ACIL ALLEN

Review of Jemena Gas Network's demand forecasts

Review of JGN demand forecasts for the Australian Energy Regulator (AER)

8 November 2024

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1 Introduction

On 29 June 2024, Jemena Gas Networks (NSW) Ltd (JGN) submitted its access arrangement proposal to the AER for the period 1 July 2025 to 30 June 2030, which was informed by a set of detailed demand and customer number forecasts for the JGN gas distribution network produced by CORE Energy and Resources.

ACIL Allen have been commissioned by the Australian Energy Regulator to review JGN's gas demand and customer number forecasts for the 2025-30 Access Arrangement period. Specifically, we have been asked to provide advice and comment on:

— The reasonableness of JGN's modelling of gas disconnection rates and new connection rates on its network (in the residential and commercial sections of its network), and whether it has taken into account all relevant information and made reasonable assumptions around the rate of disconnections and new connections.

— The reasonableness of JGN's adjustments to gas usage per customer (in the residential and commercial sections of its network), and whether JGN has considered relevant information and made reasonable assumptions when adjusting this figure from the historically observed rate.

— ACIL Allen has also been asked to provide advice on alternative inputs and assumptions in the demand forecast where ACIL Allen has considered JGN's underlying assumptions and inputs to be unreasonable.

This report is set out as follows:

— Section 2 reviews CORE Energy's methodology and approach to forecasting JGN's gas demand and customer numbers over the next Access Arrangement period.

— Section 3 presents a revised set of gas demand and customer number forecasts after incorporating alternative assumptions and inputs based on the review of CORE's methodology in Section 2.

2 Review of CORE Energy methodology and approach

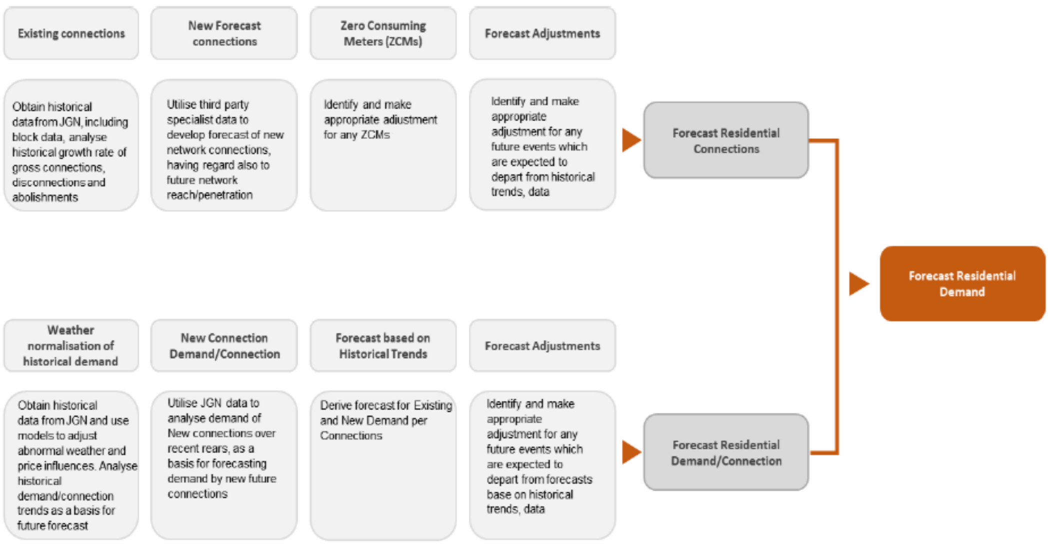
This section describes and reviews the methodology and approach adopted by CORE Energy and Resources in forecasting residential and small business gas demand and customer numbers for JGN.

2.1 Residential demand and customer numbers

Overview

CORE approaches the problem of recasting residential demand by separately modelling the average demand per connection and the number of residential connections. The product of the two sets of forecasts gives the total residential demand. **Figure 2.1** below from CORE's report[1] dated 17 April 2024 shows the separate components involved in the forecasting methodology.

Figure 2.1 Overview of residential demand forecasting methodology



Source: CORE Energy and Resources

[1] CORE Energy, Jemena Gas Networks (NSW) Gas Access Arrangement, July 2025 to 30 June 2030, 17 April 2024.

2.2 Residential demand and customer numbers

Demand per connection

The demand per connection is calculated by dividing the total residential gas usage in a given financial year by the average number of residential customers in the same financial year. The average number of customers is calculated as the average of the opening and closing customer numbers in that period. Total connections are driven by new connections to the network and disconnections from the network.

CORE apply an annual rate of decline in residential demand per connection that is based on historical data. The base rate of decline is 0.82% per annum. This is the annualised rate of decline from 2010 to 2019, excluding the post Covid years. ACIL Allen calculated the historical annualised growth rates of weather normalised demand per connection over a number of time horizons (see **Table 2.1**). While there is some variation depending on the starting period, the average rate of decline across the various time horizons was -0.82% and -0.81% for periods up to 2023 and periods pre-dating the Covid period respectively. CORE's base rate of decline in residential demand per connection is reasonable and in-line with the averages presented in the table.

Table 2.1 Annualised growth in demand per connection under various time horizons

Years	Average annualised decline to 2023	Average annualised decline to 2019
14	-0.84%	-0.90%
13	-0.62%	-0.58%
12	-0.81%	-0.86%
11	-0.97%	-1.12%
10	-0.76%	-0.79%
9	-0.65%	-0.60%
8	-0.87%	
7	-1.04%	
6	-0.77%	
Average	-0.82%	-0.81%

Source: ACIL Allen based on CORE Energy data

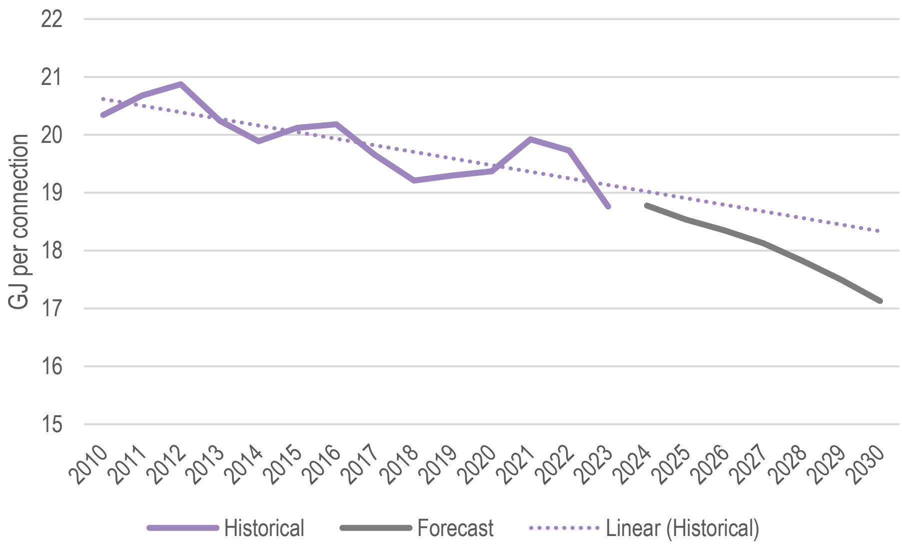
CORE then adjust this base rate decline in their model accordingly:

— In 2025, they leave the base rate unchanged
— In 2026, they increase the base rate of decline by 10%
— In 2027, they increase the base rate of decline by 30%
— In 2028 they increase the base rate of decline by 100%
— In 2029 they increase the base rate of decline by 130%
— In 2030, they increase the base rate of decline by 170%

The CORE model does not contain any internal modelling or analysis where these adjustments to the historical rate of decline are calculated. Instead, they appear in the model as a set of hard-coded factors without any quantitative justification. In our view, this reflects a lack of transparency in the forecasting process and is a serious deficiency in the model. In its report, CORE states that these adjustments were the result of expert judgement and analysis. Unfortunately, ACIL Allen is unable to review the details of this analysis as they have not been made available apart from some high-level description presented in the report.

CORE make several qualitative arguments to justify their adjustment. These have some validity and we do expect this decline to show some degree of acceleration. However, our independent analysis suggests that the rate at which the demand per connection is declining is excessive in the period after 2027. Given the high degree of uncertainty concerning the future behaviour of residential gas customers, ACIL Allen considers that a more conservative approach that weights historical behaviour more highly is prudent. We believe that this especially the case in the last few years of the forecast period, where the adjustment from the base rate of decline is excessive. **Figure 2.2** below shows the historical weather corrected residential demand per connection and CORE's forecast for the period from 2024 to 2030.

Figure 2.2 Residential demand per connection, historical and forecast, GJ per connection



Source: CORE Energy

ACIL Allen presents an alternative set of residential demand per connection forecasts in section 3 of this report.

Number of gross connections

Customer numbers are disaggregated into existing connections, new forecast connections and disconnections from the network in any given year. New connections are a function of the number of dwelling completions and the market penetration rate of those new completions.

Housing completions are derived from HIA's forecasts of NSW dwelling commencements. They are split into multi dwelling developments and detached houses. Commencements are subject to two separate lag factors to capture those commencements that are completed within 12 months and those completed within 12 and 24 months.

CORE's projected penetration rate of new connections is driven by:

— The continuation of a historical trend observed over a 12-year period
— The higher share of projected multi dwelling developments which has a lower penetration rate than detached houses
— An anticipated increase in the full electrification of new dwellings as declared by developers, builders and several inner-city councils.

ACIL Allen considers this approach to new connections to be reasonable.

To project gross connections to the JGN network, CORE used a four-step process. First, CORE relies on a projection of dwelling commencements for NSW provided by the HIA.   According to CORE, these are then cross-checked against population projections from other sources. CORE then applies a two-part lagged adjustment factor to estimate the timing of completions. The first part estimates the number of completions expected within a 12-month period. The second part relates to completions that are expected to take place within 12 and 24 months. ACIL Allen considers this to be a reasonable approach to take in converting dwelling approvals to actual completions.

Figure 2.3 below shows both historical and forecast NSW dwelling commencements. These are split between detached houses and multi-unit developments. Forecast dwelling commencements are projected to be slower over the forecast period from 2024 to 2030 compared to the previous cycle between the trough in 2012 and peak in 2017. NSW dwelling commencements were over 70,000 in 2017. The highest expected peak over the 2025-2030 period is just under 60,000 in 2026.

ACIL Allen compared the HIA projections to the series B populations projections for NSW from the ABS. The ABS has projected a period of slower projected population growth compared to that observed in the pre-Covid period. In our view, the HIA projections are broadly consistent and in line with the ABS's population projections.

Figure 2.3 NSW dwelling commencements, historical and forecast, HIA

Source: HIA

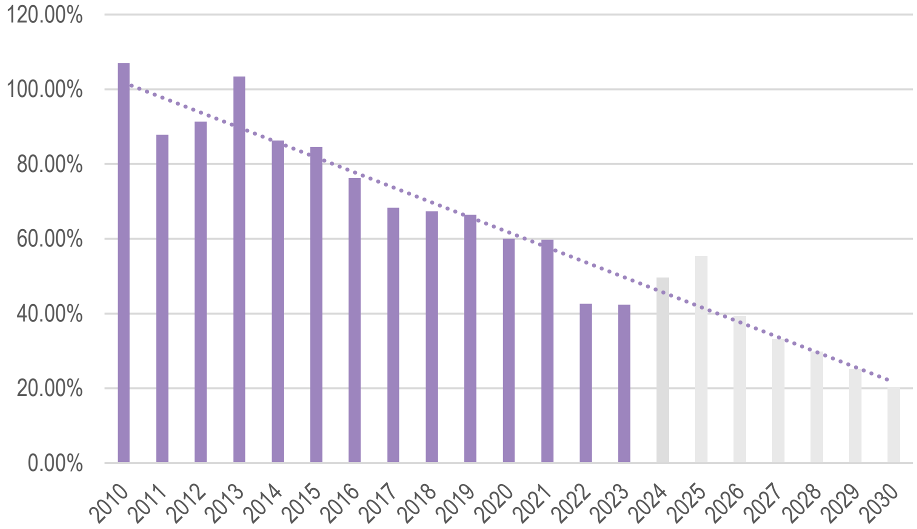
CORE then applies a forecast penetration rate which is defined as the percentage of NSW dwellings which are expected to connect to the JGN network in any given year. **Figure 2.4** shows the market share of new gas connections versus lagged dwelling commencements for both the historical period from 2010 to 2023, and the forecast period from 2024 to 2030. The figure shows that the there is a long run historical trend decline in the market penetration of new dwellings connecting to the JGN network. CORE Energy's forecast of new connections is projected to follow a trajectory that is broadly consistent with the historical trend. This is reasonable in our view, as new dwellings are much more likely to be fully electrified. This is even more likely given the increased share of smaller unit developments relative to detached houses.

There are several reasons for the continued decline in the market share of new dwellings connecting to the gas network:

— It is considerably more economical to fit a new dwelling with new electric appliances from scratch, rather than upgrading existing electric connections in existing dwellings.

- BASIX NSW increasing thermal performance standards of new dwellings will favour fully electric heat pump technologies over gas appliances.
- A greater share of multi developments versus detached houses will require less energy for heating and cooling, and therefore are more suited to electric appliances.

Figure 2.4 Market share of new gas connections versus dwelling commencements (lagged)



Source: CORE Energy

Number of disconnections

CORE's approach to disconnections from the JGN network involves the following steps:

— An estimate of a base rate of disconnections based on the historical number of disconnections as a share of the opening number of residential customers, to derive the disconnection rate.

CORE then adjust the historical disconnection rate in their model, citing the impact of a number of factors:

— The existence of 31,000 zero consuming customers as at June 2023 of which some are expected to disconnect over the next regulatory period.
— The fact that 80,000 JGN residential customers face appliance switching decisions every year at a time when preferences are starting to favour electricity over gas.
— The end of low-cost access to gas in NSW.
— Perceptions by customers that electricity prices will be lower in the mid to longer term.
— A greater understanding of the energy efficiency of heat pump technology over gas.
— Increased consumer 'social conscience' pressures as State and Commonwealth Governments aim to achieve GHG emissions targets.

These adjustments to the historical rate of disconnection appear in the model as a hard-coded set of adjustments. There is no evidence that the impact of these factors has been quantified in any way. If they have, then the calculations have been made outside the model submitted to the AER. Moreover, the rate of disconnection is forecast to increase exponentially.

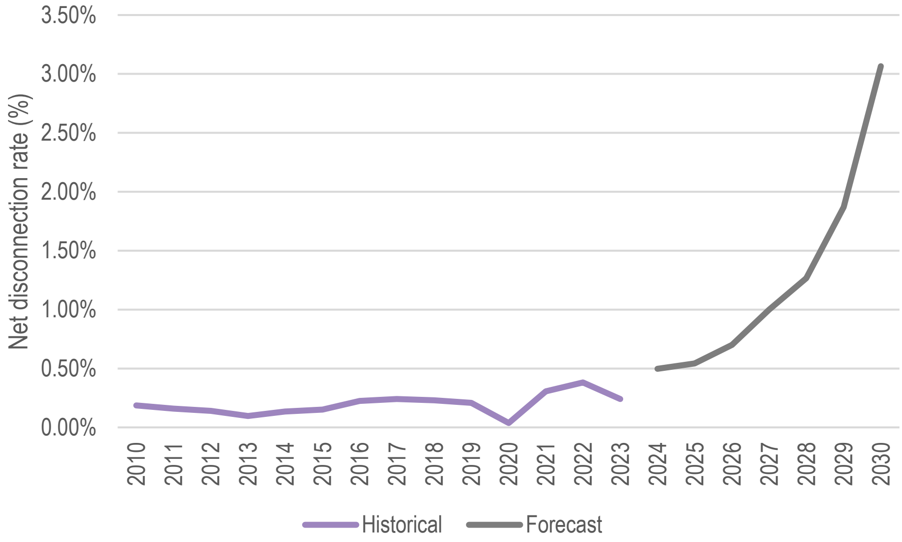
It is our view that CORE should present more evidence to support their disconnection forecasts. For example, market research of JGN's residential customers could have determined their switching intentions over the next seven years. While such stated preference surveys are susceptible to bias, a carefully designed study would be able to minimise this risk. It could also determine the factors that consumers weight most highly when facing the switching decision.

Figure 2.5 shows the net disconnection rate for JGN over the historical period against CORE's forecast net disconnection rate for the forecast period between 2024 and 2030. The net disconnection rate is defined as the number of net disconnections in any given year as a percentage of the opening number of customers. Net disconnections comprise abolishments, disconnections and reconnections. As can be seen in the figure below, the net disconnection rate for residential customers was only 0.24% in 2023. Prior to 2020, it was generally stable. After the onset of Covid, it fell to just 0.04% in 2020 and then increased substantially, peaking at 0.38% in 2022.

Over the forecast period CORE projects the net disconnection rate to more than double to 0.50% in 2025, before increasing to 0.54% in 2026. From 2027 onwards the rate of disconnection is forecast to accelerate exponentially, reaching 3.07% in 2030, a rate more than 10 times the rate observed in 2023.

ACIL Allen considers the rate of disconnection to be excessive and not sufficiently justified based on the evidence put forward by CORE in their report.

Figure 2.5 Net disconnection rate, CORE Energy, Historical and Forecast



Source: ACIL Allen

ACIL Allen considers that the short period of time between 2025 and 2030 makes it unlikely that behaviour will change so dramatically over the period. While we accept that there is likely to be an increase in the number of net disconnections in the period leading up to 2030, we consider that there are a number of factors which will result a slower rate of disconnection from the JGN network than that forecast by CORE.

First, ACIL Allen's analysis of the Net Present Value (NPV) of switching continues to favour gas for existing dwellings. ACIL Allen has analysed the relative attractiveness of gas versus electric appliances for existing dwellings. The relative NPV of switching from gas to electric is shown in **Figure 2.6** below. The figure shows that the NPV of the switching decision remains negative for cooking, hot water and ducted heating systems across the entire forecast period to 2030. The only exception is room heating which is helped by a NSW government subsidy paid to households installing reverse cycle air conditioners.

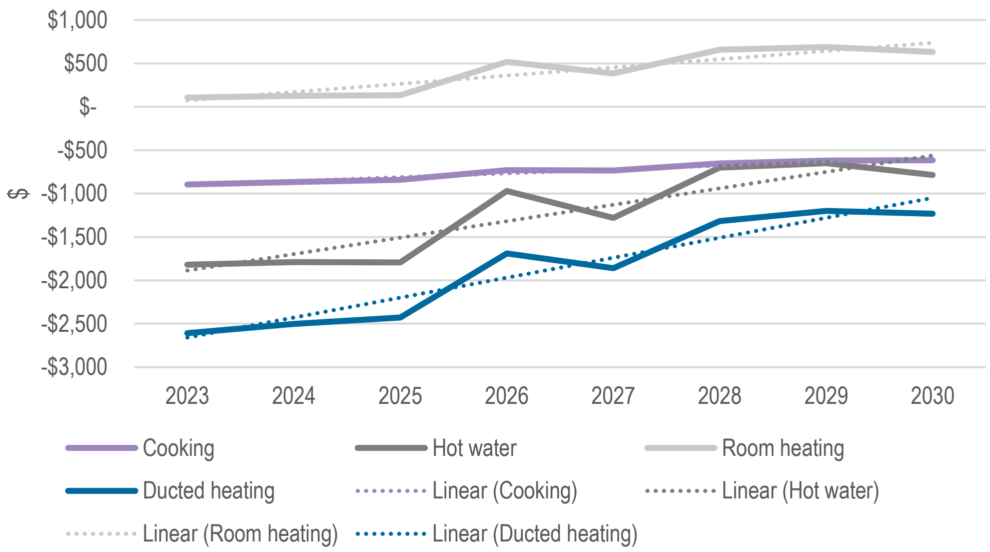
The NPV calculation is driven by factors such as:

— The upfront cost of the appliance plus installation.

— The annual running costs of the appliance, which are determined by the relative retail prices of electricity and gas, as well as changes in the relative energy efficiency of appliances over time.

A detailed presentation of the underlying assumptions of the NPV calculations are presented in Section 3 of this report.

Figure 2.6 Relative NPV of gas versus electric appliances



Source: ACIL Allen

The figure shows that over the next seven years to 2030 there is a relative improvement in the NPV of the appliance switching decision. This improvement is driven by lower relative electricity prices and improvements in appliance efficiency. Despite this, the NPV of the switching decision remains negative for most appliance types. While this improvement in the NPV of switching will lead to an increase in the number of disconnections from the JGN network, ACIL Allen consider that it is not sufficient to justify the number of disconnections that CORE is forecasting to take place.

Another factor that plays a role in the NPV calculation is the cost of disconnecting from the gas network and the cost incurred to upgrade existing electricity connections to enable households to fully electrify. In the case of gas cooktops many households are likely to have a strong preference for gas regardless of the relative economics of the switching decision. This is because many users of gas cooktops believe that gas cooktops are superior.

Moreover, the rebates and subsidies available for switching are not of sufficient size to change the outcome of the switching decision. The NSW energy saving scheme offers qualifying households between $190 and $310 to replace a gas hot water system with an electric heat pump, while eligible households who install a 6kW air conditioner could receive between $340 and $550. In the case room heating, the reverse cycle air conditioner subsidy is sufficient to tip the switching decision between a gas room heater and reverse cycle air conditioner in favour of the electric appliance. This however, is not the case for cooking, hot water and ducted heating systems, where any available rebates or subsidies are insufficient to tip the scales towards electric appliances.

Finally, NSW Government policy lacks the conviction of other State Governments such as the ACT and Victoria to force households away from gas. The NSW Government has recently stated that there will not be a ban on new connections in NSW in the foreseeable future. There is therefore no strong policy impulse pushing existing gas customers to disconnect from the gas network and fully electrify their existing homes.

In response, ACIL Allen has produced an alternative forecast of net disconnections that reflects our view that the disconnection rate from the JGN network will increase at a slower rate than that forecast by CORE. The methodology and alternative forecasts are detailed in section 3 of this report.

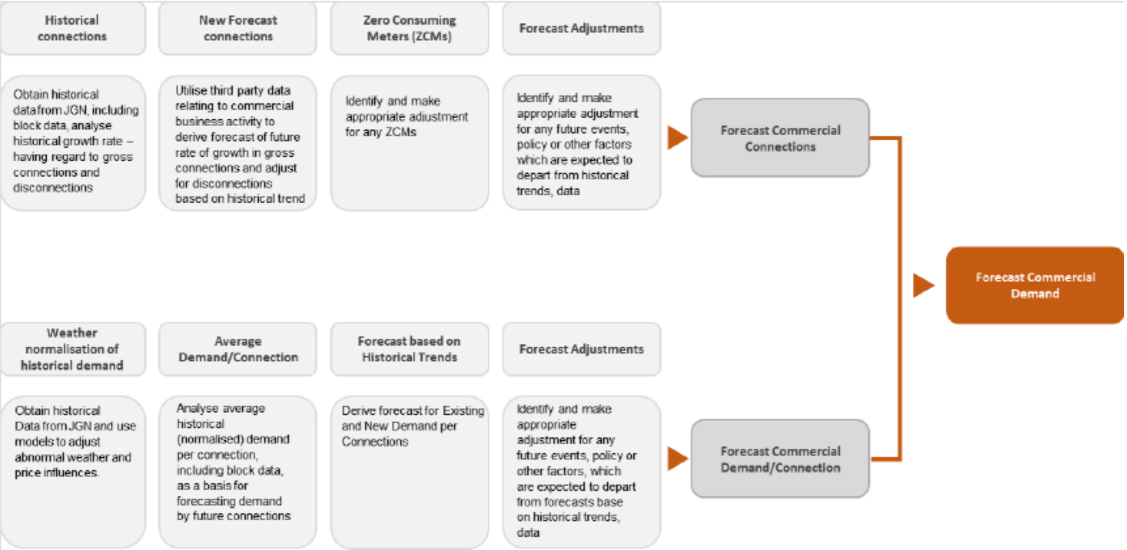
2.3 Small business gas demand and customer numbers

Overview

The approach taken to small business demand and customer numbers is similar to that taken for the residential customer class. Just like the case of the residential sector, small business demand forecasts are generated by the product of forecast demand per connection and forecast customer numbers.

Figure 2.7 below is a summary diagram that CORE include in their forecasting report summarises the steps involved.

Figure 2.7 Overview of small business demand forecasting methodology



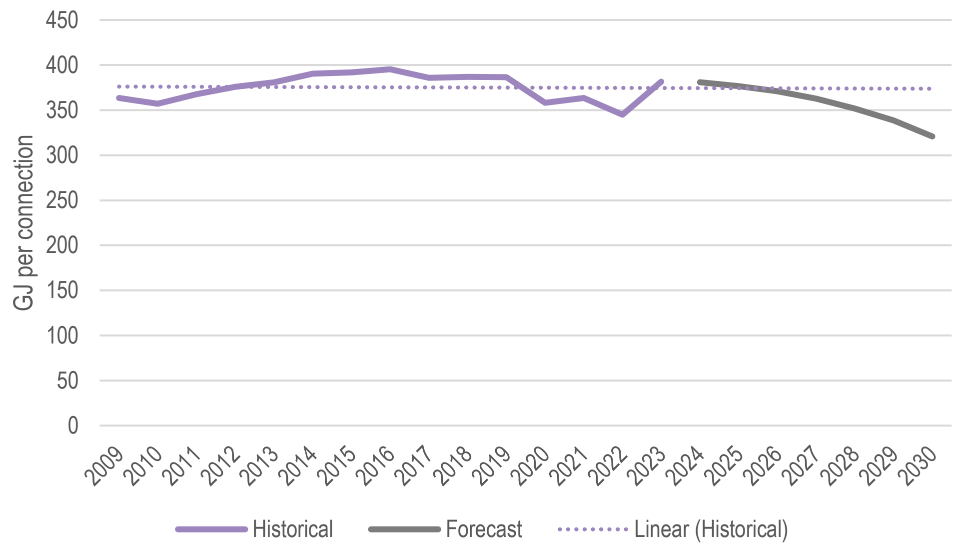
Source: CORE Energy

Demand per connection

Demand per connection for the small business category is also driven by the rate of historical change in the weather normalised demand per connection that is adjusted based on CORE Energy's judgement and analysis.

Figure 2.8 below shows JGN's historical weather normalised small business demand per connection and CORE's forecast to 2030. It is evident from the figure that small business demand per connection is projected to decline sharply over the next review period. This contrasts with the historical behaviour of the series which displays an uptrend between 2010 and 2016, declines slightly until 2019, before falling sharply during the Covid period, and then recovering back towards 2019 levels in 2023.

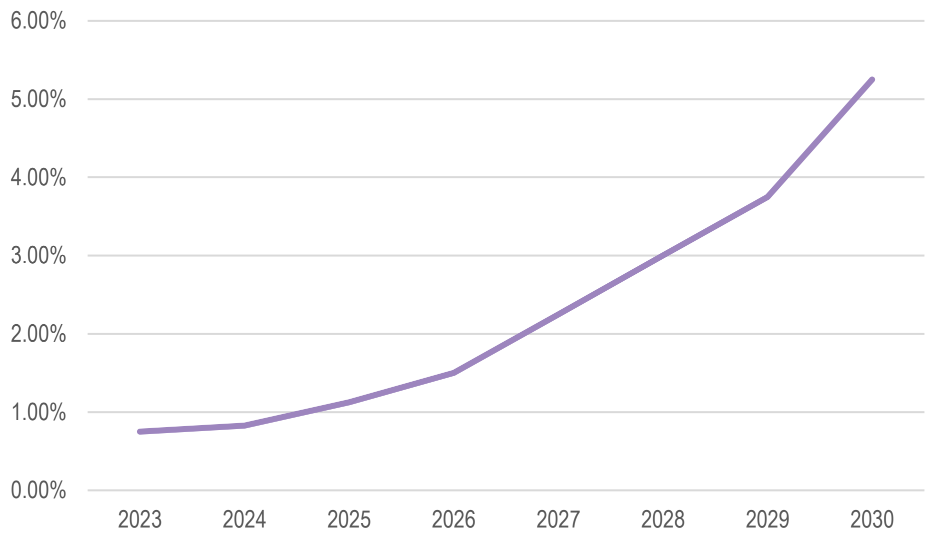
Figure 2.8 Small business demand per connection, historical and forecast, GJ per connection



Source: ACIL Allen

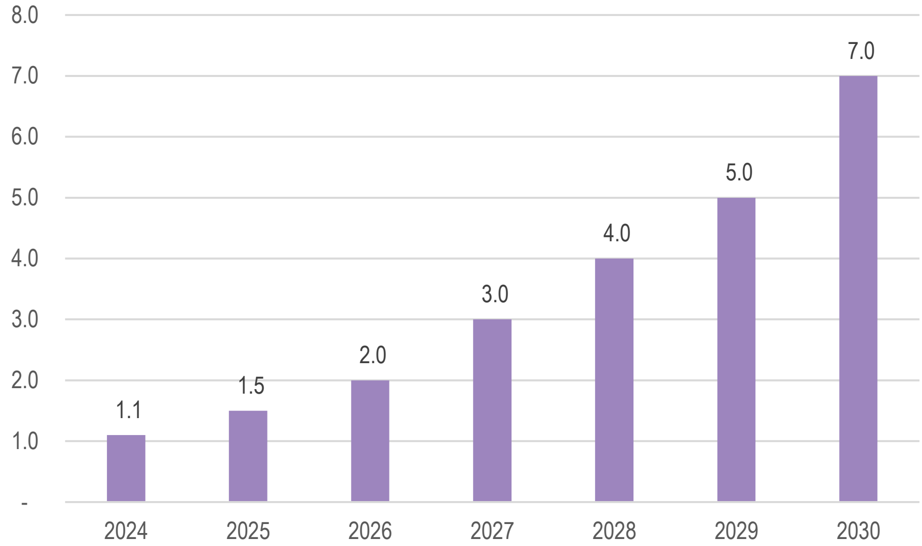
CORE have applied a base rate of decline of -0.75 per cent starting in 2023. This then increases exponentially to -5.25 per cent by 2030 (see **Figure 2.9**). The base rate of decline is adjusted downwards based on a set of hard-coded factors which are shown in **Figure 2.10** . By 2030, the base rate of decline has been magnified to 7 times its original size. Just as in the case of residential demand per connection, CORE do not reveal in their report how these factors have been determined. Given the fact they ramp up by multiples of round numbers, the factors do not look as though they have been determined according to some modelling procedure but instead have been selected based on CORE's judgement.

Figure 2.9 Annual rate of decline in small business demand per connection



Source: CORE Energy

Figure 2.10 Factor increase in rate of decline relative to 2023 level



Source: CORE Energy

An additional issue concerns CORE's choice of -0.75 per cent as the base rate of decline. It is evident from CORE's model that this number has been chosen arbitrarily. The rate of historical decline between 2010 and 2022 was -0.35 per cent. Over the period from 2010 to 2018 the demand per connection increases by an average annual rate of 0.72 per cent. It is apparent from looking at the data that the average rate of growth/decline in the demand per connection is sensitive to the choice of start and end points. It appears that there is no historical basis for CORE's choice of -0.75 per cent as the base rate of decline.

CORE Energy state that they have considered improvements in energy efficiency, appliance switching and a trend towards electrification in their analysis. While ACIL Allen regards these trends as having some validity in driving future small business gas demand, ACIL Allen considers that CORE's small business demand per connection forecasts follow a path that declines excessively between 2027 and 2030. This decline is not supported by historical behaviour and deviates very quickly from what has been observed historically.

In section 3 ACIL Allen provides an alternative forecast that places greater weight on recent historical behaviour thus reducing the steep rate of decline displayed by CORE's forecasts between 2027 and 2030.

Number of connections

Customer number forecasts are determined by new connections and disconnections from the network. These are based on historical rates of connection and disconnection that are adjusted in the forecast period based on CORE Energy's expert judgement.

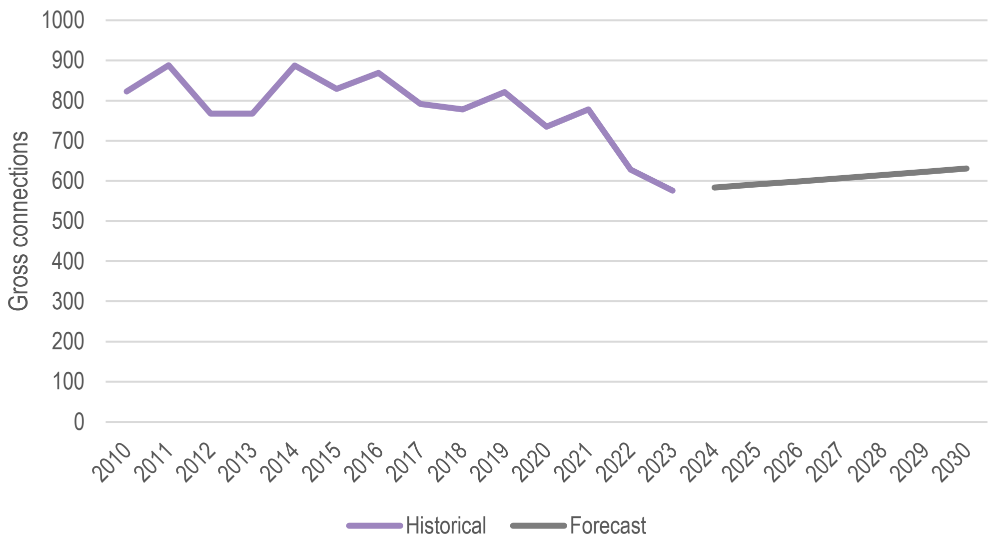
CORE Energy identify the following factors as weighing on the rate of new small business connections:

— A slower rate of economic growth over several years in the next review period.
— A trend towards substitution of gas appliances for electric appliances.
— The rising cost of gas relative to electricity.
— National/State requirements to improve energy efficiency.

ACIL Allen accepts that these factors will operate to some extent over the next regulatory period. NSW Treasury forecasts of economic growth are in fact more subdued over the coming few years. This is likely to have some impact on the creation of new small businesses in NSW leading to fewer connections to the gas network. ACIL Allen analysis in section 3 of this report also shows that there is a relative increase in the price of gas versus electricity.

Figure 2.11 shows historical and forecast gross small business connections to the JGN network. From 2018 to 2023, there were an average of 719 new connections every year. New connections commenced a downward trajectory after 2019, falling from 821 to a low of 576 in 2023. CORE then project a gradual increase off this low base, with an average forecast of 607 new connections between 2024 and 2030.

Figure 2.11 Gross small business connections, historical and forecast



Source: CORE Energy

ACIL Allen considers CORE's gross small business connection forecasts to be reasonable. The forecasts do not deviate substantially from what has been observed historically, and the lower projected levels are consistent with CORE's analysis.

ACIL Allen do not propose an alternative set of connection forecasts in this instance.

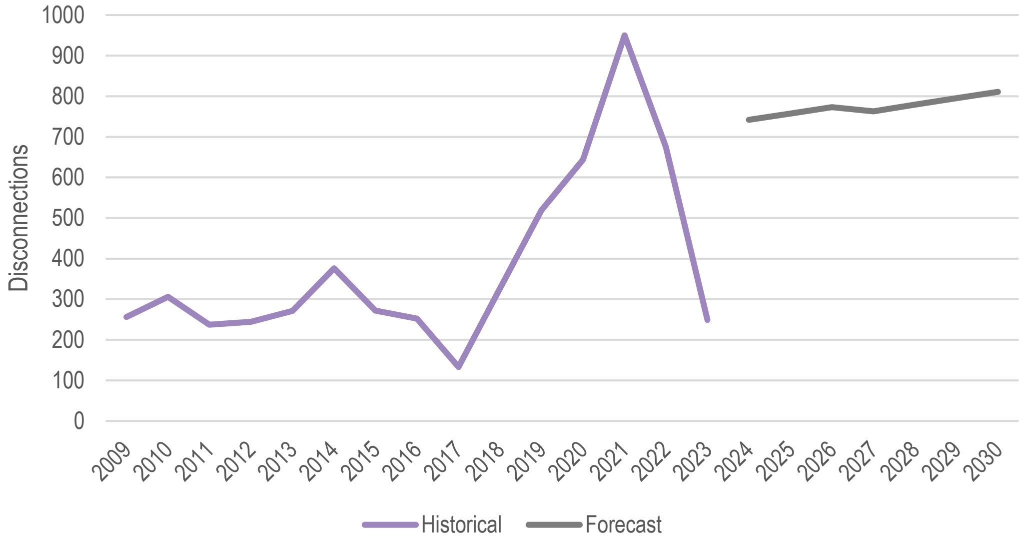
Number of disconnections

CORE's forecasts of small business disconnections are shown against historical disconnections in **Figure 2.12** below. CORE forecasts small business disconnections to increase gradually from 742 in 2024 to 811 in 2030. Over the seven-year period to 2030, CORE forecasts an average of 774 small business disconnections from JGN's network. Between 2019 and 2023, the average number of disconnections was 607.

CORE is projecting a higher level of disconnections relative to the recent past. This increase is due to the same set of factors impacting on the number of gross connections. ACIL Allen considers the small business disconnection forecasts to be reasonable. They are higher than those observed historically, but they increase in a steady and orderly fashion and do not deviate substantially of the numbers of disconnections that have been observed in the past.

ACIL Allen do not consider that an alternative set of disconnection forecasts are required in this case.

Figure 2.12 Small business disconnections, historical and forecast



Source: CORE Energy

3 Revised gas demand and customer number forecasts

In this section we present the revised residential demand per connection, revised residential disconnections and revised small business demand per connection forecasts.

3.1 Revised residential demand per connection

Methodology

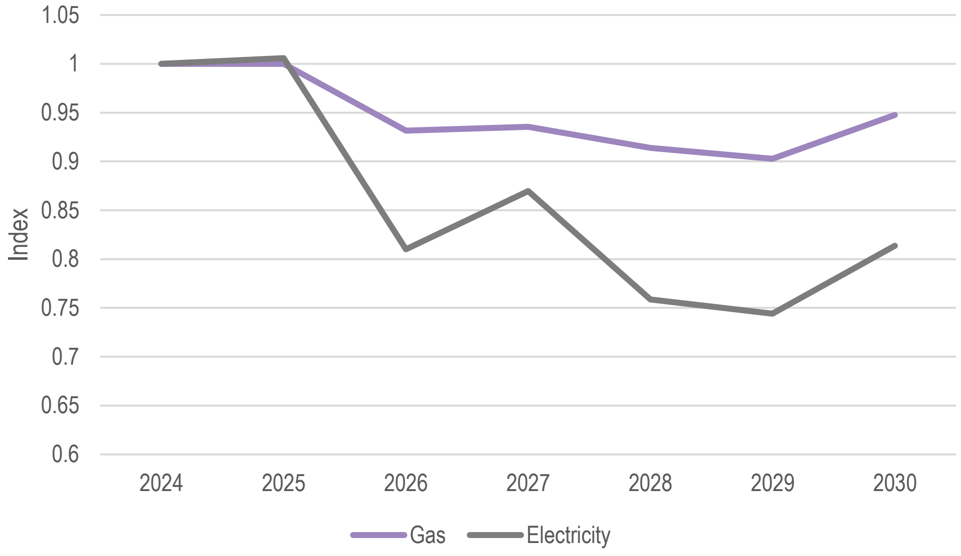
The average volume per customer consumed by residential customers is modelled via a separate econometric model. The average volume consumed is a function of the retail gas price, the retail electricity price and a declining linear trend based on historical movements. The trend decline in residential demand per connection was estimated by fitting a linear trend to the weather normalised historical data.

Two separate regressions were estimated, one covering the period from 2009 to 2019, and a second regression covering the full period from 2009 to 2023, with the Covid years accounted for by separate dummy variables. The results were similar for both regressions. Under the first regression, the estimated trend coefficient was estimated to be -0.156, whereas in the second specification the estimated annual trend decline was -0.157. The units are GJ/per annum, so that the annual average decline in residential consumption per customer declines by 0.157 GJ per year.

Additional changes to the average residential consumption per customer are then driven by changes in the relative price of gas and electricity. As gas becomes relatively more expensive than electricity, there is a behavioural shift towards less gas consumption per connection. This is due to a behavioural shift in usage patterns as well as some appliance switching.

Figure 3.1 shows the projected relative shift in gas versus electricity prices from 2024 to 2030. While real gas prices are projected to decline by 5.2% between 2024 and 2030, electricity prices are projected to decline by significantly more, declining by 18.6% from 2024 levels. This relative decline in electricity prices relative to gas prices results in a shift away from gas usage towards electricity usage. The econometric model assumes a gas price elasticity of residential demand of -0.25. In addition, there is a cross-price elasticity of demand of 0.1, so that as the price electricity falls, so does the demand for gas within the JGN network.

Figure 3.1 Gas versus electricity prices, real, index



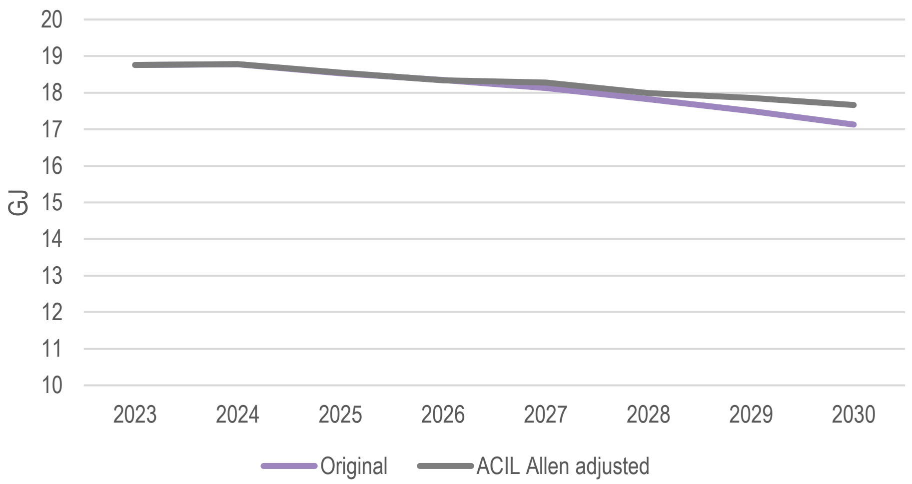
Source: ACIL Allen

It was not necessary to correct for weather related variation in usage because the base level historical data had already been weather normalised by CORE Energy using their method. ACIL Allen took the weather normalised data as a starting point, so it was not necessary to make any additional adjustments or corrections for weather.

Results

Figure 3.2 shows the amended residential demand per connection projection alongside CORE Energy's original forecast.

Figure 3.2 Residential demand per connection, Original versus adjusted



Source: ACIL Allen

Under our projection, residential demand per connection is projected to decline by -0.98% per annum over the period from 2025 to 2030, reaching 17.66 GJ per connection in 2030. This decline is significantly slower than CORE Energy's forecast decline of 1.56% per annum over the same period. Under CORE Energy's original forecasts, residential demand per connection falls to 17.13 GJ by 2030. As we said in the previous section, this is close to double the rate of decline as that observed historically. By 2030, the ACIL Allen forecast lies 3.0% above CORE Energy's original forecast.

Table 3.1 Residential demand per connection, Original versus adjusted, GJ

Year	Original	ACIL Allen adjusted	% Difference
2023	18.76	18.76	0.0%
2024	18.78	18.78	0.0%
2025	18.53	18.55	-0.1%
2026	18.35	18.34	0.1%
2027	18.13	18.28	-0.8%
2028	17.82	17.99	-0.9%
2029	17.50	17.86	-2.0%
2030	17.13	17.66	-3.0%
Annualised rate of change (2023-2030)	-1.29%	-0.86%	
Annualised rate of change 2025-2030	-1.56%	-0.97%	

Source: ACIL Allen

3.2 Revised residential customer disconnections

Methodology

For the residential customer class, ACIL Allen have used an appliance switching model based on the fundamental economic drivers of the decision to disconnect from the network.

The probability of disconnecting is a function of the NPV of switching. As the NPV of switching to electricity from gas becomes progressively less negative or positive, the proportion of customers making the switch increases. The NPV is a function of relative appliance costs and usage charges driven by the relative costs associated with gas and electricity prices. The introduction of appliance rebates to facilitate the switching from gas to electric appliances also plays a role in the NPV calculations. We allow for appliance rebates under the NSW Energy Scheme. The other main driver of the NPV calculation is the discount rate.

The key inputs into the NPV calculation for switching decisions are:

— Relative capital costs of the appliances
— Relative running costs
— Gas dis-connection charges
— Electricity upgrade connection costs
— Rebates for electric appliances

Customers are assumed to consider switching when their appliances are 15 years old. Although we don't know what the distribution of appliance ages is within the JGN network, we assume that appliance ages follow a uniform distribution as at 2024, so that there is an even spread of appliances between ages 1 and 15.

The function that is used to determine the probability of switching is the logistic function. This function resembles an S curve characterised by a slow build-up, a ramp-up phase, and a mature phase where the take-up has reached a saturation point.

The logistic model converts underlying drivers of choice to switch to electric appliances into a probability or market share of switching. The model values each attribute that drives the decision and applies an elasticity or weight to each factor. In our case, we are using a single factor, the NPV of switching, which incorporates the set of underlying drivers, such as relative prices and appliance costs, into a single measure.

The function takes any value from zero to infinity as inputs and converts them to output between zero and 1.

The function takes the form of an S curve:

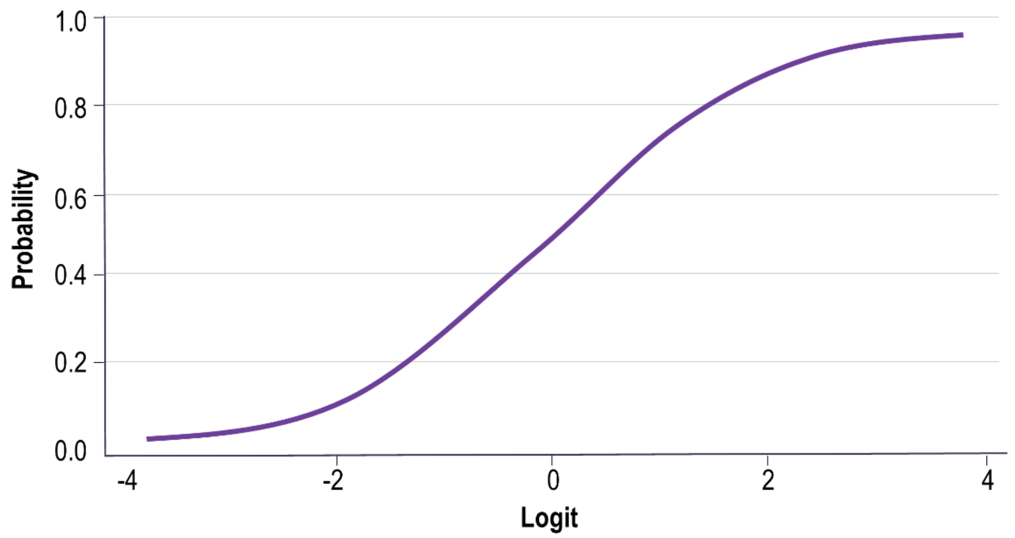
$\pi(x) = 1/(1 + \exp{(-y)}\,)$ where:

$y = \beta_0 + \beta_1 NPV$

y is a linear utility function of the drivers denoted by the NPV.

The S curve is shown in Figure 3.3 below.

Figure 3.3 The logit S curve



Input assumptions

Retail gas and electricity prices

Two key inputs into the decision to disconnect from the gas network are the retail price of gas and the retail price of electricity (see **Figure 3.4** and **Figure 3.5**). These prices play a key role in the model NPV calculations as they directly affect the relative running costs of gas versus electric appliances. ACIL Allen has through its internal proprietary models been able to construct bottom-up forecasts of the retail price of gas and electricity. The retail price of gas is made up of the following components:

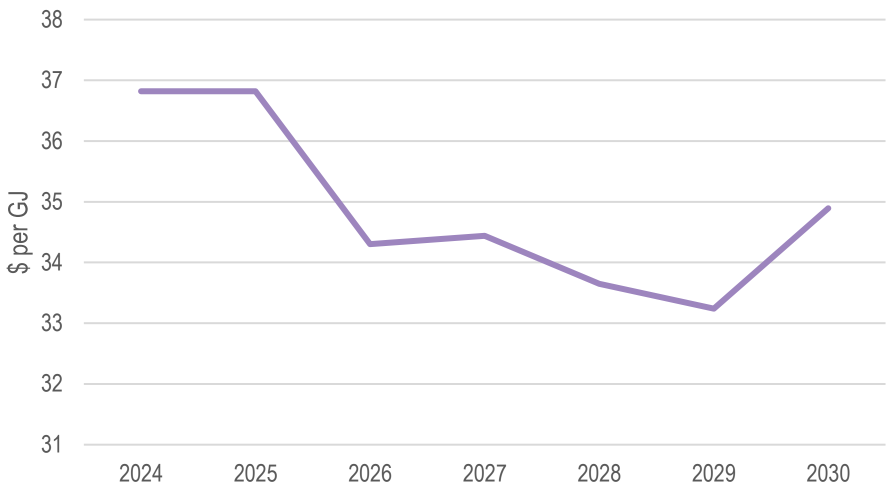
— Wholesale prices
— Network charges
— Retail margins

Similarly, the retail price of electricity is made up of:

— Wholesale prices
— Transmission costs
— Distribution charges
— Retail margins.

The retail price of gas is forecast to decline from $36.82 per GJ in 2025 to a low of $33.24 per GJ in 2029 before increasing to $34.89 in 2030. The 2030 forecast price of gas is 5.2% below the 2024 forecast price.

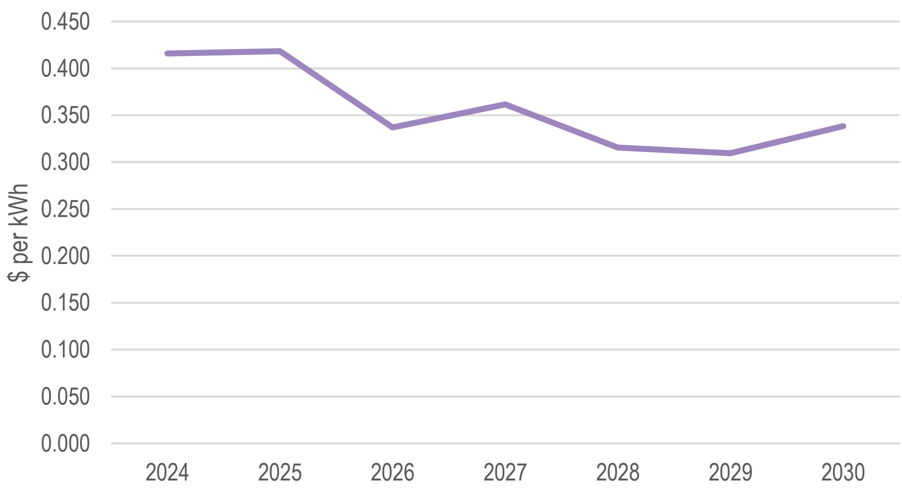
Figure 3.4 Retail price of gas, $ per GJ, real



Source: ACIL Allen

The retail price of electricity is forecast to decline by more than the price of gas in relative terms, falling from $0.416 per kWh in 2024 to $0.338 per kWh in 2030, a decline of 18.6% from the 2024 price level. The larger forecast decline represents a decrease in the relative running costs of electric versus gas appliances, thus improving the economic fundamentals of the switching decision.

Figure 3.5 Retail price of electricity, $ per kWh, real



Source: ACIL Allen

Appliance energy consumption

The assumed average energy consumption for each appliance type is shown in Table 3.2 below.

Table 3.2 Average assumed annual appliance energy consumption

	Average Consumption
Cooking	
Electric cooktop (induction) kWh	133.6
Gas stove (GJ)	1.01
Hot water	
Heat pump hot water (kWh)	1,417
Gas instant hot water (GJ)	15.0
Room heating	
RCAC split system (kWh)	652.0
Gas wall furnace (GJ)	6.90
Ducted heating	
Ducted RCAC (kWh)	1,132.0
Ducted gas heating (GJ)	11.99

Source: Grattan Institute

The appliance usage numbers were obtained from the Grattan Institute (see "Flame Out: The Future of Natural Gas", November 2020 by Tony Wood and Guy Dundas).

The equivalent electric appliance usage was derived after accounting for heat loss and efficiency gains from switching to electric appliances.

Appliance capital costs

Appliance capital costs were obtained from Appendix D of the Grattan Institute publication "Flame Out: The Future of Natural Gas", November 2020 by Tony Wood and Guy Dundas. They have been adjusted for the rate of inflation.

Table 3.3 Appliance capital costs, $real

	Appliance cost
Cooking	
Electric cooktop (induction)	2,900
Gas stove	2,100
Hot water	
Heat pump hot water	3,100
Gas instant hot water	1,400
Room heating	

	Appliance cost
RCAC split system	2,200
Gas wall furnace	1,900
Ducted heating	
Ducted RCAC	10,750
Ducted gas heating	7,600
Source: Grattan Institute	

Appliance maintenance costs

Maintenance cost data was obtained from the report "Are we still cooking with gas" produced by the ATA for the Consumer Advocacy Panel in November 2014. The numbers have been adjusted for the rate of inflation.

Table 3.4 Appliance annual maintenance costs (real $2023)

	Annual maintenance cost
Cooking	
Electric cooktop (induction)	0
Gas stove	3
Hot water	
Heat pump hot water	62
Gas instant hot water	46
Room heating	
RCAC split system	42
Gas wall furnace	37
Ducted heating	
Ducted RCAC	41
Ducted gas heating	97
Source: ATA, Are we still cooking with gas, November 2014	

Appliance usage efficiency

Appliance usage efficiency is assumed to improve by 1% every year for electric appliances. The efficiency of gas appliances is projected to remain unchanged over the forecast period.

Customer discount rates

The customer discount rates reflect how forward looking or myopic customers are when evaluating the decision to switch from gas to electric appliances. ACIL Allen have assumed a discount rate of 5% for the NPV calculations. This discount rate assumes decision makers are relatively forward looking and so have a higher propensity to switch from gas to electricity as appliance running costs move in favour of electric appliances.

Those customers from lower socioeconomic areas are likely to face significantly higher discount rates and behave in a way that weights the near future much more highly than the far future. These customers are more likely to retain gas appliances even though future appliance running costs favour electric appliances over gas appliances.

Non appliance cost related rates of connection and disconnection

The non-appliance cost rate of disconnection is calculated based on the historical rates of disconnection to the JGN network, before any significant changes to the attractiveness of switching takes place in the model. They capture the fact that customers disconnect irrespective of the relative attractiveness of doing so. ACIL Allen assumes a base disconnection rate of 0.35% of total residential connections every year.

Decision rule for switching decision

A customer is assumed to face a switching decision when their appliances are 15 years old. As at 2024, we assume that the distribution of appliance ages in the JGN network follows a uniform distribution between zero and 15 years of age. This distribution then changes over time as new customers connect, existing customers re-connect, existing customers disconnect.

Appliance rebates for switching from gas to electric appliances

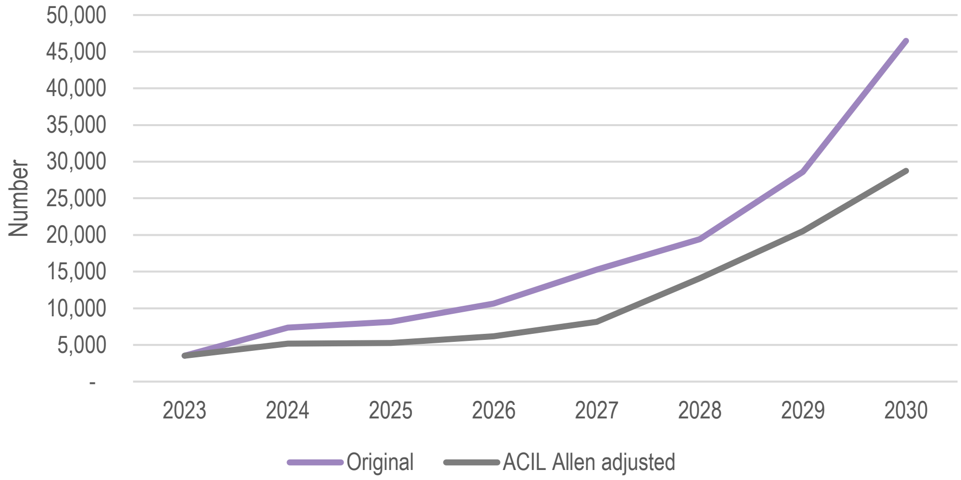
Appliance rebates and subsidies are available under the NSW Energy Saving Scheme. Under the scheme, those switching from a gas hot water system to an electric heat pump hot water system may be eligible for a rebate between $190 and $310. Those installing a 6kWh air conditioning system may be eligible for a discount between a $340 and $560.

Results

Figure 3.6 below shows the amended projected residential customer disconnections alongside the original CORE Energy forecasts. Under the amended forecasts, residential disconnections is projected to follow a slower trajectory, reaching a maximum of 28,748 in 2030. Under CORE’s original forecasts, residential disconnections are projected to reach 46,482 in 2030. In our view, the revised residential disconnections forecasts are more reasonable due to several factors:

- Unfavourable economics of switching based on an NPV calculation that includes capital costs, running costs and the costs of disconnecting from gas and upgrading existing electricity connections.
- Lack of policy at the level of NSW government to force existing customer to convert their appliances to electricity.
- Sticky existing gas connections with connections unlikely to disconnect until existing appliances break-down and the relative attractiveness of gas versus electric appliances deteriorates significantly.
- Insufficient level of rebates and subsidies to encourage mass switching.
- Future gas prices that remain relatively stable over the period from 2025 to 2030.

Figure 3.6 Residential customer disconnections, Original versus adjusted



Source: CORE Energy and ACIL Allen

Table 3.5 Residential customer disconnections, Original versus adjusted, Number

Year	Original	ACIL Allen adjusted	% Difference
2023	3,534	3,534	0.0%
2024	7,363	5,182	42.1%
2025	8,139	5,262	54.7%
2026	10,648	6,183	72.2%
2027	15,269	8,166	87.0%
2028	19,411	14,112	37.6%
2029	28,615	20,531	39.4%
2030	46,482	28,748	61.7%
Annualised rate of change (2023-2030)	44.5%	34.9%	
Annualised rate of change 2025-2030	41.7%	40.4%	

Source: CORE Energy and ACIL Allen

3.3 Revised small business demand per connection

Methodology

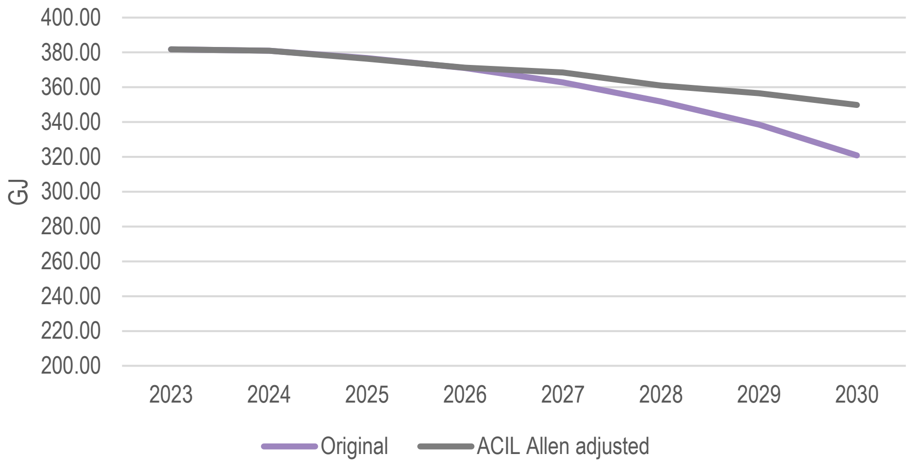
The approach to modelling small business demand per connection was similar to that applied for residential demand per connection. A trend variable was estimated by fitting a linear regression to the weather normalised small business demand per connection. This estimated trend decline was then projected to continue over the forecast period. In addition, the small business demand per connection was allowed to change in response to changes in the real retail price of gas and electricity. A price elasticity of demand for gas of -0.3 and a cross-price elasticity of 0.1 were applied. As the price of electricity declines relative to gas there is a shift away from gas towards electric appliances. This arises as a result of behavioural changes that reduce the usage of existing appliances and some appliance switching over time. Changes in efficiency are captured in the underlying trend reduction.

Results

Under CORE's original forecasts, small business demand per connection is projected to decline from 382 GJ in 2023 to 321 GJ in 2030. This is equivalent to an annual decline of 3.2 % per annum from 2025 to 2030. This is significantly lower than the amended forecasts in which small business demand per connection is projected to decline, but at a significantly slower rate of 1.5% between 2025 and 2030. Small business demand per connection is forecast to be 350 GJ in 2030 under the amended forecasts. By 2030, ACIL Allen's adjusted forecast lies 8.3 per cent above CORE Energy's original forecast.

As we have stated previously, we consider that this a more reasonable trajectory of decline than that proposed by JGN.

Figure 3.7 Small business demand per connection, Original versus adjusted



Source: CORE Energy and ACIL Allen

Table 3.6 Small business demand per connection, Original versus adjusted, GJ

Year	Original	ACIL Allen adjusted	% Difference
2023	381.77	381.77	0.0%
2024	380.99	380.99	0.0%
2025	376.70	376.30	0.1%
2026	371.05	371.17	0.0%
2027	362.71	368.52	-1.6%
2028	351.82	360.99	-2.5%
2029	338.63	356.53	-5.0%
2030	320.85	349.84	-8.3%
Annualised rate of change (2023-2030)	-2.45%	-1.24%	
Annualised rate of change 2025-2030	-3.16%	-1.45%	

Source: Core Energy and ACIL Allen

3.4 Total revised residential demand and customer number forecasts

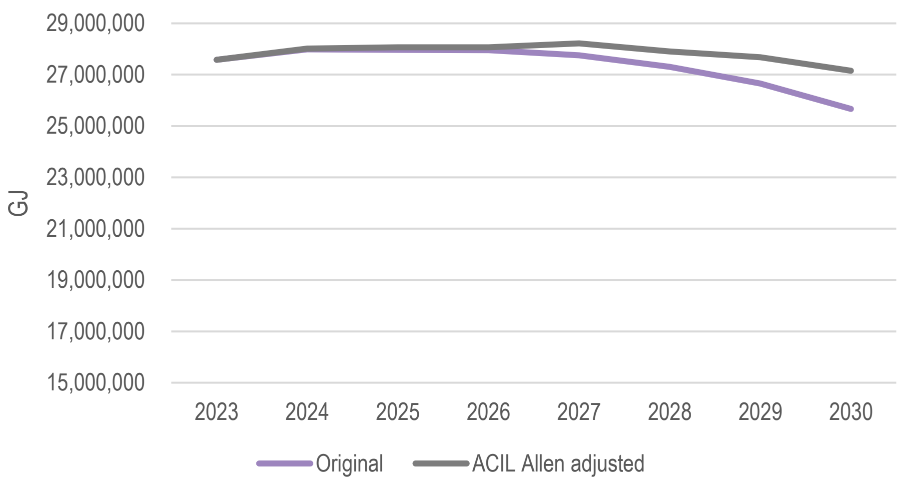
Demand

In this section, we present the revised residential demand and customer number forecasts incorporating ACIL Allen's amendments to customer disconnections and residential demand per connection, with CORE Energy's original residential gross connections numbers, which were not revised.

Figure 3.8 and **Table 3.7** below present the revised residential demand forecasts against CORE Energy's original forecasts.

Under CORE's original forecasts, residential demand is forecast to decline from 27.58 million GJ in 2023 to 25.67 million GJ in 2030, equating to an annualised decline of 1.7 per cent per annum over the 5-year period from 2025 to 2030. ACIL Allen's amended forecasts follow a more modest decline, reaching 27.2 million GJs in 2030. This is equivalent to an annualised decline of 0.66 per cent per annum. By 2030, ACIL Allen's amended forecasts are 5.5% higher than CORE Energy's original forecast. Up to the end of 2026 however, the forecasts are closely aligned, before following separate trajectories and drifting apart.

Figure 3.8 Residential demand, Original versus adjusted, GJ



Source: CORE Energy and ACIL Allen

Table 3.7 Residential demand, Original versus adjusted, GJ

Year	Original	ACIL Allen adjusted	% Difference
2023	27,582,541	27,582,541	0.0%
2024	27,986,775	28,013,273	-0.1%
2025	27,972,222	28,064,642	-0.3%
2026	27,950,597	28,069,141	-0.4%
2027	27,757,484	28,219,736	-1.6%
2028	27,308,683	27,905,879	-2.1%
2029	26,661,912	27,674,512	-3.7%
2030	25,665,813	27,153,167	-5.5%

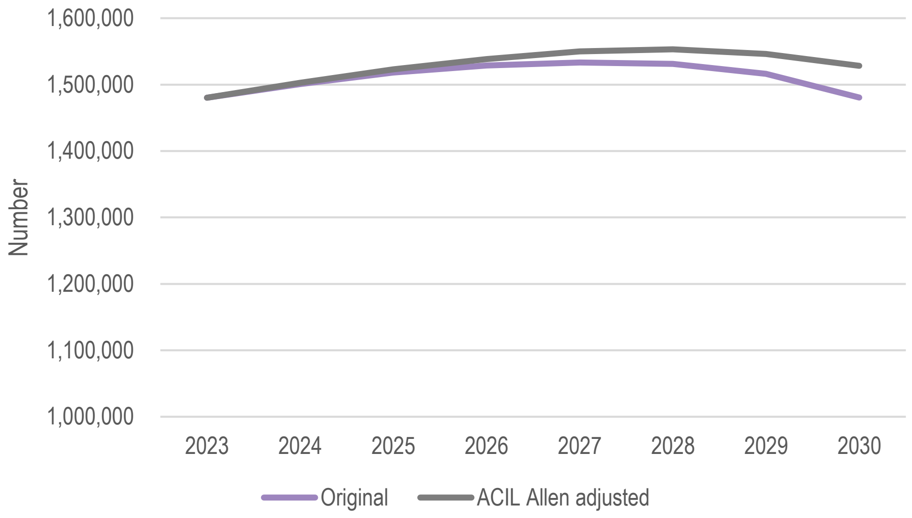
Year	Original	ACIL Allen adjusted	% Difference
Annualised rate of change (2023-2030)	-1.02%	-0.22%	
Annualised rate of change 2025-2030	-1.71%	-0.66%	

Source: CORE Energy and ACIL Allen

Customer numbers

ACIL Allen's amended residential customer forecasts are expected to increase by 0.07 per cent per annum over the period from 2025 to 2030, reaching 1.528 million customers (see **Table 3.8**). This is 3.1 per cent higher than CORE Energy's forecast which declines by -0.50 per cent over the same period. The higher ACIL Allen forecast reflects the downward adjustment in residential disconnections over the period. Gross residential connections were not amended, and CORE Energy's original numbers were retained.

Figure 3.9 Residential customer numbers, Original versus adjusted, Number



Source: CORE Energy and ACIL Allen

Table 3.8 Residential customer numbers, Original versus adjusted, Number

Year	Original	ACIL Allen adjusted	% Difference
2023	1,480,276	1,480,276	0.0%
2024	1,500,579	1,502,760	-0.1%
2025	1,517,968	1,523,026	-0.3%
2026	1,528,870	1,538,393	-0.6%
2027	1,533,285	1,549,911	-1.1%
2028	1,531,205	1,553,131	-1.4%
2029	1,516,299	1,546,309	-1.9%
2030	1,480,433	1,528,177	-3.1%
Annualised rate of change (2023-2030)	0.00%	0.46%	
Annualised rate of change 2025-2030	-0.50%	0.07%	

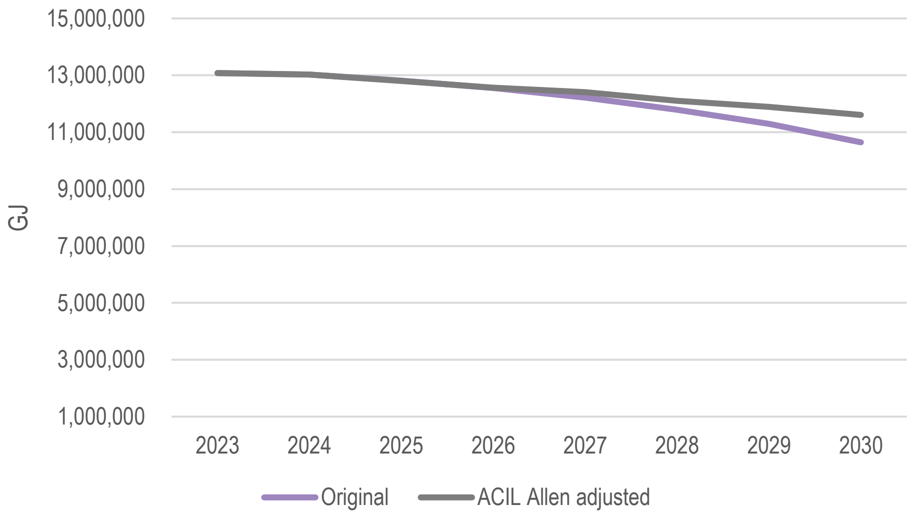
Source: CORE Energy and ACIL Allen

Small Business

Demand

Figure 3.10 and **Table 3.9** below present the revised small business demand forecasts against CORE Energy's original forecasts. It can be observed from the figure that the two sets of forecasts are closely aligned up to the end of 2026, before slowly diverging. ACIL Allen's revised small business demand forecasts decline at a rate of 1.94 per cent per annum between 2025 and 2030, reaching 11.608 million GJ's of gas, compared to 10.646 million GJ's under the original forecasts. By 2030 ACIL Allen's revised forecasts exceed CORE Energy's original forecasts by 8.3%. This is all due to the upward adjustment ACIL Allen have made to demand per connection projections.

Figure 3.10 Small business demand, Original versus adjusted, GJ



Source: CORE Energy and ACIL Allen

Table 3.9 Small business demand, Original versus adjusted, GJ

Year	Original	ACIL Allen adjusted	% Difference
2023	13,080,056	13,080,056	0.0%
2024	13,023,144	13,023,144	0.0%
2025	12,815,494	12,801,707	0.1%
2026	12,560,188	12,563,989	0.0%
2027	12,217,736	12,413,510	-1.6%
2028	11,794,816	12,102,001	-2.5%
2029	11,295,550	11,892,641	-5.0%
2030	10,646,065	11,607,792	-8.3%
Annualised rate of change (2023-2030)	-2.90%	-1.69%	
Annualised rate of change 2025-2030	-3.64%	-1.94%	

Source: CORE Energy and ACIL Allen

Customer numbers

Small business customer number forecasts were not adjusted by ACIL Allen.