified, maximum demand includes transmission losses.

Per customer connection refers to the average consumption per residential and commercial gas connection. Expressing consumption on this basis largely removes the impact of population growth, and allows commentary about underlying consumer behaviour patterns.

Probability of Exceedance (POE) refers to the likelihood that a maximum demand forecast will be met or exceeded, reflecting the sensitivity of forecasts to changes in weather patterns in any given year. The 2015 NGFR provides these forecasts:

- **1-in-2** maximum demand, also known as a 50% POE, means the projection is expected to be exceeded, on average, one out of every two years (or 50% of the time).
- **1-in-20** maximum demand, also known as a 5% POE, means the projection is expected to be exceeded, on average, one out of every 20 years (or 5% of the time).

Residential and commercial, also known as Tariff V, refers to residential and small-to-medium-sized commercial users consuming less than 10 TJ of gas per year. Unless otherwise specified, historical residential and commercial data is not weather-corrected.

Transmission losses refers to gas that is unaccounted for or consumed for operational purposes (such as compressor fuel) when transported through high-pressure transmission pipelines to lower-pressure distribution networks. Transmission losses are calculated as a percentage of total residential and commercial, industrial, and GPG consumption, and distribution losses.

Winter refers to June to August and **summer** refers to December to February.

1.5 Improvements to the 2015 NGFR

This is the second NGFR produced by AEMO. Following the first NGFR in 2014, AEMO consulted widely with industry to seek improvements to the methods, assumptions and input data.

AEMO has updated the forecasts to account for a changed domestic and international context and respond to changes in key demand drivers such as business conditions for manufacturing, domestic and international gas prices, and the circumstances of particular gas-consuming industries and users.

Key improvements made in the 2015 NGFR include:

- Consultation with LNG producers, large industrial gas users, and the gas industry in general, to test and refine forecasting assumptions, methods and outcomes.
- Updated wholesale gas price projections, and revised gas costs for GPG.
- More detailed modelling of the residential and commercial sector, to improve insights on gas to electric appliance switching, energy efficiency, and changes to retail gas prices.
- Improvements in industrial consumption models to separate growth sectors such as the services industry and food/beverage manufacturing sectors.
- Modelling of new gas connection projections using dwelling construction and population forecasts.
- Calibration of weather models to longer-term trends.

CHAPTER 2. ANNUAL GAS CONSUMPTION

2.1 Overview of annual consumption forecasts

Key points

The Australian gas industry is experiencing a period of transformation over the next five years, and annual gas consumption is forecast to change in the following ways:

- The start-up of Queensland's LNG facilities is forecast to more than double total gas consumption in eastern and south-eastern Australia (compared to aggregate demand in 2014, before these projects began), and expected to link domestic wholesale gas prices to international markets.
- In the short term, projected growth in gas consumption from food, dairy and services, and expected generally improved business conditions for manufacturing, is forecast to be offset by continued restructuring of industry away from gas-intensive manufacturing, ahead of a longer-term improved outlook.
- Gas consumption (and electricity production) by GPG is forecast to reduce in the short term. Beyond five years, GPG gas consumption is forecast to rise to support electricity consumption and withdrawal of over 2,000 MW of coal-fired generation.
- Projected improvements to energy efficiency of buildings and appliances, including gas to electric appliance switching and a growing preference for living in apartments and multi-unit dwellings, are expected to contribute to residential and commercial consumption remaining flat, offsetting growth in gas consumption from projected population increases.

Comparing forecasts in the 2014 NGFR to the 2015 NGFR across different scenarios:

- Since the 2014 NGFR was published, small adjustments in the medium and low scenarios result from changes in the domestic and international context. Long-term forecasts are marginally higher than the 2014 NGFR due to projected emerging growth sectors in industrial consumption, dominating long-term trends. Population is the main driver of forecast growth in this sector.
- In the high scenario, differences to the 2014 NGFR forecasts are the result of:
  - Changes to the assumed timing of the seventh LNG train coming online (the 2014 NGFR assumed this would occur by 2020, coincident with full LNG production, while the 2015 NGFR provides further insights into the influence on gas consumption of changes in LNG timelines).
  - Assumptions about generation retirements and carbon abatement policy settings resulting in a forecast rapid expansion in GPG after 2020.
  - Excluding LNG, the high scenario for NGFR 2015 is 1% higher, on an average annual basis, than the 2014 NGFR (see Figure 3), driven by high scenario assumptions for GPG.

Key changes to input assumptions since the 2014 NGFR, related to price, weather, new connections, and economic assumptions, are explained in detail in the relevant sector commentary sections below.

Figures 3 and 4 show actual annual gas consumption from 2010, and forecast annual gas consumption under the high, medium and low scenarios for the 20-year outlook period, including and excluding LNG.

Figure 3 Annual gas consumption, PJ

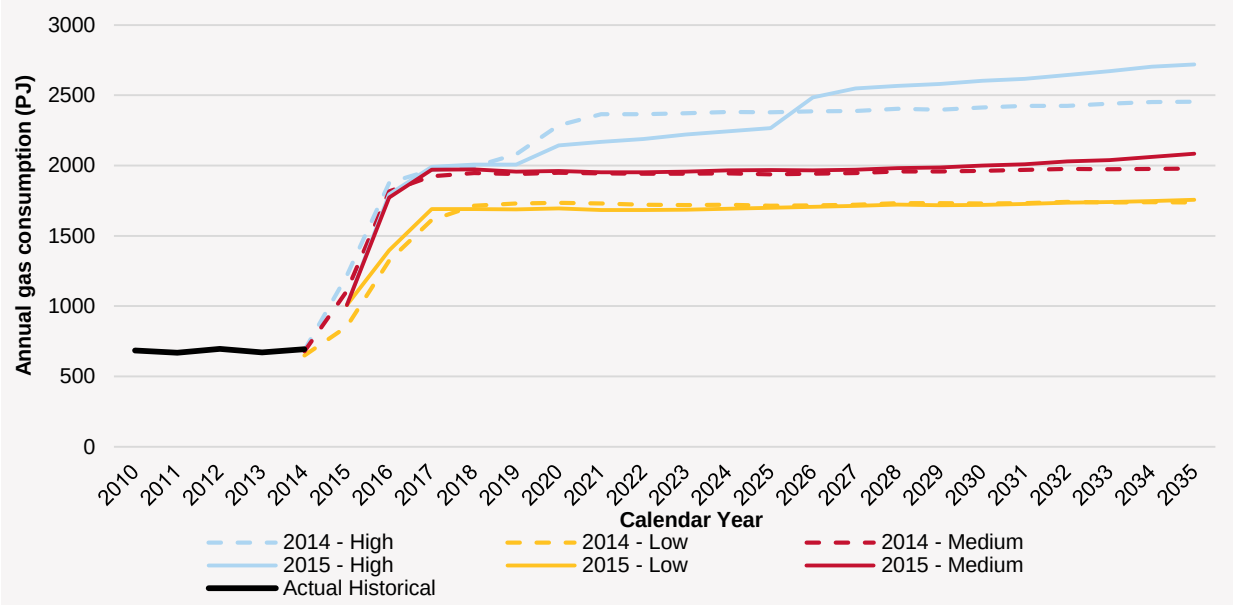


Figure 4 Annual gas consumption, PJ, excluding LNG

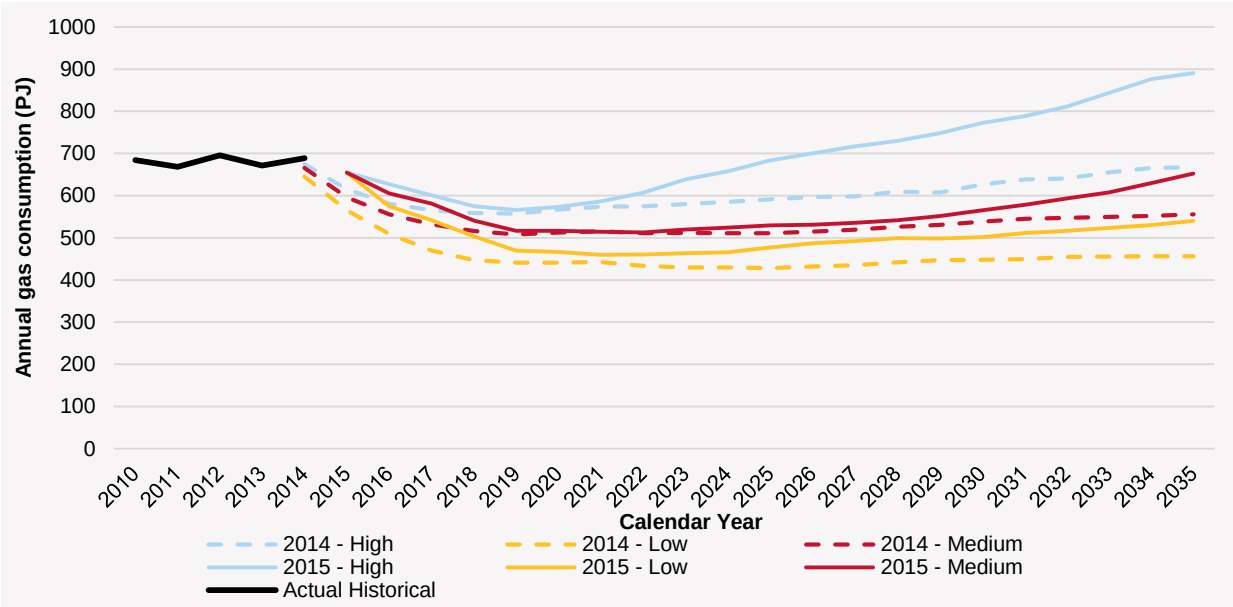


Table 6 Comparison of total annual consumption (including LNG) by scenario, 2010−35

	2014 NGFR		2015 NGFR	
	Total Change (PJ)	Average annual rate of change	Total Change (PJ)	Average annual rate of change
Low	684.0 to 1737.8	3.8% increase	684.0 to 1756.1	3.8% increase
Medium	684.0 to 1978.8	4.3% increase	684.0 to 2084.0	4.6% increase
High	684.0 to 2454.4	5.24% increase	684.0 to 2719.2	5.7% increase

Table 7 Comparison of total annual consumption (excluding LNG) by scenario, 2010−35

	2014 NGFR		2015 NGFR	
	Total Change (PJ)	Average annual rate of change	Total Change (PJ)	Average annual rate of change
Low	684.0 to 456.69	1.6% decrease	684.0 to 539.9	0.9% decrease
Medium	684.0 to 555.9	0.8% decrease	684.0 to 652.7	0.2% decrease
High	684.0 to 666.87	0.1% decrease	684.0 to 891.0	1.1% decrease

Table 8 compares forecasts from the 2014 NGFR to the 2015 NGFR for each sector. Details on drivers for changes in forecasts are in Sections 2.2 to 2.5.

Key differences to the 2014 forecasts are:

- The 2015 forecast of residential and commercial consumption is marginally higher, due to changed price and climate assumptions.
- The 2015 forecast industrial consumption decreases less, due to projections of stabilisation in business conditions for manufacturing, and growth in the services and food/beverage manufacturing sectors.
- The 2015 forecast of GPG is higher, due to changed fuel costs and generation investment and retirement assumptions for coal-fired generators.

Table 8 Sector comparisons between the 2014 NGFR and 2015 NGFR, medium scenario, 2010−35

Sector	2014 NGFR		2015 NGFR	
	Total Change (PJ)	Average annual rate of change	Total Change (PJ)	Average annual rate of change
Residential and commercial	180.7 to 201.5	0.4% increase	180.7 to 200.9	0.4% increase
Industrial	291 to 225.4	1.0% decrease	291 to 267.4	0.3% decrease
GPG	212.3 to 128.8	2.0% decrease	212.3 to 184.5	0.6% decrease
Total Losses	17.3 to 15.6	0.4% decrease	17.3 to 17.2	< 0.1% decrease

2.2 LNG consumption forecasts

About this sector

The commencement of LNG exports from Queensland in January 2015 has continued a transformation of Australia's gas industry, as international demand for Australia's gas puts the industry on a pathway to more than double total consumption in eastern and south-eastern Australia by 2020 (compared to aggregate consumption in 2014, before the Queensland projects began).

Key points

- Since the 2014 NGFR, Queensland's LNG exports have commenced. Domestic exports are rapidly increasing and annualised exports already exceed the entire annual demand of the domestic gas market.
- The low and medium scenario forecasts are not substantially changed since NGFR 2014. The high scenario examines the effect of later timing of a seventh LNG train. The low scenario examines the effect of LNG exports not increasing above take or pay levels.

Forecasts

Figure 5 shows 2015 NGFR LNG forecasts, and compares them with forecasts in the 2014 NGFR for low, medium and high scenarios. Table 9 summarises forecast trends and drivers in LNG consumption over the short, medium, and long term.

All six trains are expected to be operational by mid-2016. Based on current plans, they will be operating at capacity by 2020, at which time total gas consumption per annum is projected to be over 1,400 petajoules (PJ) and expected to maintain this level of consumption over the forecast period. This consumption will be supported by global demand for export gas.

Figure 5 Comparison of high, medium, and low scenario forecasts for LNG in eastern and south-eastern Australia

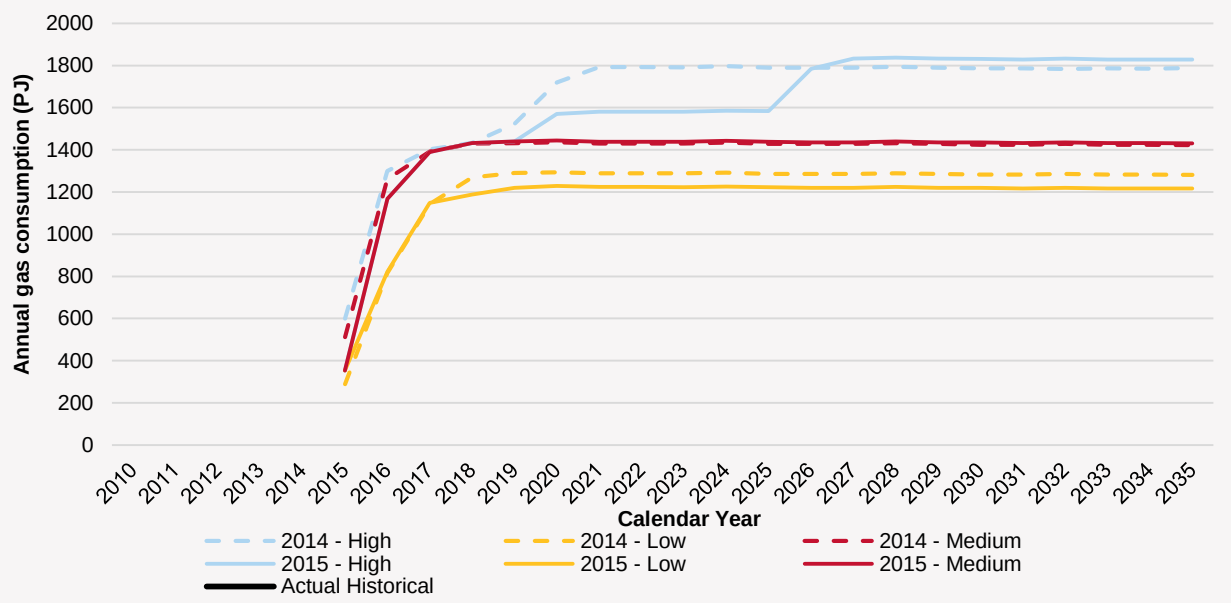


Table 9 LNG consumption over the short, medium, and long term

Timeframe	Forecast (PJ)	Average annual rate of change	Drivers
Short term (2015–20)	353.8 to 1444.3	32.5% increase	The three LNG projects (QCLNG, APLNG and GLNG) are expected to export gas from Curtis Island. All six trains are expected be in operation in the first half of 2016.
Medium term (2020–25)	1444.3 to 1437.8	0.1% decrease	All six trains are projected to continue operating with no new trains or plants expected in the medium scenario.
Long term (2025–35)	1437.8 to 1431.3	0.1% decrease	All six trains are projected to continue operating with no new trains or plants expected in the medium scenario.

Discussion – key trends and drivers

The commencement of LNG exports

Since the 2014 NGFR was published in December 2014, LNG exports have commenced, starting a rapid expansion in the demand for Australian's gas resources.

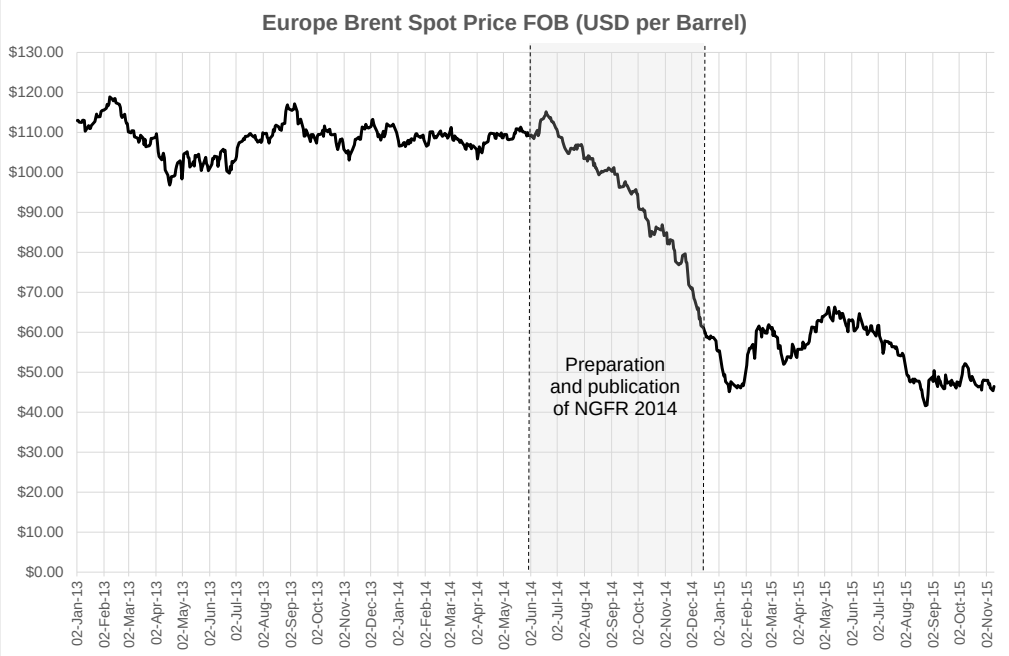
- QCLNG began exports from its first LNG train on Curtis Island, near Gladstone, in January 2015. This train was declared "commercial" (delivering LNG cargoes according to contract) and QCLNG's second train became operational in July.

- Gladstone LNG (GLNG) started LNG production in late September 2015, and APLNG is scheduled to follow in the final quarter of 2015. Both these projects' second trains are expected to start up in the first half of 2016.

LNG investment and oil price dynamics

While LNG sale contracts are negotiated confidentially, it is understood that contracts are linked to the price of Japanese customs-cleared crude oil (JCC), which reflects the average price of crude oil imported into Japan and in turn is highly correlated with the lagged price of Brent oil.[9] Since 2014, Brent oil prices have dropped (see Figure 6).

Figure 6 Historic oil prices, Brent spot FOB



While AEMO has not significantly changed its medium and low LNG consumption scenarios in the light of these changes in price dynamics, it has updated some assumptions:

- The low scenario examines the effect if LNG consumption was to reduce to take-or-pay contract levels, approximated by 85% of demand in the medium scenario.
- The high scenario examines the effect of a seventh LNG train being five years later. This is a major difference in the high scenario compared to the 2014 NGFR. Until this seventh train is operational, the high scenario assumes current operations deliver at 110% of the medium scenario, in recognition of potential for efficiencies in production and delivery.

LNG and oil-linked domestic gas prices

In the retail price projections used in the models for domestic gas demand forecasts, AEMO assumes a transition from known domestic contract prices for conventional gas supply to oil-linked prices, and similarly for the fuel prices of GPG.

AEMO's model assumes that gas producers can all access the export market and derive the export value less a fixed cost of delivery (including liquefaction), and therefore domestic purchasers must be prepared to pay this value. In practice, contracts are confidential and the value of gas to an exporter

[9] http://www.rba.gov.au/publications/bulletin/2015/mar/pdf/bu-0315-4.pdf.

can vary over a wide range, from levels close to the cost of production, to a short-run export netback value (export value less short-run liquefaction and delivery costs).

The 2015 NGFR price projections use Reserve Bank of Australia oil price forecasts from its 2015 March Quarter Bulletin.[10] From 2017, projections assume a Brent Oil price of US$70/barrel, rising to US$80/barrel by 2020, and fixed through 2035. AEMO has assumed the AUD to USD exchange rate of 0.72 to 1. Forecasts are assumed to link with Cooper Basin Joint Venture (CBJV) and Otway basin contracts prices by 2017, and remaining Gippsland Basin Joint Venture (GBJV) contracts by 2018.

2.3 GPG consumption forecasts

About this sector

GPG is used to produce electricity for the NEM. This section forecasts the amount of gas these generators would consume to produce electricity supplying the NEM in the next 20 years, over high, medium and low scenarios.

Key points

- From 2014 to 2015, actual gas consumption for electricity generation fell from 220 PJ to 175 PJ. This reduction was driven by increasing gas prices and the removal of the carbon price.
- In the next five years to 2020, GPG gas consumption is forecast to drop by 60%, from 175 PJ in 2015 to 69.3 PJ.
- Gas consumption by GPG is forecast to increase to 184.5 PJ by 2035 to support electricity consumption and the withdrawal of over 2,000 MW of coal-fired generation. As coal-fired generation is withdrawn, GPG is increasingly relied on to generate electricity in the NEM.

Forecasts

Gas consumption under the medium scenario is forecast to decrease over the next five years, and then recover from 2020 to the end of the outlook period, similar to the trends observed in the 2014 NGFR forecasts.

In the short term, the consumption is forecast to reduce from 175 PJ in 2015 to 69.3 PJ in 2020, due to a number of factors:

- Between 3,850 MW and 4,920 MW of additional wind and biomass generation capacity is forecast to be installed by 2020–21, incentivised through the currently legislated Large-scale Renewable Energy Target (LRET).[11]
- Projected average wholesale gas prices increasing from $5.46/GJ to $9.28/GJ.[12]
- The expiry of existing gas supply agreements, exposing new contracts to projected rising prices.
- The announced closure of the 171 MW gas-powered Smithfield Power Station in 2018[13], which consumes about 8.0 PJ to 8.6 PJ per year.

In the medium term from 2020–25, GPG consumption is projected to increase to 86.1 PJ. With the retirement of the 2,000 MW coal-fired Liddell Power Station in New South Wales in 2022, output from existing gas and coal-fired generation is forecast to increase to meet electricity demand.

In the long term to 2035, GPG consumption is forecast to increase to 184.5 PJ per annum, as there is an opportunity for new GPG peaking capacity to reliably meet electricity demand and manage the intermittency of renewable generation. Under the scenarios modelled, no new coal-fired generation was

[10] http://www.rba.gov.au/publications/bulletin/2015/mar/pdf/bu-0315-4.pdf.
[11] As reported in AEMO's National Transmission Network Development Plan (NTNDP). Available http://aemo.com.au/Electricity/Planning/National-Transmission-Network-Development-Plan.
[12] This value represents the straight average of five reference point gas price representing each state.
[13] Information on generation capacity mix, including retirements, can be found on AEMO's Generation Information page: http://aemo.com.au/Electricity/Planning/Related-Information/Generation-Information.

projected for the NEM. Therefore, under LRET and Direct Action policy, all new large-scale capacity installed is projected to be wind and gas-powered generation.

Table 10 summarises drivers for the medium scenario, over the short, medium and long term.

Table 10 GPG gas consumption over the short, medium, and long term for the medium scenario

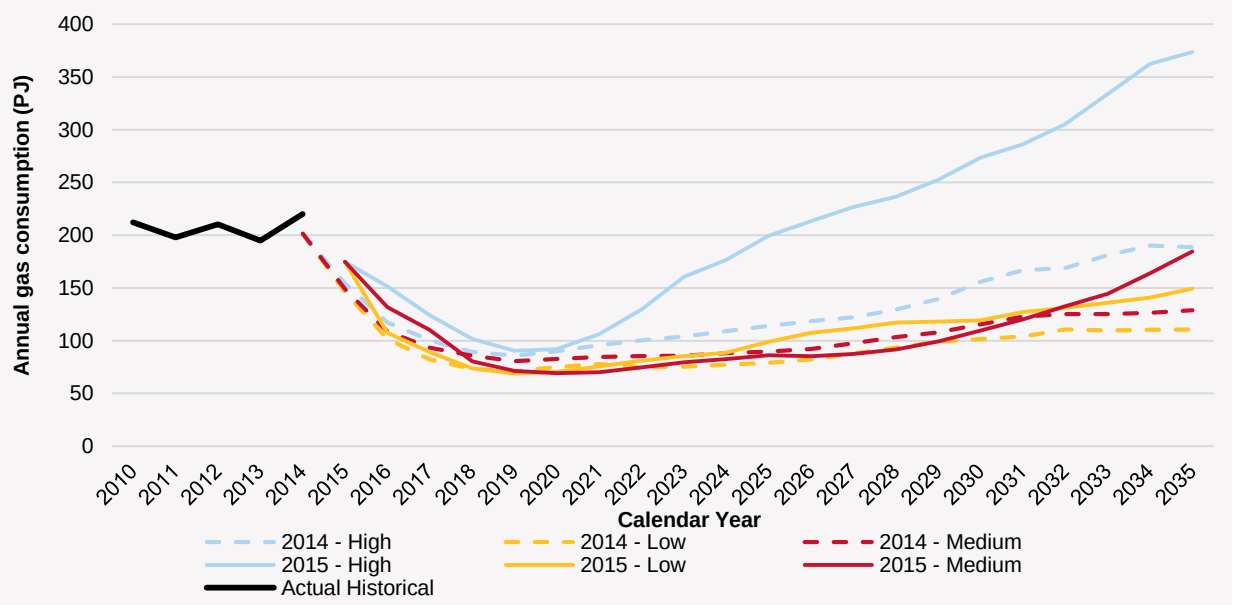
Timeframe	Forecast (PJ)	Average annual rate of change	Drivers
Short term (2015–20)	175 to 69.3	16.9% decrease	Rising gas prices, expiring gas contracts, closure of Smithfield, and uptake of renewable energy.
Medium term (2020–25)	69.3 to 86.1	4.4% increase	In the absence of new carbon abatement policy, investment in renewable generation plateaus, and retirement of the Liddell power station drives increased generation from GPG to supply increasing electricity consumption.
Long term (2025–35)	86.1 to 184.5	7.9% increase	Continued increase in GPG generation with continued investment in additional GPG capacity is forecast to meet increased demand in the NEM.

The key differences between forecasts for the low, medium, and high scenarios are primarily attributed to differing electricity operational consumption profiles:

- The low scenario forecasts a high uptake of rooftop PV, combined with a high uptake of battery storage. There is also a continued uptake of new renewable generation in the short term, driven by the currently legislated LRET. Consequently, in the low scenario little new GPG is seen during the outlook period. However, the low operational demand in this scenario drives further coal-fired withdrawals, with GPG operating more often in replacement. This has the impact of GPG consumption in the low scenario increasing above that of the medium scenario from 2020 to 2031. Also contributing to this outcome is less additional renewable generation being installed under the low scenario.
- For the high scenario, the withdrawal of the 2,000 MW coal-fired Liddell Power Station in New South Wales in 2022 has a more pronounced impact. With stronger growth in electricity operational demand, new generation investment is required earlier to meet both maximum demand and consumption requirements. Under the high scenario, new gas-powered intermediate and peaking generation is needed, leading to higher forecasts of GPG consumption.

Figure 7 shows the variation between the high, medium and low scenario forecasts for GPG, including a comparison of the three scenarios published in the 2014 NGFR.

Figure 7 Comparison of high, medium, and low scenario forecasts for GPG in eastern and south-eastern Australia



The major differences between medium scenario forecasts used in the 2015 NGFR and 2014 NGFR are:

- For the first three years of the outlook period, the 2015 forecast is higher, due to lower gas prices than were projected in the 2014 NGFR, and the closure of coal-fired Northern Power Station in March 2016 (announced in 2015, since the 2014 NGFR was published).
- Smithfield GPG, with an estimated gas consumption from 8.0 to 8.6 PJ per year, is now expected to retire in 2018. This causes a steeper ramp-down than was forecast in the 2014 NGFR.[14, 15]
- Gas consumption for electricity generation in Tasmania is forecast to be almost zero in 2016 and zero beyond 2017, following the announced retirement of 208 MW of GPG at Tamar Valley combined cycle gas turbine and 120 MW of GPG at Bell Bay Three Power Station (45 MW of which has already been withdrawn).[16] Although Tamar Valley Peaking Plant will return to service in June 2016, modelling suggests that average rainfall inflows and hydro capacity is sufficient to meet the state's electric energy needs.[17] However, in a drought period this plant may be required to meet electricity demand.
- The last few years of the outlook period have a higher level of forecast GPG consumption compared to the 2014 forecasts, due to the 2015 NGFR assumption that no new coal-fired generation would be installed in the NEM. Additional levels of GPG are therefore required in that scenario to meet increasing electricity demand.

In the high scenario, gas consumption is almost double last year's forecast by 2035, largely due to the announced withdrawal of the 2,000 MW coal-fired Liddell Power Station. This withdrawal has a more pronounced impact under this scenario as higher electricity consumption is assumed.

Discussion – key trends and drivers

Forecasts of GPG consumption are sensitive to a range of assumptions. The key assumptions considered are discussed below.

[14] http://www.aemo.com.au/Electricity/Planning/Electricity-Statement-of-Opportunities.
[15] http://www.aemo.com.au/Electricity/Planning/Related-Information/Generation-Information.
[16] http://ww.aemo.com.au/Electricity/Planning/Electricity-Statement-of-Opportunities.
[17] http://www.aemo.com.au/Electricity/Planning/Electricity-Statement-of-Opportunities.

Gas prices and gas supply agreements

Gas prices are projected to rise in the short term (by 2020) under the medium scenario, from about $5.46/GJ to about $9.28/GJ. GPG with existing gas supply agreements may increasingly choose to sell their gas into the spot market rather than use the gas to generate electricity. While the gas price remains high, GPG consumption is therefore forecast to fall.

Additionally, existing gas contracts are also expected to expire, leaving possible new gas supply agreements exposed to rising gas prices. These gas price projections are consistent with those used in the other gas sectors and based on the NTNDP.[18]

Renewable Energy Target and climate change policy

In an oversupplied market, new renewable generation displaces GPG from the electricity dispatch merit order. The LRET, which targets 33,000 GWh of large-scale renewable generation by 2020, strongly drives the installation of new renewable generation capacity. The Small-scale Renewable Energy Scheme (SRES) contributes to the lowering of electricity demand by driving an increase in rooftop PV.

Australia's Paris 2015[19] commitment is to reduce greenhouse gas emissions by between 26% and 28% below 2005 levels by 2030, and state governments are targeting increasing levels of renewable generation, but the instruments to achieve these targets are yet to be determined. Depending how this is developed, this could have a material impact on GPG forecasts in the long term.

Retirements

AEMO's 2015 Electricity Statement of Opportunities (ESOO) reported that 1,078 MW of capacity has been withdrawn since 2014, and a further 3,473 MW of capacity has been announced to withdraw over the next 10 years. These withdrawals are taken into account in the GPG forecasts. The withdrawals that impact on GPG are shown in Table 11.

Table 11 Announced withdrawals from the NEM

Date	Power station	Capacity withdrawn	Impact on GPG demand
2015	Anglesea Power Station (coal)	156 MW	Slightly increases forecast GPG annual consumption.
2016	Northern Power Station (coal)	546 MW	This withdrawal drives the South Australian GPG starting point forecast higher. This is expected to last until 2018 when new renewable energy is expected to displace some GPG's market share.
2017	Bell Bay Three Power Station (GPG)	75 MW	Bell Bay Three remains in service in Tasmania until 2017, and until retirement is projected to only generate during possible tight supply demand conditions.
2018	Smithfield Power Station (GPG)	171 MW	This retirement will lower gas consumption in New South Wales by about 8.6 PJ per year.
2022	Liddell Power Station (coal)	2,000 MW	This retirement in New South Wales leads to an increase in forecast gas consumption from 2022. Existing GPG will increase generation, and there is the opportunity for new GPG to replace the Liddell capacity. This is most notable in the high scenario.
2017	Torrens Island Power Station A (GPG)	480 MW	As TIPS A consumes significantly less gas than other GPG in South Australia, its exit does not materially impact gas forecasts.

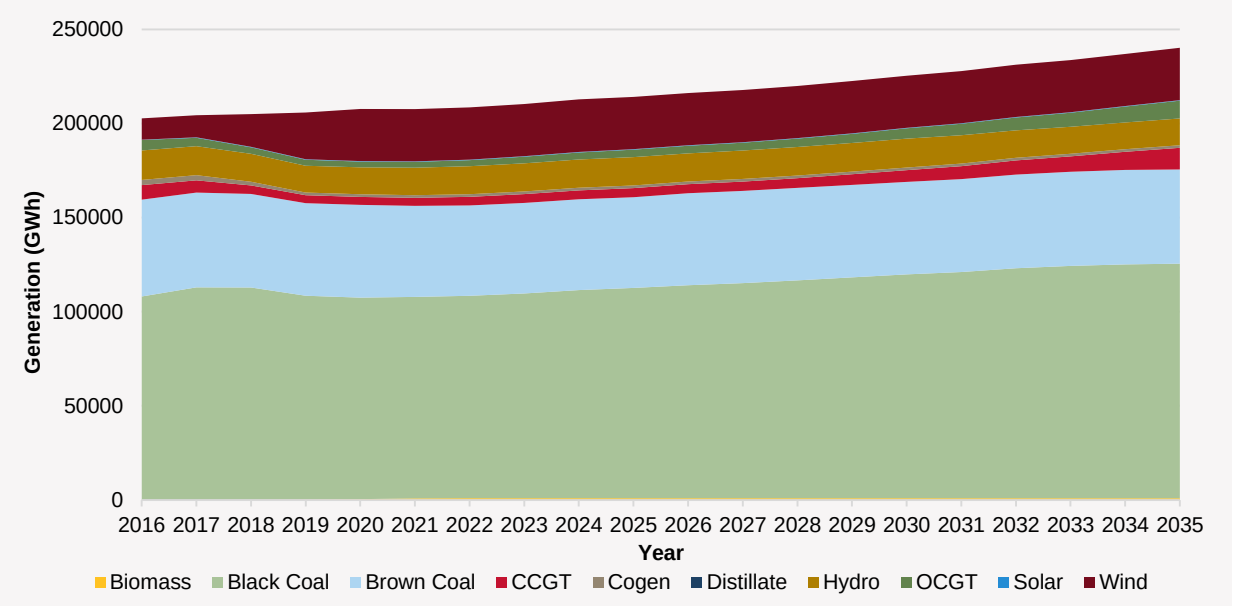
Generation Mix

The forecast change in generation mix under the medium scenario is shown in Figure 8, demonstrating the effect of the announced withdrawals of generation, coupled with additional wind generation driven by the LRET. The reduction of levels of spare generation capacity in the electricity market, as reported

[18] http://www.aemo.com.au/Electricity/Planning/National-Transmission-Network-Development-Plan.Viewed 17 November 2015.
[19] For the 21st Conference of the Parties for the United Nations Framework Convention on Climate Change.

in the 2015 ESOO, creates the opportunity for the existing GPG fleet to increase generation, and for new generation investment, in particular in gas and wind technologies. The withdrawal of coal-fired generation from the NEM also creates opportunities for new GPG investment.

Figure 8 Generation mix for medium scenario



2.4 Industrial consumption forecasts (excluding LNG)

About this sector

Industrial consumption, also known as Tariff D consumption, is defined as consumption by customers that consume more than 10 TJ/year and have their meter read daily. Typical loads include small and large manufacturing businesses, as well as large commercial loads such as shopping centres.

Key points

- Over the next five years, although state economies are expected to grow, industrial sector gas consumption is forecast to fall on average 2.3% annually, mainly due to the circumstances of large gas users, and the expected continued restructuring away from gas-intensive manufacturing. Projected declines in heavy industry offset forecast growth in gas consumption in the services sector, and in food and beverage manufacturing.
- Gas consumption by industrial gas users is forecast to reduce in response to the projected change in gas prices over the next five years.
- Beyond 2020, moderate growth in annual consumption is forecast, attributed to a growing population and an assumption of moderate business conditions for manufacturing.

Forecasts

From 2010 to 2014, industrial sector consumption declined in all states except Queensland. Driven primarily by Queensland's industrial sector, total industrial consumption across eastern and south-eastern states increased from 291.0 PJ to 297.3 PJ in this period. The longer-term historical trend of decreasing industrial consumption is projected to continue in the short term.

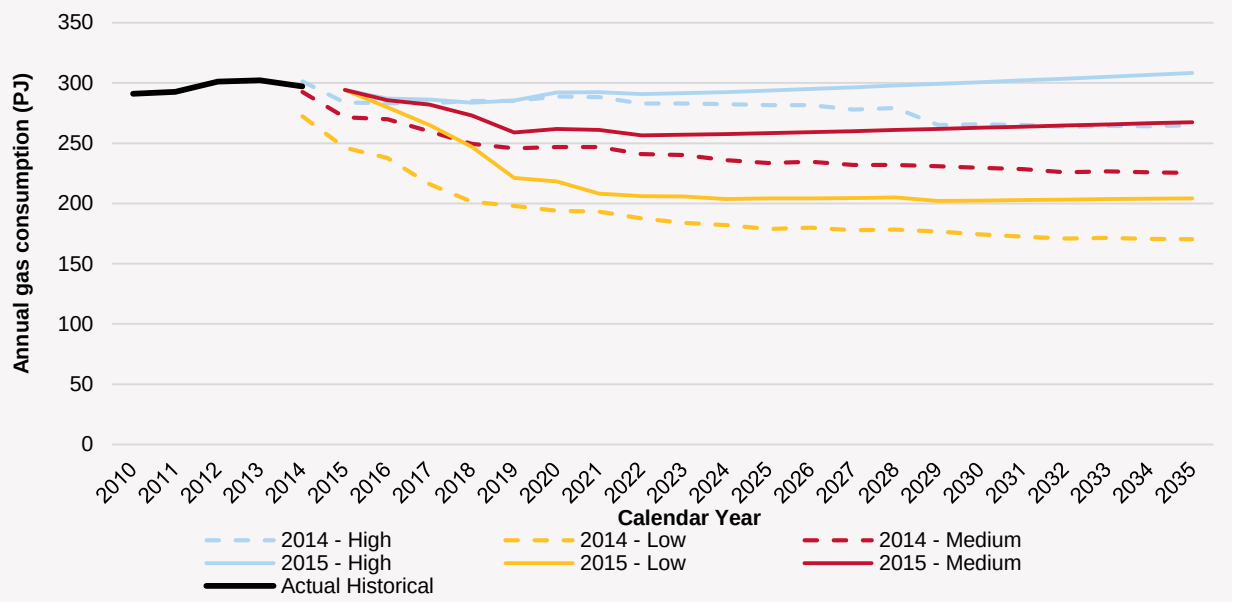
Table 12 summarises the forecast trends and drivers in industrial consumption over the short, medium, and long term.

Figure 9 shows 2015 NGFR industrial sector forecasts, and compares them with those in the 2014 NGFR, for low, medium and high scenarios. Forecasts in the 2015 NGFR show less decline in later years, due to improved modelling of growth sectors for gas consumption.

Table 12 Industrial consumption over the short, medium, and long term

Timeframe	Forecast (PJ)	Average annual rate of change	Drivers
Short term (2015–20)	294.3 to 261.9	2.3% decrease	Forecast industrial closures in manufacturing (including automotive vehicle manufacturing) and other adjustments based on advice from large industrial gas users. Response to high gas prices and other factors resulting in forecast short term decrease in consumption.
Medium term (2020–25)	261.9 to 258.4	0.3% decrease	Forecast decrease in manufacturing sectors in response to high gas prices and other factors offset by growth from food and beverage manufacturing and services sectors, resulting in a forecast marginal decrease in overall gas consumption in the medium term.
Long term (2025–35)	258.4 to 267.4	0.3% increase	Forecast stabilisation of the manufacturing sector and growth in food and beverage and services sector, resulting in forecast of increasing gas consumption.

Figure 9 Comparison of high, medium, and low scenario forecasts for the industrial sector in eastern and south-eastern Australia



Discussion – key trends and drivers

Continued economic restructuring

The manufacturing sector is reported to have been declining over the last few decades due to structural changes in the Australian economy.[20] Economic changes, from the 2008 global financial crisis, oil and commodity price shocks, and competition from increasingly integrated world markets, have coincided with a reduction in consumption by gas-intensive manufacturing.

[20] M. Emmery, "Australian Manufacturing: A Brief History of Industry Policy and Trade Liberalisation," Parliament of Australia, Research Paper 7 1999–2000 (1999). Available: http://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/rp/rp9900. Viewed: 12 November 2015.

At the same time, the services sector (which is relatively less gas-intensive) has grown, with gas consumption growing particularly in administrative services, health services and financial services.[21] Another growth sector for gas consumption has been food and beverage manufacturing (dairy, processed meat and seafood).[22] These sectors are expected to become more competitive, driven by trade liberalisation with North Asian economies as well as a depreciation in the Australian dollar[23], resulting in continuing growth in demand. Domestic food and beverage sector demand is also driven by population growth.

The combined effect of these changes has been an overall declining trend in gas consumption, except in Queensland (4.8% average annual increase from 2010 to 2014).

As a result of economic restructuring, the dynamics of how gas is used in industrial consumption are changing. Manufacturing mainly uses gas as an input in production processes, where in the more labour-intensive service sectors, heating load makes up a significant portion (17%) of total gas consumption. Consumption trends are projected to be driven by these changes:

- Short-term (0–5 years) – the economy is assumed to continue the transition from gas-intensive sectors to less gas-intensive sectors, driven by market forces and other factors.
- Medium Term (5–10 years) – manufacturing sectors are assumed to stabilise. Services and food and beverage sectors are forecast to grow, offsetting some significant anticipated operational changes for large industrial loads.
- Long Term (10–20 years) – manufacturing sectors are assumed to stabilise while services and food and beverage sectors are forecast to continue growing.

Supply and price uncertainty

In the five years to 2020, AEMO forecasts apply projected increases in retail gas prices (before inflation) for industrial customers ranging from 4.6% per annum (average) for New South Wales to 6.2% per annum (average) for Queensland.

These projected price changes result in the forecast of total annual consumption by the industrial sector in the eastern and south-eastern states in 2020 being 10.5% (31 PJ) lower than it would otherwise be.

AEMO interviewed over 50 of the largest industrial gas users across eastern and south-eastern Australia about future consumption expectations, underlying contract positions, gas supply certainty, and external business risks.

Generally, supply security was a long-term concern for industrial customers. AEMO found that most customers have entered into gas supply contracts for 2016 and 2017, ensuring gas supply in the short term. At time of interview, most customers had not started to negotiate for their gas supply for 2018 and beyond. Those that had begun negotiations reported difficulties in obtaining offers at historic prices. Some others, particularly in Queensland, reported difficulties in receiving tenders for their full demand requirements.

Although price offers in 2015 are reported to be lower than those offered in 2014, prices are still higher than historical contracts, and the reduction in price offers has often coincided with a tightening of contract terms, both take-or-pay quotas and Maximum Daily Quantity flexibility. With further price rises expected, customers have reported opting for shorter contract terms as they wait to see where the long-term price settles. Beyond 2016, only a small proportion of customers, most in Queensland, are expected to be on legacy contracts of $4–5/GJ.

AEMO was not informed of any potential closures which were not included in the 2014 NGFR, but a number of customers, for whom gas is a large cost of their business, reported their concern over projected rises in gas prices.

[21] Connolly & Lewis, "Structural Change in the Australian Economy, Reserve Bank of Australia, September Quarter 2010 Bulletin Report (2010). Available: http://www.rba.gov.au/publications/bulletin/2010/sep/1.html. Viewed: 10 November 2015.

[22] Pricewaterhouse Coopers, "The Australian Dairy Industry – the basics", 2011; prepared for The Australian Dairy Industry. Available: http://www.pwc.com.au/industry/agribusiness/assets/australian-dairy-industry-nov11.pdf. Viewed: 2 November 2015.

[23] The Centre for International Economics, "Economic Benefits of Australia's FTAs"; 2015; Prepared for Department of Foreign Affairs and Trade. Available: https://dfat.gov.au/about-us/publications/Documents/economic-modelling-of-australias-north-asia-ftas.pdf. Viewed: 2 November 2015.

Some industrial customers reported they are optimising their energy and fuel strategies to reduce their exposure to gas, including through:

- Fuel substitution and energy efficiency programs, with some returns on investment already realised.
- Switching off on-site cogeneration plants, as importing electricity has become a more cost-effective option.
- Diversifying gas procurement strategies. Many reported efforts to contract directly with producers, or to support new ventures such as Strike Energy's venture in the Southern Cooper Basin.

Automotive vehicle manufacturing

Closures of automotive vehicle manufacturing are expected to continue with the announced exits of GM Holden and Toyota by 2017–18.[24] AEMO incorporates the impact of this trend into the forecast model as a post-model adjustment. The total impact is estimated to be 2.8 PJ of consumption, predominantly in Victoria and South Australia.

Commercial heating

Continued economic restructuring and growth in the services sector has led to heating load becoming an increasing component of industrial gas consumption. Also, some large commercial customers that are sensitive to weather variations, such as retail shops, fall in the small industrial load category. Heating load comprises 2.8 % of total gas consumption forecast for the industrial sector. For this reason, AEMO has included a commercial heating trend in the industrial model.

Fuel switching

AEMO is investigating the potential impact of commercial fuel switching on gas demand. Initial investigations, based on information from industrial and commercial customers, show that rising gas prices have prompted customers to reconsider their fuel options, and fuel switching from gas to electricity is a downside risk for future gas consumption. This work is only at initial stages and AEMO plans to conduct a more detailed analysis for the 2016 NGFR.

For many interviewees, the forecast rise in gas prices has prompted a review of alternate fuel sources for either heat or energy. Some customers reduced their gas consumption when the costs of switching were low, for example, by reducing cogeneration and purchasing electricity. Where significant investment is required, a number of customers have reported committing, or completing, upgrades or changes to their equipment, with others reporting they are considering fuel switching as part of their gas price rise mitigation strategy.

2.5 Residential and commercial consumption forecasts

About this sector

Residential and commercial consumption, also known as Tariff V consumption, is defined as consumption by network customers who are billed on a volume basis. These customers typically have their meter read once every two months, and consume less than 10 TJ/year. They include households and small commercial businesses, such as restaurants and retail stores.

There are 4.1 million residential and commercial gas customers in the states covered by the NGFR. This is expected to increase to 5.6 million customers by 2035.

In 2015, the residential and commercial sector represented 18.5% of total consumption. By 2020, this is forecast to reduce to 9.5%, due to expected growth in consumption for LNG production.

[24] ABC News, "Toyota to close: Thousands of jobs to go as carmaker closes Australian plants by 2017" (2014). Available: http://www.abc.net.au/news/2014-02-10/toyota-to-pull-out-of-australia-sources/5250114. Viewed: 12 November 2015.

Key points

- Annual consumption is forecast to remain flat for the next five years, then moderate growth is forecast.
- Increasing population is forecast to be a growth driver for gas consumption, offset partly by factors such as improved energy efficiency of appliances and buildings, gas to electric appliance switching, dwelling preference changes in favour of apartments and multi-unit housing, and expected changes in customer behaviours in response to projected changes in prices.

Forecasts

Figure 10 shows 2015 NGFR residential and commercial sector forecasts, and compares them with those in the 2014 NGFR, for low, medium and high scenarios.

The 2015 NGFR forecasts start at a higher level than 2014, due mainly to a change to the methodology that reconciles the forecast to long-run weather trends compared to actuals for record warm winters in 2013 and 2014. Other differences are explained in the discussion section below.

Table 13 summarises the trends and drivers in residential and commercial consumption over the short, medium, and long term.

Figure 10 Comparison of high, medium, and low scenario forecasts for the residential and commercial sector in eastern and south-eastern Australia

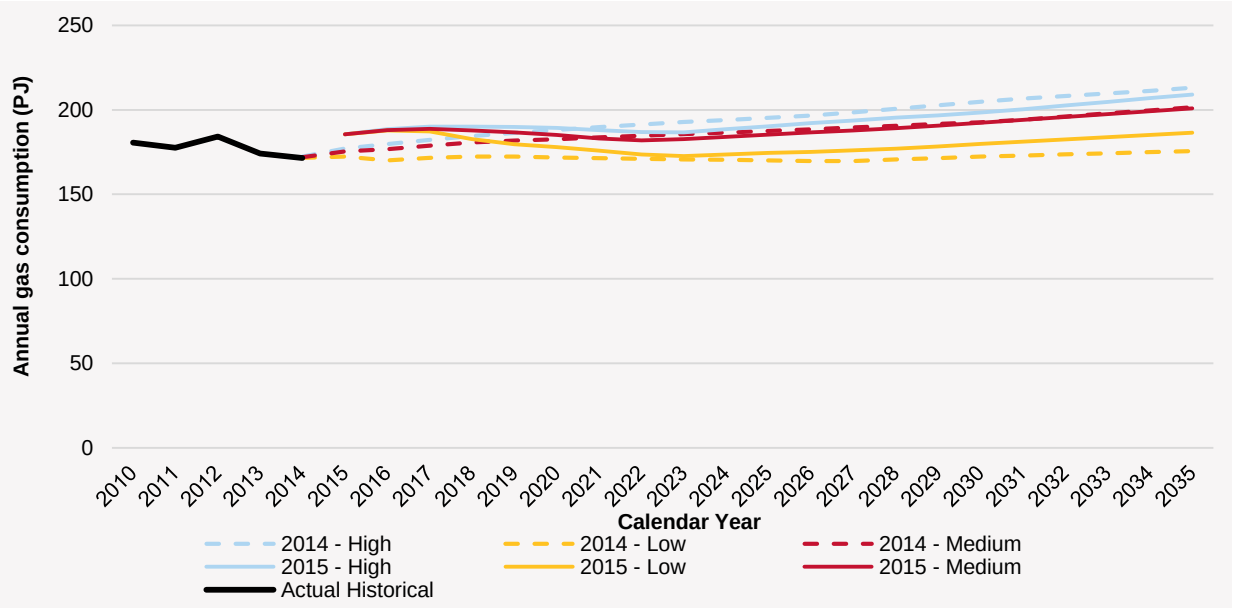


Table 13 Residential and commercial gas consumption over the short, medium, and long term

Timeframe	Forecast (PJ)	Average annual rate of change	Drivers
Short term (2015–20)	185.5 to 185.1	<0.1% decrease	Residential and commercial consumption forecast to increase due to forecast increase in new connections growth.
Medium term (2020–25)	185.1 to 185.4	<0.1% increase	New connections growth forecast to slow down in line with population projections. Energy efficiency measures and fuel substitution from gas to electricity forecast to reduce growth in residential and commercial consumption.
Long term (2025–35)	185.4 to 200.9	0.8% increase	New connections forecast to grow while the impact of current energy efficiency measures and fuel substitution from gas to electricity is forecast to reduce.

Discussion – key trends and drivers

Normal weather variability

While the forecasts assume a median (typical) climate assumption, in practice actual gas consumption can vary significantly due to weather variability within a forecast year. AEMO has estimated that the typical 20-year range of weather variability equates to annual fluctuations in annual consumption of up to 7.5% in Victoria, up to 4% in New South Wales, and up to 3% in South Australia.

Victoria has the largest heating load, representing up to 39% of the state's total demand (excluding GPG). Heating demand makes up 17% of total demand in South Australia, 20% in New South Wales, and 0.3% in Queensland (excluding LNG).

Heating demand and climate

Long-run climate trends are a key uncertainty in the forecasts. Forecasts for heating demand assume typical weather across the 20-year horizon. Historical weather data shows a warming trend until 2000, with some stability thereafter. In the long term, climate change is projected to increase average temperatures, increase the frequency of hot days and warm nights, and contribute to more extreme climate events. Further, a trend of 'urban warming' is creating a heat-island influence, caused by increased building density (and thermal mass) and urban sprawl that reduces wind-chill effects.

AEMO measures weather impacts on demand by calculating heating degrees.[25] Using this measure, a warming trend was evident in eastern and south-eastern Australia from the 1960s to 2000, with relatively stable average temperatures since 2000 in all regions (Figure 11 shows Melbourne heating degree days in Melbourne as an example).

In Victoria, this warming trend has reduced total residential, commercial and industrial gas consumption by 12% since 1970. In South Australia and New South Wales, the reduction was 2%.

AEMO has begun a review of long-run climate trends, which will continue through 2016, informed by professional advice on long-term climate trends. The 2015 NGFR forecasts are based on interim and conservative assumptions, specifically:

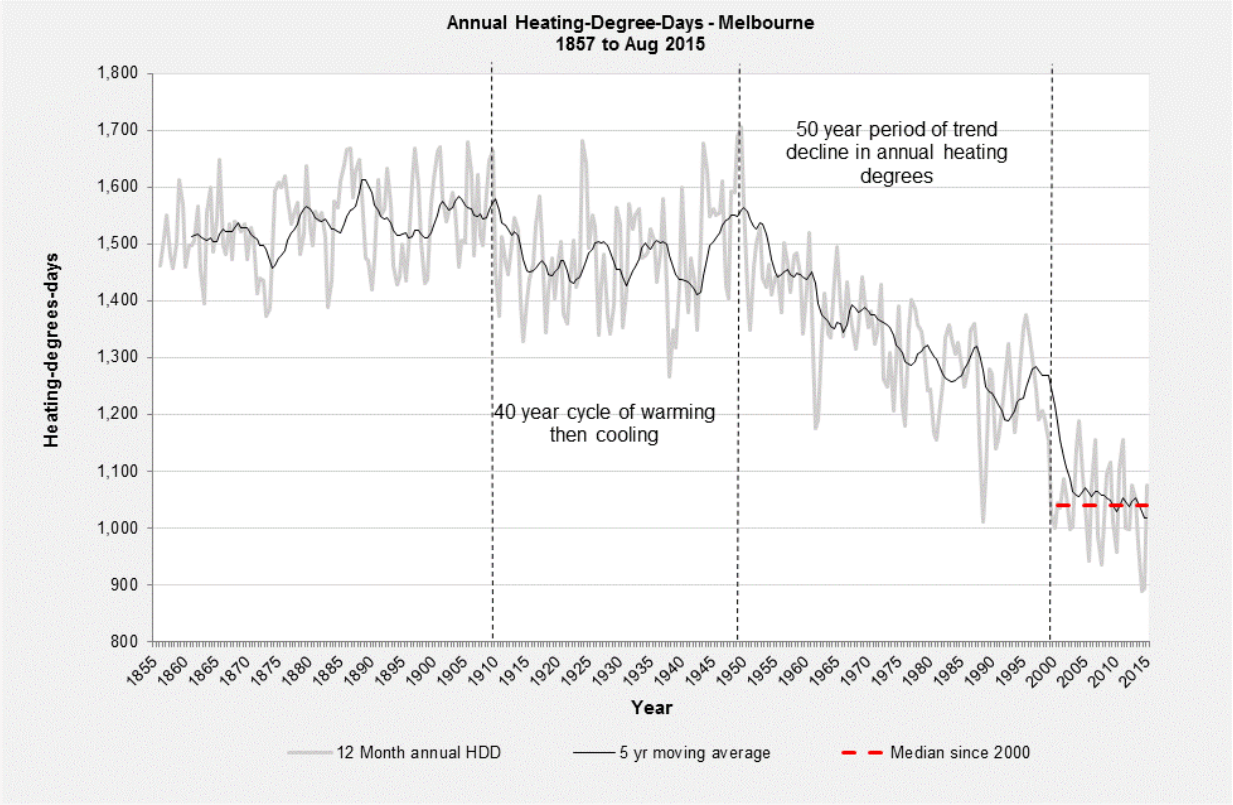
- Forecasts assume the continuance of a warm weather trend that has been evident since 2000.[26]
- Unlike in the 2014 NGFR, this NGFR does not assume a continual process of urban warming, recognising the relatively stable warm weather trend since 2000 in all regions. A review of historical weather outcomes shows cyclic trends in warming and cooling, even with longer-term warming. Figure 11 shows a 40-year cycle of warming and cooling from 1910 to 1950 in Melbourne, during which temperatures trended down for five years, remained stable for about 30 years and then went up for five years.

The difference in approach this year means that, all else unchanged, 2015 NGFR forecasts are higher than the same forecasts in the 2014 NGFR by up to 6.5% in Victoria, and up to 1.3% in New South Wales.

[25] Heating degree days (HDD) and cooling degree days (CDD) reflect the average temperature over summer or winter. HDD is the sum of the products of a) the time that a region experiences ambient temperatures below its threshold temperature and b) the number of degrees that the ambient temperature is below the threshold temperature.

[26] 2015 NGFR departs from 2014 NGFR by using a longer historic period to calculate the median weather standard (2000–14). The 2014 NGFR used a more recent period.

Figure 11 Annual heating degrees, Melbourne[27]



New (meter) connections

Population change is a key growth driver for residential gas consumption. The forecasts, however, do not use population projections directly; they are estimated through the impact of population change on dwelling construction, and the proportion of these dwellings having a gas connection.

Gas penetration, or the proportion of dwellings with gas, is forecast to continue to increase in all states. While detached houses in new subdivisions are expected to be more likely to have a gas connection than established homes in older suburbs, the proportion of high-rise inner urban dwelling construction (apartments) that are all-electric is forecast to increase.

Across all states, the gas penetration rate is currently 46%. Between states, gas penetration ranges from 10% in Queensland to 80% in Victoria. The 2015 NGFR forecasts an overall increase to 48% across all states by 2035, which is a reduction from the historical growth trend.

Table 14 shows the forecasts of gas connections and gas penetration rates for each state (residential and commercial) used in the 2015 NGFR.

Table 14 Total number of connections and gas penetration forecast by State

	NSW+ACT	QLD	SA	TAS	VIC
2015	1,427,642	197,523	450,562	13,386	2,002,350
	(45%)	(10%)	(57%)	(5%)	(80%)
2020	1,620,980	225382	483,481	17,587	2,155,049
	(47%)	(10%)	(58%)	(7%)	(78%)
2035	2,152,890	311780	565,847	22,574	2,551,397
	(52%)	(11%)	(61%)	(8%)	(75%)

[27] Calculated by AEMO based on temperature data from the Melbourne Regional Office weather station (Bureau of Meteorology).

While the overall gas penetration rate across all states is forecast to increase, consumption per connection is forecast to reduce. Contributing factors include projected continuing trends for:

- Improved thermal efficiency of new compared to existing homes (6-star building standards).
- A growing preference for smaller dwellings, such as apartments and multi-unit developments with smaller spaces to heat, fewer residents, and a greater propensity for space-heating and electric appliances. In 2014, for example, 40% of new dwellings in New South Wales were high-rise apartments, while in Victoria this dwelling type accounted for almost 30% of new home construction. In both states, this was a much higher percentage than ten years ago.

Compared to the 2014 NGFR, this NGFR projects a slightly higher growth of the total number of gas connections across all states in the period to 2020 (12.5% compared to 11.9%). In the long term (2014–35), the total number of gas connections is estimated to grow by 40.1% (lower than the 2014 NGFR figure of 41.4%).

Price

Forecast gas consumption is affected by how higher wholesale prices could impact retail prices, as well as assumed consumption patterns and changes in other gas supply costs. For the 2015 NGFR, AEMO has updated its price projections to account for known gas contract prices[28], and for a subsequent transition to market-based prices linked to international prices (that are projected to remain lower during the 20-year forecast horizon than was projected in the 2014 NGFR).[29]

Although the international oil price has dropped in the past 12 months, the domestic wholesale gas price is still projected to increase on average by more than 5.3% per annum (before inflation) over the next five years.

Table 15 shows projected retail gas prices changes assumed for annual consumption forecasts in the 2015 NGFR (in 2015 dollars, before inflation).

Table 15 Projected changes to residential retail prices compared to 2015, by state, used for the 2015 NGFR

	NSW+ACT	QLD	SA	TAS	VIC
2020	-2.1% p.a.	0.2% p.a.	1.2% p.a.	2.9% p.a.	3.1% p.a.
2035	-0.4% p.a.	0.1% p.a.	0.4% p.a.	0.9% p.a.	1% p.a.

Since 2012, residential gas prices in Queensland, New South Wales and South Australia have increased $10/GJ. In Victoria this increase has been $2/GJ.

For the 2015 NGFR, AEMO has used lower price elasticity of demand assumptions than in the 2014 NGFR to model how consumption may respond to price changes. This is due to a change in approach that separates, from the price elasticity of demand estimates, the influence of factors (such as building and appliance efficiency improvements, gas to electric appliance switching, drought, and policy response to the global financial crisis) that could otherwise distort the price elasticity estimates.

Overall, residential and commercial retail gas prices are projected to reduce total annual consumption over the next five years by 2.0% (3.7 PJ) across the eastern states, compared to what consumption would otherwise have been.

Table 16 summarises the reduction in total residential and commercial consumption attributed to price changes for each state. The percentages represent the impact of residential gas prices on final

[28] Based on advice from Core Energy, estimated based on a portfolio of wholesale gas contract prices, using Core's contract databases containing contract price and volumes.

[29] With the commencement of Queensland's LNG export industry, domestic gas prices are assumed to be linked to the international price of oil, which is a key driver of LNG prices. This linkage occurs in recognition of the opportunity value of conventional gas in the domestic market that could otherwise be traded in international market. Since NGFR 2014 was prepared, international oil prices have reduced.

residential/commercial consumption forecasts for 2020 and 2035, relative to what they would otherwise have been.

Table 16 Impact of changing residential gas prices on demand (PJ)

	NSW+ACT	QLD	SA	TAS	VIC
2020	0.20	0.02	0.13	0.01	3.32
	(0.4%)	(0.3%)	(1.3%)	(0.0%)	(2.8%)
2035	0.56	0.04	0.22	0.03	5.55
	(1.0%)	(0.6%)	(2.0%)	(2.7%)	(4.4%)

Energy efficiency

Projected changes in the energy efficiency of buildings and appliances affect forecasts of energy usage.

From its analysis, AEMO has estimated the following on a per gas connection basis:

- Gas use for cooking − no significant energy efficiency savings were identified or are expected.
- Gas use for hot water − from 2005−10, gas usage fell 6% in existing older homes and 14% in new homes. This reduction was attributable in part to the impact of the drought, that permanently reduced hot water use, and saw the widespread installation of low-flow shower heads and the introduction of other water conservation initiatives. From 2010−15, energy efficiency savings reduced consumption by 2% and 5% for existing homes and newer homes respectively. The same level of energy efficiency improvements is forecast for 2015−20. For 2020−35, AEMO has forecast further energy efficiency savings of 3% (existing homes) and 8% (newer homes).
- Gas use for heating − from 2005−10, metering data analysis did not indicate any discernible energy efficiency savings. From 2010−15, gas usage reduced 11% and 0.7% for existing and newer homes respectively. This reduction in existing homes is coincident with the widespread rollout of home insulation that was a policy response to the global financial crisis. AEMO forecasts further energy efficiency savings of 4% and 1% for existing and newer homes from 2015−20, then a further 6% and 3% for the period 2020−35.

Table 17 shows how these assumed energy efficiency savings translate to forecast reductions in gas consumption for each state, compared to what consumption would otherwise have been.

Table 17 Impact of energy efficiency on residential demand (TJ)

	NSW+ACT	QLD	SA	TAS	VIC
2020	0.55	0.09	0.14	NA	1.61
	(1.1%)	(1.6%)	(1.3%)	NA	(1.3%)
2035	3.09	0.41	0.60	NA	7.12
	(5.5%)	(6.2%)	(5.4%)	NA	(5.6%)

Appliance switching

For the 2015 NGFR, AEMO has analysed and accounted for gas-to-electric appliance switching. This includes projected shifts from traditional gas hot water systems to gas or electric-boosted hot water systems, and from gas to electric heating, using heat-pumps, or reverse cycle air-conditioners.

From this analysis, AEMO has estimated the following on a per gas connection basis:

- Hot water appliance switching − for 2015−20, AEMO has forecast switching rates of 16% and 3% for existing and newer homes. For 2020−35, switching rates are expected to be a further 14% and 1% respectively.
- Heating appliance switching − for 2015−20, AEMO has forecast switching rates of 0.4% and 1% for existing and newer homes. For 2020−35, switching rates are expected to be a further 5% and 1% respectively.

Table 18 shows how projected gas to electric appliance switching translates to changes in gas consumption forecasts for each state, compared to what consumption would otherwise have been.

Table 18 Impact of appliance switching on residential demand (TJ)

	NSW+ACT	QLD	SA	TAS	VIC
2020	2.91	0.51	0.59	NA	4.68
	(6.1%)	(9.0%)	(5.6%)	NA	(3.9%)
2035	6.15	1.01	1.25	NA	10.90
	(11.0%)	(15.2%)	(11.4%)	NA	(8.6%)

CHAPTER 3. MAXIMUM DEMAND

Forecasts of daily maximum demand are used to assess the adequacy of infrastructure supply capacity, as well as to inform commercial and operational decisions that are dependent on the potential consumption range of demand over time.

Variations in domestic gas consumption are mostly driven by heating demand and GPG. For all states except Queensland, this means maximum daily demand typically occurs during the winter heating season.

In Queensland, due to climate factors, maximum demand typically occurs during the summer. However, with the commencement of LNG exports, it is forecast that from 2015 in Queensland, maximum demand will occur during winter. This based on the assumption that liquefaction processing efficiency is lower in winter, introducing seasonality in gas usage for liquefaction and consequently a winter peak.

Key points

- Assumed seasonality in LNG liquefaction efficiency is projected to move Queensland to a winter peak. All states would then have annual maximum daily demand in winter.
- Maximum demand for the residential and commercial and industrial sectors is forecast to remain relatively flat over the 20-year forecast horizon, with a small reduction forecast by 2020 in response to price changes and reductions in large industrial loads. From 2020, maximum demand is forecast to increase to approximately 2015 levels, attributable to population growth, and offset by appliance switching and energy efficiency.
- GPG maximum demand forecasts have large step increases at times of coal capacity withdrawal from the NEM, demonstrating increased reliance on GPG for supply of electricity. The GPG maximum demand forecasts are sensitive to assumptions, and are becoming more volatile as the electricity system evolves to integrate the increasing uptake of intermittent wind generation and rooftop PV and withdrawals of fossil-fuel based generation.

The day of maximum demand for each region is typically determined by the residential, commercial and industrial sectors, based on weather conditions. On this day, fuel consumption by GPGs is typically unexceptional.

Maximum daily demand typically occurs on different days between the states. So a coincident estimate for all states is less than the sum of the maximum demand forecasts of each state. As a measure of how the forecasts have changed from the 2014 NGFR to the 2015 NGFR, on a non-coincident basis:

- Maximum demand for the residential, commercial and industrial sectors is forecast to be 14% higher (340 TJ/day) by 2035. This is attributable to changed weather assumptions, changed price projections, and improved forecasting models for emerging growth sectors in the industrial sector.
- LNG maximum demand is projected to be 1.5% lower by 2035 (60 TJ/day). This is due to adjusted operational assumptions now that actual early gas consumption data is available.

Forecasts

GPG and LNG maximum demand are driven by factors outside the domestic gas market, and factors that are somewhat independent of the behaviour of gas customers, so non-coincident estimates were derived.

Table 19 shows the maximum demand forecasts for each year from 2015 (forecast) to 2020, and then for 2035, exclusive of GPG, with Queensland forecasts shown both inclusive and exclusive of LNG.

Table 20 shows the GPG maximum demand for each region for 1-in-2 and 1-in-20 conditions.

As the maximum demand due to residential, commercial and industrial load is rarely coincident with the GPG maximum demand, an estimation has been made for the levels of GPG expected to occur on an average winter day (Monday to Thursday) during times of expected domestic maximum demand. This

GPG estimate is then aggregated with Table 19 to provide an estimate of the total maximum demand within each region, in Table 21.

Table 19 Maximum demand forecasts – total excluding GPG sector by state (TJ/day)

	QLD (incl LNG)		QLD (excl LNG)		NSW		VIC		TAS		SA	
	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20
2015	1761.1	1768.3	423.1	430.3	500.5	531.5	1188.4	1297.1	20.1	25.0	160.1	166.5
2016	4201.9	4208.6	395.0	401.8	508.4	540.2	1198.5	1308.6	20.4	25.4	162.3	168.7
2017	4539.5	4546.2	388.7	395.3	512.1	544.5	1196.0	1306.3	20.8	25.8	161.2	167.7
2018	4671.9	4678.5	386.2	392.8	513.7	546.7	1162.4	1270.9	20.9	26.0	158.9	165.3
2019	4630.9	4636.9	345.3	351.2	513.9	547.4	1155.8	1264.4	21.2	26.4	157.8	164.3
2020	4640.0	4646.1	354.3	360.4	512.5	546.6	1152.0	1261.1	21.4	26.6	156.9	163.4
2035	4634.4	4641.0	375.3	381.9	564.0	604.6	1208.9	1326.0	22.6	28.0	158.6	165.4

Table 20 GPG maximum demand forecasts – by state (TJ/day)

	QLD		NSW		VIC		TAS		SA	
	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20
2015	401.8	401.8	125.3	125.3	77.3	77.3	0	0	258.2	258.2
2016	315.0	347.7	116.0	207.5	143.0	227.5	0	0	413.2	430.8
2017	278.3	335.1	119.0	197.7	125.6	227.0	0	0	391.9	435.8
2018	242.0	314.9	105.0	175.8	138.6	226.5	0	0	370.7	438.2
2019	230.7	317.1	96.0	147.7	150.5	228.4	0	0	335.3	429.3
2020	234.7	326.7	84.3	122.7	163.5	230.0	0	0	303.1	426.3
2035	448.0	573.6	547.0	632.8	292.3	397.3	0	0	414.0	460.5

Table 21 Maximum demand forecasts – total including estimated average GPG by state (TJ/day)

	QLD (incl LNG)		QLD (excl LNG)		NSW		VIC		TAS		SA	
	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20
2015	1829.4	1836.7	491.4	498.6	570.5	601.5	1233.2	1341.9	20.1	25.0	241.9	248.3
2016	4325.8	4332.6	518.9	525.7	576.4	608.2	1245.5	1355.6	20.4	25.4	325.3	331.7
2017	4638.1	4644.8	487.2	493.9	574.7	607.2	1233.7	1344.0	20.8	25.8	292.7	299.2
2018	4735.1	4741.7	449.4	456.1	559.7	592.6	1192.3	1300.8	20.9	26.0	255.3	261.7
2019	4694.8	4700.8	409.1	415.1	547.8	581.3	1196.6	1305.2	21.2	26.4	233.1	239.5
2020	4704.8	4710.9	419.1	425.3	547.1	581.1	1192.3	1301.4	21.4	26.6	226.0	232.4
2035	4856.1	4862.7	597.0	603.6	723.2	763.9	1274.6	1391.7	22.6	28.0	310.3	317.1

Discussion – key trends and drivers

Price responsive controllable demand

The NGFR reports unconstrained demand, meaning demand for gas before the imposition of any delivery constraint that might be coincident with a peak gas consumption day. This means that the forecast maximum demand can exceed the delivery capacity of the gas supply system.

However, most domestic gas consumption occurs via wholesale spot markets that use price and spot trading to resolve supply demand imbalances. On a peak consumption day, it is possible spot market prices and costs may increase to maintain supply demand balance, and that the higher prices could mitigate some amount of price-responsive controllable demand.

Retail gas prices

Retail gas prices are discussed in Chapter 2 of this report.

The impacts of retail price projections are modelled using appliance-based forecast models, as maximum demand is driven by heating demand, and heater use is more sensitive to the impact of gas bills than is hot water or cooker use. Higher price elasticity is used for demand estimates for heating than for other appliances.

Assuming the same retail price projections as the annual consumption forecasts, AEMO forecasts that projected price changes over the next five and 20 years will have the effect of reducing maximum demand compared to the alternative with no assumed price changes. Table 22 summarises the forecast impact of these assumed price changes.

Table 22 Impact of projected price changes on maximum demand forecasts (absolute and percentage relative to the 2015 base year) (TJ/day)

	VIC		NSW		QLD		SA	
	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20
2020	-24.3	-26.8	-1.2	-1.3	-0.1	-0.1	-0.9	-0.9
	-2.1%	-2.3%	-0.2%	-0.3%	- <0.1%	- <0.1%	-0.5%	-0.6%
2035	-40.7	-45.1	-3.4	-3.7	-0.2	-0.2	-1.4	-1.5
	-3.4%	-3.7%	-0.6%	-0.7%	-0.1%	-0.1%	-0.9%	-0.9%

Appliance switching

Appliance switching trends are discussed in detail in Chapter 2 of this report.

Table 23 shows how much projected fuel-switching trends will reduce the maximum demand forecasts over the next five and 20 years, compared to the alternative without these effects.

Table 23 Impact of projected appliance switching trends on maximum demand forecasts excluding GPG (absolute and percentage relative) (TJ/day)

	VIC		NSW		QLD		SA	
	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20
2020	-34.1	-37.7	-17.4	-19.0	-2.1	-2.2	-3.7	-4.0
	-3.0%	-3.0%	-3.4%	-3.5%	-0.8%	-0.8%	-2.4%	-2.6%
2035	-80.0	-88.6	-37.2	-40.8	-4.2	-4.3	-7.9	-8.5
	-6.6%	-7.3%	-6.6%	-7.2%	-1.4%	-1.4%	-5.0%	-5.4%

Energy efficiency

Energy efficiency trends are discussed in detail in Chapter 2 of this report.

Table 24 shows how much expected fuel-switching trends will reduce the maximum demand forecasts over the next five and 20 years, compared to the alternative without these effects.

Table 24 Impact of projected energy efficiency trends on maximum demand forecasts excluding GPG (absolute and percentage relative) (TJ/day)

	VIC		NSW		QLD		SA	
	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20
2020	-11.8	-13.0	-3.3	-3.6	-0.4	-0.4	-0.9	-1.0
	-1.0%	-1.1%	-0.6%	-0.7%	-0.1%	-0.1%	-0.6%	-0.6%
2035	-52.2	-57.8	-18.7	-20.5	-1.7	-1.7	-3.8	-4.1
	-4.3%	-4.8%	-3.3%	-3.6%	-0.6%	-0.6%	-2.4%	-2.6%

Gas-powered generation

Overall, the trend in forecast maximum demand for GPG follows the trend in forecast annual consumption.

However, maximum demand for GPG may be affected by many factors, making it volatile and event-driven. Such factors include forced generation outages, intermittency of wind and rooftop PV generation, weather, industrial action, bush fires, fuel supply issues, gas pipeline leaks, major transmission outages or drought. Most peak GPG days are unlikely to occur on a peak winter day. A peak GPG day can be an unexceptional demand-day otherwise. Similarly, a peak day for the system can often be unexceptional for GPG demand.

A key input for GPG maximum demand forecasts is the assumed reliability of various generation technologies. This year's analysis uses historical outage performance parameters, while previous analysis used modelled forced outage rates. Actual historical forced outage rates for coal-fired generators are higher than the previously applied modelled outage rates, while for other technologies, including GPG, historical actual forced outage rates are lower. As a result, AEMO is projecting an increase in GPG to supply electricity during unplanned outages of coal-fired generation. This feature is reflected in the higher GPG maximum demand of the 2015 NGFR.

Higher maximum demand is also expected after the announced retirements of coal-fired generation such as the Northern and Liddell power stations, as GPG is projected to increase to meet electricity demand, or to more frequently cover outages of coal-fired generation. In the short term, the retirement of GPG such as the Smithfield Power Station decreases forecast maximum demand for GPG, as there is less GPG to supply the NEM.

In South Australia, with no coal-fired generation projected to be available after March 2016, the volatility of gas is solely dependent on the intermittency of wind and rooftop PV generation and the availability of supply via the interconnectors from Victoria. For example, if a high electricity demand day in South Australia is coincident with a day of low wind levels and full cloud cover, the state would need to rely on local GPG or imports from Victoria for electricity supply.

In Tasmania, GPG maximum demand is projected to be zero, since modelling suggests that there is enough hydro capacity and new wind generation in the state to supply electricity demand, assuming average inflows. However, the remaining open-cycle gas plant may be required to run when extreme events occur, such as drought, outages of Basslink, or when the transmission line between the north and the south of Tasmania is limited.

Appendix A. VICTORIA

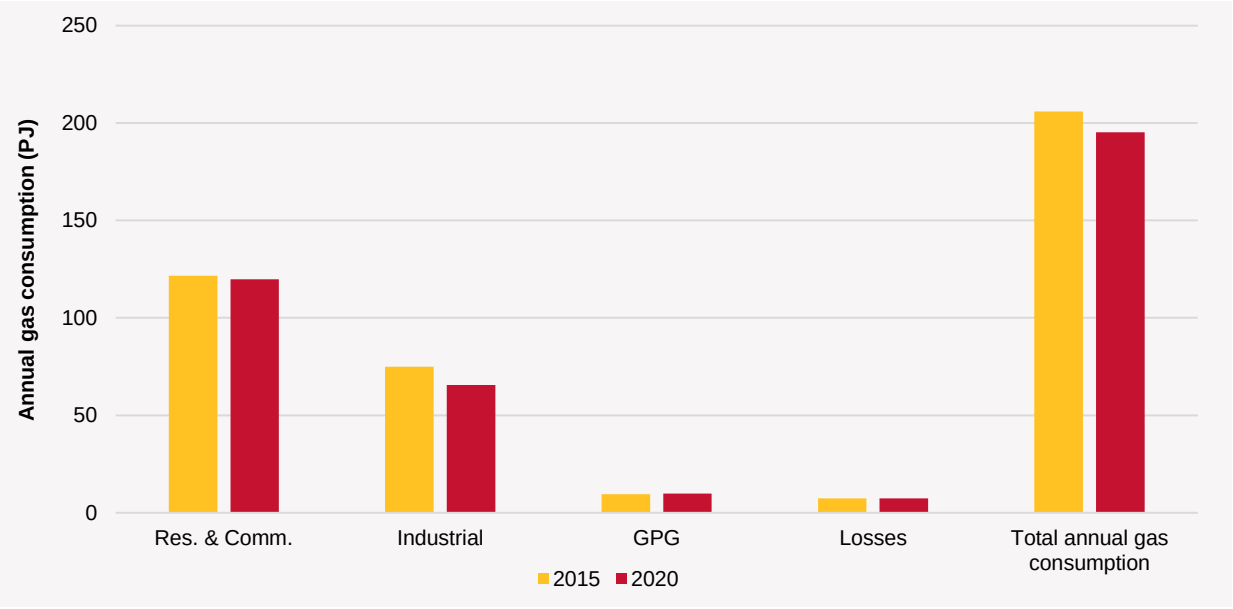
A.1 Key points for Victoria

In the five years 2016–20, the forecasts for Victoria in the medium scenario are:

- Total gas consumption is forecast to decrease at an average annual rate of 1.1%.
- Residential and commercial consumption is forecast to decrease at an average annual rate of 0.3%.
- Industrial gas consumption is forecast to decrease at an average annual rate of 2.6%.
- GPG gas consumption is forecast to decline at an average annual rate of 1%.
- Maximum daily demand is forecast to remain relatively unchanged until after 2020 when growth occurs due to increased GPG gas demand.

The long term outlook, and forecasts based on high and low scenarios, are provided in the following sections.

Figure 12 Comparison of 2015 (estimated) and 2020 (forecast) annual gas consumption in Victoria[30]



A.2 Annual consumption in Victoria

A.2.1 Overview

Victorian gas consumption declined from 210.8 PJ in 2010 to 206.5 PJ in 2014. This 0.5% average annual decline reflects reduced consumption in residential, commercial and industrial sectors, partly offset by increased GPG consumption. These trends were caused by a combined effect of gas prices changes, energy efficiency improvements, market forces and changes in industrial operations. Also, after the warm winter in 2013, residential and commercial gas consumption further declined in 2014 because of exceptionally warm temperatures, and remained flat in 2015.

Table 25 summarises forecast annual consumption trends and drivers over the short, medium, and long term under the medium scenario.

[30] Estimated and forecast consumption is calculated assuming a standard temperature pattern, estimated from historical observations.

Table 25 Total forecast annual gas consumption in Victoria over the short, medium, and long term

Timeframe	Forecast (PJ)	Average annual rate of change	Drivers
Short term (2015–20)	205.9 to 195.3	1.1% decrease	Industrial load to decrease in response to projected gas price changes. Some significant operational changes are anticipated for large industrial consumption. Continued energy efficiency improvements and gas to electric appliance switching forecast to reduce residential and commercial consumption.
Medium term (2020–25)	195.3 to 195.2	<0.1% decrease	Marginal change, with increases in GPG offsetting decrease in consumption by large industrial loads. Increases in GPG are due to forecast increased demand in the NEM and projected retirement of coal plants. Residential and commercial consumption to be relatively flat, with trend in population growth expected to be offset by energy efficiency improvements.
Long term (2025–35)	195.2 to 208.3	0.7% increase	GPG consumption to increase due to increasing demand in the NEM. Large industrial consumption to increase, due to growth in food and beverage manufacturing and services sectors. Residential and commercial consumption to increase due to population growth.

The forecast for aggregated residential and industrial demand in 2035 is 5.7% higher than was forecast in the 2014 NGFR. This is due to higher forecasts of residential and commercial consumption in the medium term and higher forecasts of industrial consumption in the long term.

Figure 13 shows the long-term, 20-year forecast for all sectors in Victoria.

Figure 13 Annual consumption forecast segments for Victoria

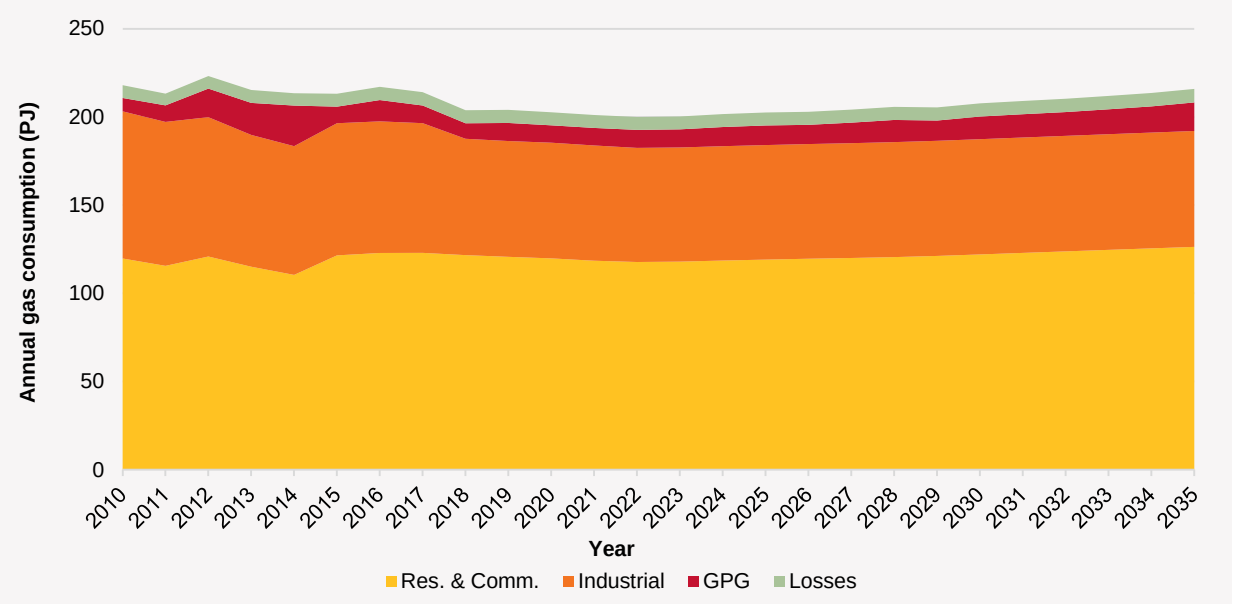
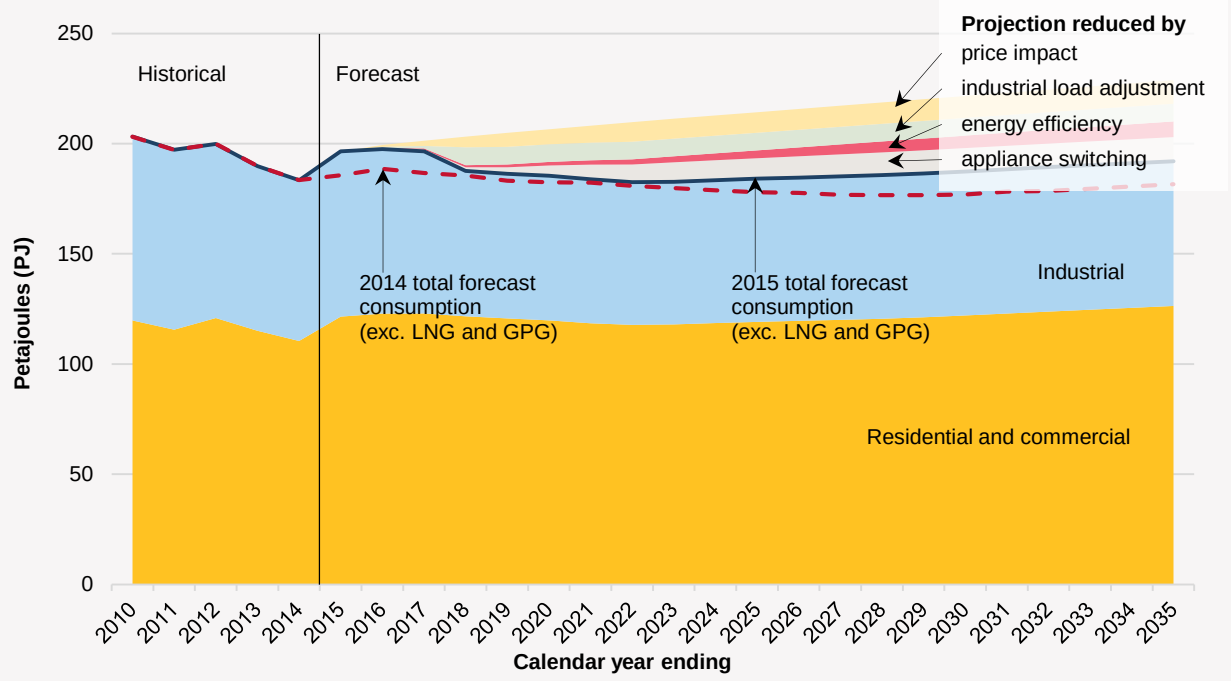


Figure 14 shows how these forecasts have been impacted by key drivers of demand reduction (that is, how each factor reduced the forecast from what it would otherwise have been). In the industrial, residential and commercial sectors, appliance switching from gas to electricity is the largest driver of the forecast reduction (10.9 PJ, corresponding to 5.7% of the aggregated industrial and residential consumption in 2035), followed by energy efficiency (7.1 PJ, or 3.4%). Projected changes in gas prices in both the residential and industrial sectors are forecast to reduce demand by 10.7 PJ (5.5%).

Figure 14 Annual consumption forecast segments for Victoria, including sources of demand reduction (excluding GPG)



A.2.2 High, medium, and low scenario forecast trends and drivers in Victoria

AEMO modelled Victoria's forecasts under high, medium and low scenarios (see Section 1.3). Compared to the medium scenario:

- The high scenario is characterised by faster population growth, lower gas prices, and industrial production less responsive to price changes. Business conditions for manufacturing are assumed to be good.
- The low scenario is characterised by slower population growth, higher gas prices, and industrial production more responsive to price changes. Business conditions for manufacturing are assumed to be challenging.

Table 26 shows short-term forecasts and key drivers for each sector, under each scenario.

Table 26 High, medium and low scenario forecast trends and drivers for Victoria, 2015−20

Sector	Scenario	Forecast (PJ)	Average annual rate of change	Key drivers
Residential and commercial	Medium	121.5 to 119.8	0.3% decrease	Growth in number of connections offset by decrease in average consumption per connection. Reduction in average consumption is driven by a shift away from gas appliances in favour of electric appliances, and by energy efficiency measures.
	High	121.5 to 123.3	0.3% increase	Higher population growth and lower retail prices.
	Low	121.5 to 114.2	1.2% decrease	Lower population growth and higher retail prices, driving a faster uptake of electric appliances.
Industrial	Medium	74.9 to 65.6	2.6% decrease	Economy continues to transition from gas-intensive sectors to less gas-intensive sectors, driven by market forces and other factors. Industrial loads respond to changes in gas prices, and some significant operational changes are anticipated for large industrial loads.
	High	74.9 to 71.9	0.8% decrease	Gas prices decrease while population grows and business conditions assist an increase in industrial output.
	Low	74.9 to 58.1	5.0% decrease	Higher gas prices, together with challenging business conditions and a greater responsiveness to prices, reduce industrial demand.
Gas-powered generation	Medium	9.4 to 9.9	1.0% increase	Initial decrease due to expected rise in gas prices, followed by a recovery as demand increases and some generators in neighbouring regions retire.
	High	9.4 to 10.0	1.1% increase	Expected to trend down initially as gas prices increase, but then to recover as some existing generators retire and demand increases. Additional non-gas generation is installed by 2020.
	Low	9.4 to 10.6	2.3% increase	Expected to trend down initially as gas prices increase, but then to recover as some existing generators retire and demand increases.

The high, medium, and low scenario short-term (2015−20) aggregated forecasts decline at annual average rates of 0.1%, 1.1% and 2.3%, respectively.

Figure 15 and Table 27 show the high, medium and low scenario forecasts for the 20-year outlook period, and compare them to the 2014 NGFR forecasts.

For the 2015 NGFR, AEMO has updated the forecasts for changes in key trends, and has introduced a number of changes to methodology that have also changed the forecasts. More detail is in the sector commentary below, and in the 2015 NGFR Methodology Information Paper.

Figure 15 Comparison of annual consumption forecast scenarios for Victoria

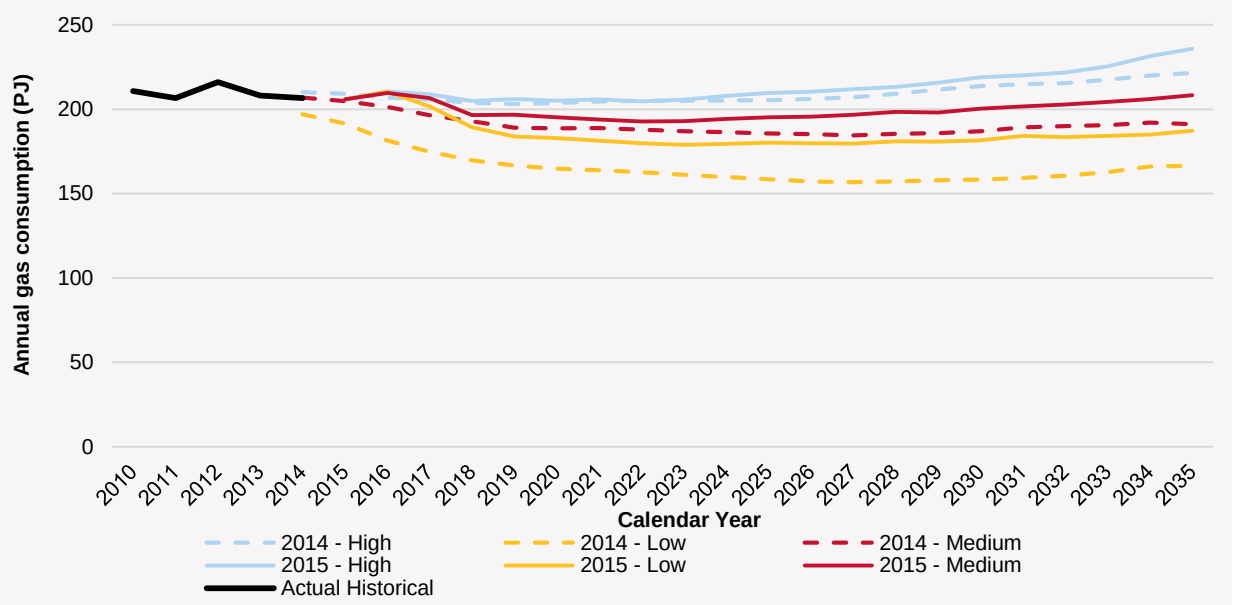


Table 27 Annual gas consumption forecasts for Victoria (PJ), 2010–35

Calendar Year	Actual	High (NGFR 2015)	Medium (NGFR 2015)	Low (NGFR 2015)	High (NGFR 2014)	Medium (NGFR 2014)	Low (NGFR 2014)
2010	210.8						
2011	206.6						
2012	216.1						
2013	208.0						
2014	206.5						
2015			205.9		209.1	204.7	191.6
2016		210.5	209.6	210.3	206.9	201.4	181.5
2017		208.9	206.5	201.6	205.8	196.4	174.8
2018		204.8	196.4	189.3	203.8	192.8	169.6
2019		205.9	196.6	183.8	203.0	189.1	166.7
2020		205.1	195.3	182.8	203.6	188.6	164.7
2021		205.7	193.8	181.4	204.5	188.8	163.9
2022		204.7	192.7	179.7	205.0	187.9	162.6
2023		205.7	193.0	178.8	205.0	187.0	161.1
2024		207.9	194.3	179.5	205.2	186.4	159.7
2025		209.6	195.2	180.3	205.4	185.6	158.5
2026		210.3	195.6	179.9	206.0	185.3	157.2
2027		211.9	196.8	179.7	207.1	184.5	156.7
2028		213.2	198.3	181.0	209.2	185.4	157.1
2029		215.6	198.0	180.8	211.5	185.9	157.9
2030		219.0	200.3	181.5	213.7	187.0	158.3
2031		220.0	201.6	184.1	214.8	189.2	159.2
2032		221.8	202.8	183.4	215.4	189.9	160.6
2033		225.4	204.4	184.2	217.4	190.6	162.7
2034		231.4	206.0	185.0	219.9	192.1	166.0
2035		235.7	208.3	187.3	221.4	191.2	166.4

A.2.3 Gas-powered generation in Victoria

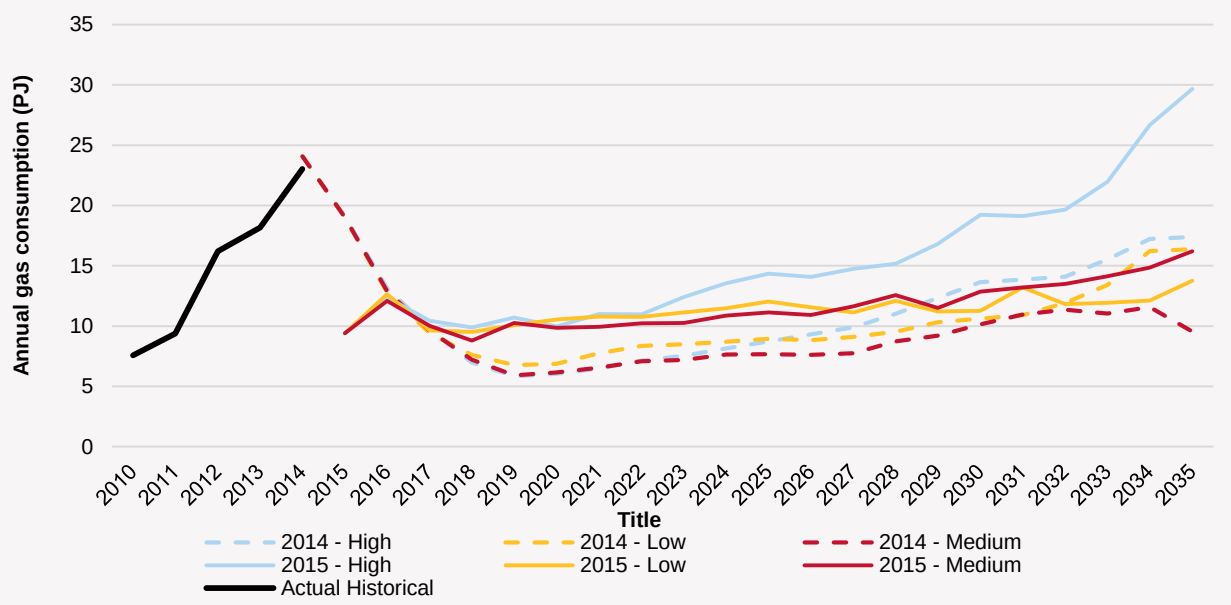
Between 2010 and 2014, gas consumption by GPG increased from 7.6 PJ to 23 PJ. This average annual increase of 32.1% was driven by the commissioning of Mortlake Power Station in 2012 and the introduction of carbon pricing.

Table 28 shows forecast GPG gas consumption trends and drivers over the short, medium and long term. In Figure 16, forecasts for the 20-year outlook period are given for high, medium and low scenarios, and compared to 2014 NGFR forecasts.

Table 28 GPG gas consumption forecasts over the short, medium, and long term

Timeframe	Forecast (PJ)	Average annual rate of change	Drivers for the medium scenario forecast
Short term (2015–20)	9.4 to 9.9	1% increase	Initial decrease due to expected rise in gas prices, followed by a recovery as demand increases and some plants in neighbouring states retire. Renewable generation capacity is installed.
Medium term (2020–25)	9.9 to 11.1	2.3% increase	Increasing demand drives increasing trend in GPG gas consumption.
Long term (2025–35)	11.1 to 16.2	3.9% increase	Continued increasing demand and investment in new GPG drives a projected increase of gas consumption in the long term.

Figure 16 Comparison of high, medium, and low scenario forecasts for GPG in Victoria



In the short to medium term, the 2015 NGFR GPG gas consumption forecast is higher than the 2014 NGFR forecast. This is driven mainly by the assumption of a smaller increase in fuel (gas) prices. The retirement of Anglesea Power Station (in August 2015, announced in May 2015) also contributes to the forecast of increased gas consumption.

A.2.4 Industrial consumption (Tariff D) in Victoria

Victoria has been impacted by the transition in the economy from gas-intensive manufacturing sectors to less gas-intensive sectors, such as services. This has resulted in a decline in gas consumption. From 2010 to 2014, industrial consumption in Victoria decreased from 83.4 PJ to 73 PJ (3.3% per annum average decrease).

Over the next five years, industrial consumption is forecast to decline, driven by manufacturing (2.6% annual average reduction).

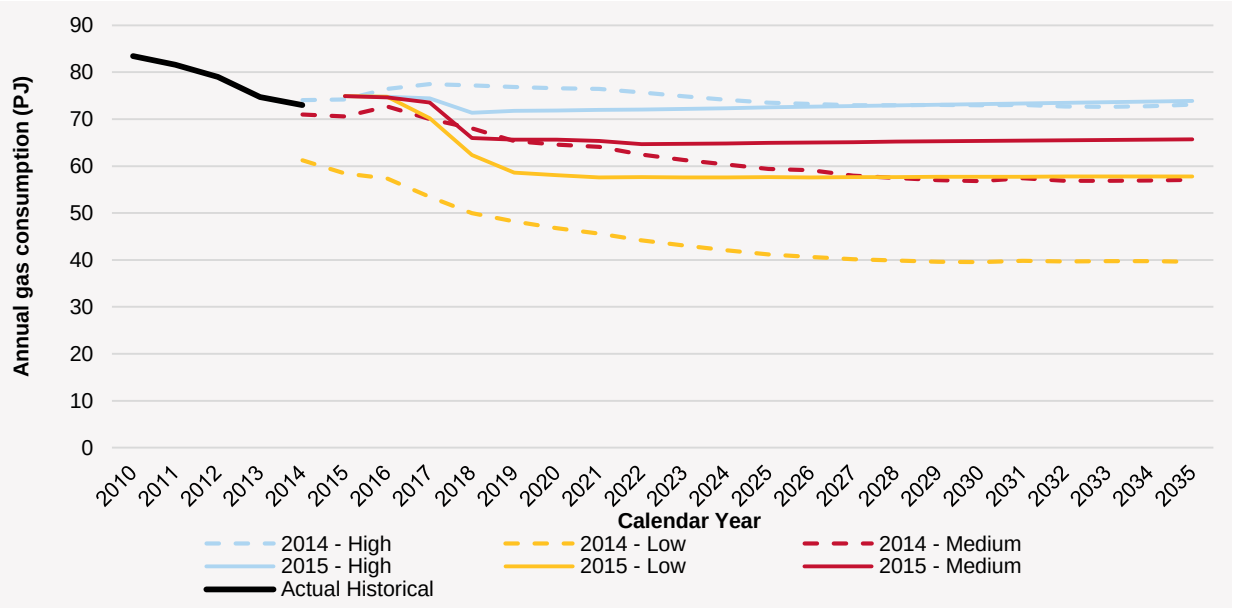
In the long term, consumption is forecast to remain flat over the 20-year outlook period, due to the offsetting effect of emerging growth sectors (food and beverage manufacturing, services) and more stable business conditions for manufacturing.

Table 29 shows forecast industrial consumption trends and drivers over the short, medium and long term. In Figure 17, forecasts for the 20-year outlook period are given for high, medium and low scenarios, and compared to 2014 NGFR forecasts.

Table 29 Industrial consumption forecasts in Victoria over the short, medium, and long term

Timeframe	Forecast (PJ)	Average annual rate of change	Drivers
Short term (2015–20)	74.9 to 65.6	2.6% decrease	Economy continues to transition from gas-intensive sectors to less gas-intensive sectors, driven by market forces and other factors. Industrial loads respond to changes in gas prices and some significant operational changes are anticipated for large industrial loads.
Medium term (2020–25)	65.6 to 64.9	0.2% decrease	Manufacturing sectors stabilise. Large industrial loads continue to respond to price changes and some operational changes in large industrial load are anticipated. Some less gas-intensive sectors exhibit growth, underpinned by population growth. This effect dominates in the long term.
Long term (2025–35)	64.9 to 65.7	0.1% increase	

Figure 17 Comparison of high, medium, and low scenario forecasts for the industrial sector in Victoria



A.2.5 Residential and commercial consumption (Tariff V) in Victoria

From 2010 to 2014, residential and commercial consumption decreased from 119.8 PJ to 110.5 PJ. On a weather-corrected basis[31], residential and commercial consumption increased at an annual average of 0.8%. This reflects an increase in connections to the gas system (due to a combination of new housing growth and all-electric homes connecting to gas).

AEMO analysed historical Victorian metering data for the residential and commercial sector h to determine the impact in existing and new homes of gas prices, trends in energy efficiency penetration, and gas to electric appliance switching. This analysis was used to calibrate projections of price response, energy efficiency and appliance switching.

[31] Estimated and forecast consumption is calculated assuming a standard temperature pattern, estimated from historical observations.

The competing forces driving residential and commercial sector consumption in Victoria include population growth (increasing the number of connections), and a reduction of the average consumption per connection driven by appliance switching (from gas to electric) and energy efficiency.

In the short and medium term, energy efficiency and appliance switching are forecast to result in a 2% decrease in residential and commercial demand over the period 2015–25. This is also assisted by a growth of the proportion of smaller, all-electric apartments in high-rise buildings.

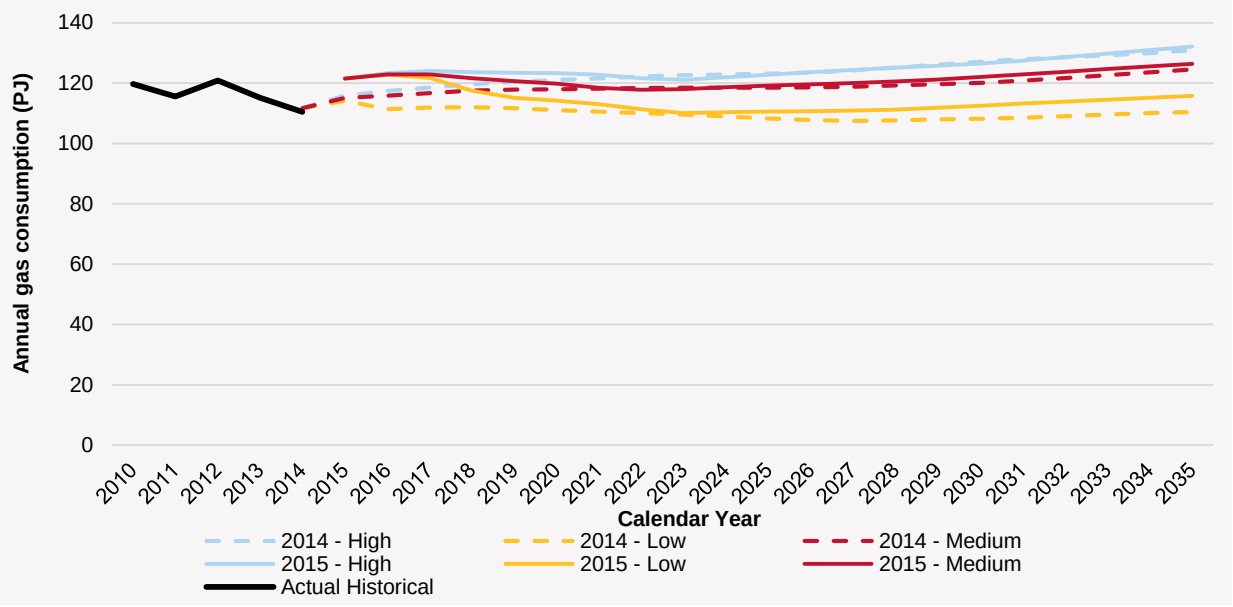
Assuming current energy efficiency regulations continue, the effect of the policies is forecast to diminish over time as population growth offsets declines, although at a slower pace. This drives the long-term forecast of growth of demand (6% from 2025–35).

Table 30 shows the residential and commercial consumption trends and drivers forecast over the short, medium and long term. In Figure 18, forecasts for the 20-year outlook period are given for high, medium and low scenarios, and compared to 2014 NGFR forecasts.

Table 30 Residential and commercial gas consumption forecasts in Victoria over the short, medium, and long term

Timeframe	Forecast (PJ)	Average annual rate of change	Drivers
Short term (2015–20)	121.5 to 119.8	0.3% decrease	Growth in number of connections offset by decreased average consumption per connection. Reduction in average consumption is driven by a shift away from gas appliances in favour of electric appliances and by energy efficiency measures.
Medium term (2020–25)	119.8 to 119.1	0.1% decrease	The impact of gas to electric appliance switching and current energy efficiency measures decreases. Population growth drives consumption in the residential sector upwards.
Long term (2025–35)	119.1 to 126.3	0.6% increase	

Figure 18 Comparison of high, medium, and low scenario residential and commercial forecasts for Victoria



Key forecast inputs

Weather

The historical range of the weather data used to define the standard weather scenario was extended back to the year 2000 (the 2014 NGFR used more recent data). As a result, a lower median temperature was used in the forecast, driving consumption upwards (see Table 31).

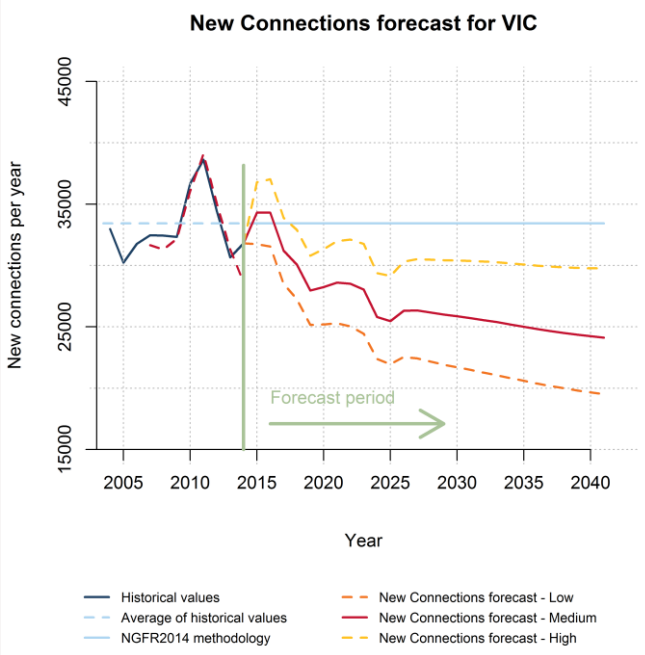
Table 31 Weather corrections in Victoria

Model	Annual EDD[32] in 2015 (˚C)	Trend (˚C / year)	Comments
2015 NGFR	1340	0	Constant across all years.
2014 NGFR	1308	-8.05	Linear downward trend.

Number of connections

The annual variation of residential and commercial connections was linked to building cycles and population projections in Victoria, with different connection rates used for single detached houses and multi-unit dwellings (the 2014 NGFR used an average of the historical rate of new connections). Over 2014–20, the number of connections is forecast to grow by approximately 187,000 units (1.5% average annual growth), compared to 200,000 predicted in the 2014 NGFR (see Figure 19).

Figure 19 Number of connections in Victoria



Energy efficiency and appliance switching

Improvements in the energy efficiency of appliances and thermal insulation of houses, as well as a gradual move from gas appliances towards electric appliances, were modelled in a bottom-up approach. This represents a difference to the 2014 NGFR methodology, where energy efficiency improvements were considered implicitly in the linear model used to regress consumption as a function of prices, with a correction term applied to the final forecast.

[32] Effective degree days (EDD) is a measure that combines a range of weather factors that affect energy demand.

Retail gas prices

Wholesale gas price projections have been updated to known contracts with future values linked to oil prices. Wholesale gas price projections are lower than those used in the 2014 NGFR following the oil price drop in the past year. Retail price margins have been calibrated using published standing tariffs. The net effect is that projections of retail prices are lower than those used in the 2014 NGFR. It is projected that retail prices in Victoria will grow by 3.1% per annum on average (before inflation) over the five-year period to 2020). A projected average annual growth of 0.3% per annum (average) has been used in the forecasts the subsequent 15 years to 2035.

A.3 Maximum demand in Victoria

Maximum demand in Victoria typically occurs in winter and is primarily driven by residential and commercial demand (weather is the key factor). The drivers of forecast annual consumption over the short, medium and long term also drive maximum demand for the respective sectors, to varying degrees.

Tables 32 to 34 show projections of daily maximum demand in Victoria under different scenarios.

The high, medium, and low short-term forecasts decrease at annual averages of 0.1%, 0.7%, and 2.0% respectively. Consistent with consumption forecasts, key drivers for the differences from the medium scenario are:

- In the high scenario, projected higher customer connection growth and lower gas prices are forecast to lead to higher residential, commercial and industrial demand. This is partly offset by fewer modelled retirements of coal-fired plants compared to the medium scenario, which reduces reliance on GPG in the NEM and thereby reduces forecast GPG gas consumption.
- In the low scenario, projected lower customer connection growth and higher gas prices are forecast to lead to lower residential, commercial, and industrial demand compared to the medium scenario. This is partly offset by additional modelled retirements of coal-fired plants, which increases reliance on GPG in the NEM, and thereby increases forecast GPG gas consumption.

The residential, commercial and industrial maximum demand forecasts are not coincident with the forecasts for GPG maximum demand, therefore the two cannot be added to obtain a regional total. The total displayed in the tables below includes the estimated average GPG on a day of total system demand.

Table 32 Winter maximum demand forecasts for Victoria (medium scenario) (TJ/day)

	Total		GPG		Residential, Commercial & Industrial	
	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20
2015	1233.2	1341.9	77.3	77.3	1188.4	1297.1
2016	1245.5	1355.6	143.0	227.5	1198.5	1308.6
2017	1233.7	1344.0	125.6	227.0	1196.0	1306.3
2018	1192.3	1300.8	138.6	226.5	1162.4	1270.9
2019	1196.6	1305.2	150.5	228.4	1155.8	1264.4
2020	1192.3	1301.4	163.5	230.0	1152.0	1261.1
2035	1274.6	1391.7	292.3	397.3	1208.9	1326.0

Table 33 Winter maximum demand forecasts for Victoria (high scenario) (TJ/day)

	Total		GPG		Residential, Commercial & Industrial	
	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20
2015	1231.1	1339.8	77.3	77.3	1188.4	1297.1
2016	1248.4	1358.7	141.9	152.3	1201.9	1312.1
2017	1243.9	1354.8	130.0	158.6	1206.3	1317.2
2018	1229.8	1340.1	175.4	165.0	1193.4	1303.7
2019	1233.8	1344.5	177.6	173.7	1194.8	1305.5
2020	1235.2	1346.7	181.9	178.8	1196.3	1307.9
2035	1390.0	1513.3	377.3	426.0	1281.1	1404.4

Table 34 Winter maximum demand forecasts for Victoria (low scenario) (TJ/day)

	Total		GPG		Residential, Commercial & Industrial	
	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20
2015	1224.3	1333.0	77.3	77.3	1188.4	1297.1
2016	1241.8	1351.9	138.6	138.4	1198.5	1308.5
2017	1204.2	1312.1	123.5	139.5	1173.3	1281.2
2018	1144.1	1246.5	140.8	140.7	1112.8	1215.2
2019	1115.0	1214.9	143.0	151.3	1081.8	1182.7
2020	1108.6	1208.5	154.9	157.0	1075.1	1175.0
2035	1154.8	1259.2	286.0	302.3	1094.1	1198.6

Appendix B. NEW SOUTH WALES

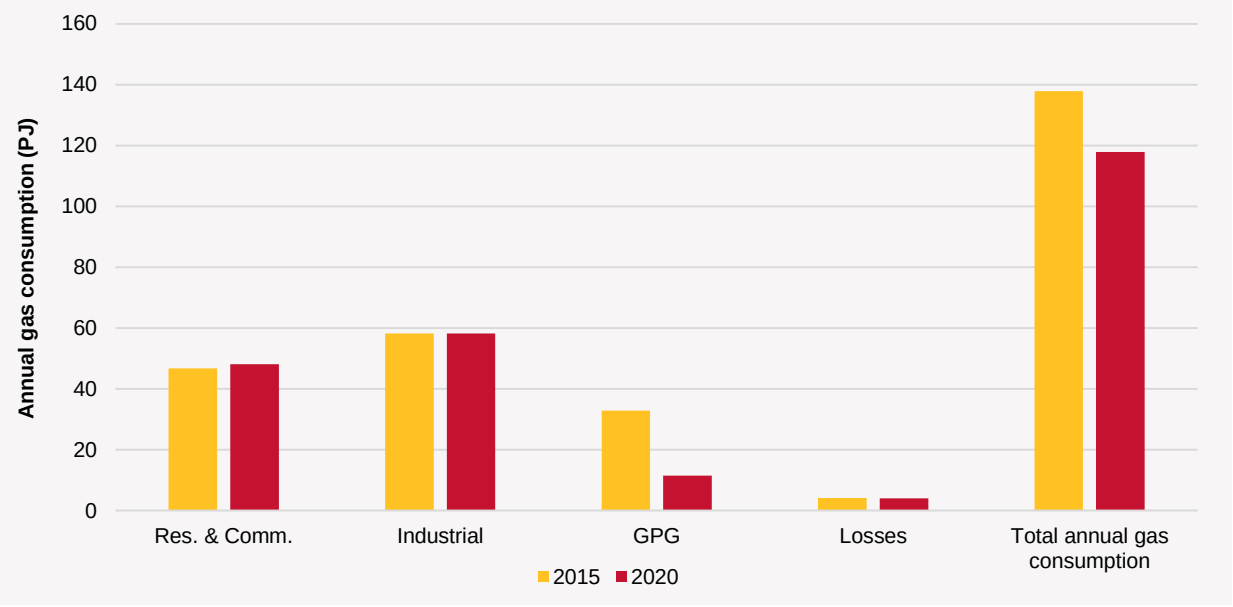
B.1 Key points for New South Wales

Key short-term (2016–20) forecasts for New South Wales in the medium scenario are:

- Total gas consumption is forecast to decrease at an average annual rate of 3.1%. The decline of forecast gas consumption from GPG is the main driver of the decrease.
- Residential and commercial gas consumption is forecast to increase at an average annual rate of 0.6%.
- Industrial gas consumption is forecast to increase at an average annual rate of <0.1%.
- GPG gas consumption is forecast to decline at an average annual rate of 18.8%.
- Maximum demand is forecast to remain relatively flat until 2020, with industrial load reductions offsetting increases from projected population growth. Between 2020 and 2035, maximum demand is forecast to increase, due to further population growth, and growth in GPG gas demand.

Longer-term forecasts, and forecasts based on high and low scenarios, are provided in the following sections.

Figure 20 Comparison of 2015 (estimated) and 2020 (forecast) annual gas consumption in New South Wales[33]



B.2 Annual consumption in New South Wales

B.2.1 Overview

From 2010 to 2014, gas consumption in NSW declined from 143.2 PJ to 139.1 PJ. This 0.7% decline was a result of the combined effect of gas prices changes, energy efficiency regulations, market forces and changes in industrial operations.

Table 35 summarises annual consumption forecast trends and drivers over the short, medium, and long term.

[33] Estimated and forecast consumption is calculated assuming a standard temperature pattern, estimated from historical observations.

Table 35 Total forecast annual gas consumption in New South Wales over the short, medium, and long term

Timeframe	Forecast (PJ)	Average annual rate of change	Drivers
Short term (2015–20)	137.8 to 117.9	3.1% decrease	Industrial load is expected to remain flat. Population growth and forecast reductions in residential gas prices (due to network tariff reductions) drive growth in the residential and commercial sector. Higher projected fuel costs and other market forces cause a large forecast reduction in GPG.
Medium term (2020–25)	117.9 to 124.0	1% increase	Large industrial loads continue to decrease in response to price and other factors. Increase in GPG, driven by increased demand in the NEM and retirement of coal-fired generation. Residential and commercial consumption remains relatively flat as increasing population growth balances the effect of appliance switching and energy efficiency improvements.
Long term (2025–35)	124.0 to 160.9	2.6% increase	Continued increasing demand and investment in new GPG drives increase in gas consumption. Increase in large industrial consumption is driven primarily by the growth in food and beverage manufacturing and services sectors. Residential and commercial consumption increases due to population growth.

Residential, commercial and industrial consumption in 2035 is forecast to be 8.2% higher than was estimated in the 2014 NGFR. This is due to forecast higher residential and commercial demand in the short term, and higher industrial consumption in the long term.

The long-term, 20-year forecast for all sectors in New South Wales is presented in Figure 21.

Figure 21 Annual consumption forecast segments for New South Wales

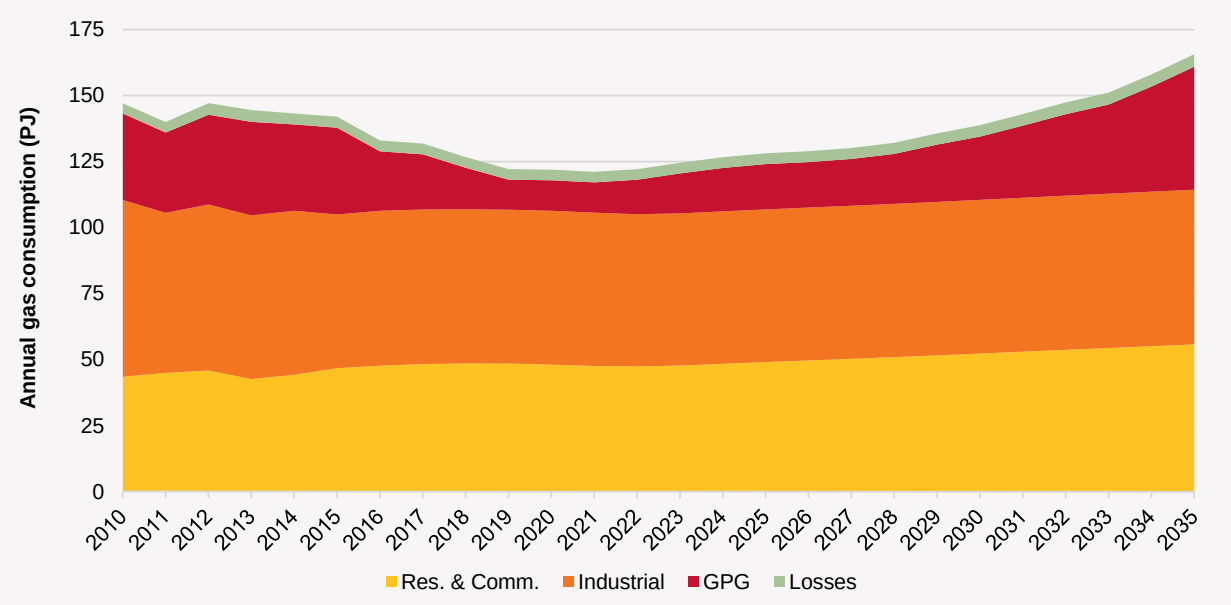
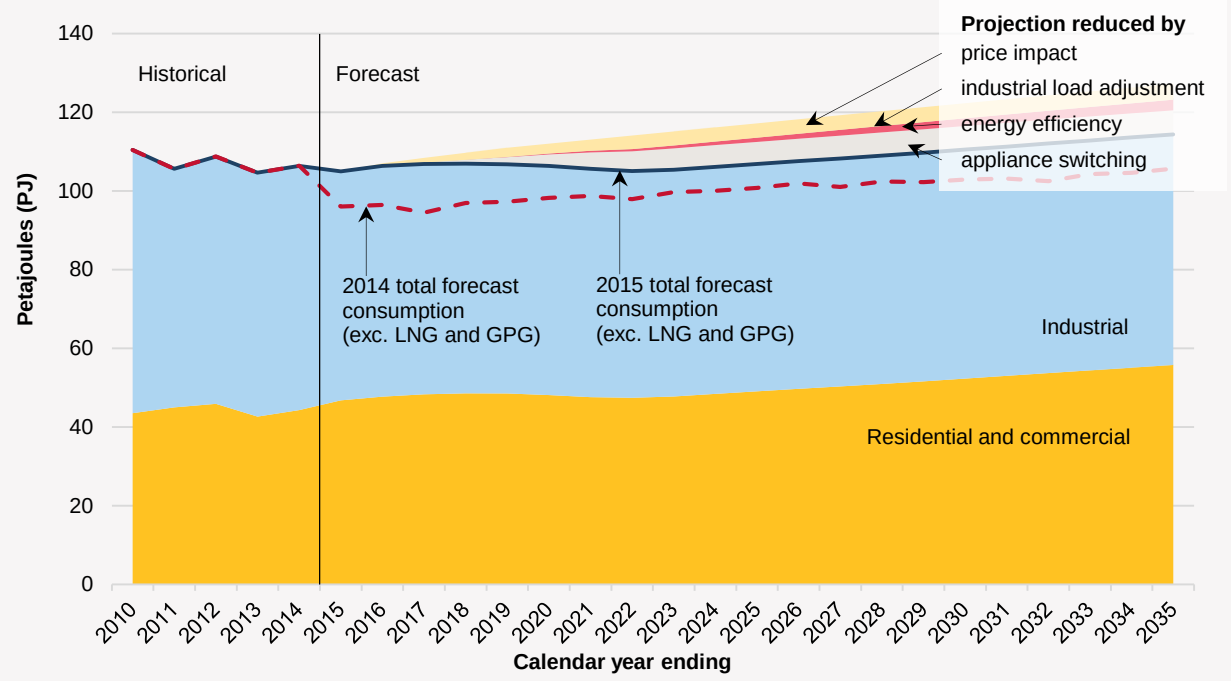


Figure 22 shows how these forecasts have been impacted by key drivers of demand (that is, how each factor reduced the forecast from what it would otherwise have been). In the residential and commercial sector, projected appliance switching from gas to electricity is the largest driver of the reduction (5.4% of the total in 2035), followed by forecast energy efficiency (2.7%). Projected changes in gas prices in both the residential and commercial and industrial sectors introduce a reduction of 3.5% in the forecasts.

Figure 22 Annual consumption forecast segments for New South Wales, including sources of demand reduction (excluding GPG)



B.2.2 High, medium, and low scenario forecast trends and drivers in New South Wales

AEMO modelled New South Wales' forecasts under high, medium and low scenarios (see Section 1.3). Compared to the medium scenario:

- The high scenario is characterised by faster population growth, lower gas prices, and industrial production less responsive to price changes. Business conditions for manufacturing are assumed to be good.
- The low scenario is characterised by slower population growth, higher gas prices, and industrial production more responsive to price changes. Business conditions for manufacturing are assumed to be challenging.

Table 36 shows the short-term forecasts and key drivers for each sector, under each scenario.

Table 36 High, medium and low scenario forecast trends and drivers for New South Wales, 2015−20

Sector	Scenario	Forecast (PJ)	Average annual rate of change	Key drivers
Residential and commercial	Medium	46.8 to 48.1	0.6% increase	Strong growth in housing construction and lower retail prices push up gas consumption, partially offset by appliance switching and energy efficiency.
	High	46.8 to 48.6	0.8% increase	Assumed stronger population growth. Lower gas prices than in the medium scenario.
	Low	46.8 to 47.1	0.1% increase	Milder population growth. Higher gas prices than in the medium scenario.
Industrial	Medium	58.2 to 58.3	<0.1% increase	Economy continues to transition from gas-intensive sectors to less gas-intensive sectors, driven by market forces and other factors. Industrial loads respond to changes in gas prices and some significant operational changes are anticipated for large industrial loads, including some short-term expansions in response to regulatory investment incentives.
	High	58.2 to 59.3	0.4% increase	Key drivers for high scenario are same as medium scenario but reflect better business conditions for manufacturing, flatter price trajectory and faster projected population growth. Some high scenario assumptions for large industrial loads are based on survey responses.
	Low	58.2 to 50.24	2.9% decrease	Key drivers for low scenario are same as medium scenario but reflect a decline in business conditions for manufacturing and more conservative population growth estimates. Some low scenario assumptions for large industrial loads are based on survey responses.
Gas-powered generation	Medium	32.9 to 11.6	18.8% decrease	The largest driver of the decline in gas consumption for GPG is the planned retirement of the Smithfield Power Station that consumes about 8.0 PJ to 8.6 PJ of gas per year.
	High	32.9 to 12.6	17.5% decrease	The largest driver of the decline in gas consumption for GPG is the planned retirement of the Smithfield Power Station that consumes about 8.0 PJ to 8.6 PJ of gas per year.
	Low	32.9 to 11.7	18.7% decrease	The largest driver of the decline in gas consumption for GPG is the planned retirement of the Smithfield Power Station that consumes about 8.0 PJ to 8.6 PJ of gas per year.

The high, medium, and low scenario short-term aggregated forecasts decline at annual average rates of 2.7%, 3.1% and 4.6%, respectively.

Figure 23 and Table 37 show the high, medium and low scenario forecasts for the 20-year outlook period, and compare them to the 2014 NGFR forecasts.

For the 2015 NGFR, AEMO has updated the forecasts for changes in key trends, and has introduced a number of changes to methodology that have also changed the forecasts. More detail is in the sector commentary below, and in the 2015 NGFR Methodology Information Paper.

Figure 23 Comparison of annual consumption forecast scenarios for New South Wales, including GPG

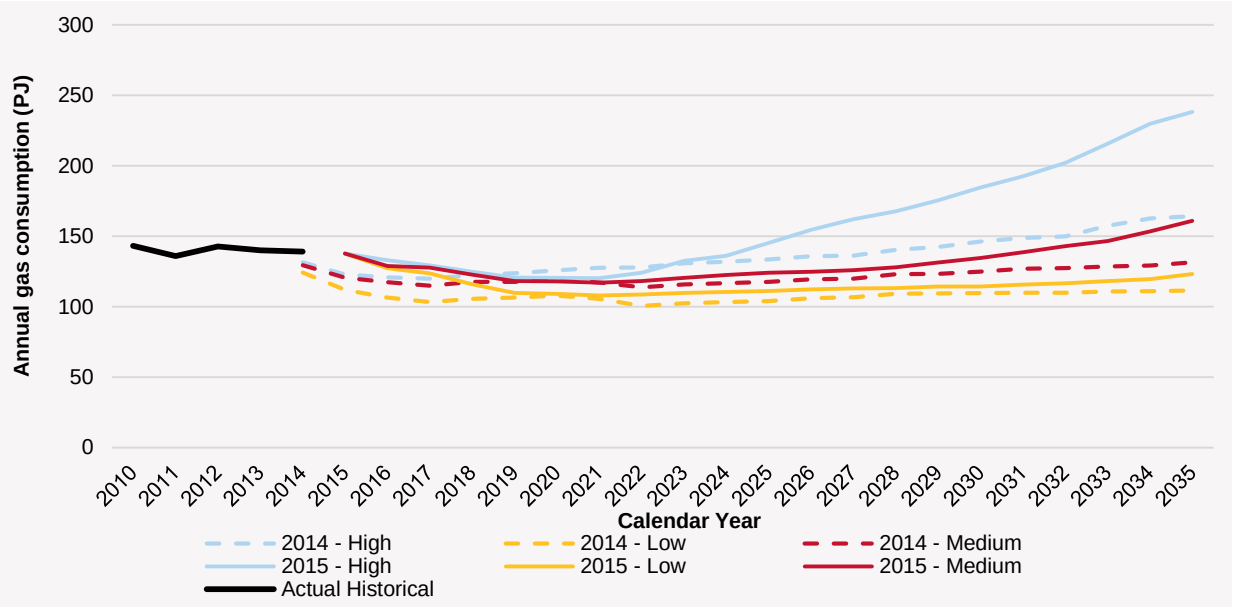


Table 37 Annual gas consumption for New South Wales (PJ), 2010–35

Calendar Year	Actual	High (NGFR 2015)	Medium (NGFR 2015)	Low (NGFR 2015)	High (NGFR 2014)	Medium (NGFR 2014)	Low (NGFR 2014)
2010	143.2						
2011	136.0						
2012	142.7						
2013	140.0						
2014	139.1						
2015			137.8		122.9	120.5	112.0
2016		133.0	128.9	127.2	120.7	117.3	106.6
2017		129.4	127.7	123.7	119.9	114.9	103.2
2018		124.8	122.7	116.0	122.3	117.6	105.5
2019		120.7	118.1	109.7	123.8	117.7	106.4
2020		120.4	117.9	109.0	125.8	119.3	107.9
2021		120.3	117.1	108.0	127.6	117.2	105.6
2022		124.1	118.1	108.6	127.9	113.8	100.6
2023		132.4	120.5	109.7	130.7	115.7	102.3
2024		136.1	122.6	110.6	132.0	116.6	103.2
2025		145.2	124.0	111.2	133.6	117.6	104.0
2026		154.6	124.8	112.2	135.9	119.4	105.9
2027		162.1	126.0	112.9	136.4	120.0	106.8
2028		167.9	127.9	113.3	140.3	123.1	109.2
2029		175.6	131.4	114.4	142.3	123.2	109.3
2030		184.6	134.4	114.3	146.2	124.8	109.7
2031		192.5	138.6	115.7	148.7	127.0	109.8
2032		202.0	142.9	116.7	149.9	127.5	109.9
2033		215.8	146.6	118.3	157.4	128.4	110.8
2034		229.9	153.4	119.6	162.5	129.3	111.1
2035		238.2	160.9	123.2	164.2	131.5	111.4

B.2.3 Gas-powered generation in New South Wales

From 2010 to 2014, GPG gas consumption trends were flat, between 32.8 PJ to 32.7 PJ.

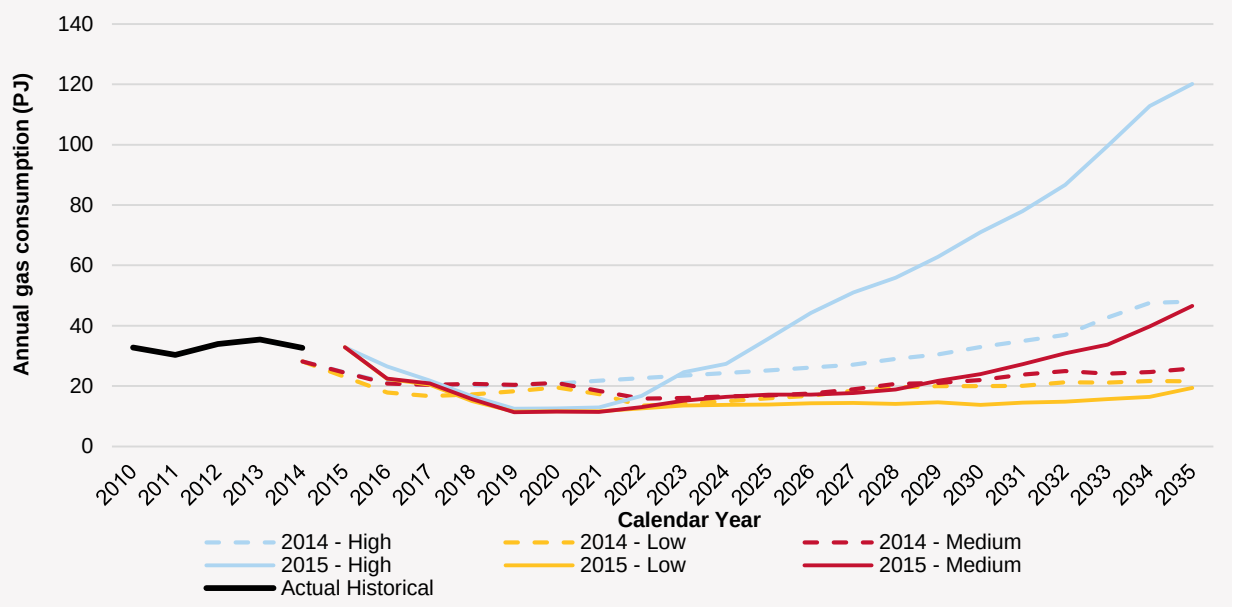
Table 38 shows GPG gas consumption forecast trends and drivers over the short, medium, and long term. In Figure 24, forecasts for the 20-year outlook period are given for high, medium and low scenarios, and compared to the 2014 NGFR predictions.

Table 38 GPG gas consumption forecasts in New South Wales over the short, medium, and long term

Timeframe	Forecast (PJ)	Average annual rate of change	Drivers
Short term (2015–20)	32.9 to 11.6	18.8% decrease	The largest driver of the decline in gas consumption for GPG is the planned retirement of the Smithfield Power Station that consumes about 8.0 PJ to 8.6 PJ of gas per year. The expiration of existing gas supply agreements also exposes GPG to projected fuel price increases, reducing its competitiveness in the electricity market.
Medium term (2020–25)	11.6 to 17.2	8.2% increase	GPG projected to increase generation when 2000 MW Liddell coal-fired Power Station retires in 2022.[a]
Long term (2025–35)	17.2 to 46.6	10.5% increase	Opportunities for new investments in GPG to meet increasing demand.

[a] Owner AGL Energy Limited has announced plans to close Liddell C Power Station (2,000 MW) in 2022.

Figure 24 Comparison of high, medium, and low scenario forecasts for GPG in New South Wales



In the short to medium term, the forecast for GPG gas consumption has a higher starting point than that forecast in the 2014 NGFR, due to lower assumed gas prices and the incorporation of known gas supply contracts in fuel price projections. In addition, the rate at which it is projected to decline in the next five years is faster than in the 2014 NGFR, due to the planned retirement of the Smithfield Power Station in 2018.[34]

Over the period 2022–29, the medium scenario follows the same trend as in the 2014 NGFR. Beyond 2029, the 2015 NGFR forecasts increasing gas consumption by GPG to supply increasing electricity consumption.

In the high scenario, forecast consumption by GPG is more than twice as large as the equivalent 2014 NGFR forecast by 2035. This is because the 2,000 MW Liddell Power Station, which is set to retire in

[34] http://www.aemo.com.au/Electricity/Planning/Related-Information/Generation-Information.

2022, is forecast to be replaced by a mixture of gas-fired and renewable generation. This withdrawal was announced after the 2014 NGFR was published.

B.2.4 Industrial consumption (Tariff D) in New South Wales

New South Wales has been impacted by transition in the economy, from gas-intensive manufacturing sectors to less gas-intensive sectors, such as services. This has resulted in a decline in gas consumption. From 2010 to 2014, industrial consumption in New South Wales decreased from 66.9 PJ to 62.1 PJ.

Over the next five years, a small decline in industrial gas consumption is forecast, driven by projected reductions in manufacturing output, offset by growth in sectors like food and beverage manufacturing and services. The overall forecast short-term decline is 0.1%.

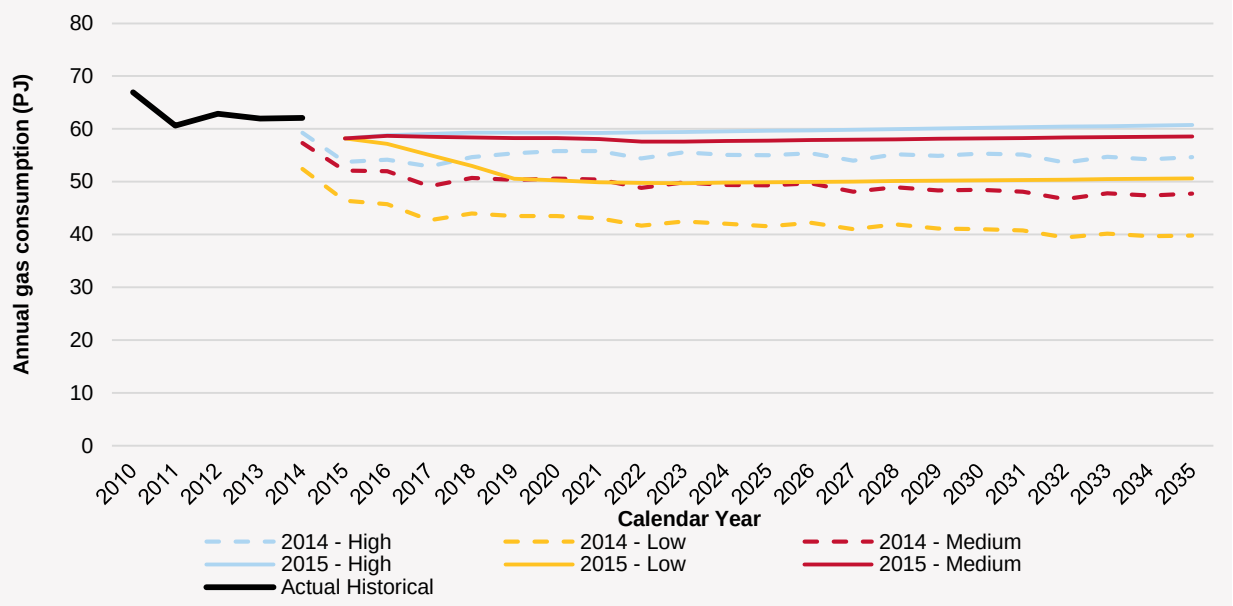
In the medium and long term, projected population and economic growth are forecast to offset this decline and consumption is forecast to be flat over the 20-year outlook period.

Table 39 shows industrial consumption forecast trends and drivers over the short, medium, and long term. In Figure 25, forecasts for the 20-year outlook period are given for high, medium and low scenarios, and compared to 2014 NGFR forecasts.

Table 39 Industrial consumption forecasts over the short, medium, and long term

Timeframe	Forecast (PJ)	Average annual rate of change	Drivers
Short term (2015–20)	58.4 to 58.2	<0.1% increase	Economy continues to transition from gas-intensive sectors to less gas-intensive sectors, driven by market forces and other factors. Industrial loads respond to changes in gas prices and some significant operational changes are anticipated for large industrial loads, including some short term expansions in response to regulatory investment incentives.
Medium term (2020–25)	58.2 to 57.7	0.2% decrease	Manufacturing sectors stabilise. Large industrial loads continue to respond to price changes. Some less gas-intensive sectors exhibit growth, underpinned by population growth. This effect dominates in the long term.
Long term (2025–35)	57.7 to 58.5	0.1% increase	

Figure 25 Comparison of high, medium, and low scenario forecasts for the industrial sector in New South Wales



B.2.5 Residential and commercial consumption (Tariff V) in New South Wales

From 2010 to 2014, residential and commercial gas consumption in New South Wales increased from 43.5 PJ to 44.3 PJ. On a weather-corrected basis[35], residential and commercial consumption increased at an annual average of 1.3%. This reflected an increase in connections to the gas network (due to a combination of new housing growth and all-electric homes connecting to gas).

Average use per connection is forecast to decline over the outlook period, linked to appliance switching trends and energy efficiency improvements. AEMO analysed the New South Wales residential historical metering data using a bottom-up approach to determine the projected impact of these factors on residential consumption in existing and new homes.

Projected growth in housing construction in the next few years is forecast to increase gas consumption. Lower network tariffs are projected to reduce residential gas prices, also assisting growth in consumption. Compared to the past, the impact of the increase in number of connections on residential demand is limited because of the tendency to build smaller dwellings in high-rise buildings. This type of dwelling tends to use more electricity and less gas.

While projected energy efficiency improvements and a shift to electric appliances reduce some consumption growth, these effects are reduced by projected lower retail prices.

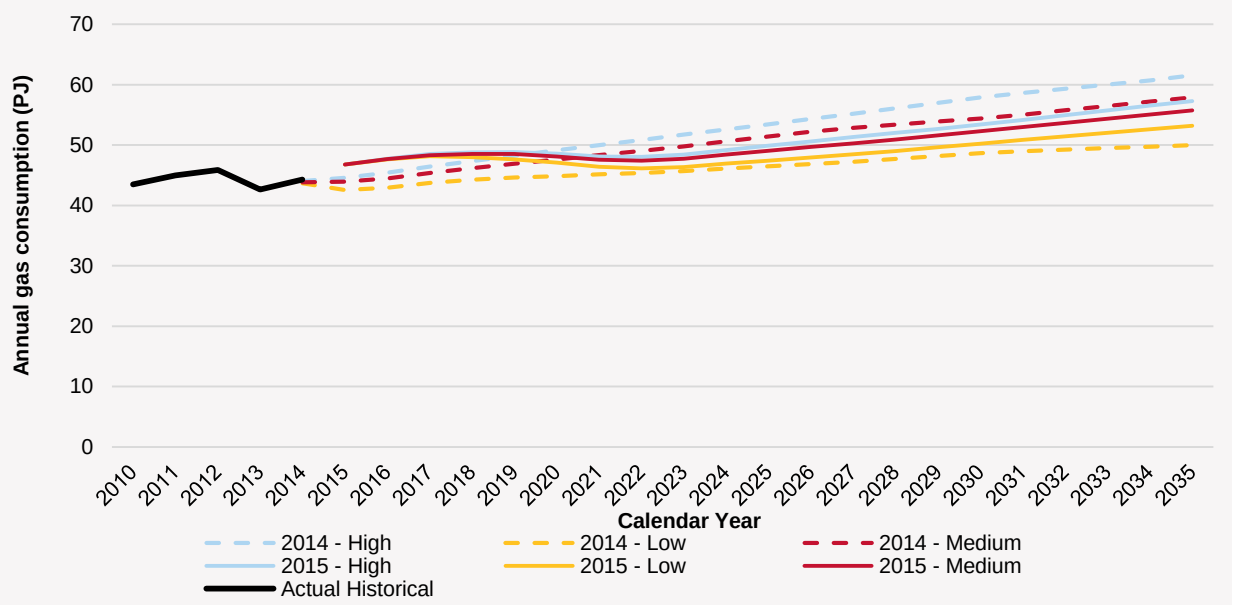
Table 40 shows the residential and commercial consumption forecast trends and drivers over the short, medium and long term. In Figure 26, forecasts for the 20-year outlook period are shown for high, medium and low scenarios, and compared to 2014 NGFR forecasts.

Table 40 Residential and commercial gas consumption forecasts for New South Wales over the short, medium, and long term

Timeframe	Forecast (PJ)	Average annual rate of change	Drivers
Short term (2015–20)	46.8 to 48.1	0.6% increase	Strong growth housing construction and lower retail prices push up gas consumption, partially offset by appliance switching and energy efficiency
Medium term (2020–25)	48.1 to 49.1	0.4% increase	Housing construction growth slows compared to 2014–20, but keeps a high pace. The impact of appliance switching and energy efficiency improvements decreases.
Long term (2025–35)	49.1 to 55.8	1.3% increase	

[35] Estimated and forecast consumption is calculated assuming a standard temperature pattern, estimated from historical observations.

Figure 26 Comparison of high, medium, and low scenario residential and commercial sector forecasts for New South Wales



Key forecast inputs

Weather

The historical range of the weather series used to define the standard weather scenario has been extended back to the year 2000 (the NGFR 2014 used more recent data), resulting in a lower median temperature being used for the forecast, driving consumption upwards (see Table 41).

Table 41 Weather corrections in New South Wales

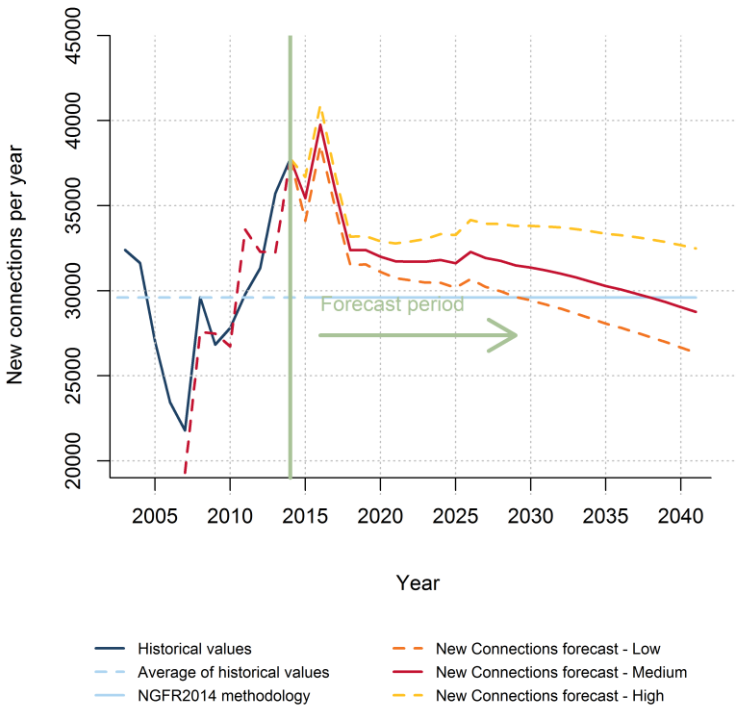
Model	Annual EDD[36] in 2015 (˚C)	Trend (˚C / year)	Comments
2015 NGFR	1070	0	Constant across all years.
2014 NGFR	1081	-3.79	Linear downward trend.

Number of connections

For the 2015 NGFR, the annual variation of residential and commercial connections was linked to building cycles and population projections in New South Wales, with different connection rates used for single detached houses and multi-unit dwellings (the 2014 NGFR used an average of the historical rate of new connections). Over 2014–20, the number of connections is projected to grow by approximately 214,000 units (2.7% average annual growth), compared to 180,000 predicted in the 2014 NGFR (see Figure 27).

[36] Effective degree days (EDD) is a measure that combines a range of weather factors that affect energy demand.

Figure 27 Number of connections in New South Wales



Energy efficiency and appliance switching

Improvements in the energy efficiency of appliances and thermal insulation of houses, as well as a gradual move from gas appliances towards electric appliances, were modelled in a bottom-up approach. This represents a significant difference to the 2014 NGFR methodology, where energy efficiency improvements were considered implicitly in the linear model used to regress consumption as a function of prices, with a correction term applied to the final forecast.

Retail gas prices

Wholesale gas price projections have been updated to known contracts with future values linked to oil prices. Wholesale gas price projections are lower than those used in the 2014 NGFR following the oil price drop in the past year. The result is that projected retail prices are significantly lower than were projected in the 2014 NGFR. Over the five years to 2020, prices are projected to decrease 2.3% per annum on average (before inflation), driven mainly by the recent revision of network tariffs by the regulator. Between 2020 and 2035, a projected average increase of the prices in NSW by 0.2% per annum (average) has been applied for the forecasts of consumption.

B.3 Maximum demand in New South Wales

Maximum demand in New South Wales typically occurs in winter, driven by residential and commercial demand. The forecast drivers of annual consumption over the short, medium and long term are also expected to drive maximum demand for the respective sectors.

Tables 42 to 44 show projections of maximum demand in New South Wales under the different scenarios. The high, medium, and low short-term forecasts decrease at annual averages of 0.1%, 0.7%, and 2.0% respectively. Consistent with annual consumption forecasts, key drivers for the differences in maximum demand from the medium scenario are:

- In the high scenario, higher residential, commercial and industrial demand is forecast as a result of higher projected customer connection growth and lower projected gas prices. This is partly offset by a reduction in projected retirements of coal-fired generators compared to the medium scenario, projected to increase gas demand by GPG.
- In the low scenario, lower residential, commercial, and industrial demand is forecast as a result of lower projected customer connection growth and higher projected gas prices. In addition, the low scenario models additional retirement of coal-fired generators compared to the medium scenario, which offsets this reduction as GPG gas demand is projected to increase.

The residential, commercial and industrial forecasts of maximum demand are not coincident with the forecasts of maximum demand for GPG, therefore the two cannot be added to obtain a regional total. The total displayed in the tables below includes the forecast average GPG on a day of total system demand.

Table 42 Maximum demand forecasts for New South Wales (medium scenario) (TJ/day)

	Total		GPG		Residential, Commercial & Industrial	
	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20
2015	570.5	601.5	125.3	125.3	500.5	531.5
2016	576.4	608.2	116.0	207.5	508.4	540.2
2017	574.7	607.2	119.0	197.2	512.1	544.5
2018	559.7	592.6	105.0	175.8	513.7	546.7
2019	547.8	581.3	96.0	147.7	513.9	547.4
2020	547.1	581.1	84.3	122.7	512.5	546.6
2035	723.2	763.9	547.0	632.8	564.0	604.6

Table 43 Maximum demand forecasts for New South Wales (high scenario) (TJ/day)

	Total		GPG		Residential, Commercial & Industrial	
	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20
2015	590.2	621.2	125.3	125.3	500.5	531.5
2016	587.2	619.0	166.5	239.3	509.3	541.1
2017	580.5	613.1	170.7	236.5	515.3	547.9
2018	567.4	600.6	170.7	230.0	518.7	551.9
2019	557.0	590.8	162.0	210.5	519.8	553.7
2020	556.4	590.8	154.3	193.3	519.2	553.6
2035	957.8	999.6	767.7	848.7	581.5	623.3

Table 44 Maximum demand forecasts for New South Wales (low scenario) (TJ/day)

	Total		GPG		Residential, Commercial & Industrial	
	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20
2015	570.2	601.2	125.3	125.3	500.5	531.5
2016	570.8	602.4	103.0	167.0	502.6	534.2
2017	563.1	595.2	96.7	139.5	498.4	530.5
2018	534.8	566.8	88.0	113.2	490.1	522.1
2019	514.6	546.6	79.3	99.0	479.4	511.4
2020	512.3	544.7	77.0	99.3	476.1	508.5
2035	581.9	619.8	300.0	369.0	517.7	555.6

Appendix C. QUEENSLAND

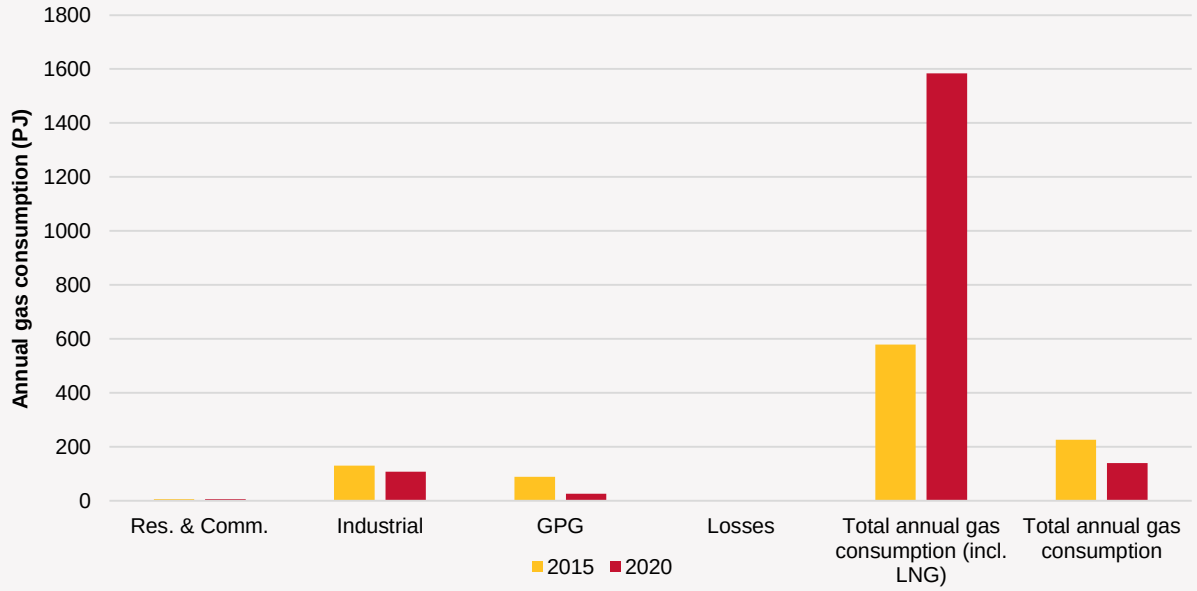
C.1 Key points for Queensland

Key short-term (2016–20) forecasts for Queensland in the medium scenario are:

- Total gas consumption is forecast to increase at an average annual rate of 22.3%, driven by the rapid increase in gas consumption for the LNG facilities (see Figure 28).
- LNG gas consumption is forecast to grow at an average annual rate of 32.5% to 2020.
- Excluding gas consumption for LNG, gas consumption in Queensland is forecast to decrease in the short term (see Figure 29), due to:
  - A forecast decrease of industrial gas consumption at an average annual rate of 3.7%.
  - A forecast decrease of GPG gas consumption at an average annual rate of 21.9%.
  - A forecast of relatively flat residential and commercial consumption at an average annual rate of 0.2%.
- Maximum demand is forecast to rise as the LNG facilities become operational. This more than offsets forecasts of falls in maximum demand attributable to the GPG, residential and commercial and industrial sectors.

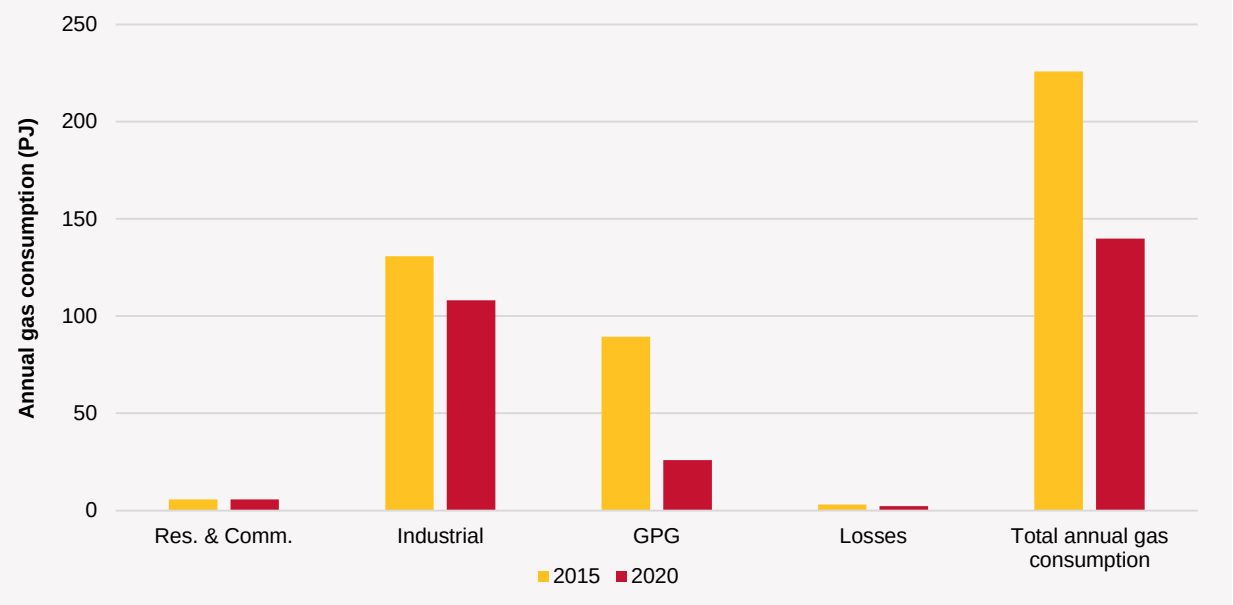
Longer-term forecasts, and forecasts based on high and low scenarios, are provided in the following sections.

Figure 28 Comparison of 2015 (estimated) and 2020 (forecast) annual gas consumption in Queensland (including LNG) [37]



[37] Estimated and forecast consumption is calculated assuming a standard temperature pattern, estimated from historical observations.

Figure 29 Comparison of 2015 (estimated) and 2020 (forecast) annual gas consumption in Queensland (excluding LNG)



C.2 Annual consumption in Queensland

C.2.1 Overview

From 2010 to 2014, gas consumption in Queensland increased from 209.9 PJ to 251.8 PJ. This increase was driven by gas consumption by GPG for electricity generation and, to a lesser extent, gas consumption associated with initiation of LNG facilities.

Gas consumption by the LNG facilities will dominate Queensland in future.

Table 45 summarises annual consumption forecast trends and drivers (excluding LNG) over the short, medium, and long term.

Table 45 Total annual gas consumption forecasts over the short, medium, and long term (excl. LNG)

Timeframe	Forecast (PJ)	Average annual rate of change	Drivers
Short term (2015–20)	225.9 to 139.7	9.2% decrease	GPG and industrial load decrease in response to gas price changes. Some significant operational changes are anticipated for large industrial loads. Energy efficiency measures and appliance switching away from gas results in a decline in residential and commercial consumption.
Medium term (2020–25)	139.7 to 143.5	0.5% increase	Large industrial loads continue to decrease in response to various factors. Increase in GPG, driven by increased demand in the NEM and retirement of coal-fired generation. Residential and commercial consumption remains relatively flat as increasing population growth balances the effect of energy efficiency measures.
Long term (2025–35)	143.5 to 196.8	3.2% increase	Continued increasing demand and investment in new GPG drives increase of gas consumption. Increase in large industrial consumption is driven primarily by growth in the food and beverage manufacturing and services sectors. Residential and commercial consumption increases due to population growth.

Residential, commercial and industrial consumption is forecast to be 22.1% higher in 2035 than was forecast in the 2014 NGFR. This is mainly due to updated gas price projections for the industrial sector and – to a minor extent – an updated higher number of residential connections expected.

The long-term 20-year forecast for all sectors in Queensland is presented in Figure 30. It shows again that LNG-related consumption is forecast to greatly outweigh the other sectors.

To show trends in other sectors, Figure 31 shows the long-term forecasts without LNG. Mostly because of the warmer climate, residential and commercial use of gas is proportionally smaller in Queensland than in other states. The short-term decline of consumption by GPG is driven by the projected increase of gas prices.

Figure 30 Annual consumption forecast segments for Queensland (including LNG)

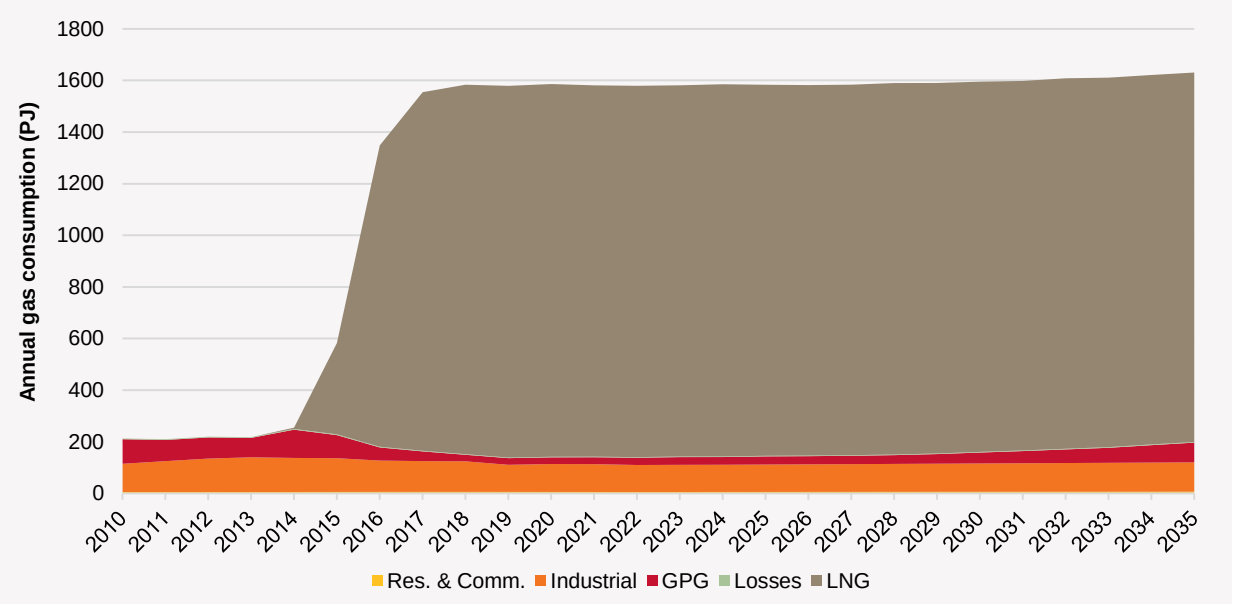


Figure 31 Annual consumption forecast segments for Queensland (excluding LNG)

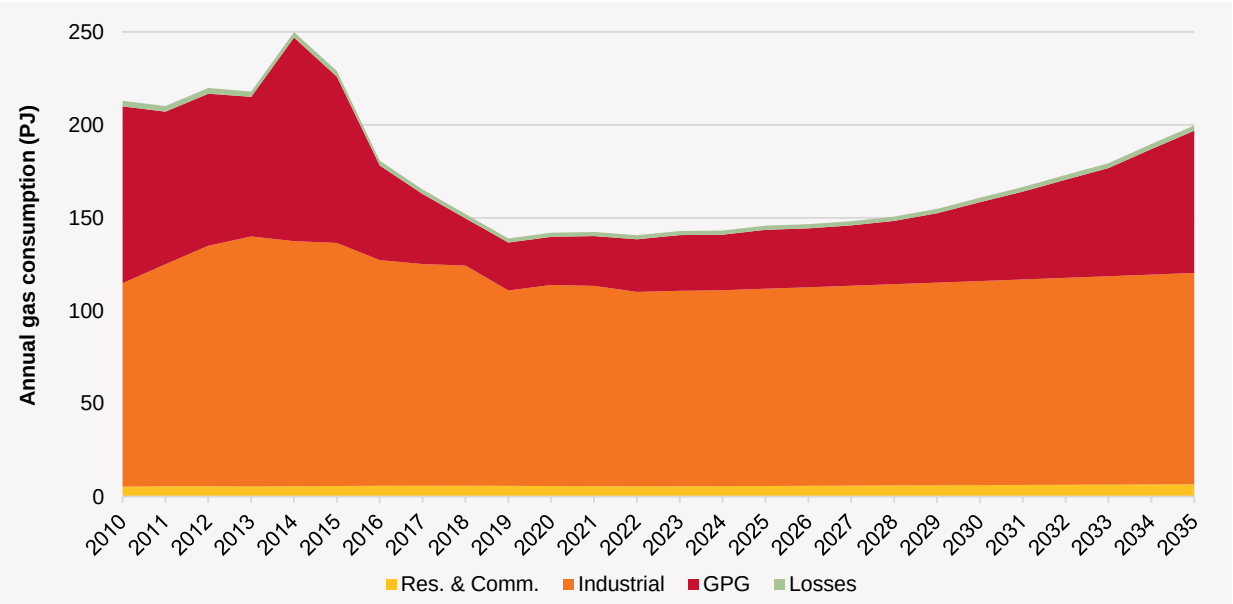
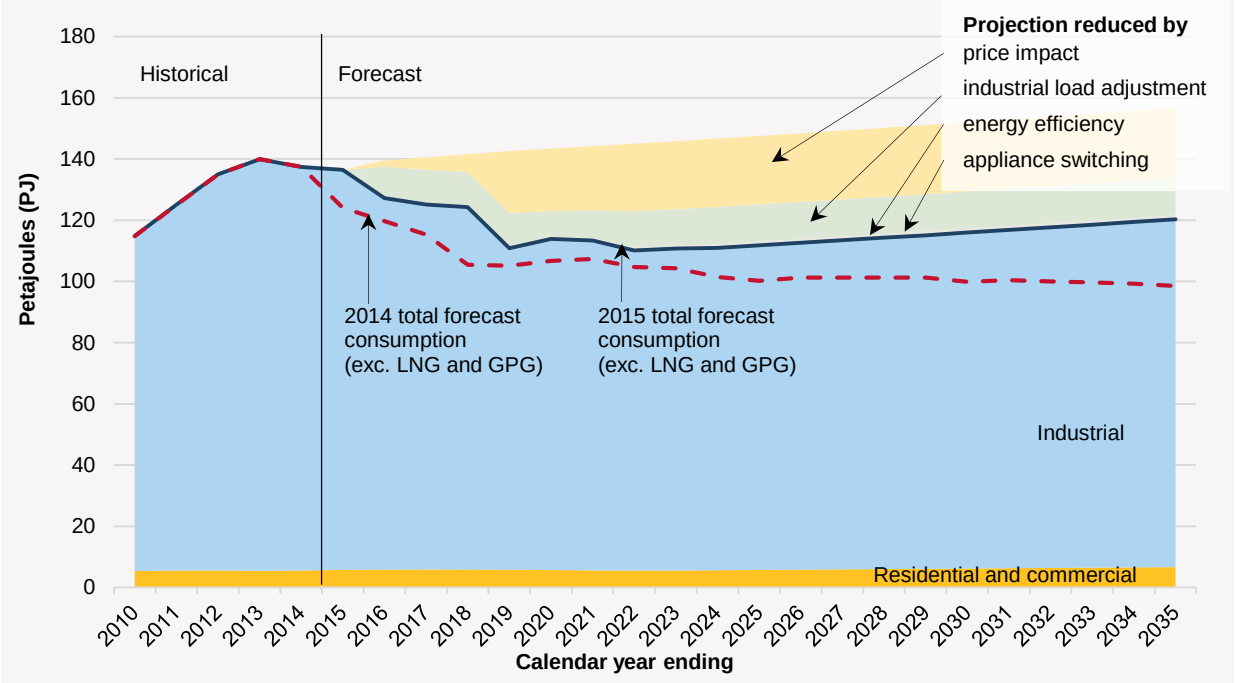


Figure 32 shows how these forecasts are influenced by these factors (that is, how each reduced the forecast from what it would otherwise have been). Projected changes in the composition of the industrial sector are the main driver in forecasts of a 10.1% decrease of aggregated residential and industrial consumption by 2035. In the long term, a projected increase of prices has a larger impact on consumption. In the 2015 NGFR, this is forecast to reduce residential and commercial and industrial consumption by 19% by 2035.

Figure 32 Annual consumption forecast segments for Queensland, including sources of demand reduction



C.2.2 High, medium, and low scenario forecast trends and drivers in Queensland

AEMO modelled Queensland's forecasts under high, medium and low scenarios (see Section 1.3). Compared to the medium scenario:

- The high scenario assumes sustained international demand of gas for LNG and the start of a seventh LNG train in ten years, faster population growth, lower domestic gas prices, and industrial production less responsive to price changes. Business conditions for manufacturing are assumed to remain good.
- The low scenario is characterised by projected demand of gas for LNG at take-or-pay levels, slower population growth, higher gas prices, and industrial production more responsive to price changes. Business conditions for manufacturing are assumed to be challenging.

Table 46 shows short-term forecasts and key drivers for each sector, under each scenario.

Table 46 High, medium and low scenario forecast trends and drivers for Queensland, 2015−20

Sector	Scenario	Forecast (PJ)	Average annual rate of change	Key drivers
Residential and commercial	Medium	5.74 to 5.70	0.2% decrease	Growth in number of connections (driven by population growth) is offset by increasing prices, appliance switching and energy efficiency improvements.
	High	5.74. to 5.77	0.1% increase	Larger population growth increases number of connections. Lower prices push up consumption.
	Low	5.74 to 5.56	0.7% decrease	Milder population growth, higher prices.
Industrial	Medium	130.7 to 108.2	3.7% decrease	Economy continues to transition from gas-intensive sectors to less gas-intensive sectors, driven by market forces and other factors. Industrial loads respond to changes in gas prices and some significant operational changes are anticipated for large industrial loads.
	High	130.7 to 129.9	0.1% decrease	Better business conditions for manufacturing. Lower gas prices and greater population growth than in the medium scenario.
	Low	130.7 to 85.5	8.1% decrease	More challenging business conditions for manufacturing. Higher gas prices and slower population growth than in the medium scenario.
Gas-powered generation	Medium	89.4 to 25.9	22.0% decrease	As gas prices are projected to increase and existing gas supply agreements are expected to expire or continue at lower volumes, gas fuel consumption trends downwards.
	High	89.4 to 40.8	14.5% decrease	As gas supply agreements are expected to expire or continue at lower volumes, gas fuel consumption trends downwards.
	Low	89.4 to 26.8	21.4% decrease	As gas supply agreements are expected to expire or continue at lower volumes, gas fuel consumption trends downwards.

Including LNG, the high, medium, and low scenario short-term aggregated forecasts increase at annual average rates of 24.7%, 22.3%, and 18.4% respectively. The main driver of this increase is projected gas consumption by the LNG facilities. Excluding gas consumption by LNG facilities, total consumption is forecast to decrease at rates of 4.8%, 9.2%, and 12.2% in the high, medium and low scenarios, respectively.

Figures 33 and 34 and Table 47 show the high, medium, and low scenario forecasts for the 20-year outlook period, and compare them to the 2014 NGFR forecasts.

For the 2015 NGFR, AEMO has updated the forecasts for changes in key trends, and has introduced a number of changes to methodology that have also changed the forecasts. More detail is in the sector commentary below, and in the 2015 NGFR Methodology Information Paper.

Figure 33 Comparison of annual consumption forecast scenarios for Queensland (including LNG)

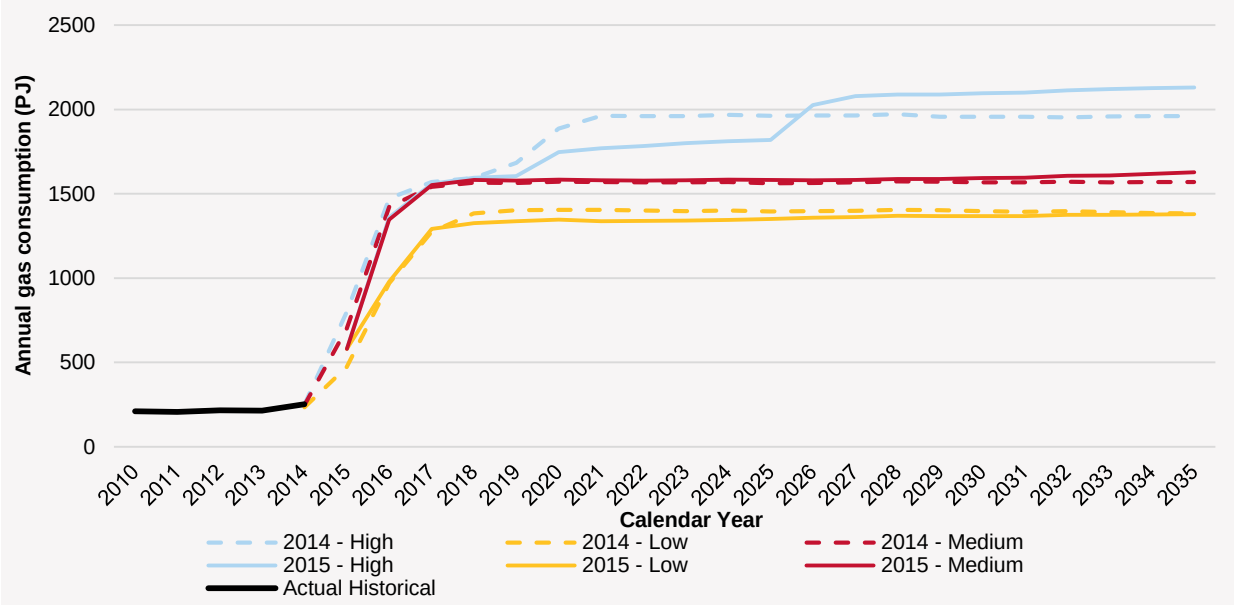


Figure 34 Comparison of annual consumption forecast scenarios for Queensland (excluding LNG)

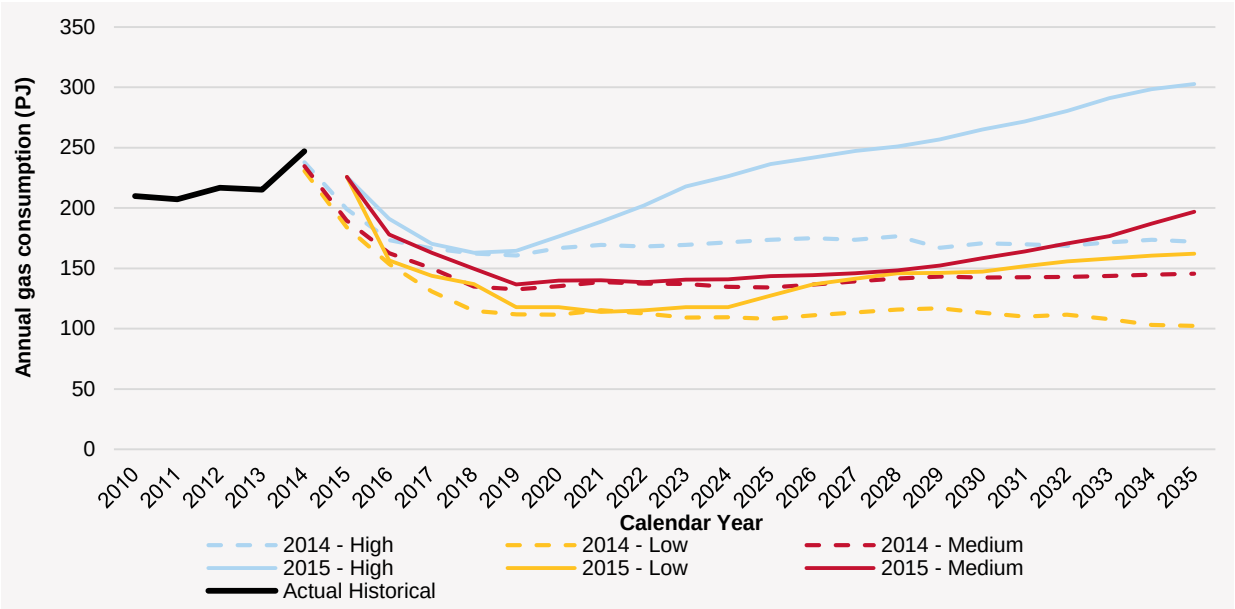


Table 47 Annual gas consumption forecasts for Queensland (PJ)

Calendar Year	Actual	High (NGFR 2015)	Medium (NGFR 2015)	Low (NGFR 2015)	High (NGFR 2014)	Medium (NGFR 2014)	Low (NGFR 2014)
2010	209.9						
2011	207.1						
2012	216.7						
2013	215.1						
2014	251.8						
2015			579.7		799.8	701.0	473.4
2016		1,358.9	1346.0	979.4	1472.3	1423.9	969.3
2017		1,559.9	1552.3	1292.3	1569.8	1541.4	1274.1
2018		1,594.6	1581.4	1325.2	1594.9	1564.8	1383.5
2019		1,605.1	1577.1	1337.2	1683.5	1564.1	1401.7
2020		1,746.5	1584.1	1346.4	1886.4	1570.8	1404.9
2021		1,770.3	1579.0	1337.5	1961.3	1569.0	1403.8
2022		1,783.6	1577.3	1339.0	1960.1	1567.9	1401.1
2023		1,799.0	1579.2	1341.3	1961.1	1567.4	1397.6
2024		1,811.9	1583.3	1344.5	1968.2	1568.7	1401.2
2025		1,819.7	1581.3	1350.0	1963.1	1561.8	1394.1
2026		2,025.3	1580.0	1357.2	1964.4	1564.4	1397.0
2027		2,079.6	1581.5	1362.0	1963.1	1567.1	1399.4
2028		2,088.3	1587.8	1369.8	1971.0	1573.3	1405.3
2029		2,089.1	1588.0	1366.6	1956.3	1570.9	1403.0
2030		2,096.5	1593.0	1366.7	1957.0	1567.0	1395.9
2031		2,100.1	1595.8	1368.4	1956.2	1567.2	1392.8
2032		2,113.8	1606.0	1375.6	1952.4	1571.4	1397.8
2033		2,119.6	1608.5	1374.6	1957.7	1568.2	1390.7
2034		2,127.0	1618.7	1377.0	1959.5	1569.2	1385.8
2035		2,130.7	1628.1	1378.2			

C.2.3 Gas-powered generation in Queensland

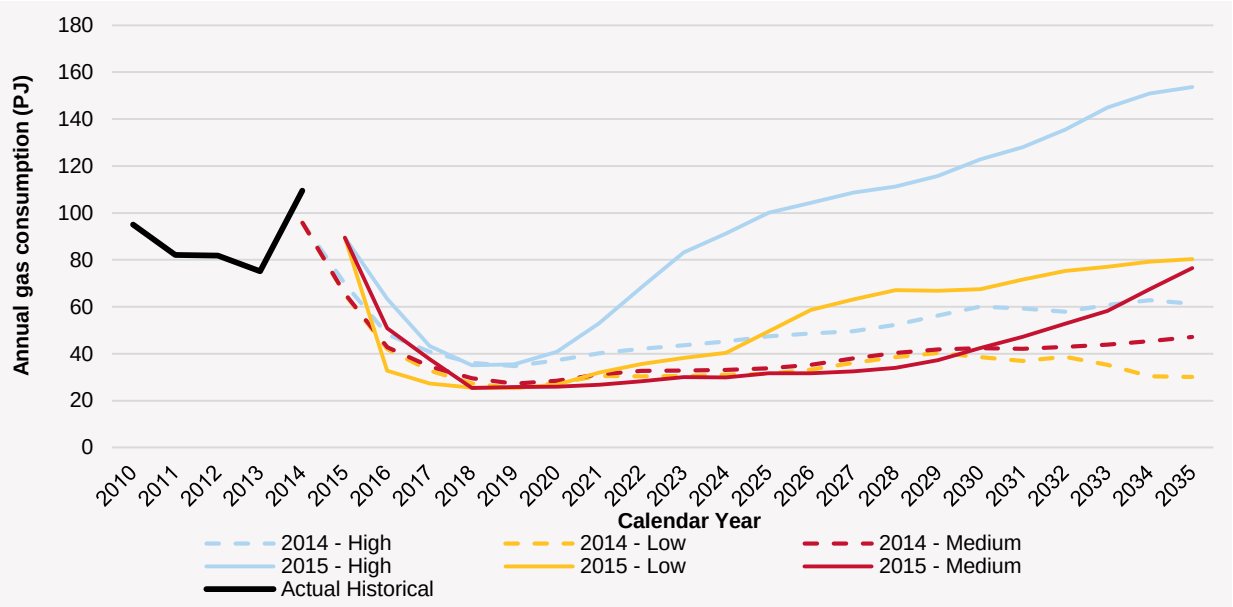
Between 2010 and 2014 gas consumption by GPG increased from 95.1 PJ to 109.5 PJ, due to electricity generation under existing gas supply agreements at low prices, and gas consumption associated with LNG production.

Table 48 presents forecast GPG gas consumption forecasts with trends and drivers over the short, medium, and long term. In Figure 35, forecasts for the 20-year outlook period are given for high, medium and low scenarios, and compared to the 2014 NGFR forecasts.

Table 48 GPG gas consumption forecasts over the short, medium, and long term

Timeframe	Forecast (PJ)	Average annual rate of change	Drivers
Short term (2015–20)	89.4 to 25.9	21.9% decrease	Gas prices are projected to increase. Existing (lower cost) gas supply agreements are projected to expire or continue at lower volumes. As a result, gas consumption trends downwards.
Medium term (2020–25)	25.9 to 31.7	4.1% increase	Electricity demand increases, creating increasing need for GPG.
Long term (2025–35)	31.7 to 76.5	9.2% increase	Growing trend continues due to the same drivers. It has been assumed that no new coal generation is installed. This drives increased investment in GPG.

Figure 35 Comparison of high, medium, and low scenario forecasts for GPG in Queensland



In both the NGFR 2014 and NGFR 2015, a similar trend has been forecast – decreasing consumption in the near term, followed by increasing gas consumption beyond that period. This year's medium scenario forecast generally aligns with the 2014 NGFR forecast until 2030, when further increases in GPG gas consumption are projected.

The high scenario produces a greater increase in forecast GPG consumption by 2035. This is driven by a combination of factors, which include higher forecast electricity consumption due to LNG production (see AEMO's 2015 National Electricity Forecasting Report Update), and no new coal-fired generation coming online (creating opportunities for renewables and GPG as options to meet increasing electricity supply needs).

C.2.4 Industrial consumption (Tariff D) in Queensland

Queensland has been impacted by the historical transition in the economy from gas-intensive manufacturing sectors to less gas-intensive sectors, such as services. In recent years, this has resulted in a decline in gas consumption. However, in Queensland from 2010 to 2014 industrial consumption increased from 109.5 to 131.9 PJ, driven by large industrial load expansions in the mining and manufacturing sectors.

Over the next five years, industrial consumption is forecast to decline, driven by manufacturing changes and some projected changes in consumption based on advice from large industrial users.

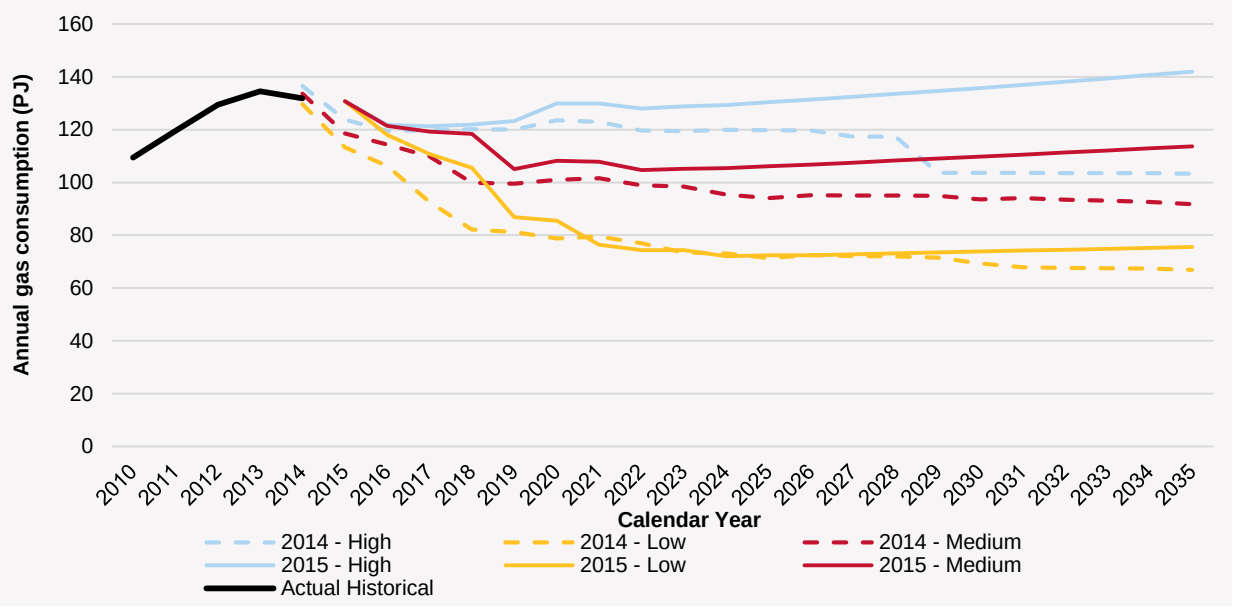
In the long term, consumption is forecast to remain flat, due to the projected offsetting effect of emerging growth sectors and more stable business conditions for manufacturing.

Table 49 presents the forecast trends and drivers in industrial consumption over the short, medium, and long term. In Figure 36, forecasts for the 20-year outlook period are given for high, medium and low scenarios, and compared to 2014 NGFR forecasts.

Table 49 Industrial consumption forecast over the short, medium, and long term

Timeframe	Forecast (PJ)	Average annual rate of change	Drivers
Short term (2015–20)	130.7 to 108.2	3.7% decrease	Economy continues to transition from gas-intensive sectors to less gas-intensive sectors, driven by market forces and other factors. Industrial loads respond to changes in gas prices and some significant operational changes are anticipated for large industrial loads.
Medium term (2020–25)	108.2 to 106.1	0.4% decrease	Manufacturing sectors stabilise. Large industrial loads continue to respond to price changes and some operational changes in large industrial load are anticipated in the medium term. Some less gas-intensive sectors exhibit growth, underpinned by population growth. This effect dominates in the long term.
Long term (2025–35)	106.1 to 113.7	0.7% increase	

Figure 36 Comparison of high, medium, and low scenario forecasts for the industrial sector in Queensland



C.2.5 Residential and commercial consumption (Tariff V)

From 2010 to 2014 residential and commercial consumption increased from 5.37 PJ to 5.54 PJ. On a weather-corrected basis[38], residential and commercial consumption increased at an annual average rate of 0.1%. This reflects an increase in connections to the gas network.

Warm climate and high retail prices in Queensland are forecast to slow the uptake of gas appliances, keeping consumption relatively flat in the short to medium term.

Average gas use per connection is forecast to decline over the outlook period, linked to projected rising gas prices, appliance switching trends, and savings from federal energy efficiency programs.

In the long term, residential consumption is forecast to increase as a result of sustained population growth.

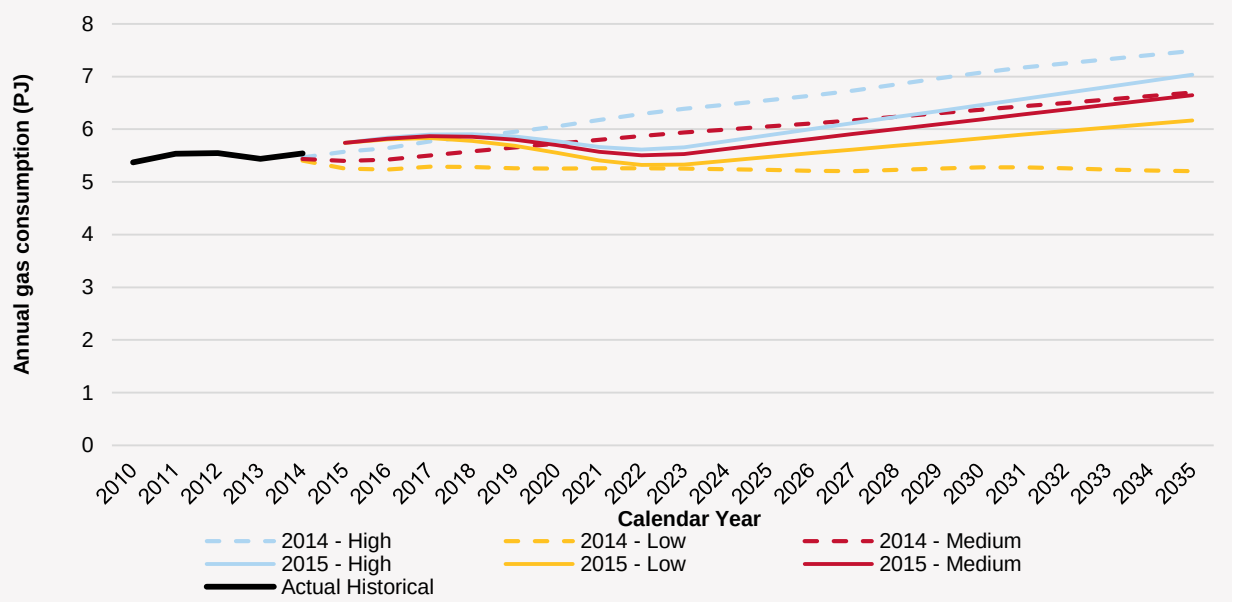
[38] Estimated and forecast consumption is calculated assuming a standard temperature pattern, estimated from historical observations.

Table 50 and Figure 37 show residential and commercial consumption forecast trends and drivers over the short, medium and long term.

Table 50 Residential and commercial gas consumption forecasts in Queensland over the short, medium, and long term

Timeframe	Forecast (PJ)	Average annual rate of change	Drivers
Short term (2015–20)	5.74 to 5.70	0.2% decrease	Growth in number of connections (driven by population growth) is offset by increasing prices, appliance switching and energy efficiency improvements.
Medium term (2020–25)	5.70 to 5.72	0.1% increase	Growth rate in number of connections remains stable while the impact of appliance switching and energy efficiency reduces.
Long term (2025–35)	5.72 to 6.64	1.5% increase	

Figure 37 Comparison of high, medium, and low scenario forecasts for the residential and commercial sector in Queensland



Key forecast inputs

Weather

The historical range of the weather series used for defining the standard weather scenario has been extended back to the year 2000 (the 2014 NGFR used more recent data). As a result, a lower median temperature was used in the forecast, driving consumption upwards (see Table 51).

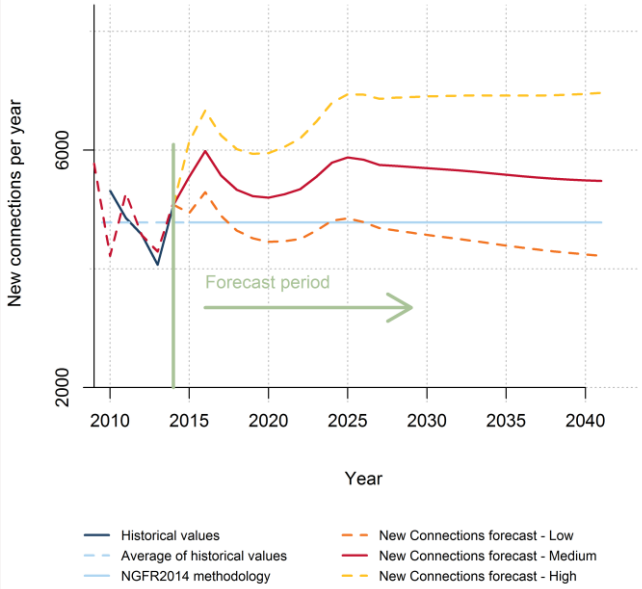
Table 51 Weather corrections in Queensland

Model	Annual EDD in 2015 (˚C)	Trend (˚C / year)	Comments
NGFR 2015	210	0	Constant across all years.
NGFR 2014	382	-4.25	Linear downward trend.

Number of connections

For the 2015 NGFR, annual variation of residential and commercial connections was linked to building cycles and population projections in Queensland. Different connection rates were used for single detached houses and multi-unit dwellings. In contrast, the 2014 NGFR used an average of the historical rate of new connections. As a result, over the period 2014–20, the number of connections is projected to grow by approximately 33,500 units (2.7% average annual growth), compared to the 21,000 predicted in the 2014 NGFR (see Figure 38).

Figure 38 Number of connections in Queensland



Energy efficiency and appliance switching

Improvements in the energy efficiency of appliances and thermal insulation of houses, as well as a gradual move from gas appliances towards electric appliances, were modelled directly in a bottom-up approach. This represents a significant difference to the 2014 NGFR methodology, where energy efficiency improvements were considered implicitly in the linear model used to regress consumption as a function of prices, with a correction term applied to the final forecast.

Retail gas prices

Wholesale gas price projections have been updated to known contracts with future values linked to oil prices. Wholesale gas price projections are lower than those used in the 2014 NGFR, following the oil price drop in the past year. The net effect of the changed projections is projected retail prices that are higher than those used in the 2014 NGFR. The projected change in gas price is expected to be relatively flat, with a 0.24% average annual increase in the first five years, followed by an average annual increase of 0.1% until 2035.

C.3 Maximum demand in Queensland

Table 52 to Table 54 show projections of maximum demand in Queensland under the different scenarios.

In the 2015 NGFR, seasonal differences in efficiency of LNG processing have been included, resulting in forecasts of Queensland's peak demand shifting to winter. Without seasonality, the maximum demand would be forecast to occur in summer, as in the 2014 NGFR.

The residential, commercial and industrial forecasts of maximum demand are not coincident with the forecasts of maximum demand for GPG, therefore the two cannot be added to obtain a regional total. The total displayed in the tables below includes the forecast average GPG on a day of total system demand.

Table 52 Maximum demand forecasts for Queensland (medium scenario) (TJ/day)

	Total		GPG		Residential, Commercial & Industrial	
	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20
2015	1829.44	1836.67	401.8	401.8	423.06	430.29
2016	4325.8	4332.6	315.0	347.7	394.99	401.76
2017	4638.1	4644.8	278.3	335.1	388.65	395.33
2018	4735.1	4741.7	242.0	314.9	386.18	392.82
2019	4694.8	4700.8	230.7	317.1	345.26	351.23
2020	4704.8	4710.9	234.7	326.7	354.29	360.42
2035	4856.1	4862.7	448.0	573.6	375.34	381.88

Table 53 Maximum demand forecasts for Queensland (high scenario) (TJ/day)

	Total		GPG		Residential, Commercial & Industrial	
	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20
2015	1855.91	1863.14	401.8	401.8	423.06	430.29
2016	4357.98	4364.77	351.5	387.9	396.32	403.11
2017	4649.55	4656.33	324.0	383.0	394.98	401.76
2018	4763.23	4770.05	309.3	380.2	396.96	403.78
2019	4764.05	4770.93	307.0	392.7	401.02	407.91
2020	5225.68	5232.90	330.3	410.5	420.77	427.99
2035	6371.27	6379.25	634.0	732.7	463.11	471.10

Table 54 Maximum demand forecasts for Queensland (low scenario) (TJ/day)

	Total		GPG		Residential, Commercial & Industrial	
	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20
2015	1797.11	1804.34	401.8	401.8	423.06	430.29
2016	3104.21	3110.81	300.0	341.1	384.57	391.17
2017	3885.44	3891.68	285.7	335.8	362.53	368.77
2018	3960.41	3966.39	269.0	329.9	346.69	352.66
2019	4001.59	4006.62	276.0	344.2	289.25	294.28
2020	4000.03	4004.99	285.0	366.1	284.53	289.49
2035	4121.59	4126.14	428.3	567.7	256.98	261.54

Appendix D. SOUTH AUSTRALIA

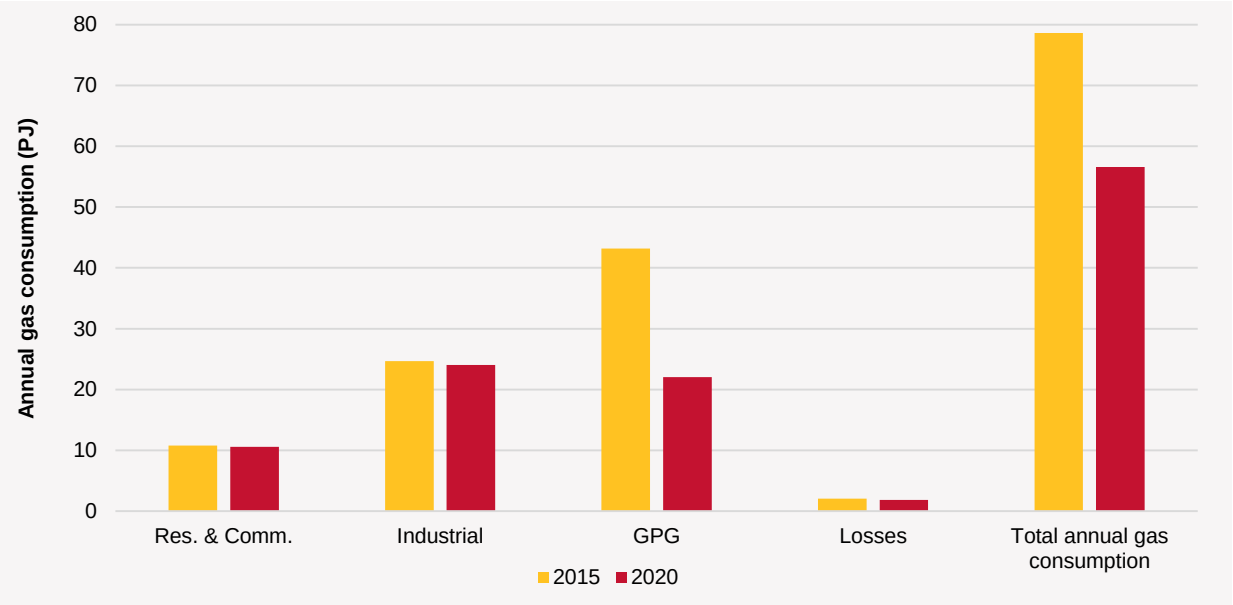
D.1 Key points for South Australia

Key short-term (2016–20) forecasts for South Australia in the medium scenario are:

- Total gas consumption is forecast to decrease at an average annual rate of 6.4%.
- Residential and commercial consumption is forecast to decrease at an average annual rate of 0.4%.
- Industrial gas consumption is forecast to decrease at an average annual rate of 0.5%.
- GPG gas consumption is forecast to decline at an average annual rate of 12.6%.
- Maximum demand is forecast to grow across the 20-year horizon due to projected growth in GPG gas consumption.

Longer-term forecasts, and forecasts based on high and low scenarios, are provided in the following sections.

Figure 39 Comparison of 2015 (estimated) and 2020 (forecast) annual gas consumption in South Australia[39]



D.2 Annual consumption in South Australia

D.2.1 Overview

From 2010 to 2014 gas consumption in South Australia decreased from 104.6 PJ to 84.4 PJ. This decrease was driven mostly by a reduction in GPG consumption. This trend is expected to continue for the next five years.

Table 55 summarises annual consumption forecast trends and drivers over the short, medium, and long term.

[39] Estimated and forecast consumption is calculated assuming a standard temperature pattern, estimated from historical observations.

Table 55 Total annual gas consumption forecasts over the short, medium, and long term

Timeframe	Forecast (PJ)	Average annual rate of change	Drivers
Short term (2015–20)	78.6 to 56.6	6.4% decrease	GPG and industrial load decrease in response to gas price changes. Some significant operational changes are anticipated for large industrial loads. Energy efficiency improvements and appliance switching away from gas results in a projected decline in residential and commercial consumption.
Medium term (2020–25)	56.6 to 60.21	1.2% increase	Large industrial loads continue to decrease consumption in response to price and other factors. Increase in GPG, driven by increased demand in the NEM and retirement of coal-fired generators. Residential and commercial consumption remains relatively flat, as increasing population growth balances the effect of energy efficiency measures.
Long term (2025–35)	60.21 to 79.8	2.9% increase	Continued increasing demand and investment in new GPG drives increase in gas consumption. Increase in large industrial consumption is driven primarily by growth in the food and beverage manufacturing and services sectors. Residential and commercial consumption increases due to population growth.

Residential, commercial and industrial consumption in 2035 is forecast to be 5.2% lower than was estimated in the 2014 NGFR. This is due to projections of fewer new gas connections and lower industrial consumption in the long term.

The long-term 20-year forecast for all sectors in South Australia is presented in Figure 40.

Figure 40 Annual consumption forecast segments for South Australia

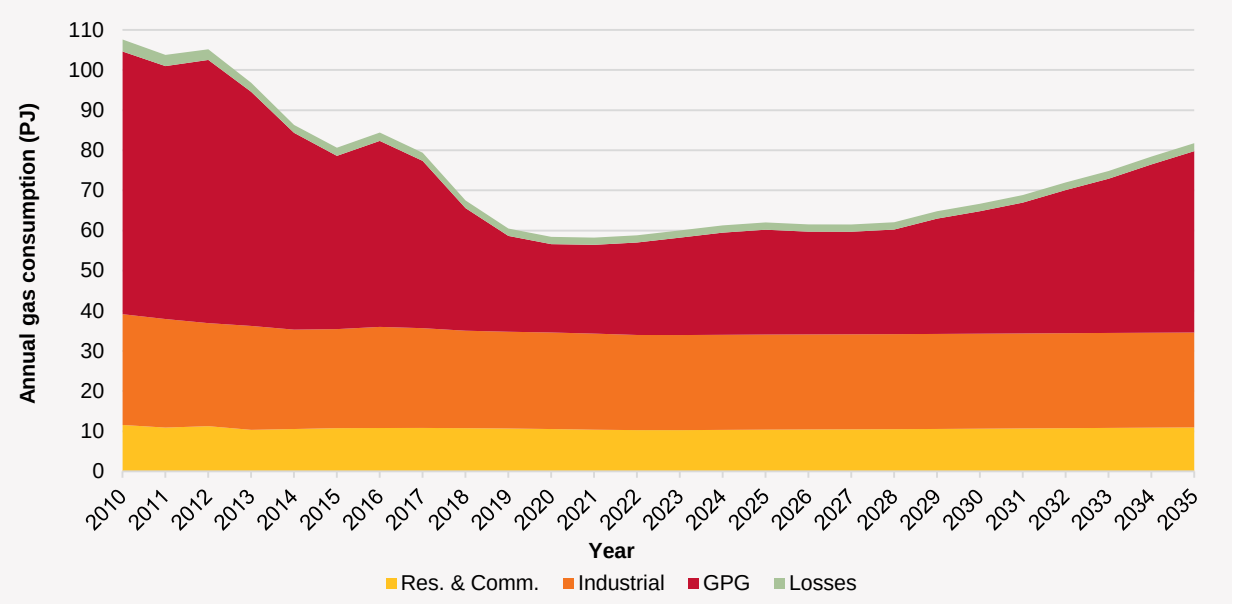
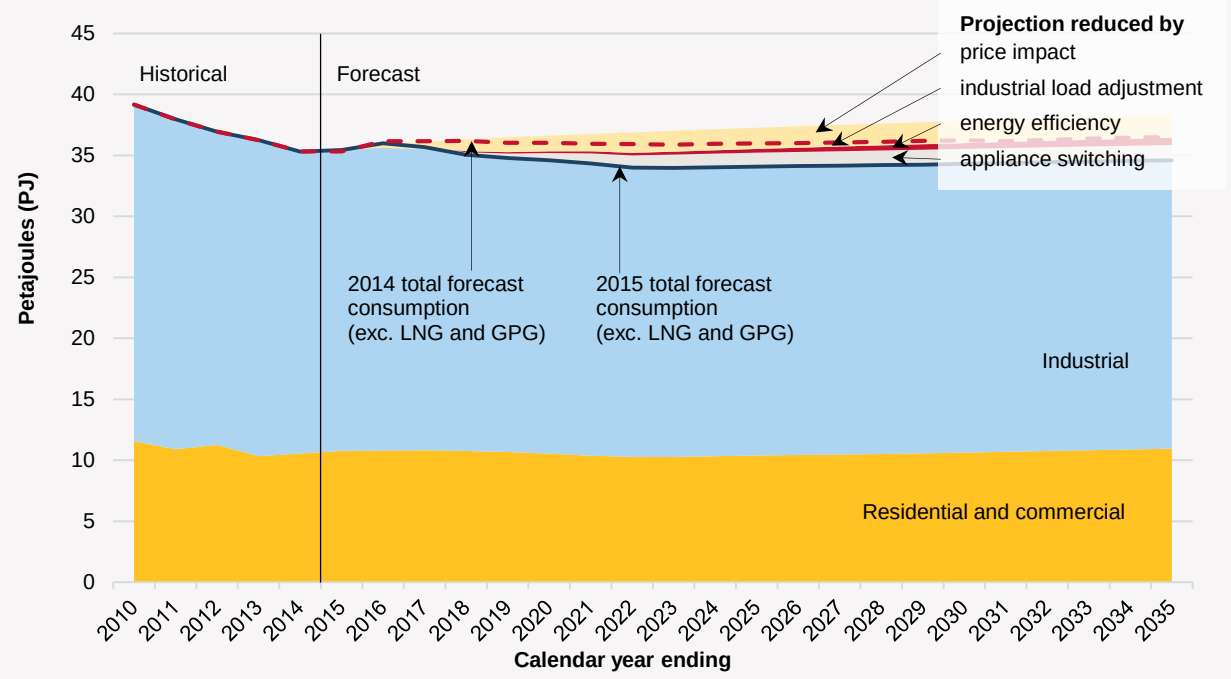


Figure 41 shows how these forecasts have been impacted by key drivers of consumption (that is, how each factor reduced the forecast from what it would otherwise have been). Appliance switching from gas to electric is projected to be the largest driver of the forecast reduction (3.5% of the sum of residential and commercial and industrial consumption in 2035), followed by energy efficiency (1.7%). Projected changes in gas prices in both the residential, commercial and industrial sectors are forecast to reduce consumption by 5.5% relative to what it would have otherwise have been.

Figure 41 Annual consumption forecast segments for South Australia, including sources of demand reduction



D.2.2 High, medium, and low scenario forecast trends and drivers in South Australia

AEMO modelled South Australia's forecasts under high, medium and low scenarios (see Section 1.3).

Compared to the medium scenario:

- The high scenario is characterised by faster population growth, lower gas prices, and industrial production less responsive to price changes. Business conditions for manufacturing are assumed to be good.
- The low scenario is characterised by slower population growth, higher gas prices, and industrial production more responsive to price changes. Business conditions for manufacturing are assumed to be challenging.

Table 56 shows the short-term forecasts and key drivers for each sector, under each scenario.

Table 56 High, medium and low scenario trends and drivers for South Australia, 2015−20

Sector	Scenario	Forecast (PJ)	Average annual rate of change	Key drivers
Residential and commercial	Medium	10.8 to 10.5	0.4% decrease	Rate of growth of connections slows down over the years. Increasing retail prices, appliance switching, and impact of energy efficiency improvements drive down residential and commercial consumption.
	High	10.8 to 10.6	0.3% decrease	Larger number of new residential connections and lower retail gas prices.
	Low	10.8 to 10.2	1.1% decrease	Smaller number of new connections and higher retail gas prices.
Industrial	Medium	24.7 to 24.1	0.5% decrease	Economy continues to transition from gas-intensive sectors to less gas-intensive sectors, driven by market forces and other factors. Industrial loads respond to changes in gas prices and some significant operational changes are anticipated for large industrial loads.
	High	24.7 to 25.0	0.2% increase	Better business conditions for manufacturing. Lower gas prices and greater population growth than in the medium scenario.
	Low	24.7 to 21	3.2% decrease	More challenging business conditions for manufacturing. Higher gas prices and slower population growth than in the medium scenario.
Gas-powered generation	Medium	43.2 to 21.9	12.6% decrease	New wind generation reduces need for GPG. Gas prices increase and existing gas supply contracts expire, increasing operating costs for GPG.
	High	43.2 to 28.7	7.9% decrease	A greater proportion of electricity demand met by GPG.
	Low	43.2 to 21.6	13% decrease	Forecast electricity consumption is lower than the medium scenario. As a result GPG is lower.

The high, medium, and low scenario short-term forecasts decline at annual average rates of 4.0%, 6.4% and 7.7%, respectively.

Figure 42 and Table 57 show the high, medium and low consumption forecasts for the 20-year outlook period, and compare them to the 2014 NGFR forecasts.

For the 2015 NGFR, AEMO has updated the forecasts for changes in key trends, and has introduced a number of changes to methodology that have also changed the forecasts. More detail is provided in the sector commentary below, and in the 2015 NGFR Methodology Information Paper.

Figure 42 Comparison of annual consumption forecast scenarios for South Australia

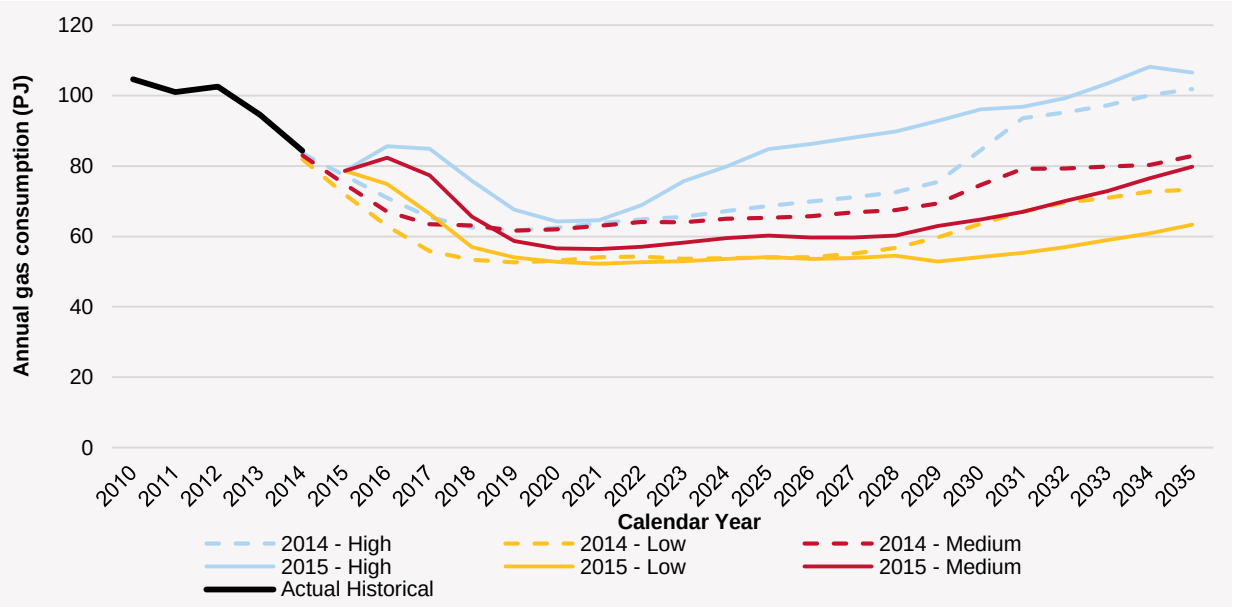


Table 57 Annual gas consumption forecasts for South Australia (PJ) , 2010–35

Calendar Year	Actual	High (NGFR 2015)	Medium (NGFR 2015)	Low (NGFR 2015)	High (NGFR 2014)	Medium (NGFR 2014)	Low (NGFR 2014)
2010	104.6						
2011	101.0						
2012	102.5						
2013	94.6						
2014	84.4						
2015			78.6		77.3	74.8	71.9
2016		85.6	82.3	74.9	70.9	67.0	62.9
2017		84.9	77.4	66.4	65.5	63.5	55.8
2018		75.8	65.6	57.0	62.6	63.1	53.3
2019		67.6	58.7	54.1	61.6	61.6	52.7
2020		64.2	56.6	52.8	62.5	62.0	53.1
2021		64.6	56.4	52.2	63.7	63.0	54.1
2022		68.9	57.0	52.7	64.9	64.1	54.2
2023		75.7	58.2	53.0	65.5	64.0	53.6
2024		79.8	59.5	53.6	67.2	65.0	53.8
2025		84.8	60.2	54.2	68.6	65.3	54.0
2026		86.3	59.7	53.6	69.9	65.7	54.1
2027		88.1	59.7	53.9	71.1	66.8	55.1
2028		89.8	60.3	54.5	72.6	67.5	56.8
2029		92.8	63.0	52.9	75.5	69.4	59.7
2030		96.1	64.8	54.2	84.4	74.6	63.5
2031		96.8	67.0	55.3	93.6	79.2	67.0
2032		99.3	70.1	57.0	95.2	79.3	69.6
2033		103.4	72.9	58.9	97.2	79.8	70.9
2034		108.2	76.5	60.8	100.1	80.3	72.7
2035		106.5	79.8	63.4	101.8	82.8	73.3

D.2.3 Gas-powered generation

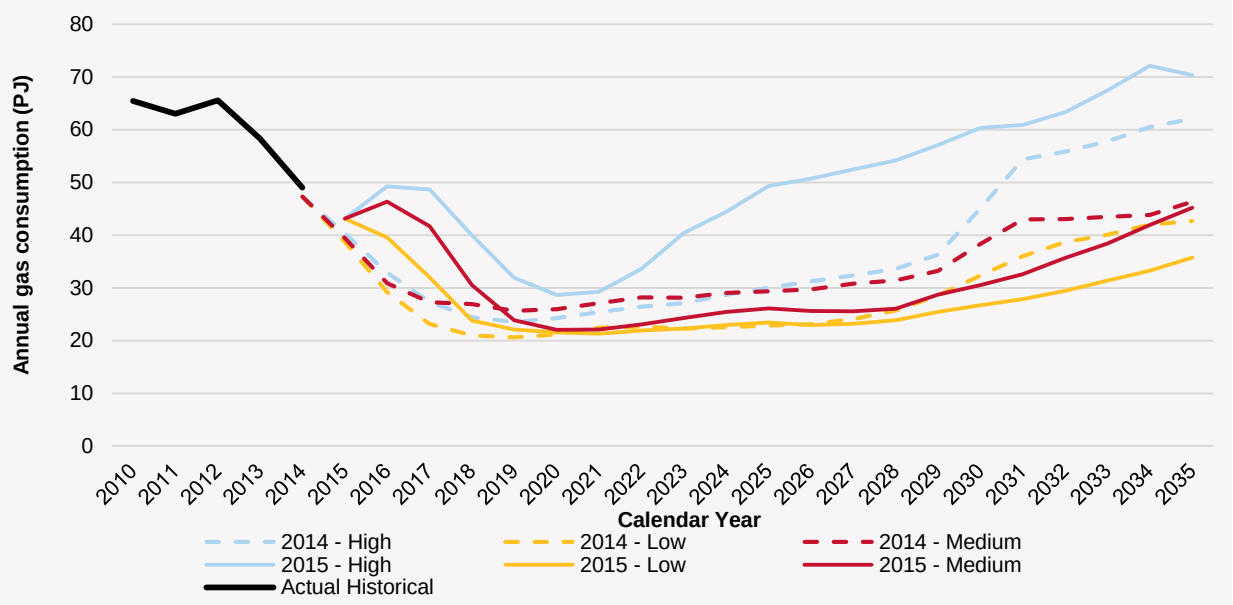
From 2010 to 2014 GPG gas consumption decreased from 65.4 PJ to 49.0 PJ,as new renewable generation came onto the market and, more recently, some gas generation was partially mothballed.[40]

Table 58 shows the forecast trends and drivers in GPG gas consumption over the short, medium, and long term. In Figure 43, forecasts for the 20-year outlook period are given for high, medium and low scenarios, and compared to the 2014 NGFR predictions.

Table 58 GPG gas consumption forecasts over the short, medium, and long term

Timeframe	Forecast (PJ)	Average annual rate of change	Drivers
Short term (2015–20)	43.2 to 22	12.6% decrease	Early retirement of the Northern Power Station revised upwards the starting point of the forecast. GPG consumption reduces as electricity supply is met by new wind generation coming online. The expiration of existing (lower cost) gas supply agreements also exposes GPG to projected fuel price increases, reducing its competitiveness in the electricity market.
Medium term (2020–25)	22 to 26.1	3.5% increase	Demand increases and increased electricity supply from GPG drives gas annual consumption.
Long term (2025–35)	26.1 to 45.2	5.6% increase	The increasing trend in the medium term continues until the end of the outlook period as demand picks up.

Figure 43 Comparison of high, medium, and low scenario forecasts for GPG in South Australia



Due to the early retirement of coal-fired Northern Power Station, the forecast GPG gas consumption is 5 to 10 PJ higher for 2016 than was previously forecast in the 2014 NGFR. This retirement drives up gas consumption for electricity generation in the first three years.

In the long term, GPG consumption is forecast to increase to produce electricity to supply forecast rising electricity consumption.

[40] http://www.aemo.com.au/Electricity/Planning/Related-Information/Generation-Information.

D.2.4 Industrial consumption (Tariff D)

South Australia has been impacted by a transition of the economy from gas-intensive manufacturing to less gas-intensive sectors, such as services, resulting in a decline in gas consumption. From 2010 to 2014, industrial consumption decreased from 27.6 PJ to 24.8 PJ, an average annual decrease of 2.7%.

Over the next five years, industrial consumption is forecast to decline, mainly due to forecast lower consumption by manufacturing. Some sectors, like food and beverage manufacturing and services, are growing, and these are forecast to partially compensate for this reduction in gas consumption.

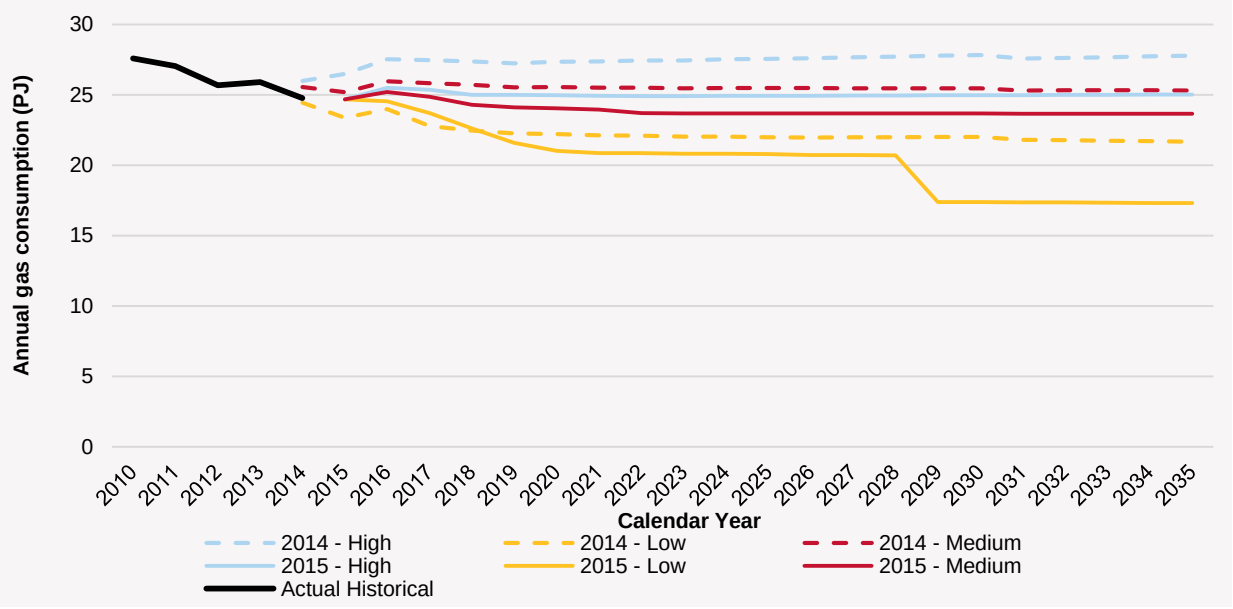
In the medium and long term, consumption is forecast to be flat over the outlook period.

Table 59 shows forecast trends and drivers in industrial consumption over the short, medium, and long term. In Figure 44, forecasts for the 20-year outlook period are shown for the high, medium and low scenarios, and compared to 2014 NGFR forecasts.

Table 59 Industrial consumption forecasts over the short, medium, and long term

Timeframe	Forecast (PJ)	Average annual rate of change	Drivers
Short term (2015–20)	24.7 to 24.1	0.5% decrease	Economy continues to transition from gas-intensive manufacturing to less gas-intensive production, driven by market forces and other factors. Industrial loads respond to changes in gas prices and some significant operational changes are anticipated for large industrial loads.
Medium term (2020–25)	24.1 to 23.7	0.3% decrease	Manufacturing sectors stabilise. Large industrial loads continue to respond to price changes and some operational changes in large industrial load are anticipated. Some less gas-intensive sectors exhibit growth, underpinned by population growth. This results in a flattening of gas consumption in the long term.
Long term (2025–35)	23.7	<0.1% decrease	

Figure 44 Comparison of high, medium, and low scenario forecasts for the industrial sector in South Australia



D.2.5 Residential and commercial consumption (Tariff V) in South Australia

From 2010 to 2014, residential and commercial consumption decreased from 11.6 PJ to 10.6 PJ. On a weather-corrected basis[41], residential and commercial consumption decreased at an annual average of 2.2%.

Average use per connection is forecast to decline over the outlook period, linked to projected rising gas prices, appliance switching trends, and savings from energy efficiency improvements.

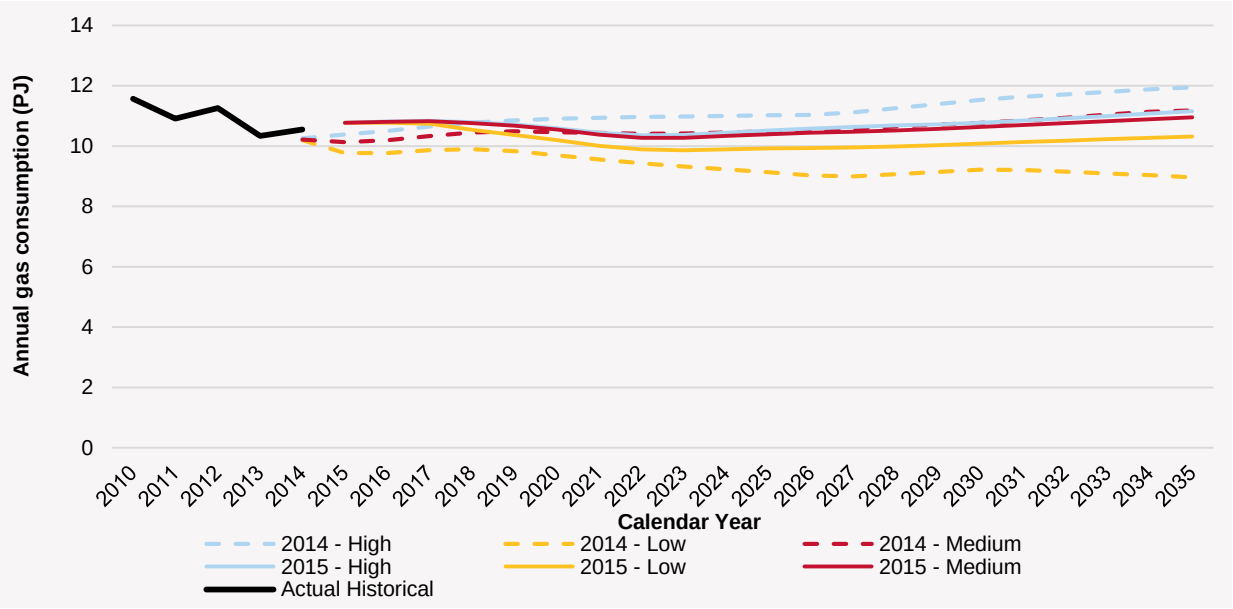
- Housing construction is projected to grow at a slowing pace.
- Projected energy efficiency improvements, and projections of a shift from gas to electric appliances, result in a forecast decrease in residential and commercial demand in the short and medium term. Under current regulatory incentives, the impact of energy efficiency and appliance switching is projected to decrease, driving a forecast recovery of demand over the longer term.

Table 60 shows residential and commercial consumption forecast trends and drivers over the short, medium and long term. In Figure 45, forecasts for the 20-year outlook period are shown for high, medium and low scenarios, and compared to 2014 NGFR forecasts.

Table 60 Residential and commercial gas consumption forecasts over the short, medium, and long term

Timeframe	Forecast (PJ)	Average annual rate of change	Drivers
Short term (2015–20)	10.8 to 10.5	0.4% decrease	Housing construction slows over the years. Increasing retail prices, appliance switching and impact of energy efficiency improvements drive down residential consumption
Medium term (2020–25)	10.5 to 10.4	0.3% decrease	
Long term (2025–35)	10.4 to 11.0	0.6% increase	Prices stabilise and energy efficiency improvements from current policies reduce. Population growth drives the trend increase.

Figure 45 Comparison of high, medium, and low scenario residential and commercial sector forecasts for South Australia



[41] Estimated and forecast consumption is calculated assuming a standard temperature pattern, estimated from historical observations.

Key forecast inputs

Weather

The historical range of the weather series used for defining the standard weather scenario has been extended back to the year 2000 (the NGFR 2014 used more recent data). As a result, a lower median temperature was used in the forecast, driving consumption upwards (see Table 61).

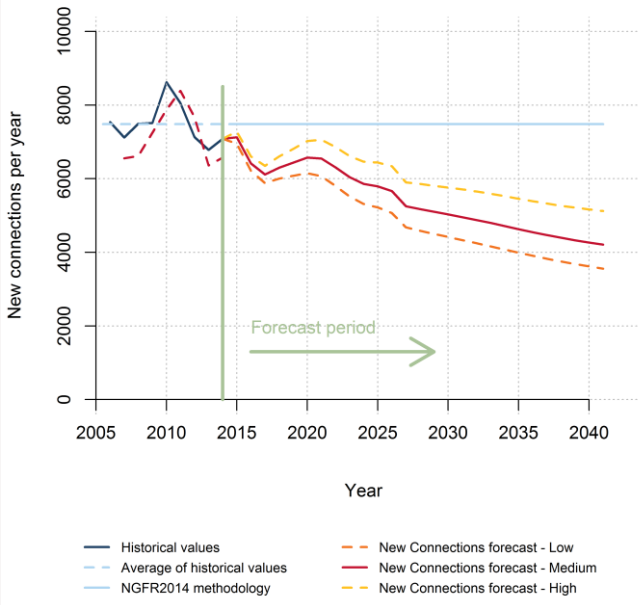
Table 61 Weather corrections in South Australia

Model	Annual EDD in 2015 (˚C)	Trend (˚C / year)	Comments
NGFR 2015	1070	0	Constant across all years.
NGFR 2014	1054	-3.56	Linear downward trend.

Number of connections

The annual variation of residential and commercial connections was linked to building cycles and population projections in South Australia, with different connection rates used for single detached houses and multi-unit dwellings (the 2014 NGFR used an average of the historical rate of new connections). Over 2014–20, the number of connections is projected to grow by approximately 40,600 units (1.5% average annual growth), compared to 45,200 predicted in the 2014 NGFR (see Figure 46).

Figure 46 Number of connections in South Australia



Energy efficiency and appliance switching

Improvements in the energy efficiency of appliances and thermal insulation of houses, as well as a gradual move from gas appliances towards electric appliances, were modelled directly in a bottom-up approach. This is different to the 2014 NGFR methodology, where energy efficiency improvements were considered implicitly in the linear model used to regress consumption as a function of prices, with a correction term applied to the final forecast.

Retail gas prices

Wholesale gas price projections have been updated to known contracts with future values linked to oil prices. Wholesale gas price projections are lower than those used in the 2014 NGFR, following the oil price drop in the past year. The net effect of the new methodology is that projected retail prices are lower than were estimated in the 2014 NGFR. Over the five years to 2020, prices are projected to increase at an average annual rate of 1.1%. Between 2020 and 2035, a projected average increase of 0.2% per annum is assumed.

D.3 Maximum demand in South Australia

Maximum demand in South Australia occurs typically in winter and is primarily driven by residential and commercial demand.

The drivers of forecast annual consumption over the short, medium and long term also influence maximum demand for the respective sectors.

Tables 62 to 64 show projections of maximum demand in South Australia under the different scenarios.

The residential, commercial and industrial forecasts of maximum demand for are not coincident with the forecasts of maximum demand for GPG, therefore the two cannot be added to obtain a regional total. The total displayed in the tables below includes the forecast average GPG on a day of total system demand.

Table 62 Maximum demand forecasts for South Australia (medium scenario) (TJ/day)

	Total		GPG		Residential, Commercial & Industrial	
	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20
2015	241.9	248.3	258.2	258.2	160.1	166.5
2016	325.3	331.7	413.2	430.8	162.3	168.7
2017	292.7	299.2	391.9	435.8	161.2	167.7
2018	255.3	261.8	370.7	438.2	158.9	165.3
2019	233.1	239.5	335.3	429.3	157.8	164.3
2020	226.0	232.4	303.1	426.3	156.9	163.4
2035	310.3	317.1	414.0	460.5	158.6	165.4

Table 63 Maximum demand forecasts for South Australia (high scenario) (TJ/day)

	Total		GPG		Residential, Commercial & Industrial	
	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20
2015	244.5	250.9	258.2	258.2	160.1	166.5
2016	334.0	340.5	425.2	439.0	163.4	169.9
2017	313.8	320.3	411.4	439.8	163.2	169.7
2018	287.5	294.0	397.7	412.1	161.6	168.1
2019	257.8	264.3	379.2	434.0	161.3	167.8
2020	250.0	256.6	358.8	430.0	160.6	167.1
2035	389.3	396.3	519.9	501.4	164.9	171.8

Table 64 Maximum demand forecasts for South Australia (low scenario) (TJ/day)

	Total		GPG		Residential, Commercial & Industrial	
	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20
2015	233.8	240.2	258.2	258.2	160.1	166.5
2016	301.9	308.4	364.8	424.0	159.7	166.2
2017	264.5	270.9	340.1	431.8	156.4	162.8
2018	229.8	236.1	315.3	437.6	151.3	157.5
2019	217.3	223.5	274.1	418.9	146.5	152.7
2020	211.4	217.5	247.9	409.5	143.6	149.7
2035	257.0	263.2	323.7	404.3	131.2	137.4

Appendix E. TASMANIA

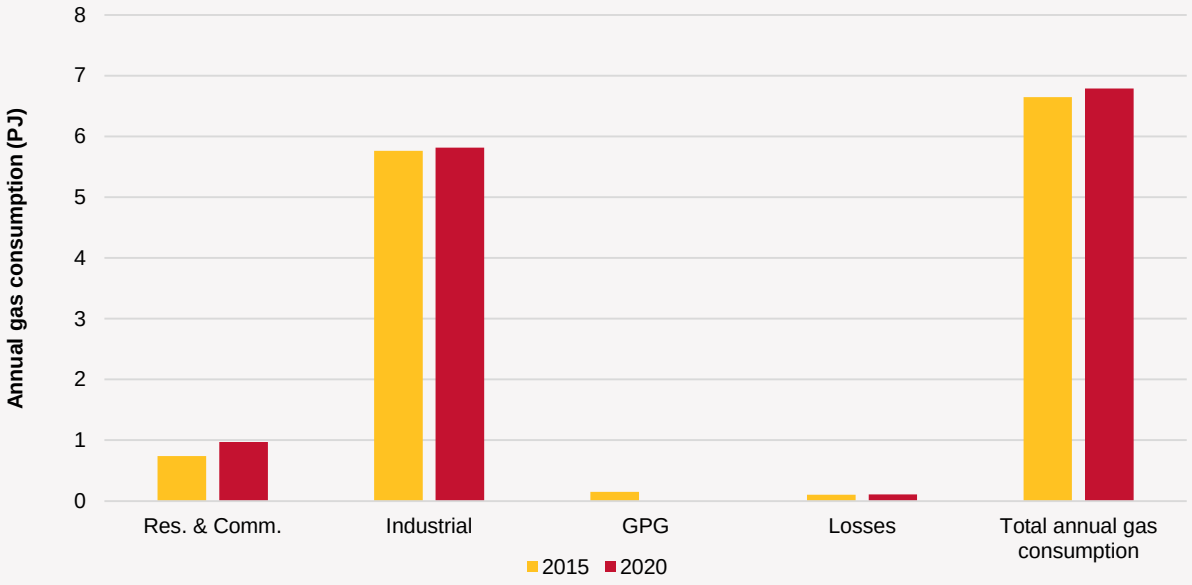
E.1 Key points for Tasmania

Key short-term (2016–20) forecasts for Tasmania in the medium scenario are:

- Total gas consumption is forecast to increase at an average annual rate of 0.4%.
- Residential and commercial consumption is forecast to increase at an average annual rate of 5.7%.
- Industrial gas consumption is forecast to increase at an average annual rate of 0.2%.
- GPG gas consumption is forecast to decline to almost zero by 2017, due to forecast low growth in electricity consumption and supply from renewable generation.
- Maximum demand is forecast to rise as population growth increases demand for the residential, commercial and industrial sector.

Longer-term forecasts, and forecasts based on high and low scenarios, are provided in the following sections.

Figure 47 Comparison of 2015 (estimate) and 2020 (forecast) annual gas consumption in Tasmania[42]



E.1 Annual consumption in Tasmania

E.1.1 Overview

Gas consumption in Tasmania decreased from 15.5 PJ in 2010 to 12.0 PJ in 2014, due mainly to a sharp decline in gas consumption for electricity generation since 2013. While residential, commercial and industrial consumption growth continued, this was not sufficient to offset the decline in GPG.

Table 65 summarises annual consumption trends and drivers over the short, medium, and long term.

[42] Estimated and forecasted consumption is calculated assuming a standard temperature pattern, estimated from historical observations.

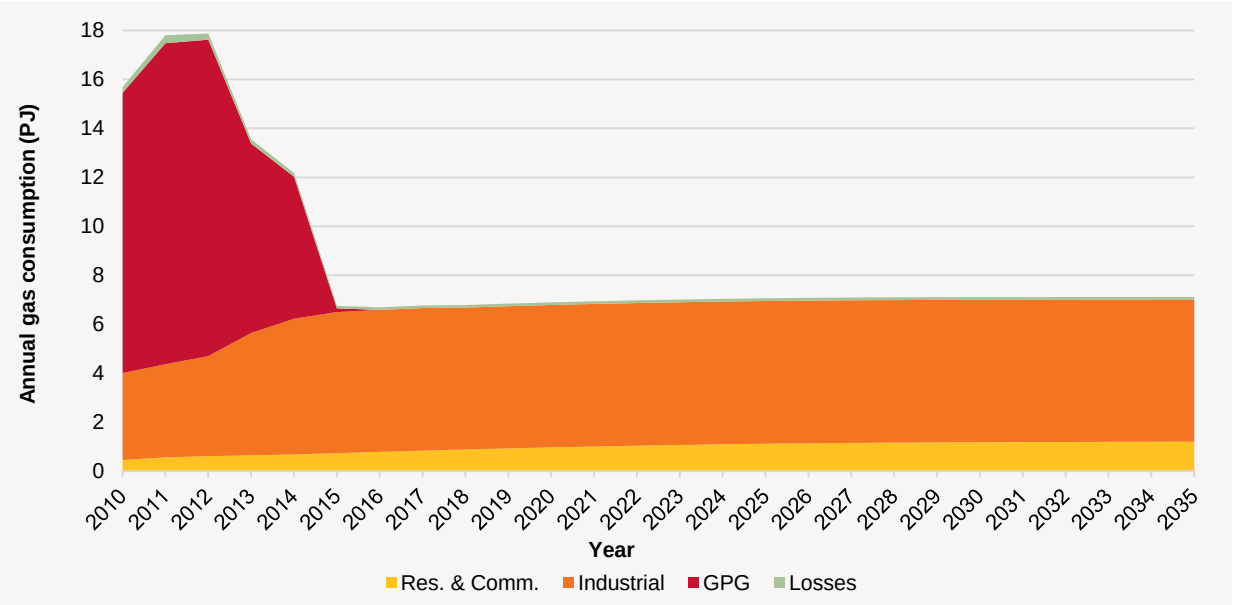
Table 65 Total annual gas consumption over the short, medium, and long term

Timeframe	Forecast (PJ)	Average annual rate of change	Drivers
Short term (2015–20)	6.6 to 6.8	0.4% increase	Increase driven by revised retail price projections and projected growth in new connections for residential, commercial and industrial consumption. GPG declines to near zero after the announced retirement of Bell Bay Three peaking gas plants and Tamar Valley combined cycle gas turbine plant.[43]
Medium term (2020–25)	6.8 to 7.0	0.5% increase	Continued growth in residential, commercial and industrial gas consumption, largely driven by population growth and continued uptake of gas given the relatively new gas reticulation system.
Long term (2025–35)	7.0 to 7.1	0.1% increase	Growth in residential, commercial and industrial gas consumption underpinned by population growth.

Forecast residential and industrial consumption in 2035 is 2.3 PJ (49.6%) higher than was forecast in the 2014 NGFR. This is due to revised price projections (price increases are lower than forecast in 2014) as well as adjustments in the outlook for large industrial consumption.

Figure 48 shows the long-term, 20-year forecast for all sectors in Tasmania. The forecast large decline in total consumption from 2014 to 2018 is due to the announced retirements of Bell Bay Three peaking plants and the Tamar Valley combined-cycle gas turbine plant. Although the Tamar Valley peaking plant will return to service in June 2016, modelling suggests that average rainfall inflows and hydro capacity is sufficient to meet the state's electrical energy needs.

Figure 48 Annual consumption forecast segments for Tasmania



E.1.2 High, medium, and low scenario trends and drivers in Tasmania

AEMO modelled Tasmania's forecasts under high, medium and low scenarios (see Section 1.3).

Compared to the medium scenario:

- The high scenario is characterised by high population growth rate, lower retail prices and more new connections as consumers continue to transition to the gas market.

[43] AEMO. 2015 Electricity Statement of Opportunities. Available: http://ww.aemo.com.au/Electricity/Planning/Electricity-Statement-of-Opportunities.

- The low scenario is characterised by slower population growth rate, higher retail prices, and more subdued growth in new connections, as consumers transition to the gas market.

Table 66 shows short-term forecasts and key drivers for each component, for each scenario.

Table 66 Summary of high, medium, and low scenario trends and drivers in Tasmania in the short term (2015–20)

Forecast component	Scenario	Forecast (PJ)	Average annual rate of change	Key drivers
Residential and commercial	Medium	0.74 to 0.97	5.7% increase	Population and reticulation growth drive the uptake of gas consumption in the residential sector.
	High	0.74 to 1.00	6.3% increase	Higher population and lower retail prices.
	Low	0.74 to 0.91	4.2% increase	Lower population and higher retail prices.
Industrial	Medium	5.8 to 5.8	0.2% increase	Growth in gas consumption driven by new connections.
	High	5.8 to 6.3	1.7% increase	High scenario is created based on the 10% probability of exceedance. Some expansion in large industrial loads is also considered.
	Low	5.8 to 3.5	9.5% decrease	Low scenario is created based on the 90% probability of exceedance. The low scenario includes anticipated reductions in industrial consumption.
Gas-powered generation	Medium	0.15 to 0	100% decrease	Closure of the majority of GPG drives forecast to zero. Installed hydro capacity is forecast to meet electricity needs.
	High	0.15 to 0	100% decrease	
	Low	0.15 to 0	100% decrease	

In the high and medium scenarios, consumption is forecast to increase in the short-term (2015–20) at annual average rates of 1.7% and 0.4% respectively, and the low scenario consumption in the short term is forecast to decrease at an annual average rate of 7.9%.

Figure 49 and Table 67 show the high, medium and low consumption forecasts for the 20-year outlook period, and compare them to the 2014 NGFR forecasts.

For the 2015 NGFR, AEMO has updated the forecasts for changes in key trends, and has updated the outlook of consumption in the industrial sector after consultations with industry.

More detail is in the sector commentary below, and in the 2015 NGFR Methodology Information Paper.

Figure 49 Comparison of annual consumption forecast scenarios for Tasmania

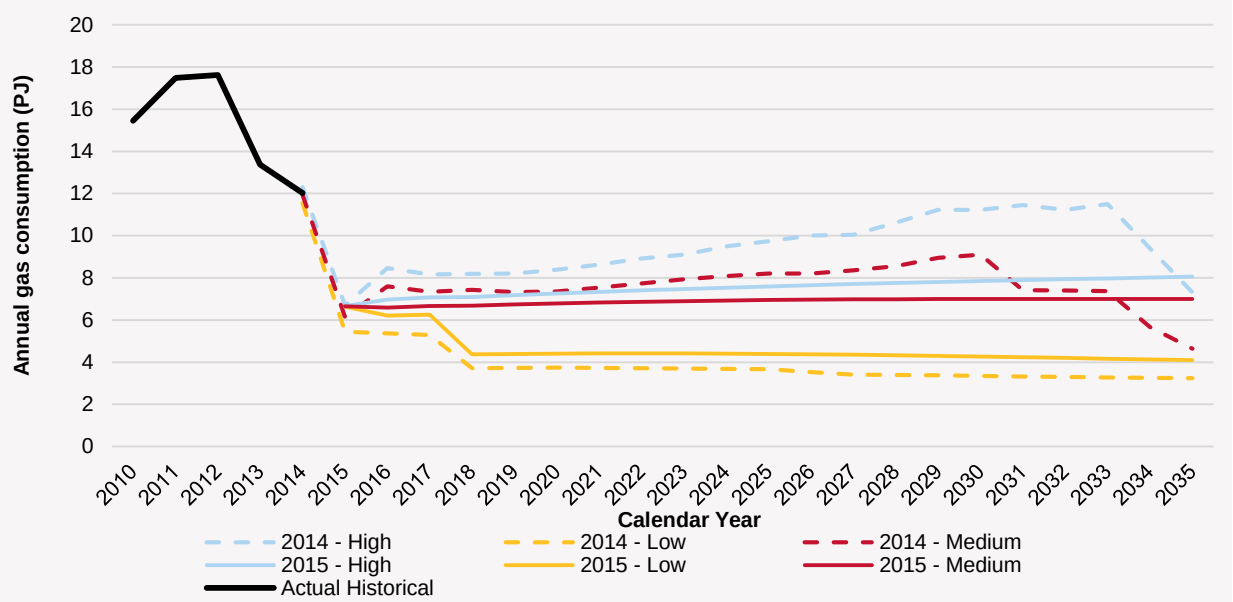


Table 67 Annual gas consumption for Tasmania (PJ)

Calendar Year	Actual	High (NGFR 2015)	Medium (NGFR 2015)	Low (NGFR 2015)	High (NGFR 2014)	Medium (NGFR 2014)	Low (NGFR 2014)
2010	15.5						
2011	17.5						
2012	17.6						
2013	13.4						
2014	12.0						
2015			6.6		6.7	6.1	5.4
2016		7.0	6.6	6.2	8.5	7.6	5.4
2017		7.1	6.7	6.3	8.2	7.3	5.3
2018		7.1	6.7	4.4	8.2	7.4	3.7
2019		7.2	6.7	4.4	8.2	7.3	3.7
2020		7.3	6.8	4.4	8.4	7.3	3.7
2021		7.3	6.8	4.4	8.6	7.5	3.7
2022		7.4	6.9	4.4	8.9	7.7	3.7
2023		7.5	6.9	4.4	9.1	7.9	3.7
2024		7.5	6.9	4.4	9.5	8.1	3.7
2025		7.6	7.0	4.4	9.7	8.2	3.7
2026		7.7	7.0	4.4	10.0	8.2	3.5
2027		7.7	7.0	4.4	10.0	8.4	3.4
2028		7.8	7.0	4.3	10.6	8.6	3.4
2029		7.8	7.0	4.3	11.2	9.0	3.4
2030		7.8	7.0	4.3	11.2	9.1	3.3
2031		7.9	7.0	4.2	11.5	7.4	3.3
2032		7.9	7.0	4.2	11.2	7.4	3.3
2033		8.0	7.0	4.2	11.5	7.4	3.3
2034		8.0	7.0	4.1	9.4	5.7	3.3
2035		8.1	7.0	4.1	7.3	4.6	3.2

E.1.3 Gas-powered generation in Tasmania

From 2010 to 2014 GPG gas consumption decreased from 11.4 PJ to 5.8 PJ, driven by conditions in the NEM that resulted in strong demand for hydro power generation and less need for GPG in Tasmania.

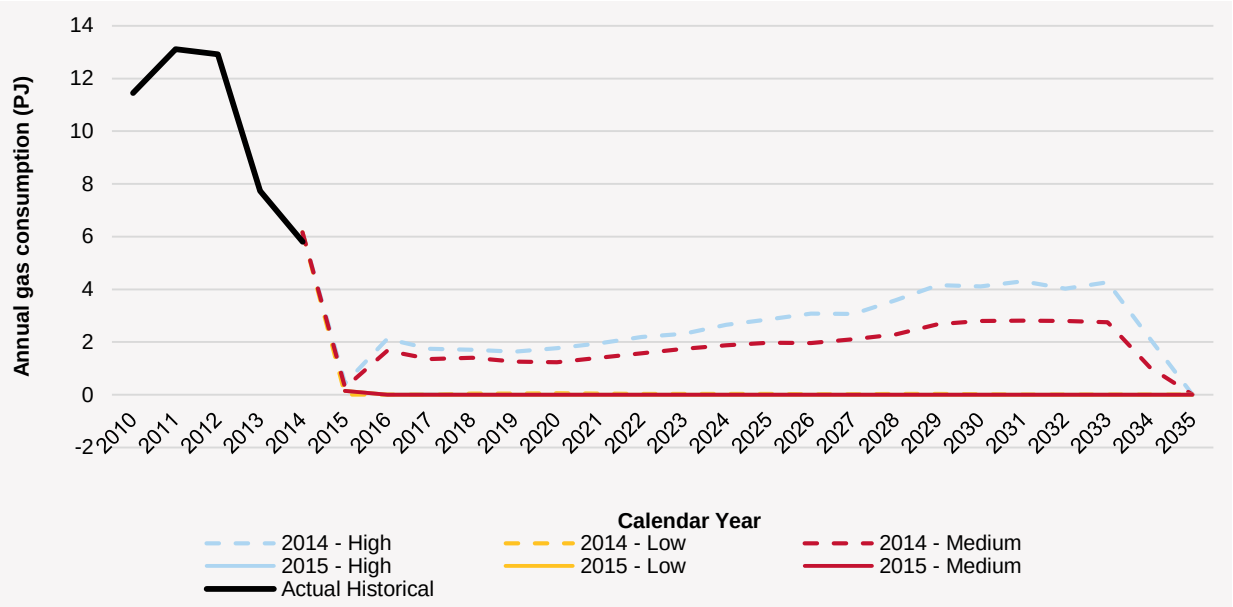
Tasmanian gas consumption for GPG is forecast to be almost zero in 2016 and zero beyond 2017, following the announced retirement of 208 MW of GPG at Tamar Valley Combined Cycle Gas Turbine and 120 MW of GPG at Bell Bay Three Power Station (45 MW of which has already been withdrawn).[44] Although Tamar Valley Peaking Plant will return to service in June 2016, modelling suggests that average rainfall inflows and hydro capacity will be sufficient to meet the state's electrical energy needs.[45] However, in a drought period this plant may be required to meet electricity demand.

Table 68 shows the trends and drivers in GPG gas consumption over the short, medium, and long term. In Figure 50, forecasts for the 20-year outlook period are given for high, medium and low scenarios, and compared to 2014 NGFR forecasts

Table 68 GPG gas consumption over the short, medium, and long term

Timeframe	Forecast (PJ)	Average annual rate of change	Drivers
Short term (2015–20)	0.15 to 0	100% decrease	Closure of the majority of GPG drives forecast to zero. Installed hydro capacity is forecast to meet electricity needs.
Medium term (2020–25)	0 to 0	No change	Closure of the majority of GPG drives forecast to zero. Installed hydro capacity is forecast to meet electricity needs.
Long term (2025–35)	0 to 0	No change	Closure of the majority of GPG drives forecast to zero. Installed hydro capacity is forecast to meet electricity needs.

Figure 50 Comparison of high, medium, and low scenario forecasts for GPG in Tasmania



E.1.4 Industrial consumption (Tariff D) in Tasmania

AEMO forecasts mild growth in industrial gas consumption, attributable to generally improved business conditions for the sector.

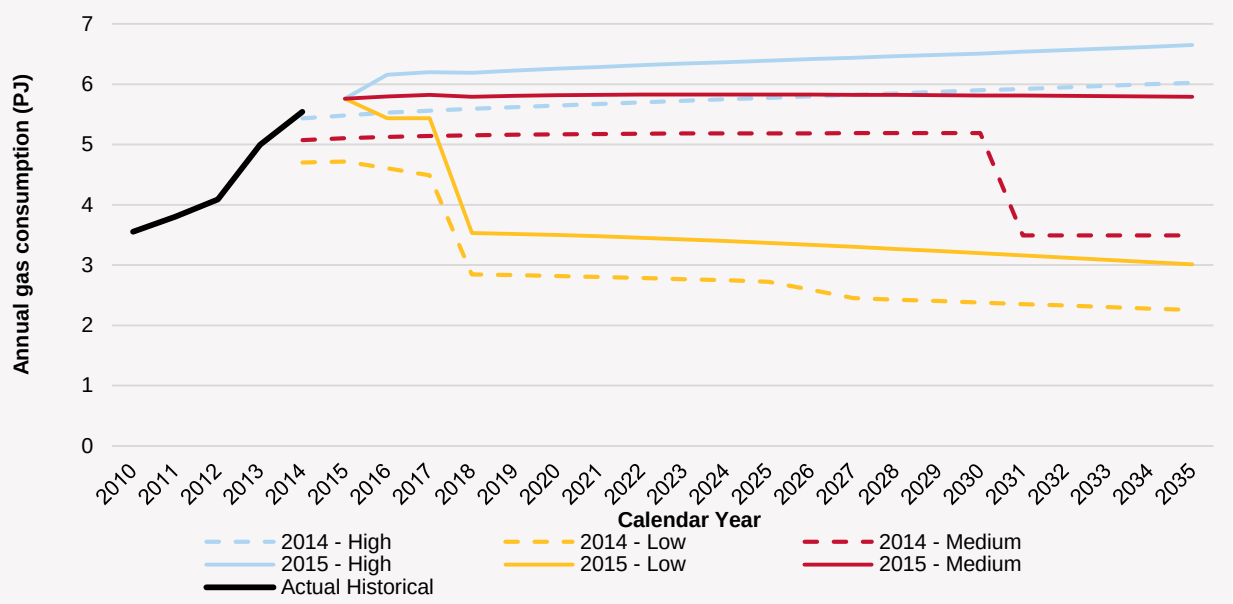
[44] http://www.aemo.com.au/Electricity/Planning/Electricity-Statement-of-Opportunities.
[45] http://www.aemo.com.au/Electricity/Planning/Electricity-Statement-of-Opportunities.

Table 69 discusses the key drivers for short-term, medium-term and long-term projections of industrial gas consumption. In Figure 51, forecasts for the 20-year outlook period are given for high, medium and low scenarios, and compared to 2014 NGFR forecasts.

Table 69 Industrial consumption in Tasmania over the short, medium, and long term

Timeframe	Forecast (PJ)	Average annual rate of change	Drivers
Short term (2015–20)	5.76 to 5.82	0.2% increase	Increase in small industrial load consumption underpinned by population growth. Large industrial loads maintain consistent consumption levels.
Medium term (2020–25)	5.82 to 5.83	< 0.1% increase	Continued growth in small industrial load, driven by population growth. Large industrial loads maintain consistent consumption levels.
Long term (2025–35)	5.83 to 5.79	0.1% decrease	Small industrial consumption continues to increase but some contraction in large industrial consumption is anticipated, based on survey responses from large industrial gas users.

Figure 51 Comparison of high, medium, and low scenario forecasts for the industrial sector in Tasmania



E.1.5 Residential and commercial consumption (Tariff V) in Tasmania

Demand in the residential sector is forecast to follow the typical trend of a new market, with a rapid growth in the initial years that gradually flattens.

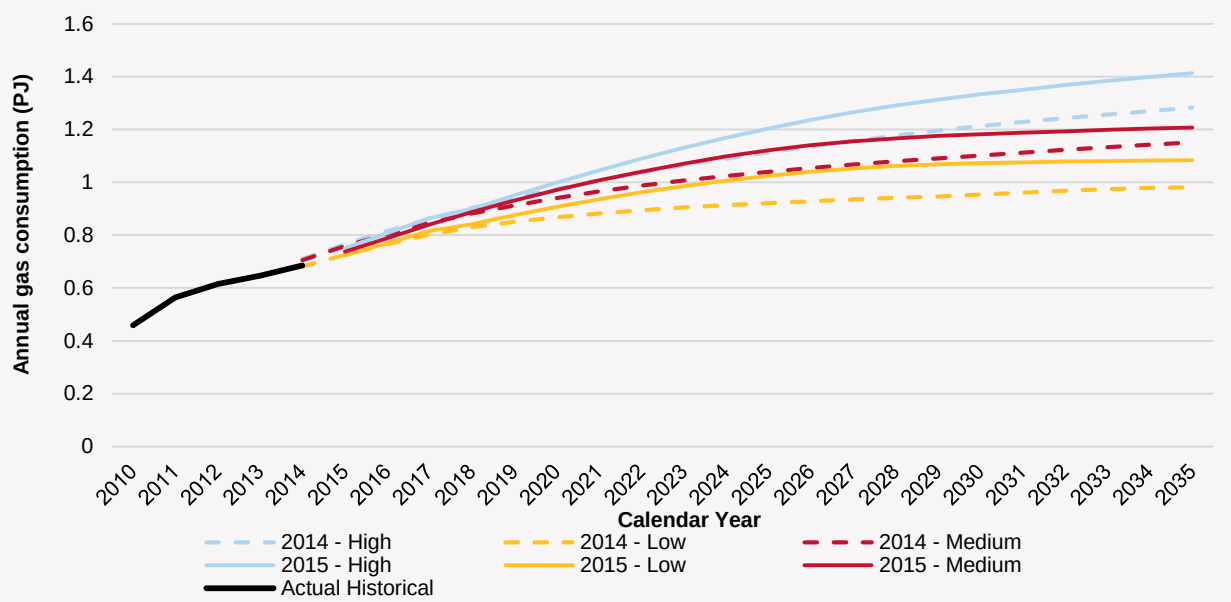
Historically, from 2010 to 2014, residential and commercial consumption increased from 0.46 PJ to 0.69 PJ. This reflected an increase in connections to the gas network due to a combination of new housing growth and all-electric homes connecting to the recently created gas network. The average consumption per connection has been relatively stable in the past years, between 27 and 30 TJ/year.

Table 70 shows forecast residential and commercial consumption trends and drivers over the short, medium and long term. In Figure 52, forecasts for the 20-year outlook period are shown for high, medium and low scenarios, and compared to NGFR 2014 forecasts.

Table 70 Residential and commercial gas consumption in Tasmania over the short, medium, and long term

Timeframe	Forecast (PJ)	Average annual rate of change	Drivers
Short term (2015–20)	0.74 to 0.97	5.7% increase	Increase in number of connections linked to population growth and the relatively new gas reticulation system.
Medium term (2020–25)	0.97 to 1.12	2.9% increase	Increase in number of connections linked to population growth. In the longer term, as the new industry matures, growth is assumed to converge to levels not dissimilar from those of mainland states.
Long term (2025–35)	1.12 to 1.21	0.8% increase	

Figure 52 Comparison of high, medium, and low scenario residential and commercial forecasts for Tasmania



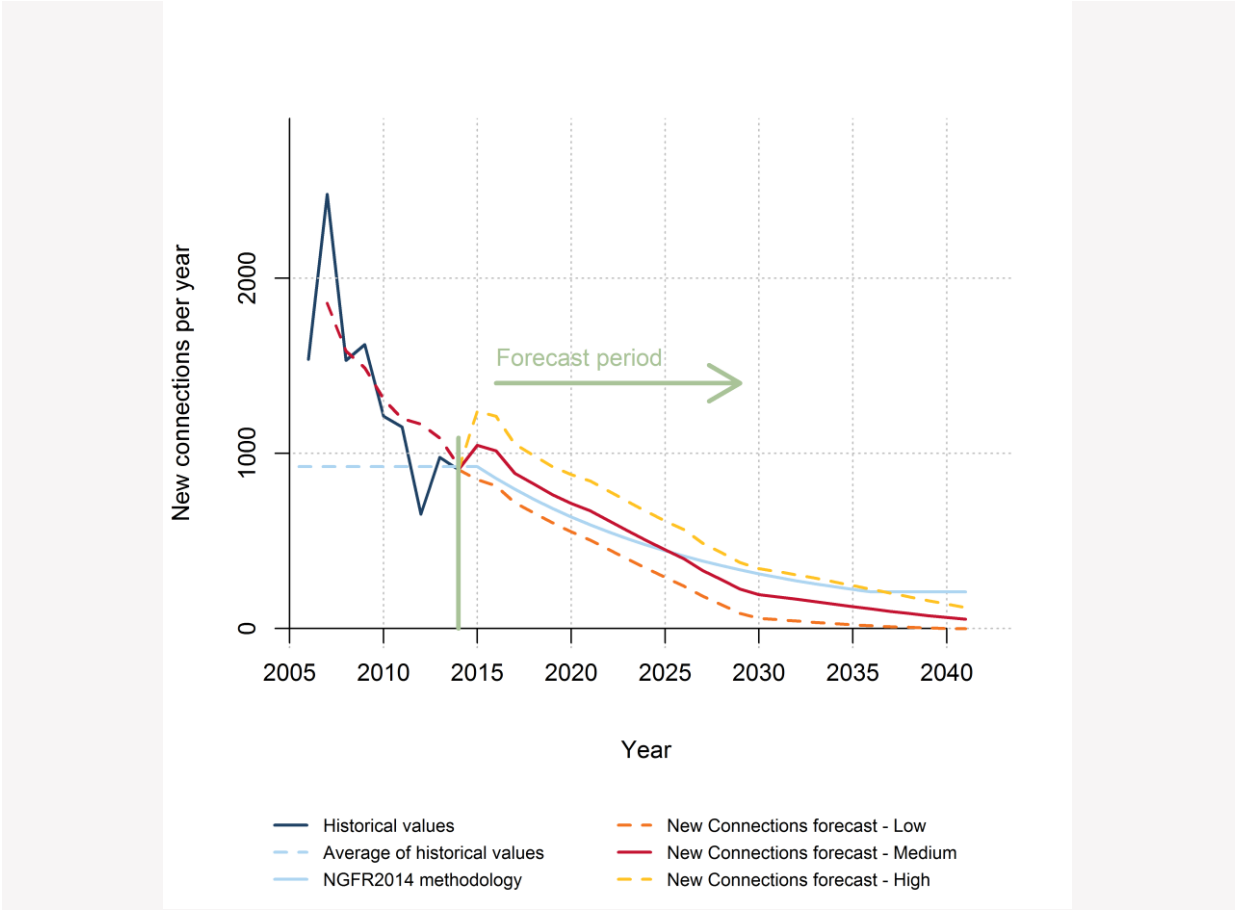
Key forecast inputs

Number of connections

AEMO revised the method used to forecast the number of new gas connections, from that used in the 2014 NGFR. In the 2015 NGFR, projections of annual variation of residential and commercial connections have been linked to building cycles and population projections in Tasmania, using different connection rates for single detached houses and multi-unit dwellings. The 2014 NGFR used a model based on assumptions on reticulation growth and gas appliance penetration for the residential sector.

Over the period 2014–20, the number of connections is expected to grow by approximately 5,200 units (average annual growth: 6.1%), compared to the 4,700 predicted in the 2014 NGFR (see Figure 53).

Figure 53 Number of connections in Tasmania



Retail gas prices

Wholesale gas price projections have been updated to the prices of known gas supply contracts with future values linked to oil prices. Wholesale gas price projections are lower than those used in the 2014 NGFR, following the oil price drop in the past year. Retail prices have been calibrated using published standing tariffs. The net effect is projected retail prices lower than were estimated in the 2014 NGFR. Over the five years to 2020, prices are projected to increase at an average annual rate of 2.9%. Between 2020 and 2035, a projected average increase of 0.2% per annum is assumed.

E.2 Maximum demand in Tasmania

Maximum demand in Tasmania typically occurs in winter and is primarily driven by residential and commercial demand.

Tables 71 to 73 provide projections of daily maximum demand under the different scenarios.

The high, medium, and low short-term 50% POE forecasts change at annual averages of 2.3%, 1.3%, and -6.5% respectively. Consistent with consumption forecasts, key drivers for the differences from the medium scenario are:

- In the high scenario, population growth and lower price increases.
- In the low scenario, adjustments of industrial demand and higher price increases.

In these forecasts, maximum demand for GPG is projected to be zero across all three scenarios, based on projections of GPG retirements with additional electricity demand supplied by hydro generation.

The residential, commercial and industrial forecasts of maximum demand for are not coincident with the forecasts of maximum demand for GPG, therefore the two cannot be added to obtain a regional total.

The total displayed in the tables below includes the forecast average GPG on a day of total system demand.

Table 71 Maximum demand in Tasmania (medium scenario) (TJ/day)

	Total		GPG		Residential, Commercial & Industrial	
	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20
2015	20.1	25.0	0.0	0.0	20.1	25.0
2016	20.4	25.4	0.0	0.0	20.4	25.4
2017	20.8	25.8	0.0	0.0	20.8	25.8
2018	20.9	26.0	0.0	0.0	20.9	26.0
2019	21.2	26.4	0.0	0.0	21.2	26.4
2020	21.4	26.6	0.0	0.0	21.4	26.6
2035	22.6	28.0	0.0	0.0	22.6	28.0

Table 72 Maximum demand in Tasmania (high scenario) (TJ/day)

	Total		GPG		Residential, Commercial & Industrial	
	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20
2015	20.1	25.1	0.0	0.0	20.1	25.1
2016	21.4	26.9	0.0	0.0	21.4	26.9
2017	22.0	27.5	0.0	0.0	22.0	27.5
2018	22.1	27.7	0.0	0.0	22.1	27.7
2019	22.5	28.1	0.0	0.0	22.5	28.1
2020	22.7	28.5	0.0	0.0	22.7	28.5
2035	26.0	32.6	0.0	0.0	26.0	32.6

Table 73 Maximum demand in Tasmania (low scenario) (TJ/day)

	Total		GPG		Residential, Commercial & Industrial	
	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20
2015	20.1	25.0	0.0	0.0	20.1	25.0
2016	19.3	23.8	0.0	0.0	19.3	23.8
2017	19.6	24.2	0.0	0.0	19.6	24.2
2018	14.2	18.4	0.0	0.0	14.2	18.4
2019	14.3	18.6	0.0	0.0	14.3	18.6
2020	14.4	18.6	0.0	0.0	14.4	18.6
2035	14.0	17.8	0.0	0.0	14.0	17.8

Appendix F. VICTORIAN DECLARED TRANSMISSION SYSTEM

Table 74 Annual gas consumption forecasts for the Victorian DTS (PJ), 2010–35

Calendar Year	Total High	Total Medium/ Actual	Total Low	GPG High	GPG Medium/ Actual	GPG Low	Residential, Commercial & Industrial High	Residential, Commercial & Industrial Medium/ Actual	Residential, Commercial & Industrial Low
2010		210.7			7.6			203.1	
2011		205.5			8.5			197	
2012		203.4			3.3			200.1	
2013		192.1			2.7			189.4	
2014		187.1			4.1			183	
2015		198.0			2.2			195.8	
2016	198.1	197.4	197.4	0.7	0.6	0.6	197.4	196.8	196.8
2017	198.8	196.4	191.5	1	0.6	0.3	197.8	195.8	191.2
2018	195.6	187.7	179.6	1.4	0.7	0.4	194.2	187.0	179.2
2019	195.7	186.4	174.0	1.2	0.7	0.9	194.5	185.7	173.1
2020	195.8	185.4	173.0	1.3	0.7	1.3	194.5	184.7	171.7
2021	195.5	183.8	171.6	1.5	0.6	1.6	194.0	183.2	170.0
2022	194.9	182.5	170.1	1.9	0.7	1.7	193.0	181.8	168.4
2023	196.1	183.5	169.1	3.5	1.4	2.1	192.6	182.1	167.0
2024	197.8	184.8	169.6	4.2	2	2.2	193.6	182.8	167.4
2025	200.1	185.9	170.4	5.5	2.5	2.8	194.6	183.4	167.6
2026	200.8	186.2	170.2	5.2	2.2	2.5	195.6	184.0	167.7
2027	201.9	186.5	170.4	5.4	2	2.5	196.5	184.5	167.9
2028	203.5	187.3	170.9	6.2	2.2	2.6	197.3	185.1	168.3
2029	205.7	188.6	171.4	7.6	2.8	2.5	198.1	185.8	168.9
2030	209.3	190.4	172.2	10.3	3.7	2.6	199.0	186.7	169.6
2031	209.8	191.6	173.3	9.7	3.9	3	200.1	187.7	170.3
2032	212.0	193.5	174.3	10.6	4.9	3.3	201.4	188.6	171.0
2033	215.1	194.0	175.0	12.4	4.5	3.4	202.7	189.5	171.6
2034	221.6	196.1	175.4	17.6	5.6	3.1	204.0	190.5	172.3
2035	226.0	198.9	177.1	20.7	7.5	4.2	205.3	191.4	172.9

The forecasts of maximum demand for residential, commercial and industrial maximum demand are not coincident with the forecasts of maximum demand for GPG, therefore the two cannot be added to obtain a regional total. The total displayed in the tables below includes the forecast average GPG on a day of total system demand.

Table 75 Winter maximum demand forecasts for the DTS (medium scenario) (TJ/day)

Year	Total		GPG		Residential, Commercial & Industrial	
	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20
2015	1184.1	1292.8	54.2	54.2	1,184.1	1,292.8
2016	1,194.2	1,304.4	57.0	95	1,194.2	1,304.3
2017	1,191.8	1,302.1	50.1	100	1,191.8	1,302.1
2018	1,158.6	1,267.2	55.3	105	1,158.5	1,267.0
2019	1,152.0	1,260.6	60.1	110	1,151.9	1,260.5
2020	1,148.3	1,257.5	65.3	115	1,148.2	1,257.3
2035	1,228.8	1,345.9	157.8	271	1,205.0	1,322.2

Table 76 Winter maximum demand forecasts for the DTS (high scenario) (TJ/day)

Year	Total		GPG		Residential, Commercial & Industrial	
	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20
2015	1184.1	1292.8	54.2	54.2	1,184.1	1,292.8
2016	1,197.6	1,307.9	56.6	32.0	1,197.6	1,307.8
2017	1,202.1	1,313.0	51.9	45.5	1,202.0	1,312.9
2018	1,190.3	1,300.6	70.0	59.0	1,189.3	1,299.6
2019	1,191.3	1,302.0	70.9	73.3	1,190.6	1,301.4
2020	1,193.2	1,304.7	72.6	80.4	1,192.2	1,303.8
2035	1,345.3	1,468.6	240.2	305.6	1,276.9	1,400.2

Table 77 Winter maximum demand forecasts for the DTS (low scenario) (TJ/day)

Year	Total		GPG		Residential, Commercial & Industrial	
	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20
2015	1184.1	1292.8	54.2	54.2	1184.1	1292.8
2016	1,194.2	1,304.2	55.3	16.6	1,194.2	1,304.2
2017	1,169.2	1,277.1	49.3	11.7	1,169.2	1,277.1
2018	1,109.0	1,211.4	56.2	6.8	1,109.0	1,211.4
2019	1,078.2	1,178.1	57.0	14.9	1,078.2	1,178.1
2020	1,071.6	1,171.5	61.8	25.4	1,071.6	1,171.4
2035	1,098.8	1,203.3	132.2	155	1,090.6	1,195.1

Appendix G. DISTRIBUTION AND TRANSMISSION LOSSES

Gas is transported through high-pressure transmission pipelines to lower-pressure distribution networks before it is used.[46] During this process, some gas is unaccounted for and some is used for operational purposes. This gas is collectively referred to as “losses” in this document.

In the distribution networks, losses are typically a result of gas leaks and metering uncertainties. These losses are also known as unaccounted for gas (UAFG).

Transmission pipeline losses are mainly compressor and heater losses in support of normal pipeline operation. UAFG also occurs along high-pressure pipelines, but in smaller quantities.

Table 78 shows the annual actuals and forecasts (medium scenario) of losses for different regions, while Table 79 shows the maximum demand forecasts for losses.

Table 78 Annual actuals/forecasts of losses (medium scenario) (PJ)

Calendar Year	NSW	Qld	SA	Tas	Vic
2010 (actual)	3.8	3.0	3.0	0.2	7.3
2011 (actual)	4.0	3.0	2.8	0.3	6.7
2012 (actual)	4.4	3.1	2.7	0.3	7.1
2013 (actual)	4.5	2.8	2.3	0.2	7.3
2014 (actual)	4.2	2.9	2.0	0.2	7.0
2015 (estimated)	4.2	3.0	2.0	0.1	7.3
2016	4.1	2.6	2.1	0.1	7.5
2017	4.1	2.4	2.0	0.1	7.6
2018	4.1	2.3	1.9	0.1	7.4
2019	4.0	2.2	1.8	0.1	7.4
2020	4.0	2.2	1.8	0.1	7.4
2021	4.0	2.2	1.8	0.1	7.3
2022	4.0	2.2	1.8	0.1	7.3
2023	4.0	2.2	1.8	0.1	7.3
2024	4.1	2.2	1.8	0.1	7.3
2025	4.1	2.3	1.8	0.1	7.4
2026	4.1	2.3	1.8	0.1	7.4
2027	4.2	2.3	1.8	0.1	7.4
2028	4.2	2.3	1.8	0.1	7.4
2029	4.3	2.4	1.8	0.1	7.4
2030	4.3	2.4	1.9	0.1	7.5
2031	4.4	2.5	1.9	0.1	7.5
2032	4.5	2.6	1.9	0.1	7.5
2033	4.5	2.6	1.9	0.1	7.6
2034	4.6	2.7	2.0	0.1	7.6
2035	4.7	2.8	2.0	0.1	7.6

[46] Many commercial and Industrial gas consumers also take gas directly from high-pressure pipelines.

Table 79 Winter maximum demand forecasts for losses (medium scenario) (TJ/day)

Year	NSW		Qld		SA		Tas		Vic	
	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20	1-in-2	1-in-20
2015	17.7	18.8	20.4	20.7	7.9	8.2	0.4	0.5	45.2	48.9
2016	17.9	19.1	19.0	19.4	8.0	8.3	0.4	0.5	45.6	49.3
2017	18.1	19.2	18.7	19.1	8.0	8.3	0.4	0.5	45.5	49.3
2018	18.1	19.3	18.6	18.9	7.9	8.2	0.4	0.5	44.4	48.1
2019	18.1	19.3	16.7	17.0	7.8	8.1	0.4	0.6	44.1	47.8
2020	18.1	19.3	17.1	17.4	7.8	8.1	0.4	0.6	44.0	47.7
2035	19.9	21.3	18.1	18.5	7.8	8.2	0.5	0.6	45.9	49.9

Appendix H. DEFINITION OF CONSUMPTION ZONES

H.1 Consumption zones included in the forecast

Table 80 lists the consumption zones included within each region, and are consistent with those used in AEMO's Gas Statement of Opportunities (GSOO) reports.[47]

While gas consumption or maximum demand considered for a given region generally takes place within the physical boundary of that region, there are several exceptions. For example, gas consumption at Albury, New South Wales is included within the Victoria region from where it has traditionally been supplied. Further, many AEMO zones relate to consumption from a specific pipeline. For example, consumption at Mildura (Victoria) is supplied from a lateral to the Moomba to Adelaide Pipeline System and has been allocated to the South Australian region.

Table 80 Consumption zones included in each regional forecast

Region	Which consumption zone is included?	Further notes
Vic	The Victorian Declared Transmission System (DTS): • Consumption in the **LMP zone**, which is supplied from the Longford-to-Melbourne Pipeline to customers in and around Gippsland. • Consumption in the **SWP zone**, which is supplied from the South West Pipeline to customers in and around Geelong and Western Victoria. • Consumption in the **MEL zone**, which serves customers in and around Melbourne, central and northern Victoria, parts of southern New South Wales (e.g. Albury and the Murray Valley region). Non-DTS: • Gas used in the **SW VIC GPG zone**, for power generation in south west Victoria. • Consumption in South Gippsland.	AEMO allocates all demand served by the DTS to the Vic region. This includes supply to parts of southern NSW including Albury and the Murray Valley region. AEMO allocates all demand served by the EGP to the NSW region. Consumption in Mildura (Vic) is included in the SA region. Gas consumed in the Grampians is included in the MEL zone. Distribution businesses covered in the Vic region include Envestra, Multinet and SP Ausnet Gas.
NSW	• Consumption in the **SYD zone**, which includes gas supplied from the Moomba to Sydney Pipeline (MSP) at Wilton and from the Eastern Gas Pipeline (EGP) at Horsley Park, Albion Park and Port Kembla and coal seam gas supplied directly into gas networks. • Consumption in the **ACT zone**, which includes gas supplied from the MSP at the Canberra city gate at Watson and from the EGP at Hoskinstown. • Consumption in the **MSP zone**, which includes gas supplied to consumers from the MSP and its laterals north of Culcairn, excluding that supplied to consumers in the SYD and ACT zones. • Consumption in the **EGP zone**, which includes gas supplied to consumers from the EGP, excluding that supplied to consumers in the SYD and ACT zones. This includes supply to Bairnsdale town and Bairnsdale GPG in Victoria.	AEMO allocates all consumption served by the EGP to the NSW region. NSW consumption south of Culcairn, including Albury and the Murray Valley region, is included in the Vic region. Distribution businesses covered in the NSW region include ActewAGL, Envestra, and Jemena Gas Network.

[47] The 2015 GSOO is available at: http://www.aemo.com.au/Gas/Planning/Gas-Statement-of-Opportunities.

Region	Which consumption zone is included?	Further notes
Qld	• Consumption in the **CGP Zone**, which includes all gas supplied from the Carpentaria Gas Pipeline to customers in and around Mount Isa. • Consumption in the **NQGP zone**, which includes all gas supplied from the North Queensland Gas Pipeline to customers in and around Townsville • Consumption in the **QGP zone**, which includes all gas supplied from the Queensland Gas Pipeline to customers in and around Gladstone, Rockhampton and Wide Bay, • Consumption in the **RBP zone**, which is all gas supplied from the Roma to Brisbane Pipeline to customers along the pipeline and in and around Brisbane. • Consumption in the **SWQP zone**, which is all gas supplied from the South West Queensland Pipeline directly to end consumers. • Consumption by large industrial customers which take gas directly from gas fields is included within the closest pipeline zone.	All consumption in the CGP zone has been evaluated as industrial consumption. Gas supplied directly from gas fields and consumed at Moranbah is included within the NQGP zone. Gas consumed at industrial facilities near Moura is included within the QGP zone. The SWQP zone excludes gas which is supplied to customers in another zone. Gas consumed at Daandine power station is excluded. Distribution businesses covered in the Qld region include Allgas Gas Network and Envestra.
SA	• Consumption in the **ADL zone**, which includes gas supplied from the Moomba to Adelaide Pipeline System (MAPS) to Adelaide city gates or to GPG consumers in the Adelaide area, and from the SEA Gas Pipeline (SEA Gas) to Adelaide city gates or to GPG consumers in the Adelaide area. • Consumption in the **MAPS zone**, which includes all gas supplied to consumers (including those in Whyalla and Port Pirie) from the MAPS and its laterals, excluding that supplied to consumers in the ADL zone. • Consumption in the **SEA zone**, which includes all gas supplied to consumers (including those in Mount Gambier) from the SEA Gas and its laterals, excluding that supplied to consumers in the ADL zone.	Gas supplied to Mildura in Vic is included within the MAPS zone in the SA region. The distribution business covered in the SA region is Envestra.
Tas	• All consumption in Tasmania supplied from the Tasmanian Gas Pipeline (TGP) and its lateral is included in the **TGP zone**.	The distribution business covered in the Tas region is TasGas networks.

Appendix I. GAS-POWERED GENERATORS

This appendix provides a list of generators included in the gas-powered generation projections for each region. These generators are dispatchable generating units in the NEM.

Other gas-powered generators not shown here are included in the industrial forecasts. These generators are typically co-generation installed at particular industrial sites (e.g., Yarwun Power Station), or generators that are not connected to the NEM (e.g., Diamantina Power Station).

Table 81 Generators included in the gas-powered generation forecasts for the NSW region

Power station	Installed capacity (MW)	Plant type	Fuel	Dispatch type
Bairnsdale	94	OCGT	Natural Gas Pipeline	Scheduled
Colongra	724	OCGT	Natural Gas Pipeline	Scheduled
Smithfield Energy Facility	170.9	CCGT	Natural Gas Pipeline	Scheduled
Tallawarra	420	CCGT	Natural Gas Pipeline	Scheduled
Uranquinty	664	OCGT	Natural Gas Pipeline	Scheduled

Table 82 Generators included in the gas-powered generation forecasts for the Qld region

Power station	Installed capacity (MW)	Plant type	Fuel	Dispatch type
Barcaldine	55	CCGT	Natural Gas Pipeline	Scheduled
Braemar	504	OCGT	Coal Seam Methane	Scheduled
Braemar 2	519	OCGT	Coal Seam Methane	Scheduled
Condamine A	144	CCGT	Coal Seam Methane	Scheduled
Darling Downs	644.5	CCGT	Coal Seam Methane	Scheduled
Oakey	282	OCGT	Gas/Distillate	Scheduled
Roma Gas Turbine	80	OCGT	Natural Gas Pipeline	Scheduled
Townsville Gas Turbine (Yabulu)	244	CCGT	Coal Seam Methane	Scheduled

Table 83 Generators included in the gas-powered generation forecasts for the SA region

Power station	Installed capacity (MW)	Plant type	Fuel	Dispatch type
Dry Creek Gas Turbine Station	156	OCGT	Natural Gas Pipeline	Scheduled
Hallett GT	228.3	OCGT	Natural Gas Pipeline	Scheduled
Ladbroke Grove Power Station	80	OCGT	Natural Gas Pipeline	Scheduled
Mintaro Gas Turbine Station	90	OCGT	Natural Gas Pipeline	Scheduled
Osborne Power Station	180	CCGT	Natural Gas Pipeline	Scheduled
Pelican Point Power Station	478	CCGT	Natural Gas Pipeline	Scheduled
Quarantine Power Station	224	OCGT	Natural Gas Pipeline	Scheduled
Torrens Island A	480	Steam Sub Critical	Natural Gas Pipeline	Scheduled
Torrens Island B	800	Steam Sub Critical	Natural Gas Pipeline	Scheduled

Table 84 Generators included in the gas-powered generation forecasts for the Tas region

Power station	Installed capacity (MW)	Plant type	Fuel	Dispatch type
Bell Bay Three	120	OCGT	Natural Gas Pipeline	Scheduled
Tamar Valley Combined Cycle	208	CCGT	Natural Gas Pipeline	Scheduled
Tamar Valley Peaking	58	OCGT	Natural Gas Pipeline	Scheduled

Table 85 Generators included in the gas-powered generation forecasts for the Vic region

Power station	Installed capacity (MW)	Plant type	Fuel	Dispatch type
Jeeralang A	212	OCGT	Natural Gas Pipeline	Scheduled
Jeeralang B	228	OCGT	Natural Gas Pipeline	Scheduled
Laverton North	312	OCGT	Natural Gas Pipeline	Scheduled
Mortlake Units	566	OCGT	Natural Gas Pipeline	Scheduled
Newport	500	Steam Sub Critical	Natural Gas Pipeline	Scheduled
Somerton	160	OCGT	Natural Gas Pipeline	Scheduled
Valley Power Peaking Facility	300	OCGT	Natural Gas Pipeline	Scheduled

Table 86 Generators included in the gas-powered generation forecasts for the Victorian DTS region

Power station	Installed capacity (MW)	Plant type	Fuel	Dispatch type
Jeeralang A	212	OCGT	Natural Gas Pipeline	Scheduled
Jeeralang B	228	OCGT	Natural Gas Pipeline	Scheduled
Laverton North	312	OCGT	Natural Gas Pipeline	Scheduled
Newport	500	Steam Sub Critical	Natural Gas Pipeline	Scheduled
Somerton	160	OCGT	Natural Gas Pipeline	Scheduled
Valley Power Peaking Facility	300	OCGT	Natural Gas Pipeline	Scheduled