FINAL REPORT

Update of 2023-2028 GAAR gas forecasts

Usage and customer number projections

Prepared for
AusNet Services

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THE CENTRE FOR INTERNATIONAL ECONOMICS
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Summary

In 2021, The CIE prepared forecasts for the 2023 to 2028 Gas Access Arrangement Review period for the AusNet Victorian gas distribution network.[1] AusNet Services has commissioned the CIE to update forecasts for 2024 to 2028 based on the latest available information. This report sets out the approach that we have taken, the key assumptions that have been made and the forecasts.

Our approach

Our approach to forecasting demand has been based on three steps.

1. Understanding the key drivers of demand and the magnitude of the impact of these drivers on demand using statistical analysis of AusNet Services' billing database.
2. Projecting forward key drivers using publicly available estimates.
3. Projecting forward demand using the relationships established between drivers and demand and the projections of key drivers.

Customer numbers

There are four main drivers of changes in the number of new residential customers, namely:

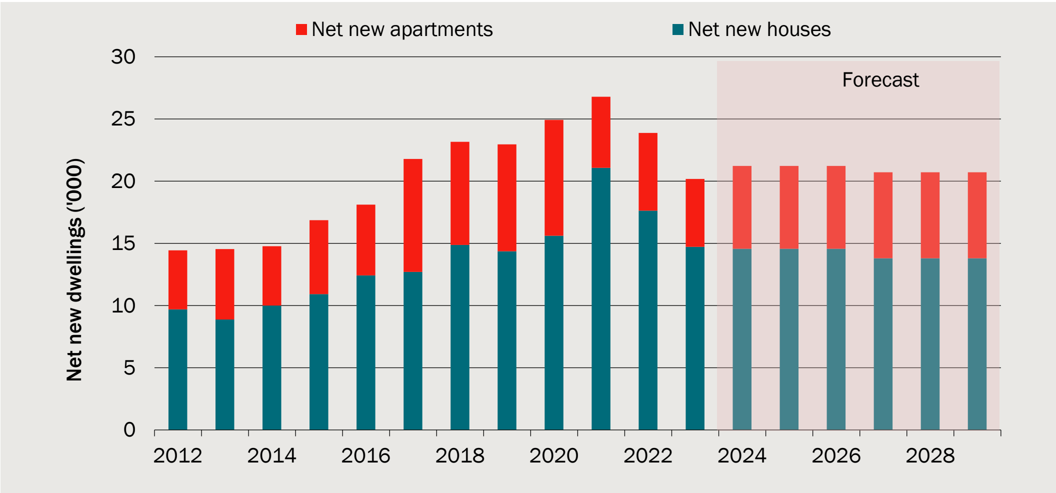
- **changes in potential customers** — the number of new dwellings reflects the number of potential customers that may connect to AusNet's network. The number of net new dwellings appears to have peaked in 2021 and declined in 2022 and 2023. The latest available forecasts from the Victorian Government (the Victoria in Future projections) suggest dwelling growth will be below these recent highs (chart 1).
- **changes in government policy** — the number of net new dwellings that may connect to gas has been restricted by policy, so that new dwellings that do not have a lodged or approved planning permit prior to 1 January 2024 cannot connect to gas. This means that there is a declining potential number of potential new customers going forward. Government policy may also impact demand, by requiring the full efficient costs of a gas connection to be passed onto new customers, increasing the costs of connecting for those that are still permitted to do so
- **changes in preferences** — take-up of gas connections by new dwellings: This can be considered through a measure of the 'marginal penetration rate' (MPR), which is the

1 The CIE, 2021, *2023-2028 GAAR Demand, Energy and Customer Forecast*, Final Report, prepared for AusNet Services.

number of net new customers divided by the number of net new dwellings. While the marginal penetration rate for houses has fluctuated historically, it has more or less remained stable around a mean value. In contrast, the MPR for apartments has been trending downward. Data on customer sentiment and developer sentiment indicates that marginal penetration rates are likely to decline, even for dwellings that are allowed to connect to gas. The marginal penetration rate that captures all of the effects modelled (historical trends, changes to government policy and customer sentiment), leads to an overall downward trend for the take-up rate for gas (chart 1).

- **the impact of investment and network expansion** (allowing households who were not previously able to connect to gas to connect to gas) — this will also be captured through the marginal penetration rate of each postcode, provided that the network is not expanding to new postcodes.

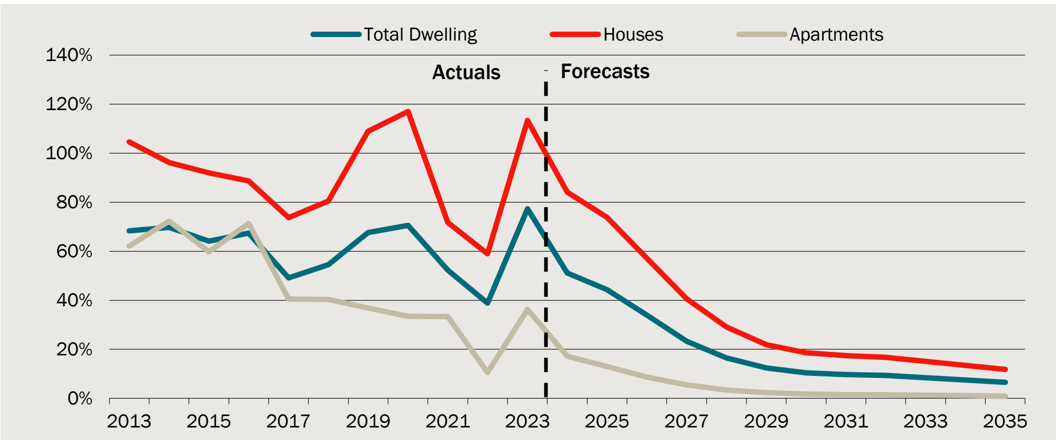
1 Net new dwellings by type, based on Victoria in Future projections



Note: This excludes postcodes fully within the Campaspe, Darebin, Melbourne, Mitchell, Whittlesea, West Wimmera, Yarriambiack LGAs, which have average penetration rates of below 10 per cent.

Data source: CIE.

2 Marginal penetration rate in AusNet Area, Scenario 0



Note: This excludes postcodes fully within the Campaspe, Darebin, Melbourne, Mitchell, West Wimmera, Whittlesea, Yarriambiack LGAs, which have average penetration rates of below 10 per cent.

Data source: CIE.

The number of residential customers will also change based on rate of disconnection of existing customers. Increases in disconnection rates are expected as customers switch gas appliances for electric appliances, with some deciding to disconnect or abolish. Survey data and evidence from the ACT suggests that disconnection rates will increase for AusNet's customer base.

Impact of additional scenarios for disconnections and new customer growth

There is still substantial uncertainty about new gas connections and disconnections, because of the high level of change in policies and sentiment related to gas connections. As such, we have developed a baseline scenario as well as additional scenarios which vary core assumptions to account for this uncertainty.

The baseline scenario (scenario 0) incorporates the most recent data on gas connections and disconnections as well as the quantifiable impacts of recent policy decisions and their impacts on gas take-up and usage. This baseline scenario projects customer numbers based on customer behaviours only varying based on historical relationships with known parameters. The baseline scenario assumes a declining connection rate for apartments, while assuming a historical 3-year average connection rate for houses for properties that are still able to connect to gas.

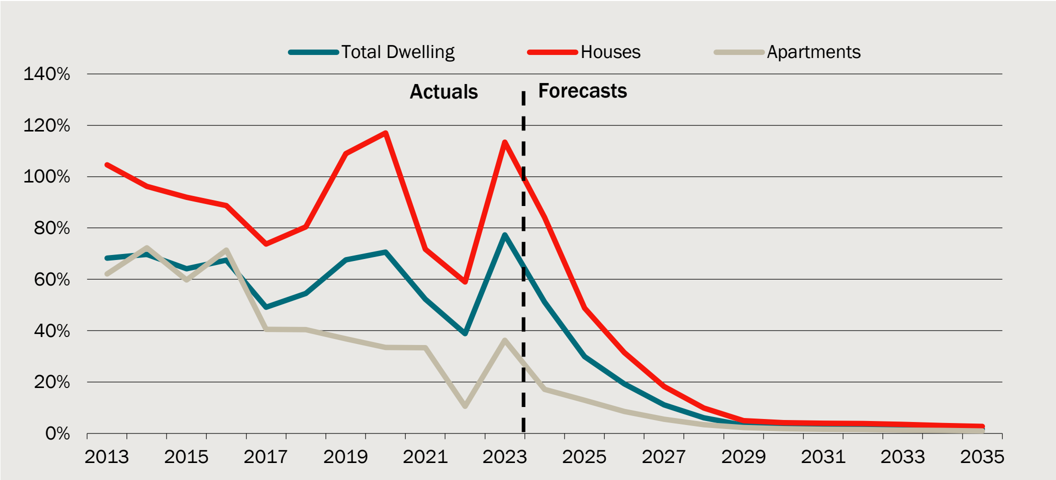
The baseline scenario does not factor in any additional change in sentiment for detached dwellings, where home builders increasingly choose not to connect to the gas network, even where they are legally and technically able to do so. As such, we considered additional scenarios that vary the rate at which new customers join the network per new house construction (i.e. the connection rate before the impact of other policies). While it is difficult to project a future change in customer behaviour, not considering this impact risks underestimating the possible magnitude of the changes. We have also considered additional scenarios where we varied the rate at which customers disconnect from the gas network. These scenarios are set out in table 3. Projected marginal penetration rates for Scenario 4 are shown in chart 4, which apply a lower trajectory for houses than scenario 0.

3 Additional scenarios for customer numbers

Scenario	Year that 1.25% disconnection rate is reached	Customer connection rate for houses
	Per cent	
Baseline - Scenario 0	2028	3-year average
Scenario 1	2026	3-year average
Scenario 2	2028	60% from 2025
Scenario 3	2026	60% from 2025
Scenario 4	2028	60% in 2025, 20% by 2029
Scenario 5	2026	60% in 2025, 20% by 2030

Source: CIE.

4 Marginal penetration rate in AusNet Area, Scenario 4



Note: This excludes postcodes fully within the Campaspe, Darebin, Melbourne, Mitchell, West Wimmera, Whittlesea, Yarriambiack LGAs, which have average penetration rates of below 10 per cent.

Data source: CIE.

Customer number forecasting results

An increased rate of disconnections compared to current, in combination with reduced new customer growth, will lead to residential customer numbers falling under Scenario 0 (table 5). Forecasting the number of commercial customers is less straightforward. The most reliable relationship for the purpose of forecasting commercial customers is the correlation between residential and commercial customer growth. We project that 11 new commercial customers will connect per 1000 new residential customers. These methods yield a forecast of gradually increasing residential and commercial customers, albeit at a lower rate than historical growth. The projected residential and commercial customer numbers are set out in table 5 for Scenario 0.

5 Forecast of Commercial and Residential Numbers, Scenario 0

Actual or projected	Year	Residential	Commercial	Total
		Number	Number	Number
Actual	2019	701 077	16 778	717 854
	2020	723 488	16 708	740 196
	2021	741 923	17 102	759 025
	2022	754 807	17 207	772 014
Projected	2023	775 610	17 268	792 877
	2024	787 079	17 360	804 439
	2025	795 581	17 406	812 988
	2026	799 379	17 380	816 759
	2027	798 197	17 278	815 475
	2028	793 301	17 114	810 415
	2029	787 323	16 938	804 260

Source: CIE.

The projected residential and commercial customer numbers are likewise set out in table 6 for Scenario 4.

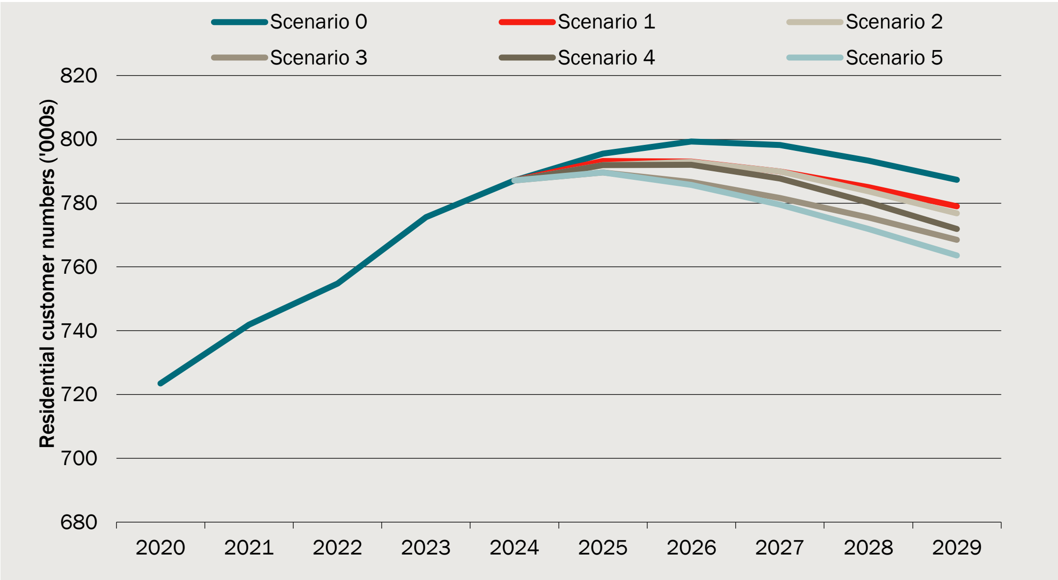
6 Forecast of Commercial and Residential Numbers, Scenario 4

Actual or projected	Year	Residential	Commercial	Total
		Number	Number	Number
Actual	2019	701 077	16 778	717 854
	2020	723 488	16 708	740 196
	2021	741 923	17 102	759 025
	2022	754 807	17 207	772 014
Projected	2023	775 610	17 268	792 877
	2024	787 079	17 360	804 439
	2025	791 947	17 366	809 313
	2026	792 019	17 299	809 318
	2027	787 764	17 163	804 927
	2028	780 215	16 970	797 186
	2029	771 906	16 769	788 675

Source: CIE.

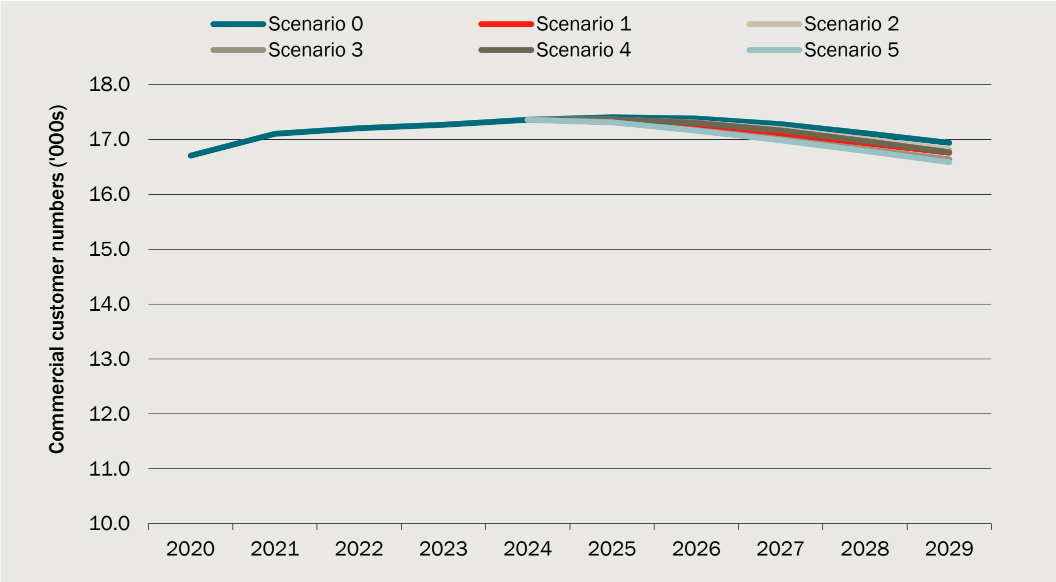
The additional scenarios for disconnection and marginal penetration rates lead to lower projections for both residential and commercial customers (charts 7 and 8).

7 Residential customer numbers by scenario



Data source: CIE.

8 Commercial customer numbers by scenario



Data source: CIE

Usage forecasts

Residential usage

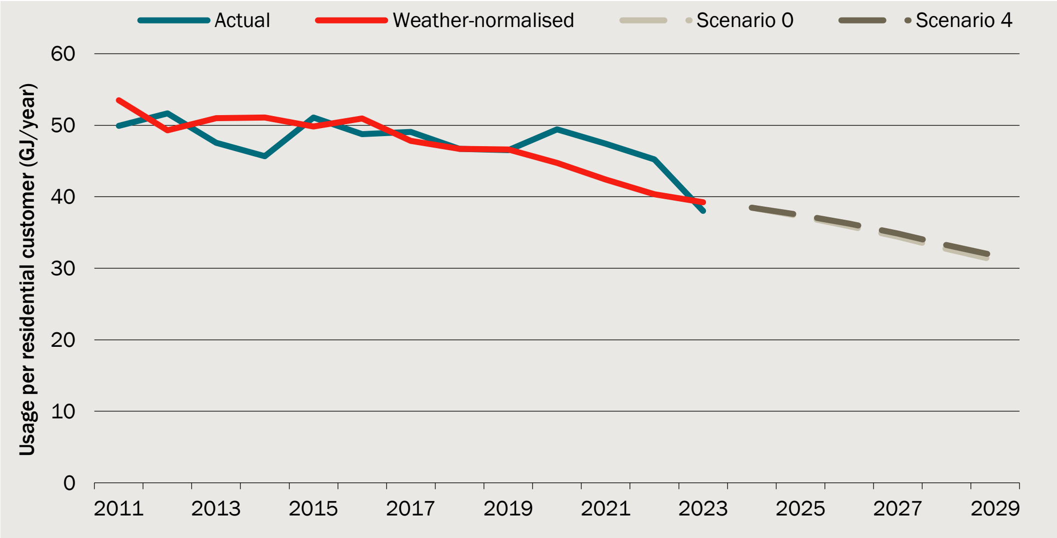
A few main trends have driven continued declines in residential usage per customer over the forecast period (chart 9):

- usage per customer is declining over time due to customers switching from gas to electric appliances, increases in temperature over time are leading to less heating load and energy efficiency improvements
- new residential houses and units use less gas than existing dwellings of the same type, and
- the share of new units in total new dwellings is higher than for the existing customer base, and units use less gas than houses.

The key driver of forecast declines in usage per customer is electrification, which we have projected by applying AEMO's estimate of the impact of electrification on usage from the 2024 GSOO. To avoid double-counting with the effect of electrification on customer numbers, we apply only 75 per cent of AEMO's electrification estimate, which implicitly assumes that 25 per cent of the impact of electrification arises through changes to customer numbers (reduced new customer growth and disconnections).

We have found that gas usage is relatively price-inelastic, meaning that usage changes little as consumption changes. Much of this is evident in the fact that prices rose dramatically in 2023, and there has been little deviation of usage from pre-existing trends. This finding is consistent with AEMO's assumptions of low price elasticity of demand in the GSOO 2024 forecasts.

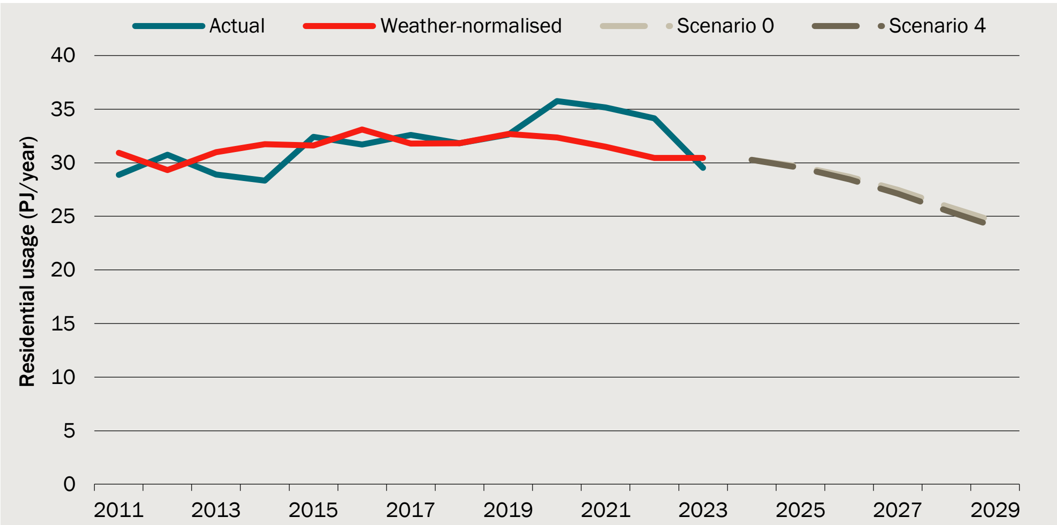
9 Actual, weather-normalised and forecast residential usage per customer



Data source: CIE.

The forecast decline in total residential usage reflects and acceleration of the pre-existing trend since 2016 (chart 10). The trend accelerates due to customer growth reversing from positive to negative over the forecast period, and due to falling usage per customer.

10 Actual, weather-normalised and forecast residential usage

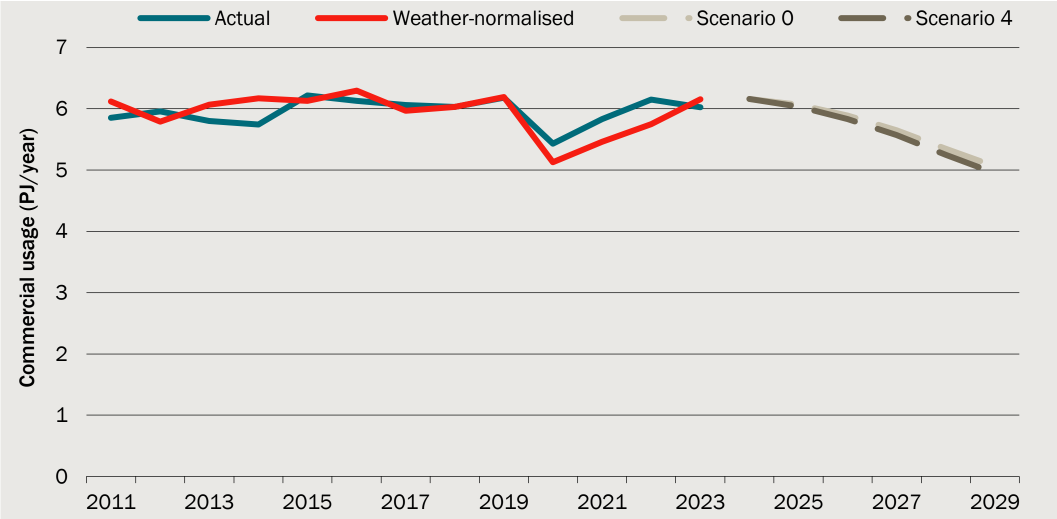


Data source: CIE.

Commercial usage

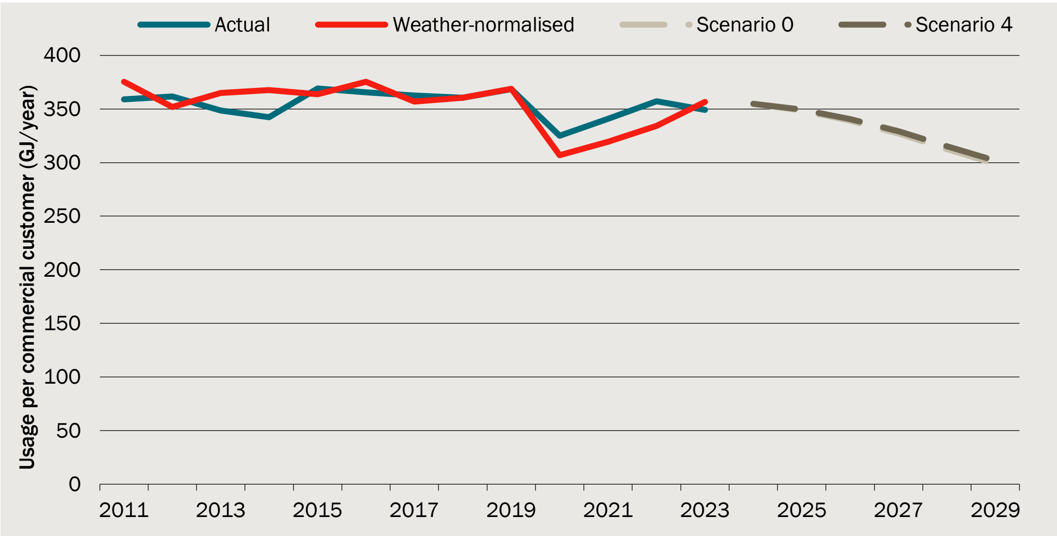
Total commercial usage (chart 11) and usage per customer (chart 12) are both projected to fall at a similar rate. This mainly reflects the impact of electrification reducing usage per customer. The downward effect of COVID-19 in 2020 2021 is evident. In our statistical modelling. We tested different specifications of models to account for these effects, finding that the effects of COVID-19 during 2020 and 2021 were consistently negative, but not finding evidence of negative effects in subsequent years.

11 Actual, weather-normalised and forecast commercial usage



Data source: CIE.

12 Actual, weather-normalised and forecast commercial usage per customer

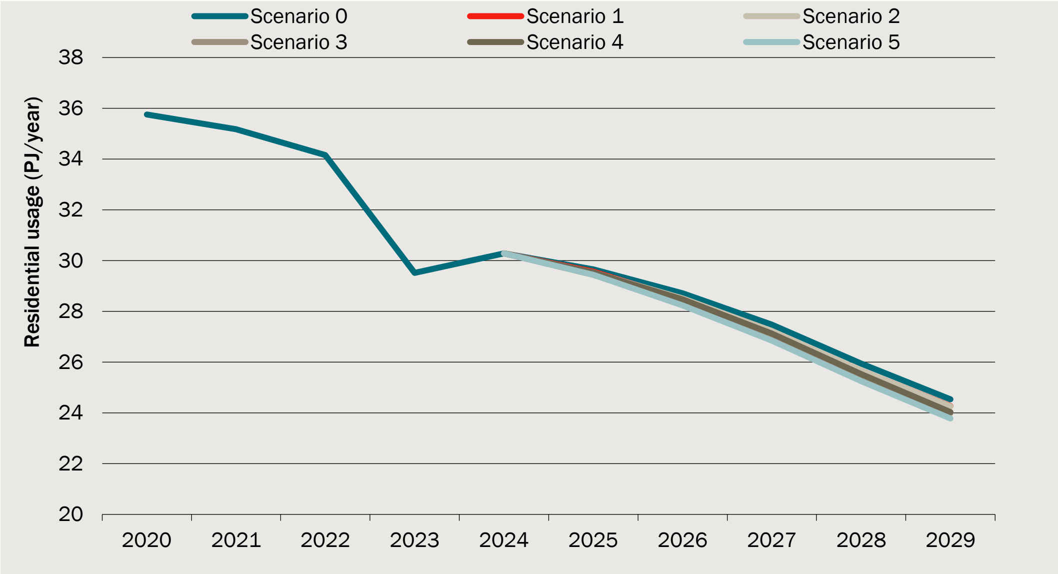


Data source: CIE.

Impact of additional scenarios for disconnections and new customer growth

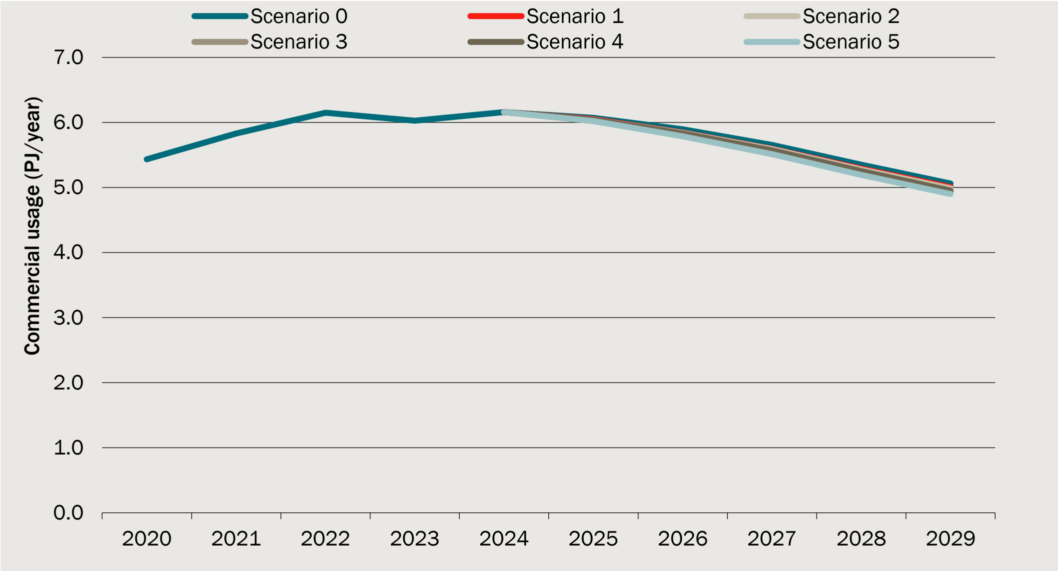
We also consider the additional scenarios that vary the rate at which customers disconnect from the gas network, as well as the rate at which new customers join the network per new house construction (the marginal penetration rate) in terms of their impact on customer usage. The scenarios have downwards impact on both residential and commercial customer usage (charts 13 and 14).

13 Residential customer usage by scenario



Data source: CIE

14 Commercial customer usage by scenario



Data source: CIE

Conversion of forecasts from calendar years to financial years

Forecasts of gas demand for the 2018-2022 GAAR were on a calendar year basis. However, regulatory periods for gas are changing from calendar years to financial years in 2023, with a half-year 'stub' period covering the first half of 2023.

We convert the forecasts from calendar years to financial years and for the stub period at the end of the modelling process. This involves the following calculations for customer numbers and usage respectively:

- **Customer numbers** — We assume that net new connections occur in equal proportion in the first and second half of the year. Therefore, projected net new connections in 2023/24, for example, will be the average of net new connections in 2023 and in 2024.
- **Usage** — we split usage in each block between the first and second half of the year based on the patterns in monthly demand data by block, region, and customer class. This allows for calendar year usage projections to be split into half years and then allocated to each financial year for the forecasting period.

1 Introduction

Purpose of forecasts

AusNet Services require independent and detailed forecasts of energy use and customer numbers for their gas distribution network for the period of 2023 – 2028. These forecasts will be used for its Gas Access Arrangement Review (GAAR) and general planning and forecasting.

Demand forecasts form a primary input into regulatory decisions. Demand forecasts:

- influence the notional revenue allowance through
  - operating expenditure projections
  - capital expenditure projections and hence the regulatory asset base, which is turn impacts on depreciation and the return on capital; and
- influence prices as prices are set so that demand multiplied by prices is equal to the notional revenue allowance.

Demand forecasts are also a primary input into decision-making by businesses. They can help to inform:

- pricing structures, which can be changed throughout the regulatory period to maximise revenue
- marketing — demand forecasting requires an understanding of the choices customers and potential customers are making, which is useful information for targeting of customers
- risks and risk management — if demand forecasts have a stochastic component rather than being a single forecast, and
- capital and operating expenditure planning decisions.

Key policy changes warranting a reopener

The motivation for a reopener is to account for a range of significant policy changes affecting gas demand. Key changes to incorporate into the forecasts include:

- From January 1, 2024, any new residential build and subdivisions, that require a planning permit will not be able to get a gas connection.
  - The majority of new homes do not require a planning permit. Most houses (so long as they are building a typical house on a typical block) will be able to continue connecting to an existing gas network that is available in their street.
  - New greenfield subdivisions require planning permits and so gas reticulation in new estates will stop in the next few years. However, there is a significant lag

between when a planning permit is granted and when the subdivision is completed (it is typically at least a year from when AusNet receives an application to reticulate a new estate until that work is competed). Further, in a new estates the majority of new homes are connected in the first 3 years after the estate is ready. As such, there is potentially a long tail of connections.

- The Essential Services Commission has recently released its final decision on the Gas Distribution System Code of Practice Review. The ESC has introduced a new connections framework which is to begin from 1 January 2025. The connection framework:
  - requires the full efficient costs of new connections to be funded by new customers.
  - removes the requirement for distributors to connect customers residing in the minor or infill extension area. Gas distributors will still have an obligation to connect a customer who requests a connection only if the connection would involve minimal or no extension or augmentation of the distribution system.
  - This draft decision is likely to have significant impact on customer behaviour and how quickly the connection ban will affect existing connection pipeline.
- The Victorian Minister for Energy has also put forward a Ministerial Order that bans Gas Distribution networks from offering incentives or rebates for gas connections. While AusNet does not offer these types of incentives at present it impacts the ability of gas networks to take action on connections.
- The Victorian Government is considering gas appliance bans for rental properties. The Government recently published a draft Regulatory Impact Statement (RIS), which has preferred options requiring end-of-life replacement of gas hot water and space heating systems from 30 October 2025 (subject to some exemptions).

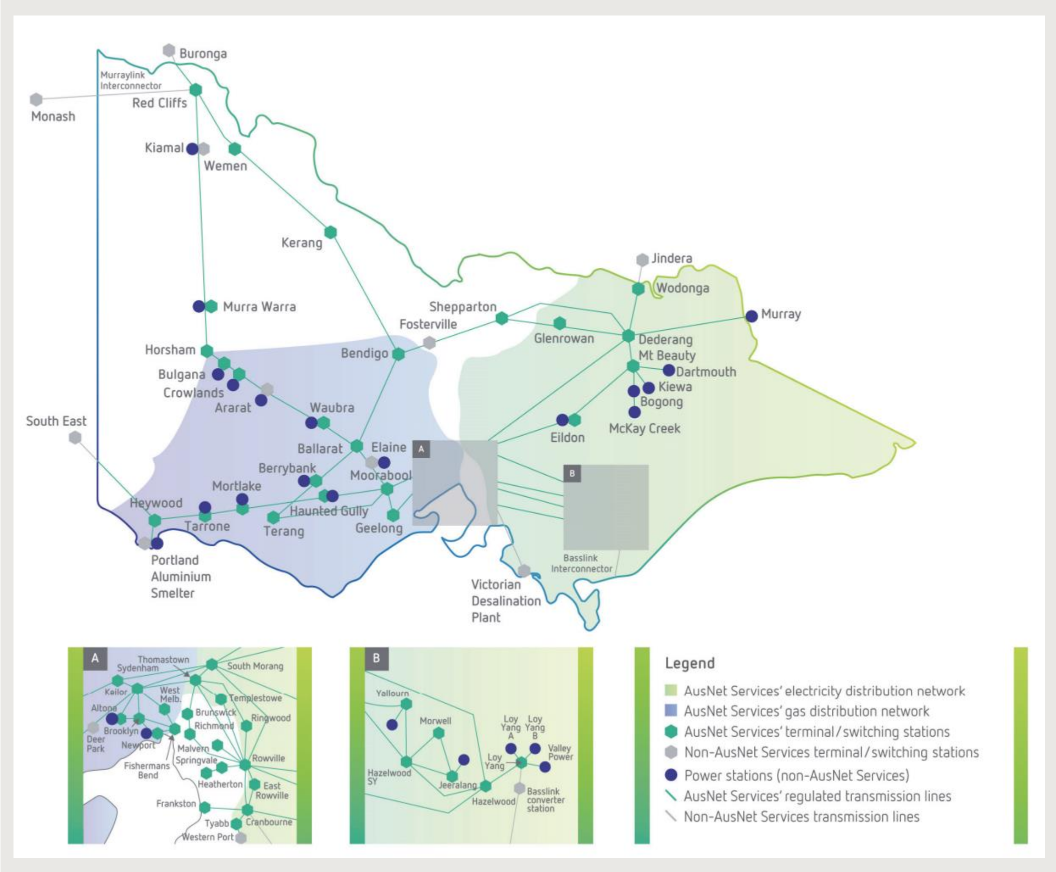
Background on AusNet Services' distribution network

AusNet Services is a diversified energy business providing the following services:

- Gas distribution network — transporting gas to approximately 750 000 customers across central and western Victoria including some of Melbourne's western suburbs.
- Electricity distribution network — carrying electricity from the high voltage transmission grid to approximately 737 000 customers across eastern Victoria including Melbourne's outer eastern suburbs.
- Electricity transmission network – carrying electricity from power stations to electricity distributors across all of Victoria.

The focus of this study is on AusNet Services' gas distribution network. Chart 1.1 shows AusNet Services' area of operations for its gas distribution network. Apart from AusNet Services, there are two other gas distribution network providers in Victoria — Multinet which operates in a part of the Melbourne area and Australian Gas Networks (AGN) which provides services in the central, northeast and eastern parts of Victoria.

1.1 AusNet Services gas distribution network

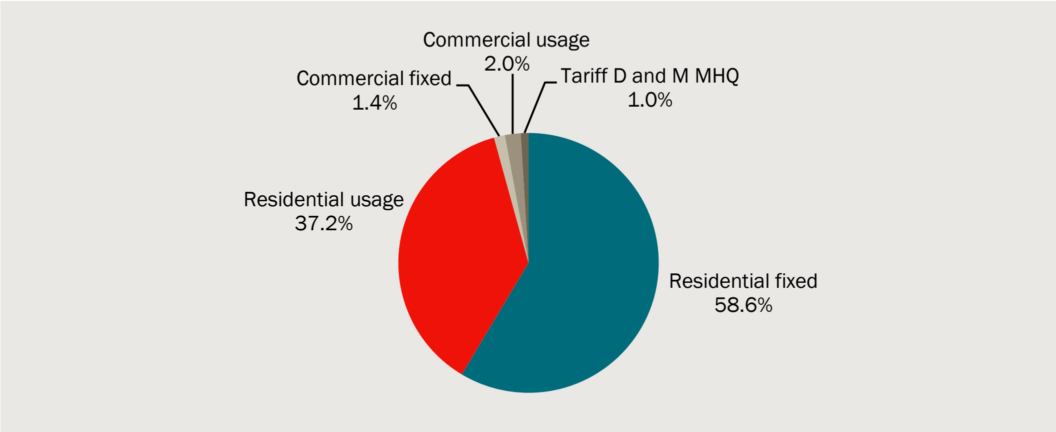


Data source: AusNet Gas Access Arrangement Reference Services Proposal — FY2024-28 (https://www.aer.gov.au/system/files/AusNet%20-%20Reference%20Service%20Proposal%20-%201%20July%202021_0.pdf)

Impact of different components of demand on revenue projections

The shares of revenue from different customers and fixed versus variable charges are shown in chart 1.2. Residential uses comprise 97 per cent of revenue, split almost evenly between usage charges and fixed charges. For this reason, we have placed the greatest focus on forecasting residential gas use.

1.2 Revenue shares by user and component



Data source: CIE calculations based on wholesale prices effective 1 July 2023 (available at: https://www.ausnetservices.com.au/-/media/project/ausnet/corporate-website/files/gas/gas-distribution-charges/2022/ausnet---gas-schedule-of-distribution-use-of-system-2023-24.pdf?rev=bb37c374e856448284e25a4b8fce3307) and tariff volumes for 2023.

This report

AusNet Services has commissioned the CIE to provide updated forecasts of demand for its Victorian gas distribution network for 2023 to 2028. These updated forecasts are intended to support a potential reopener of the GAAR.

This report sets out the approach that we have taken, the key assumptions that have been made and the forecasts.

The structure of this report is as follows:

- Chapter 2 discusses the key issues in forecasting gas demand.
- Chapter 3 explains the CIE's general approach.
- Chapter 4 projects customer numbers for residential users
- Chapter 5 projects customer usage for residential users
- Chapter 6 projects customer numbers for commercial users
- Chapter 7 projects customer usage for commercial users
- Chapter 8 projects Tariff D maximum hourly quantities
- Chapter 9 considers the risks surrounding projections and whether adjustments to projections are warranted.

2 Key issues in forecasting gas

Impact of electrification on usage and customer numbers

The Victorian Gas Substitution Roadmap states that gas consumption must be cut in order to meet Victoria's emissions reduction targets, including reaching net zero by 2045.[2]

The Victorian Gas Substitution Roadmap identified that electrification, especially of homes and businesses, is the most cost-effective decarbonisation pathway for Victoria's gas use.

Electrification refers to the transition away from gas towards electricity usage. It includes substitution from gas space heating, water heating, and cooking appliances to electrical appliances in new and existing homes and businesses. The channels through which electrification impacts gas usage includes:

- **reduced take-up of gas connections for new dwellings**, with the Australian Technology Association estimating that new homes which go all-electric with solar would achieve significant savings compared to homes with gas appliances and no solar.[3]
- **increases in the rate of disconnections** due to houses that renovate and replace gas appliances with electric alternatives, and
- **reductions in usage per customer** due to
  - replacement of gas appliances with electric appliances, or
  - less frequent use of existing gas appliances.

AEMO's estimate of the overall impact of electrification on usage

Forecasts of gas usage prepared by AEMO for the *Gas Statement of Opportunities 2021* (GSOO) explicitly estimate the effect of electrification on usage. AEMO publishes multiple scenarios for projected gas usage, with different post-modelling adjustments for each scenario based on multi-sector modelling by CSIRO.[4] Among these scenarios,

2 See Victoria Department of Energy, Environment and Climate Action, 2023, *Gas Substitution Roadmap Update*, p.2.

3 See https://thefifthestate.com.au/innovation/residential-2/theres-no-reason-for-new-homes-to-include-gas-report-finds/

4 CSIRO and Climateworks Centre, 2022, *Multi-sector energy modelling 2022: Methodology and results Final report*, available at: https://aemo.com.au/-/media/files/stakeholder_consultation/consultations/nem-consultations/2022/2023-inputs-assumptions-and-scenarios-consultation/supporting-materials-for-2023/csiro-climateworks-centre-2022-multisector-modelling-report.pdf

AEMO has selected 'Step Change' as the most likely scenario for the Draft 2024 Integrated System Plan, based on advice from an anonymous panel of experts.[5] The impact of electrification for this scenario is described by CSIRO as follows:[6]

> "Step Change: Consumer-led change with a focus on energy efficiency, distributed energy resources (DER), digitalisation and increases in global emissions policy ambition compared with Exploring Alternatives. Domestic and international action limits global temperature rise to well below 2°C compared to pre-industrial levels."

Based on the CSIRO modelling for this scenario, AEMO estimates that electrification will lead to a reduction in usage of 28.1 per cent by 2030, relative to a scenario without electrification (chart 2.1).[7]

AEMO also estimated the impact of electrification in the GSOO 2023,[8] with the forecast impact of electrification on residential and commercial usage remaining similar between the two publications. However, there have been significant policy announcements by the Victorian Government between the publication of the 2023 and 2024 GSOOs, such as implementation of a ban on future gas connections for dwellings requiring a planning permit. AEMO states that "a review of forecast method suitability for gas connection growth is ongoing for Victoria and other jurisdictions with similar proposed policies".[9]

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5 See the 2024 ISP Delphi Panel document published by AEMO, which states "*Step Change* has been identified as the most likely scenario for the 2024 ISP": AEMO, 2023, *2024 ISP Delphi Panel*, available at: https://aemo.com.au/-/media/files/major-publications/isp/2023/2024-isp-delphi-panel---overview.pdf?la=en

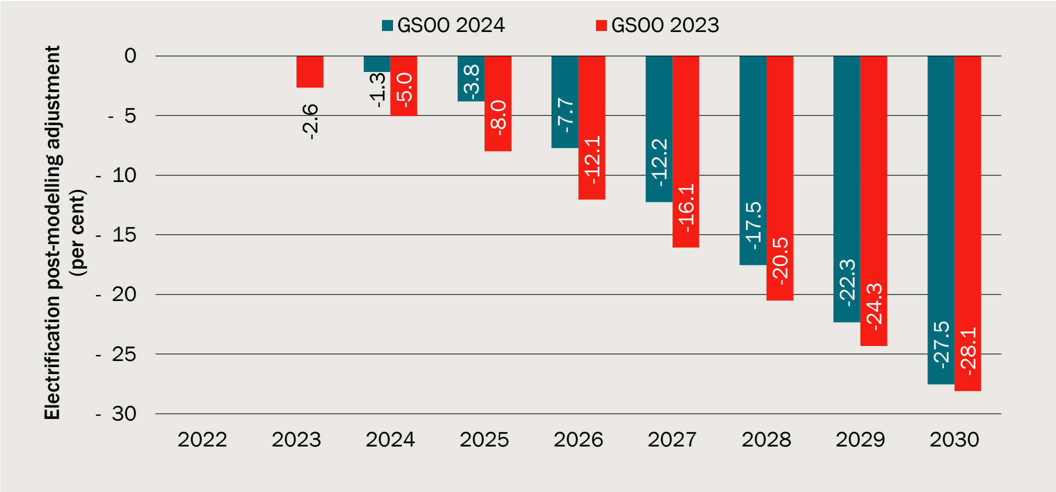
6 CSIRO and Climateworks Centre, 2022, *Multi-sector energy modelling 2022: Methodology and results Final report*, p.8.

7 In addition, AEMO account for the effect of energy efficiency improvements, which are measured separately.

8

9 AEMO, 2023, *2023 Inputs, Assumptions and Scenarios Report, Addendum — For use in Forecasting and Planning studies and analysis,* 15 December 2023, p.16, available at: https://aemo.com.au/-/media/files/major-publications/isp/2023/addendum-to-2023-inputs-assumptions-and-scenarios-report.pdf?la=en

2.1 Estimated impact of electrification in AEMO GSOO 2024

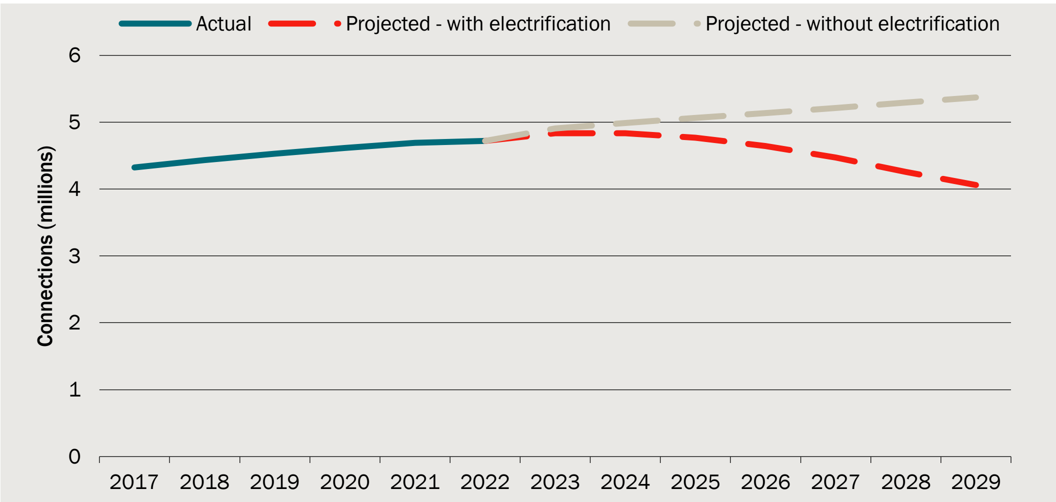


Note: The impact of electrification on the forecasts has been estimated based on the ratio of the electrification impact on residential and commercial usage (reported by AEMO in PJ) and projected residential and commercial usage before the impact of electrification and energy efficiency improvements. For example, AEMO project usage of 121.2 PJ for residential and commercial customers in 2025, and that the impact of electrification is -10.9 PJ and energy efficiency improvements have a -4.4 PJ impact. Therefore, the impact of electrification in 2025 is -8.0 per cent.

Data source: AEMO GSOO 2024 (estimates accessed through the forecasting portal, available at: https://aemo.com.au/energy-systems/gas/gas-forecasting-and-planning/gas-forecasting-data-portal, CIE.

AEMO have not explicitly split the impact of electrification into effects on usage per customer, existing customer disconnections, and new customer growth. In the GSOO 2024, AEMO presents an estimate of the number of connections without electrification and what they refer to as ‘effective connections’, which is the number of connections that would be consistent with reductions implied by the electrification impacts above but with usage per customer maintained as historical levels.[10]

2.2 Projected baseline connections and effective connections, Australia



Data source: AEMO (2024) *Gas Statement of Opportunities 2024*, available at: https://aemo.com.au/-/media/files/gas/national_planning_and_forecasting/gsoo/2024/aemo-2024-gas-statement-of-opportunities-gsoo-report.pdf?la=en

10 See Figure 13 and the note underneath it in AEMO, 2024, *Gas Statement of Opportunities*, p.25.

AEMO's estimates of the reduction in usage due to electrification from the GSOO 2024 are reliable and independent, providing a good basis for applying reductions to forecasts of usage in our modelling.

However, our forecasts are intended to feed into a submission to a Gas Access Arrangement Review, which requires projections of both customer numbers and usage. Hence, we must separately estimate the impact of electrification on customer numbers and usage.

Impacts of specific policies driving electrification

Ban on connection of new dwellings requiring a planning permit

The Victorian Gas Substitution Roadmap Update[11] banned new gas connections for developments requiring a planning permit from 1 January 2024 (through an amendment of the Victorian Planning Provisions),

Dwellings which require planning permits include apartments, new residential subdivisions as well as staged subdivisions. If a planning permit has been lodged or approved prior to 1 January 2024, then these developments are eligible to connect to gas after the cutoff. Alterations and additions to an existing dwelling, while requiring a permit, may still connect to gas at future points.

Single, freestanding houses generally do not require a planning permit so normally are exempt from the connection ban. However, we expect the majority of house construction to occur in conjunction with some form of subdivision (particularly in greenfield areas and growth areas within the AusNet footprint). Available lots from previous subdivisions, including those in now infill areas would generally be exempt from the ban, however (table 2.3).

Without access to planning data, it is difficult to estimate the proportion of development types that fall within each category. For modelling purposes, we have assumed that **80 per cent** of new dwellings require a planning permit and are thus affected by the policy in the medium term. This is based on the fact that there will likely be some stock of dwellings that will be constructed on previously subdivided land that will occur after the cutoff-date and may yet connect to gas. Over the longer term, however, this stock of eligible dwellings should diminish, coinciding with a decline in eligible dwellings to near zero.

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11 Victoria Department of Energy, Environment and Climate Action, 2023, *Gas Substitution Roadmap Update*, available at: https://www.energy.vic.gov.au/__data/assets/pdf_file/0027/691119/Victorias-Gas-Substitution-Roadmap-Update.pdf

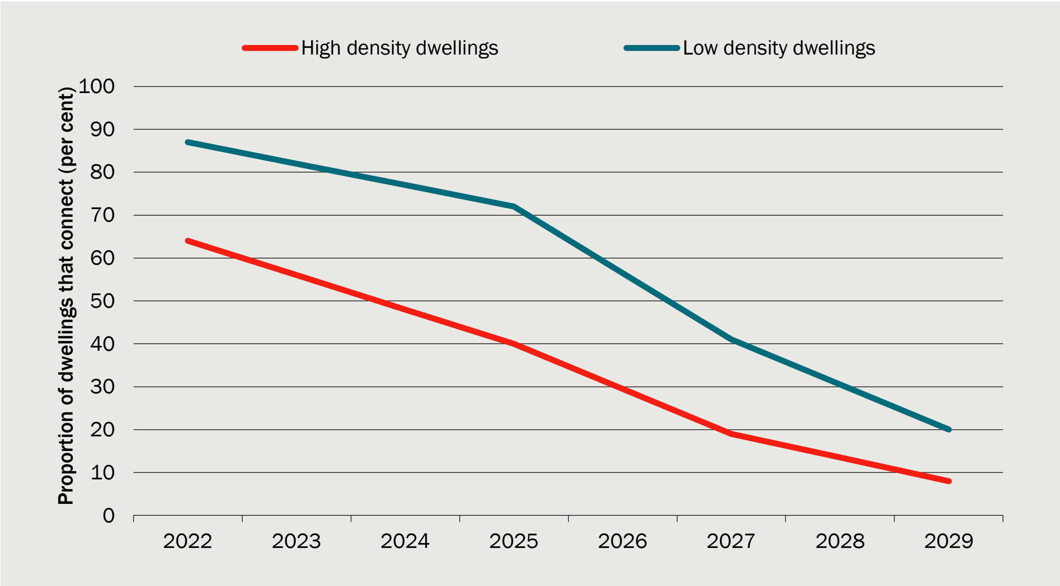
2.3 Permit requirements by dwelling type

Development type	Lodged/approved/existed before January 1 2024	Lodged/approved/existed after January 1 2024
Require planning permit		
Apartments	✓	×
New residential subdivisions	✓	×
Staged subdivisions	✓	×
Alteration/extension of existing dwelling	✓	✓
Do not require planning permit		
Houses (likely greenfield)	✓	✓
Small second dwellings (e.g. granny flats)	×	×
New second dwelling (if within or partially within existing GFA)	✓	✓
Pre-existing dwelling within a subdivision	✓	✓

Data source: The CIE

This is largely supported by developer expectations. The AusNet developer survey found that developers anticipate that only 20 per cent of low density dwellings and under 10 per cent of high density dwellings would likely connect to gas within 5 years' time (chart 2.4)

2.4 Developer expectations on dwellings which connect to gas

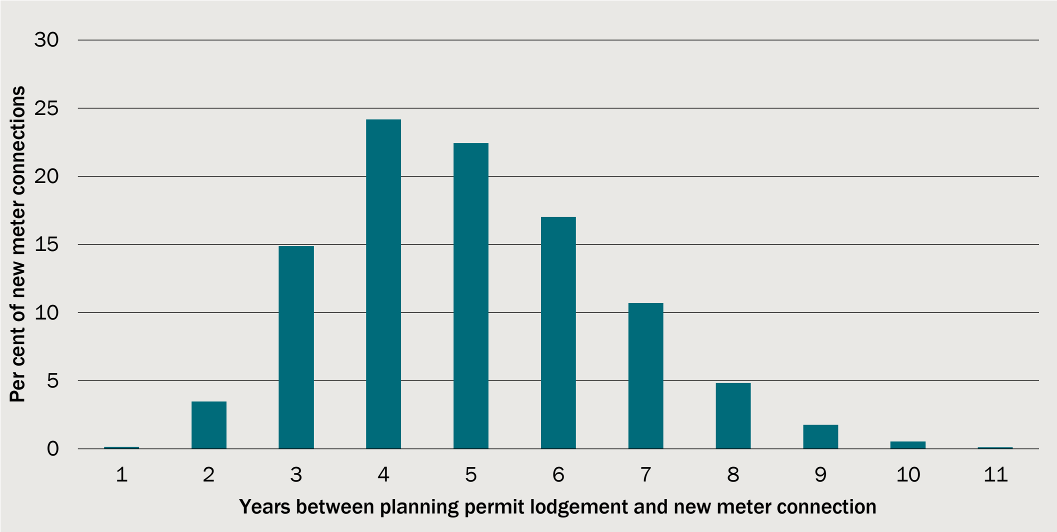


Data source: AusNet developer survey 2024

Because the policy exempts planning permits that were not only approved, but lodged before the cutoff, we expect the connection ban to have a lagged impact on future gas connections. This is because there is a significant time lag between when a planning permit is granted and when a new development (such as a subdivision) is completed. Further, in a new estate, the majority of new homes are connected in the first 3 years after the estate is ready. This can lead to a long tail of connections after the ban has taken place.

Chart 2.5 compares the time between planning permit lodgement to an observed meter connection. This was calculated by combining a dataset on historical planning permit lodgement and approvals with AusNet data on reticulation applications and completions. On average, it takes between 4 to 5 years from loading a planning permit to having a gas meter connected.

2.5 Time between planning permit lodgement to meter connection



Data source: The CIE.

ESC requirement to pass on full connection costs to customers

The Essential Services Commission (ESC) has made a new Gas Distribution Code of Practice. The Gas Distribution Code of Practice requires gas distributors to charge the full costs of new connections upfront for any new connection application from 1 January 2025.[12,13] The ESC estimates that that the average incremental upfront cost per residential connection would be $1778.

Imposing an upfront charge to dwellings that newly connect to the network will reduce the rate of new connections. The magnitude of the reduction in new connections is uncertain. It will depend on the price responsiveness of potential new connections to increases in upfront costs. Additionally, while there will be a direct response to the price increase, this may change the sentiment and messaging around gas connections and we have considered additional impacts in our additional scenarios.

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12 Essential Services Commission, 2024, *Gas Distribution System Code of Practice review — Final decision*, available at: https://www.esc.vic.gov.au/sites/default/files/documents/FDP%20-%20Gas%20Distribution%20Code%20of%20Practice%20review%20-%20FINAL.pdf

13 Another relatively more minor change is the removal of the requirement for distributors to connect customers residing in the minor or infill extension area. Gas distributors will still have an obligation to connect a customer who requests a connection only if the connection would involve minimal or no extension or augmentation of the distribution system.

One indicator of the price responsiveness of consumers to upfront costs of a gas connection is the price responsiveness of their usage of gas. In chapter 5 and 7 of this report, we present estimates of the price elasticity of demand for gas, which is a parameter capturing the degree of price responsiveness. We estimate that the price elasticity of annual usage for residential customers is -0.18, which can be interpreted as saying that a 1 per cent increase in the price of gas leads to a 0.18 per cent decrease in annual usage per customer. This is a fairly low price elasticity of demand, and in that sense is conservative (tending towards smaller estimates of the impact of upfront costs).

The ESC requirement to pass on the full efficient costs of connection has the effect of increasing the lifetime cost of gas per new customer. Typically, the average quarterly bill for residential gas users in Victoria is around $237,[14] or around $948 per year. Over a ten-year period, the present value of gas usage for the average residential gas customer is $7 124[15]. Based on an additional upfront cost of $1 778, the ten-year total present value cost increases to $8 902 for new customers, or around a 25 per cent increase (table 2.6). We estimate that this drives a reduction in new customer demand of 4.5 per cent, based on a price elasticity of demand of -0.18.

2.6 Cost comparison

Scenario	Up-front charges	Ongoing charges	Ten-year cost
	$	$/year	$, present value
Base case	0	948	7 124
ESC policy case	1 778	974	8 902

Note: Ongoing charges reduce slightly to the rest of the customer base, as new connection costs are no longer funded by existing customers. The present value is calculated at a 7 per cent discount rate.

Source: CanstarBlue, available at: https://www.canstarblue.com.au/gas/average-gas-bill/, Accessed at 30/04/2024, Draft Decision Gas distribution practice code review 2023, p33-35: https://www.esc.vic.gov.au/sites/default/files/documents/Draft%20decision%20-%20Gas%20Distribution%20Code%20of%20Practice%20review%20%20-%2020231114_0.pdf

Further, the Victorian Government has made ministerial orders that ban Gas Distribution networks from offering incentives or rebates for gas connections.[16] Such incentives might be used by distributors to offset the upfront cost, and thus prevent a reduction in new connections. AusNet does not provide such incentives.

Removed obligation to reticulate

The VPP and planning schemes were also changed in August 2022 to remove requirements for new developments to be connected to reticulated gas.[17] This may mean

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14 CanstarBlue, available at: https://www.canstarblue.com.au/gas/average-gas-bill/, Accessed at 30/04/2024

15 Discounted using a real social discount rate of 7 per cent per year

16 Victoria Government Gazette, 2024, No. S 184 Thursday 18 April 2024, Order under Section 40A *Gas Industry Act 2001*, makes this order specifically for AusNet Gas Services, available at: https://www.gazette.vic.gov.au/gazette/Gazettes2024/GG2024S184.pdf

17 See Victoria Department of Energy, Environment and Climate Action, 2023, *Gas Substitution Roadmap Update*, p.37.

that if the share of new dwellings connecting to gas falls sufficiently, whether due to the ban on

Victorian Energy Upgrades program

Victorian Energy Efficiency Certificates (VEECs) are electronic certificates created under the Victorian Energy Upgrades (VEU) program when energy efficiency activities are undertaken. Each certificate represents one tonne of greenhouse gas emissions reduction.[18]

A publicly available Register of VEECs provides data about the number of VEECs registered and what energy efficiency activities they were generated for. This data can provide insight into the frequency of households engaging in particularly appliance-switching behaviours, and therefore of gas-to-electric appliance switching.

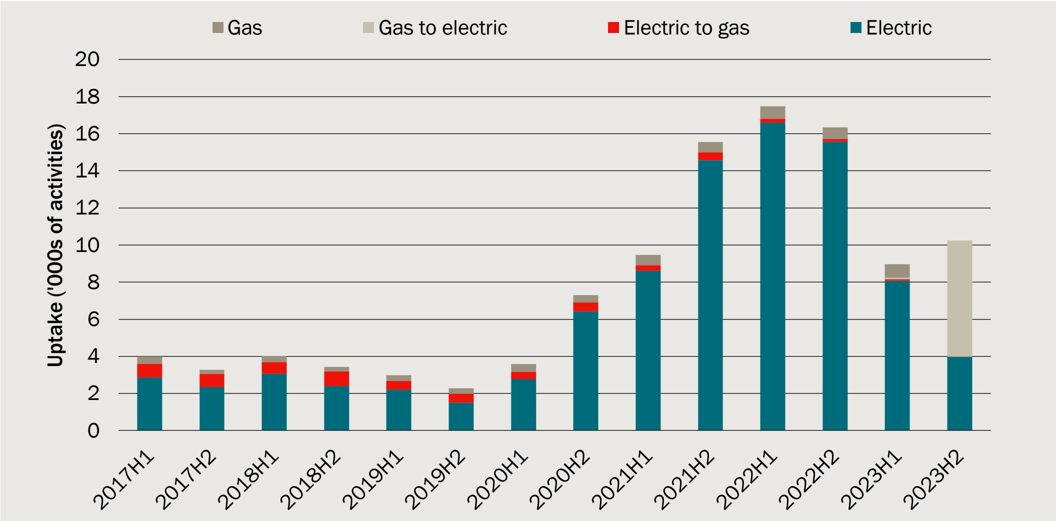
Further, the VEU program itself provides an incentive for gas-to-electric appliance switching. More than 6000 certificates were registered in the second half of 2023 (chart 2.7) for replacing gas hot water heaters with electric heat pump units.[19] The main activity for generation of certificates is replacement of electric hot water or space heating systems with more efficient electric systems. While certificates were formerly available for electric-to-gas switching (e.g. replacing electric resistance hot water heaters with gas instantaneous heaters), this is no longer an eligible activity under the VEU program.

This data supports there being a trend of increasing gas-to-electric appliance switching. A proportion of households, after switching from gas to electric hot water heating systems, will fully disconnect from the gas network.

18 The Essential Service Commission (ESC) website has an explanation of the VEECs and VEU: https://www.esc.vic.gov.au/victorian-energy-upgrades-program/about-victorian-energy-upgrades-program/victorian-energy-efficiency-certificates-veecs

19 "Heat pump replacing gas/LPG (activity 3C)" an eligible water heating activity under the VEU program: https://www.esc.vic.gov.au/victorian-energy-upgrades/activities-offered-under-veu-program/water-and-space-heating-and-cooling-activities/water-heating-and-space-heatingcooling-activities-residential-and-business

2.7 Victoria Energy Efficiency Certificates registered, by activity



Data source: VEU registry, data has been extracted for each half-year (based on activity data range) from the 'Register of Activities' (https://www.veu-registry.vic.gov.au/Public/ActivitiesPostcodeSearch.aspx) and collated by CIE.

Seven Star standard

The Victorian Government agreed to apply stronger efficiency standards for new homes as outlined in changes to the 2022 National Construction Code (NCC), including a move to 7 stars and new requirements for fixed appliances such as heating and cooling, hot water systems and lighting, to come into effect, retiring the existing 6 Star standard.

Under NCC 2022, new homeowners and developers will be able to choose a mix of fixed appliances that suit them (including heating, cooling and hot water) provided they meet the new whole of home energy budget. The whole of home energy budget provides for installation of on-site energy generation and storage such as adoption of solar PV and will be supported by new tools through the Nationwide House Energy Rating Scheme (NatHERS).[20]

We estimate the 7-star standard will reduce gas usage of new dwellings by 3.5 per cent for houses and 27.3 per cent for apartments, relative to recently constructed new connections. These estimates rely on the Consultation RIS by Acil Allen. Further detail on the calculation of these impacts is provided in Appendix A.

Other policy changes

The Victorian Government policy of removing the charge for abolishment of a gas connection is likely to result in more disconnections. Previously, abolishment of a gas connection result in a cost being imposed on the customer by the gas distributor under a cost recovery arrangement. Similarly to the impact of imposing an upfront charge to connect, but in reverse, making it free to abolish is likely to increase the rate of abolishments.

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20 Victoria Department of Environment, Land, Water and Planning 2022. Gas Substitution Roadmap.

The Victorian Government is considering gas appliance bans for rental properties. The Department of Energy, Environment and Climate Action published a draft RIS about minimum energy efficiency and safety standards for rental homes.[21] The preferred option identified in the RIS for rental properties involves an effective ban on gas appliances. The trigger for compliance with this ban would be the end-of-life of existing hot water/space heating systems from 30 October 2025. Some exemptions do exist where the cost to install an efficient system is significant higher than the average. Government is currently undertaking consultation for the proposed regulations, which are expected to be made in October 2024.

Impact of changing sentiment about gas

Survey evidence collected by AusNet suggests that the share of customers who expect to stop using their gas connection in the next ten years has more than tripled between Spring 2021 and Spring 2023 to 40 per cent (chart 2.8). While this data relates to existing gas customers, it is suggestive that owners of new dwellings may be increasingly uninterested in a gas connection for their new dwelling.

Similarly, AusNet survey evidence suggests that around 65 per cent of those customers have taken at least one step to removing their home from the gas network, including 8 per cent who have enquired about disconnection, 13 per cent who have research gas free homes on the internet and 19 per cent who have already started proactively replacing as appliances with electric ones.[22] Reasons for wanting to leave include gas being too expensive and the Government net zero emissions target.[23]

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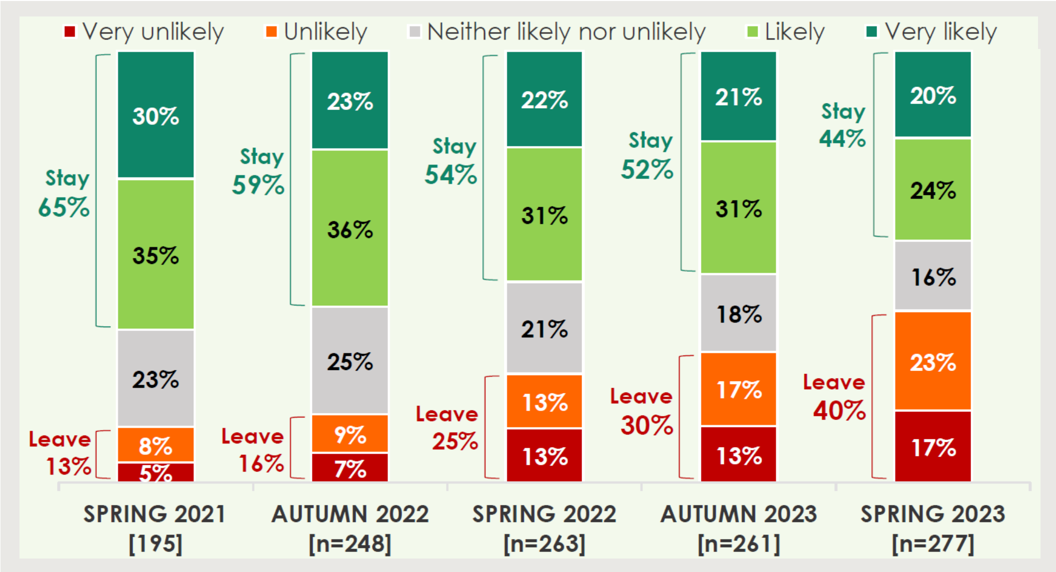
21 Deloitte Access Economics, 2024, *Minimum energy efficiency and safety standards for rental homes — Regulatory Impact Statement*, prepared for the Department of Energy, Environment and Climate Action.

22 AusNet, 2023, *Energy Sentiment Tracker: Gas*, November 2023, p.15.

23 AusNet, 2023, *Energy Sentiment Tracker: Gas*, November 2023, p.13.

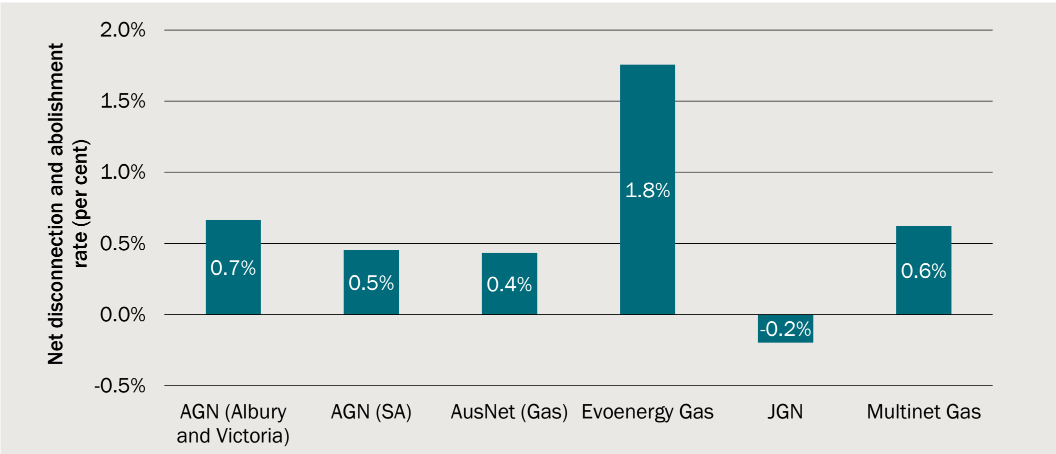
2.8 Customer intent to leave the gas network



Note: Shows responses to: *"In 10 years time, how likely are you to be using the gas connection at your house/business?"*.
Data source: AusNet, 2023, *Energy Sentiment Tracker: Gas*, November 2023, p.13.

The net disconnection and abolishment rate for residential and commercial customers is much higher for the EvoEnergy network in the ACT compared to Victorian networks (chart 7), which of which likely reflects differences in sentiment. A survey published by Energy Consumers Australia found that 25 per cent of Canberra residents are seriously considering making their homes all-electric, compared to 11 per cent Australia-wide.[24] Similar trends in sentiment in Victoria are likely to drive higher disconnections, lower new connections, and lower usage per customer.

2.9 Net disconnection and abolishment rate by network, 2023



Note: This chart includes residential and commercial customers and excludes industrial customers. The number of net disconnections is the sum of the number of disconnections and abolishments minus reconnections of existing customers.
Data source: AER monthly disconnection reporting, CIE.

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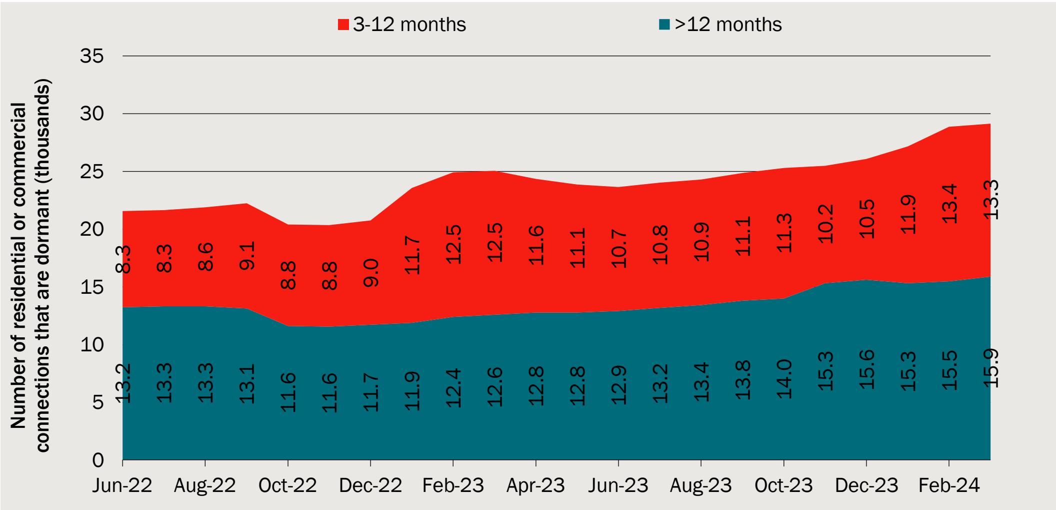
24 Energy Consumers Australia, 2023, *Canberra residents lead the nation as government policy encourages energy transition*, available at: https://energyconsumersaustralia.com.au/news/canberra-residents-lead-the-nation-as-government-policy-encourages-energy-transition

Another indication of changing sentiment is the increasing number of residential and commercial connections that are dormant (chart 2.10). The number of meters than have been dormant for at least 3 months has increased 35 per cent since June 2022. This likely reflects customers replacing their gas appliances with electrical appliances, but not yet removing their gas connection. Upon the removal of abolishment charges, there may be a significant number of these dormant meters that abolish. Further, the trend of increasing numbers of dormant meters is likely evidence of increased appliance switching, and points to ongoing increases in abolishment rates.

2.10 Number of dormant residential and commercial connections, by duration



Note: This chart shows the number of dormant connections on a monthly basis, and is split between whether the connection has a meter or not, and the duration that the connection has been dormant. The number of meters that are dormant for only 3 months is based on only 2 zero-consumption meter reads and, hence, is a less certain indication of dormancy.

Data source: AusNet data about the number of dormant meters, CIE.

Impact of changing prices for gas and electricity

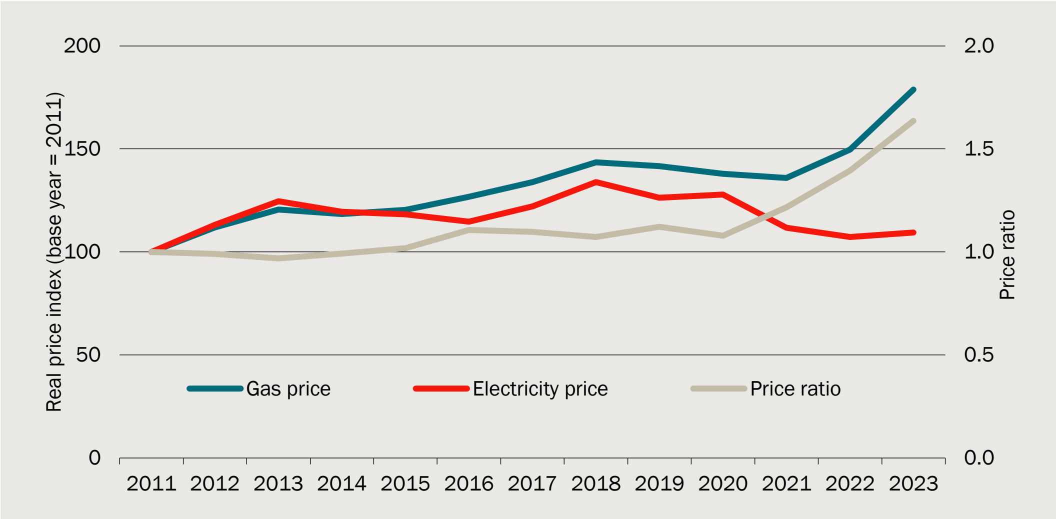
Changes in gas prices are expected to significantly influence usage patterns. People respond to an increase in price by decreasing their consumption. For cooking, hot-water and space heating households can choose between gas and electricity. Therefore, electricity prices also influence gas usage. If electricity prices rise, consumers are likely to shift away from electricity towards using more gas.

Wholesale costs, network charges and a retail margin are the three main components of a typical energy bill. Changes in energy prices have mainly been influenced by changes in wholesale prices.

Gas prices and electricity prices over the past decade

Historically, gas has been more expensive than electricity, but after 2020, this gap widened significantly, with gas prices soaring while electricity prices dipped (see Chart 2.11).

2.11 Residential gas prices, electricity prices and price ratio



Note: Price ratio = Gas price/Electricity price.

Data source: ABS Consumer Price Index, The CIE.

In 2020, wholesale gas prices hit their lowest point since 2015, resulting in lower retail bills. However, by September 2021, retail gas prices surged again, driven by wholesale price fluctuations.[25] A sharp surge in prices was observed in 2022, particularly due to the Russian invasion of Ukraine. This, combined with concerns over domestic fuel supply and other factors such as fluctuations in wind and solar output and an early winter in certain areas, led to an 'energy squeeze' and higher prices. Wholesale gas price movements continued to influence retail prices until September 2023.

On the other hand, electricity prices dropped after peaking in 2018 and 2019, mainly due to lower wholesale costs driven by renewable energy generation and moderate weather conditions. Prices in most jurisdictions were the lowest they had been over the past five years. However, in 2022, electricity prices surged to record levels due to breakdowns at coal-fired power stations, and rain and supply chain disruptions. Since then, a shift to renewable energy and other factors such as milder weather have led to a decrease in wholesale electricity prices, although it takes time for these reductions to flow through to retain tariffs.

Gas prices relative to electricity prices

Gas and electricity are substitute goods. When gas prices are high relative to electricity prices, consumers would be expected to relatively increase their consumption of electricity compared to gas. From 2020 to 2023, household retail prices rose by 30 per cent for gas but fell by 15 per cent for electricity, in real terms. Chart 4.11 shows the ratio of gas prices to electricity prices for the past 10 years, revealing a sharp increase in the gas prices relative to electricity prices post 2020.

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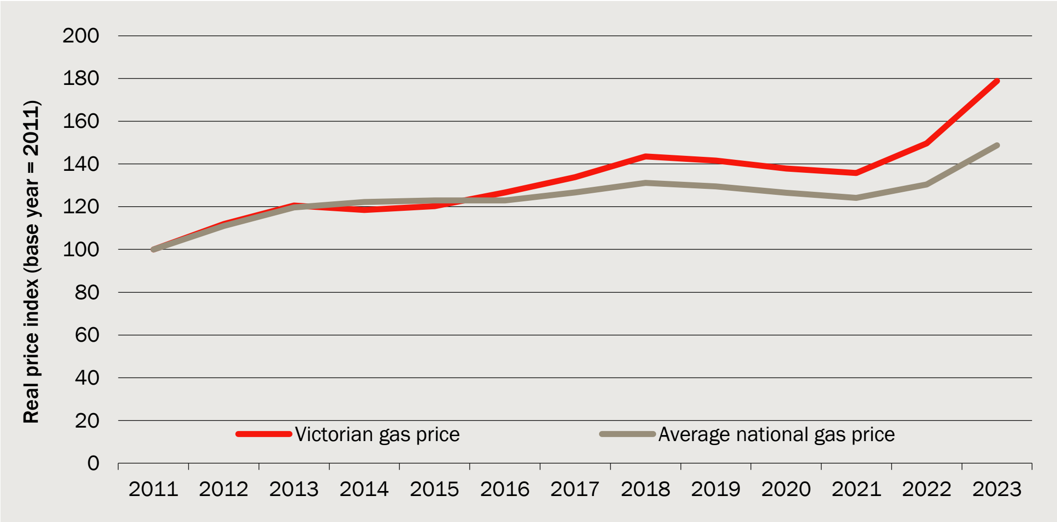
25 Reserve Bank of Australia, 2022, *Statement on Monetary Policy,* Box A: Recent Developments in Energy Prices, available at: https://www.rba.gov.au/publications/smp/2022/aug/box-a-recent-developments-in-energy-prices.html

Victoria versus other states on the East Coast

Wholesale gas prices in Victoria are lower, partly due to higher number of residential gas customers, resulting in cost savings due to economies of scale in pipeline network costs. High household usage in Victoria results in fixed supply charge being distributed across a larger customer base when assessing costs on a per-unit basis.

Nonetheless, a higher gas consumption in Victoria leads to higher annual gas expenses compared to other regions, notwithstanding the lower cost per unit. Chart 2.12 shows retail prices in Victoria have gone up more than in other states.

2.12 Gas prices in Victoria compared to the national average gas prices



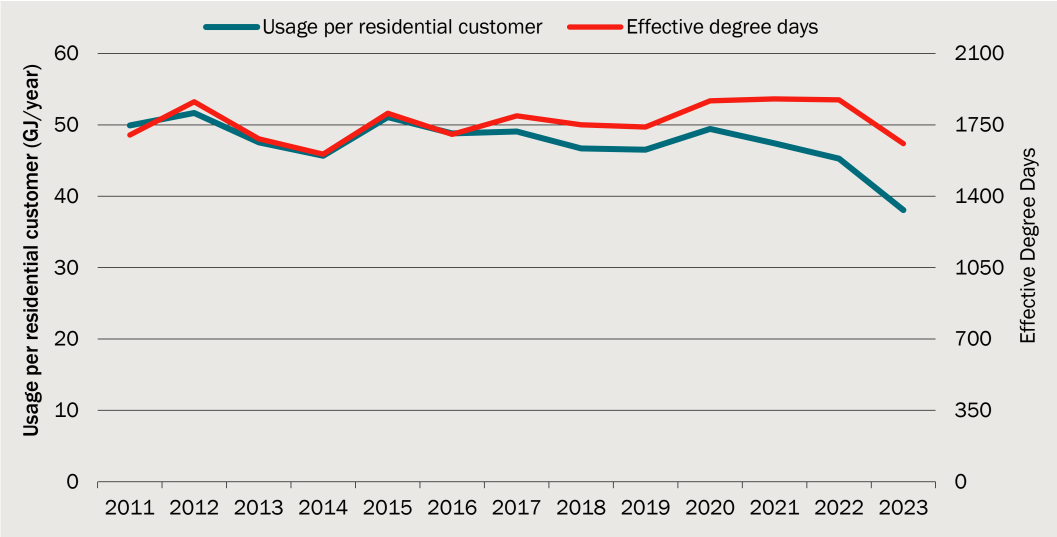
Data source: ABS, The CIE.

Weather impacts

Weather is the most important short-term driver of gas usage. Weather outcomes are shown in terms of effective degree days, the preferred measure for both gas forecasting and understanding gas usage per customer.

Chart 2.13 examines the relationship between consumption and EDD over time. Typically, gas usage increases during colder weather. However, the spike in 2019 can be attributed to both colder weather and COVID restrictions, which compelled people to stay indoors, thus increasing their gas usage. Furthermore, from 2020 to 2022, the relationship appears less robust, with gas usage declining despite stable weather conditions.

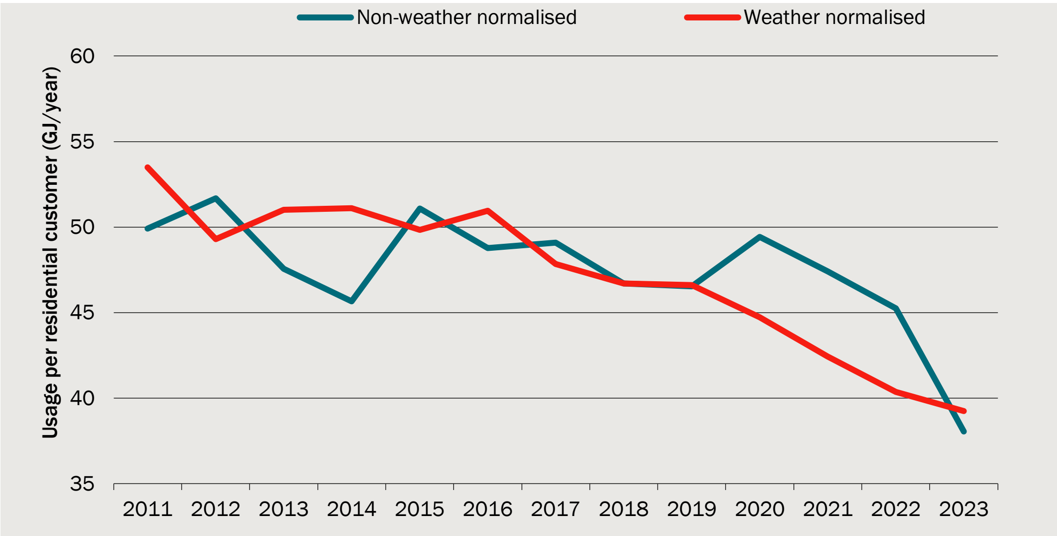
2.13 Gas usage per residential customer and EDD



Data source: CIE.

To check if there has been a decline in the gas usage trend over time, we look at consumption trends without the influence of weather variations. As weather normalised usage lies consistently below non-weather normalised usage after 2019, it implies that after adjusting for weather conditions, actual usage has been decreasing (see Chart 2.14, showing residential usage only to illustrate).

2.14 Weather normalised usage per residential customer



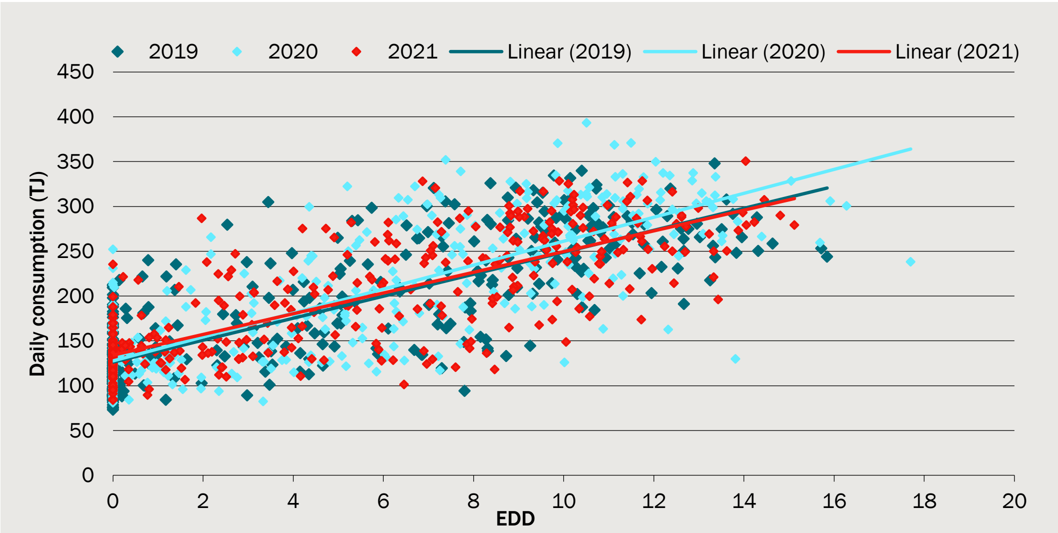
Data source: CIE.

We can examine the daily consumption of tariff V customers (residential and commercial) by using data from flow points in the network.

- In Chart 2.15, we set out daily gas use for tariff V customers against effective degree days for 2019, 2020 and 2021.

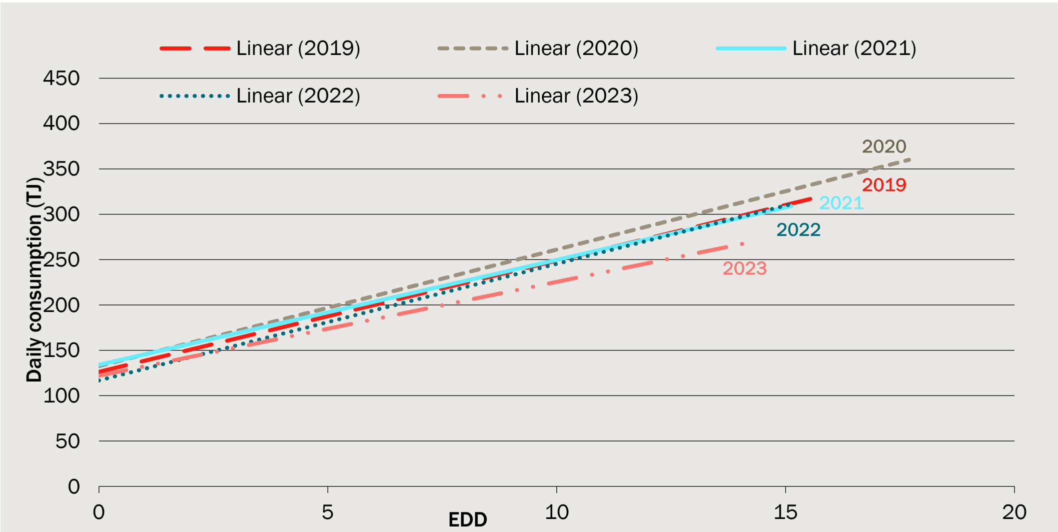
- The colder outcomes for 2020 can be seen in the somewhat larger number of points being concentrated on the right side, with effective degree days greater than 10, compared to previous years.
- Chart 2.16 shows trend lines over 5 years from 2019 to 2023. There is little difference in consumption for a given level of EDDs, as shown by the similarity of trend lines for 2019, 2021 and 2022.
- The intercept indicates gas consumption when EDD is equal to 0. A decreasing intercept over each year in Chart 2.16 further indicates that gas usage is declining. The slope for 2023 is also considerably flatter than the preceding years. This means that for a given level of EDD, gas consumption is lower than in previous years.

2.15 Gas use for tariff V customer and effective degree days over 3 years



Data source: AusNet, CIE.

2.16 Gas use for tariff V customer and effective degree days over 5 years



Data source: AusNet, CIE.

3 The CIE's approach

What is required to be forecast

Table 3.1 summarises the forecasts produced in this report.

3.1 Forecast items

Forecast item	Customer type	Customer zone
Customer numbers	Residential	LGA and postcode
	Commercial	LGA and postcode
	Tariff D/M	LGA
Disconnections	Residential	Aggregate, Central, West
	Commercial	Aggregate, Central, West
Usage – by block	Residential	Aggregate, Central, West
	Commercial	Aggregate, Central, West
Maximum hourly quantity	Tariff D/M	Aggregate, Central, West

Source: CIE.

The forecasts are developed to 2028, with a starting year of the partially complete 2021 calendar year. In 2023, the annual regulatory period will change from calendar years to financial years, meaning that a forecast must be prepared for the 'stub period' covering 1st January 2023 to 30th June 2023 and for the financial years from 2023/24 to 2027/28.

Principles of forecasting

Forecasting is an inherently imprecise science. In arriving at demand forecasts for a regulatory determination:

- it is important that forecasts are unbiased. That is, projections do not systematically understate or overstate demand and hence lead to an overstatement or understatement of prices necessary to generate the allowable rate of return, and
- it is important that forecasts are as accurate as is possible. The less accurate the forecast the greater the risks to the regulated business and customers.

Forecasts can be inaccurate but unbiased if over a sufficiently long period of time the forecast error is zero or in expectation the forecast error is zero. This would be the case for climatic conditions for example which are inherently uncertain.

There are many possible areas where forecast errors can arise. They have been detailed in technical terms by Hendry and Clements 2001 (shown in table 2.3). In plain English, the main areas of forecast error in gas forecasting are likely to be:

- uncertainty around drivers of gas use, such as
  - climatic conditions
  - economic activity, and
  - population
- uncertainty around the impact that past drivers of gas use will have in the future, such as:
  - weather impacts remaining similar to those experienced in the past
  - uptake rates remaining similar to those experienced in the past
  - commercial uses remaining similar to those of the past, and
- impacts of additional policy, with many policies concurrently being undertaken that will impact on gas use.

3.2 Forecast error taxonomy

1 Shifts in the coefficients of stochastic terms	2 Shifts in the coefficients of stochastic terms
3 Misspecification of deterministic trends	4 Misspecification of stochastic terms
5 Misestimation of the coefficients of deterministic terms	6 Misestimation of the coefficients of stochastic terms
7 Mismeasurement of the data	8 Changes in the variances of the errors
9 Errors cumulating over the forecast horizon	

Source: Hendry, D. and M. Clements (2001), "Economic forecasting: some lessons from recent research", *Economic modelling*, vol. 20(2), (March, pp. 301–29).

The uncertainty around demand drivers can have substantial impacts on the ability of a regulated business to achieve its regulated rate of return. For example, if winters were mild over the next five years then gas consumption might be 5 per cent lower than projected under average climatic conditions, leading to significant reductions in the rate of return achieved by the business. The variations in demand forecasts that have the greatest impact on regulated rates of return are those that are systematic. For example, a shift in average climatic conditions due to climate change could lead to regulated revenues being higher or lower than required over a long period of time. In comparison, annual volatility would impact on revenue for a only single year.

Basis of arriving at forecasts

The projections in this report have followed a three step process.

- Describing changes in gas use over the period for which data is available. This has typically been undertaken using statistical analysis of AusNet Services's billing database and daily outcomes, as set out in the previous chapter.

- Understanding the drivers of these changes, particularly those drivers that can be projected forward.
- Projecting forward using independent estimates of drivers and adjustments reflecting the impact of additional change not part of the historical time series, such as policies.

We have then considered projections relative to a continuation of historical trends in new connections and usage per connection, as a top-down check on the validity of projections.

A large part of the work has involved statistical analysis of AusNet Services' billing database, to identify trends in consumption at a much smaller granularity than possible through aggregate analysis. We consider that this allows a better understanding in particular of the consumption of new customers vis-à-vis existing customers and the impact of weather and prices on consumption.

Note that all statistical analysis has been in-sample — i.e. using historical data on usage and drivers and establishing relationships within this sample. We recognise that out-of-sample is preferable for forecasting, as stressed by ACIL Tasman, but that this is not plausible given the data available for this project[26]. In practice, any reasonable forecasting exercise will involve the use of both statistical models and judgement.[27]

The basic conceptual forecasting model that we work with is a set of dependent variables representing demand (a vector of customer numbers, customer consumption, etc) and their relationship to a set of demand driver variables. Mathematically, this can be represented as follows.[28]

$$\widetilde{D}_t = B.\widetilde{X}_{t/t-1} + \widetilde{\varepsilon}_t$$

Where

$\widetilde{D}_t$ is a Nx1 vector capturing N different types of demand at time t.

$\widetilde{X}_{t/t-1}$ is a Mx1 vector of explanatory variables (such as population level, income level). It can be for variables of the current period (t) or past periods (such as t-1)

B is a NxM matrix of coefficients (such as the response of customer numbers to a higher population)

$\widetilde{\varepsilon}_t$ is a Nx1 vector of error terms in the forecasts

For the purposes of forecasting, we are seeking to identify $\widetilde{D}_{t+n}$ — i.e. demand in future years with n = 1 to 5. Clearly then, with a model specified as above, this requires some

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26 ACIL Tasman 2010, *Victorian electricity distribution price review: review of electricity sales and customer number forecasts*, prepared for the Australian Energy Regulator, April, p. 4.

27 Reserve Bank of Australia 2004, 'Better than a coin toss: the thankless task of economic forecasting', speech by Deputy Governor GR Stevens 17 August 2004, also reported in the Reserve Bank of Australia Bulletin September 2004.

28 Note that this sets out the deterministic components only. We have not sought to model the stochastic component.

understanding of $\tilde{X}$ in future periods rather than purely population growth from past periods. In the absence of this information, our forecast model has not assisted in improving forecasts. For this reason, we focus on $\tilde{X}$ for which there are *independent and publicly available* projections.

The second main element of the model is the coefficients B. In some instances, these can be arrived at through statistical estimation using historical data. Under the assumption that the historical coefficients will remain unchanged in the future these can then be used for projections.

But also note that $\tilde{X}$ can capture future drivers such as policy change, for which coefficients cannot be estimated statistically.

For the purposes of gas demand forecasting for the AER, the distributor has to satisfy the AER that forecasts used in setting reference tariff(s) are arrived at on a *reasonable* basis and represent the best forecast or estimate possible in the circumstances. We consider that this is satisfied by:

- using independent projections of drivers
- estimating B using statistical analysis where possible, and
- where B cannot be estimated empirically using independent studies or assessments of impacts.

We split our analysis into analysis of customer numbers and analysis of usage per customer.

Possible drivers of gas demand

For regulatory purposes gas demand comprises customer numbers, the amount of gas that they use and, for some customers the maximum gas that they use. There are many potential drivers of these measures of demand. For the purposes of forecasting, it is only useful to understand drivers that can themselves be projected or for which there are clearly independent measures of demand available. For example, if it was found that dwelling size was an important driver of residential gas use but there was no independent projections of dwelling size or means to project dwelling size then this would not assist in developing projections of gas demand. Drivers of demand that we consider are:

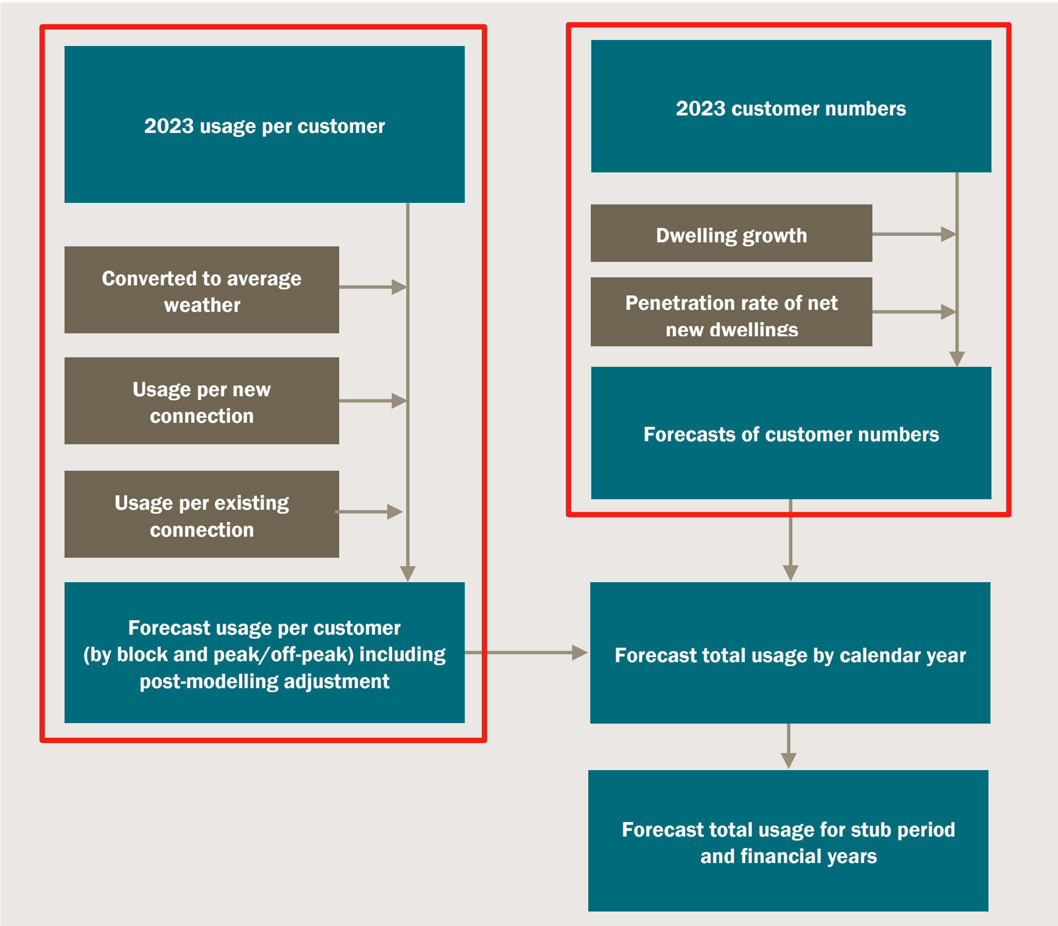
- population growth — the level of population growth is a major driver of the catchment for potential gas customers
- expansions of AusNet Services' network
- weather — consumption is impacted by temperature and other climatic conditions captured in measures of effective degree days
- the age of the connection, with new customers potentially having different characteristics to existing customers
- the composition of dwellings, with flats using considerably less gas than houses
- government policies

  - there are a range of policies at the Australian Government level and Victorian Government level that could impact on gas use and gas connections, ranging from subsidies (eg First Home Owners Grant) to a carbon tax, and
  - policies aimed at building design are likely to be particularly important for gas use
- types of activities businesses are undertaking, such as growth or slowing in retail sectors, and
- prices of wholesale gas and alternative fuels such as electricity.

Models used to develop forecasts

The model used for developing residential gas connections and usage forecasts is set out in chart 3.3. A similar model is employed for commercial, albeit with different drivers. The conversion of calendar year forecasts to financial years and estimation of usage for the stub period takes place at the end of the forecasting methodology.

3.3 Forecasts of gas connections and usage



Data source: CIE.

Approach to formal statistical analysis

The formal statistical analysis is undertaken using panel data regression in STATA, a statistical software package. Our approach has allowed for:

- Testing of different models.
- Undertaking a variable selection process from general to specific, to identify a parsimonious model of gas use.

The models are shown in the relevant chapters.

4 Residential customer numbers

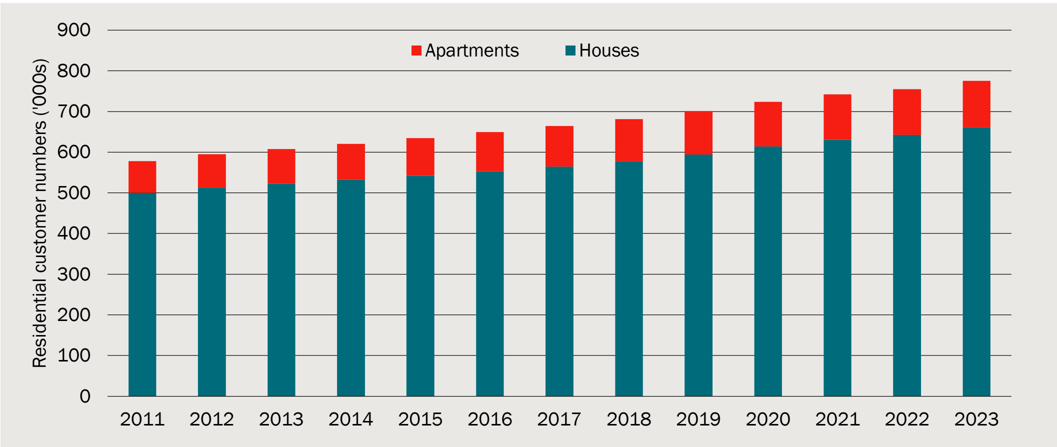
Residential customers are connections to the gas network by households. Combined with average use per customer, they drive total gas usage across AusNet's gas network. We project residential customers numbers based on assumed relationships between future dwelling completions and new customer connections, together with assumptions about the number of existing customers that disconnect.

Snapshot of residential customer numbers

The data shown in chart 4.1 and our forecasts of customer numbers are based on a time series of the number of customers in each year between 2011 and 2023, provided by AusNet. The most recent data point in this time series shows that there were 775 610 residential customers at the end of 2023. Of these customers, over 85 per cent reside in houses, with the remainder in apartments.

In addition to these data, AusNet have provided billing data until the end of December 2023, from which we can estimate a count of customers in each postcode, and splits of customers into houses and apartments. We have used counts of customers estimated by The CIE using this billing dataset to prepare forecasts of net new customers, which are then added to the starting point shown in chart 4.1.

4.1 AusNet residential customer numbers by dwelling type



Data source: CIE.

Geographical breakdown of customers

AusNet's customers are largely spread in the Western half of Victoria – stretching from the Western suburbs of Melbourne, out to the Western regional and rural areas of the state. Currently, AusNet's customers are spread over 117 postcodes.

As noted below, 'occupied private dwellings' are a key driver of residential customer numbers. The Victorian Government provides long-term forecasts of 'occupied private dwellings' at the LGA level. Given this, we estimate the postcode level data from the forecasts using concordance tables or correspondence data that we generate between 2023 LGA data and 2021 postcode data linked using mesh block correspondence data. Therefore, we allocate Victoria in Future 2023 forecast on occupied private dwelling and ABS dwelling data across Victorian LGA covered by AusNet to the 117 postcodes areas using concordance tables between postcodes and LGAs that we have combined for this purpose.[29] Similarly, we have used this correspondence data to allocate customer numbers across LGAs set out in Table 4.2.

4.2 Residential Customer Numbers by LGA (UTD 2023)

LGA	Residential Customer Numbers
	Number of customers
Ararat (RC)	3 406
Ballarat (C)	49 961
Brimbank (C)	160 437
Campaspe (S)	8 551
Central Goldfields (S)	4 201
Colac-Otway (S)	6 862
Corangamite (S)	0
Darebin (C)	3
Glenelg (S)	4 565
Golden Plains (S)	8 900
Greater Bendigo (C)	36 352
Greater Geelong (C)	116 311
Hepburn (S)	3 588
Hindmarsh (S)	0
Hobsons Bay (C)	35 688
Horsham (RC)	6 559
Hume (C)	78 107
Loddon (S)	0
Macedon Ranges (S)	8 613
Maribyrnong (C)	26 504

29 1270.0.55.003; We created correspondence data between ABS postcode area 2016 data to ABS LGA 2020 linking them using Mesh block correspondence data. This was done because the newest correspondence between LGA 2020 and postcode area 2020 is not available and due to be released at the time of this analysis.

LGA	Residential Customer Numbers
Melbourne (C)	5 907
Melton (C)	104 645
Mitchell (S)	0
Moonee Valley (C)	24 566
Moorabool (S)	0
Moreland (C)	40 777
Mount Alexander (S)	3 367
Moyne (S)	2 487
Northern Grampians (S)	2 367
Pyrenees (S)	110
Queenscliffe (B)	0
Southern Grampians (S)	3 863
Surf Coast (S)	9 247
Warrnambool (C)	14 156
West Wimmera (S)	0
Whittlesea (C)	0
Wyndham (C)	5 509
Yarriambiack (S)	0
Total	**775 610**

Note: Based on customer billing data up to the end of June 2021

Source: CIE.

Drivers of residential customer numbers

Forecast dwelling completions

A key driver of future connections is the expected number of future occupied dwellings. To estimate both the historical and future rate of occupied dwellings, we combine information on dwelling approvals in each LGA[30] and then adjust these totals by converting dwelling approvals to completions based on a completion rate (see table 4.3). These figures are further disaggregated down to the postcode level using a corresponding we have developed between ABS LGAs within the AusNet area and mesh block categories.

4.3 Assumptions to convert dwelling approvals into additions to the dwelling stock

Area	Definition	Assumption
Demolition rate in Victoria	Existing houses knocked down (per cent of approvals)	7.04 per cent
Houses completions in Victoria	Per cent of houses approvals that are not completed as a dwelling	3.6 per cent

30 See Building Approvals by Local Government Area, https://stat.data.abs.gov.au/Index.aspx?DatasetCode=BA_GCCSA (accessed July 2021)

Area	Definition	Assumption
Completions for other dwelling types in Victoria (includes units, flats, etc)	Per cent of approvals for other dwelling types that are not completed as a dwelling	6.85 per cent
Lag for houses	Lag between dwelling approval and completed house	0 years
Lag for other dwelling types	Lag between dwelling approval and completed dwelling	2 years

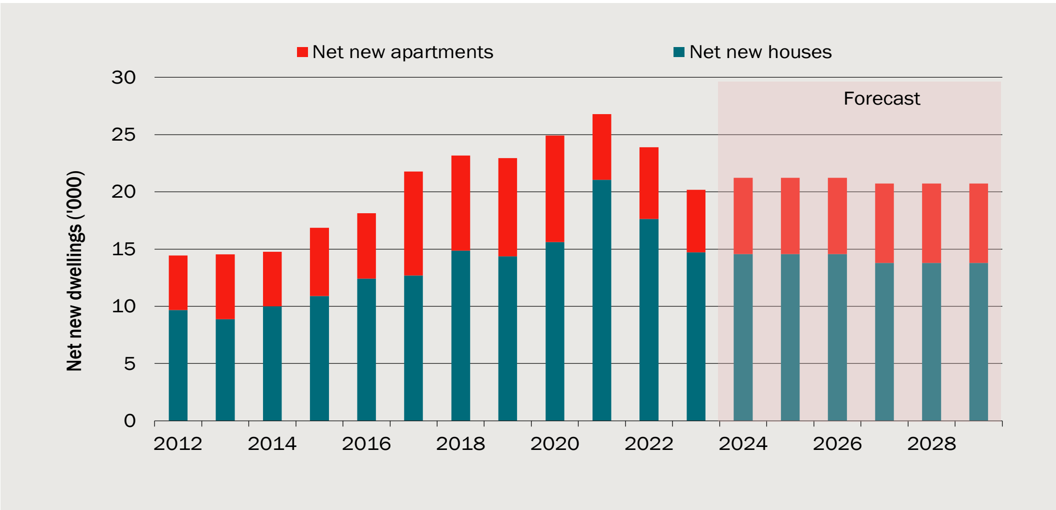
Note: The effective lag for houses is 6 months and for other dwellings is 2.5 years given the approval data are in Fiscal year and Customer data is calculated in calendar year

Source: NHSC 2011; CIE.

The Victorian Government provides an estimate of occupied private dwellings in each LGA in 2021, 2026, 2031 and 2036.[31] From these data we project a time series based on the growth rates between ach forecast interval from the Victoria in Future dataset. The number of net new dwellings has been high in recent years, peaking in 2021. The latest available forecasts by the Victorian Government suggest dwelling growth will be below these recent highs in future years (chart 4.4).

A key driver of high approval numbers, particularly for houses in 2021 is the HomeBuilder program,[32] whereby eligible owner occupiers were provided with a grant to support building or substantially renovating a home. This program ended at 31 March 2021. Grants were up to $25 000 and a total of 32 823 applications were made for new builds in Victoria under the scheme.

4.4 Net new dwellings by type, based on Victoria in Future projections



Note: This excludes postcodes fully within the Campaspe, Darebin, Melbourne, Mitchell, West Wimmera, Whittlesea, Yarriambiack LGAs, which have average penetration rates of below 10 per cent.

Data source: CIE.

31 See the Victoria in Future forecasts, https://www.planning.vic.gov.au/land-use-and-population-research/victoria-in-future (accessed July 2021)

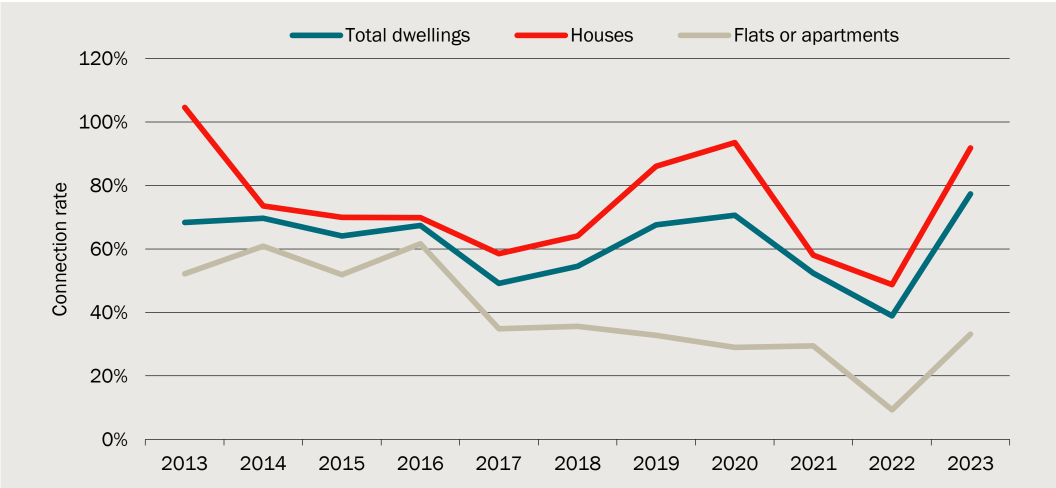
32 See https://treasury.gov.au/coronavirus/homebuilder

Baseline preferences for gas (connection rate)

The preferences for households are measured by the connection rate, which is measured by the as ratio of net new customers to net new dwellings (i.e. the proportion of new dwellings that connect to the gas network).

The connection rates for houses are typically higher than apartments and this difference appears to have increased throughout time. The overall rate appears to fluctuate throughout time, peaking in 2020 at around 92 per cent for houses and reaching a trough in 2022 at around 50 per cent. This appears to have reversed for the most recent year of data for 2023 (chart 4.5).

4.5 Connection rate in AusNet's area



Note: The marginal penetration rate is defined as net new customers divided by net new dwellings. *This excludes postcodes fully within the Campaspe, Darebin, Melbourne, Mitchell, West Wimmera, Whittlesea, Yarriambiack LGAs, which have average penetration rates of below 10 per cent.*

Data source: CIE.

Impact of government policies

The future rate at which new dwellings will connect to gas will be impacted by government policies enacted in place to both restrict and discourage new gas connections. We have accounted for two impacts:

- Dwellings which require planning permits that have been lodged or approved after 1 January 2024 are ineligible to connect to the gas network. However, we expect a significant lagged impact on the number of dwellings that become ineligible to connect. We assume that 80 per cent of future dwellings will be ineligible to connect to gas as a result of the policy. The delay between lodging a planning permit and having a meter connected is 4-5 years on average, meaning that the full impact of the policy is not felt until up to ten-years after the introduction of the connection ban (chart 4.5).
- We estimate that the ESC decision that gas distributors pass on the full efficient costs of connection ($1778/dwelling additional upfront costs) leads to a reduction in new customer connections of 4.5 per cent.

These policies have a downward impact on the marginal penetration rate (defined as the number of net new customers per dwelling that is still permitted to connect to gas) The impact of these policy changes on the marginal penetration is shown in table 4.6.

4.6 Impact of governments policies on the marginal penetration rate

Projection of MPR	2024	2025	2026	2027	2028	2029
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
3-year average MPR for each postcode	56.3	56.3	56.3	53.8	53.8	53.8
Percentage point reduction due to banning planning permits	1.6	9.7	20.3	28.8	35.9	40.3
Further percentage point reduction due to passing through upfront cost of connection	2.4	4.1	3.2	2.2	1.6	1.2
Final projected MPR	**52.2**	**42.5**	**32.9**	**22.8**	**16.4**	**12.3**

Source: CIE.

Forecasts of residential customer numbers

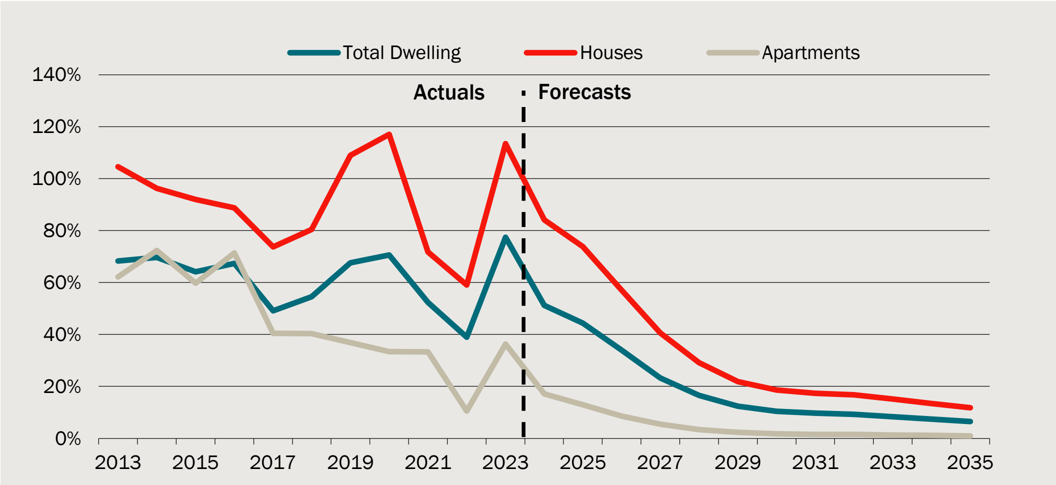
To forecast residential customer numbers across the 117 postcodes within the AusNet footprint, we apply the forecast marginal penetration rate to the forecast number of net new dwellings.

To forecast the marginal penetration rate, we assume a current (2024) value equal to the average of the previous 3 years values for the marginal penetration rate for houses and a trend decline for apartments (based on the observed historical decline in penetration rates). This starting point is then altered by the expected impact of the various policies, including:

- A decrease in the number of potential dwellings completed each year that are eligible to connect to gas (given by chart 4.7)
- A decrease in the level of demand of 4.5 per cent in response to an increase in connection costs of 25 per cent (or $1 778 per new connection per customer)

This leads to a strong decline in the marginal penetration rate across all dwelling types in 2024 and beyond. The marginal penetration rate across all dwellings decreases from almost 80 per cent in 2023 to 20 per cent by 2028 (chart 4.7).

4.7 Penetration rates in AusNet area (with forecast), Scenario 0

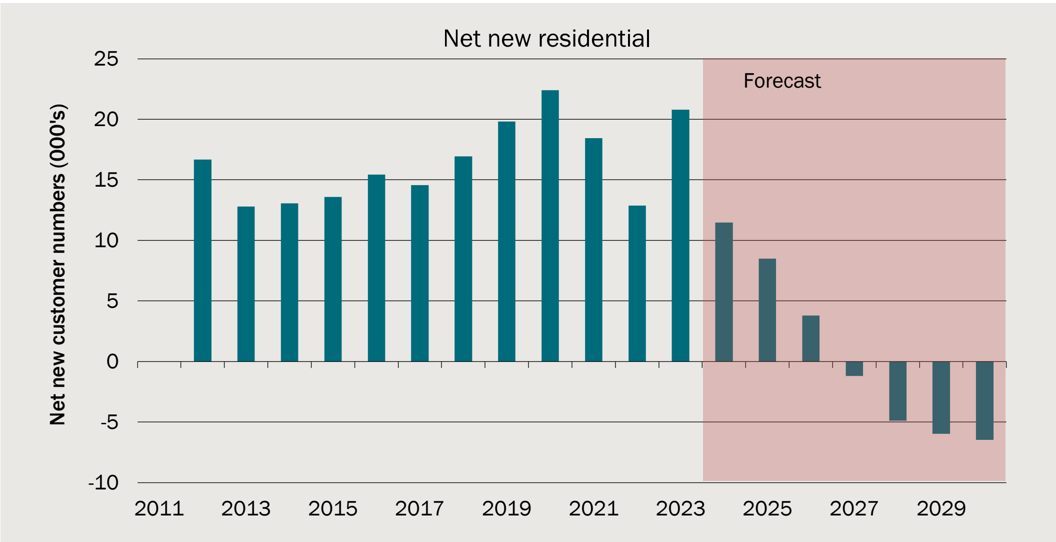


Note: This excludes the Campaspe, Darebin, Melbourne, Mitchell, West Wimmera, Whittlesea, and Yarriambiack LGAs, which have average penetration rates of below 10 per cent.

Data source: CIE.

Where previously, net new customers would primarily be driven by the level of residential development, the number of net new customers is now effectively capped by development that was lodged or determined prior to 1 January 2024 and decreases over time. This can be seen in the number of projected net new customers, which declines sharply from over 20 000 net new customers in 2023 to under 5 000 net new customers in 2026 and then a net loss in customers thereafter. The net loss in customers is driven by disconnections exceeding the rate of new connections.

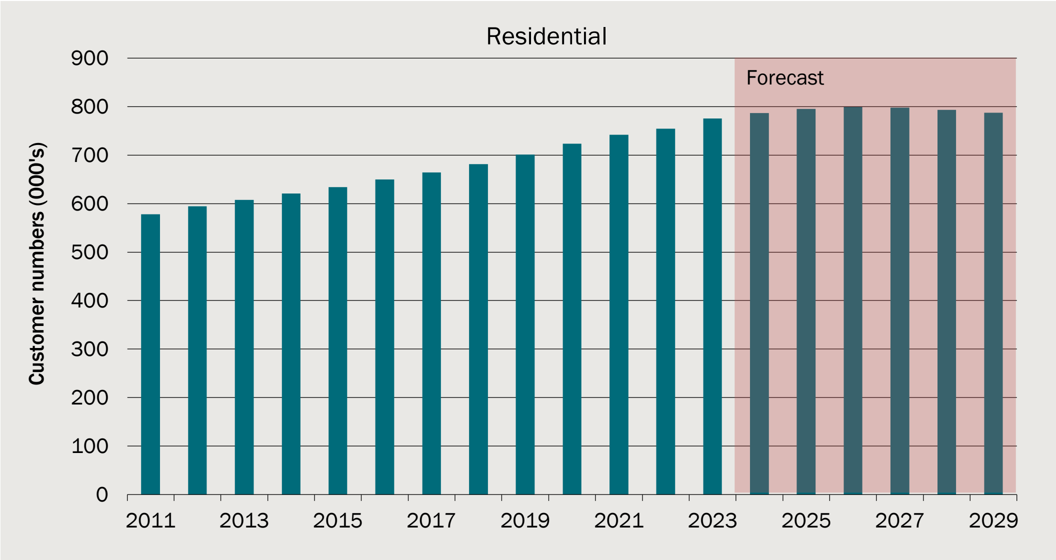
4.8 Net new residential customers, Scenario 0



Data source: The CIE

Expressed in terms of total customer numbers, the trend increase in the number of residential customers effectively flattens off after 2024. With subdued growth, the effect of disconnections begins to outpace new connections, leading to an eventual decline in the AusNet customer base (chart 4.9).

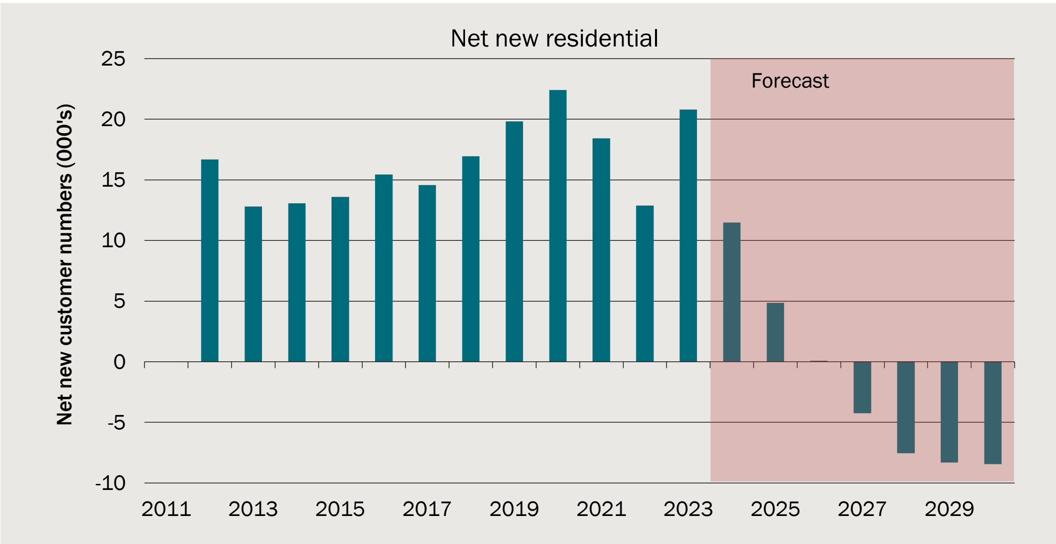
4.9 Total residential customers, Scenario 0



Data source: The CIE

Net new residential customers decline more sharply under Scenario 4, which maintains the same assumptions as scenario 0, but assumes a decline in the connection rate for houses to 60 per cent in 2025, with a further (linear) decline to 20 per cent in 2029. This accounts for changing customer sentiment for those dwellings that are able to connect to gas (scenario 0 assumes the historical connection rate applies to eligible properties) (chart 4.10)

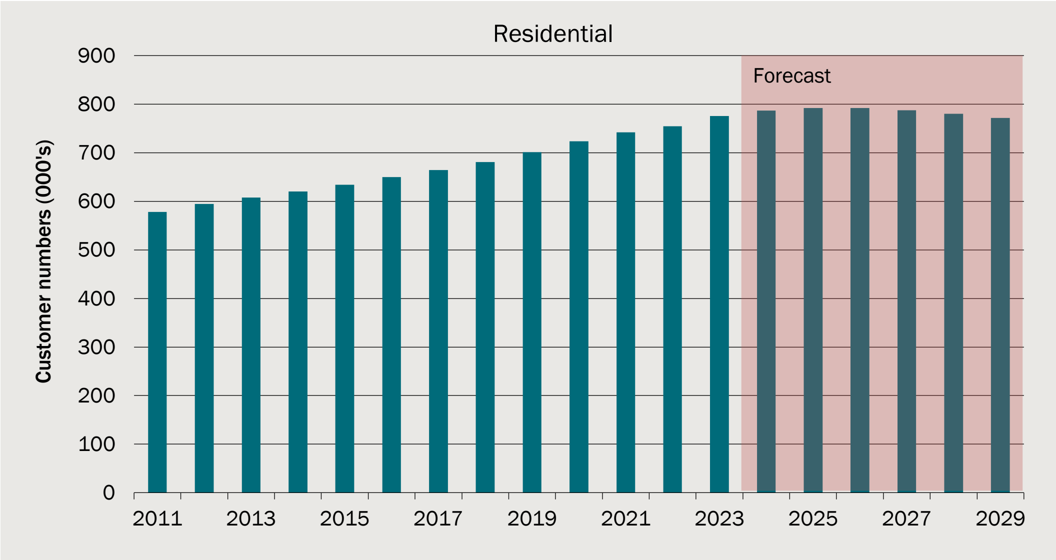
4.10 Net new residential customers, Scenario 4



Data source: The CIE

The total residential customer forecast flattens off more strongly in Scenario 4, compared to scenario 0, due to the downward impacts of changing customer sentiment (chart 4.11)

4.11 Total residential customers, Scenario 4



Data source: The CIE

Conversion from calendar to financial years

To convert forecasts for future calendar years into forecasts aligning to the new regulatory years, which are financial years plus a stub (half-year) period in 2023, we assume that half of net new customers in a calendar year connect in the first of the year, and the remaining half connect in the second half of the year. Therefore, the number of net new connections in a half-year period is half the number of net new connections in that calendar year. Relatedly, the number of net new connections in a financial year is the average of the number of net new connections in the preceding and subsequent calendar years.

Based on this approach, we estimate the number of connections for financial years and the stub period as shown in table 4.12.

4.12 Forecast residential customer numbers for new regulatory years, scenario 0

Year	Central	West	Adjoining Central	Adjoining West
	No.	No.	No.	No.
2020	560 241	151 553	2 769	8 925
2021	575 343	154 425	2 940	9 214
2022	585 864	156 470	3 079	9 393
2023 stub	594 584	158 012	3 139	9 474
2023/24	608 284	160 203	3 244	9 613
2024/25	617 020	161 270	3 326	9 714
2025/26	622 594	161 729	3 386	9 771
2026/27	624 149	161 444	3 420	9 775
2027/28	622 119	160 467	3 431	9 731

Source: The CIE

The forecasts on a per financial year basis are similarly presented for scenario 4 (table 4.13.

4.13 Forecast residential customer numbers for new regulatory years, scenario 4

Year	Central	West	Adjoining Central	Adjoining West
	No.	No.	No.	No.
2020	560 241	151 553	2 769	8 925
2021	575 343	154 425	2 940	9 214
2022	585 864	156 470	3 079	9 393
2023 stub	594 584	158 012	3 139	9 474
2023/24	608 284	160 203	3 244	9 613
2024/25	615 218	161 147	3 414	9 734
2025/26	617 238	161 318	3 613	9 815
2026/27	615 656	160 699	3 719	9 818
2027/28	611 076	159 396	3 758	9 760

Data source: The CIE

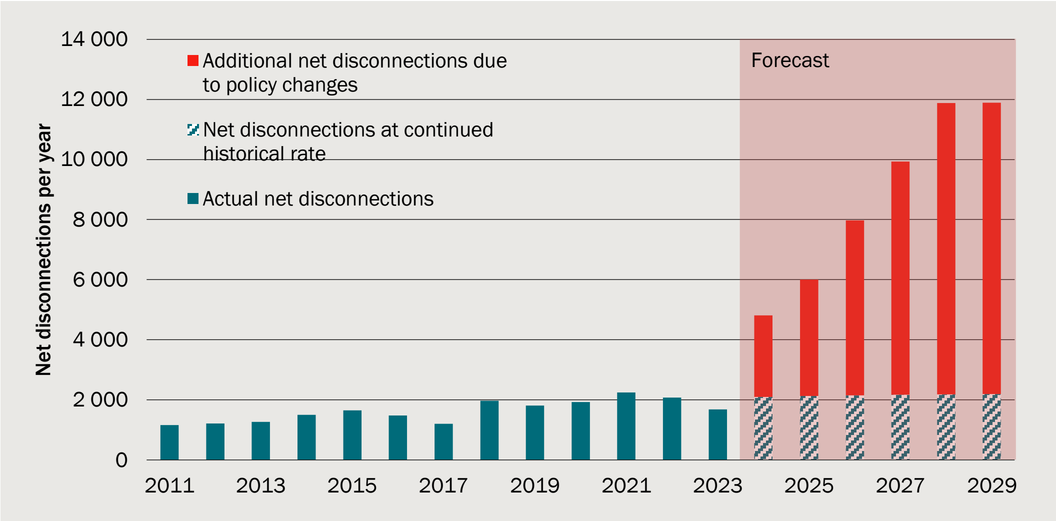
Disconnections

The rate of net disconnections among residential customers has fluctuated over time (chart 4.14). For example, in 2017 there were 1201 net disconnections of residential customers (0.18 per cent of residential customers) while 2021 saw almost twice that amount at 2244 net disconnections (0.30 per cent of residential customers).

As a starting point for building up policy impacts, we project that net disconnections will continue at their average rate over the past 3 years, which is around 2 000 customers per year (chart 4.14), or 0.27 per cent as a proportion of residential customers in each of the coming years. Based on this constant rate of disconnections as a share of residential customers, we project future disconnections to increase gradually (chart 4.15).

In addition, policy changes lead to additional disconnections beyond this historical level, reflecting a change in sentiment about gas and the removal of the abolishment charge (see Chapter 2). Expressed as a share of residential customers in 2023, the additional disconnections increase from 0.35 per cent in 2024 to 1.25 per cent by 2028 (table 4.18).

4.14 Rate of residential customer disconnections, scenario 0



Data source: CIE.

4.15 Projected residential disconnections at historical rates

Measure	2024	2025	2026	2027	2028	2029
	No.	No.	No.	No.	No.	No.
Net disconnections	2 095	2 130	2 156	2 174	2 187	2 197
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Net disconnections as a share of projected residential customers in each year	0.27	0.27	0.27	0.28	0.28	0.28

Source: CIE.

4.16 Additional residential disconnections due to policy and sentiment changes

Measure	2024	2025	2026	2027	2028	2029
	No.	No.	No.	No.	No.	No.
Net disconnections	2 715	3 878	5 817	7 756	9 695	9 695
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Net disconnections as a share of residential customers in 2023	0.35	0.50	0.75	1.00	1.25	1.25

Source: CIE.

There are clear grounds to project that abolishments will increase in AusNet's gas network. Key evidence discussed in chapter 2 includes:

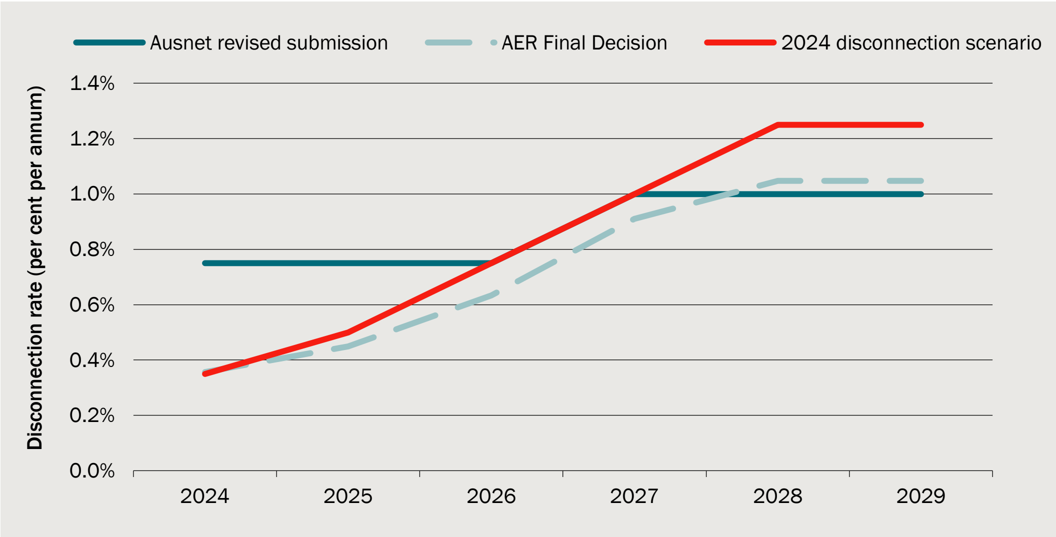
- Policy decisions by Government expected to increase abolishments, such as removal of abolishment charges and a potential effective ban on gas appliances in rental properties, which may drive further sentiment change,
- Victoria Energy Efficiency Certificates being issued for gas-to-electric appliance switching, which may precede disconnection,
- Survey data showing increasing sentiment about wanting to disconnect, and
- Increases in the number of dormant meters, which are more likely to disconnect.

However, the speed at which this increase occurs is inherently uncertain. For example, the timing of intentions to disconnect revealed through surveys translating into abolishment behaviour is uncertain. There is little past experience to draw upon to project future changes because of the unprecedented nature of the Victoria-wide transition away from residential and commercial gas usage. As a result, we has taken an assumption-driven approach about the quantum of changes in sentiment.

The disconnection rate under the '2024 disconnection scenario' is bounded by the highest observable disconnection rate already seen by a gas network in Australia. This means that we are assuming that AusNet's abolishment rate in the next 5 years does not get higher than that already seen by Evoenergy.

The projected rate of disconnections (chart 4.17) is close to the AER Final Decision in 2024, but has a higher trajectory towards an ultimately higher rate by 2028.

4.17 Comparison of disconnection projections



Data source: AER Final Decision Attachment 6 Table 6.2, available at: https://www.aer.gov.au/documents/aer-final-decision-ausnet-2023-28-attachment-6-operating-expenditure-june-2023, CIE.

Additional scenarios for residential customer numbers

There is still substantial uncertainty about new gas connections and disconnections, because of the high level of change in policies and sentiment related to gas connections. As such, we have developed a baseline scenario as well as additional scenarios which vary core assumptions to account for this uncertainty.

The baseline scenario (scenario 0) incorporates the most recent data on gas connections and disconnections as well as the quantifiable impacts of recent policy decisions and their impacts on gas take-up and usage. This baseline scenario projects forward based on customer behaviours only varying based on historical relationships with known parameters. The baseline scenario assumes a declining connection rate for apartments, while assuming a historical 3-year average connection rate for houses for properties that are still able to connect to gas.

The baseline scenario does not factor in any additional change in sentiment for detached dwellings, where home builders increasingly choose not to connect to the gas network, even where they are legally and technically able to do so. As such, we considered additional scenarios that vary as the rate at which new customers join the network per new house construction (i.e. the connection rate before the impact of other policies). While it is difficult to project a future change in customer behaviour, not considering this impact risks underestimating the possible magnitude of the changes. We have also considered additional scenarios where we varied the rate at which customers disconnect from the gas network.

Assumptions underlying the additional scenarios are as follows:

- The house connection penetration rate is projected to be 60 per cent in all postcodes from 2024 onwards. This is based on an AusNet survey finding that 40 per cent of customers expressed a desire to leave the gas network (implying that at most 60 per cent of new home builders will want to connect to gas). This establishes a baseline connection rate that reflects customer underlying preferences before they are impacted by policies.
  - A stronger variant of this assumption is an increasing share of customers expressing a desire to leave the network over time, implying a lower share of new home builders wanting gas. We project a decline from the customer connection rate from 60 per cent to 20 per cent (linearly) by 2029, reflecting a declining sentiment over time. The scenarios are set out in table 4.18.
- For disconnections, the scenarios consider different years in which disconnections reach the projected rate of 1.25 per cent. While Scenario 0 assumes this occurs in 2028, additional scenarios 2, 4 and 6 bring this forward to 2026.

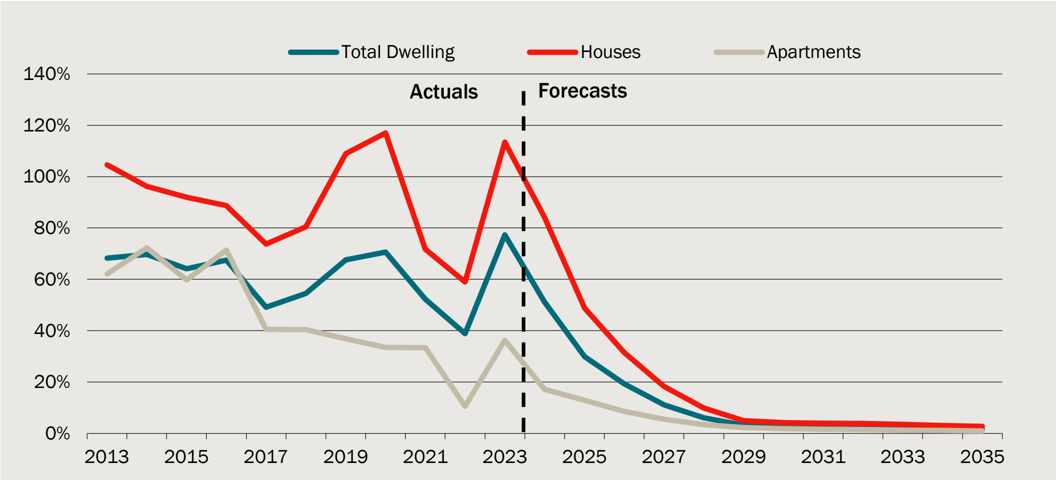
4.18 Additional scenarios for customer numbers

Scenario	Year that 1.25% disconnection rate is reached	Customer connection rate for houses
	Per cent	
Scenario 0	2028	3-year average
Scenario 1	2026	3-year average
Scenario 2	2028	60% from 2025
Scenario 3	2026	60% from 2025
Scenario 4	2028	60% in 2025, 20% by 2029
Scenario 5	2026	60% in 2025, 20% by 2030

Source: CIE.

Chart 4.19 shows the marginal penetration rate projections for Scenario 4, which differ from those for Scenario 0 in that the trajectory for houses is lower.

4.19 Marginal penetration rate in AusNet Area, Scenario 4

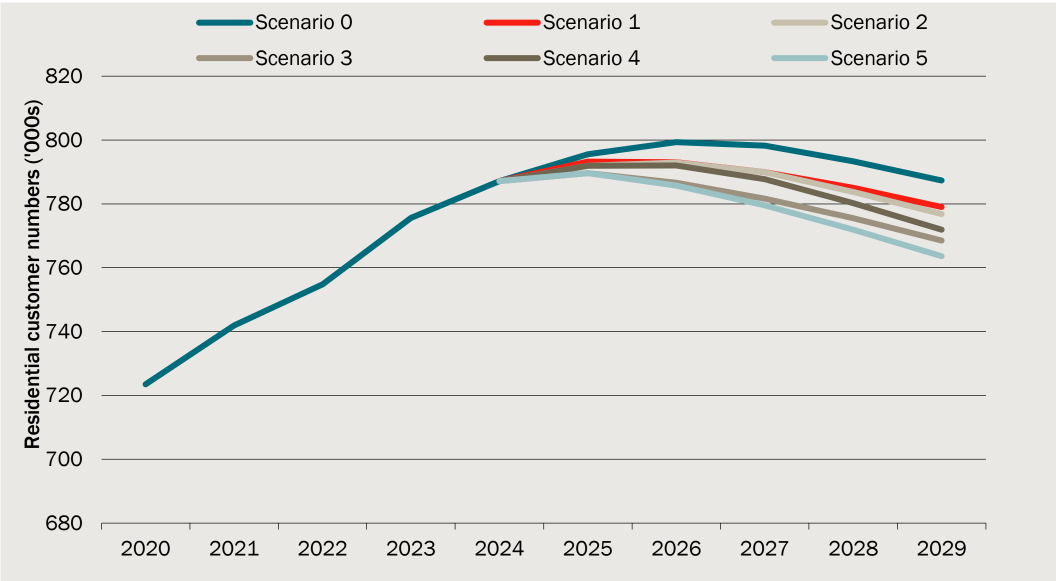


Note: This excludes postcodes fully within the Campaspe, Darebin, Melbourne, Mitchell, West Wimmera, Whittlesea, Yarriambiack LGAs, which have average penetration rates of below 10 per cent.

Data source: CIE.

Applying different combinations of these effects leads to lower projected customer numbers across all scenarios, with an almost 24 000 customer difference between scenario 5 and scenario 0 by 2029 (chart 4.20).

4.20 Residential customer numbers by scenario



Data source: CIE.

5 *Residential customer usage*

Total usage of gas by households in AusNet Services' area reflect the combination of the number of customers and usage per customer.

The usage of residential customers has changed over the last 20 years. A few major trends have driven the changes in usage, which were examined in Chapter 2. This chapter uses these changes as a basis for projecting future gas use for existing and new residential customers.

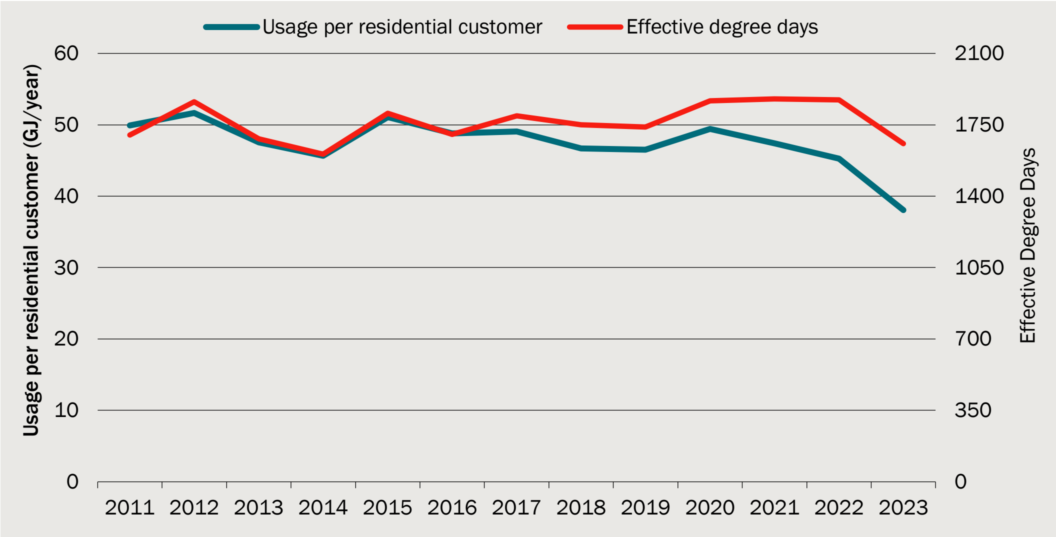
Descriptive analysis

The use of gas by residential customers varies across different customer types and has changed significantly since 2011. Assessing these changes requires looking through the year-to-year volatility in gas consumption arising from weather outcomes.

Annual residential usage per customer has been decreasing gradually over time (chart 5.1). There was a notable usage increase in 2015, however this reflected colder weather in the year. Similarly, the spike in 2020 can be attributed to a combination of weather patterns and COVID-related restrictions. Despite stable weather conditions from 2020 to 2022, residential customer usage continued to decrease. Overall, there has been a noticeable continuing decline in underlying consumption.

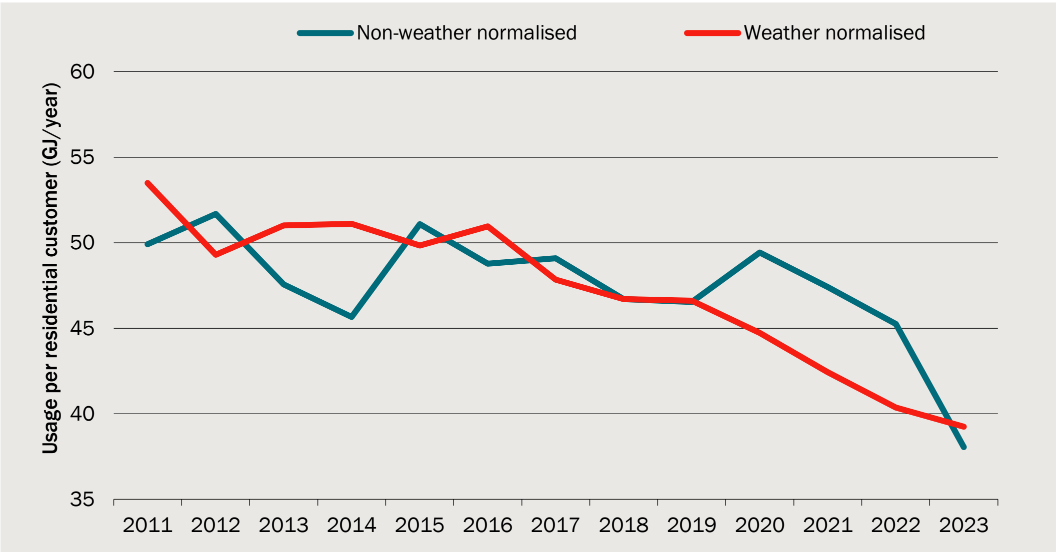
The weather-normalised usage line in Chart 5.2, represents consumption trends without the influence of yearly weather variations. Notably, there is a consistent pattern of decreasing weather-normalised usage suggesting that actual usage has been lower than expected after adjusting for weather conditions. Additionally, during the COVID and post-COVID periods (2019-2023), weather-normalised usage residential usage per customer consistently fell below non-weather normalised usage, suggesting the unique impact of the pandemic on energy consumption patterns.

5.1 Relationship between usage per residential customer and EDD



Data source: CIE.

5.2 Weather normalised usage per residential customer



Note: Usage per residential customer is weather normalised using the coefficients estimated in the statistical models presented throughout this chapter.

Data source: CIE.

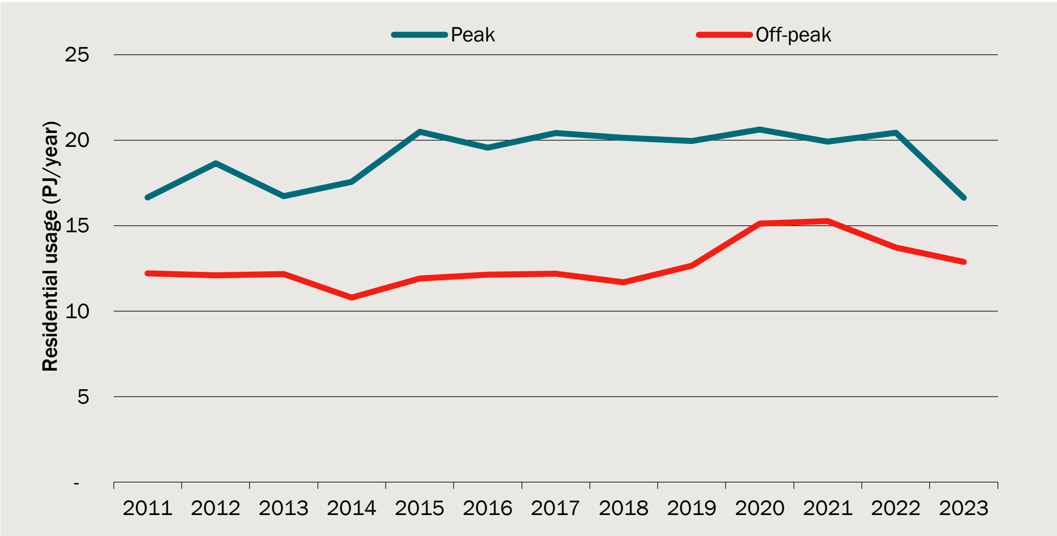
AusNet Services' tariff structures contain a peak and an off-peak period. The peak period is between 1 June until 30 September, while the off-peak period covers all other times. Approximately 60 per cent of annual gas consumption is consumed in the peak period (assuming average weather conditions).

Peak and off-peak usage of gas vary differently over time. Peak usage has grown over time as the number of customers has grown, but it dropped sharply in 2022, possibly due to the increase in the number of new connections being offset by the gradual uptake of fuel switching via electrification and the adoption of the energy efficiency Victorian Energy Upgrade (VEU) program and the Home Heating and Cooling Upgrades

Program.[33] Both schemes serve to reduce gas consumption per connection for residential customers. Peak usage also responds more strongly to weather conditions, with a proportionally larger increase in usage in 2015 associated with the cold conditions.

Off-peak usage stayed constant until 2019, implying falling usage per customer, however recently it has experienced a period of growth likely due to COVID and weather effects (chart 5.3). It stayed consistent at 2019 levels until 2021, indicating a decrease in usage per customer, before declining in 2022, possibly as the effects of COVID diminished. These differing patterns suggest that the approach to statistical analysis should account for different relationships between usage and driver variables as well as different trends over time between the peak and off-peak periods.

5.3 Comparisons of peak and off-peak usage by residential customer



Data source: CIE.

Formal statistical analysis

Analysis of key areas of change one by one cannot give a good characterisation of all the changes that have occurred together. This can only be done by formal statistical analysis. In this section we conduct formal statistical analysis of historical gas use.

Note that analysis of how change has occurred is only a starting point for the purpose of forecasting. Once we have correctly characterised historical change, we then need to understand why these changes have occurred and whether they will continue over into the next regulatory period.

33 AEMO. 2023. Victorian Gas Planning Report. Available at: https://aemo.com.au/-/media/files/gas/national_planning_and_forecasting/vgpr/2023/2023-victorian-gas-planning-report.pdf?la=en

Model form

A fixed effects model was estimated for residential gas consumption using billing data across dwellings and over time. This data is known as panel data. This model allows each household to have a different base consumption and then uses changes in this through time to assess the impact of variables that also change through time. This method is best for identifying impacts of variables that change through time, such as the weather or prices. It cannot be used for variables that remain the same for a dwelling such as the age of the building or type of dwelling.

Consistent with previous modelling, the fixed effects model specification was chosen as the base model. Other types of models that could be estimated are — a random effects model and a pooled regression model.

There are additional models explored in this analysis such as using only 2020 to capture the impact of COVID. Some models omit the COVID variable altogether, while others utilised Poisson regression instead of linear regression. However, these alternative approaches did not yield superior predictive power and thus are not reported or discussed further.

The explicit set up of the panel regression model is shown in the equation below.

$$
\begin{aligned}
q_{it} = \beta_0 + \beta_1.flat_i + \tilde{\beta}_2.year\ connected_i + \mu_i + \\
\gamma_1.year_t + \gamma_2.edd_t + \gamma_3.COVID_t + \\
\delta_1.price_{it} + \varepsilon_{it}
\end{aligned}
$$

The dependent variable, q_{it} is the natural log of the quantity of gas used by dwelling i in year t. We estimate our model using the log of consumption, as drivers would be expected to have similar percentage impacts on usage rather than similar GJ impacts on usage. The use of natural logs means that parameters can be interpreted as the per cent changes resulting from the change in the parameter.

The first row of explanatory variables contains dwelling characteristics — whether the dwelling is a single dwelling or flat (the *flat* variable), i number of (0,1) dummy variables for the year in which the dwelling was connected (the *year connected* variables) and a dwelling specific error term (μ_i).

The second row of explanatory variables is time specific characteristics, such as *year*, effective degree days (*edd*) and a dummy variable to account for COVID lockdowns.

The third row of explanatory variables is characteristics that vary by both time and dwelling, which includes *price* and an error term for that dwelling for that year.

When a fixed effects model is used then the first row becomes a constant μ_i estimated for each specific dwelling. We then follow a second-stage process of estimating a model of fixed effects based on characteristics of residential connections. The second stage of the statistical estimation is to estimate the fixed effect against connection characteristics as follows.

$$
\mu_i = \beta_0 + \beta_1.flat_i + \sum_{t=2010}^{2022} \beta_t.year\ connected + \varepsilon_i
$$

This equation estimates the customer-specific fixed effect using a set of dummy variables indicating the year that the customer was connected. A dummy variable takes either a value of 0 or a value of 1. For the dummy variable for year of connection for 2010 for example, all connections established in 2010 would have a value of 1 and all other connections would have a value of 0. We use a dummy for each year because we would not expect that the impact of year created would be linear. We have assigned a value of 1 to the year connected variable for all connections prior to 2010.

These variables have been selected for the modelling based on the data that is available and views about what the important drivers of gas demand are. Consideration has been given to the inclusion of an electricity price variable, and the reasons for not doing so are discussed further in this chapter. Importantly, in estimating these statistical models we determined that these variables have statistically significant relationships in predicting usage per customer.

We do not have income variables for each household or information on household size etc. Hence these cannot be included. It would be possible to include income variables or household size variables at a postcode level, although information would primarily be from the Census and thus not of sufficient frequency to enable accurate estimation of any income effects. This may have implications for forecasting if we could identify new customers with different incomes than existing customers. A more pragmatic alternative would be to allow a dummy variable specific to each tariff class region, however this does not change the results.

The model we estimate is based on levels of usage per household and levels of variables such as prices. Given the time and resource constraints we do not seek to model dynamic processes around the patterns of change.

Model estimation

The model form that we estimate for our base model is set out in the section above.

The model is estimated in STATA, which is a data analysis and statistical software package.[34] STATA uses generalised least squares regression to estimate coefficients for panel regressions under random effects and fixed effects assumptions. We allow for error terms in regressions to be clustered by customer in constructing the statistical significance of parameters.

For the exogenous variables we use dummy variables for the year of gas connection creation. (This variable is considered a proxy for year of dwelling creation.) We define *year* as year since 2009. We generally do not use a dummy variable approach for year because then we would not be able to differentiate between weather effects and any time trend in consumption. The use of year as a scalar variable implies that the effect is linear — i.e. each year on average leads to the same x per cent change in consumption.

34 See http://www.stata.com/ for more details.

We do not know the price paid by each customer. We have defined price as a price index for the entire state of Victoria based on a quarterly index of Victorian gas prices sourced from the Australian Bureau of Statistics for 2003-2023.[35]

Main model specification and constraining the price variable

Two models were evaluated —an unconstrained model and a constrained model where the *price* coefficient was constrained.

We analysed fixed effects models for estimation using total, peak, and off-peak residential usage as dependent variables. Table 5.4 presents the estimated coefficients and results of significant tests for models of residential usage.

Examples of interpretation of these results is as follows.

- The *year* coefficient of -0.0355 indicates that there has been a trend decrease of 3.55 per cent per year in gas consumption after accounting for other factors.
- The *EDD* coefficient of 0.000276 indicates that an additional EDD is associated with a 0.027 per cent increase in usage per customer.
- The *COVID-19* coefficient of 0.0488 indicates that gas usage increased by 4.8 per cent during the years of 2020 and 2021.

5.4 Results of residential usage fixed effects model

Sample	Total	Peak	Offpeak
Year	-0.0355***	-0.0532***	-0.0166***
EDD	0.000276***	0.000387***	0.000128***
Gas price	-0.179***	-0.0888***	-0.306***
COVID-19	0.0488***	0.0219***	0.0899***
Constant	82.31***	116.7***	44.27***
N	8646236	8646236	8646236

Note: The R^2 of the model is not presented because fixed effects do not account for individual variation, and therefore R^2 does not have a meaningful interpretation here.

P-values are indicated by the asterisks, with p<0.05 = *, p<0.01=*, p<0.001=***.

Source: CIE.

The constrained model was chosen as the main model of specification because it demonstrated higher statistical significance across all coefficients. Other coefficients in the model such as those associated with EDD and the time trend have not been constrained. We fit models that estimate these other coefficients consistent with the constrained value of the *price* coefficient.

Once we opted for the constrained model as our main model specification, we calculated coefficients for each residential usage block. However, we refrained from individually estimating the *price* coefficient for each block due to inconsistent results from model

35 Australian Bureau of Statistics, *Consumer Price Index, Australia*, March 2024, Series: A2328106A and A2331886K.

testing (variously negative and positive). Instead, we focused on two models – one for peak usage blocks and another for off-peak usage blocks.

In the model for peak usage blocks, we set the gas *price* coefficient to align with the value from the peak residential usage model, which was -0.09. Likewise, in the model for off-peak usage blocks, we adjusted the gas *price* coefficient to match the value from the off-peak residential usage model, which was -0.31 (refer to Table 5.4).

Model results

Table 5.5 presents the estimated coefficients of the models estimated for each block of residential usage. All coefficients except the *new connections* and *flats* coefficients are directly estimated using fixed effects models for each block of usage.

The *new connections* coefficient is determined according the following formula:

$$New\ connections = \frac{\sum_{t=2020}^{2022} \beta_t \times new\ connected_t}{\sum_{t=2020}^{2022} new\ connected_t} - \frac{\sum_{2010}^{2022} \beta_t \times new\ connected_t}{\sum_{2010}^{2022} new\ connected_t}$$

This formula calculates the difference in the weighted average coefficient of *year connected* dummy variables over the past 3 years compared to the weighted average coefficient of all *year connected* dummy variables that are estimated over 2010-2022. These averages are weighted by the number of new connections in that year. The $new\ connected_t$ variable identifies the number of newly connected customers in that year.

The *flat* coefficient is negative for all blocks confirming that usage is lower for flats relative to single dwellings after controlling for the year that a customer is connected. The coefficient on the *year* variable can be interpreted as a time trend in percentage terms. For example, the model estimates a time trend in usage for the 'Peak 0-0.1' block of 3 per cent decrease per year (a coefficient of -0.029). The time trend is negative across all blocks except during the highest peak and off-peak block usage, suggesting a downward trend in gas usage.

We have not taken the log transform of the *EDD* variable because analysis of the relationship between daily weather and usage did not suggest a substantial non-linear component to this relationship. Therefore, the coefficient may be interpreted as the per cent change in usage for a block from an additional EDD per year.

The *gas price* variable is in log terms, and thus it suggests that, across all peak usage blocks, a 1 per cent rise in gas prices is associated with a 0.09 *decrease* in usage. Similarly, for all off-peak usage blocks, a 1 per cent rise increase in gas prices corresponds to a 0.3 per cent *decrease* in usage. As stated earlier, the gas *price* coefficient for peak blocks was set at -0.09, derived from a fixed effects model with peak usage as the dependent variable. Likewise, for off peak blocks, the gas *price* coefficient was constrained to -0.31, based on its estimation in a fixed effects model where off-peak usage was the dependent variable.

The *COVID-19* variable indicates that, considering the 'Peak 0-0.1' block, there was a increase in usage of 1.4 per cent during the COVID-19 period, which includes the years 2020 and 2021.

5.5 Coefficients used to forecast residential demand

Model/block	*Flat*	*Year*	*EDD*	*Gas price*	*COVID-19*	*New connections*
Peak 0 - 0.1	-0.513	-0.029	0.000125	-0.089	0.014	-0.084
Peak 0.1 - 0.2	-2.722	-0.159	0.000986	-0.089	0.095	-0.663
Peak 0.2 - 1.4	-3.179	-0.168	0.001666	-0.089	0.087	-0.838
Peak > 1.4	-0.010	0.003	0.000004	-0.089	-0.012	0.002
Off Peak 0 - 0.1	-0.515	-0.009	0.000036	-0.306	0.059	-0.224
Off Peak 0.1 - 0.2	-2.668	-0.125	0.000995	-0.306	0.270	-0.763
Off Peak 0.2 - 1.4	-2.365	-0.106	0.001373	-0.306	0.268	-0.745
Off Peak > 1.4	-0.004	0.013	-0.000019	-0.306	-0.033	0.004

Source: CIE.

Do electricity prices drive gas consumption

Electricity prices would be expected to be positively related to gas prices because they represent the price of a substitute good. Electricity price data has been obtained from the ABS[36]. When electricity prices are high relative to gas prices, customers would be expected to relatively increase their consumption of gas compared to electricity. This behavioural relationship may be reflected in the statistical analysis using two variables:

1 Directly including an electricity price variable in the models.

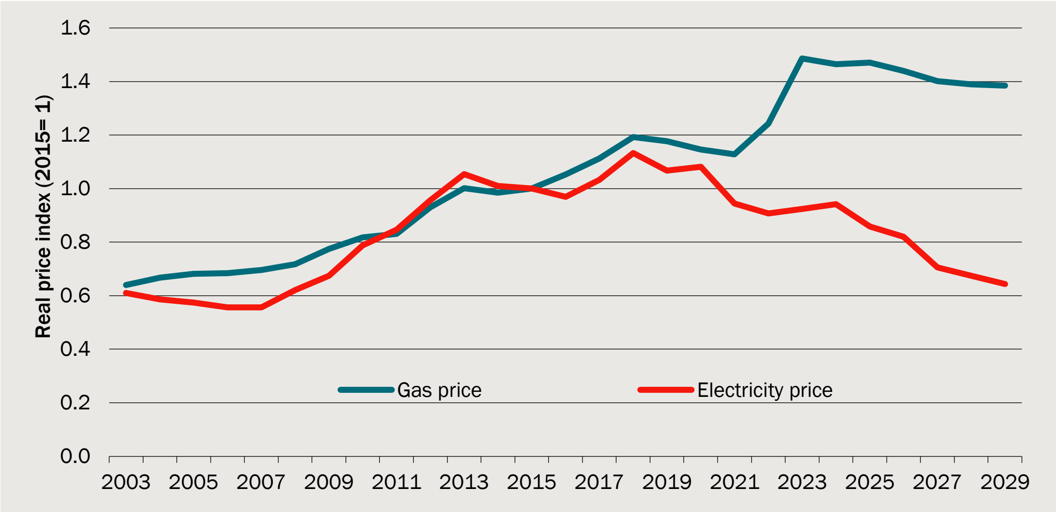
2 Including a variable measuring the relationship between gas and electricity prices (a *price ratio* variable).

However, electricity and gas prices have historically tended to vary similarly over the period from 2003 to 2020, as shown in chart 5.6. They started to diverge after 2020 and our forecasts predict that with increased electrification, such gap between the prices will further widen. If, as expected in the price forecasts shown in chart 5.6, there is a change in the progression of electricity and gas prices, the forecasts will be less precise. It also creates a problem of multicollinearity. The correlation makes forecasting tricky because the model finds it hard to separate the distinct impacts of the gas price and electricity price variables.

The first method above - including an electricity price variable in the statistical models - leads to significant changes in the coefficient of gas prices. Surprisingly, it becomes positive, which contradicts the typical expectation that gas usage decreases when gas price rises.

36 Australian Bureau of Statistics, *Consumer Price Index, Australia*, March 2024, Series: A2328106A.

5.6 Indexes of real gas and electricity prices



Data source: ABS, CIE.

A *price ratio* variable will be dependent on both gas and electricity prices, however is not correlated in the same way with each variable individually. Therefore, the forecasts will not suffer from the same imprecision as with an electricity price variable. Additionally, this variable more directly models the effect of changes in the relative price of the two substitute energy sources. A downside of this approach is that it will not account for an 'income effect', whereby falls in electricity prices and gas prices result in an increase in real income, which would have a positive effect on usage. Variation of both electricity and gas prices in the same magnitude and direction will not change the *price ratio* variable, however would have an effect on usage.

Gas prices are expected to be a more important driver of changes in usage. Thus, to avoid misestimating the coefficient of gas prices, we consider that using an electricity price variable directly in the estimation would lead to worse forecasts. In testing models including the *priceratio* variable, it was found be highly correlated with the gas price variable. Hence, we chose not to include the *priceratio* variable in our models.

Thus, electricity prices have not been included in the model through either variable.

Projection of key drivers of usage

Adjustments for electrification and energy efficiency

We apply three adjustments to projections of usage:

- A downward adjustment to total usage based on the impact of electrification estimated in the AEMO GSOO 2024,
- A downward adjustment to total usage based on the impact of energy efficiency estimated in the AEMO GSOO 2024, and
- A downward adjustment to usage per new residential customers based on the estimated impact of the 7 Star Standard.

Table 5.7 shows AEMOs estimates of the impact of appliance switching and energy efficiency reaching -7.7 per cent and -1.1 per cent by 2029, respectively.

Further, we assume that 25 per cent of the impact of appliance switching by AEMO is already accounted for by our estimates of the impacts of policy changes on customer numbers. This results in an approximately equal forecast trajectory to one where we use AEMO's full electrification adjustment and no shift in customer numbers due to policy (chart 5.8).

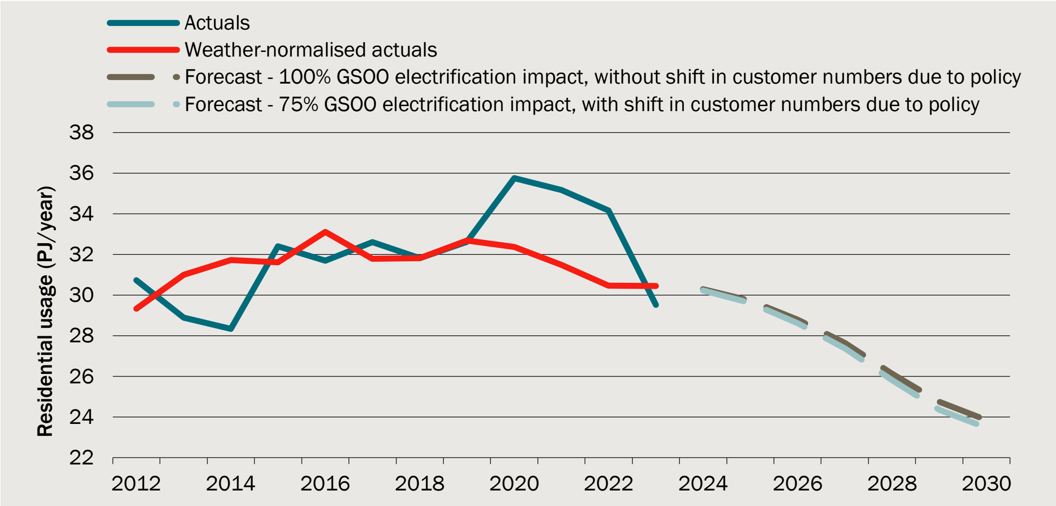
We expect that the time trends estimated in our statistical modelling (table 3.2) in large part capture the effects of electrification. The size of these negative trends in the history provide supporting evidence for electrification of residential loads. To avoid double-counting of electrification impacts, we do not project the continuation of these time trends in the history, instead adopting the trajectory implied by AEMOs electrification estimates.

5.7 Impact of appliance switching in AEMO GSOO 2024 forecasts

Calendar Year	Usage, excluding effect of electrification and energy efficiency	Impact of Appliance Switching	Impact of Appliance Switching	Impact of Energy Efficiency	Impact of Energy Efficiency	Usage, including effect of electrification and energy efficiency
	PJ/year	PJ/year	Per cent	PJ/year	Per cent	PJ/year
2019	111.3	0.0	0.0	0.0	0.0	
2020	125.3	0.0	0.0	0.0	0.0	
2021	122.6	0.0	0.0	0.0	0.0	
2022	127.8	0.0	0.0	0.0	0.0	
2023	123.0	0.0	0.0	0.0	0.0	
2024	125.4	0.0	0.0	0.0	0.0	117.9
2025	129.2	0.0	0.0	0.0	-0.2	116.0
2026	127.9	0.0	0.0	0.3	-0.5	112.3
2027	126.1	0.0	-1.3	0.6	-0.7	107.8
2028	110.9	1.6	-3.8	0.9	-0.9	102.4
2029	119.8	4.6	-7.7	1.1	-1.1	97.4
2030	121.1	9.5	-12.2	1.4	-1.2	91.7

Source: AEMO *Gas Statement of Opportunities 2024* results accessed through the AEMO forecasting portal . https://aemo.com.au/energy-systems/gas/gas-forecasting-and-planning/gas-forecasting-data-portal, CIE.

5.8 Removal of part of AEMO electrification impact to avoid double-counting



Note: Both forecasts incorporate

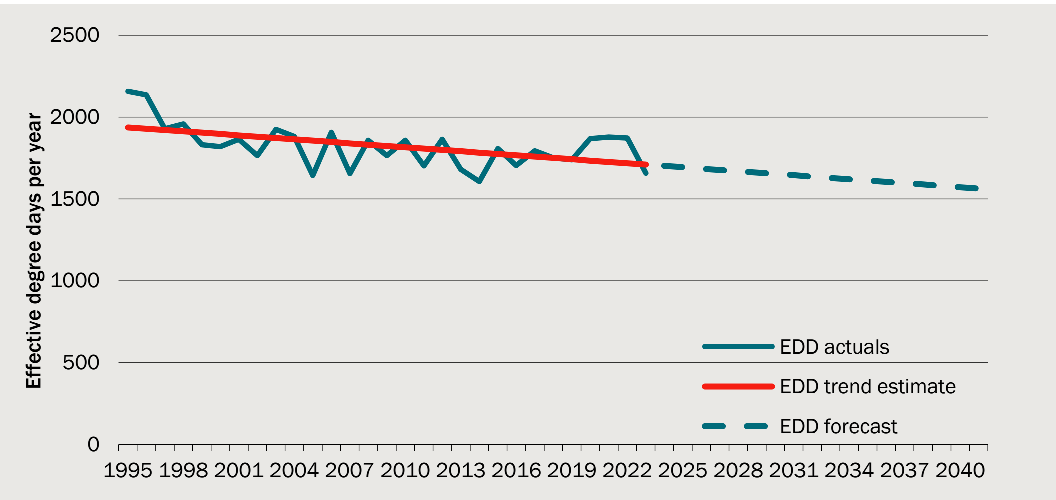
Data source: CIE.

We estimate that the 7 Star Standards reduce consumption per new customer by 3.5 per cent for houses and 27.3 per cent for apartments. These reductions are applied to the estimated usage of new customers based on estimates from our statistical model (see table 2.15). These estimates are based on the Consultation RIS by Acil Allen. Further detail is provided in Appendix A.

Projected weather outcomes

To project usage, we need to project weather outcomes for future years. However, weather outcomes, measured by the Effective Degree Days variable, are highly uncertain. We project Effective Degree Days to fall consistent with the trend in Effective Degree Days observed since data is first available (1995). This data reveals a negative trend in EDDs of 8.124 EDDs per year (chart 5.9). This means that expected EDDs falls from 1709 in 2023 to 1660 in 2029.

5.9 Historical and projected Effective Degree Days



Data source: CIE.

Forecasts of residential gas use

Forecasts of total residential gas usage combine projections of usage per customer with forecasts of customer numbers. These two components combine according to the following equation to obtain total usage per block.

$$Q_{brt} = \frac{(customers_t + customers_{t+1})}{2} \times q_{ibt}$$

Q_{bt} is total usage of block *b*, region *r*, in year *t*. It is the product of two components:

- the average number of customers in a year, which is equal to half the sum of customers at the beginning of year *t* and the beginning of year *t+1*, and
- the usage per customer (*i*) of block *b*, region *r*, in year *t*.

Usage per customer is multiplied by the average number of customers in a year to account for customers who connect during the year. This method assumes that customers are connected in equal proportion throughout the year.[37]

Usage per customer is a function of projected *EDD*, *gas price*, and the coefficients of these variables. The number of existing customers is the number of customers in 2023 for each region/class. We do not use the negative time trends estimated in our statistical models as part of the projections, instead relying on the AEMO GSOO 2024 estimate of the impact of electrification and energy efficiency to capture these factors.

Usage per customer is forecast separately for new and existing customers. To the extent that there are disconnections due to policy changes, these are accounted for as reductions in the number and usage of existing customers.

Usage per new customer is forecast in the same manner as existing customers, however there are two additional components that are projected.

- The proportion of new customers that are flats is calculated based on the share of flat and non-flat customers in the projections of customer numbers by dwelling type discussed in the previous chapter.
- A factor is applied that accounts for new connections having lower usage per customer. The factor applied is determined using the *new connections* variable described above table 5.13).

Thus, usage per new customer is as follows:

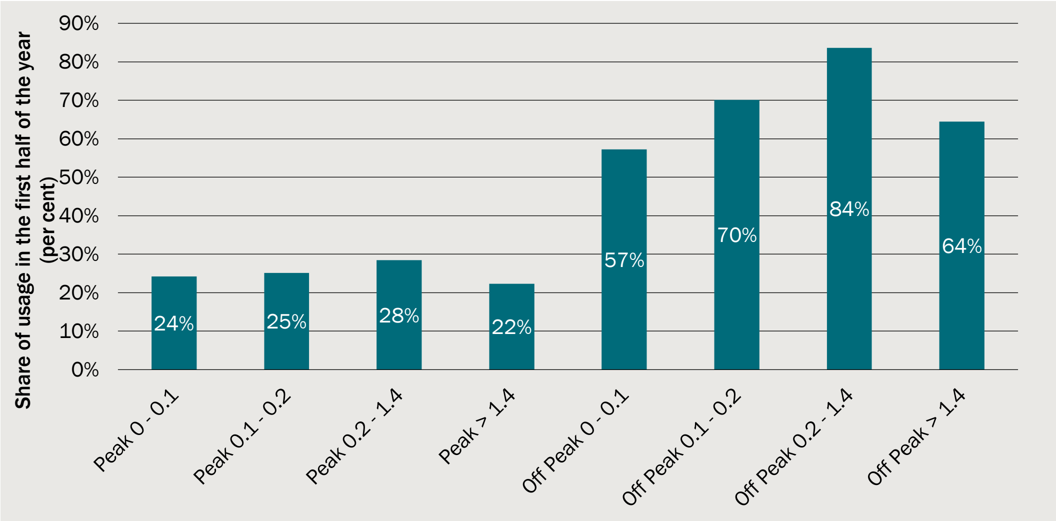
$$usage\ per\ customer_{new,t} = usage\ per\ customer_{existing,t} \times (1 + \beta_{flats} flat) \times (1 + \beta_{new\ connections})$$

where *flat* is the proportion of new customers that are flats.

37 For the purpose of this calculation, we require an estimate of the number of customers in 2029, since the average number of connections in 2028 is equal to the average of the number of connections at the beginning of 2028 and the number of connections at the beginning of 2029. For the purpose of this calculation, we project the number of connections at the beginning of 2029 based on the number of net new customers to the beginning of 2029 being the same at the number of net new customers to the beginning of 2028.

Table 5.11 shows projections for Scenario 0 by calendar year, which are then converted to projections by regulatory year, shown in table 5.12. Similarly table 5.13 shows projections for Scenario 4 by calendar year, which are then converted into projects by regulatory year, shown in table 5.14. To convert the calendar year usage forecasts to financial year forecasts and a forecast for the stub period, we estimate the relationship between usage in the first half of a calendar year and the second. This allows us to allocate usage to each half of the year, and thereby estimate usage for the stub period and financial years that occupy the second of a year and the first half of the subsequent year. The ratio of usage in the first and second half of the year is estimated for each block based on data of monthly usage by block. We take an average of this share between 2019 and 2023 (chart 5.10).

5.10 Share of usage in the first half of each year



Data source: AusNet Services monthly usage data, CIE calculations.

5.11 Projections of residential usage under Scenario 0, by calendar year

Region/ Block	Unit	2021	2022	2023	2024	2025	2026	2027	2028	2029
		Actual	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Tariff V - SP AusNet Central - Domestic										
Fixed Charge	No.	575 343	585 864	603 303	613 265	620 775	624 413	623 884	620 354	615 912
Peak 0 - 0.1	GJ	5 584 551	5 639 297	5 492 436	5 540 958	5 474 514	5 326 411	5 117 236	4 854 162	4 605 456
Peak 0.1 - 0.2	GJ	3 842 291	3 896 673	3 218 522	3 346 969	3 267 885	3 147 334	2 992 390	2 816 167	2 650 109
Peak 0.2 - 1.4	GJ	5 678 347	6 064 379	3 852 179	4 113 272	3 990 590	3 819 473	3 609 966	3 377 309	3 159 505
Peak > 1.4	GJ	55 163	66 970	59 661	59 926	59 304	57 767	55 596	52 774	50 119
Off Peak 0 - 0.1	GJ	8 003 252	7 656 180	7 375 553	7 418 039	7 312 552	7 141 520	6 899 330	6 555 002	6 223 881
Off Peak 0.1 - 0.2	GJ	2 212 262	1 808 815	1 547 154	1 612 560	1 571 305	1 518 731	1 451 653	1 367 752	1 287 554
Off Peak 0.2 - 1.4	GJ	1 209 899	935 321	858 266	908 638	882 904	850 779	810 891	761 666	714 830
Off Peak > 1.4	GJ	76 448	53 836	58 700	59 092	58 435	57 198	55 382	52 675	50 072
Total	**GJ**	**26 662 214**	**26 121 472**	**22 462 470**	**23 059 453**	**22 617 489**	**21 919 213**	**20 992 444**	**19 837 508**	**18 741 526**
Tariff V - SP AusNet West - Domestic										
Fixed Charge	No.	154 425	156 470	159 554	160 853	161 687	161 772	161 117	159 818	158 372
Peak 0 - 0.1	GJ	1 505 049	1 510 451	1 449 218	1 450 962	1 424 093	1 377 994	1 320 662	1 248 948	1 187 079
Peak 0.1 - 0.2	GJ	1 101 574	1 096 181	943 916	976 485	948 777	909 482	863 929	810 278	767 602
Peak 0.2 - 1.4	GJ	1 701 926	1 715 446	1 247 950	1 326 499	1 281 419	1 221 273	1 153 503	1 075 738	1 013 024
Peak > 1.4	GJ	13 271	11 115	10 132	10 098	9 926	9 618	9 230	8 739	8 295
Off Peak 0 - 0.1	GJ	2 176 727	2 036 213	1 935 729	1 934 049	1 895 535	1 842 329	1 776 046	1 682 880	1 600 357
Off Peak 0.1 - 0.2	GJ	737 867	581 989	507 487	526 461	510 743	491 563	469 460	440 970	417 579
Off Peak 0.2 - 1.4	GJ	499 254	348 825	311 847	328 613	317 924	305 097	290 527	272 095	256 723
Off Peak > 1.4	GJ	14 198	7 133	9 581	9 569	9 399	9 152	8 836	8 382	7 964
Total	**GJ**	**7 749 864**	**7 307 354**	**6 415 860**	**6 562 735**	**6 397 816**	**6 166 508**	**5 892 194**	**5 548 030**	**5 258 621**

Region/ Block	Unit	2021	2022	2023	2024	2025	2026	2027	2028	2029
		Actual	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Tariff V - SP AusNet Central - New Town Domestic										
Fixed Charge	No.	2 940	3 079	3 198	3 289	3 363	3 409	3 432	3 431	3 421
Peak 0 - 0.1	GJ	16 067	15 812	15 197	15 511	15 476	15 161	14 683	13 990	13 322
Peak 0.1 - 0.2	GJ	10 715	10 260	8 623	9 045	8 894	8 603	8 235	7 766	7 324
Peak 0.2 - 1.4	GJ	15 418	15 730	11 076	11 918	11 635	11 177	10 629	9 960	9 335
Peak > 1.4	GJ	384	496	530	538	538	528	512	489	466
Off Peak 0 - 0.1	GJ	21 332	20 632	19 598	19 912	19 798	19 453	18 926	18 052	17 196
Off Peak 0.1 - 0.2	GJ	6 293	4 392	4 674	4 910	4 816	4 673	4 494	4 242	4 001
Off Peak 0.2 - 1.4	GJ	5 905	3 334	4 193	4 474	4 375	4 232	4 058	3 819	3 592
Off Peak > 1.4	GJ	682	477	447	455	454	448	437	418	399
Total	**GJ**	**76 796**	**71 132**	**64 337**	**66 762**	**65 985**	**64 275**	**61 974**	**58 736**	**55 635**
Tariff V - SP AusNet West - New Town Domestic										
Fixed Charge	No.	9 214	9 393	9 555	9 672	9 756	9 785	9 765	9 698	9 619
Peak 0 - 0.1	GJ	114 684	117 788	114 057	114 638	112 896	109 511	105 172	99 598	94 383
Peak 0.1 - 0.2	GJ	89 539	91 093	80 263	83 235	81 060	77 838	74 064	69 542	65 359
Peak 0.2 - 1.4	GJ	173 816	180 581	130 797	139 320	134 856	128 721	121 762	113 667	106 213
Peak > 1.4	GJ	2 537	2 339	2 140	2 141	2 112	2 052	1 973	1 871	1 775
Off Peak 0 - 0.1	GJ	171 707	161 075	154 058	154 445	151 817	147 875	142 813	135 485	128 507
Off Peak 0.1 - 0.2	GJ	70 404	57 777	49 093	51 041	49 620	47 831	45 750	43 017	40 449
Off Peak 0.2 - 1.4	GJ	57 300	42 202	36 707	38 766	37 583	36 123	34 449	32 295	30 276
Off Peak > 1.4	GJ	3 812	2 597	2 192	2 198	2 167	2 115	2 046	1 944	1 846
Total	**GJ**	**683 798**	**655 451**	**569 307**	**585 784**	**572 111**	**552 066**	**528 029**	**497 419**	**468 808**

Source: CIE.

5.12 Projections of residential usage under Scenario 0, by regulatory year

Region/ Block	Unit	2021	2022	2023 stub	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29
		Actual	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Tariff V - SP AusNet Central - Domestic										
Fixed Charge	No.	575 343	585 864	594 584	608 284	617 020	622 594	624 149	622 119	618 133
Peak 0 - 0.1	GJ	5 584 551	5 639 297	1 299 445	5 504 163	5 524 899	5 438 719	5 275 855	5 053 652	4 794 051
Peak 0.1 - 0.2	GJ	3 842 291	3 896 673	809 352	3 250 827	3 327 079	3 237 566	3 108 365	2 948 069	2 774 403
Peak 0.2 - 1.4	GJ	5 678 347	6 064 379	1 215 012	3 926 334	4 078 428	3 941 989	3 759 969	3 543 887	3 315 449
Peak > 1.4	GJ	55 163	66 970	10 409	59 720	59 787	58 961	57 282	54 966	52 182
Off Peak 0 - 0.1	GJ	8 003 252	7 656 180	4 497 049	7 399 871	7 357 662	7 214 658	7 002 897	6 702 247	6 365 478
Off Peak 0.1 - 0.2	GJ	2 212 262	1 808 815	1 336 121	1 593 010	1 583 636	1 534 445	1 471 702	1 392 829	1 311 525
Off Peak 0.2 - 1.4	GJ	1 209 899	935 321	853 643	900 385	887 120	856 043	817 427	769 731	722 504
Off Peak > 1.4	GJ	76 448	53 836	33 898	58 953	58 669	57 638	56 027	53 638	50 998
Total	**GJ**	**26 662 214**	**26 121 472**	**10 054 928**	**22 693 263**	**22 877 278**	**22 340 018**	**21 549 525**	**20 519 020**	**19 386 589**
Tariff V - SP AusNet West - Domestic										
Fixed Charge	No.	154 425	156 470	158 012	160 203	161 270	161 729	161 444	160 467	159 095
Peak 0 - 0.1	GJ	1 505 049	1 510 451	342 220	1 449 640	1 444 468	1 412 951	1 364 137	1 303 329	1 233 995
Peak 0.1 - 0.2	GJ	1 101 574	1 096 181	243 267	952 107	969 516	938 894	898 025	850 436	799 544
Peak 0.2 - 1.4	GJ	1 701 926	1 715 446	386 351	1 270 259	1 313 695	1 264 337	1 202 025	1 131 416	1 057 926
Peak > 1.4	GJ	13 271	11 115	1 917	10 124	10 059	9 857	9 531	9 120	8 640
Off Peak 0 - 0.1	GJ	2 176 727	2 036 213	1 184 218	1 934 767	1 912 005	1 865 082	1 804 391	1 722 721	1 635 646
Off Peak 0.1 - 0.2	GJ	737 867	581 989	415 663	520 790	515 441	497 296	476 067	449 485	424 570
Off Peak 0.2 - 1.4	GJ	499 254	348 825	293 446	325 865	319 676	307 198	292 914	275 115	259 242
Off Peak > 1.4	GJ	14 198	7 133	6 492	9 573	9 460	9 240	8 948	8 544	8 112
Total	**GJ**	**7 749 864**	**7 307 354**	**2 873 573**	**6 473 127**	**6 494 320**	**6 304 854**	**6 056 039**	**5 750 166**	**5 427 675**

Region/ Block	Unit	2021	2022	2023 stub	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29
		Actual	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Tariff V - SP AusNet Central - New Town Domestic										
Fixed Charge	No.	2 940	3 079	3 139	3 244	3 326	3 386	3 420	3 431	3 426
Peak 0 - 0.1	GJ	16 067	15 812	3 420	15 273	15 502	15 400	15 046	14 515	13 829
Peak 0.1 - 0.2	GJ	10 715	10 260	2 215	8 729	9 007	8 821	8 511	8 117	7 655
Peak 0.2 - 1.4	GJ	15 418	15 730	3 869	11 315	11 837	11 505	11 022	10 439	9 783
Peak > 1.4	GJ	384	496	133	532	538	536	524	507	484
Off Peak 0 - 0.1	GJ	21 332	20 632	11 732	19 777	19 846	19 600	19 151	18 426	17 563
Off Peak 0.1 - 0.2	GJ	6 293	4 392	3 686	4 840	4 844	4 715	4 547	4 317	4 073
Off Peak 0.2 - 1.4	GJ	5 905	3 334	2 997	4 428	4 391	4 255	4 086	3 858	3 629
Off Peak > 1.4	GJ	682	477	243	452	454	450	441	425	406
Total	**GJ**	**76 796**	**71 132**	**28 296**	**65 345**	**66 421**	**65 283**	**63 328**	**60 604**	**57 419**
Tariff V - SP AusNet West - New Town Domestic										
Fixed Charge	No.	9 214	9 393	9 474	9 613	9 714	9 771	9 775	9 731	9 658
Peak 0 - 0.1	GJ	114 684	117 788	26 542	114 197	114 217	112 078	108 463	103 825	98 337
Peak 0.1 - 0.2	GJ	89 539	91 093	19 948	81 011	82 688	80 250	76 889	72 927	68 490
Peak 0.2 - 1.4	GJ	173 816	180 581	38 074	133 217	138 052	133 114	126 745	119 463	111 550
Peak > 1.4	GJ	2 537	2 339	719	2 140	2 135	2 099	2 035	1 950	1 849
Off Peak 0 - 0.1	GJ	171 707	161 075	93 770	154 279	152 941	149 561	144 977	138 618	131 491
Off Peak 0.1 - 0.2	GJ	70 404	57 777	38 232	50 458	50 044	48 366	46 372	43 834	41 217
Off Peak 0.2 - 1.4	GJ	57 300	42 202	31 670	38 429	37 777	36 362	34 723	32 648	30 607
Off Peak > 1.4	GJ	3 812	2 597	1 529	2 196	2 178	2 134	2 071	1 980	1 881
Total	**GJ**	**683 798**	**655 451**	**250 484**	**575 928**	**580 032**	**563 962**	**542 274**	**515 246**	**485 423**

Source: CIE.

5.13 Projections of residential usage under Scenario 4, by calendar year

Region/ Block	Unit	2021	2022	2023	2024	2025	2026	2027	2028	2029
		Actual	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Tariff V - SP AusNet Central - Domestic										
Fixed Charge	No.	575 343	585 864	603 303	613 265	617 171	617 305	614 006	608 145	601 693
Peak 0 - 0.1	GJ	5 584 551	5 639 297	5 492 436	5 540 958	5 440 784	5 263 693	5 029 860	4 750 422	4 485 129
Peak 0.1 - 0.2	GJ	3 842 291	3 896 673	3 218 522	3 346 969	3 250 095	3 115 764	2 946 020	2 760 872	2 582 805
Peak 0.2 - 1.4	GJ	5 678 347	6 064 379	3 852 179	4 113 272	3 970 956	3 784 983	3 559 192	3 317 002	3 086 028
Peak > 1.4	GJ	55 163	66 970	59 661	59 926	58 957	57 111	54 702	51 718	48 922
Off Peak 0 - 0.1	GJ	8 003 252	7 656 180	7 375 553	7 418 039	7 273 207	7 067 969	6 796 180	6 432 226	6 081 251
Off Peak 0.1 - 0.2	GJ	2 212 262	1 808 815	1 547 154	1 612 560	1 563 617	1 505 016	1 431 412	1 343 576	1 258 129
Off Peak 0.2 - 1.4	GJ	1 209 899	935 321	858 266	908 638	878 724	843 316	799 972	748 676	699 144
Off Peak > 1.4	GJ	76 448	53 836	58 700	59 092	58 093	56 548	54 491	51 620	48 876
Total	**GJ**	**26 662 214**	**26 121 472**	**22 462 470**	**23 059 453**	**22 494 432**	**21 694 401**	**20 671 831**	**19 456 111**	**18 290 285**
Tariff V - SP AusNet West - Domestic										
Fixed Charge	No.	154 425	156 470	159 554	160 853	161 442	161 193	160 204	158 589	156 849
Peak 0 - 0.1	GJ	1 505 049	1 510 451	1 449 218	1 450 962	1 421 845	1 372 786	1 312 443	1 237 894	1 175 276
Peak 0.1 - 0.2	GJ	1 101 574	1 096 181	943 916	976 485	947 506	906 492	858 980	803 250	761 134
Peak 0.2 - 1.4	GJ	1 701 926	1 715 446	1 247 950	1 326 499	1 279 877	1 217 654	1 147 502	1 067 203	1 005 342
Peak > 1.4	GJ	13 271	11 115	10 132	10 098	9 911	9 583	9 176	8 668	8 215
Off Peak 0 - 0.1	GJ	2 176 727	2 036 213	1 935 729	1 934 049	1 892 927	1 836 254	1 766 395	1 669 866	1 586 443
Off Peak 0.1 - 0.2	GJ	737 867	581 989	507 487	526 461	510 128	490 111	467 045	437 537	414 410
Off Peak 0.2 - 1.4	GJ	499 254	348 825	311 847	328 613	317 553	304 224	289 086	270 065	254 830
Off Peak > 1.4	GJ	14 198	7 133	9 581	9 569	9 385	9 119	8 785	8 315	7 887
Total	**GJ**	**7 749 864**	**7 307 354**	**6 415 860**	**6 562 735**	**6 389 132**	**6 146 223**	**5 859 413**	**5 502 799**	**5 213 537**

Region/ Block	Unit	2021	2022	2023	2024	2025	2026	2027	2028	2029
		Actual	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Tariff V - SP AusNet Central - New Town Domestic										
Fixed Charge	No.	2 940	3 079	3 198	3 289	3 539	3 687	3 752	3 764	3 750
Peak 0 - 0.1	GJ	16 067	15 812	15 197	15 511	16 237	16 324	15 970	15 267	14 529
Peak 0.1 - 0.2	GJ	10 715	10 260	8 623	9 045	9 198	9 064	8 743	8 265	7 793
Peak 0.2 - 1.4	GJ	15 418	15 730	11 076	11 918	11 983	11 702	11 204	10 523	9 861
Peak > 1.4	GJ	384	496	530	538	565	570	558	535	509
Off Peak 0 - 0.1	GJ	21 332	20 632	19 598	19 912	20 650	20 761	20 385	19 503	18 570
Off Peak 0.1 - 0.2	GJ	6 293	4 392	4 674	4 910	4 964	4 899	4 745	4 489	4 234
Off Peak 0.2 - 1.4	GJ	5 905	3 334	4 193	4 474	4 509	4 436	4 283	4 040	3 799
Off Peak > 1.4	GJ	682	477	447	455	477	483	477	457	436
Total	**GJ**	**76 796**	**71 132**	**64 337**	**66 762**	**68 583**	**68 241**	**66 365**	**63 080**	**59 732**
Tariff V - SP AusNet West - New Town Domestic										
Fixed Charge	No.	9 214	9 393	9 555	9 672	9 796	9 834	9 802	9 717	9 614
Peak 0 - 0.1	GJ	114 684	117 788	114 057	114 638	113 326	110 014	105 539	99 766	94 342
Peak 0.1 - 0.2	GJ	89 539	91 093	80 263	83 235	81 270	78 072	74 226	69 611	65 337
Peak 0.2 - 1.4	GJ	173 816	180 581	130 797	139 320	135 160	129 056	121 990	113 763	106 181
Peak > 1.4	GJ	2 537	2 339	2 140	2 141	2 121	2 062	1 981	1 874	1 774
Off Peak 0 - 0.1	GJ	171 707	161 075	154 058	154 445	152 322	148 468	143 249	135 685	128 458
Off Peak 0.1 - 0.2	GJ	70 404	57 777	49 093	51 041	49 736	47 961	45 841	43 056	40 437
Off Peak 0.2 - 1.4	GJ	57 300	42 202	36 707	38 766	37 670	36 221	34 517	32 324	30 267
Off Peak > 1.4	GJ	3 812	2 597	2 192	2 198	2 176	2 126	2 054	1 948	1 845
Total	**GJ**	**683 798**	**655 451**	**569 307**	**585 784**	**573 780**	**553 979**	**529 396**	**498 027**	**468 640**

Source: CIE.

5.14 Projections of residential usage under Scenario 4, by regulatory year

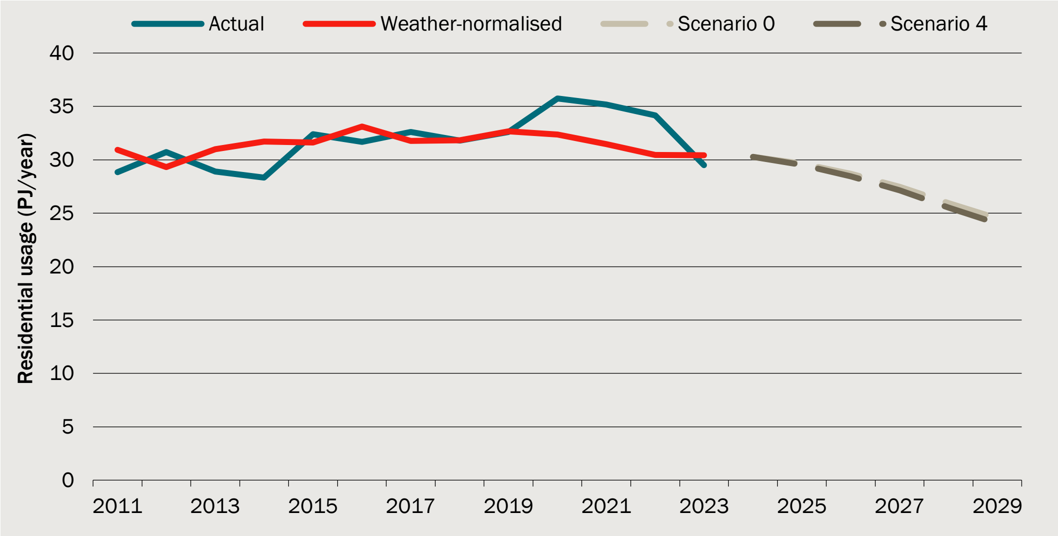
Region/ Block	Unit	2021	2022	2023 stub	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29
		Actual	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Tariff V - SP AusNet Central - Domestic										
Fixed Charge	No.	575 343	585 864	594 584	608 284	615 218	617 238	615 656	611 076	604 919
Peak 0 - 0.1	GJ	5 584 551	5 639 297	1 299 445	5 504 163	5 516 746	5 397 982	5 207 177	4 962 321	4 686 302
Peak 0.1 - 0.2	GJ	3 842 291	3 896 673	809 352	3 250 827	3 322 605	3 216 310	3 073 073	2 899 454	2 716 088
Peak 0.2 - 1.4	GJ	5 678 347	6 064 379	1 215 012	3 926 334	4 072 851	3 918 136	3 720 854	3 490 406	3 251 401
Peak > 1.4	GJ	55 163	66 970	10 409	59 720	59 709	58 545	56 573	54 036	51 094
Off Peak 0 - 0.1	GJ	8 003 252	7 656 180	4 497 049	7 399 871	7 335 141	7 155 735	6 912 405	6 587 863	6 231 338
Off Peak 0.1 - 0.2	GJ	2 212 262	1 808 815	1 336 121	1 593 010	1 578 245	1 522 531	1 453 412	1 369 830	1 283 669
Off Peak 0.2 - 1.4	GJ	1 209 899	935 321	853 643	900 385	883 625	849 118	807 074	757 080	707 259
Off Peak > 1.4	GJ	76 448	53 836	33 898	58 953	58 448	57 097	55 222	52 641	49 852
Total	**GJ**	**26 662 214**	**26 121 472**	**10 054 928**	**22 693 263**	**22 827 372**	**22 175 455**	**21 285 791**	**20 173 632**	**18 977 002**
Tariff V - SP AusNet West - Domestic										
Fixed Charge	No.	154 425	156 470	158 012	160 203	161 147	161 318	160 699	159 396	157 719
Peak 0 - 0.1	GJ	1 505 049	1 510 451	342 220	1 449 640	1 443 925	1 409 988	1 358 201	1 294 425	1 222 760
Peak 0.1 - 0.2	GJ	1 101 574	1 096 181	243 267	952 107	969 196	937 191	894 543	844 964	792 658
Peak 0.2 - 1.4	GJ	1 701 926	1 715 446	386 351	1 270 259	1 313 257	1 262 205	1 197 729	1 124 696	1 049 633
Peak > 1.4	GJ	13 271	11 115	1 917	10 124	10 056	9 838	9 492	9 063	8 567
Off Peak 0 - 0.1	GJ	2 176 727	2 036 213	1 184 218	1 934 767	1 910 512	1 860 489	1 796 269	1 711 145	1 622 117
Off Peak 0.1 - 0.2	GJ	737 867	581 989	415 663	520 790	515 010	496 094	473 939	446 357	421 322
Off Peak 0.2 - 1.4	GJ	499 254	348 825	293 446	325 865	319 365	306 408	291 567	273 181	257 326
Off Peak > 1.4	GJ	14 198	7 133	6 492	9 573	9 451	9 214	8 903	8 482	8 039
Total	**GJ**	**7 749 864**	**7 307 354**	**2 873 573**	**6 473 127**	**6 490 772**	**6 291 425**	**6 030 644**	**5 712 312**	**5 382 423**

Region/ Block	Unit	2021	2022	2023 stub	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29
		Actual	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Tariff V - SP AusNet Central - New Town Domestic										
Fixed Charge	No.	2 940	3 079	3 139	3 244	3 414	3 613	3 719	3 758	3 757
Peak 0 - 0.1	GJ	16 067	15 812	3 420	15 273	15 686	16 258	16 238	15 800	15 089
Peak 0.1 - 0.2	GJ	10 715	10 260	2 215	8 729	9 083	9 164	8 983	8 623	8 147
Peak 0.2 - 1.4	GJ	15 418	15 730	3 869	11 315	11 936	11 903	11 561	11 010	10 335
Peak > 1.4	GJ	384	496	133	532	544	566	567	553	529
Off Peak 0 - 0.1	GJ	21 332	20 632	11 732	19 777	20 334	20 714	20 546	19 880	18 969
Off Peak 0.1 - 0.2	GJ	6 293	4 392	3 686	4 840	4 948	4 919	4 791	4 566	4 310
Off Peak 0.2 - 1.4	GJ	5 905	3 334	2 997	4 428	4 503	4 448	4 308	4 080	3 839
Off Peak > 1.4	GJ	682	477	243	452	469	481	479	464	444
Total	**GJ**	**76 796**	**71 132**	**28 296**	**65 345**	**67 505**	**68 453**	**67 474**	**64 977**	**61 661**
Tariff V - SP AusNet West - New Town Domestic										
Fixed Charge	No.	9 214	9 393	9 474	9 613	9 734	9 815	9 818	9 760	9 666
Peak 0 - 0.1	GJ	114 684	117 788	26 542	114 197	114 321	112 526	108 932	104 144	98 455
Peak 0.1 - 0.2	GJ	89 539	91 093	19 948	81 011	82 741	80 466	77 105	73 065	68 536
Peak 0.2 - 1.4	GJ	173 816	180 581	38 074	133 217	138 139	133 426	127 049	119 653	111 609
Peak > 1.4	GJ	2 537	2 339	719	2 140	2 137	2 108	2 044	1 957	1 852
Off Peak 0 - 0.1	GJ	171 707	161 075	93 770	154 279	153 230	150 116	145 480	138 920	131 548
Off Peak 0.1 - 0.2	GJ	70 404	57 777	38 232	50 458	50 126	48 492	46 474	43 888	41 219
Off Peak 0.2 - 1.4	GJ	57 300	42 202	31 670	38 429	37 850	36 458	34 796	32 684	30 604
Off Peak > 1.4	GJ	3 812	2 597	1 529	2 196	2 184	2 143	2 079	1 985	1 882
Total	**GJ**	**683 798**	**655 451**	**250 484**	**575 928**	**580 726**	**565 734**	**543 961**	**516 296**	**485 706**

Source: CIE.

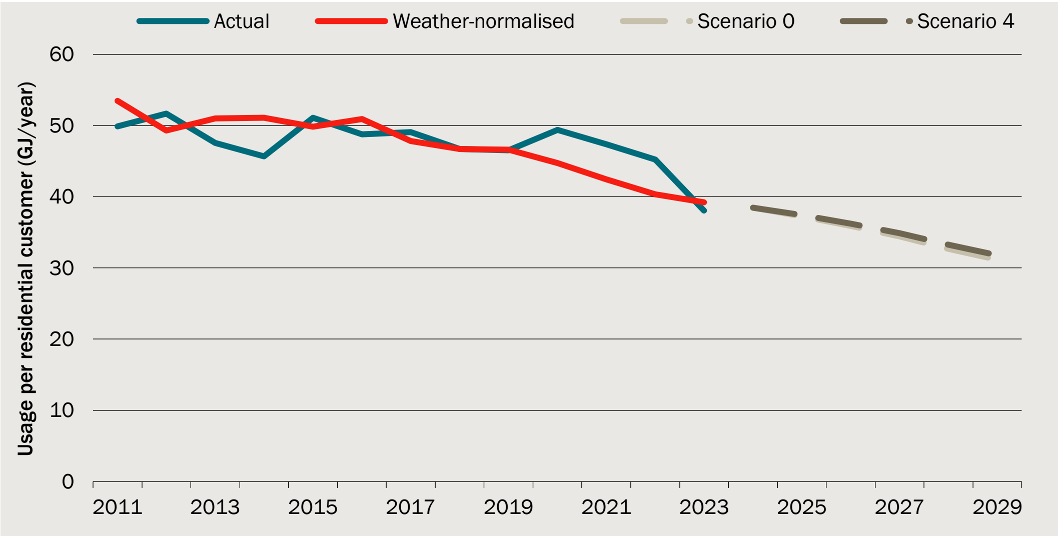
Total usage and usage per customer are forecast to decline over the forecast period (chart 5.15 and chart 5.16, respectively). For usage per customer, this is broadly consistent with the downward trend since around 2016. For total usage, the decline reflects an acceleration of the slight downward trend evident since 2016, which is as a result of the change in customer growth from positive to negative over the forecast period.

5.15 Actual, weather-normalised and forecast residential usage



Data source: CIE.

5.16 Actual, weather-normalised and forecast residential usage per customer



Data source: CIE.

Sensitivity testing

Testing of assumptions underlying customer number forecasts

We consider additional scenarios that vary the rate at which customers disconnect from the gas network, as well as the rate at which new customers join the network per new house construction (the marginal penetration rate). These assumptions have flow on impacts on the usage per customer forecasts. The scenarios are set out in table 5.17.

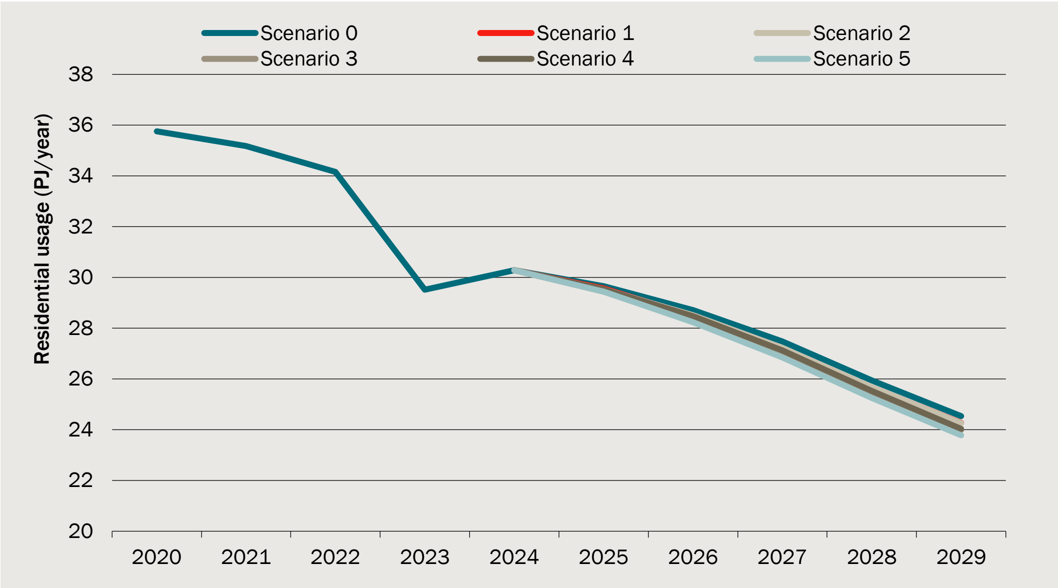
5.17 Additional scenarios for customer numbers

Scenario	Year that 1.25% disconnection rate is reached	Customer connection rate for houses
	Per cent	
Scenario 0	2028	3-year average
Scenario 1	2026	3-year average
Scenario 2	2028	60% from 2025
Scenario 3	2026	60% from 2025
Scenario 4	2028	60% in 2025, 20% by 2029
Scenario 5	2026	60% in 2025, 20% by 2030

Source: CIE.

Applying different combinations of these effects leads declining residential customer gas usage across all scenarios (chart 5.18).

5.18 Residential customer usage by scenario



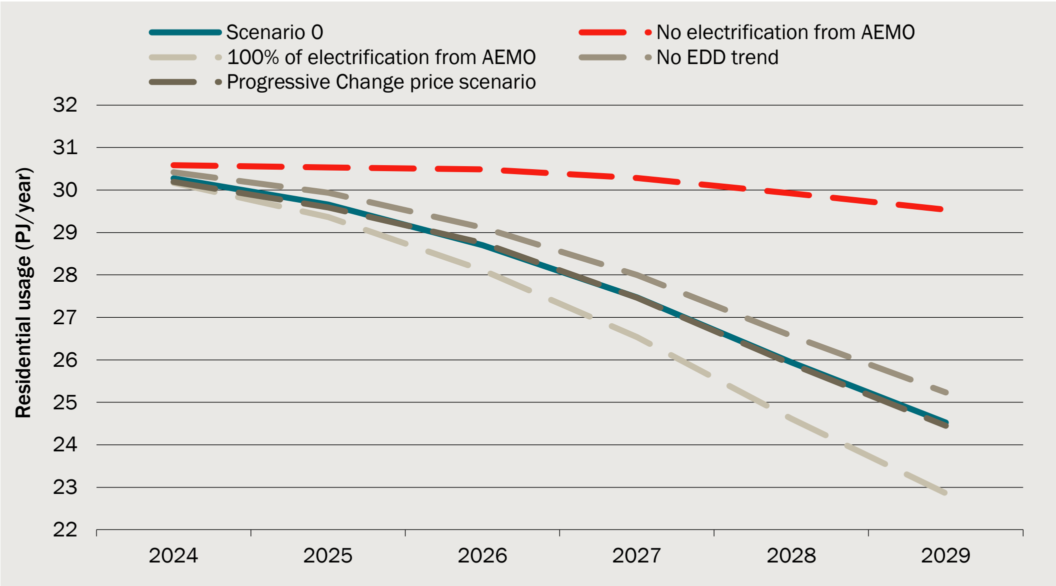
Data source: CIE.

Testing of alternative assumptions underlying usage per customer forecasts

We have tested the sensitivity of the forecast to inputs to projecting usage per customer. This testing used Scenario 0 as a starting point, but impacts are very similar if Scenario 4 is used instead.

- The trajectory of the usage forecasts are mainly determined by the impact of electrification estimated in the 2024 GSOO. Excluding the electrification adjustment results in a forecast of only slightly declining usage, which is due to the impact of policies affecting customer numbers. Incorporating the entire adjustment (i.e. assuming that the impact of customer number policies and changing sentiment are *additional* to AEMO's estimated impacts of electrification) results in a lower forecast trajectory.
- The impact of not applying a trend in EDDs is relatively minor, and there is almost no difference between usage forecasts under the Progressive Change price scenario provided by AEMO.[38]

5.19 Residential usage sensitivity testing



Data source: CIE.

[38] Scenario 0 forecasts rely on the 'Step Change' scenario, which is AEMO's central scenario for the GSOO 2024.

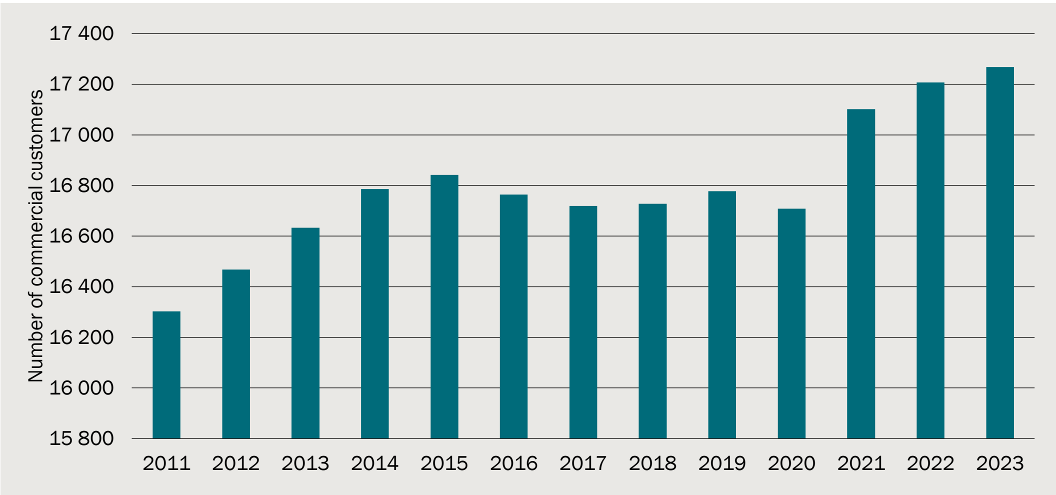
6 Commercial customer numbers

Commercial customers are small or medium businesses connected to the gas network. These businesses will be restaurants and cafes (who use gas for cooking) and other businesses who use gas for heating. We have projected commercial customer numbers at the postcode level by applying a fixed ratio of net new residential customers to net new commercial customers.

Snapshot of commercial customer numbers

In 2023 (YTD estimate), there were 17 267 commercial customers connected to gas in AusNet's area (see Chart 6.1). As noted in Chapter 5, this area covers 117 postcodes. Growth in commercial customers has been much slower than growth in residential customers – commercial customers have grew on average by 0.48 per cent per year between 2011 and 2023.

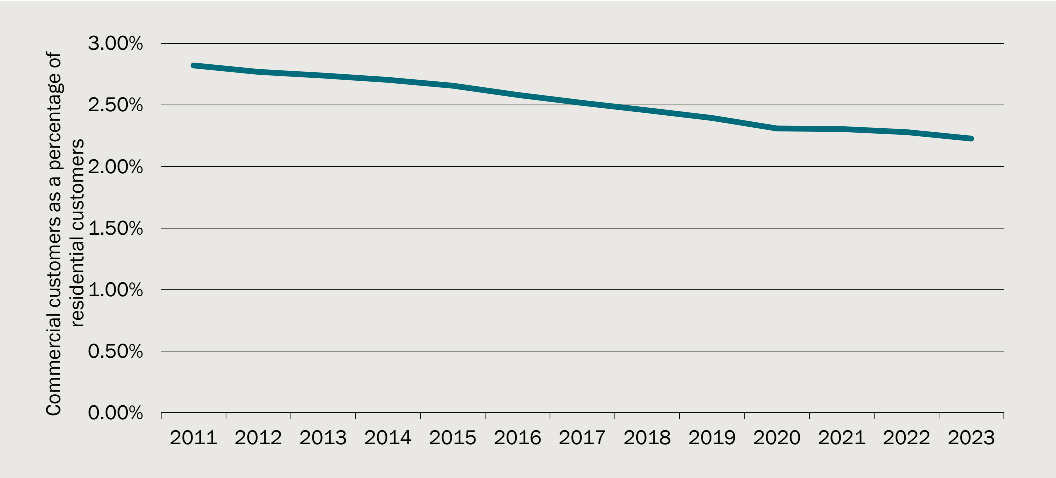
6.1 AusNet Commercial Customer



Data source: AusNet, CIE.

Between 2011 and 2021, commercial customers, measured as percentage of residential customers, declined at a reasonably constant rate (Chart 6.2).

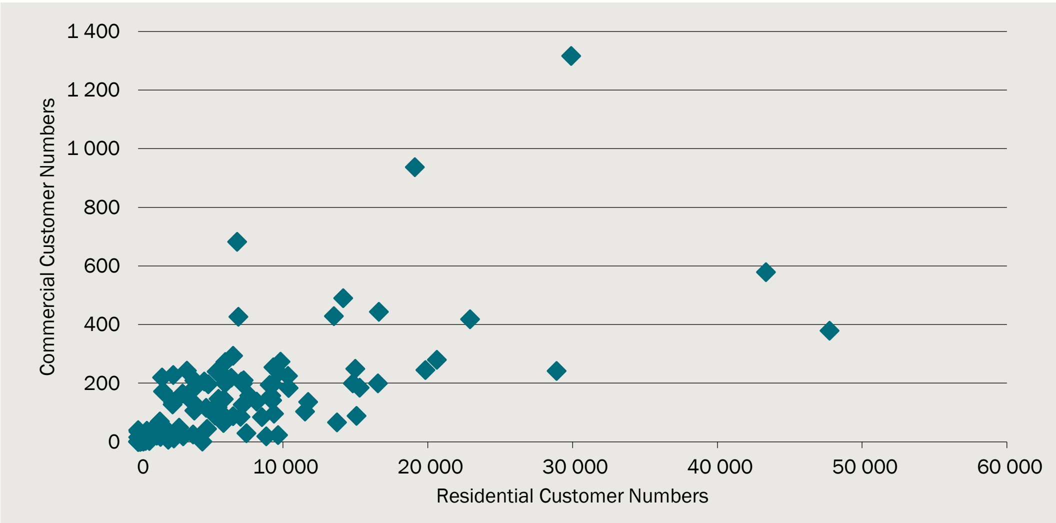
6.2 Commercial customers (as a percentage of residential customers)



Data source: AusNet; CIE.

Commercial customers are spread around AusNet's area in a similar pattern to residential customers. There is a moderate, positive, linear relationship between residential customer numbers and commercial customer numbers - see Chart 6.3.

6.3 Commercial customer numbers vs residential customer numbers (by postcode)

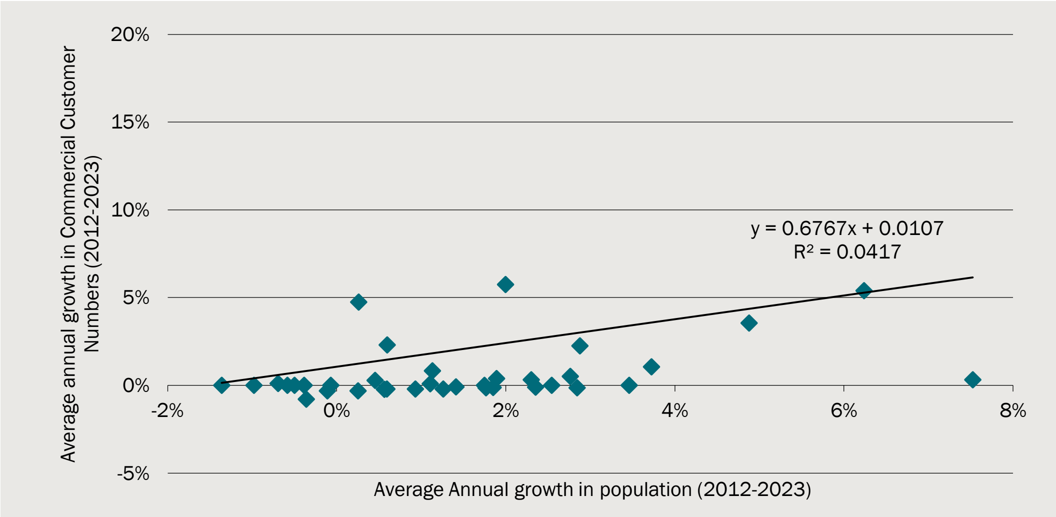


Data source: AusNet; CIE.

Measuring drivers of commercial customer numbers

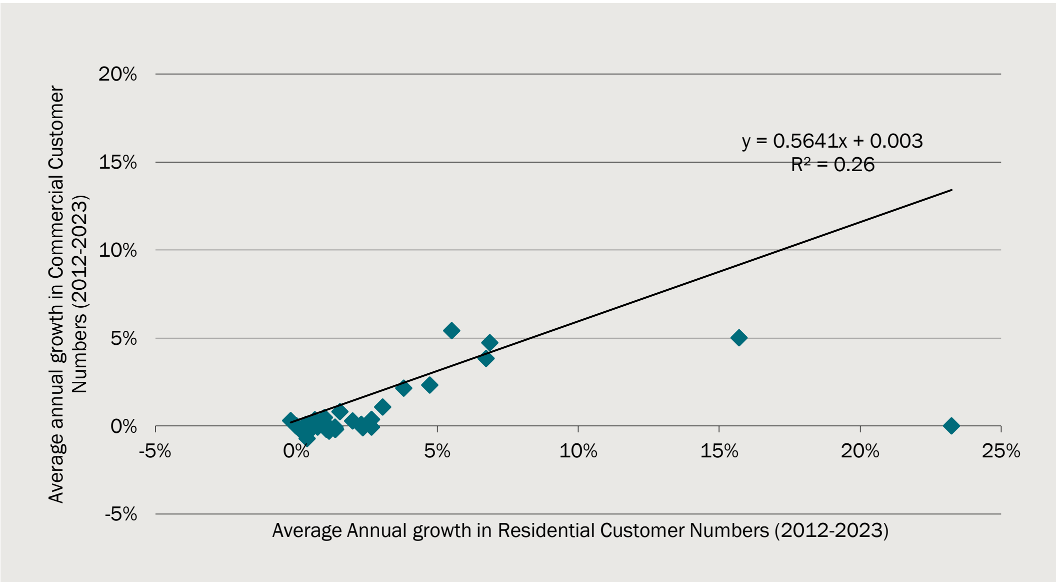
We expect that the drivers of commercial customers are largely the same as those for residential customers. This is because commercial customer growth is strongly associated with both population trends across different areas, as well as the overall patterns of residential customer growth. The following two Charts (6.4 and 6.5) show the relationship between growth in commercial customer numbers and growth in residential customer numbers is stronger than the relationship between growth in commercial customer numbers and growth in population. The closeness of the relationship is demonstrated by the higher R-squared. Residential customer numbers are broadly influenced by population growth, and so therefore pick up economic growth to some extent.

6.4 Growth in commercial customers vs growth in population (by LGA)



Data source: CIE.

6.5 Growth in commercial customers vs growth in residential customer numbers (by LGA)

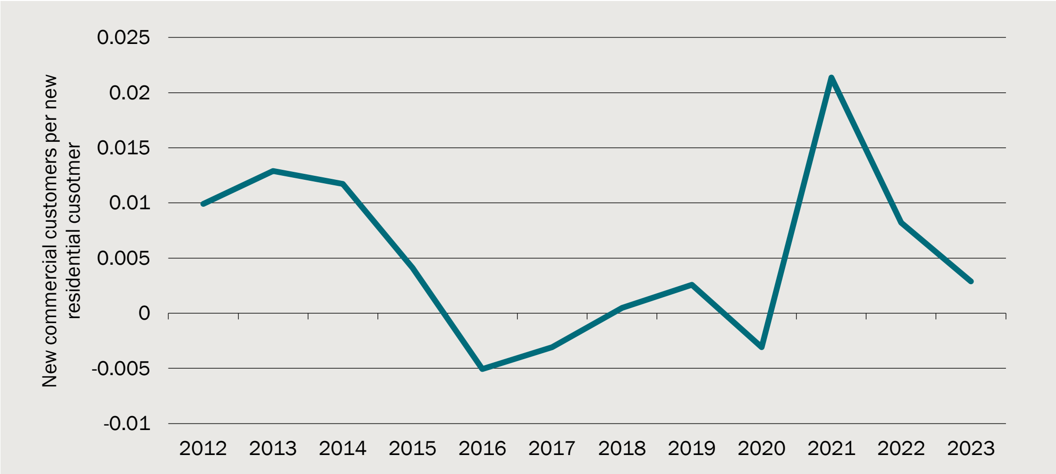


Data source: CIE.

Methodology used to forecast commercial customer numbers

We forecast the number of commercial customers by estimating the number of new commercial customers that are associated for each new residential customer. Chart 6.6 tracks this relationship over time, highlighting a reltively volatile relationship. For the pruposes of this forecast, we consider the average rate of net new commercial customers per net new residentail customer over the last three years.

6.6 Number of new commercial customers created for every new residential customer created (total across AusNet area)

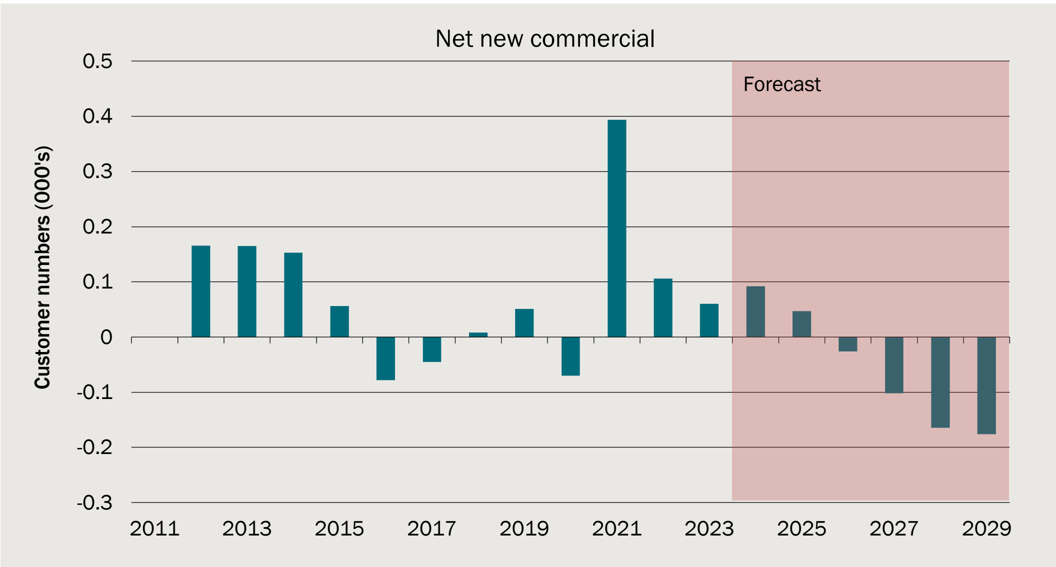


Data source: CIE.

Forecasts

Using the relationship between the number of new commercial customers per new residential customer, we project the number of net new commercial customers within each postcode of the AusNet network area. The impact of the policies can be seen, with a declining rate of net new residential customers to 2025 and then a net loss in commercial customers thereafter (chart 6.7).

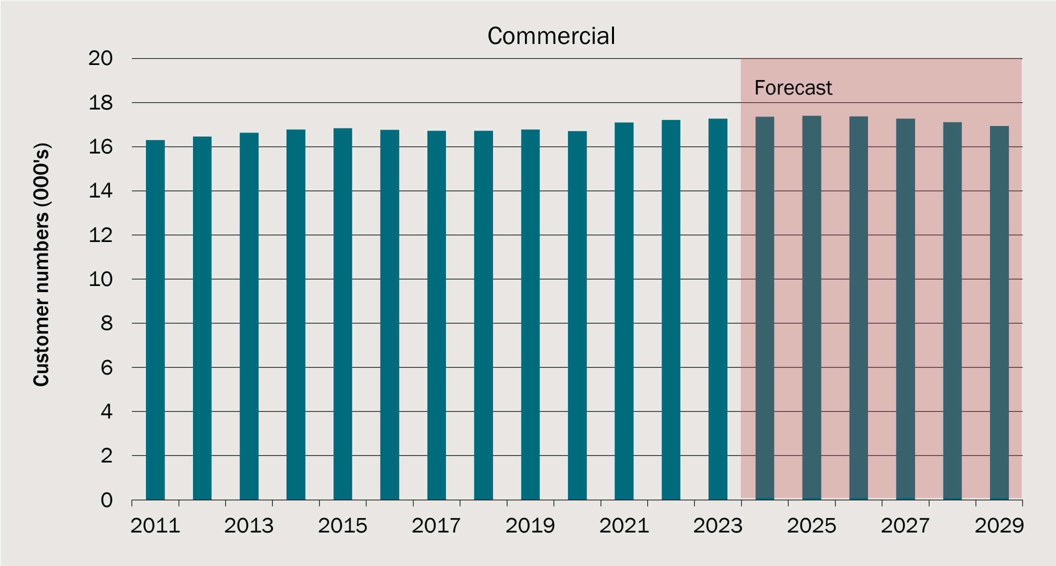
6.7 Net new commercial customers, scenario 0



Data source: The CIE

The total number of commercial customers declines from around 17 300 in 2023 to around 16 900 by 2029 (chart 6.8).

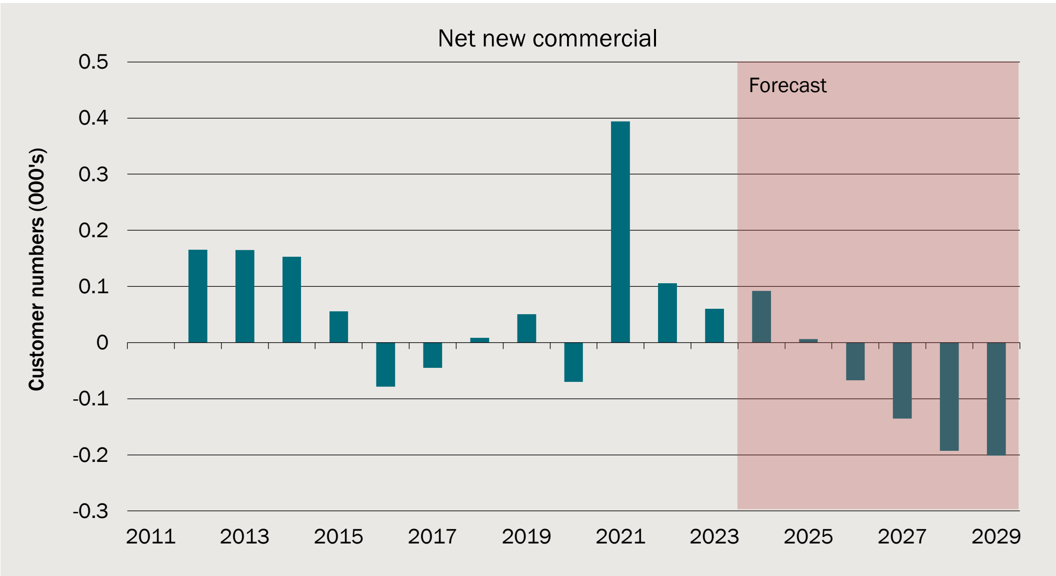
6.8 Total commercial customers, scenario 0



Data source: The CIE

The rate of commercial customer decline in stronger under scenario 4. While scenario 4 directly assumes a lower residential customer connection rate, the flow on effects also reduce commercial customer uptake, due to the quantified relationship between commercial and residential customer growth (chart 6.9)

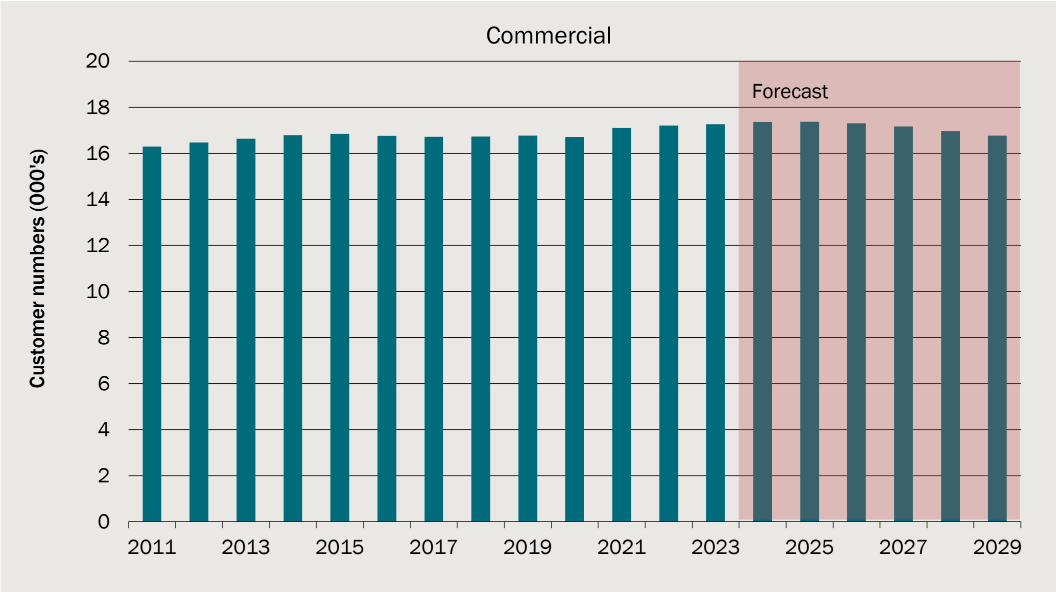
6.9 Net new commercial customers, scenario 4



Data source: The CIE

Scenario 4 similarly leads to lower overall total residential customers over the forecast period compared to scenario 0 (Chart 6.10)

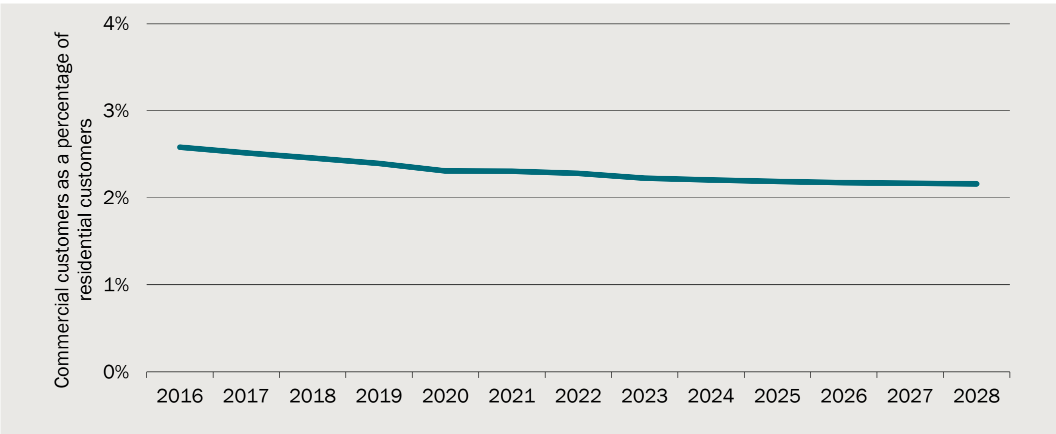
6.10 Total commercial customers, scenario 4



Data source: The CIE

Our forecasts imply that commercial customer numbers, measured as percentage of residential customer numbers, will continue to decline, consistent with their decline over recent years. This is shown in Chart 2.2.

6.11 Commercial customers (as a percentage of residential customers), including forecasts



Data source: CIE.

Conversion from calendar to financial years

To convert forecasts for future calendar years into forecasts aligning to the new regulatory years, which are financial years plus a stub (half-year) period in 2023, we assume that half of net new customers in a calendar year connect in the first of the year, and the remaining half connect in the second half of the year.

Based on this approach, we estimate the number of connections for financial years and the stub period as shown in table 6.12 for scenario 0.

6.12 Forecast commercial customer numbers for new regulatory years, scenario 0

Year	Central	West	Adjoining Central	Adjoining West
	No.	No.	No.	No.
2020	10 342	6 096	25	245
2021	10 638	6 182	27	255
2022	10 761	6 160	27	260
2023 stub	10 796	6 151	29	260
2023/24	10 878	6 142	32	261
2024/25	10 954	6 134	33	262
2025/26	10 986	6 112	34	261
2026/27	10 965	6 070	34	260
2027/28	10 894	6 009	35	258

Source: CIE.

The financial year values are similarly presented for scenario 4 (chart 6.13)

6.13 Forecast commercial customer numbers for new regulatory years, scenario 0

Year	Central	West	Adjoining Central	Adjoining West
	No.	No.	No.	No.
2020	10 342	6 096	25	245
2021	10 638	6 182	27	255
2022	10 761	6 160	27	260
2023 stub	10 796	6 151	29	260
2023/24	10 878	6 142	32	261
2024/25	10 934	6 133	34	262
2025/26	10 927	6 107	36	262
2026/27	10 871	6 062	38	260
2027/28	10 773	5 998	38	258

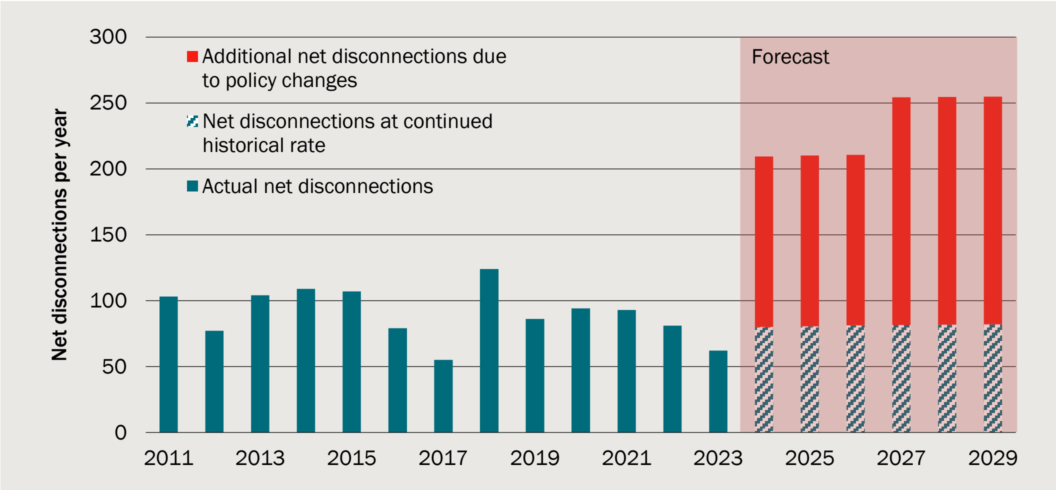
Source: CIE.

Disconnections

The rate of net disconnections among commercial customers has fluctuated over time (chart 6.14). For example, in 2017 there were 55 net disconnections of commercial customers (0.33 per cent of commercial customers) while 2018 saw 124 net disconnections (0.74 per cent of commercial customers).

We project that net disconnections will continue at their average rate over the past 3 years, which is 80-82 customers per year (table 6.15), or 0.46-0.48 per cent as a proportion of commercial customers in each of the coming years. In addition, policy changes lead to additional disconnections.

6.14 Rate of commercial customer disconnections, scenario 0



Data source: CIE.

6.15 Projected commercial disconnections, scenario 0

Net disconnections measure	2024	2025	2026	2027	2028	2029
	No.	No.	No.	No.	No.	No.
Number of net disconnections	80	81	81	81	82	82
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Net disconnections as a share of projected residential customers in each year	0.46	0.46	0.47	0.47	0.47	0.47

Data source: CIE.

Additional scenarios for commercial customer numbers

The projection of net new commercial customers is driven by the relationship between observed net new commercial customers per new residential customer. As such, the projections of alternate scenarios for commercial customers varies in line with the same drivers of residential customers. These scenarios are set out in in table 6.16.

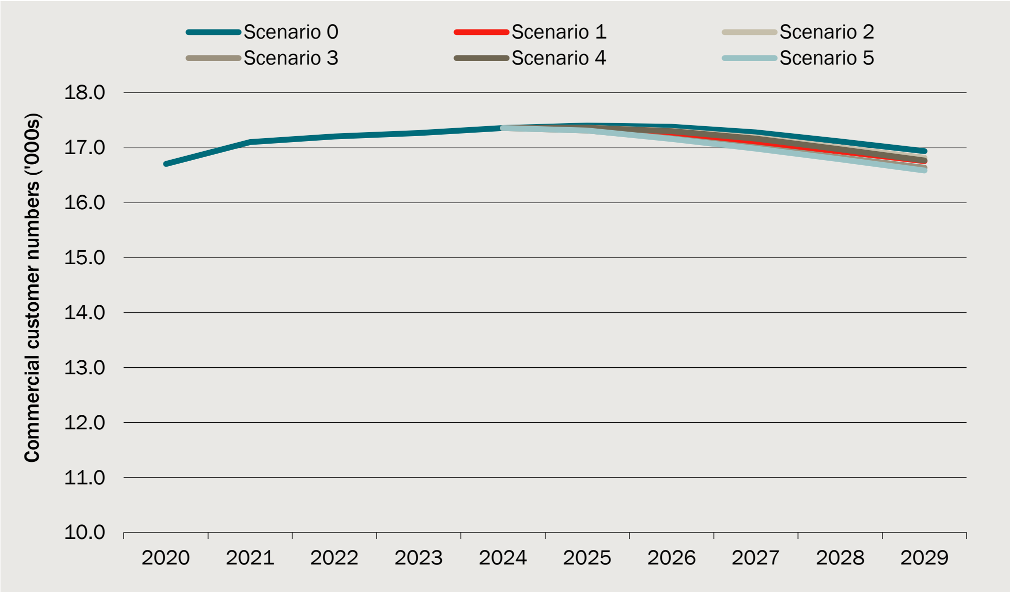
6.16 Additional scenarios for customer numbers

Scenario	Year that 1.25% disconnection rate is reached	Customer connection rate for houses
	Per cent	
Scenario 0	2028	3-year average
Scenario 1	2026	3-year average
Scenario 2	2028	60% from 2025
Scenario 3	2026	60% from 2025
Scenario 4	2028	60% in 2025, 20% by 2029
Scenario 5	2026	60% in 2025, 20% by 2030

Source: CIE.

Applying different combinations of these effects leads to lower projected commercial customer numbers across all scenarios, with a 351 customer difference between scenario 5 and scenario 0 by 2029 (chart 6.17).

6.17 Commercial customer numbers by scenario



Data source: CIE

7 Commercial customer usage

Commercial demand comprises non-residential customers that use less than 10 000 Gigajoules of gas in a 12 month period and less than 10 Gigajoules in an hour. Consumption patterns of different customers vary far more among commercial customers than residential customers, which has consequences for the approach to statistical estimation used.

The first part of the chapter describes changes in gas consumption patterns, the second part applies formal statistical techniques and the third and fourth develop the projections.

Descriptive analysis

Total commercial usage is dominated by the usage of large customers. Usage per commercial customer is more widely distributed in comparison to residential customers.

Table 7.1 shows the distribution of gas usage by tariff class. It is clear that commercial usage per customer is much more spread, with the 99th percentile of usage per customer being over 430 times the magnitude of the 20th percentile of usage, while for residential the 99th percentile is less than 7 times the 20th percentile.

7.1 Distribution of annual usage per customer by tariff class

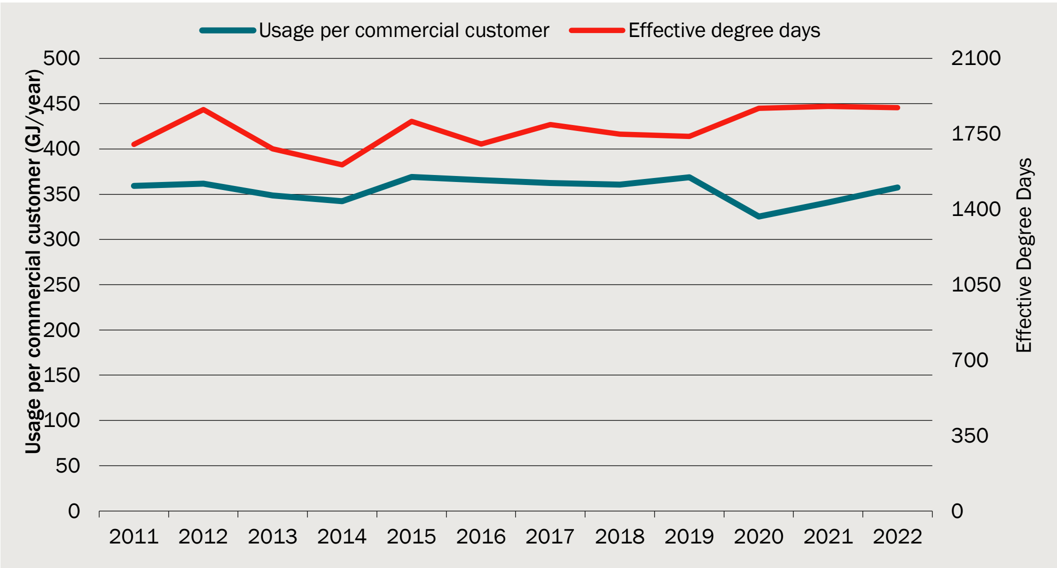
Percentile of usage in class	Tariff class	
	Residential	Commercial
	GJ/year	GJ/year
20th	19	12
40th	33	38
60th	46	94
80th	63	277
90th	78	601
95th	92	1 280
99th	126	5 167

Source: CIE.

Total commercial usage per year has been relatively stable over time. A weaker relationship is evident between EDD and usage per commercial customer than was the case for usage per residential customer. However, usage per customer does increase in line with the higher number of EDD, such as in 2015 relative to 2014. Thus, weather-correction will still be important to determine the starting point of the forecasts. This relationship is not very evident after 2016 and discontinues at the onset of the COVID pandemic, whereby increased EDD corresponds to a reduction in usage. Chart 7.2 presents the relationship between usage per commercial customer and EDD.

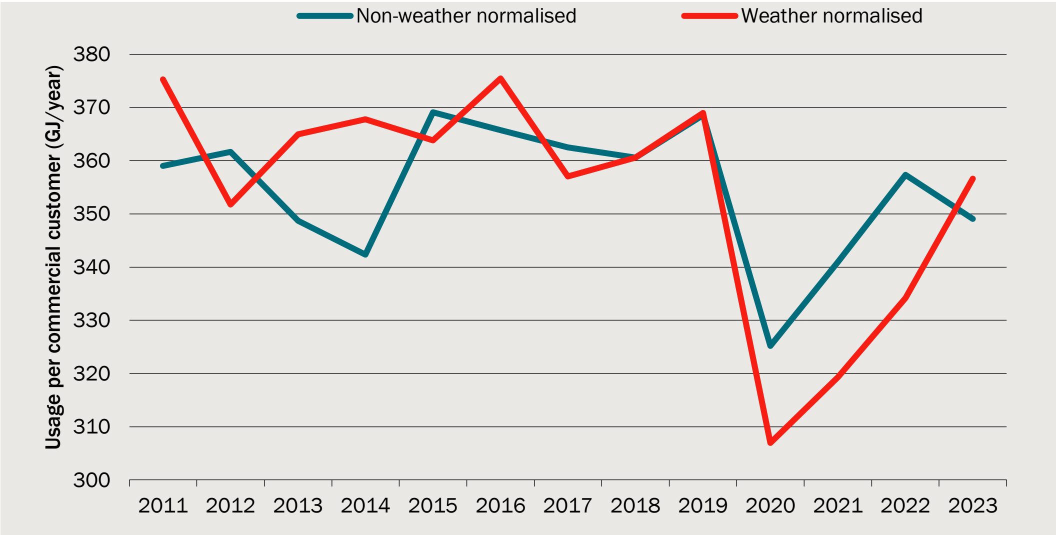
Chart 7.3 shows weather-normalised and non-weather-normalised usage per customer. There is more variation in commercial usage remaining after weather normalisation compared to weather-normalised residential usage. Unlike residential usage, commercial weather normalised usage does not have a clear downward trend. In 2020, the sharp decline in usage is evidenced in both usage lines. The weather-normalised usage line reflects commercial consumption trends excluding weather-related variations in a given year. Throughout the COVID and post-COVID periods (2019-2023), weather normalised usage consistently falls below non-weather normalised usage. This suggests that after accounting for weather conditions, actual usage has been lower than anticipated during this timeframe.

7.2 Relationship between usage per commercial customer and EDD



Data source: CIE.

7.3 Weather normalised usage per commercial customer

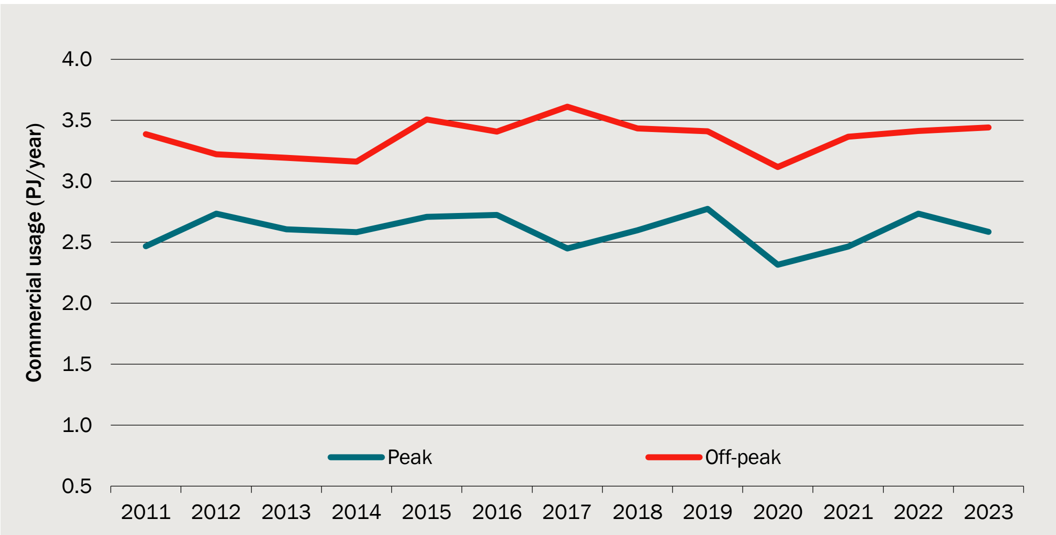


Note: Usage per commercial customer is weather normalised using the coefficients estimated in the statistical models presented throughout this chapter.

Data source: CIE.

Peak and off-peak usage vary differently over time. While total usage has risen over the years, off-peak usage has contributed more to this increase compared to peak usage, which has seen a slower growth. The impact of COVID is evident in both peak and off-peak usage, with a noticeable decline from 2019 to 2020. Although usage begins to recover after 2020, peak usage has not returned to pre-COVID levels yet. Chart 7.4 shows a comparison of peak and off-peak usage by commercial customers.

7.4 Comparison of peak and off-peak usage by commercial customers



Data source: CIE.

Formal statistical analysis

Model form

As seen above, an important characteristic of commercial usage is that total commercial usage is more concentrated among a smaller number of customers than was the case for residential usage. The model specification used for residential demand would not allow for different weighting to be given to large customers and small customers. Weighting large customers more greatly would produce estimates of usage per customer that, when aggregated, would be more accurate estimates of total usage than those produced by an unweighted approach. Failure to weight large customers more would result in a model that would only yield accurate estimates of total usage if large and small customers have the same relationships with driver variables, which is unlikely to be the case.

Therefore, in our statistical modelling we have weighted observations of each customer by their average usage per year over the period they are in the dataset.

A consequence weighting observations in panel data models is that the model must either be a fixed effects or pooled regression model. Random effects models do not allow for weights on observations. We therefore follow a two-stage process of estimating a fixed effects model and then estimating a model predicting these fixed effects based on characteristics of commercial connections.

The fixed effects model is shown in the equation below.

$$\begin{aligned} q_{it} = \mu_i + \\ v.year_t + \gamma_2.edd_t + \gamma_3.COVID_t \\ \delta_1.price_{it} + \varepsilon_{it} \end{aligned}$$

The dependent variable, q_{it} is the natural log of the quantity of gas used by commercial customer i in year t. We estimate our model using the log of consumption, as drivers would be expected to have similar percentage impacts on usage rather than similar GJ impacts on usage.

The first row of explanatory variables is the fixed effect for each commercial customer, μ_i.

The second row of explanatory variables is time specific characteristics, such as *year* and effective degree days (*edd*) and a dummy variable for COVID-19 lockdowns. This includes both 2020 and 2021.

The third row of explanatory variables is characteristics that vary by both time and dwelling, which includes *price* and an error term for that commercial customer for that year.

The second stage of the statistical estimation is to estimate the fixed effect against connection characteristics as follows.

$$\mu_i = \beta_0 + \sum_{t=2010}^{2022} \beta_t.year\ connected + \varepsilon_i$$

This equation estimates the customer-specific fixed effect using a set of dummy variables indicating the year that the customer was connected. A dummy variable takes either a value of 0 or a value of 1. For the dummy variable for year of connection for 2010 for example, all connections established in 2010 would have a value of 1 and all other connections would have a value of 0. We use a dummy for each year because we would not expect that the impact of year created would be linear. We have assigned a value of 1 to the year connected variable for all connections prior to 2010.

The variables used have been selected for the modelling based on the data that is available and views about what the important drivers of gas demand are. Consideration has been given to the inclusion of an electricity price variable, and the reasons for not doing so are discussed in Chapter 6 (in the context of residential usage).

In estimating these statistical models we determined that these variables generally have statistically significant relationships in predicting usage per customer in most model specifications. We have chosen to use the same variable selection for all models instead of only choosing variables with statistical significant relationships in a given model. This is done because of the strong theoretical reasons that such relationships would be significant, such as in the case of Effective Degree Days.

We do not have revenue variables for each commercial customer, hence these cannot be included. It is possible to include aggregate measures of income such as Gross State Product (GSP), however precise forecasts of aggregate income variables specific to the AusNet geographical areas are not available.

The model we estimate is based on levels of usage per customer and levels of variables such as prices. Given the time and resource constraints we do not seek to model dynamic processes around the patterns of change.

Model estimation

The model form that we estimate for our base model is set out in the section above.

The model is estimated in STATA, which is a data analysis and statistical software package.[39] STATA uses generalised least squares regression to estimate coefficients for panel regressions under fixed effects assumptions. We allow for error terms in regressions to be clustered by customer in constructing the statistical significance of parameters.

We define *year* as year since 2009. We generally do not use a dummy variable approach for year because then we would not be able to differentiate between weather effects and any time trend in consumption. The use of year as a scalar variable implies that the effect is linear — i.e. each year on average leads to the same x per cent change in consumption.

We do not know the price paid by each customer. We have defined price as a price index for the entire state of Victoria based on a quarterly index of Victorian gas prices sourced

39 See http://www.stata.com/ for more details.

from the Australian Bureau of Statistics for 2003-2023. This assumes that same per cent changes to prices is applied across all AusNet geographical areas.

Main model specification and constraining the price variable

Two models were evaluated — an unconstrained model and a constrained model where the *price* coefficient was constrained.

We analysed fixed effects models for estimation using total, peak, and off-peak commercial usage as dependent variables. Table 7.5 presents the estimated coefficients and results of significant tests for models of commercial usage. It shows fixed effects models for estimation using total, peak, and off-peak commercial usage as dependent variables in different models.

Examples of interpretation of these results is as follows.

- The *year* coefficient is not significant below 5 per cent
- The *EDD* coefficient of 0.000287 indicates that an additional EDD is associated with a 0.0287 per cent increase in usage per customer.
- The COVID-19 coefficient of -0.233 indicates that during the COVID-19 period gas usage decreased by 23.3 per cent.

7.5 Results of commercial usage fixed effects model

Sample	Total	Peak	Off-peak
Year	-0.0101	-0.0162	-0.000313
EDD	0.0000957*	0.000158***	0.0000453
Gas price	-0.115	-0.0298	-0.175
COVID-19	-0.116***	-0.198***	-0.0690***
Constant	34.74*	45.63*	14.76
N	62453967	61834428	62427246

Note: The R^2 of the model is not presented because fixed effects do not account for individual variation, and therefore R^2 does not have a meaningful interpretation here.

P-values are indicated by the asterisks, with p<0.05 = *, p<0.01=*, p<0.001=***.

Source: CIE.

The constrained model was chosen as the main model of specification because it demonstrated higher statistical significance across all coefficients. Other coefficients in the model such as those associated with EDD and the time trend have not been constrained. These other coefficients have been estimated given the constraint on *price* coefficients.

Once we opted for the constrained model as our main model specification, we calculated coefficients for each commercial usage block. We have not separately estimated the *price* coefficient for each block, given that model testing indicated inconsistent estimates (variously negative and positive). Instead, we focused on two models — one for peak usage blocks and another for off-peak usage blocks.

The *price* coefficient estimated in the unconstrained peak and off-peak usage per customer models are used in their corresponding blocks usage models. Specifically, in the model for peak usage blocks, we set the gas *price* coefficient to align with the value from the peak commercial usage model, which was -0.03. Likewise, in the model for off-peak usage blocks, we adjusted the gas *price* coefficient to match the value from the off-peak commercial usage model, which was -0.17 (see Table 8.2).

Model results

Table 7.6 presents the estimated coefficients of the models estimated for each block of commercial usage. All coefficients except the *new connections* coefficient are directly estimated using the first stage fixed effect models for each block of usage.

The *new connections* coefficient is calculated based on the estimated coefficients from the second-stage regression that estimates the fixed effects from the first-stage model. It is determined according the following formula:

$$New\ connections = \frac{\sum_{t=2020}^{2022} \beta_t \times new\ connected_t}{\sum_{t=2020}^{2022} new\ connected_t} - \frac{\sum_{2010}^{2022} \beta_t \times new\ connected_t}{\sum_{2010}^{2022} new\ connected_t}$$

This formula calculates the difference in the weighted average coefficient of *year connected* dummy variables over the past 3 years compared to the weighted average coefficient of all *year connected* dummy variables that are estimated over 2010-2022. These averages are weighted by the number of new connections in that year. The $new\ connected_t$ is the number of newly connected customers in that year.

We have not taken the log transform of the *EDD* variable because analysis of the relationship between daily weather and usage did not suggest a substantial non-linear component to this relationship. Therefore, the coefficient may be interpreted as the per cent change in usage for a block from an additional EDD per year.

The *gas price* variable is in log terms, and thus it suggests that, considering the 'Peak 0-0.1' block, a 1 per cent increase in the gas price is associated with a 0.03 per cent *decrease* in usage (given the sign of the coefficient is negative).

The *COVID-19* variable indicates that, considering the 'Peak 0-0.1' block, there was a decrease in usage of 4.4 per cent during the COVID-19 period.

7.6 Coefficients used to forecast commercial demand

Model/block	*Year*	*EDD*	*Gas price*	*COVID-19*	*New connections*
Peak 0 - 0.1	-0.039	0.0001	-0.030	-0.044	0.278
Peak 0.1 - 0.2	-0.049	0.0001	-0.030	-0.109	0.408
Peak 0.2 - 1.4	-0.067	0.0002	-0.030	-0.225	0.606
Peak > 1.4	-0.084	0.0005	-0.030	-0.570	0.481
Off Peak 0 - 0.1	-0.037	0.0001	-0.175	-0.009	0.308

Model/block	Year	EDD	Gas price	COVID-19	New connections
Off Peak 0.1 - 0.2	-0.046	0.0002	-0.175	-0.036	0.494
Off Peak 0.2 - 1.4	-0.061	0.0003	-0.175	-0.076	0.781
Off Peak > 1.4	-0.067	0.0005	-0.175	-0.208	0.844

Source: CIE.

Projection of key drivers of usage

Adjustments for electrification and energy efficiency

We apply three adjustments to projections of usage:

- A downward adjustment to total usage based on the impact of electrification estimated in the AEMO GSOO 2024,
- A downward adjustment to total usage based on the impact of energy efficiency estimated in the AEMO GSOO 2024, and

These adjustments are identical to those made for residential usage (table 2 shows AEMOs estimates of the impact of appliance switching and energy efficiency), including the removal of 25 per cent of AEMO's electrification adjustment to avoid double-counting with customer number impacts.

Projected weather outcomes

Consistent with our approach to forecasting residential usage, we project EDD to decline at a rate consistent with the historical trend of -8.124 EDD per year (see chart 8.3).

Forecasts of commercial gas use

Forecasts of total commercial gas usage combine projections of usage per customer from the statistical modelling described above with forecasts of customer numbers. These two components are combined according to the following equation to obtain total usage per block.

$$Q_{brt} = \frac{(customers_t + customers_{t+1})}{2} \times q_{ibt}$$

Q_{bt} is total usage of block *b*, region *r*, in year *t*. It is the product of two components:

- the average number of customers in a year, which is equal to half the sum of customers at the beginning of year *t* and the beginning of year *t+1*, and
- the usage per customer (*i*) of block *b*, region *r*, in year *t*.

As noted earlier, the statistical models of commercial usage are estimated using data that exclude observations of usage within the same year that a customer is connected. Customers may only be connected for part of the first year they become connected. For this reason, usage per customer is multiplied by the average number of customers in a year to account for customers who connect during the year. This method assumes that customers are connected in equal proportion throughout the year.

Usage per customer is a function of projected *EDD*, *gas price*, and the coefficients of these variables. The number of existing customers is the number of customers in 2023 for each region/class. We do not use the negative time trends estimated in our statistical models as part of the projections, instead relying on the AEMO GSOO 2024 estimate of the impact of electrification and energy efficiency to capture these factors.

Usage per customer is forecast separately for new and existing customers. To the extent that there are disconnections due to policy changes, these are accounted for as reductions in the number and usage of existing customers.

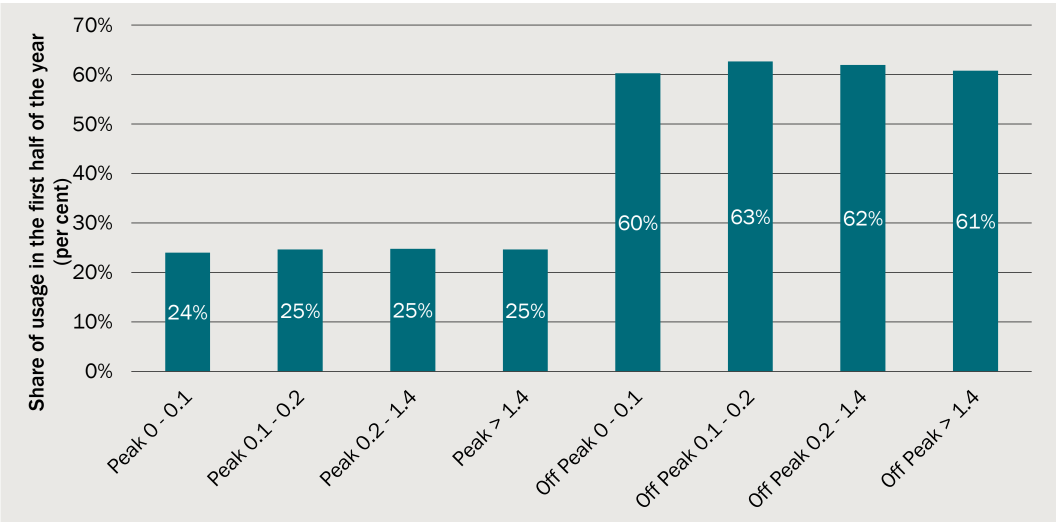
Usage per new commercial customer is forecast in the same manner as existing customers, with one adjustment made for new connections having lower usage per customer. The factor applied is determined using the *new connections* variable.

Thus, usage per new commercial customer is as follows:

$$usage\ per\ customer_{new,t} = usage\ per\ customer_{existing,t} \times (1 + \beta_{new\ connections})$$

To convert the calendar year usage forecasts to financial year forecasts and a forecast for the stub period, we estimate the relationship between usage in the first half of a calendar year and the second. This allows us to allocate usage to each half of the year, and thereby estimate usage for the stub period and financial years that occupy the second of a year and the first half of the subsequent year. The ratio of usage in the first and second half of the year is estimated for each block based on data of monthly usage by block. We take an average of this share between 2019 and 2023 (chart 7.7).

7.7 Share of usage in the first half of each year, commercial



Data source: AusNet Services monthly usage data, CIE calculations.

Tables 7.8 and 7.9 show the forecasts by calendar and regulatory year, respectively, for Scenario 0. Similarly, tables 7.10 and 7.11 show these results for Scenario 4.

7.8 Projections of commercial usage under Scenario 0, by calendar year

Region/ Block	Unit	2021	2022	2023	2024	2025	2026	2027	2028	2029
		Actual	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Tariff V - AusNet Central - Commercial										
Fixed Charge	No.	10 638	10 761	10 832	10 924	10 983	10 989	10 940	10 848	10 746
Peak 0 - 0.1	GJ	92 484	95 017	93 872	94 089	92 774	89 967	86 250	81 671	77 416
Peak 0.1 - 0.2	GJ	74 691	77 320	74 859	75 415	74 449	72 256	69 295	65 629	62 212
Peak 0.2 - 1.4	GJ	447 228	486 016	466 467	473 844	468 852	455 767	437 430	414 485	392 984
Peak > 1.4	GJ	1 130 744	1 289 184	1 217 452	1 248 006	1 229 734	1 190 967	1 139 398	1 076 380	1 017 639
Off Peak 0 - 0.1	GJ	161 901	166 566	165 464	166 783	164 316	159 800	153 744	145 700	138 120
Off Peak 0.1 - 0.2	GJ	116 351	122 096	119 108	120 911	119 354	116 229	111 897	106 086	100 584
Off Peak 0.2 - 1.4	GJ	675 995	719 663	716 677	735 591	729 190	712 279	686 901	652 039	618 711
Off Peak > 1.4	GJ	1 487 300	1 504 338	1 533 366	1 588 970	1 574 951	1 537 720	1 481 725	1 405 217	1 331 991
Total	**GJ**	**4 186 694**	**4 460 200**	**4 387 264**	**4 503 608**	**4 453 620**	**4 334 984**	**4 166 641**	**3 947 207**	**3 739 658**
Tariff V - AusNet West - Commercial										
Fixed Charge	No.	6 182	6 160	6 142	6 141	6 128	6 095	6 044	5 975	5 904
Peak 0 - 0.1	GJ	47 829	48 766	47 247	46 847	45 760	44 046	42 027	39 636	37 472
Peak 0.1 - 0.2	GJ	36 259	37 889	35 665	35 490	34 664	33 361	31 823	30 003	28 356
Peak 0.2 - 1.4	GJ	193 509	208 687	197 844	197 984	193 384	186 085	177 448	167 227	157 987
Peak > 1.4	GJ	398 981	444 802	407 004	411 729	401 083	384 944	366 166	344 238	324 416
Off Peak 0 - 0.1	GJ	77 870	76 845	75 816	75 573	73 738	71 164	68 134	64 303	60 792
Off Peak 0.1 - 0.2	GJ	51 324	50 393	49 184	49 263	48 068	46 383	44 395	41 884	39 584
Off Peak 0.2 - 1.4	GJ	259 821	262 002	261 524	263 693	257 437	248 472	237 810	224 304	211 955
Off Peak > 1.4	GJ	472 302	450 299	458 562	466 275	454 723	438 368	419 027	394 714	372 504
Total	**GJ**	**1 537 895**	**1 579 683**	**1 532 846**	**1 546 854**	**1 508 857**	**1 452 822**	**1 386 830**	**1 306 308**	**1 233 064**

Region/ Block	Unit	2021	2022	2023	2024	2025	2026	2027	2028	2029
		Actual	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Tariff V - AusNet Central - New Town Commercial										
Fixed Charge	No.	27	27	32	33	34	34	35	35	34
Peak 0 - 0.1	GJ	219	232	281	290	292	289	281	269	257
Peak 0.1 - 0.2	GJ	153	180	196	204	207	205	200	192	183
Peak 0.2 - 1.4	GJ	746	844	1 370	1 446	1 478	1 471	1 441	1 385	1 328
Peak > 1.4	GJ	291	390	348	369	374	370	361	346	330
Off Peak 0 - 0.1	GJ	336	351	264	274	277	274	268	257	246
Off Peak 0.1 - 0.2	GJ	198	208	88	93	94	94	92	89	85
Off Peak 0.2 - 1.4	GJ	1 516	1 369	524	563	579	581	574	554	532
Off Peak > 1.4	GJ	371	608	663	721	743	747	737	711	683
Total	**GJ**	**3 831**	**4 181**	**3 734**	**3 960**	**4 045**	**4 030**	**3 954**	**3 801**	**3 644**
Tariff V - AusNet West - New Town Commercial										
Fixed Charge	No.	255	260	261	262	262	261	259	256	254
Peak 0 - 0.1	GJ	2 714	2 954	2 940	2 926	2 867	2 767	2 645	2 498	2 363
Peak 0.1 - 0.2	GJ	2 209	2 304	2 325	2 323	2 278	2 198	2 102	1 985	1 877
Peak 0.2 - 1.4	GJ	12 616	14 063	12 992	13 070	12 825	12 383	11 841	11 180	10 571
Peak > 1.4	GJ	23 994	27 447	25 771	26 192	25 618	24 663	23 516	22 146	20 885
Off Peak 0 - 0.1	GJ	4 909	4 874	4 960	4 963	4 859	4 702	4 511	4 263	4 033
Off Peak 0.1 - 0.2	GJ	3 753	3 507	3 498	3 520	3 449	3 338	3 203	3 027	2 863
Off Peak 0.2 - 1.4	GJ	20 422	20 399	20 250	20 547	20 168	19 546	18 766	17 741	16 779
Off Peak > 1.4	GJ	31 929	29 265	30 849	31 578	30 973	29 989	28 763	27 160	25 656
Total	**GJ**	**102 546**	**104 812**	**103 584**	**105 118**	**103 036**	**99 586**	**95 346**	**90 001**	**85 027**

Source: CIE.

7.9 Projections of commercial usage under Scenario 0, by regulatory year

Region/ Block	Unit	2021	2022	2023 stub	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29
		Actual	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Tariff V - AusNet Central - Commercial										
Fixed Charge	No.	10 638	10 761	10 796	10 878	10 954	10 986	10 965	10 894	10 797
Peak 0 - 0.1	GJ	92 484	95 017	21 656	93 924	93 773	92 100	89 075	85 151	80 650
Peak 0.1 - 0.2	GJ	74 691	77 320	17 539	74 996	75 177	73 908	71 526	68 391	64 787
Peak 0.2 - 1.4	GJ	447 228	486 016	112 385	468 296	472 606	465 608	451 221	431 741	409 154
Peak > 1.4	GJ	1 130 744	1 289 184	286 956	1 224 980	1 243 504	1 220 183	1 178 261	1 123 872	1 061 907
Off Peak 0 - 0.1	GJ	161 901	166 566	100 278	166 259	165 297	161 595	156 151	148 898	141 134
Off Peak 0.1 - 0.2	GJ	116 351	122 096	73 547	120 238	119 935	117 396	113 514	108 255	102 638
Off Peak 0.2 - 1.4	GJ	675 995	719 663	442 548	728 391	731 627	718 717	696 562	665 311	631 399
Off Peak > 1.4	GJ	1 487 300	1 504 338	948 870	1 567 162	1 580 449	1 552 322	1 503 687	1 435 223	1 360 710
Total	**GJ**	**4 186 694**	**4 460 200**	**2 003 778**	**4 444 244**	**4 482 368**	**4 401 828**	**4 259 997**	**4 066 843**	**3 852 379**
Tariff V - AusNet West - Commercial										
Fixed Charge	No.	6 182	6 160	6 151	6 142	6 134	6 112	6 070	6 009	5 939
Peak 0 - 0.1	GJ	47 829	48 766	11 164	47 151	46 586	45 348	43 561	41 453	39 116
Peak 0.1 - 0.2	GJ	36 259	37 889	8 701	35 622	35 286	34 343	32 981	31 374	29 596
Peak 0.2 - 1.4	GJ	193 509	208 687	49 502	197 879	196 844	191 574	183 943	174 914	164 936
Peak > 1.4	GJ	398 981	444 802	105 290	408 168	409 106	397 107	380 317	360 763	339 354
Off Peak 0 - 0.1	GJ	77 870	76 845	45 867	75 670	74 468	72 187	69 338	65 826	62 187
Off Peak 0.1 - 0.2	GJ	51 324	50 393	30 825	49 234	48 514	47 012	45 138	42 821	40 442
Off Peak 0.2 - 1.4	GJ	259 821	262 002	163 611	262 867	259 818	251 885	241 869	229 446	216 656
Off Peak > 1.4	GJ	472 302	450 299	282 058	463 250	459 254	444 782	426 613	404 250	381 215
Total	**GJ**	**1 537 895**	**1 579 683**	**697 018**	**1 539 840**	**1 529 876**	**1 484 238**	**1 423 761**	**1 350 847**	**1 273 504**

Region/ Block	Unit	2021	2022	2023 stub	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29
		Actual	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Tariff V - AusNet Central - New Town Commercial										
Fixed Charge	No.	27	27	29	32	33	34	34	35	34
Peak 0 - 0.1	GJ	219	232	89	283	290	291	287	278	266
Peak 0.1 - 0.2	GJ	153	180	81	198	205	206	204	198	190
Peak 0.2 - 1.4	GJ	746	844	553	1 389	1 454	1 476	1 463	1 427	1 371
Peak > 1.4	GJ	291	390	107	353	371	373	368	357	342
Off Peak 0 - 0.1	GJ	336	351	189	270	276	275	270	261	250
Off Peak 0.1 - 0.2	GJ	198	208	80	91	94	94	93	90	86
Off Peak 0.2 - 1.4	GJ	1 516	1 369	705	548	573	580	576	561	540
Off Peak > 1.4	GJ	371	608	526	698	734	745	741	722	694
Total	**GJ**	**3 831**	**4 181**	**2 329**	**3 831**	**3 997**	**4 042**	**4 002**	**3 894**	**3 739**
Tariff V - AusNet West - New Town Commercial										
Fixed Charge	No.	255	260	260	261	262	261	260	258	255
Peak 0 - 0.1	GJ	2 714	2 954	719	2 936	2 912	2 843	2 738	2 610	2 466
Peak 0.1 - 0.2	GJ	2 209	2 304	558	2 324	2 312	2 258	2 175	2 073	1 958
Peak 0.2 - 1.4	GJ	12 616	14 063	3 011	13 011	13 009	12 715	12 249	11 677	11 029
Peak > 1.4	GJ	23 994	27 447	5 828	25 875	26 050	25 382	24 380	23 178	21 835
Off Peak 0 - 0.1	GJ	4 909	4 874	3 022	4 962	4 901	4 764	4 587	4 362	4 125
Off Peak 0.1 - 0.2	GJ	3 753	3 507	2 214	3 512	3 475	3 379	3 253	3 093	2 924
Off Peak 0.2 - 1.4	GJ	20 422	20 399	13 185	20 434	20 312	19 782	19 063	18 132	17 146
Off Peak > 1.4	GJ	31 929	29 265	19 376	31 292	31 210	30 375	29 244	27 789	26 246
Total	**GJ**	**102 546**	**104 812**	**47 913**	**104 346**	**104 181**	**101 500**	**97 688**	**92 913**	**87 729**

Source: CIE.

7.10 Projections of commercial usage under Scenario 4, by calendar year

Region/ Block	Unit	2021	2022	2023	2024	2025	2026	2027	2028	2029
		Actual	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Tariff V - AusNet Central - Commercial										
Fixed Charge	No.	10 638	10 761	10 832	10 924	10 943	10 911	10 832	10 714	10 590
Peak 0 - 0.1	GJ	92 484	95 017	93 872	94 089	92 331	89 135	85 125	80 345	75 919
Peak 0.1 - 0.2	GJ	74 691	77 320	74 859	75 415	74 047	71 500	68 272	64 424	60 852
Peak 0.2 - 1.4	GJ	447 228	486 016	466 467	473 844	465 781	450 002	429 639	405 314	382 643
Peak > 1.4	GJ	1 130 744	1 289 184	1 217 452	1 248 006	1 222 594	1 177 591	1 121 362	1 055 193	993 804
Off Peak 0 - 0.1	GJ	161 901	166 566	165 464	166 783	163 510	158 279	151 680	143 265	135 371
Off Peak 0.1 - 0.2	GJ	116 351	122 096	119 108	120 911	118 652	114 907	110 104	103 972	98 200
Off Peak 0.2 - 1.4	GJ	675 995	719 663	716 677	735 591	723 544	701 656	672 502	635 081	599 598
Off Peak > 1.4	GJ	1 487 300	1 504 338	1 533 366	1 588 970	1 561 995	1 513 381	1 448 781	1 366 477	1 288 392
Total	**GJ**	**4 186 694**	**4 460 200**	**4 387 264**	**4 503 608**	**4 422 453**	**4 276 453**	**4 087 465**	**3 854 071**	**3 634 779**
Tariff V - AusNet West - Commercial										
Fixed Charge	No.	6 182	6 160	6 142	6 141	6 125	6 089	6 034	5 962	5 888
Peak 0 - 0.1	GJ	47 829	48 766	47 247	46 847	45 734	43 987	41 935	39 517	37 336
Peak 0.1 - 0.2	GJ	36 259	37 889	35 665	35 490	34 642	33 309	31 744	29 900	28 239
Peak 0.2 - 1.4	GJ	193 509	208 687	197 844	197 984	193 233	185 738	176 915	166 531	157 197
Peak > 1.4	GJ	398 981	444 802	407 004	411 729	400 805	384 310	365 193	342 970	322 980
Off Peak 0 - 0.1	GJ	77 870	76 845	75 816	75 573	73 695	71 065	67 981	64 103	60 565
Off Peak 0.1 - 0.2	GJ	51 324	50 393	49 184	49 263	48 034	46 306	44 276	41 727	39 406
Off Peak 0.2 - 1.4	GJ	259 821	262 002	261 524	263 693	257 197	247 922	236 962	223 196	210 699
Off Peak > 1.4	GJ	472 302	450 299	458 562	466 275	454 273	437 336	417 437	392 641	370 155
Total	**GJ**	**1 537 895**	**1 579 683**	**1 532 846**	**1 546 854**	**1 507 614**	**1 449 973**	**1 382 443**	**1 300 585**	**1 226 578**

Region/ Block	Unit	2021	2022	2023	2024	2025	2026	2027	2028	2029
		Actual	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Tariff V - AusNet Central - New Town Commercial										
Fixed Charge	No.	27	27	32	33	36	37	38	38	38
Peak 0 - 0.1	GJ	219	232	281	290	313	320	316	303	290
Peak 0.1 - 0.2	GJ	153	180	196	204	223	230	228	219	209
Peak 0.2 - 1.4	GJ	746	844	1 370	1 446	1 618	1 684	1 677	1 618	1 548
Peak > 1.4	GJ	291	390	348	369	406	419	414	398	380
Off Peak 0 - 0.1	GJ	336	351	264	274	297	305	302	290	277
Off Peak 0.1 - 0.2	GJ	198	208	88	93	103	106	106	102	98
Off Peak 0.2 - 1.4	GJ	1 516	1 369	524	563	643	679	682	661	633
Off Peak > 1.4	GJ	371	608	663	721	830	879	884	857	820
Total	**GJ**	**3 831**	**4 181**	**3 734**	**3 960**	**4 433**	**4 622**	**4 608**	**4 449**	**4 256**
Tariff V - AusNet West - New Town Commercial										
Fixed Charge	No.	255	260	261	262	262	261	259	257	253
Peak 0 - 0.1	GJ	2 714	2 954	2 940	2 926	2 873	2 774	2 650	2 501	2 363
Peak 0.1 - 0.2	GJ	2 209	2 304	2 325	2 323	2 283	2 205	2 106	1 987	1 877
Peak 0.2 - 1.4	GJ	12 616	14 063	12 992	13 070	12 861	12 427	11 873	11 195	10 567
Peak > 1.4	GJ	23 994	27 447	25 771	26 192	25 683	24 739	23 572	22 172	20 879
Off Peak 0 - 0.1	GJ	4 909	4 874	4 960	4 963	4 870	4 714	4 520	4 268	4 032
Off Peak 0.1 - 0.2	GJ	3 753	3 507	3 498	3 520	3 458	3 349	3 211	3 031	2 862
Off Peak 0.2 - 1.4	GJ	20 422	20 399	20 250	20 547	20 236	19 627	18 826	17 769	16 773
Off Peak > 1.4	GJ	31 929	29 265	30 849	31 578	31 085	30 121	28 861	27 206	25 646
Total	**GJ**	**102 546**	**104 812**	**103 584**	**105 118**	**103 349**	**99 955**	**95 619**	**90 129**	**84 998**

Source: CIE.

7.11 Projections of commercial usage under Scenario 4, by regulatory year

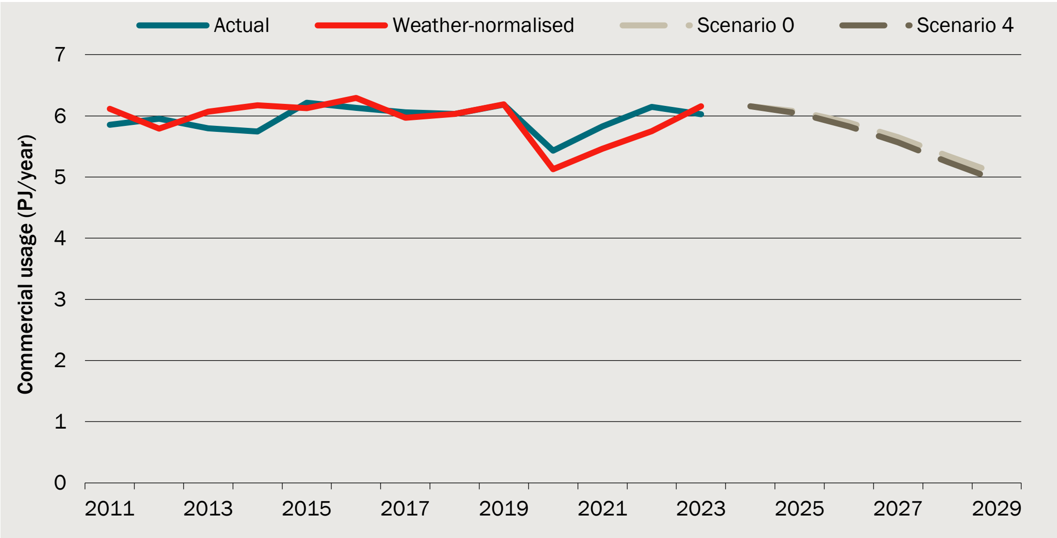
Region/ Block	Unit	2021	2022	2023 stub	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29
		Actual	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Tariff V - AusNet Central - Commercial										
Fixed Charge	No.	10 638	10 761	10 796	10 878	10 934	10 927	10 871	10 773	10 652
Peak 0 - 0.1	GJ	92 484	95 017	21 656	93 924	93 667	91 564	88 173	83 978	79 282
Peak 0.1 - 0.2	GJ	74 691	77 320	17 539	74 996	75 077	73 419	70 704	67 323	63 543
Peak 0.2 - 1.4	GJ	447 228	486 016	112 385	468 296	471 845	461 869	444 953	423 608	399 693
Peak > 1.4	GJ	1 130 744	1 289 184	286 956	1 224 980	1 241 745	1 211 506	1 163 738	1 105 060	1 040 068
Off Peak 0 - 0.1	GJ	161 901	166 566	100 278	166 259	164 811	160 359	154 303	146 610	138 510
Off Peak 0.1 - 0.2	GJ	116 351	122 096	73 547	120 238	119 495	116 305	111 897	106 261	100 355
Off Peak 0.2 - 1.4	GJ	675 995	719 663	442 548	728 391	728 130	709 989	683 601	649 327	613 106
Off Peak > 1.4	GJ	1 487 300	1 504 338	948 870	1 567 162	1 572 575	1 532 448	1 474 117	1 398 757	1 319 017
Total	**GJ**	**4 186 694**	**4 460 200**	**2 003 778**	**4 444 244**	**4 467 345**	**4 357 458**	**4 191 486**	**3 980 924**	**3 753 574**
Tariff V - AusNet West - Commercial										
Fixed Charge	No.	6 182	6 160	6 151	6 142	6 133	6 107	6 062	5 998	5 925
Peak 0 - 0.1	GJ	47 829	48 766	11 164	47 151	46 580	45 314	43 494	41 355	38 993
Peak 0.1 - 0.2	GJ	36 259	37 889	8 701	35 622	35 281	34 313	32 923	31 289	29 490
Peak 0.2 - 1.4	GJ	193 509	208 687	49 502	197 879	196 806	191 375	183 550	174 340	164 217
Peak > 1.4	GJ	398 981	444 802	105 290	408 168	409 038	396 741	379 600	359 717	338 045
Off Peak 0 - 0.1	GJ	77 870	76 845	45 867	75 670	74 442	72 111	69 207	65 645	61 971
Off Peak 0.1 - 0.2	GJ	51 324	50 393	30 825	49 234	48 493	46 951	45 034	42 679	40 273
Off Peak 0.2 - 1.4	GJ	259 821	262 002	163 611	262 867	259 670	251 453	241 135	228 437	215 457
Off Peak > 1.4	GJ	472 302	450 299	282 058	463 250	458 980	443 979	425 241	402 366	378 974
Total	**GJ**	1 537 895	1 579 683	697 018	1 539 840	1 529 290	1 482 237	1 420 185	1 345 828	1 267 420

Region/ Block	Unit	2021	2022	2023 stub	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29
		Actual	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Tariff V - AusNet Central - New Town Commercial										
Fixed Charge	No.	27	27	29	32	34	36	38	38	38
Peak 0 - 0.1	GJ	219	232	89	283	295	315	319	313	300
Peak 0.1 - 0.2	GJ	153	180	81	198	209	225	229	225	217
Peak 0.2 - 1.4	GJ	746	844	553	1 389	1 489	1 634	1 682	1 662	1 601
Peak > 1.4	GJ	291	390	107	353	378	409	418	410	393
Off Peak 0 - 0.1	GJ	336	351	189	270	288	301	303	295	283
Off Peak 0.1 - 0.2	GJ	198	208	80	91	99	105	106	104	99
Off Peak 0.2 - 1.4	GJ	1 516	1 369	705	548	612	665	681	669	644
Off Peak > 1.4	GJ	371	608	526	698	787	860	882	868	835
Total	**GJ**	**3 831**	**4 181**	**2 329**	**3 831**	**4 158**	**4 515**	**4 620**	**4 546**	**4 372**
Tariff V - AusNet West - New Town Commercial										
Fixed Charge	No.	255	260	260	261	262	262	260	258	255
Peak 0 - 0.1	GJ	2 714	2 954	719	2 936	2 913	2 849	2 744	2 615	2 468
Peak 0.1 - 0.2	GJ	2 209	2 304	558	2 324	2 313	2 264	2 181	2 077	1 960
Peak 0.2 - 1.4	GJ	12 616	14 063	3 011	13 011	13 018	12 754	12 289	11 705	11 040
Peak > 1.4	GJ	23 994	27 447	5 828	25 875	26 066	25 450	24 452	23 227	21 853
Off Peak 0 - 0.1	GJ	4 909	4 874	3 022	4 962	4 907	4 776	4 597	4 368	4 126
Off Peak 0.1 - 0.2	GJ	3 753	3 507	2 214	3 512	3 481	3 389	3 262	3 098	2 925
Off Peak 0.2 - 1.4	GJ	20 422	20 399	13 185	20 434	20 354	19 859	19 131	18 172	17 152
Off Peak > 1.4	GJ	31 929	29 265	19 376	31 292	31 278	30 499	29 355	27 855	26 258
Total	**GJ**	**102 546**	**104 812**	**47 913**	**104 346**	**104 332**	**101 841**	**98 011**	**93 116**	**87 781**

Source: CIE.

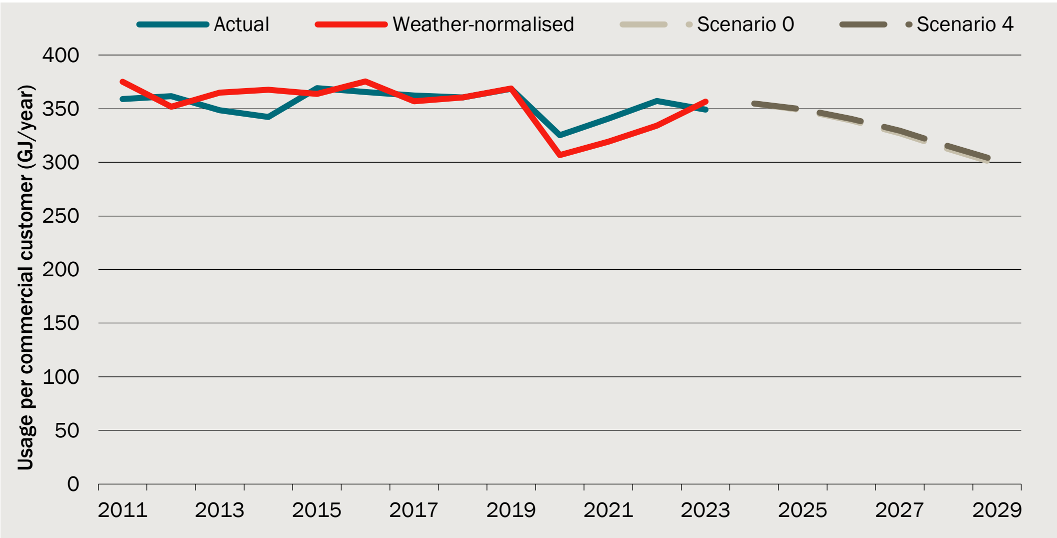
Total commercial usage (chart 7.12) and usage per customer (chart 7.13) are both projected to fall at a similar rate. This mainly reflects the impact of electrification reducing usage per customer.

7.12 Actual, weather-normalised and forecast commercial usage



Data source: CIE.

7.13 Actual, weather-normalised and forecast commercial usage per customer



Data source: CIE.

Sensitivity testing

Testing of alternative assumptions underlying customer number forecasts

We consider additional scenarios that vary the rate at which customers disconnect from the gas network, as well as the rate at which new customers join the network per new house construction (the marginal penetration rate). These assumptions have flow on impacts on the usage per customer forecasts. The scenarios are set out in table 7.14.

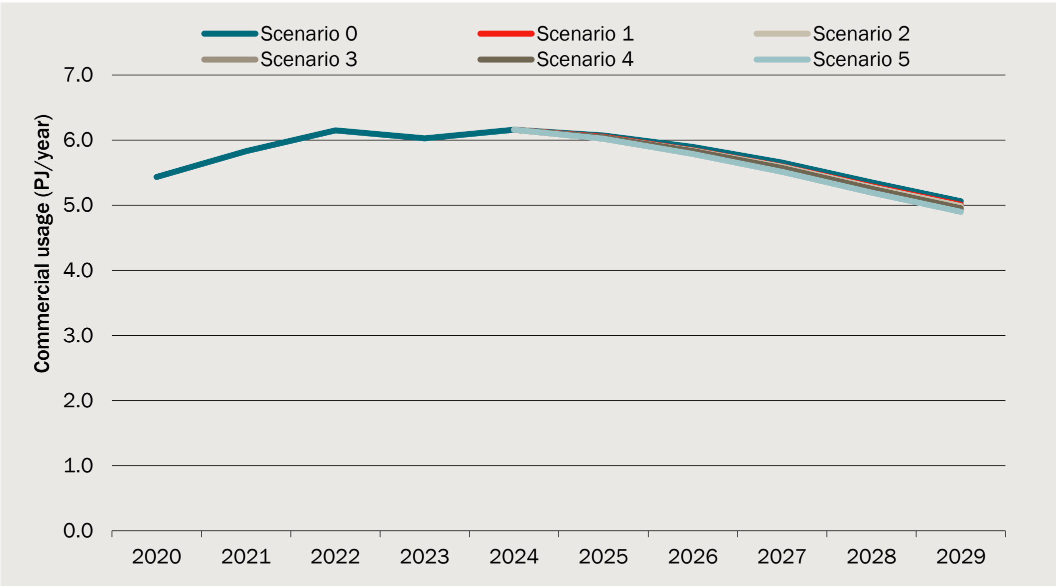
7.14 Additional scenarios for customer numbers

Scenario	Year that 1.25% disconnection rate is reached	Customer connection rate for houses
	Per cent	
Scenario 0	2028	3-year average
Scenario 1	2026	3-year average
Scenario 2	2028	60% from 2025
Scenario 3	2026	60% from 2025
Scenario 4	2028	60% in 2025, 20% by 2029
Scenario 5	2026	60% in 2025, 20% by 2030

Source: CIE.

Applying different combinations of these effects leads declining commercial customer gas usage across all scenarios (chart 7.15).

7.15 Commercial customer usage by scenario

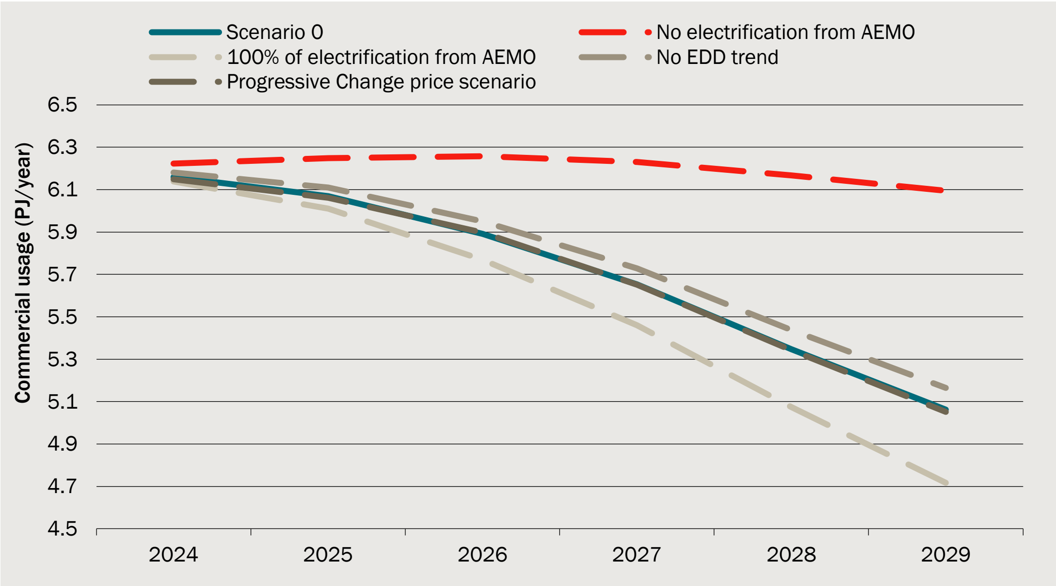


Data source: CIE

Testing of alternative assumptions underlying usage per customer forecasts

Consistent with our testing of additional scenarios for residential usage, we test alternative input assumptions for commercial usage per customer and find that electrification is the biggest driver (chart 7.16). This testing used Scenario 0 as a starting point, but impacts are very similar if Scenario 4 is used instead.

7.16 Commercial usage sensitivity testing



Data source: CIE.

8 *Tariff D and M*

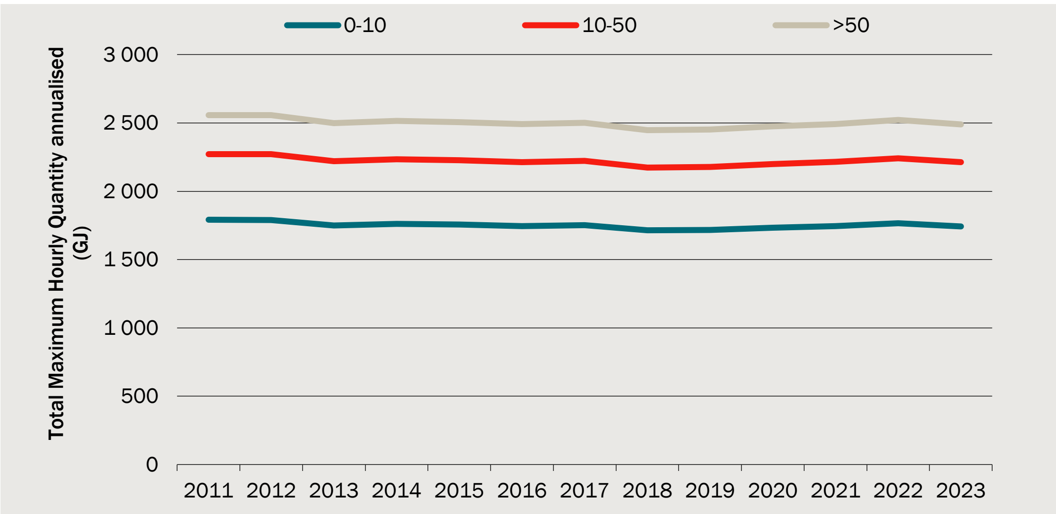
In this chapter we produce forecasts of maximum hourly quantity for tariff D and M customers using projections of Total tariff D system demand produced by AEMO.[40]

Descriptive analysis

AusNet Services has provided data on the total annual MHQ and usage of Tariff D and Tariff M customers from 2011-2020.

Chart 8.1 presents total Maximum Hourly Quantity (MHQ) by block for tariff D customers. Total MHQ for tariff D customers is gradually declining.

8.1 Total Maximum Hourly Quantity by block — Tariff D

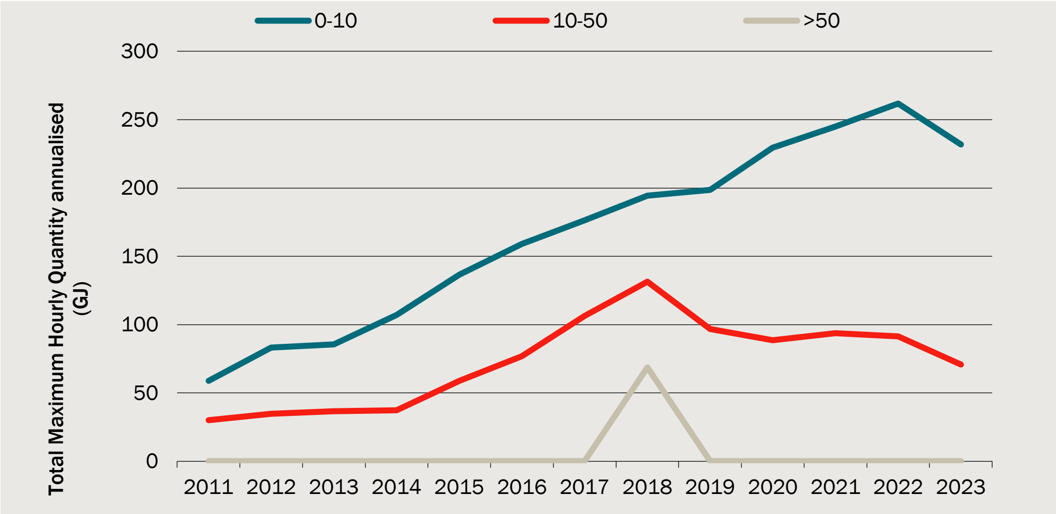


Data source: CIE.

Chart 8.2 shows total MHQ for tariff M customers. There was a step change between 2013 and 2015, where MHQ increased by around 100 per cent, after which MHQ has been gradually decreasing.

40 AEMO, 2021, *Gas Statement of Opportunities*, forecasts accessed through AEMO's forecasting dashboard, available at: http://forecasting.aemo.com.au/Gas/AnnualConsumption/Total

8.2 Total Maximum Hourly Quantity by block — Tariff M



Data source: CIE.

Consistently with our forecasts in 2011, we assume that the rate of change of usage is the same as the rate of change of MHQ.

Adjustments to account for closure of large business customers

Consistent with the approach taken to developing the forecasts for the previous GAAR period, we have chosen not to make a separate adjustment for the closure of any large business customers. Anticipated closures would already be accounted for in AEMO's projections of total industrial usage that drive our forecasts of MHQ.

Forecasts of Tariff D and M Maximum Hourly Quantity

Our projections of MHQ for tariff D and tariff M customers are presented in table 8.3.

8.3 Projections of Tariff D and M Maximum Hourly Quantity

Region/ Block	Unit	2021	2022	2023	2024	2025	2026	2027	2028	2029
		Actual	F'cast	F'cast	F'cast	F'cast	F'cast	F'cast	F'cast	F'cast
Tariff D - Central and West										
0 - 10	GJ	1 939	1 953	1 736	1 769	1 769	1 729	1 741	1 735	1 724
10-50	GJ	2 337	2 419	2 209	2 252	2 251	2 200	2 215	2 207	2 194
> 50	GJ	3 564	3 711	2 508	2 557	2 556	2 498	2 515	2 506	2 491
Tariff M - Central										
0 - 10	GJ	188	197	173	177	177	173	174	173	172
10-50	GJ	58	57	43	44	44	43	43	43	43
> 50	GJ	0	0	0	0	0	0	0	0	0
Tariff M - West										
0 - 10	GJ	57	65	58	59	59	58	58	58	58

Region/ Block	Unit	2021	2022	2023	2024	2025	2026	2027	2028	2029
		Actual	F'cast	F'cast	F'cast	F'cast	F'cast	F'cast	F'cast	F'cast
10-50	GJ	36	34	28	28	28	27	28	27	27
> 50	GJ	0	0	0	0	0	0	0	0	0
Tariff D - New Town West & Central										
0 - 10	GJ	22	23	21	21	21	21	21	21	21
10-50	GJ	24	25	20	21	21	20	20	20	20
> 50	GJ	0	0	0	0	0	0	0	0	0
Tariff M - New Town Central										
0 - 10	GJ	0	0	0	0	0	0	0	0	0
10-50	GJ	0	0	0	0	0	0	0	0	0
> 50	GJ	0	0	0	0	0	0	0	0	0
Tariff M - New Town West										
0 - 10	GJ	0	0	0	0	0	0	0	0	0
10-50	GJ	0	0	0	0	0	0	0	0	0
> 50	GJ	0	0	0	0	0	0	0	0	0

Source: CIE.

We have adjusted this calendar year forecasts to develop forecasts for the stub period and new regulatory periods, which are financial years (table 8.4). This is based on the assumption that MHQ in a financial year is the weighted average of the calendar years before and afterwards. For example, 2023/24 MHQ is equal to the average of 2023 MHQ and 2024 MHQ. For the 2023 stub period covering only the first half of 2023, we assume that MHQ is equal to half the MHQ for 2023.

8.4 Projections of Tariff D and M Maximum Hourly Quantity for new regulatory years

Region/ Block	Unit	2023 stub (h.1)	2023 /24	2024 /25	2025 /26	2026 /27	2027 /28	2028 /29
		Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Tariff D - Central and West								
0 - 10	GJ	1 736	1 753	1 769	1 749	1 735	1 738	1 729
10-50	GJ	2 209	2 230	2 251	2 226	2 207	2 211	2 201
> 50	GJ	2 508	2 532	2 556	2 527	2 506	2 511	2 499
Tariff M - Central								
0 - 10	GJ	173	175	177	175	173	174	173
10-50	GJ	43	44	44	44	43	43	43
> 50	GJ	0	0	0	0	0	0	0
Tariff M - West								
0 - 10	GJ	58	59	59	59	58	58	58
10-50	GJ	28	28	28	28	27	28	27
> 50	GJ	0	0	0	0	0	0	0

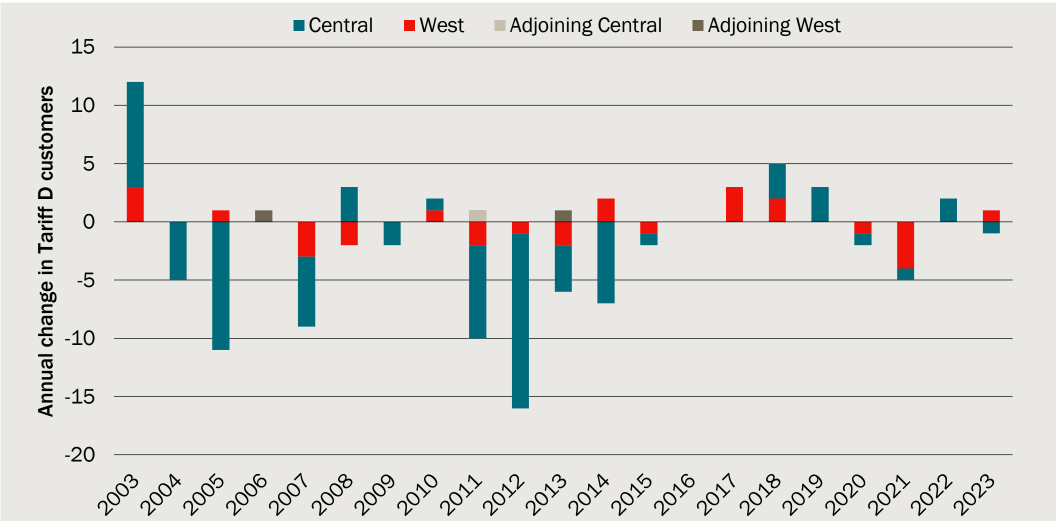
Region/ Block	Unit	2023 stub (h.1)	2023 /24	2024 /25	2025 /26	2026 /27	2027 /28	2028 /29
		Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Tariff D - New Town West & Central								
0 - 10	GJ	21	21	21	21	21	21	21
10-50	GJ	20	20	21	20	20	20	20
> 50	GJ	0	0	0	0	0	0	0
Tariff M - New Town Central								
0 - 10	GJ	0	0	0	0	0	0	0
10-50	GJ	0	0	0	0	0	0	0
> 50	GJ	0	0	0	0	0	0	0
Tariff M - New Town West								
0 - 10	GJ	0	0	0	0	0	0	0
10-50	GJ	0	0	0	0	0	0	0
> 50	GJ	0	0	0	0	0	0	0

Source: CIE.

Tariff D and M customer numbers

Tariff D customers have not exhibited a clear trend of growth or decline (chart 8.5). While Tariff M customer numbers were in decline between 2011 to 2015, since 2016 there have been periods of both growth and decline. Given the fluctuations in growth and lack of a clear trajectory, we project that tariff D customers remain constant at their 2023 level over the forecast period.

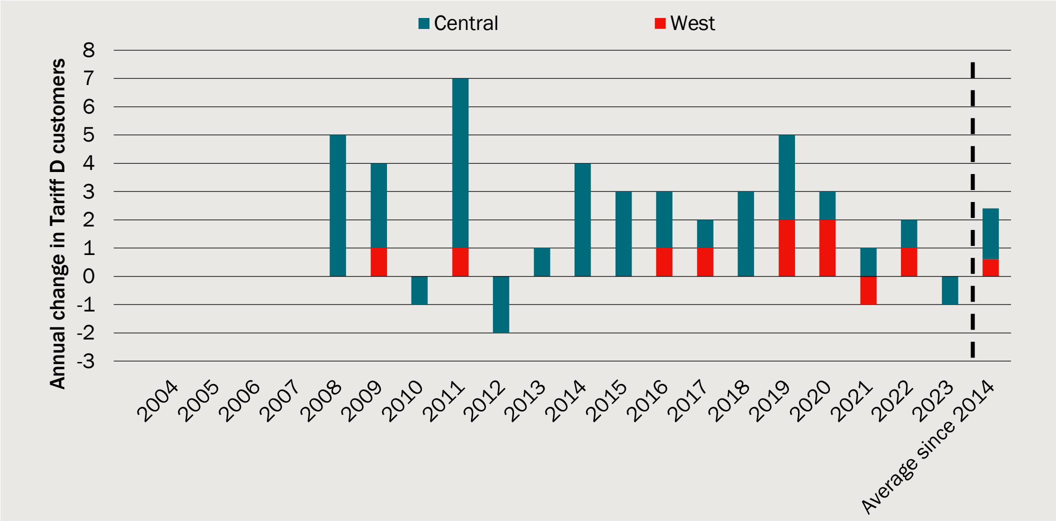
8.5 Tariff D customer number growth



Data source: AusNet Tariff D billing data, CIE.

On the other hand, Tariff M customers have been growing in number in most years (chart 8.6). While there was only one tariff M customer until 2007, since then there has been consistent growth. The growth over the past 10 years has been 1.8 customers per year in the central region and 0.6 in the west region. We project that growth to continue over the forecast horizon.

8.6 Tariff M customer number growth



Note: There are no Tariff M customers in the Adjoining Central or Adjoining West regions.

Data source: AusNet Tariff D/M billing data, CIE.

A Impact of the 7 Star Standards and whole of home energy budget

As part of the NCC 2022 development process, the ABCB engaged ACIL Allen to develop a Consultation Regulation Impact Statement (RIS) assessing the costs and benefits of proposed increases in energy efficiency requirements in the NCC 2022 for new residential buildings. We have used the change in gas usage estimates calculated using the policy options modelled in the Consultation RIS. There are two options modelled under the RIS apart from the Business-as-usual case. The options include[41]:

- Option B sets a maximum annual energy use budget for the elements of a building regulated by the National Construction Code (NCC) (space conditioning, water heating systems, lighting and pool and spa pumps). The budget allocation is based on a 'benchmark home' built with the following characteristics:
  - building shell performance level: equivalent to a 7 Star Nationwide House Energy Rating Scheme (NatHERS) rated dwelling
  - heating equipment: equivalent to a 4.5 star rated (Greenhouse and Energy Minimum Standards (GEMS) 2012) heat pump heater (Annualised Energy Efficiency Ratio, AEER = 4.5)
  - cooling equipment: equivalent to a 4.5 star rated (GEMS 2012) heat pump cooler (Annualised Coefficient of Performance, ACOP = 4.5)
  - water heater: instantaneous gas
  - 4 Watts per square metre of lighting
- Option A is based on 70 per cent of the Option B benchmark and the same energy use budget as Option B. Therefore, under option A, compliant buildings must achieve savings equivalent to savings equivalent of 30 per cent of the societal cost of applying the equipment and building fabric performance level of the benchmark building specified in Option B).

Under both options, a societal cost of operating this benchmark building is calculated and a new building is deemed to be compliant if it has the same cost as the benchmark building. If a piece of equipment (e.g. water heating) is installed that performs worse than the benchmark, this will have to be offset either through installing other equipment that performs sufficiently better than the benchmark (e.g. cooling) or through the installation of on-site renewables (solar PV).

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41 ACIL Allen 2021, Consultation Regulation Impact Statement for a proposal to increase residential building energy efficiency requirements, https://consultation.abcb.gov.au/engagement/consultation-ris-proposed-ncc-2022-residential/.

Option B is considered the low-cost implementation option compared to Option A (high cost). We assume that Victoria is implementing Option B.

Estimated impacts from the Consultation RIS

Table 4.10 shows the estimated changes in gas consumption calculated in the Consultation RIS for Class 1 and Class 2 dwellings under Option B. Results are shown for Victoria — the teal rows are the climate zones relevant for AusNet's distribution area. We also show NSW as a comparator, as it is evident that there are large differences in assumed appliance switching across states.

The consultation RIS expects fairly small gas impacts for Class 1 dwellings (detached houses). This is because it is expected that these dwellings would largely meet requirements by installing solar PV. For Class 2 dwellings (apartments), larger reductions in gas use are expected, because these dwellings have less scope for solar PV.

A.1 Estimated changes in energy consumption for Class 1 and Class 2 dwellings across different jurisdictions and climate zones modelled under Option B

Jurisdiction	NCC climate	Class 1 dwellings: Change in annual gas consumption (MJ)	Class 2 dwellings: Change in annual gas consumption (MJ)
		MJ/dwelling/year	MJ/dwelling/year
NSW	2	-3 541	-7 418
NSW	4	-5 701	-7 694
NSW	5	-5 883	-7 570
NSW	6	-6 914	-8 319
NSW	7	-6 481	-8 623
NSW	8	-9 375	NA
VIC	4	-1 993	NA
VIC	6	-2 357	-9 676
VIC	7	-2 412	-10 274
VIC	8	-3 108	NA

Source: ACIL Allen 2021, Consultation Regulation Impact Statement for a proposal to increase residential building energy efficiency requirements, https://consultation.abcb.gov.au/engagement/consultation-ris-proposed-ncc-2022-residential/.

The percentage reduction expected is calculated based on AusNet annual usage per dwelling, the marginal penetration rate and AusNet usage per connected dwelling, as shown in table A.2. This is based on most new developments being in climate zone 6. Gas use is reduced by 27 per cent for apartments (Class 2 dwellings). For houses (Class 1 dwellings), gas use is reduced by 3.5 per cent under Option B.

A.2 Percentage impact of revised building energy efficiency standards

	Marginal Penetration rate	Average Gas Usage per connected dwelling	Per cent change in gas use
		In MJ per annum	Per cent
Houses (Class 1)	0.79509	53 092	-3.5
Flats/Apartments (Class 2)	0.80759	28 622	-27.3

Source: CIE

The expected pathways for compliance with the new standards may include either improving the performance of the building and its equipment (all appliance pathway) or adding solar PV or a combination of both these approaches. The equipment performance can be improved either by:

- using more efficient gas appliances
- switching from gas to electric

Given the lack of data about the split in solar PV penetration by building class, the analysis assumes that the current and future penetration of solar PV in Class 2 dwellings (flats/apartments) is effectively zero. This is also due to the difficulty of implementing solar PV in Class 2 dwellings. Therefore, compliance in Class 2 dwellings is expected to be achieved using an all-appliance pathway.

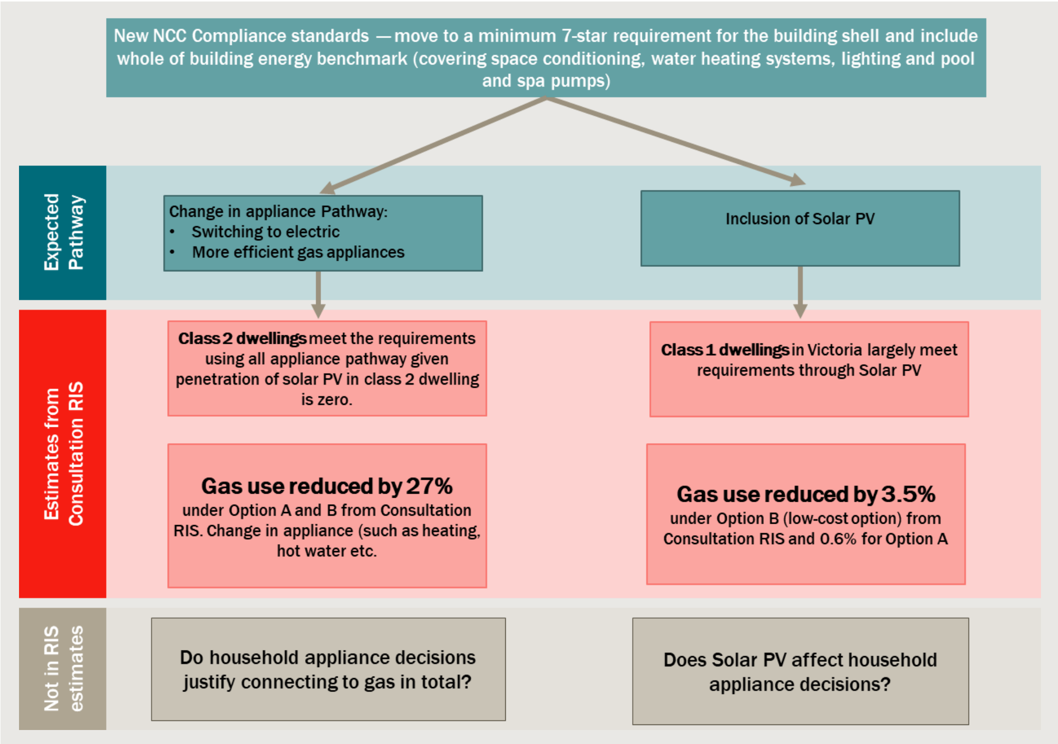
On the other hand, Class 1 dwellings (i.e. houses) in Victoria are largely expected to meet requirements through solar PV as the fall in gas usage is minimal. That is, households are largely meeting new building standards through simply adding solar PV and continuing to use gas as they currently do.

The Consultation RIS does not consider flow-on impacts of changes to appliances or solar PV. In particular, whether:

- a detached house connected to solar PV is less likely to use gas for all or some appliances, or
- an apartment that moves some appliances to gas would make a decision to move others or go all electric.

A summary of what is and is not in the RIS is shown in chart A.3.

A.3 Summary of impacts of energy efficiency standards covered by the RIS



Data source: The CIE.

Flow-on impacts of revised energy efficiency standards

The work undertaken for the Consultation Regulation Impact Statement has not investigated flow-on impacts, such as developers no longer reticulating gas and customers shifting off gas because they have fewer appliances on gas or have solar electricity. From a gas demand perspective, these flow-on impacts could be very significant. For example:

- The Roadmap notes that an existing detached dual-fuel home with rooftop solar photovoltaic (PV) that moves from using gas for heating, hot water and cooking to using efficient electric appliances could reduce its average energy bill by around $1250 per year. For a household without solar, going all-electric could save around $1020. This indicates that the incentives for households to use gas are changed when they have access to solar.
- EvoEnergy surveys of customers found that there were considerable interactions in appliance decisions[42]:
  - two thirds of respondents would choose to change their hot water system if they switched their heating to electric and about half would change their cooking
  - 60 per cent of respondents indicated they were extremely likely or very likely to switch their heating to electric if they installed a solar system. 57 per cent were

42 Sagacity Research 2021, *Demand for natural gas: understanding future uncertainty,* prepared for EvoEnergy, pp. 36, 39., available at: https://www.aer.gov.au/system/files/Evoenergy%20-%20Sagacity%20Research%20-%20Attachment%208.3%20-%20Demand%20for%20natural%20gas%20report%20-%20January%202021_0.pdf

  extremely likely or very likely to switch their hot water to electric if they installed a solar system
- AusNet consultation with developers and building industry associations has indicated that some developers would no longer reticulate gas under the revised home energy efficiency standards.

These findings suggest that changes to one appliance and to having solar PV will lead to flow-on impacts to other choices related to use of gas. We have not found robust evidence about how large these flow-on impacts could be at this stage. We have therefore used a scenario approach and compared this with top-down modelling of expected gas consumption trends.

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