ATTACHMENT 07.001
CORE ENERGY - GAS DEMAND FORECAST

ATCO PLAN 2025-29

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ATCO Gas Australia MWGDS AA6

Gas Demand Forecast

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Glossary

AA or GAA	Access Arrangement; Gas Access Arrangement
ABS	Australian Bureau of Statistics
ACQ	Annual Consumption Quantity
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AGA	ATCO Gas Australia
CORE	Core Energy and Resources
D/C	Demand per connection
EDD	Effective Degree Day
ERA	Economic Regulation Authority - Western Australia
GJ	Gigajoule
GSP	Gross State Product
MHQ	Maximum Hourly Quantity
MWSWGDS	Mid-West and South-West Gas Distribution Systems
NGR	National Gas Rules
PJ	Petajoule
R-C	Reverse Cycle
Review Period	The Access Arrangement Period: 1st January 2025 to 31 December, 2029
TJ	Terajoule
WA	Western Australia
ZCM	Zero-Consuming Meter

1. Introduction

1.1. Report Scope

This report has been prepared by Core Energy and Resources Pty Ltd ("**CORE**") for the purpose of providing ATCO Gas Australia ("**AGA**") with an independent forecast of gas customers and gas demand for the company's natural gas distribution network in Western Australia ("**WA**"), referred to as the Mid-West and South-West Gas Distribution Systems ("**MWSWGDS**"), for the five year Review Period from 1 January 2025 to 31 December 2029 ("**Review Period**").

The projections presented in this report and related forecast models, will form part of AGA's Access Arrangement ("**AA**") Proposal submission to the Economic Regulation Authority, Western Australia ("**ERA**").

CORE has taken all reasonable steps to ensure this report, and the approach to deriving the forecasts referred to within the report, comply with Part 9, Division 2 of the National Gas Rules ("**NGRs**"). This division outlines "access arrangement information relevant to price and revenue regulation", including ss 74; 75:

74. Forecasts and estimates

(1) Information in the nature of a forecast or estimate must be supported by a statement of the basis of the forecast or estimate.

(2) A forecast or estimate:

(a) must be arrived at on a reasonable basis; and

(b) must represent the best forecast or estimate possible in the circumstances.

75. Inferred or derivative information

Information in the nature of an extrapolation or inference must be supported by the primary information on which the extrapolation or inference is based.

In addition to this report, CORE attaches the following confidential models to this report:

- EDD Model
- Weather Normalised Demand Model – B1, B2, B3
- MWSWGDS AA6 Demand Forecast Model

1.2. Report Structure

All years refer to calendar years unless stated otherwise.

The report comprises the following main elements, supported by certain Annexures:

1. Introduction
2. Executive Summary
3. Methodology

4. Weather Normalisation
5. Tariff B3 Demand and Connection - History and Forecast
6. Tariff B1 and B2 Demand and Connections – History and Forecast
7. Tariff A1 and A2 Demand and Connections – History and Forecast
8. Ancillary Services

1.3. Overview of MWSWGDS

AGA operates three networks in Western Australia:

- Mid-West and South-West Gas Distribution System (MWSWGDS)
- The Kalgoorlie GDS
- Albany GDS

The MWSWGDS, which is the focus of this report, serves the Eneabba, Bunbury, Busselton, Harvey, Pinjarra, Kemerton, Capel and the Perth greater metropolitan area including Mandurah. The MWSWGDS is a covered pipeline subject to the National Gas Access (WA) Act (2009) (NGL) and the National Gas Rules (NGR). The MWSWDGS is subject to an Access Arrangement that is approved by the ERA.

The MWSWGDS supplies approximately 785,000 customers through a network of pipes that are over 14,500 kilometres in length.

Figure 1.1 Map Showing AGA Distribution Networks Including MWSWGDS

Source: AGA

AGA offers a range of Haulage and Ancillary services as summarised in the following tables:

Table 1.1 Haulage Services

A1	Major industrial customers using > 35 TJ of gas per year, at high or medium pressures.
A2	Large customers using between 10 and 35 TJ of gas per year, at high or medium pressures.
B1	Medium sized customers using < 10 TJ of gas per year, at high or medium pressures.
B2	Small-use customers with a standard meter with capacity from 12 m^3/h to less than 18 m^3/h, typically commercial or large residential, supplied at medium or low pressures.
B3	Small-use customers with a standard meter capacity less than 12 m^3/h, typically residential or small business customers, supplied at medium or low pressures.

Source: AGA, Reference Service Proposal

Table 1.2 Ancillary Services

Applying a meter lock	Attaching a lock to the valve that comprises part of the standard delivery facilities to prevent gas from being received at the delivery point. This service is available at delivery points receiving the B2 or B3 haulage service.
Remove regulator	Physically disconnecting a delivery point to prevent gas from being delivered to the delivery point. This service is available at delivery points receiving the B2 or B3 haulage service.
Removing a meter lock	Removing the lock that was applied to a valve comprising part of the standard delivery facilities to prevent gas from being received at the delivery point. This service is available at delivery points receiving the B2 or B3 haulage service.
Re-install regulator	Reconnecting a delivery point to allow gas to be delivered to the delivery point. This service is available at delivery points receiving the B2 or B3 haulage service.
Deregistering a delivery point	A delivery point is permanently deregistered by: i) removing the delivery point (as per the Retail Market Procedures), ii) removing the delivery point from the Delivery Point Register, and iii) for delivery points receiving the B2 or B3 haulage service, removing the meter (where ATCO considers necessary). For delivery points receiving the A1, A2 or B1 haulage service, removal of the meter set is a separate service.[7]
Cut and cap service pipe at the main	Following the successful deregistration and meter removal, this service is for the capping of the service pipe at the main to make safe under standard site conditions. This service is available only at delivery points that previously received the B2 or B3 haulage service and have also sought the “deregistering a delivery point” service.
Special read	Request to perform a special read on a basic meter. This service is available at delivery points receiving the B1, B2 or B3 haulage service.

Source: AGA, Reference Service Proposal Decision

2. Executive Summary

2.1. Introduction

This report has been prepared by Core Energy and Resources Pty Ltd ("CORE") for the purpose of providing ATCO Gas Australia ("AGA") with an independent forecast of gas customers and gas demand for the company's natural gas distribution networks in Western Australia ("WA"), referred to as the Mid-West and South-West Gas Distribution Systems ("MWSWGDS"), for the five year Review Period from 1 January 2025 to 31 December 2029 ("Review Period").

2.2. Methodology

CORE has used a methodology which is consistent with AA5, with adjustments to reflect ERA comments, changes in circumstances, including the impact of COVID, and changing Government policy stance as it relates to (GHG) emissions including future gas use.

CORE's methodology has considered Access Arrangement Proposals and Decisions by ERA and AER, and forecasting techniques and methodologies adopted by leading energy forecasting organisations, both throughout Australia and internationally. This ensures that CORE's approach meets the specific requirements of the NGR.

2.3. Demand Forecast

CORE has been engaged to develop demand forecasts for the MWSWGDS for the 2025-2029, AA6 access arrangement, having regard to the specific requirements of the NGR. The resulting forecast for the five AA6 years, are summarised as follows:

Table 2.1 CORE MWSWGDS Demand Forecast

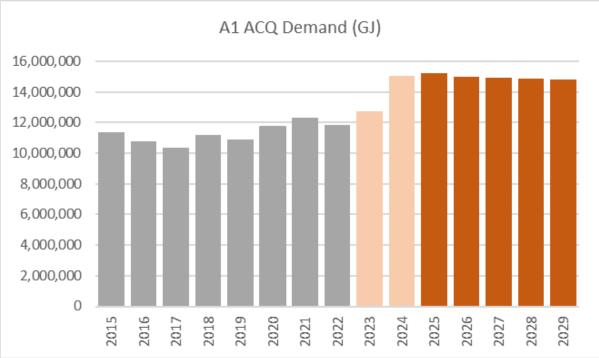
Forecast Element	2025	2026	2027	2028	2029	Average annual %
Tariff A1 ACQ Demand | GJ '000	15,220,828	14,972,673	14,949,598	14,884,434	14,840,908	-0.27%
Tariff A1 MHQ Demand | GJ	7,272	7,153	7,142	7,111	7,090	-0.27%
Tariff A2 ACQ Demand | GJ '000	1,933,416	1,919,986	1,915,818	1,910,919	1,906,091	-0.36%
Tariff B1 Demand | GJ '000	2,049,800	2,029,902	2,010,197	1,990,683	1,971,358	-0.97%
Tariff B2 Demand | GJ '000	1,273,114	1,269,238	1,265,373	1,261,520	1,257,679	-0.30%
Tariff B3 Demand | GJ '000	9,575,007	9,389,004	9,219,968	9,070,417	8,936,747	-1.78%
Total Demand GJ '000 (Excl MHQ)	30,052,166	29,580,802	29,360,955	29,117,973	28,912,783	**-0.78%**

The following paragraphs provide a concise overview of CORE's demand forecast for each tariff class.

2.3.2. Tariff A1

Tariff A1 MHQ and ACQ is forecast to fall by an average annual rate of –0.27% during the review period, consistent with customer survey responses and relevant historical trends, adjusted as appropriate for changes in macro and micro industry customer environments (see section 3 – Methodology). The demand movement is a function of flat connections and a moderate fall in demand per connection – with the major forecast fall in 2025-26 due to a fall in demand by a large customer.

Figure 2.1 A1 Demand – history and forecast.



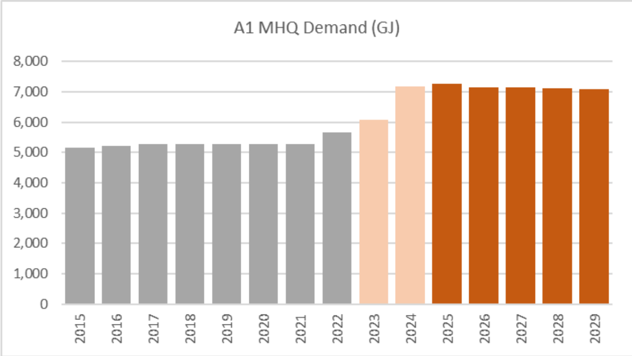


Figure 2.2 Connections – history and forecast.

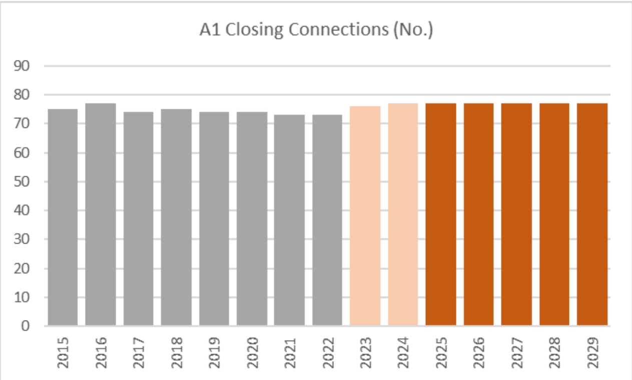
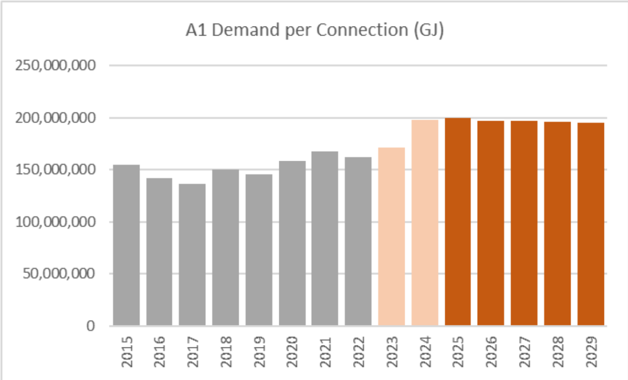


Figure 2.3 A1 Demand per Connection – history and forecast.



2.3.3. Tariff A2

Tariff A2 ACQ is forecast to fall by an average annual rate of -0.36% during the Review period, consistent with customer survey responses and relevant historical trends, adjusted as appropriate for changes in macro and micro industry customer environments (see section 3 – Methodology). The demand movement is a function of flat connection numbers and a minor fall in demand per connection.

Figure 2.4 A2 ACQ Demand – history and forecast.

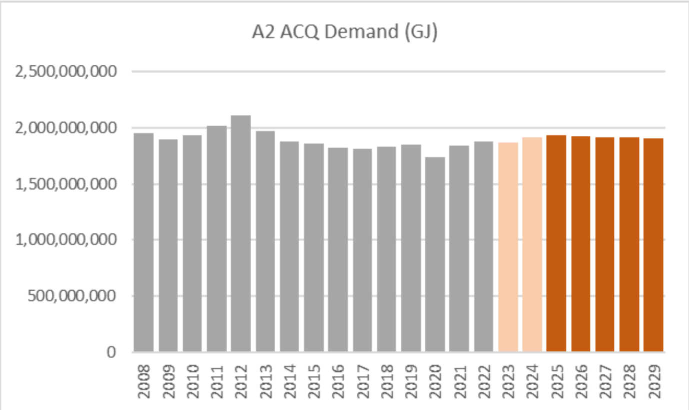


Figure 2.5 A2 Connections – history and forecast.

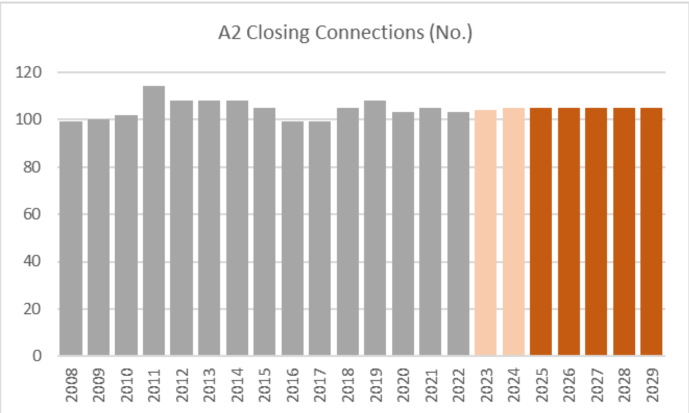
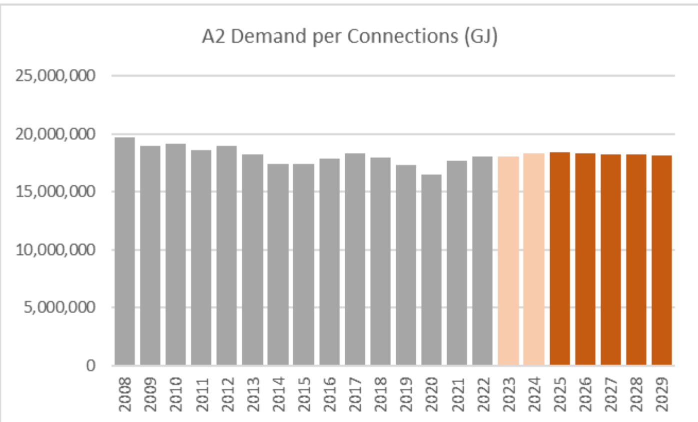


Figure 2.6 A2 Demand per Connection – history and forecast.



2.3.4. Tariff B1

In deriving this forecast CORE has considered relevant micro and macro factors relating to MWSWGDS B1 customer environment.

B1 demand is forecast to fall at an annual average rate of -0.97% during the Review Period, due to growth in net connections which averages +2.90%, offset by a -3.76% average annual reduction in demand per connection.

Figure 2.7 B1 Demand – history and forecast.

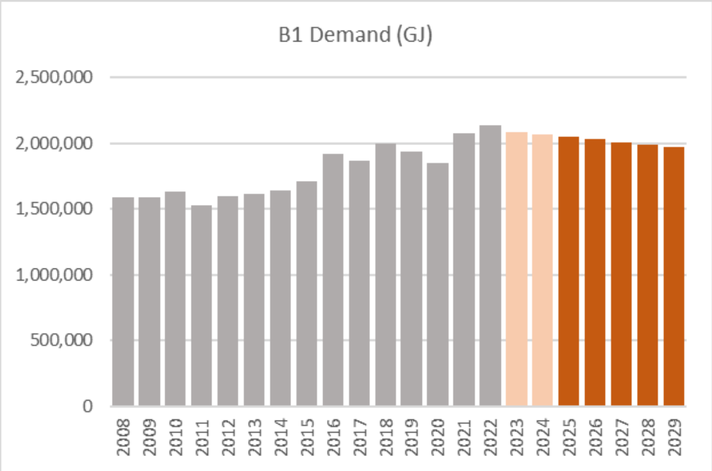


Figure 2.8 B1 Connections – history and forecast.

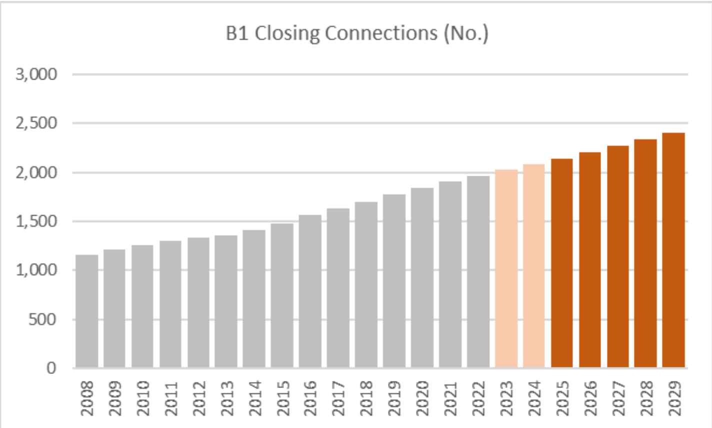
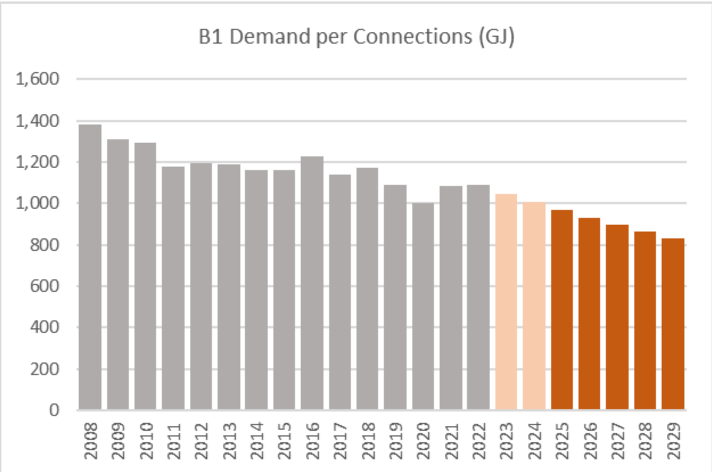


Figure 2.9 B1 Demand per Connection – history and forecast.



2.3.5. Tariff B2

In deriving this forecast CORE has considered relevant micro and macro factors relating to MWSWGDS B2 customer environment.

B2 demand is forecast to decrease at an annual average rate of -0.30% during the Review Period, due to growth in net connections which averages +1.90%, offset by a -2.16% average annual reduction in demand per connection.

Figure 2.10 B2 Demand – history and forecast.

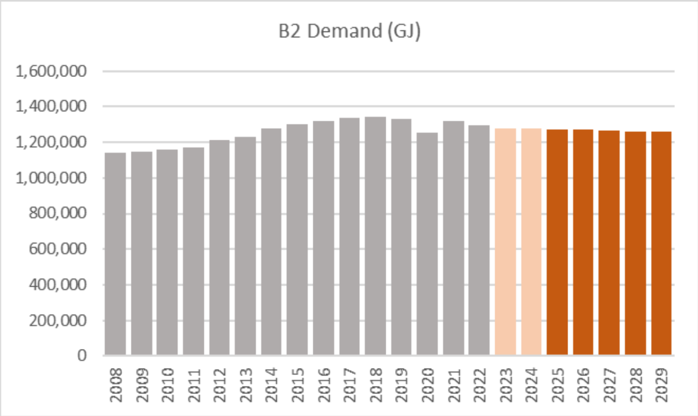


Figure 2.11 B2 Connections – history and forecast.

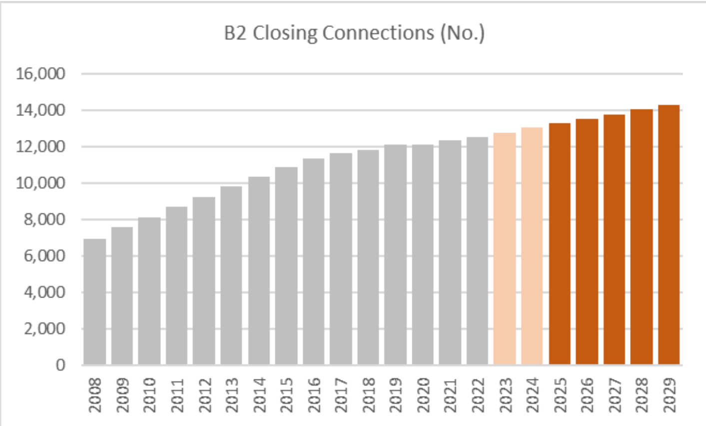
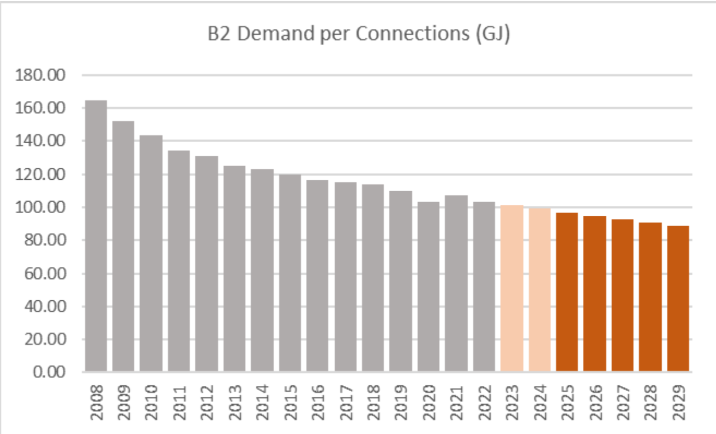


Figure 2.12 B2 Demand per Connection – history and forecast.

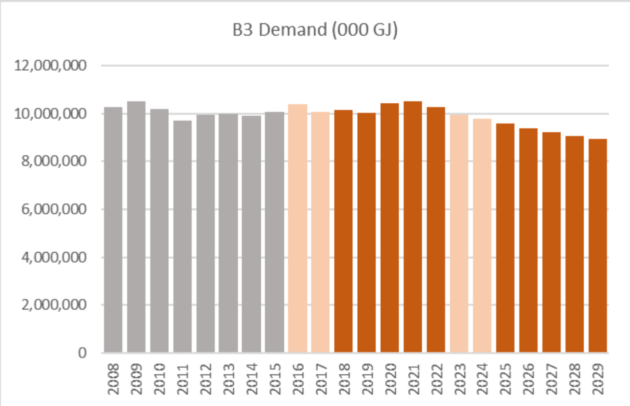


2.3.6. Tariff B3

In deriving this forecast, CORE has considered relevant micro and macro factors relating to MWSWGDS B3 tariff customer environments.

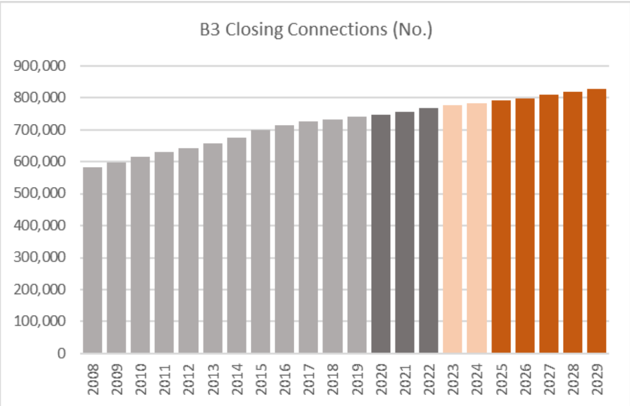
B3 demand is forecast to decrease at an annual average rate of -1.36% during the Review Period, due to a growth in net connections which average +1.12%, offset by a -2.84% average annual reduction in demand per connection.

Figure 2.13 B3 Demand – history and forecast.



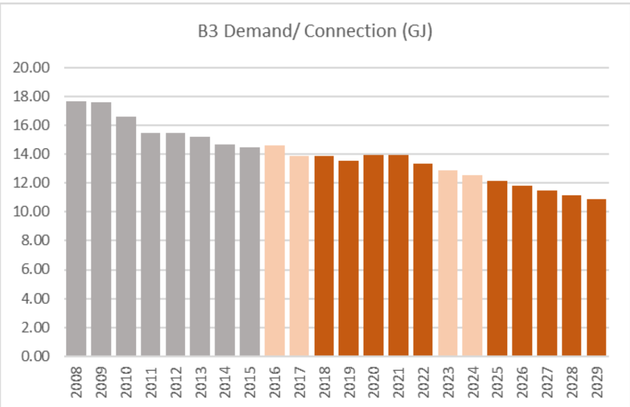
Source: CORE based on AGA data to 2022 and CORE Demand model thereafter

Figure 2.14 B3 Connections – history and forecast.



Source: CORE based on AGA data to 2022 and CORE Demand model thereafter

Figure 2.15 B3 Demand per Connection – history and forecast.



Source: CORE based on AGA data to 2022 and CORE Demand model thereafter

2.4. Ancillary Services

Ancillary Services forecasts are based on B3 customer numbers and forecasts of B3 connections as addressed above, as B3 customers represent approximately 95% of the Ancillary Services activity. That said, CORE has considered the materiality of relationships between other tariff classes.

The 2023-24 period for most services is expected to be lower than the subsequent period, due to a recovery of activity levels following COVID, in a transition toward rates observed historically.

Table 2.2 Ancillary Services Forecast

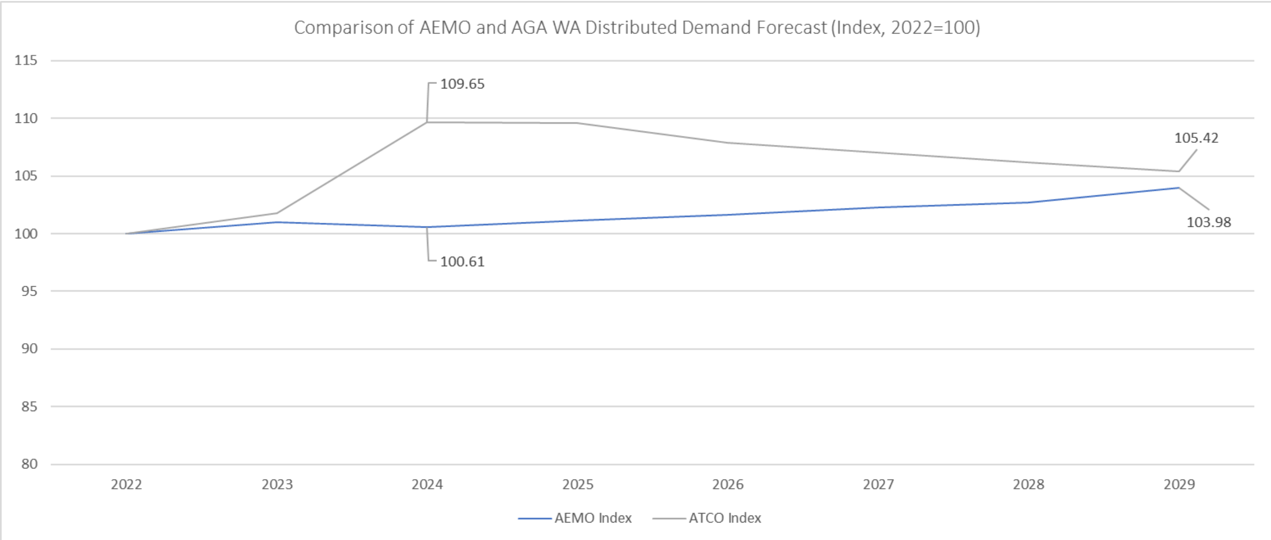
Service	2025	2026	2027	2028	2029
Meter Lock Applications:	8,651	8,737	8,835	8,941	9,050
Meter Lock Removals:	8,454	8,544	8,645	8,750	8,857
Deregistrations:	3,508	3,543	3,582	3,625	3,669
Regulator Removals:	3,696	3,733	3,775	3,820	3,867
Regulator Reinstalls:	3,067	3,098	3,133	3,170	3,209
Special Meter Reads:	102,241	103,258	104,418	105,666	106,956
Cut and Cap:	1,671	2,047	2,120	2,180	2,217

Source: CORE Demand Model

2.5. Validation

As a significant element of a broader validation process, to ensure that CORE estimates are the best under the circumstances, as required by the NGR, CORE has undertaken a comparison of its forecast with the forecast presented by AEMO within its 2023 Gas Statement of Opportunities (GSOO) as summarised in the following figure.

Table 2.3 Comparison of total CORE forecast and AEMO 2023 GSOO ('000 GJ/TJ)



Source: CORE Demand Model

This figure illustrates that the GSOO forecast (on an index basis) is above the CORE forecast for the 2025 to 2029 period. CORE notes that the industrial survey results – which would most likely not have be known to AEMO at the time, provide evidence of a higher level of demand in 2023 and 2024 before reducing during 2025, which provides a logical explanation for the variance.

CORE considers this validation process to provide further support of the CORE forecast.

3. Methodology

3.1. Overview

The methodology adopted by CORE to derive gas demand forecast for the MWSWGDS, which is consistent with the approach adopted for AA5, involves four primary elements. Each element is expanded upon in subsequent sections of this report.

1. An approach to normalising historical demand to remove the impact of abnormal weather (Section 3.2)
2. An approach to deriving a forecast of Tariff B3 customer demand (Section 3.3)
3. An approach to deriving a forecast of Tariff B1 and B2 customer demand (Section 3.4)
4. An approach to deriving a forecast of Tariff A1 & A2 industrial demand (Section 3.5)

The methodology adopted by CORE takes into consideration all recent AA demand forecast proposals, draft and final decisions, which, together with consideration of approaches adopted by leading national and international organisations engaged in energy forecasting, including AEMO, results in a best-practice approach to gas connections and demand forecasting.

The methodology favours a highly transparent approach, including a demand forecast model that examines all material factors that are considered likely to, or have the potential to, impact normalised demand.

This report sets out material underlying facts and assumptions relied upon to develop the demand forecast gas demand. This includes actual connections and demand data provided by AGA for the period 1 January 2008 to 31 December 2022.

CORE considers this process to be compliant with s 74(2) of the NGRs - Forecasts are constructed on a reasonable basis whilst representing the best forecasts possible in the circumstances.

Further detail on the approach is set out below for B3 tariff customers, B1 and B2 tariff customers and industrial (A1 and A2) tariff classes.

3.2. Weather Normalised Demand

Gas consumption is materially influenced by weather, including seasonal winter heating season. Accordingly, the weather impact on historical B1,B2 and B3 tariff customer consumption is normalised to provide an appropriate, 'normalised' basis for demand forecasting.

Consistent with AA5, CORE has adopted a weather normalisation methodology based on AEMO's EDD forecasting guidelines, as the EDD methodology has been demonstrated to provide a more rigorous and accurate approach to normalisation. This approach involves the derivation of an EDD Index and the application of that index to historical actual demand to arrive at normalised historical actual demand.

3.2.1. EDD Index

The weather index selected for weather normalisation was based on AEMO's EDD_{312} methodology which has been approved by the ERA in previous access arrangements ("**AA**") including MWSWGDS AA5. The calculation method and resulting parameters are outlined below:

EDD Calculation:

1. Develop an EDD Index Model to calculate the EDD Index coefficients – this model is included as a supporting Confidential document to this report.
2. Use the EDD Model to derive EDD Index coefficients by regressing daily gas demand on climate data, ranging from 01/01/2008 to 31/12/2022 (B1, B2 and B3 only). Consistent with AA5, historical climate data for the Perth Airport weather station was obtained from the Bureau of Meteorology (temperature, wind speed, sunshine hours).
3. Calculate EDD by using the weather normalised demand model and derived EDD index coefficients. The weather normalisation model is included as a supporting Confidential document to this report.

Below are the model structure and coefficients of CORE's EDD_{312} Index:

Daily demand per connection = $b_0 + b_1$*EDD + b_2*Friday + b_3*Saturday +b_4*Sunday.

EDD =	Degree Day ("**DD312**")	temperature effect
	+ 0.0366 * MAX (19.2900 - Temperature, 0) * Wind speed	wind chill factor
	- 0.00 * sunshine hours	warming effect of sunshine
	+ Max (4.2604*2* Cos $\left(\frac{2\pi(\text{day}-190)}{365}\right)$)	seasonality factor

Where DD_{312} is the degree day as calculated by the following table:

DD_{312} =	$T_2 - T_1$ if $T_1 < T_2$	Daily temperature above threshold temperature
	0 if $T_1 > T_2$	Daily temperature below threshold temperature

- T_1 is the average of 8 three-hourly temperature readings (in degrees Celsius) from 3.00am to 12.00am from the Bureau of Meteorology's Perth Airport Weather Station- deemed by CORE to be an appropriate weather station for the MWSWGDS gas network.
- T_2 represents the estimated threshold temperature for gas heating within the MWSWGDS.
- Average wind speed is the average of the 8 three-hourly wind observations (measured in knots) from 3.00am to 12.00am measured at the Perth Airport Weather Station.

- Sunshine hours are the number of hours of sunshine above a standard intensity as measured at the Weather Bureau's Perth Airport Weather Station. CORE notes that the associated coefficient was estimated to be 0 across the sample period. This is not uncommon for gas networks in temperate regions of Australia where maximum temperature statistically captures most of the sunshine impact.
- The seasonality factor models variability in consumer response to different weather. It indicates that residential and commercial consumers more readily turn on, adjust heaters higher or leave heaters on longer in winter than in the shoulder seasons given the same weather or change in weather conditions. For example, central heaters are often programmed once cold weather sets in resulting in more regular use and consumers are potentially in the habit of using heating appliances once the middle of winter is reached. Further, there is evidence of higher level of hot water use in winter, related to extended showers and longer time to heat water to desired temperature, from ambient temperature. This change in consumer behaviour is captured in the Cosine term in the EDD formula, which implies that for the same weather conditions heating demand is higher in winter than in the shoulder seasons or in summer.[1]

3.2.2. Weather Normalised Demand - B1,2,3

CORE developed a model to facilitate weather normalisation analysis which has been used for B1,2 and 3. CORE has not observed a statistically significant relationship between A1,2 demand and weather and therefore no weather normalisation has been undertaken for these segments. The model is consistent with the one used for AA5.

The EDD_{312} Weather Index was then used for regression analysis on AGA's B3, B1 and B2 consumption data.

1.	B1, B2, B3 data was regressed on historical EDD data, monthly.
2.	The statistical relationship between customer gas demand and weather fluctuations was determined.
3.	The regressions were performed with the two main data sets: ▪ Monthly sum of EDDs (calculated from the daily EDD series obtained from the first stage) ▪ Monthly sum of gas demand (AGA demand data)

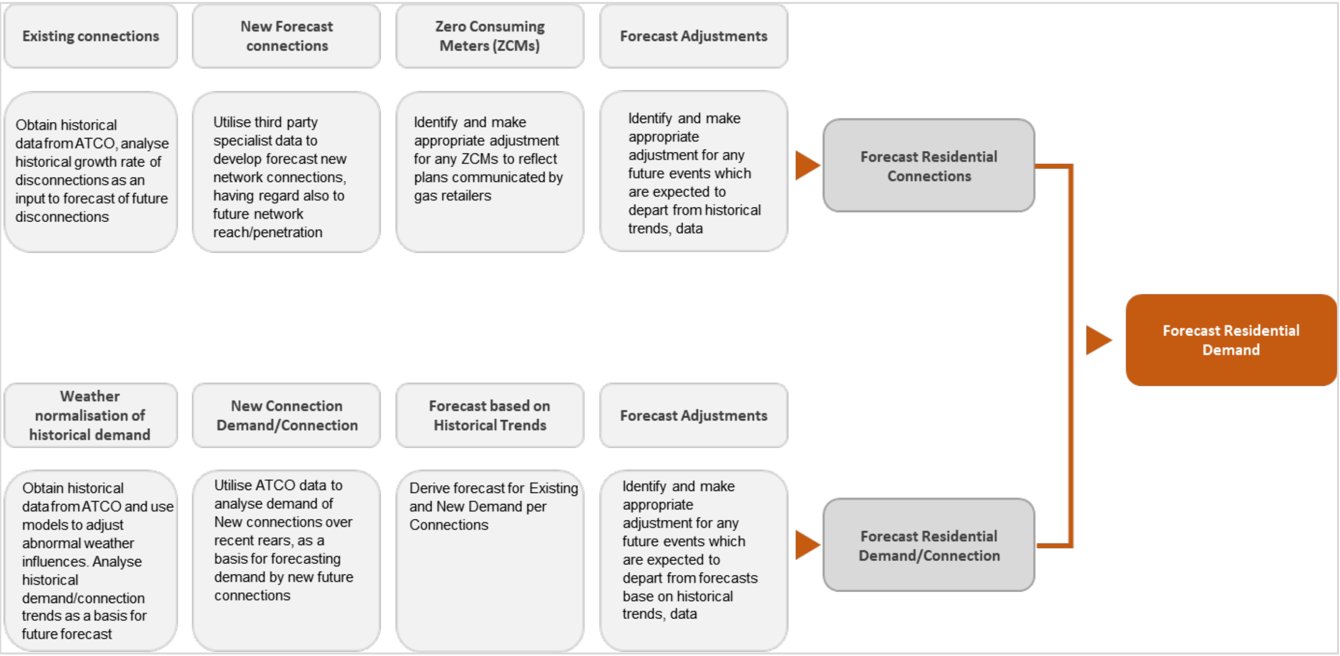
CORE considers this process to be compliant with s 74(2) of the NGRs. Forecasts are constructed on a reasonable basis whilst representing the best forecasts possible in the circumstances.

[1] As described in; AEMO, *Victorian EDD Weather Standards – EDD312 (2012)*

3.3. B3 Tariff Customers

The methodology adopted by CORE for B3 tariff customer demand forecasting purposes, is outlined in the figure below. This figure shows that B3 tariff customer demand is the product of forecast connections and demand per connection.

Figure 3.1 Tariff B3 Demand Forecast Methodology



Source: CORE

3.3.1. Connections

This section details the approach undertaken to derive a best estimate of B3 connections.

Due to the different types of dwellings, CORE reconciles bottom-up and top-down approaches. The integration of third-party specialist forecasts is inherent to this approach.

- The bottom-up approach analyses historical trends and major factors which influence gas connections; and
- The top-down approach utilises forecasts completed by specialist third parties. The specific focus here is on dwelling completions within the distribution network.

The results of these two approaches are compared and differences are examined before arriving at a final forecast.

3.3.1.1 Existing Connections

- B3 connection numbers for 2008 to 2022 were compiled by CORE based on data provided by AGA.[2] However, CORE's focus was on data to 2019, to eliminate the impact of COVID, and recovery from COVID pandemic, on energy utilisation.
- CORE derived the rates of disconnections from AGA.
- The closing 2022 connections are defined as existing connections for the forecast. The forecast of existing connections for a given year is derived by removing the predicted disconnections in the previous year from the opening number of connections in the previous year. Forecast disconnections are based on the historical average of disconnections as a

[2] AGA – Volume and Connections History

percentage of the year-opening number of connections, and adjusting for any factors which vary between the forecast and historical periods.

- There are meters on the AGA network for which there is no associated consumption. This situation may occur if a property is vacant or if supply has been cut off because of non-payment. For AA6 no adjustment has been made for Zero Consuming Meters.

3.3.1.2 New Connections

CORE has derived an estimate of new dwelling connections in the 2025 to 2029 period via a four-step process:

1. Estimate new dwellings in WA.
   > CORE has undertaken an extensive literature search and statistical analysis to derive a forecast of WA dwelling completions. In particular CORE has relied upon independent studies completed by the Housing Industry Association(**"HIA**"). CORE considered the use of data from other Providers, and HIA was preferred because its data was most current, provided more detail regarding dwelling types and has been the preferred source of data in other network demand forecasts submitted to the AER, including Victoria and NSW.
2. Estimate number of new dwellings in WA that will be developed within the MWSWGDS area.
   > CORE has undertaken analysis of dwelling completions within the MWSWGDS region relative to total WA.
3. Estimate the number of dwellings within MWSWGDS area that are forecast to be connected to the gas network.
   > CORE has undertaken analysis of the historical MWSWGDS network penetration rate and determined any adjustments based on forecast demographic and other trends.
4. Determine the apportionment of future dwelling connections in the MWSWGDS area that are single vs cluster dwellings, to enable analysis of the difference in demand per connection between the two dwelling types.
   > CORE has undertaken analysis of the historical average increase of cluster or higher density dwellings relative to single houses and considered future events which may vary from historical trends.

3.3.2. Demand per Connection

CORE has considered the alternative methodologies that could reasonably be used to forecast B3 demand per connection. CORE considers that the most accurate estimate would be formed by analysing the historical annual average growth and then adjusting for the impact of each material factor. Regression analysis was completed for a range of other macroeconomic variables such as household income. Ultimately, no statistical trend fitted to the data set was significant, meaning that weather and price-normalised historical average growth rates were a more reliable alternative. In carrying out this approach, it was ensured that all analysis was rigorous, data of a suitable quality was utilised, the forecast was set out in a transparent fashion and any assumptions, inputs, calculations, and results were displayed.

Therefore, the steps taken to arrive at a forecast of demand per connection were as follows:

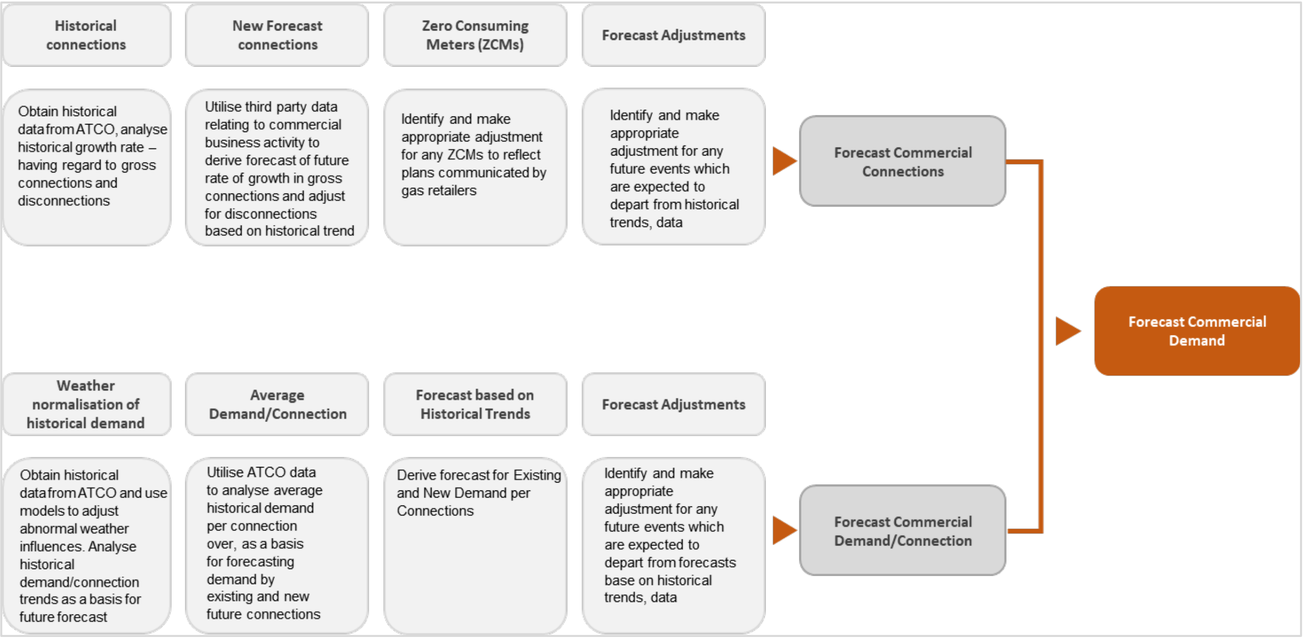
- Normalise demand per connection for the effects of weather using the process outlined in Section 4.

- Derive the historical annual average growth in demand per connection based on normalised demand per connection between 2008 and 2022 using data provided by AGA.[3]
- Derive a forecast of demand per connection, having regard to major factors which have the potential to influence demand per connection including economic activity, government policy and efficiency trends.

3.4. B1 and B2 Customer Tariff

The methodology adopted to derive a forecast of demand for B1 and B2 is similar to the approach used for demand B3, although different drivers of demand are relied upon. The figure and paragraphs below provide relevant detail of the approach to deriving both Connections and Demand per Connection which form the basis of the Demand forecast.

Figure 3.2 Tariff B1 and B2 Demand Forecast Methodology



Source: CORE

3.4.2. Connections

The following steps were taken to derive a forecast of B1 and B2 connections.

- Collate connections data from the 2008 to 2022 period based on inputs provided by AGA.[4] Focus on period to end 2019 to remove impact of COVID period.
- Undertake analysis to arrive at the most appropriate drivers to use as a basis for forecasting future connections.
- Use the selected driver to forecast connections for the two 'bridging years' of 2023 and 2024 and the forecast for the AA6 Review Period

3.4.3. Demand per Connection

The approach used in the B3 demand forecast was also adopted for B1 and B2.

[3] AGA – Volume and Connections History

[4] AGA – Volume and Connections History

- Normalise demand per connection for the effects of weather using the process outlined in Section 4.
- Determine the historical annual average growth in demand per connection based on demand per connection between 2008 and 2022, for both existing and new connections based on inputs provided by AGA.[5]
- Determine the forecast of demand per connection, having regard to the normalised historical annual average growth and the movement in factors that are expected to impact demand per connection. These factors include policy change and appliance trends.

3.5. Industrial Tariff Classes (A1 and A2)

Industrial A1 and A2 demand is forecast by:

1. analysis of individual customer historical demand trends based on data provided by AGA.
2. customer surveys for largest customers - including customers estimates of forecast ACQ and MHQ
3. research and analysis of third-party data to assess factors that are expected to impact A1 and A2 ACQ demand.
4. for A1 customers that also require an MHQ forecast, the historical ratio with annual demand was reviewed as a basis for the forecast, in addition to any known closures and load changes.

This analysis includes consideration of both Macro and Micro factors which are expected to impact A1 and A2 customers, including:

Macro

- impact of future economic activity on different industry classes
- outlook for construction and related activity gas consumption based on third party estimates of construction activity.
- trends in energy efficiency
- scope for government policy to assist large consumers reduce GHG emissions.

Micro

- qualitative evidence of planned initiatives by specific industry sectors as it relates to reduction of energy generally and gas specifically, including:
  - Bricks, construction material and related services
  - Transport
  - Food processing
  - Other manufacturing
  - Government and public services
  - Retailing

[5] AGA – Volume and Connections History

4. Weather Normalised Demand

4.1. Introduction

CORE's analysis of historical demand is based on normalised data to remove abnormal fluctuations caused by weather factors.

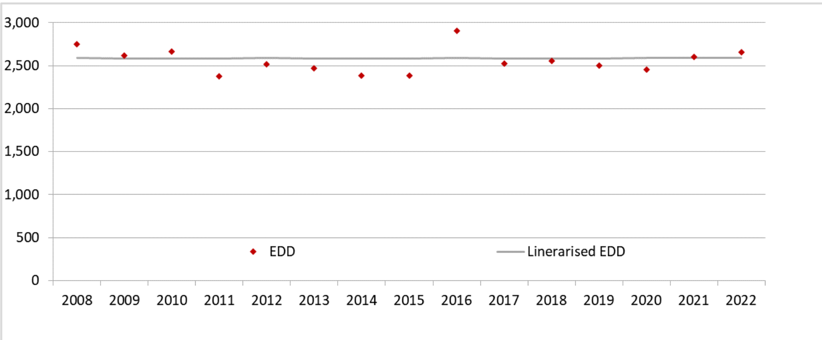
The following paragraphs summarise the results of the weather normalisation process. CORE's proprietary EDD index model and weather normalised demand model should be read in conjunction with this report. These models have been submitted to AGA and form a confidential attachment to AGA's Access Arrangement Information.

4.2. EDD Index

Historical demand data was normalised to remove the impact of weather on demand and demand per connection for the Tariff B1, B2 and B3 customer groups.

The EDD Index presented in the following figure and tables were used to normalise Tariff B1, B2 and B3 demand. As part of this process, the long-term, linearised trend of EDD is compared to the annual fluctuations in weather. Actual EDD greater than the EDD trend, implies that weather in this year was colder than normal and vice versa. Colder weather induces higher demand per connection, as more gas is required for heating (space and water).

Figure 4.1 EDD Index



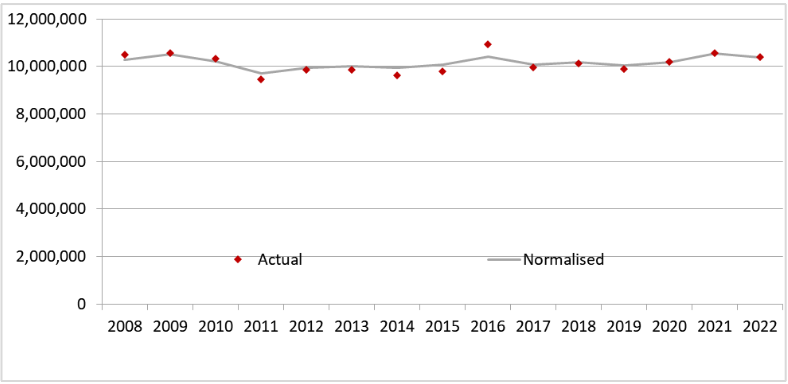
Source: CORE based on EDD model

4.3. Weather Normalised Demand Results | Tariffs B1, B2, B3

4.3.1. B3

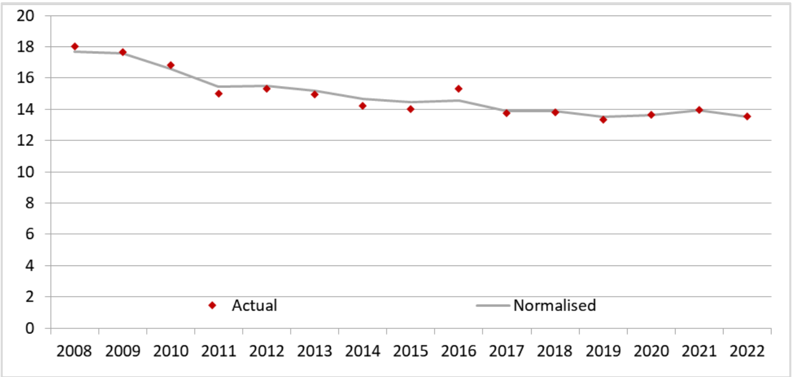
For the B3 customer group, total demand has remained relatively flat (due to impact of connections offsetting D/C), whereas historical normalised demand per connection exhibits a steady declining trend.

Figure 4.2 Tariff B3 Demand | GJ



Source: CORE based on weather normalisation model

Figure 4.3 Tariff B3 Demand per Connection | GJ



Source: CORE based on weather normalisation model

4.3.2. B1

Normalised B1 demand has experienced an upward trend on average, with a decline in demand per connections offset by connection growth.

Figure 4.4 Tariff B1 Demand | GJ

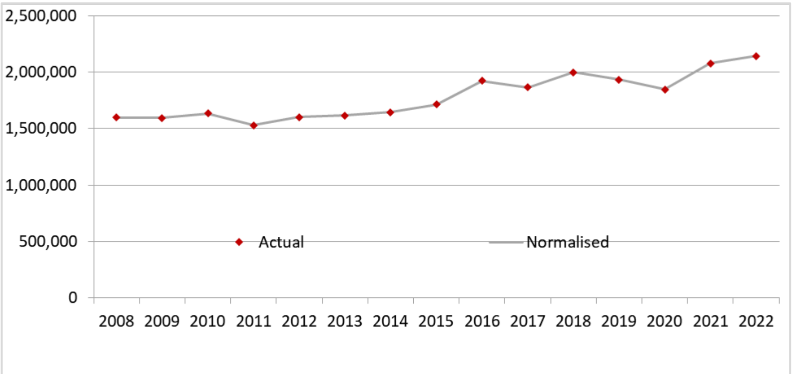
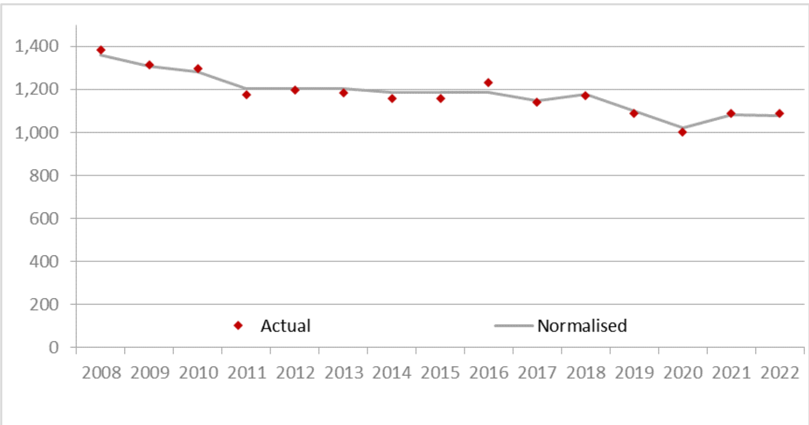


Figure 4.5 Tariff B1 Demand per Connection | GJ



4.3.3. B2

Normalised B2 demand has experienced declining growth since 2016, with a decline in volume per connections mostly offset by connection growth.

Figure 4.6 Tariff B2 Demand | GJ

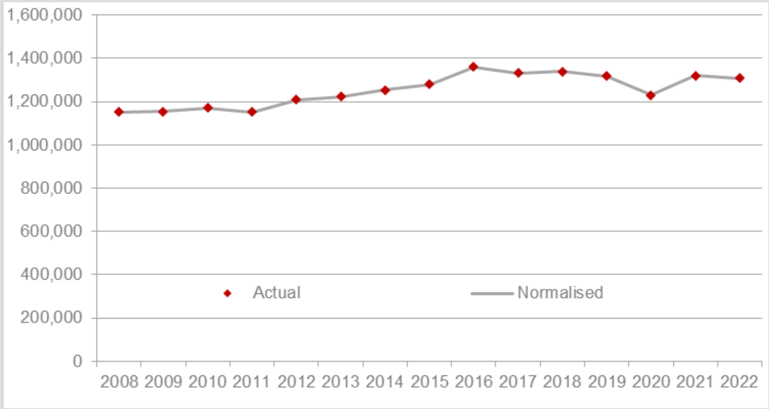


Figure 4.7 Tariff B2 Demand per Connection | GJ

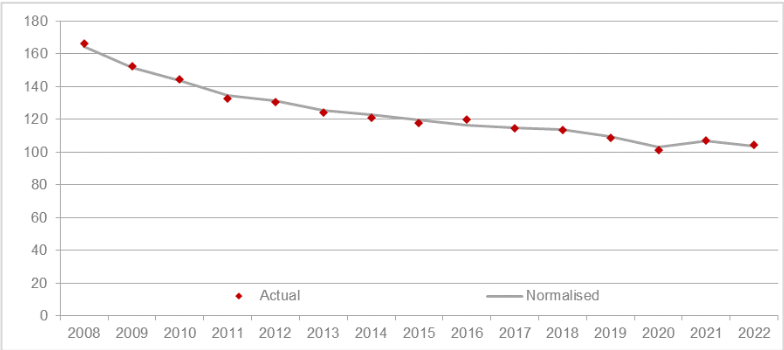


Table 4.1 Summary of EDD, Historical actual demand and weather normalised demand and demand per connection

Year		2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
EDD																
Linearised EDD	(°C)	2,587	2,581	2,582	2,582	2,590	2,583	2,584	2,584	2,592	2,585	2,586	2,586	2,594	2,587	2,588
EDD	(°C)	2,752	2,616	2,665	2,378	2,520	2,468	2,386	2,382	2,904	2,521	2,556	2,501	2,454	2,605	2,659
Difference	(°C)	165	35	83	(205)	(70)	(116)	(198)	(202)	312	(64)	(30)	(85)	(140)	18	71
B3																
Tariff Residential normalised demand	(GJ)	10,276,265	10,508,265	10,208,677	9,725,589	9,949,739	10,013,294	9,911,192	10,089,837	10,408,873	10,063,457	10,156,378	10,041,040	10,421,271	10,518,328	10,256,845
Tariff Residential actual demand	(GJ)	10,501,100	10,561,920	10,331,162	9,440,001	9,853,762	9,845,906	9,615,152	9,776,930	10,926,351	9,962,876	10,109,662	9,900,058	10,180,722	10,553,061	10,385,543
Difference	(GJ)	224,835	53,655	122,486	(285,588)	(95,977)	(167,388)	(296,040)	(312,908)	517,478	(100,581)	(46,716)	(140,982)	(240,550)	34,733	128,698
Tariff Residential normalised demand per connection	(GJ/no.)	17.66	17.60	16.62	15.45	15.49	15.23	14.66	14.46	14.59	13.89	13.86	13.54	13.96	13.91	13.37
Tariff Residential actual demand per connection	(GJ/no.)	18.04	17.69	16.82	14.99	15.34	14.98	14.22	14.01	15.32	13.75	13.80	13.35	13.64	13.96	13.54
Difference	(GJ)	.4	.1	.2	(.5)	(.1)	(.3)	(.4)	(.4)	.7	(.1)	(.06)	(.19)	(.32)	.05	.2
B1																
Tariff B1 Commercial normalised demand	(GJ)	1,569,832	1,587,645	1,617,803	1,561,144	1,611,975	1,638,160	1,676,340	1,750,986	1,856,809	1,877,530	2,003,010	1,953,023	1,878,635	2,071,868	2,122,604
Tariff B1 Commercial actual demand	(GJ)	1,596,258	1,594,862	1,632,684	1,525,630	1,600,373	1,616,361	1,639,546	1,711,429	1,925,320	1,864,491	1,997,505	1,933,786	1,844,438	2,077,647	2,142,483
Difference	(GJ)	26,425	7,217	14,880	(35,514)	(11,602)	(21,799)	(36,795)	(39,557)	68,511	(13,039)	(5,504)	(19,237)	(34,197)	5,780	19,878
Tariff B1 Commercial normalised demand per connection	(GJ/no.)	1,359	1,308	1,283	1,202	1,205	1,202	1,186	1,186	1,188	1,147	1,175	1,101	1,020	1,084	1,079
Tariff B1 Commercial actual demand per connection	(GJ/no.)	1,382	1,314	1,295	1,174	1,196	1,186	1,160	1,160	1,232	1,139	1,172	1,090	1,002	1,087	1,089
Difference	(GJ)	22.9	5.9	11.8	(27.3)	(8.7)	(16.0)	(26.0)	(26.8)	43.8	(8.0)	(3.2)	(10.8)	(18.6)	3.0	10.1
B2																
Tariff B2 Commercial normalised demand	(GJ)	1,138,670	1,149,341	1,162,743	1,170,527	1,214,345	1,234,258	1,274,866	1,303,752	1,318,946	1,339,645	1,343,499	1,329,860	1,251,115	1,318,045	1,296,952
Tariff B2 Commercial actual demand	(GJ)	1,151,725	1,153,318	1,170,695	1,152,255	1,208,362	1,222,612	1,253,134	1,280,110	1,359,527	1,332,081	1,339,960	1,318,637	1,230,972	1,320,673	1,307,333
Difference	(GJ)	13,056	3,977	7,952	(18,271)	(5,983)	(11,646)	(21,733)	(23,642)	40,581	(7,565)	(3,538)	(11,222)	(20,144)	2,628	10,381
Tariff B2 Commercial normalised demand per connection	(GJ/no.)	164	152	143	135	131	125	123	120	116	115	114	110	103	107	103
Tariff B2 Commercial actual demand per connection	(GJ/no.)	166	152	144	132	131	124	121	118	120	114	113	109	101	107	104
Difference	(GJ)	1.9	.5	1.0	(2.1)	(.6)	(1.2)	(2.1)	(2.2)	3.6	(.6)	(.30)	(.93)	(1.66)	.21	.8

Source: CORE based on EDD and weather normalisation models

5. Tariff B3 Demand and Connections - History and Forecast

5.1. Introduction

This section of the report presents detail of CORE's approach to derivation of the Tariff B3 demand forecast.

B3 demand is derived using a bottom-up approach: the product of forecast connections and demand per connection.

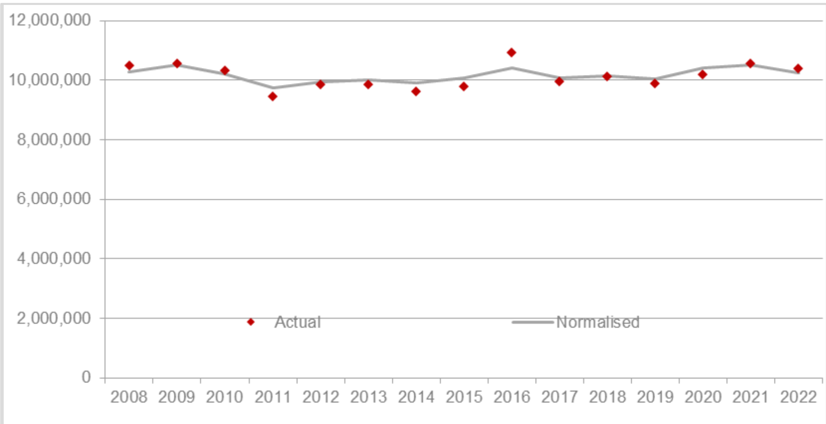
CORE's approach takes into consideration historical trends as well as expectations of future drivers of demand which are not present in the historic data/trends – both macro and micro in nature.

The demand data and forecasts presented in this section are weather normalised.

5.2. Historical Trend Analysis

The approach to deriving a forecast of B3 demand commences with analysis of historical connections and demand per connection, on a weather normalised basis.

Figure 5.1 B3 Actual and weather normalised demand to 31 December 2022 | GJ



Source: CORE based on EDD, Weather normalisation model

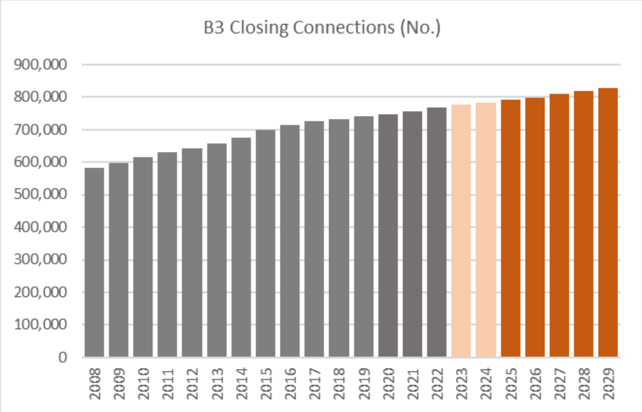
The key point to note is that normalised demand has fallen by an average of -0.23% between 2008 and 2019 (excluding COVID impacted years and 2022 recovery year).

Historical normalised demand is analysed at a connections and demand per connection level as set out below.

5.2.2. Historical Connections

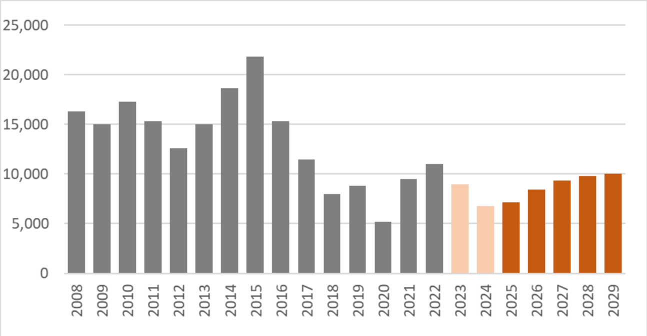
The following figures include actual closing connections to 31 December 2022 and annual movement in connection. These figures highlight the material reduction in net connections and rate of net connection growth since 2008 and even more so from 2015.

Figure 5.2 B3 Closing Connections



Source: CORE based on AGA data, CORE model thereafter

Figure 5.3 B3 Net Connections Growth (No.)



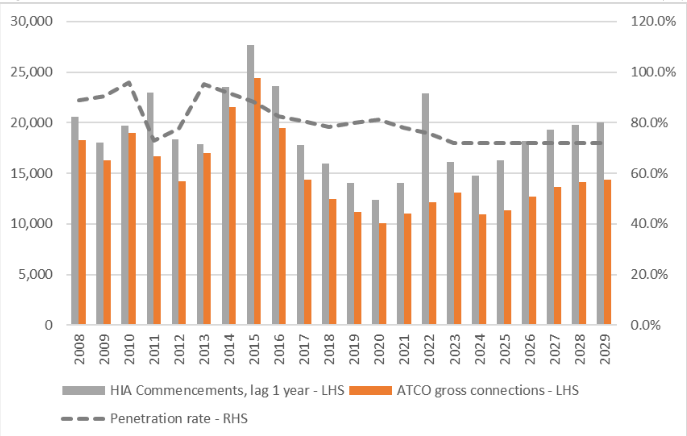
Source: CORE based on AGA data, CORE model thereafter

Net connections are a function of gross connections (new connections within a year) less disconnections (existing connections which were disconnected within a year). The following paragraphs address these elements.

5.2.2.1 Gross Connections

The following chart summarises HIA dwelling commencements (lagged 1 year to estimate completions), and ATCO gross B3 connections, together with the network penetration rate.

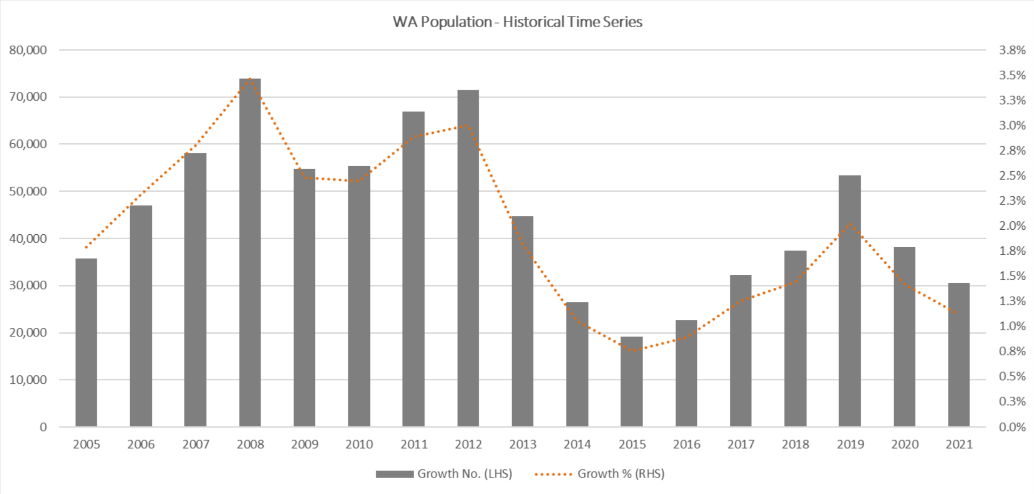
Figure 5.4 HIA commencements, B3 Gross Connections and Penetration rate (%)



Source: CORE based on AGA data to 2022, CORE model thereafter

The material reduction in HIA commencements and MWSWGDS gross connections from 2015 is largely attributable to reductions in population growth from 2013, together with delayed impact due to level of existing housing stock at 2013 and 1-2 year completion and connection lags, relative to population, beyond 2013.

Figure 5.5 Population growth and annual growth rate (%)



Source: CORE based on ABS 3101

The key points to note in relation to the penetration rate are as follows:

1. The rate averaged high 80s% before 2014.
2. The rate has fallen by approximately 10%, below 80% during 2017-2019 (pre COVID period)
3. The low rate in 2022 is attributable to COVID impacted resourcing challenges and construction delays, with 2022 commencements to result in completion in 2023 vs 2022.

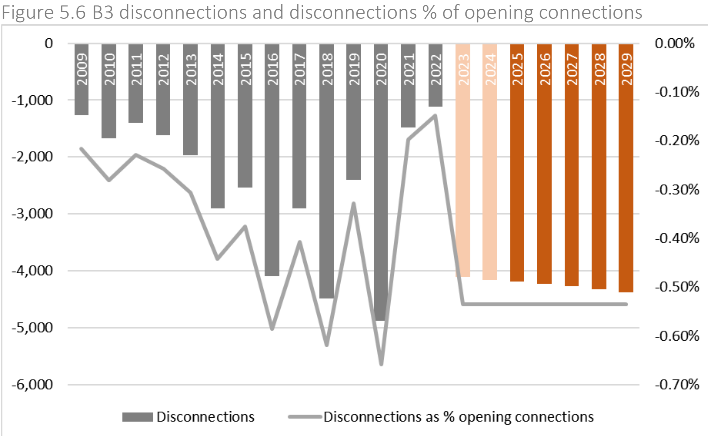
The fall in penetration rate is largely a function of an increase in 100% electrified homes vs dual fuel and a growth of dwelling activity in areas outside the MWSWGDS network area.

5.2.2.2 Disconnections and Net Connections

Net connections are Gross connection less disconnections within a year.

The following chart summarises the annual disconnections and annual disconnections as a % of opening connections for each year.

Figure 5.6 B3 disconnections and disconnections % of opening connections

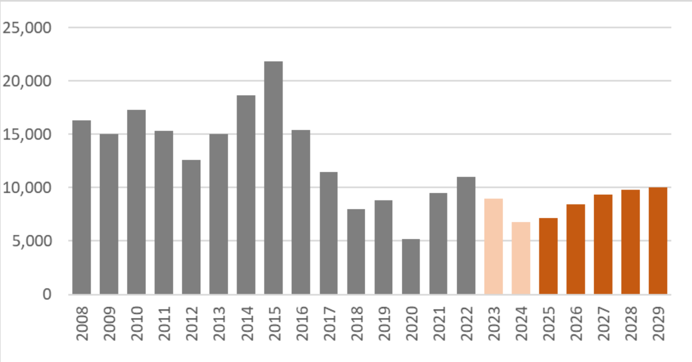


Source: CORE based on AGA data to 2022, CORE model thereafter

A key point to note is that the average rate of disconnections has increased significantly beyond 2015 (prior to COVID impacted years) from an average close to 2,000 before end 2015 and closer to 3,500 in the period to 2020.

The following chart summarises the resulting net connections (gross connections less disconnections)

Figure 5.7 B3 net connections



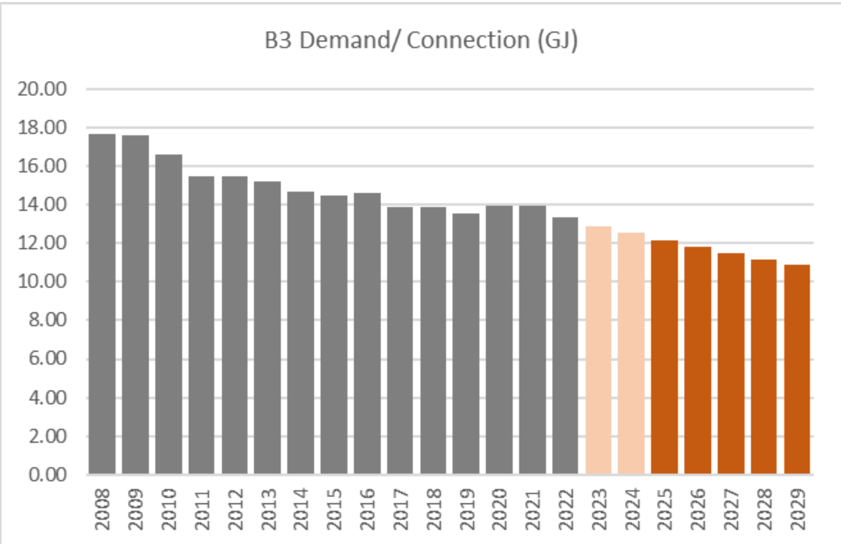
Source: CORE based on AGA data to 2022, CORE model thereafter

The key point to note is the material reduction in net connections from above 15,000 per year prior to 2016 and averaging materially below 10,000 in later years.

5.2.3. Demand/Connection (D/C)

The following figure presents a summary of the historical trend in B3 customer normalised demand/connection between 2008 and 2022.

Figure 5.8 B3 Demand/connection



Source: CORE based on AGA data to 2022, CORE model thereafter

This figure highlights a consistent downward trend in D/C until 2019 (a reduction of 23%, CAGR of -2.4%), with a flattening out during 2020 and 2021. CORE notes that the 2020-21 period is materially influenced by COVID, which caused a stepped increase in household focused personal and business-related activity and consequential increased use of energy, including gas.

The reduction in demand per connection is related to a combination of influences, including:

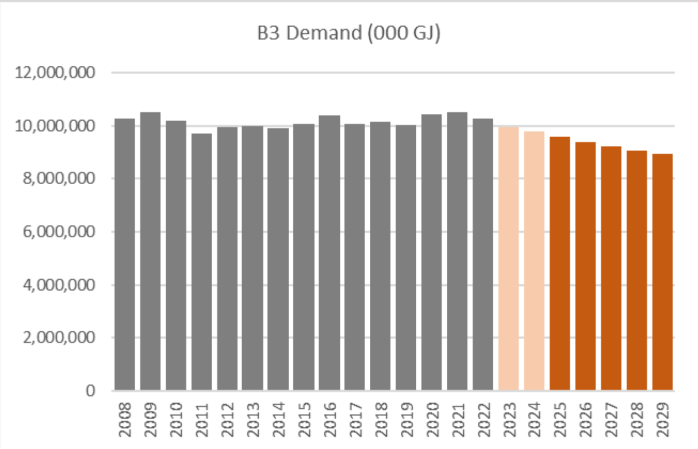
- Improved gas appliance efficiency
- Improved dwelling energy efficiency
- Changes in consumer behaviour and price response
- Trend in substitution away from gas central heating (large gas use) to R-C air-conditioning and some substation toward solar water heating – impacting both newer dwellings and replacements in other dwellings.

5.3. B3 Forecast Demand

5.3.1. Demand Summary

Based on the methodology outlined in Section 3 above, CORE has derived a forecast of B3 demand, which is summarised in the following figure, together with historical normalised demand.

Figure 5.9 B3 Demand – history and forecast.



Source: CORE based on AGA data to 2022 and CORE Demand model thereafter

The following figure summarises the underlying data for the period from 2019 to 2029.

Table 5.1 B3 Demand – history and forecast.

B3	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Demand	10,027,430	10,426,409	10,521,221	10,255,398	9,940,439	9,766,714	**9,575,007**	**9,389,004**	**9,219,968**	**9,070,417**	**8,936,747**

The primary reasons for the trend reduction in B3 demand from 2022 are as follows:

- A forecast reduction in dwelling completions activity, based on independent HIA data.
- The continuation of a trend reduction in MWSWGDS network penetration rate
- The continuation of a long-standing trend reduction in demand/connection

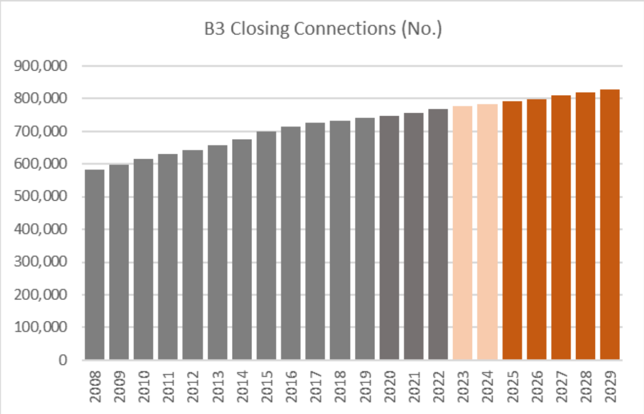
The two primary elements of the B3 Demand forecast - forecast average annual connections and annual demand per connection are addressed in the following paragraphs.

5.3.2. B3 Connections

CORE has derived a forecast of B3 closing connections, based on the methodology outlined in Section 3. The resulting forecast is summarised in the following figure.

Growth in closing connections has slowed from a CAGR of 2.6% in 2015 to 2.2% in 2019 (a 0.1% reduction pa) and to 2.0% in 2022. The projections below result in a CAGR in 2029 of 1.75% which is a continuation of the slowing growth in connections currently being experienced.

Figure 5.10 B3 Closing connections – history and forecast.



Source: CORE based on AGA data to 2022 and CORE Demand model thereafter

Table 5.2 B3 Closing Connections – history and forecast.

B3	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Closing Connections	741,437	746,639	756,154	767,161	776,126	782,880	790,060	798,526	807,905	817,732	827,739

Source: CORE based on AGA data to 2022 and CORE Demand model thereafter

These Closing Connection results are used to derive Average Connections based on the formula: Average = (opening + closing)/2.

The average forecast connections are summarised in the following table.

Table 5.3 B3 Average Connections – forecast.

B3	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Average Forecast Connections					771,643	779,503	786,470	794,293	803,215	812,819	822,736

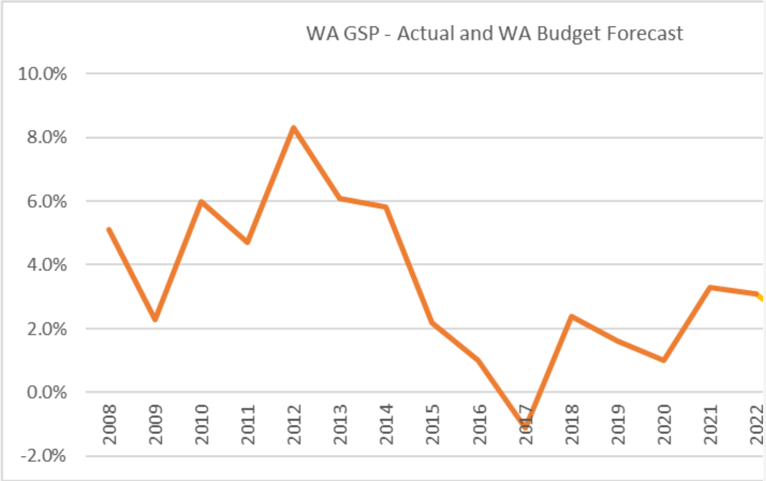
Source: CORE Demand model

As previously stated, the Closing Connection forecast (basis for average forecast) is the result of forecast growth in gross connections, less forecast annual disconnections, to derive an annual net movement in connections. These elements are addressed in the following paragraphs.

5.3.2.1 B3 Gross Connections

CORE analysis indicates that of a range of drivers of B3 connections, the most statistically significant factor impacting gross connections is the growth in dwelling completions. CORE has considered movements of GSP between 2008 and 2022, which is summarised in the figure below. However, CORE observed a stronger relationship with dwelling completions, which is also supported by CORE's qualitative "causal analysis".

Figure 5.11 Historical and Forecast WA GSP



Source: Various WA Government Sources

Following CORE analysis of alternative approaches, Gross connections have been derived by forecasting the total number of WA dwellings to be completed over the forecast period and applying a Network Penetration rate.

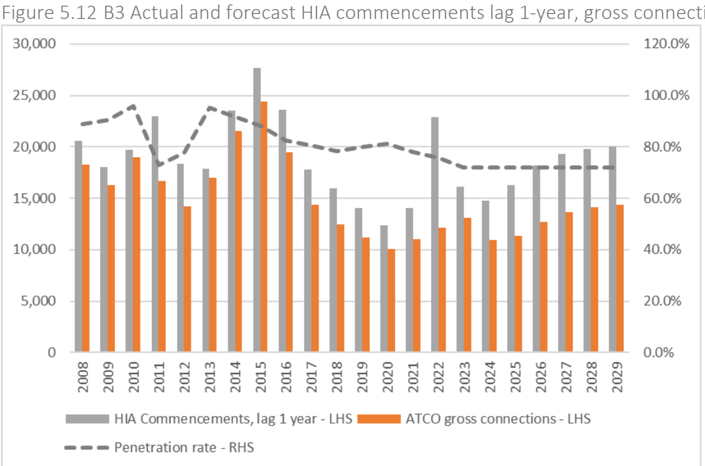
The forecast of WA dwelling completions is based on HIA forecast commencement data dated May 2023 which is lagged by one year (with adjustment after 2023 to lag 30% a further two months to reflect expected future lags due to resourcing constraints), to estimate the timing of dwelling completions. The results are summarised in following figure 5.13.

The Penetration rate is based on the historical actual penetration and trend, adjusted for additional factors expected to influence future connections, which are not reflected in the historical trend, as summarised in the following table.

Factor	Impact on penetration rate
Historical Penetration Rate – per demand model	79.6%
Less: historical trend reduction	8.3% of 79.6 = 6.6%
Less: estimated impact of policy, NCC, Customer response	1.00%
Forecast Penetration rate	**72%**

The forecast gross connections and Penetration rate are summarised in the following figure.

Figure 5.12 B3 Actual and forecast HIA commencements lag 1-year, gross connections and penetration rate.



Source: CORE based on AGA data to 2022 and CORE Demand model thereafter

Full detail relating to the adjustment after 2022 is included in the CORE demand forecast model.

5.3.2.2 B3 Forecast Disconnections and Net Connections

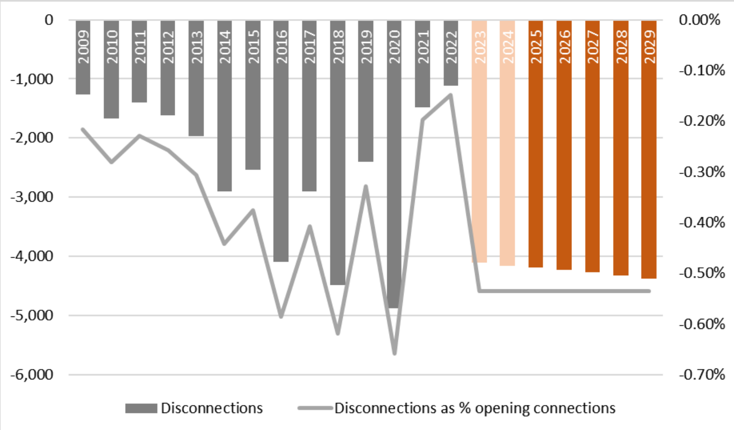
Annual disconnections are deducted from gross connections to derive net annual connections.

The number of disconnections in absolute terms has been increasing since 2009 peaking 4,093 in 2016, 4,490 in 2018 and 4,880 in 2020. In addition, the percentage of disconnections has also been increasing to 0.62% in 2018 and 0.66% in 2020.

In absolute terms the number of disconnections is expected to return to pre COVID levels before AA6. During AA6 the number of disconnections is expected to rise but not at the trajectories seen between 2009 and 2020 and not to the levels experienced in 2018 or 2020.

The disconnection forecast rate (0.54%) is based on the historical actual average disconnection rate based on the range observed in recent years excluding COVID (a period which represents a clear departure from rates experienced in earlier years).

Figure 5.13 B3 Historical and forecast disconnections and disconnections as %

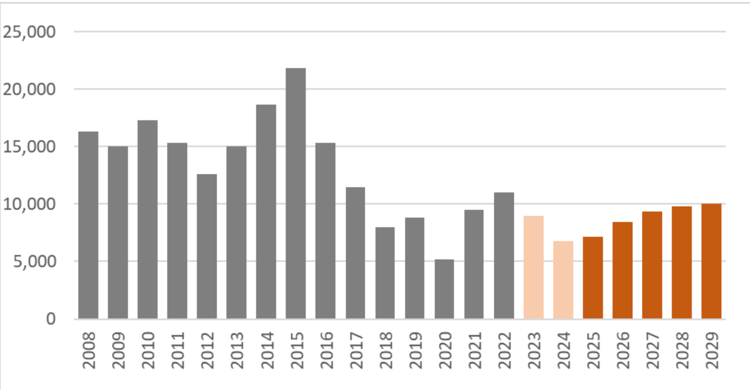


Source: CORE based on AGA data to 2022 and CORE Demand model thereafter

Deducting disconnections from gross connections results in net connections, as presented in the following figure.

Net connections in absolute terms have decreased from 2008 levels and have decreased significantly since the high of 2015.

Figure 5.14 B3 Historical and forecast net connections (No.).



Source: CORE based on AGA data to 2022 and CORE Demand model thereafter

5.3.3. B3 Demand per Connection

CORE has developed a forecast of B3 demand per connection having regard to

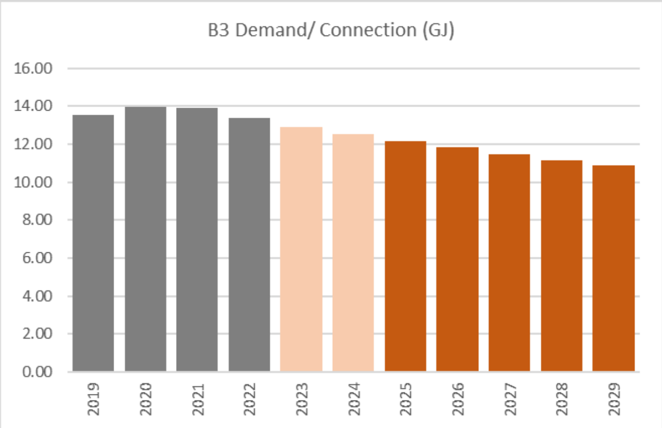
- historical annual trend across the total B3 customer base since 2008 (excluding the COVID years)

- historical movements within B3 consumption bands – across low, mid, and higher consuming connection bands
- economic, demographic, and other factors which are expected to influence future demand per connection.

CORE considers that the average historical annual rate per connection (CAGR) between 2008 and 2019 (pre COVID) of -2.4%, provides the best estimate of the rate of decline of future demand per connection. The continued declining rate, as presented in CORE's demand model results in a CAGR of -2.8% which is a moderately higher rate of decline than experienced pre COVID. This is consistent with a materially lower rate in average demand observed for new customers.

The resulting forecast is summarised in the following figure.

Figure 5.15 B3 Historical and forecast demand per connection.



Source: CORE based on AGA data to 2022 and CORE Demand model thereafter

5.4. Qualitative Analysis

In addition to the quantitative analysis presented above, CORE has undertaken research of publicly released studies which address future scenarios of household energy demand/use. Once such study for the Federal Government titled Every Building Counts, was undertaken by Green Building Council of Australia and Australian Property Council of Australia, was released in 2023.

This study focuses on a pathway to decarbonisation of buildings, including residential dwellings by 2050 by implementing change in dwelling design/structure and appliances, with a focus on electrification delivered by zero/low emission sources.

Recommended actions include:

- a move to all electric appliances in new residential developments under a 2025 National Construction Code
- phase out sale of gas appliances.
- introduction of a plan to phase out fossil gas use in existing residences.
- a retrofit program focused on lower income and vulnerable households – moving to electrical appliances.
- focus on skills and resources and technological advancement to support large scale electrification.

6. Tariff B1 and B2 Demand and Connections – History and Forecast

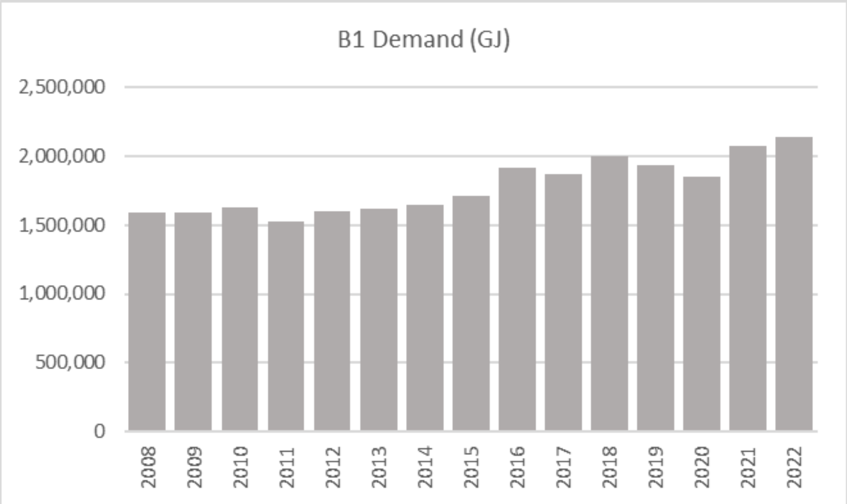
6.1. Introduction

The MWSWGDS Tariff B1 and B2 demand forecast is derived using a bottom-up approach, as the product of forecasts of connections and demand per connection. These forecasts take into consideration historical trends as well as best estimates of future drivers of demand not observed in the historic data/trends.

6.2. B1 and B2 historical demand overview

The following figures summarise historical normalised demand for B1 and B2.

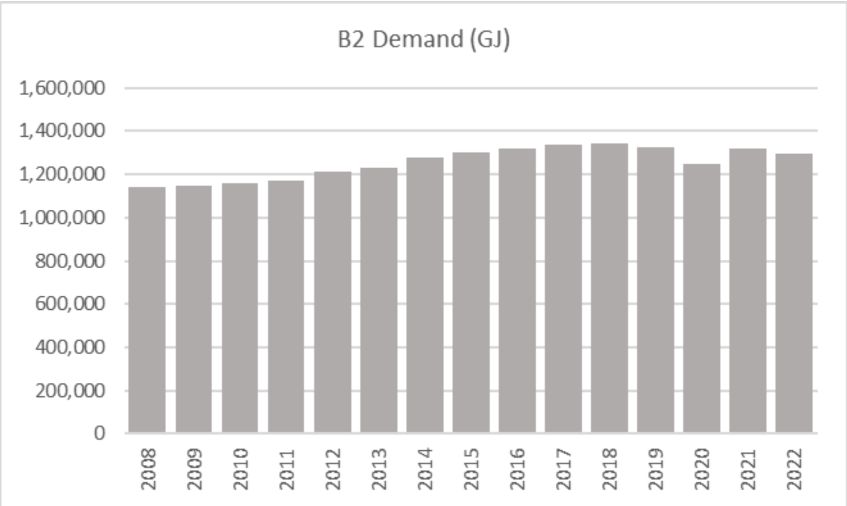
Figure 6.1 B1 Historical demand



Source: CORE based on AGA data to 2022 and CORE Demand model thereafter

The B1 CAGR on historical normalised demand has slowed from a peak of +2.35% in 2016 to +1.76%, excluding COVID impacted years.

Figure 6.2 B2 Historical demand



Source: CORE based on AGA data to 2022 and CORE Demand model thereafter

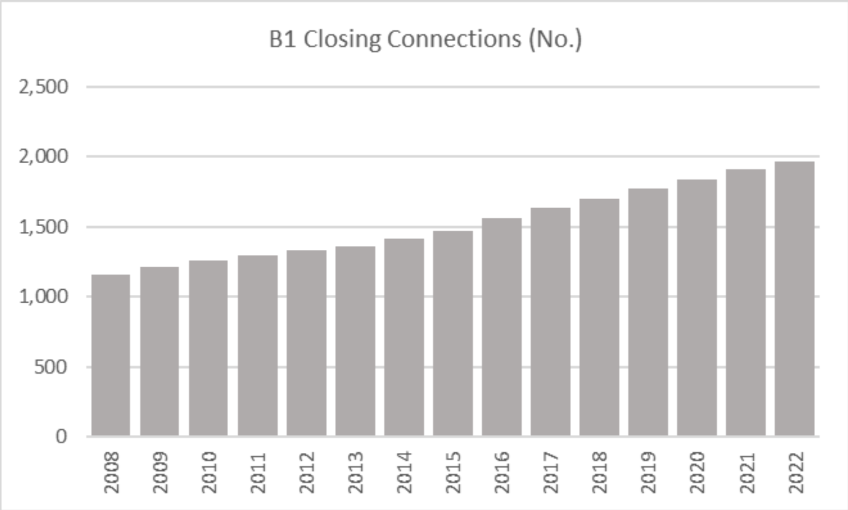
The B2 CAGR on historical normalised demand has declined materially from a peak of +1.94% in 2015 to +1.41% in 2019 and +0.93% in 2022. Normalised demand has fallen in 3 out of the 4 years following the peak in 2018.

The primary drivers of historical demand are addressed in the following paragraphs.

6.2.2. Connections

Historical actual connections are summarised in the following figures:

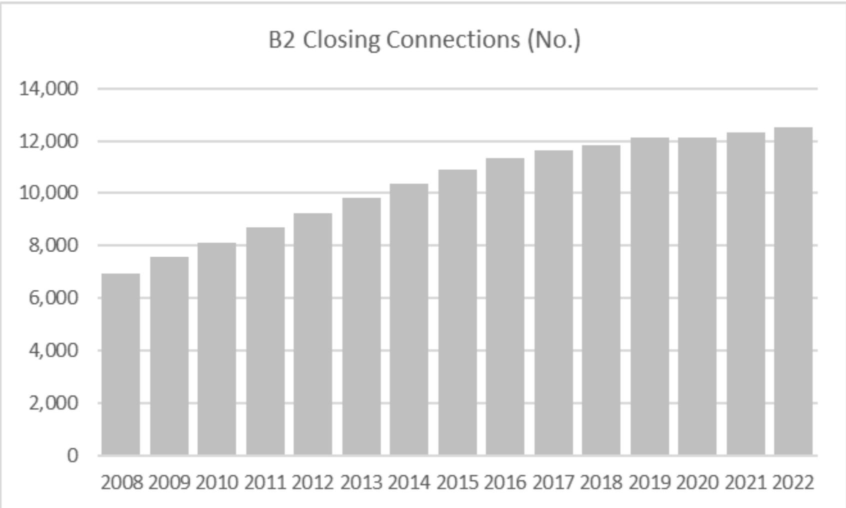
Figure 6.3 B1 Historical Connections



Source: CORE based on AGA data

The average B1 Connections growth rate between 2008 and 2019 was +3.98% and this rate has fallen to +2.93% in the first year following COVID, 2022. The B1 CAGR on closing connections in both 2009 and 2010 were at historical highs of +5.11% and 4.49% respectively, reducing to +3.98% in 2019 and since then has continued to reduce to +3.88% in 2022.

Figure 6.4 B2 Historical Connections



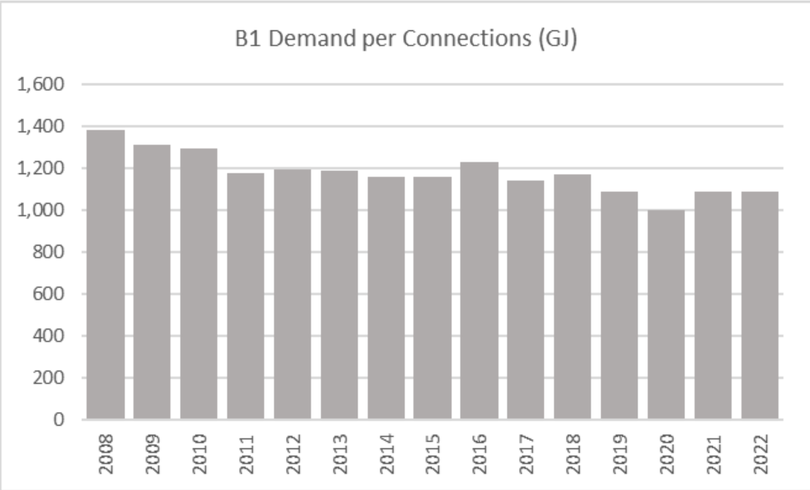
Source: CORE based on AGA data

The average B2 Connections growth rate between was +2.23% during the 2016-2019 period and this rate has fallen to +1.80% in the first year following COVID, 2022. The B2 CAGR on closing connections in both 2009 and 2010 were at historical highs of +9.22% and +8.17% respectively, reducing to +5.21% in 2019 and since then has continued to reduce to +4.33% in 2022.

6.2.3. Demand/Connection

Historical actual demand/connection is summarised in the following figures:

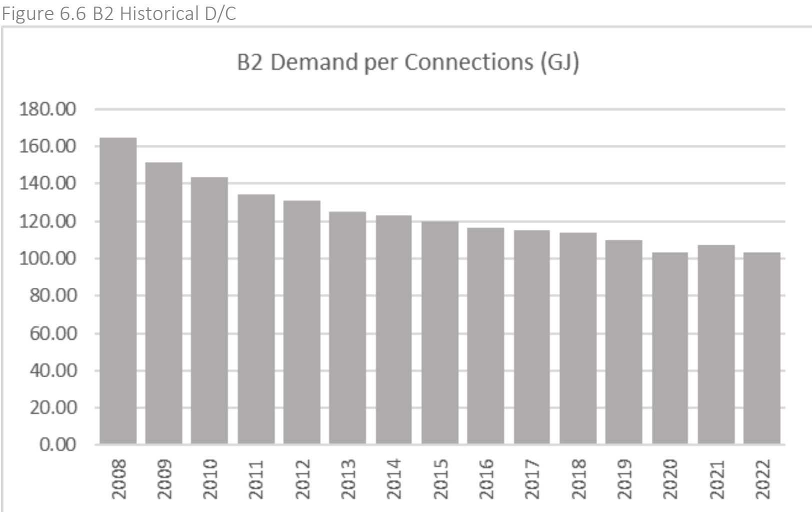
Figure 6.5 B1 Historical D/C



Source: CORE based on AGA data

The average B1 decline in D/C between 2008 and 2019 was -2.02% and the average decline between 2016 and 2019 was -3.76%. The B1 CAGR on normalised demand per connection between 2008 and 2019 was -2.12% and up to 2022 the rate of decline was -1.69%.

Figure 6.6 B2 Historical D/C



Source: CORE based on AGA data

The average B2 decline in D/C between 2008 and 2019 was -3.60% and the average decline between 2016 and 2019 was -2.16%. The B2 CAGR on normalised demand per connection between 2008 and 2019 was -3.62% and up to 2022 the rate of decline was -3.26%.

6.3. Tariff B1 and B2 Demand and Connections Forecast

6.3.1. Demand Forecast

CORE's approach to deriving a forecast of demand includes an analysis of historical trends and drivers and analysis of all material factors which were not evident in historical trends, but which are expected to influence future demand. Such factors include:

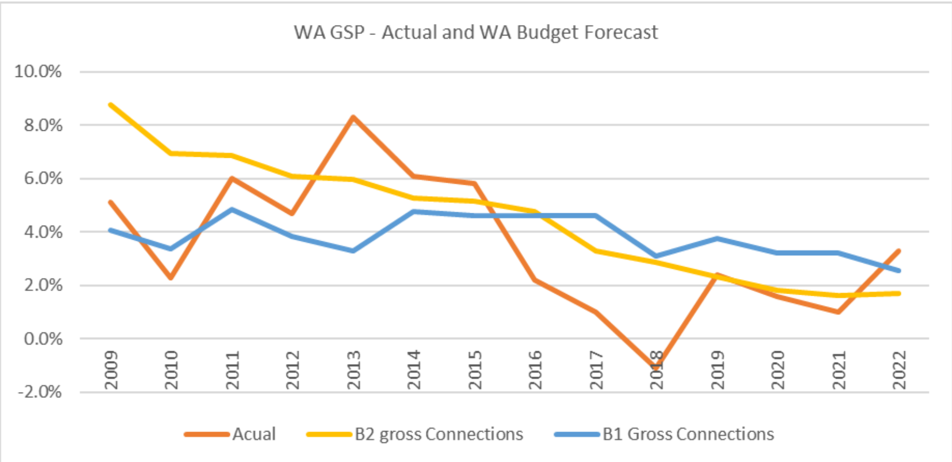
- Economic circumstances as they relate to business formation.
- Business mix – as it relates to types of business that will favour all electricity or electricity and gas.
- Government policy, including Government preference to favour electricity over gas.
- Cost/price considerations – capital cost of appliances and operating costs

CORE notes that it has undertaken analysis of the relationship between B1 and B2 demand, connections and demand per connection and single factors. This analysis indicates that no single factor provides a statistically reliable basis for forecasting purposes. Further CORE has observed a lack of consistent data series to facilitate rigorous statistical analysis. For this reason, CORE has favoured an analysis of historical actual trend and adjusting these as appropriate to account for future influence which vary from history.

One factor CORE considered in detail is WA GSP, which is summarised in the following figure. Whilst average rates over time do indicate a degree of relationship with growth in connections – the relationship varies between B1 and B2 and between years, as summarised in the following figure. Correlation analysis indicates the absence of a statistically robust relationship which can be relied upon for forecasting purposes (the B1 coefficient is low and the B2 is modestly negative, which is counter intuitive).

Despite the above, the analysis does show that GSP has averaged close to 4% in the period between 2008 and 2019, as addressed below, whereas it is fell below this level through to 2022 and is forecast to increase by a lower level in future years (2% in 2023-4 per WA budget).

Figure 6.7 Historical GSP

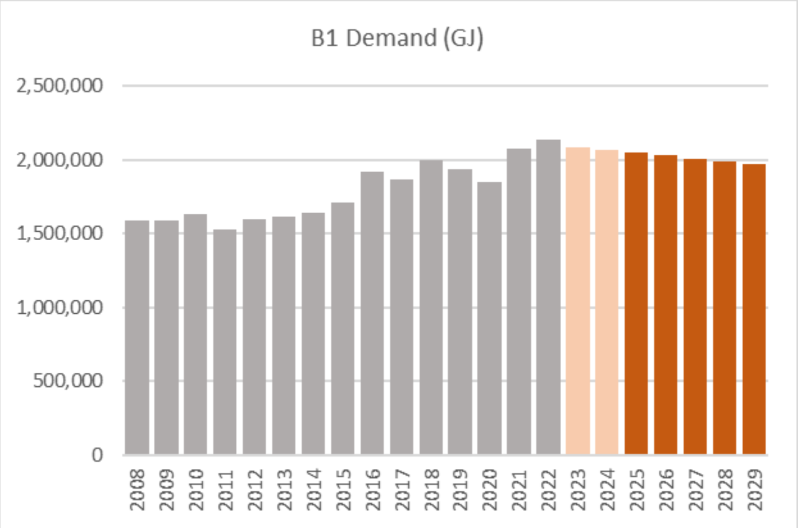


Source: B1 and B2 AGA, weather normalised by CORE; Actual GSP various WA Government Sources

Having regard to these factors CORE has derived the following forecasts:

B1 demand is forecast to fall by an average rate of -0.97%, based on an average growth in connections of 2.9% and an annual reduction in demand per connection of -3.76%

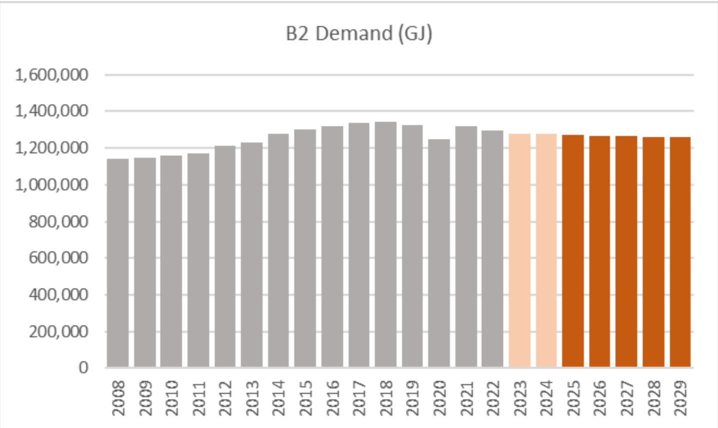
Figure 6.8 B1 Historical and forecast demand.



B1	2023	2024	2025	2026	2027	2028	2029
Demand	2,090,184	2,069,893	2,049,800	2,029,902	2,010,197	1,990,683	1,971,358

B2 demand is forecast to fall by an average rate of -0.3%, based on an average growth in connections of 1.9% and an annual reduction in demand per connection of -2.16%

Figure 6.9 B2 Historical and forecast demand.



B2	2023	2024	2025	2026	2027	2028
Demand	1,280,902	1,277,002	1,273,114	1,269,238	1,265,373	1,261,520

6.3.2. B1 and B2 Connections Forecast

The B1 connections forecast summarised in Figure 6.10 below represents an average annual increase between 2025 and 2029 of 2.9%. The B1 CAGR on closing connections has reduced from historical highs in 2009 and 2010 of +5.11% and +4.49% respectively to +3.98% in 2019 and +3.88%% in 2022. This continued slowing of growth in connections is projected to continue into AA6 where in 2029 CAGR is projected to be +3.55%

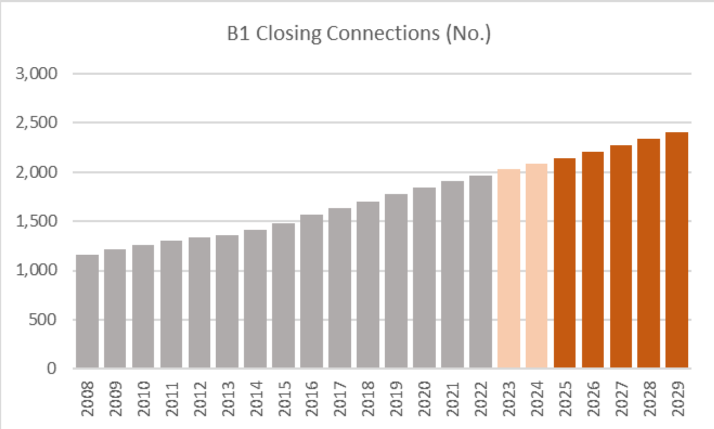
Key influences on this assessment were:

- the actual 2022 (post COVID) increase of 2.93%

- the continued slowing in CAGR from +5.11% in 2008 to +3.88% in 2022 results in an average decline in CAGR of 0.1% per annum. Continuing this decline would result in a CAGR in 2029 of +3.48% whereas our projections result in a more optimistic CAGR of +3.55% in 2029.
- the WA Government budget projected a fall in annual GSP growth from a recent actual growth rate of 2.6% and 3.75% in 2022 and 2023 moderating to lower levels to 2024-25.[6].

Evidence – Future of Gas et al

Figure 6.10 B1 Historical and forecast closing connections.



	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Connections															
Opening	1,414	1,476	1,563	1,637	1,704	1,774	1,841	1,912	1,968	2,025	2,084	2,144	2,206	2,270	2,336
Gross Connections	65	68	72	51	64	57	59	49	50	51	52	53	55	56	58
Disconnections/reconnections	-3	19	2	16	6	10	12	7	7	8	8	9	9	10	10
Net Movement	62	87	74	67	70	67	71	56	57	59	60	62	64	66	68

The B2 connections forecast summarised in Figure 6.11 represents an average annual increase between 2025 and 2029 of 1.9%. The B2 CAGR on closing connections has reduced from historical highs in 2009 and 2010 of +9.22% and +8.17% respectively to +5.21% in 2019 and +4.33% in 2022. This continued slowing of growth in connections is projected to continue into AA6 where in 2029 the CAGR is projected to be +3.51%

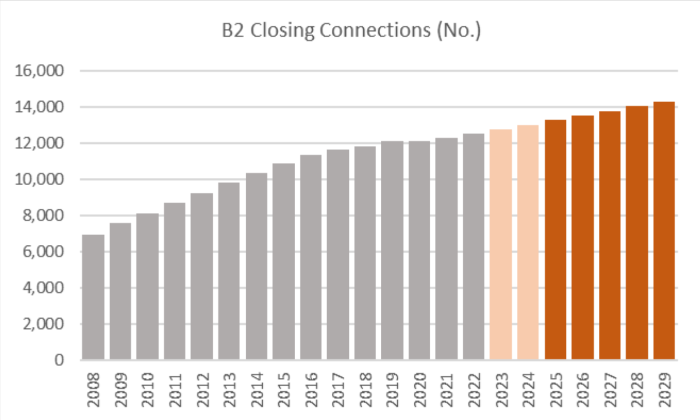
Key influences on this assessment were:

- the WA Government budget projected fall in annual GSP growth of a recent high from 3.75% in 2023 and to 2% in 2024 and 2025
- the continued slowing in CAGR from +9.22% in 2008 to +4.33% in 2022 results in an average decline in CAGR of 0.3% per annum. Continuing this decline would result in a CAGR in 2029 of +3.29% whereas our projections result in a more optimistic CAGR of +3.51% in 2029.
- the following historical annual average rates of growth in connections.

[6] WA Government State Budget 2023

Average Annual Movement	%
Net Movement in 2022%	1.80%
Net Movement (Average %) - 2017-2022	1.69%
Net Movement (Average %) - 2017-19	2.23%

Figure 6.11 B2 Historical and forecast closing connections.



	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Connections															
Opening	10,364	10,885	11,344	11,649	11,828	12,120	12,139	12,318	12,540	12,778	13,021	13,268	13,521	13,777	14,039
Gross New	534	517	373	335	277	220	197	212	230	234	238	243	247	252	257
Disconnections/Reconnections	-13	-58	-68	-156	15	-201	-18	10	8	9	9	9	10	10	10
Net Movement	521	459	305	179	292	19	179	222	238	243	247	252	257	262	267
Closing	10,885	11,344	11,649	11,828	12,120	12,139	12,318	12,540	12,778	13,021	13,268	13,521	13,777	14,039	14,306
Average Connections (Forecast)									12,659	12,900	13,145	13,394	13,649	13,908	14,173

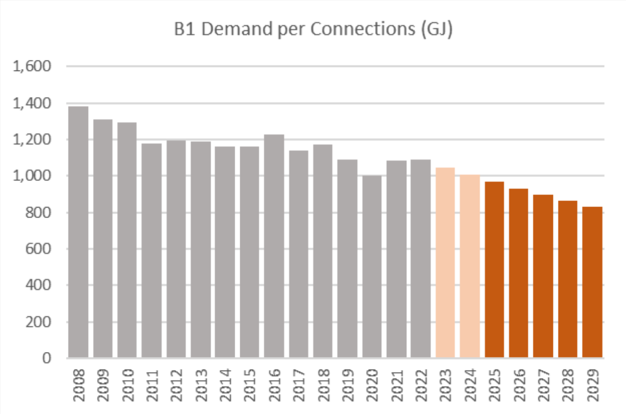
6.3.3. B1 and B2 Demand per Connection Forecast

B1 demand per connection forecast summarised in Figure 6.12 below represents an average annual reduction between 2025 and 2029 of -3.76%.

Key influences on this assessment were:

- the average reduction between 2008 and 2019 of -2.02%. CORE considers that all factors considered, demand per connection is likely to be lower for B1 customers than the 2008 to 2019 period and be more reflective of the reduction between 2017 and 2019 of -3.76%.
- a policy environment which is favouring a reduction in fossil fuels, including gas.
- material gap between electrical heat pump appliance efficiency (higher efficiency for hot water and R-C air conditioning) and gas appliances.
- Price considerations – possible perceptions that gas prices may increase faster than electricity given the observations of movements in eastern Australia.
- an increasing tendency for businesses to promote programs which reduce emission intensity.
- the WA Government budget projected fall in annual GSP growth from a recent actual growth rate 3.75% in 2020-21 to 2023 to 2024 and 2025 which could impact business energy use behaviour. This reduced level of growth is considered by CORE to be more likely to give rise to a reduction in annual demand per connection than an increase in annual demand per connection.

Figure 6.12 B1 Historical and forecast demand per connection.



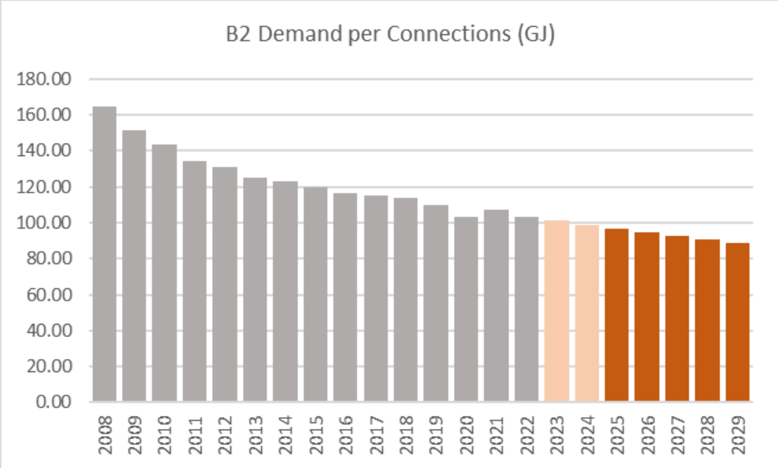
Demand per Connection	2023	2024	2025	2026	2027	2028	2029
Normalised (GJ)	1,047	1,008	970	933	898	864	832

B2 demand per connection forecast summarised in Figure 6.13 below represents an average annual reduction between 2025 and 2029 of -2.16%. The B2 CAGR in normalised demand per connection has been slowing from highs in 2009 and 2010 of -7.66% and -6.64% respectively to -3.62% in 2019 and -3.26% in 2022. The AA6 projections continue this slowing/flattening of the reduction in demand per connection whereby 2029 CAGR is -2.89%,

Key influences on this assessment are consistent with factors considered for B1:

- the average reduction between 2008 and 2019 of -3.60%. CORE considers that all factors considered, demand per connection for B2 customers is likely to be slightly higher than the average of the 2008 to 2019 period.
- a policy environment which is favouring a reduction in fossil fuels, including gas
- material gap between electrical heat pump appliance efficiency (higher efficiency for hot water and R-C air conditioning) and gas appliances
- Price considerations – possible perceptions that gas prices may increase faster than electricity given the observations of movements in eastern Australia.
- an increasing tendency for businesses to promote programs which reduce emission intensity.
- the WA Government budget projected fall in annual GSP growth from a recent actual growth rate of 3.75% in 2023 and is forecast to fall to 2.0 % in 2024 and 2025 which could impact business energy use behaviour. This reduced level of growth is considered by CORE to be more likely to give rise to a reduction in annual demand per connection than an increase in annual demand per connection.

Figure 6.13 B2 Historical and forecast demand per connection.



B2	2022	2023	2024	2025	2026	2027	2028	2029
Normalised	103.42	101.18	99.00	96.85	94.76	92.71	90.70	88.74

7. Tariff A1 and A2 Demand and Connections - History and Forecast

7.1. Historical Demand

7.1.1. A1 Tariff Class

The MWSWGDS includes larger industrial customers (A1) that are reasonably anticipated to consume more than 35,000GJ per annum. In the Greater Perth region this typically includes manufacturing operations, construction, chemicals, or minerals processing and gas fuel transport operations. These customers generally require gas for process heat.

Smaller A1 customers are more likely to consume gas for large-scale space heating and water heating including shopping centres, hotels, hospitals and other large public buildings.

For the A1 customer group, CORE has forecast annual consumption volumes (ACQ) and capacity (measured by GJ of MHQ).

The following figure summarises the trend in A1 demand between 2008 and 2022 calendar years. In general terms A1 customer demand in aggregate exhibited a downward trend between 2009 and 2017, due primarily to a net decline in manufacturing activity, increased energy efficiency and change in energy intensity of economic activity.

Whilst this trend appears to have changed from 2017, more detailed analysis highlights that a downward trend continued for most sectors and customers, with these declines offset by a few major customers in the mining and mineral processing sectors.

Figure 7.1 A1 actual ACQ demand (GJ)

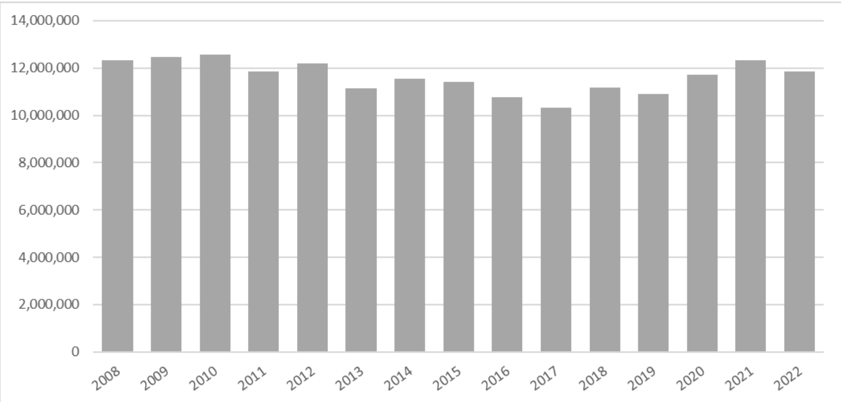
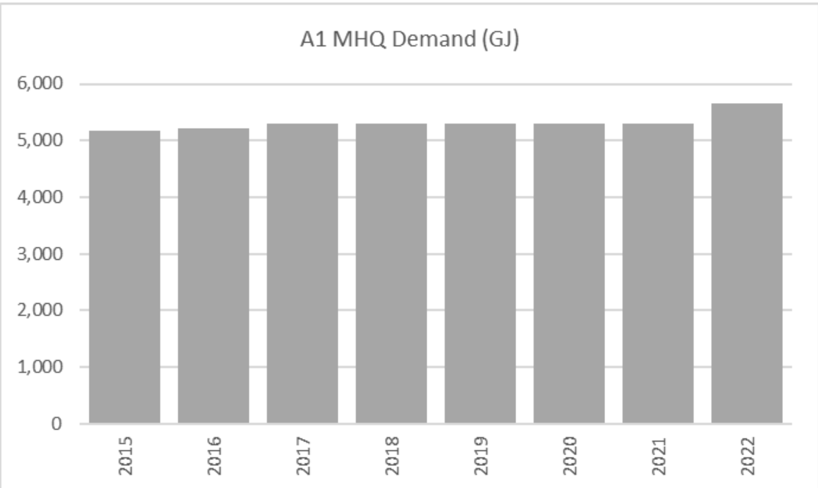


Figure 7.2 A1 actual MHQ demand (GJ) ensure consistency between use and contract levels.

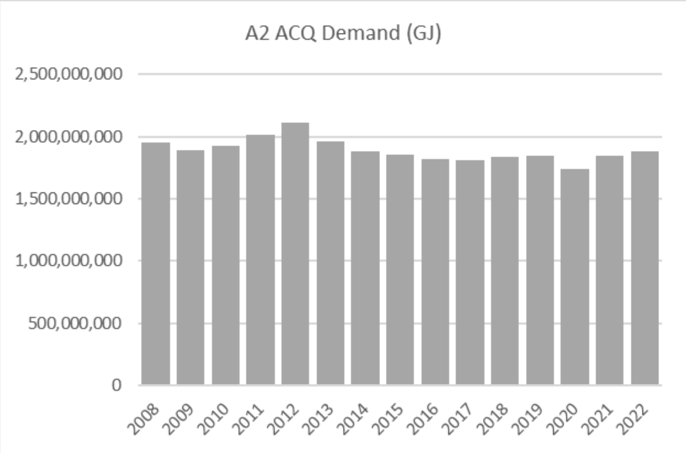


7.1.2. A2 Tariff Class

For the smaller A2 customer group, CORE has forecast annual consumption volumes (ACQ) but not MHQ given that A2 tariffs do not include an MHQ component. Historical ACQ is presented below.

The following figure summarises a moderate decline in demand between 20012 and 2019, with the following years impacted by COVID and post COVID response periods.

Figure 7.3 A2 actual ACQ demand (GJ)



7.2. Forecast Demand

Two broad approaches were used to forecast A1 ACQ and MHQ and A2 ACQ:

- The first involved the completion and analysis of induvial customer surveys.
- The second, for non-survey customers, involved an analysis of historical trends, at both for customers and industry segment levels.

The following table summarise the use of these two approaches.

Survey Type	Description	A1 Forecast	A2 Forecast	Combined
Surveyed customers	MHQ and ACQ forecast based on individual customer surveys	42% No. 67% Volume	48% No. 44% Volume	64% Volume
Average Trend Customers	For customers who were not surveyed ACQ was forecast according to observed historical trend consideration of others factors as set out below	58% No. 34% Volume	52% No. 56% Volume	36%

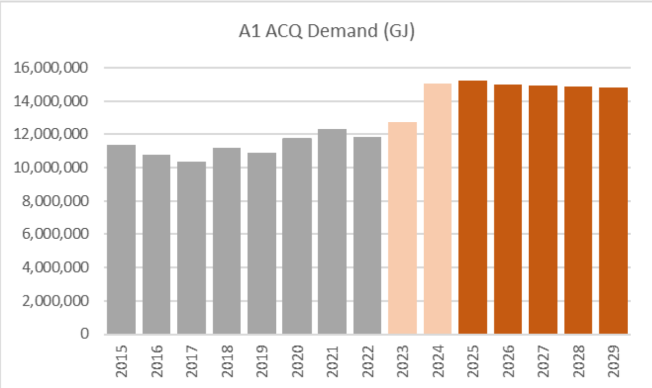
7.2.1. A1 Demand Forecast

A1 ACQ and MHQ are forecast to increase in 2023-25 but falling beyond the 2025 period. This is largely influenced by specific survey responses from 3 large customers and the forecast trend for 1 non-survey customer and closure of 1 non-survey customer.

CORE's forecast has relied upon:

- the 42% of survey responses by no. and 66% by volume, which include customer forecasts of both ACQ and MHQ for 2025 to 2029
- 58% of customers by no. and 34% by volume, not surveyed - analysis of historical trend in demand per connection (given connections are forecast to remain constant), to derive a forecast of -0.93% on average between 2025 to 2029.
- MHQ forecast for 58% of customers not surveyed - analysis of historical relationship between ACQ and MHQ which resulted in application of a factor of 0.0048% against forecast ACQ to derive forecast MHQ.

Figure 7.4 A1 ACQ demand (GJ)



Demand ACQ	2023	2024	2025	2026	2027	2028	2029
Surveyed ACQ & known changes forecast (TJ)	10,121,576	8,942,606	8,762,153	8,360,098	8,382,694	8,362,776	8,364,076
Surveyed ACQ Forecast (GJ)	10,121,576,000	8,942,606,000	8,762,153,000	8,360,098,000	8,382,694,000	8,362,776,000	8,364,076,000
Other known changes advised by AGA	-2,437,800,000	1,098,800,000	1,498,800,000	1,698,800,000	1,698,800,000	1,698,800,000	1,698,800,000
Total Surveyed and Known (GJ)	**7,683,776,000**	**10,041,406,000**	**10,260,953,000**	**10,058,898,000**	**10,081,494,000**	**10,061,576,000**	**10,062,876,000**
Remaining ACQ/ Forecast (GJ)	**5,053,375,532**	**5,006,406,967**	**4,959,874,950**	**4,913,775,425**	**4,868,104,372**	**4,822,857,808**	**4,778,031,788**
Remaining Customer Net Movement	-47,409,210	-46,968,565	-46,532,016	-46,099,525	-45,671,053	-45,246,564	-44,826,020
Remaining ACQ Customer Forecast growth rate	-0.93%	-0.93%	-0.93%	-0.93%	-0.93%	-0.93%	-0.93%
Total ACQ Forecast	**12,737,151,532**	**15,047,812,967**	**15,220,827,950**	**14,972,673,425**	**14,949,598,372**	**14,884,433,808**	**14,840,907,788**

Figure 7.5 A1 MHQ demand (GJ)

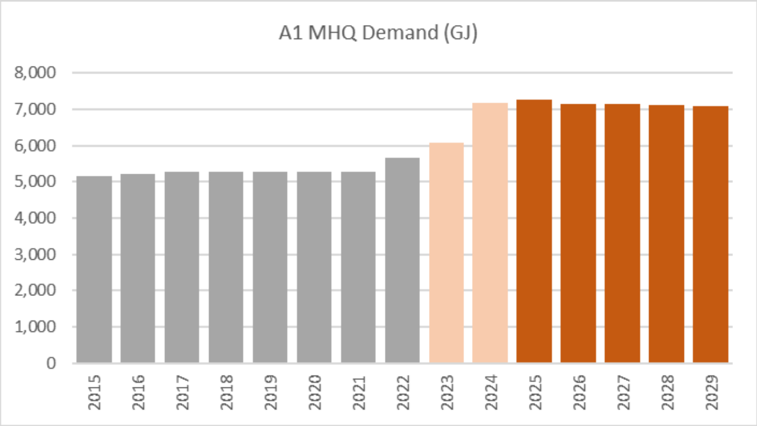


Figure 7.6 A1 Connections

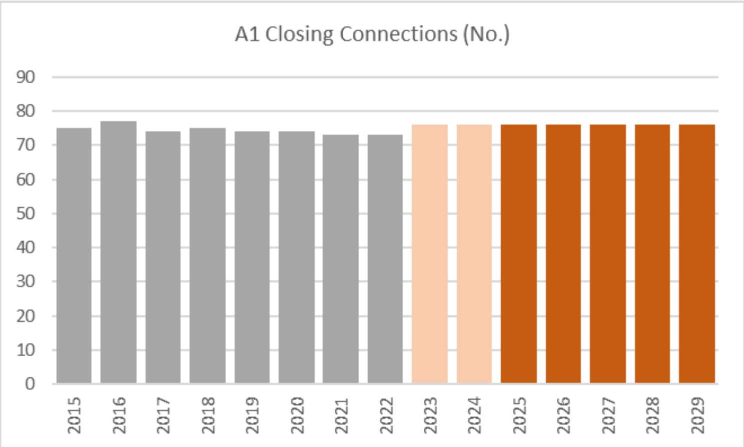
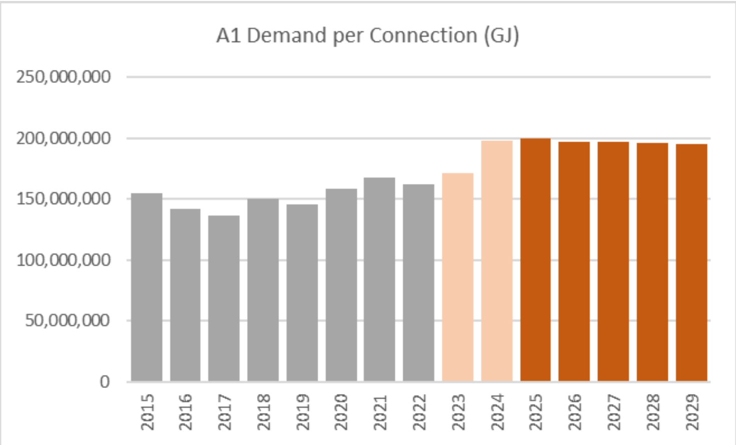


Figure 7.7 A1 Demand per Connection



7.2.2. A2 Demand Forecast

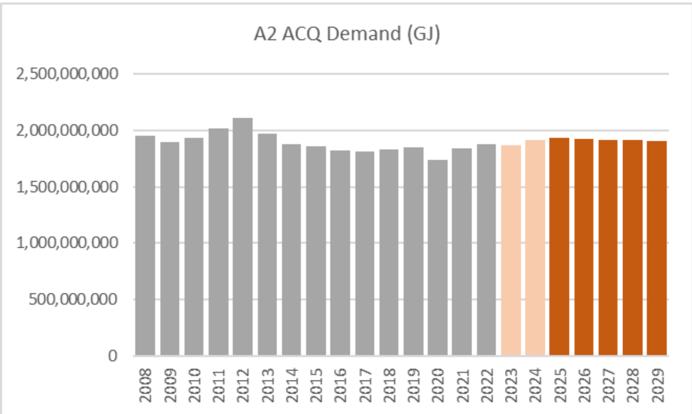
A2 ACQ is forecast to follow a relatively consistent trend from 2023 to 2029.

CORE's forecast has relied upon:

- the 48% of survey responses by No. which include ACQ forecasts for 2025 to 2029 .
- 52% of customers by No. not surveyed - analysis of historical trend in demand per connection (given connections are forecast to remain constant), to derive a forecast of -1.12% on average between 2025 to 2029, based on the average actual annual movement between 2008 and 2019 as presented below.

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Demand per Connection												
ACQ	19,717,907	19,009,604	19,108,416	18,626,382	19,010,240	18,196,003	17,413,919	17,408,719	17,842,389	18,327,813	17,985,974	17,359,072
Movement		-708,303	98,812	-482,034	383,859	-814,238	-782,084	-5,199	433,669	485,424	-341,839	-626,903
Movement (%)		-3.59%	0.52%	-2.52%	2.06%	-4.28%	-4.30%	-0.03%	2.49%	2.72%	-1.87%	-3.49%
Movement - % 2008-2019												-1.12%

Figure 7.8 A2 ACQ Demand (GJ)



Demand ACQ	2023	2024	2025	2026	2027	2028	2029
Surveyed ACQ Forecast (TJ)	799,238	854,737	887,959	886,204	893,581	900,097	906,558
Surveyed ACQ Forecast (GJ)	799,238,000	854,737,000	887,959,000	886,204,000	893,581,000	900,097,000	906,558,000
Remaining ACQ Forecast (GJ)	1,069,204,566	1,057,264,261	1,045,457,298	1,033,782,189	1,022,237,462	1,010,821,660	999,533,343
Remaining Customer Net Movement	-12,075,155	-11,940,306	-11,806,963	-11,675,109	-11,544,727	-11,415,802	-11,288,317
Remaining ACQ Customer Forecast growth rate	-1.12%	-1.12%	-1.12%	-1.12%	-1.12%	-1.12%	-1.12%
Total ACQ Forecast	**1,868,442,566**	**1,912,001,261**	**1,933,416,298**	**1,919,986,189**	**1,915,818,462**	**1,910,918,660**	**1,906,091,343**

Figure 7.9 A2 Connections

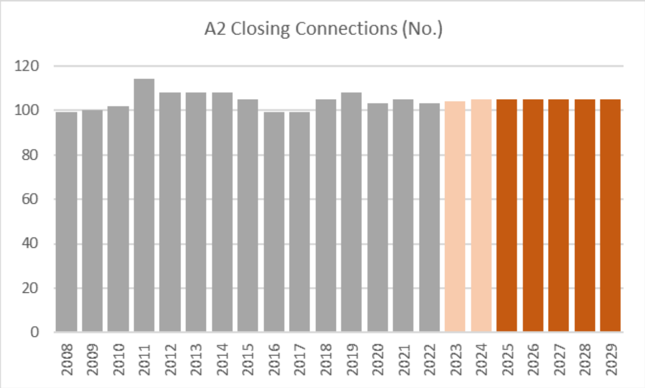
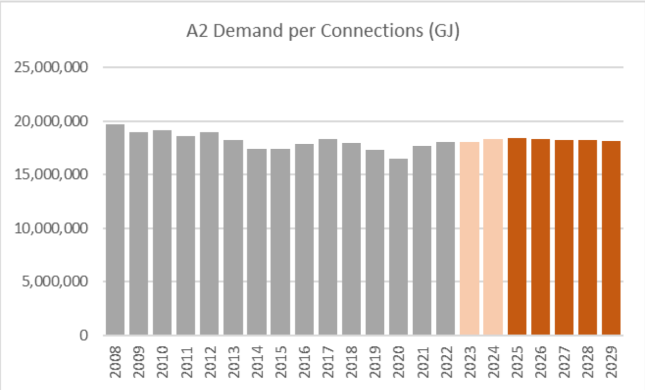


Figure 7.10 A2 Demand per Connection



8. Ancillary Services Forecast

1. Introduction

CORE has considered alternative approaches to developing a forecast of each Ancillary service. Having regard to the fact that most of each service relate to the B3 Tariff class (>95%), CORE considers that the best approach is to analyse the historical relationship between services and B3 connections and to apply an appropriate factor against forecast B3 connections, to arrive at forecasts of each ancillary service. More specifically, CORE has focused on the average rate between 2015 and 2019 to assess the expected average rate of growth, excluding impact of COVID period and first recovery year 2022.

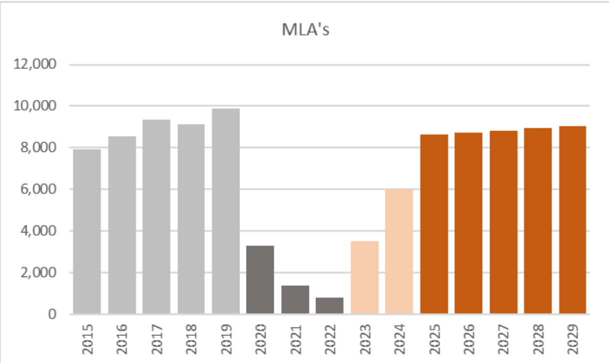
Due to the significant impact of COVID on certain ancillary services (such as MLA's, MLR's and Deregistrations), and uncertainty relating to the timing of future recovery/growth, CORE has consulted with AGA management to discuss scenarios before arriving at an appropriate forecast.

2. Meter Lock Applications (MLA's)

The CORE forecast of MLA's has been derived by applying a factor which represents the % of B3 opening connections which are expected to result in future MLA's.

CORE considers that the best estimate of future MLA's is an increasing trajectory between 2023-24, which recovers from COVID, toward an average rate of 1.10%, being the rate assessed by CORE having regard to the average rate between 2015 and 2019, as summarised below and changing market circumstances.

Figure 8.1 Historical and Forecast MLA's



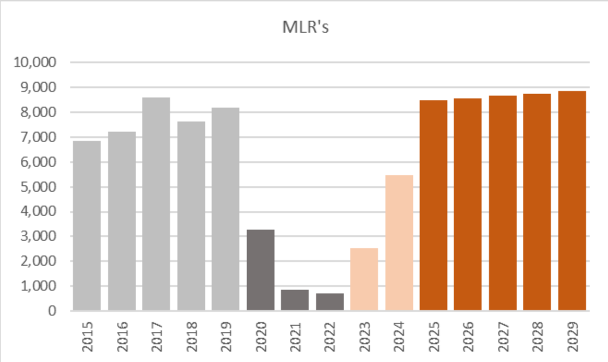
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
B3 Connections															
Closing	697,831	713,194	724,627	732,627	741,437	746,639	756,154	767,161	776,126	782,880	790,060	798,526	807,905	817,732	827,739
Average	686,911	705,513	718,911	728,627	737,032	744,038	751,397	761,658	771,643	779,503	786,470	794,293	803,215	812,819	822,736
Meter Lock Application (MLA)															
Actual	7,923	8,549	9,364	9,109	9,906	3,305	1,367	813							
Average		8,236	8,957	9,237	9,508	6,606	2,336	1,090							
CORE Forecast									3,510	6,024	8,651	8,737	8,835	8,941	9,050
% Average B3		1.17%	1.25%	1.27%	1.29%	0.89%	0.31%	0.14%	0.45%	0.77%	1.10%	1.10%	1.10%	1.10%	1.10%

3. Meter Lock Removals (MLR's)

The CORE forecast of MLR's has been derived by applying a factor which represents the % of B3 opening connections which are expected to result in future MLR's.

CORE considers that the best estimate of future MLR's is an increasing trajectory, which recovers from COVID between 2023-24, toward an average rate of 1.07%, being the average rate between 2015 and 2019, as summarised below.

Figure 8.2 Historical and Forecast MLR's



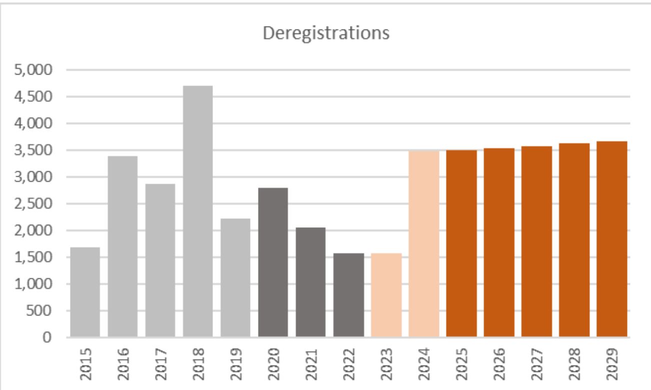
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
B3 Connections															
Closing	697,831	713,194	724,627	732,627	741,437	746,639	756,154	767,161	776,126	782,880	790,060	798,526	807,905	817,732	827,739
Average	686,911	705,513	718,911	728,627	737,032	744,038	751,397	761,658	771,643	779,503	786,470	794,293	803,215	812,819	822,736
Meter Lock Removal (MLR)															
Actual	6,839	7,205	8,578	7,613	8,158	3,263	872	720							
Average		7,022	7,892	8,096	7,886	5,711	2,068	796							
CORE Forecast									2,520	5,457	8,454	8,544	8,645	8,750	8,857
% Average B3		1.00%	1.10%	1.11%	1.07%	0.77%	0.28%	0.09%	0.32%	0.70%	1.07%	1.07%	1.07%	1.07%	1.07%

4. Deregistrations

The CORE forecast of Deregistrations has been derived by applying a factor which represents the % of B3 connections which are expected to result in future Deregistrations.

CORE considers that the best estimate of future Deregistrations is an increasing trajectory, which recovers from COVID, toward an average rate of 0.446%, being the average rate between 2015 and 2019, as summarised below.

Figure 8.3 Historical and Forecast Deregistrations



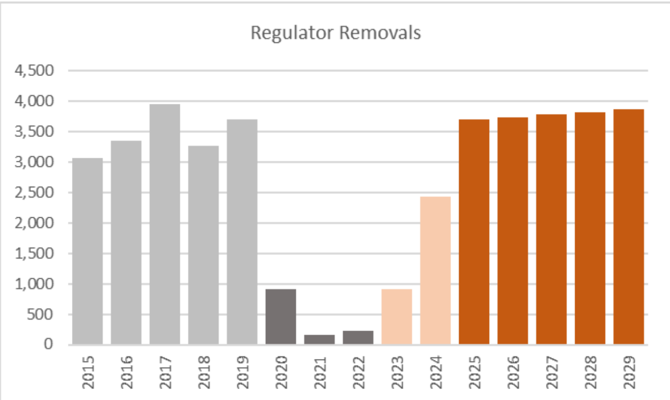
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
B3 Connections															
Closing	697,831	713,194	724,627	732,627	741,437	746,639	756,154	767,161	776,126	782,880	790,060	798,526	807,905	817,732	827,739
Average	686,911	705,513	718,911	728,627	737,032	744,038	751,397	761,658	771,643	779,503	786,470	794,293	803,215	812,819	822,736
Deregistrations															
Actual	1,689	3,388	2,872	4,704	2,222	2,802	2,048	1,570							
Average		2,539	3,130	3,788	3,463	2,512	2,425	1,809							
CORE Forecast									1,575	3,477	3,508	3,543	3,582	3,625	3,669
% Average B3		0.360%	0.435%	0.520%	0.470%	0.338%	0.323%	0.238%	0.204%	0.446%	0.446%	0.446%	0.446%	0.446%	0.446%

5. Regulator Removals

The CORE forecast of Regulator Removals has been derived by applying a factor which represents the % of B3 connections which are expected to result in future Regulator Removals.

CORE considers that the best estimate of future Regulator Removals is an increasing trajectory between 2023-24, which recovers from COVID, toward an average rate of 0.47%, being the average rate between 2015 and 2019, as summarised below.

Figure 8.4 Historical and Forecast Regulator Removals



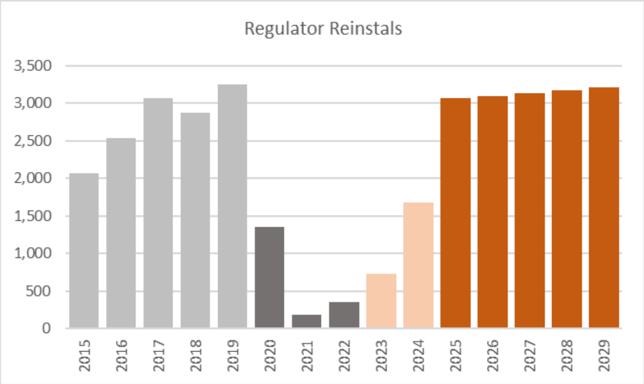
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
B3 Connections															
Closing	697,831	713,194	724,627	732,627	741,437	746,639	756,154	767,161	776,126	782,880	790,060	798,526	807,905	817,732	827,739
Average	686,911	705,513	718,911	728,627	737,032	744,038	751,397	761,658	771,643	779,503	786,470	794,293	803,215	812,819	822,736
Regulator Removals															
Actual	3,063	3,344	3,949	3,267	3,695	911	163	219							
Average		3,204	3,647	3,608	3,481	2,303	537	191							
CORE Forecast									910	2,423	3,696	3,733	3,775	3,820	3,867
% Average B3		0.45%	0.51%	0.50%	0.47%	0.31%	0.07%	0.03%	0.12%	0.31%	0.47%	0.47%	0.47%	0.47%	0.47%

6. Regulator Reinstallations

The CORE forecast of Regulator Reinstals has been derived by applying a factor which represents the % of B3 connections which are expected to result in future Regulator Reinstals.

CORE considers that the best estimate of future Regulator Reinstals is an increasing trajectory between 2023-24, which recovers from COVID, toward an average rate of 0.39%, being the average rate between 2015 and 2019, as summarised below.

Figure 8.5 Historical and Forecast Regulator Reinstals



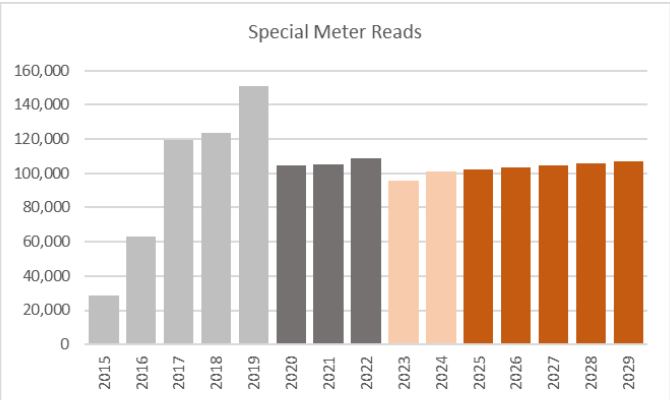
Regulator Reinstals															
Actual	2,074	2,535	3,074	2,870	3,255	1,357	182	357							
Average		2,305	2,805	2,972	3,063	2,306	770	357							
CORE Forecast									730	1,678	3,067	3,098	3,133	3,170	3,209
% Average B3		0.33%	0.39%	0.41%	0.42%	0.31%	0.10%	0.05%	0.09%	0.22%	0.39%	0.39%	0.39%	0.39%	0.39%

7. Special Reads

The CORE forecast of Special Reads has been derived by applying a factor which represents the % of B3 connections which are expected to result in future Special Meter Reads.

CORE considers that the best estimate of future Special Reads is an increasing trajectory between 2023-24, which recovers from COVID, toward an average rate of 13%, being the average rate between 2017 and 2019 (removing initial year which was immature), as summarised below, adjusted to address changes in market circumstance.

Figure 8.6 Historical and Forecast Special Meter Reads



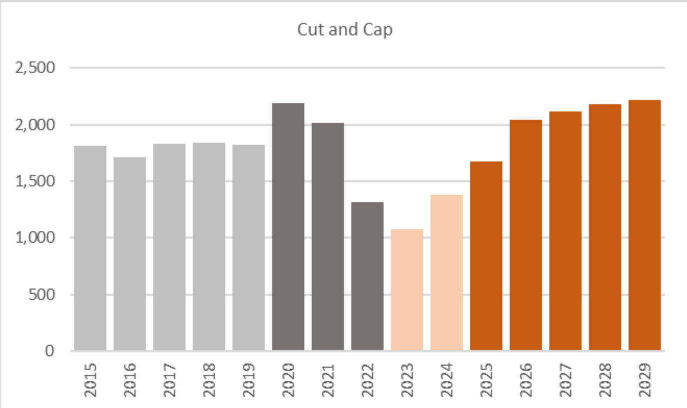
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
B3 Connections															
Closing	697,831	713,194	724,627	732,627	741,437	746,639	756,154	767,161	776,126	782,880	790,060	798,526	807,905	817,732	827,739
Average	686,911	705,513	718,911	728,627	737,032	744,038	751,397	761,658	771,643	779,503	786,470	794,293	803,215	812,819	822,736
Special Meter Reads															
Actual	28,772	63,077	119,622	123,645	151,050	104,837	105,295	108,797							
Average		45,925	91,350	121,634	137,348	127,944	105,066	107,046							
CORE Forecast									95,544	101,335	102,241	103,258	104,418	105,666	106,956
% Average B3		6.51%	12.71%	16.69%	18.64%	17.20%	13.98%	14.05%	12.38%	13.00%	13.00%	13.00%	13.00%	13.00%	13.00%

8. Cut and Cap

The CORE forecast of Cut and Cap has been derived by applying a factor which represents the % of B3 connections which are expected to result in future Cut and Cap services.

CORE considers that the best estimate of future Cut and Cap is an increasing trajectory, which recovers from COVID, toward an average rate of 0.248%, being the average rate between 2015 and 2019 as summarised below and adjusted for assessed changes in market circumstances.

Figure 8.7 Historical and forecast Cut and Cap



	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
B3 Connections															
Closing	697,831	713,194	724,627	732,627	741,437	746,639	756,154	767,161	776,126	782,880	790,060	798,526	807,905	817,732	827,739
Average	686,911	705,513	718,911	728,627	737,032	744,038	751,397	761,658	771,643	779,503	786,470	794,293	803,215	812,819	822,736
Cut and Cap															
Actual	1,813	1,711	1,832	1,841	1,825	2,191	2,010	1312							
Average		1,762	1,771	1,837	1,833	2,008	2,100	1,661							
CORE Forecast									1,078	1,379	1,671	2,047	2,120	2,180	2,217
% Average B3		0.240%	0.253%	0.251%	0.246%	0.293%	0.266%	0.171%	0.140%	0.177%	0.212%	0.258%	0.264%	0.268%	0.269%

References

- ABS, 4602.0.55.001 – Environmental Issues: Energy Use and Conservation;
- ABS, 5220.0 Australian National Accounts; State Accounts;
- ABS, Greater Perth GCCSA;
- ABS, 5609.0 Housing Finance;
- ABS, 3218.0 Regional Population Growth;
- ABS, 8731.0 Building Approvals
- ABS, 2071.0 Census of Population and Housing: Reflecting Australia;
- AEMO, 2012 Weather Standards for Gas Forecasting;
- AEMO, Gas Statement of Opportunities
- AEMO, Forecasting Methodology Information Paper; Dec 2014
- AEMO, Forecasting Methodology Information Paper, National Electricity Forecasting Report 2014; Jul 2014
- AEMC, WA Residential Electricity Price Trends
- AEMO, Western Australian Functions;
- AGA, Volumes and Connection History
- AGA, Forecast Tariffs
- AER, Access Arrangements
- Australian Building Codes Board, releases
- BIS Shrapnel, Australian Housing Outlook
- BOM, Perth Airport Weather Station Data
- NABERS, NABERS for Apartment Buildings
- NatHERS, Nationwide House Energy Rating Scheme (NatHERS)
- COAG Energy Council, National Energy Productivity Plan 2015-2030
- Department of Industry, Impacts of the E3 program: Projected energy, cost and emission savings
- EECCA, Schemes – Western Australia
- ERAWA, Switched On: Energy Consumers Guide; Accessed 2018
- Fielding, K. et al. (Australian Housing and Urban Research Institute), Environmental Sustainability: understanding the attitudes and behaviour of Australian households; Oct 2010
- Government of Western Australia Housing Authority, Strategic Plan
- HIA, Housing Forecasts
- IEA, National Strategy on Energy Efficiency (NSEE)

- IEA, National Energy Productivity Plan
- JACOBS, Projections of uptake of small-scale systems
- Office of the Chief Economist, End-use Energy Intensity in Australia
- Synergy, Our Energy – They sound tiny but micro-grids could be the next big thing in Australia
- Synergy, Electricity Pricing Charges
- WA Government, HIFG Forecast Dwelling Commencements in Western Australia;
- WA State Government, State Budget
- WA Government, WA Tomorrow
- Western Power, Network Access Price List

A1. Terms of Reference

Scope and Context

CORE has been engaged to deliver a gas demand forecast for MWSWGDS AA6 pursuant to the terms contained herein. The forecast addresses the level of demand arising from the B3, B1&2 and A1&2, tariff classes as well as forecasting customer numbers. The methodology reviews the leading approaches to forecasting demonstrated by previous AAs and other experts in the field. The opinions formed are based entirely on quality statistical analysis, economic theory, and industry experience. The analysis forecasts the customer numbers and total demand for each connection type, within each sector and under each tariff class. The approach is quantitative whenever appropriate although qualitative analysis will also be required to justify the methodology and results of the forecast. The context of the forecast and report is that of an independent expert. Accordingly, the methodology and output are a best-practice approach that complies with the *NGRs*.

Relevant Considerations

Consideration and analysis of elements listed below. The relevant time frame for the forecast includes the period leading up to the Review Period as well as all years contained within the period.

- Annual gas demand for new and existing users within the MWSWGDS distribution network.
- Quantity and capacity-based demand for industrial users within the network.
- The historical trends in gas demand and customer numbers. The relevance of these trends should also be examined.
- The various drivers and variables that create movements in average gas usage.
- The suitability and reliability of each statistical method used for the forecast.
- Appliance trends and policies driving appliance efficiency changes.
- Macroeconomic analysis such as population growth, GSP.

Output

The following deliverables:

- EDD Model
- Weather normalisation model
- Demand model
- Report

Upon completion of the ERA Report, all results, forecasts, and assumptions are clearly set out. All methodology is revealed and explained. The findings are adequately justified and compliance with the *NGRs* is shown.

A2. WA Energy and Gas Use Trends

The following paragraphs provide additional details relating to factors that continue to drive demand per connection. Data available for these factors is not suitable to quantify each factor individually; however, the combined effect is considered in arriving at the historical annual average growth rates. The qualitative and quantitative evidence for these factors is presented below and supports why CORE considers it likely for the combined effect of these factors to maintain these trends experienced since 2008.

Western Australia Energy Use Trends

The most significant uses of gas for Australian households are space heating, water heating and cooking.

Data released by the ABS and other third-party sources shows that gas appliances are being substituted for electricity and solar energy in space heating and water heating.[7]

As previously noted, the trends between 2008 and 2015 and post 2015 vary materially in several areas, therefore CORE has analysed data within these two periods.

2008-15

Gas Substitution in Room/Space Heating

Gas room heating is the highest of the main areas of gas use – Room/Space heating, water heating and cooking appliances.

The table below illustrates the significant increase in the number of Western Australian households that used electricity for their heating purposes. Between the years 2011 and 2014, the market share of electricity for space heating increased by 2.5%. The market share for gas heating appliances fell by 7.1% over the same period. This is likely due to the increase in R-C air-conditioning use for heating purposes. Among several forces, consumers are favouring the convenience of a single appliance that has two functions, cooling and heating.

Figure 8.8 Western Australian Energy Use | % of Households 2008 to 2014

Energy Use	2008	2011	2014
Electricity main source for heating	30.0	35.9	38.4
Gas main source for heating	35.1	36.0	28.9

Source ABS, 2008, 2011, 2014

A study titled 'Are We Still Cooking with Gas?' conducted by the Alternative Technology Association ("ATA") and supported by the energy market's Consumer Advocacy Panel found that houses already connected to the gas network could steadily withdraw from using gas for space heating in favour of using reverse cycle air conditioners, on economic grounds.

Appliance Efficiency

A further factor influencing gas use is the efficiency of the room heating appliance. For example, analysis shows that space gas heating appliance efficiency can improve by 20% by moving from 4 start to 6 star rating.

[7] ABS, *4602.0.55.001 - Environmental Issues: Energy Use and Conservation*.

Dwelling energy efficiency

A further influence on gas room heating is the thermal efficiency of dwellings. The use of insulation and more efficient buildings through initiatives such as double glazing, reduce the level of heating activity and thus use of gas. The number of WA homes with insulation increased from 69% to 75% from 2008 to 2014. A continuation of this insulation trend is expected to reduce gas space heating requirements of households.

2015-2022

Gas Substitution

The National Construction Code (NCC) has introduced a seven-star rating for dwellings, effective beyond 2023. As gas heating appliances do not have a seven-star series available, gas heating will need to combine with solar facilities to meet the requirement.

The above requirement is expected to cause certain developers and customers to favour all electricity, or all electric room/space heating, due to economic impact of this change in requirement.

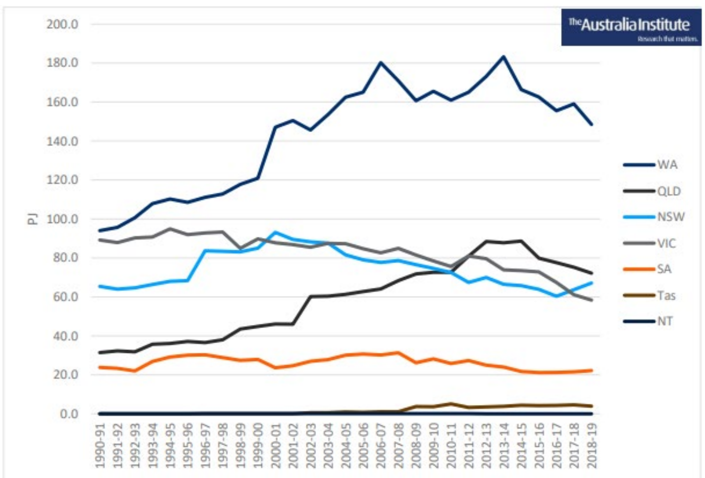
Appliance Efficiency

As referenced above, a trend toward higher rating gas appliances is expected to result in a lower use of gas as:

- new dwellings are connected with high rating appliances.
- existing dwelling appliances are replaced with higher rating appliances (approximately every 12-15 years).
- Renovations cause certain appliances to be replaced early.

Continuing reduction in Manufacturing gas consumption

Use of gas by manufacturing activities has fallen materially since 2015, return to near 2002 levels as illustrated below.



Source: Department of Industry, Science, Energy and Resources (2019) *Australian Energy Update 2020,* Table F, https://www.energy.gov.au/publications/australian-petroleum-statistics-2020

A3. WA Energy Policy

CORE is not aware of any specific, quantified targets for reduction in gas use, under WA Government policy, as has been defined in other jurisdictions such as Victoria. Therefore, CORE has summarised broad statements made by the WA Government, related agencies or regulatory bodies.

WA Climate Policy :

- **Net zero greenhouse gas emissions by 2050** - The policy underscores commitment to adapting to climate change and to working with all sectors of the economy to achieve the target.
- **Government Leadership** - Requiring the development of net zero emissions transition plans for government agencies and government trading enterprises (GTEs).
- **Distributed Energy Resources Roadmap** - which targets enhanced integration of Solar PV and battery storage.
- **Household Energy Efficiency Scheme** - Aids households, including those in energy retailer hardship programs, to enhance energy efficiency and reduce energy costs.
- **Green industry transformation** - Identify the policy, regulatory and infrastructure requirements to unlock the transformational potential of large-scale, low-cost renewable energy projects and stimulate new energy-intensive and clean manufacturing industries.
- **Distributed Energy Buyback Scheme** - introduces payments for energy exported to the grid from eligible home batteries and electric vehicles to support their uptake which could favour electricity over future gas use
- **Support microgrids** which will reduce gas use within network areas – Horizon energy is active in this area
- **Net zero industrial estates** - Through Development WA's Industrial Lands Authority, plan, design and deliver industry land and infrastructure, including Technology Precincts, to support those industry estates move towards net zero emissions by 2050.
- School Virtual Power Plants