Natural gas, customer number and MHQ forecasts for Multinet Gas to 2026

(Calendar year basis)

VOLUME ONE

A report for
MULTINET GAS

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August 2016

While the National Institute endeavours to provide reliable forecasts and believes the material is accurate it will not be liable for any claim by any party acting on such information.

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Executive summary

E.1 Introduction

Multinet Gas commissioned the National Institute of Economic and Industry Research (NIEIR) to prepare forecasts of gas consumption and customer numbers for the regulatory review period 2018 to 2022. Forecasts were prepared for the following customer groups:

- Residential – dwellings that use gas for cooking, water heating and space heating;
- Business – small business customers who use less than 10 terajoules of natural gas each year; and
- Industrial – large business customers who use more than 10 terajoules of gas per year.

The forecasts were developed for each of Multinet Gas pricing zones which are Melbourne, Yarra Valley and South Gippsland.

The gas demand forecasts are important as they are a key input into determining capex (capital expenditure), opex (operating expenditure) and Reference Tariffs for Multinet Gas.

NIEIR has applied the same methodologies used to develop forecasts for Multinet Gas for the current Access Arrangement period (2013 to 2017), and also the previous Access Arrangement (2008 to 2012) for all three Victorian gas distribution businesses. NIEIR has also considered the Australian Energy Market Operator (AEMO) forecasts of gas demand. NIEIR prepared the AEMO gas projections for the GSOO up to 2013.

E.2 National gas rules

Multinet Gas (MG) demand forecasts must be best estimates arrived at on a reasonable basis. Given the greater emphasis on stakeholder and customer engagement, Multinet Gas conducted a survey of future gas usage for its large industrial customers.

E.3 Forecasting approach

NIEIR's national state and regional economic models were used to develop the driver variables for Multinet Gas volume and customer forecasts.

The residential and business customers were modelled using average consumption per connection. Total volumes are net customer connections by the average usage per connection.

The industrial volumes were modelled on an industry basis for Multinet Gas. Key driver variables were industrial output growth, real price impacts and other information on expansion and closures from the large customer survey.

E.3.1 Customer growth – Multinet Gas

There are around 695,000 residential and small business customers currently connected to the Multinet Gas network. These customers account for around 79 per cent of total gas volumes on the Multinet Gas network. The number of large industrial customers is around 265, representing 21 per cent of total volumes.

Forecasts of residential customer growth are based upon forecasts of Multinet Gas' share of Victorian dwelling completions and the consequent growth in Multinet Gas dwelling stock. Forecasts of net customer growth is total new connections less forecast disconnections. Residential forecasts are separated between existing and new customers.

Forecasts of small business customers are arrived at from the forecasts of total small business volumes and forecast average usage for these customers. Similarly, large industrial customer growth is driven by forecasts of large industrial volumes on an industry basis and forecast average usage for these customers on an industry basis.

E.3.2 Volume forecasts – Multinet Gas

Multinet Gas volume forecasts are developed from a modelling methodology that takes account of a number of different drivers. These include the following:

- weather impacts on gas usage;
- changing levels of gas usage by existing and new residential customers;
- income and economic growth impacts;
- price impacts; and
- policy impacts on gas usage, such as minimum energy performance standards.

NIEIR modelling methodology employs a multi-variate approach and does not simply rely upon trend extrapolations.

Victorian gas usage is highly weather sensitive, mainly due to space and central heating system loads. Multinet Gas volumes for each sector, residential, small business and large industrial are adjusted for weather conditions which vary from month to month and year to year.

A weather standard is calculated and applied across each class of customer. The approach used for Multinet Gas is similar to the approach used by AEMO in its National Gas Forecasting report.

Residential volumes for Multinet Gas are determined from a model that separates out existing and new customer usage. Existing customers in the Multinet Gas region have average usage of around 57 GJ per customer and typically have gas hot water, gas cook tops and space or central heating. New customers in the Multinet Gas region, on the other hand, consume only 42 GJ per customer and have much more efficient appliances, as well as more thermally efficient dwellings. In addition, smaller townhouses may not have gas space heating but electric reverse cycle heating.

Residential usage is also impacted by the growth in real household income per capita, real energy prices and assessed policy impacts.

Small business volume growth is linked to a model that includes projections of business output growth and real energy prices. Small business volumes have been declining in the Multinet Gas region.

Large industrial volume growth is modelled across 17 industries. The model is driven by output growth by industry and the change in real energy prices. The forecasts are supplemented with information collected from the large industrial customer survey.

E.4 Residential forecasts for Multinet Gas

Residential forecasts for Multinet Gas are based on average consumption for new and existing customers and customer growth.

Residential customer growth is forecast to average 0.5 per cent per year over the 2018 to 2022 period. This is similar to the actual growth over the 2012 to 2017 AA period. Total residential gas connections rise from around 674,931 in 2015 to 684,783 in 2018 and 698,507 in 2022.

Residential consumption per connection has been declining steadily in Victoria and average usage in the Multinet Gas region has fallen from 63.0 GJ in 2008 to 56.8 GJ per connection in 2015. The decline in average residential usage reflects a number of factors including, the marked increase in the thermal efficiency of new dwellings, improvements in appliance efficiencies, and the substitution of electricity for gas in space heating. The latter point is reinforced by the shift away from detached houses to small townhouses and apartments in the Multinet Gas area. These smaller dwellings would usually use reverse cycle electric heating.

The trend rate of decline in average consumption in the Multinet Gas region was 1.5 per cent between 2008 and 2015. Over the review period, 2018 to 2022, a very similar rate of decline is forecast at 1.8 per cent per annum. Average usage falls to 51.2 GJ per connection by 2022.

Table E.2 shows the volume forecasts and actuals for Multinet Gas. Table E.1 shows customers, volumes and average usage over the next Access Arrangement period for residential in the Multinet Gas region.

Figure E.1: Residential consumption per connection – Multinet Gas (GJ) – Weather normalised

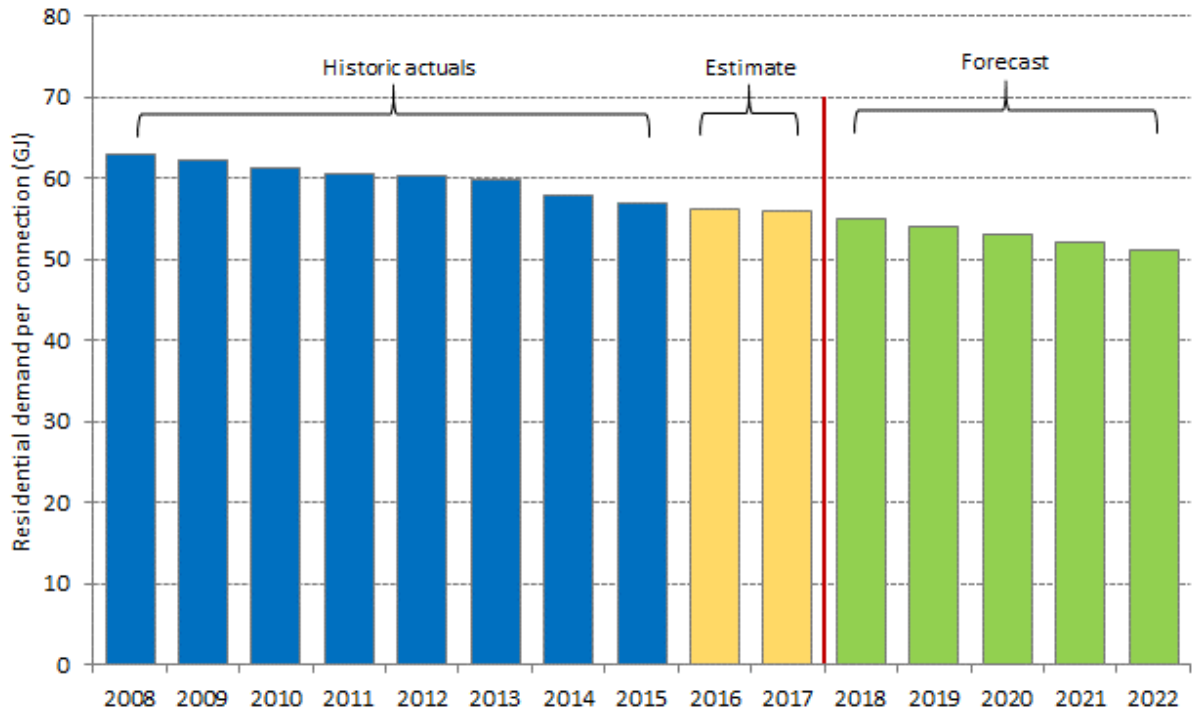


Figure E.2: Residential demand – Multinet Gas (TJ) – Weather normalised

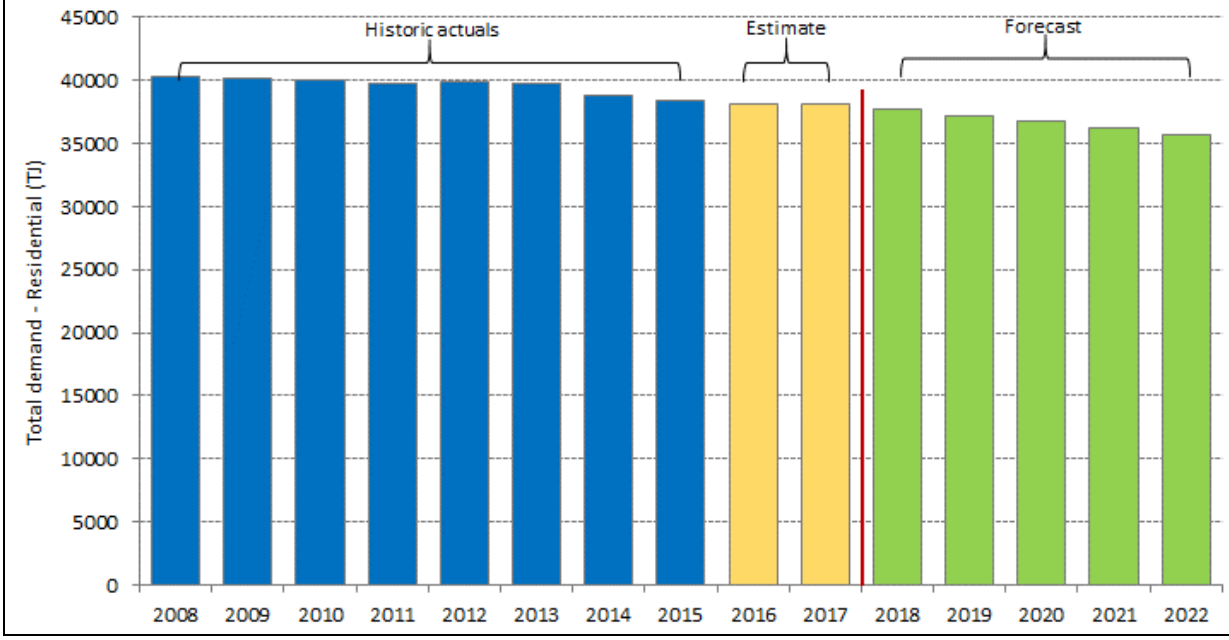


Table E.1 Residential demand forecast – Multinet Gas					
	2018	**2019**	**2020**	**2021**	**2022**
Net customer numbers	684,783	688,279	691,752	695,209	698,507
Consumption per connection (WN)	55.1	54.1	53.2	52.1	51.2
Total consumption (WN)	37,715	37,231	36,777	36,241	35,748

Note: Figures may not reconcile exactly due to rounding.
(WN) – Weather normalised

E.5 Small business forecasts for Multinet Gas

Multinet Gas small business volumes and customers have been declining. Total gas volumes fell by 2.2 per cent per year between 2008 and 2015. Customers fell by 0.6 per cent per year over the same period.

Consumption per connection has also declined significantly historically and is forecast to decline further. Total small business volumes fall by 2.7 per cent per year between 2018 and 2022, while customers fall by 1.0 per cent per year.

Figure E.3 shows small business consumption per connection for small business to 2022, while Figure E.4 shows the total small business volume forecasts. Table E.2 shows volumes, customers and average usage over the next Access Arrangement period for Multinet Gas.

Figure E.3: Small business consumption per connection – Multinet Gas (GJ) – Weather normalised

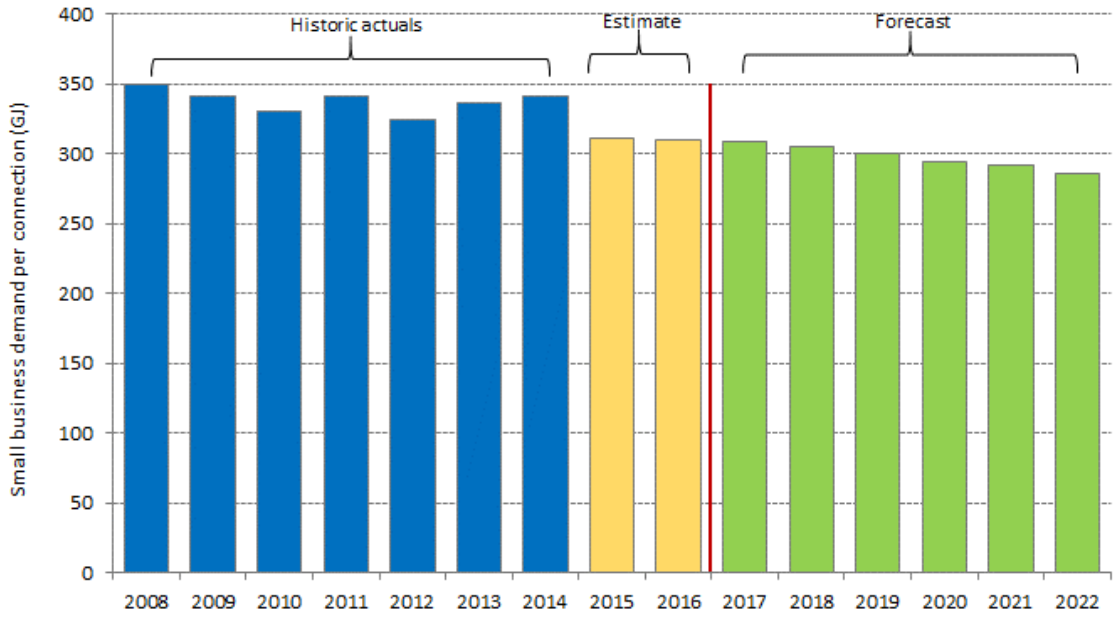


Figure E.4: Small business demand – Multinet Gas (TJ) – Weather normalised

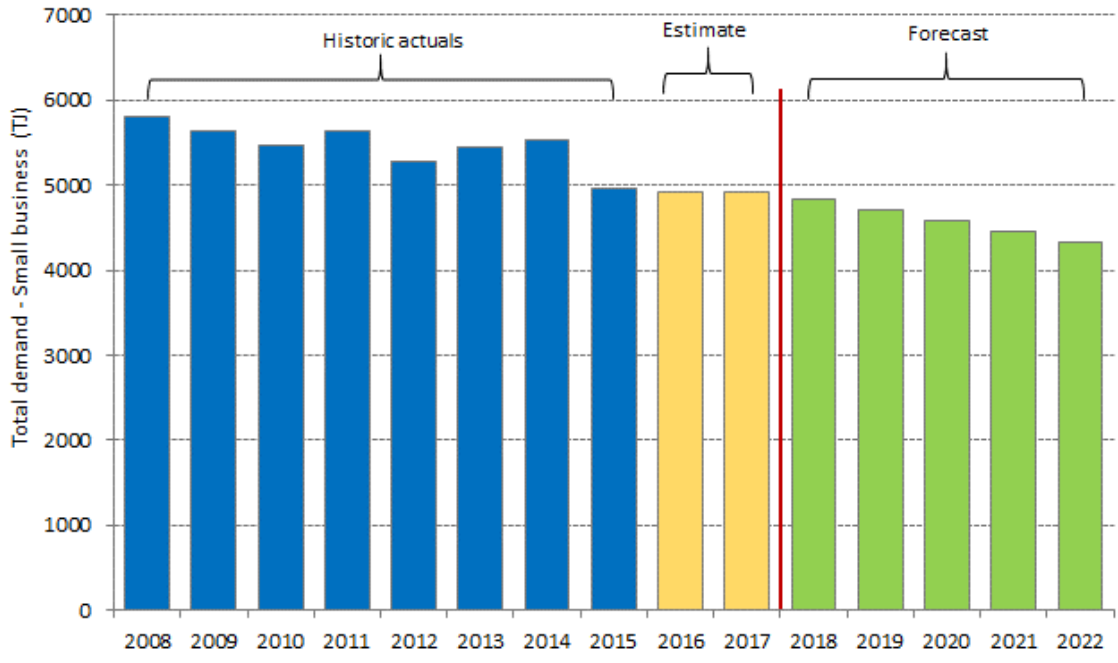


Table E.2 Small business demand forecast – Multinet Gas					
	2018	2019	2020	2021	2022
Net customer numbers	15,524	15,388	15,290	14,974	14,898
Consumption per connection (WN)	311.3	306.2	300.1	297.0	290.9
Total consumption (WN)	4,832	4,712	4,588	4,448	4,334

Note: Figures may not reconcile exactly due to rounding.
(WN) – Weather normalised.

E.6 Large industrial (Tariff D) forecasts for Multinet Gas

Multinet Gas' large industrial volumes have historically fallen significantly over the last 10 years. Total volumes were 14.2 petajoules in 2006, but had fallen to 11.2 petajoules by 2015.

Multinet Gas' large industrial demands (MHQ) have not fallen as rapidly as total volumes, partly reflecting the addition of two new customers on the South Gippsland network. Total MHQ (maximum hourly quantity) for large industrials is shown in Figure E.5. Total MHQ for Multinet Gas' large industrials falls by 0.9 per cent per annum over the 2018 to 2022 period.

The decline in manufacturing in Victoria, with increased competition from Asian countries, underlies the poor historical and forecast outlook for large industrial customers. Table E.3 shows the Multinet Gas MHQ over the next AA period.

Figure E.5: Industrial (Tariff D) MHQ – Multinet Gas (GJ)

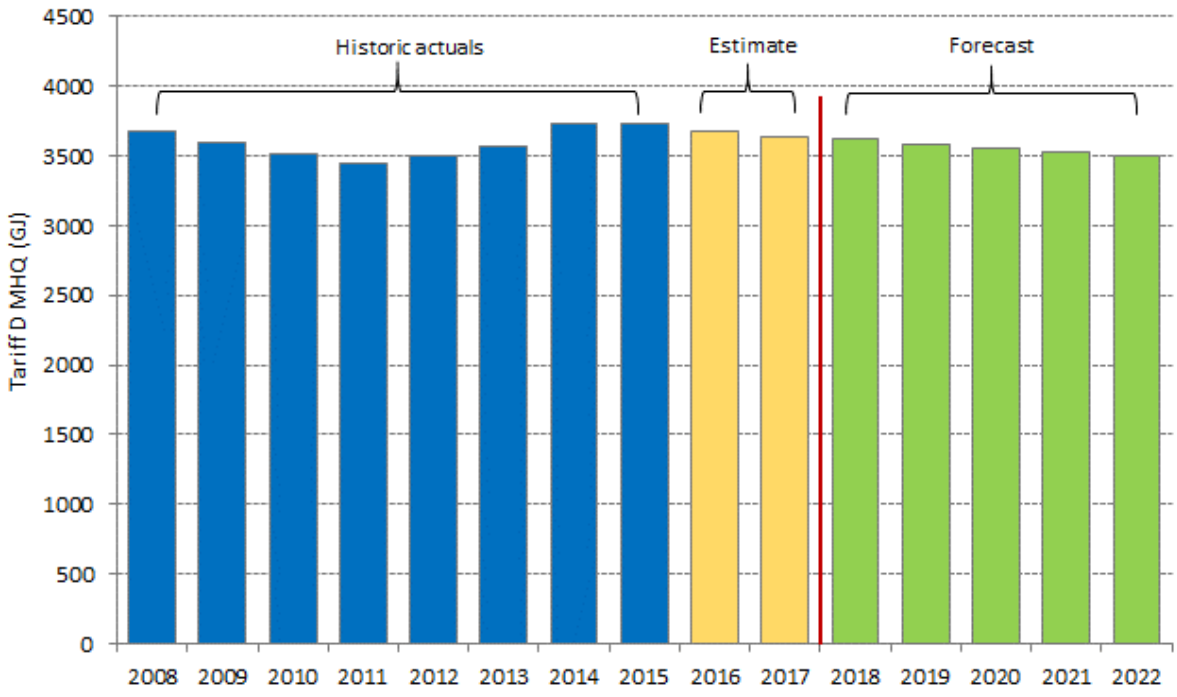


Table E.3 Industrial (Tariff D) MHQ demand forecast – Multinet Gas					
	2018	2019	2020	2021	2022
MHQ	3,621	3,588	3,549	3,529	3,496

1. Introduction

Multinet Gas (MG) requested the National Institute of Economic and Industry Research (NIEIR) to prepare forecasts for MG's upcoming 2018 to 2022 Gas Access Arrangement Review (GAAR). The forecasts were required for the following:

- natural gas consumption;
- natural gas demand; and
- customer numbers.

MG's study brief and forecasting requirements are reproduced below. NIEIR's reports for MG have been split into two volumes:

- Volume one contains forecasts and drivers and assumptions for natural gas consumption, MHQ and customer numbers by pricing zone to 2026; and
- Volume two contains Peak Day, Peak Hour and Postcode based projections of customers, volumes and MHQ to 2026.

MG's context and requirements were as follows.

1.1 Context

Under the National Gas Rules (**Rules**) (R 52(1)), MG is required to submit a Revised Access Arrangement for the 2018 to 2022 period to the Australian Energy Regulator (**AER**) by 30 December 2016. The Rules (Rule 72(1)(a)(iii)) require that for the 2018 to 2022 access arrangement period MG includes in its Access Arrangement Information (**AAI**):

> *Usage of the pipeline over the earlier access arrangement period showing:*
>
> *(A) For a distribution pipeline, minimum, maximum and average demand...; and*
>
> *(B) For a distribution pipeline, customer numbers in total and by tariff class...*

Demand forecasts are critical to MG's investment and expenditure decision making processes and Tariffs. In particular, MG requires:

- demand forecasts to prepare its demand-related capex (required to augment the system to meet forecast increases in network load growth);
- connection numbers by customer class to prepare its customer initiated capex (required to meet the needs of new or existing customers);
- customer numbers and energy usage to prepare 'rate of change' adjustment to be applied to base year opex. The 'rate of change' recognises opex impacts associated with growth in the network; and
- demand forecast to prepare its Reference Tariffs under a price cap form of regulation. This is because prices are determined by dividing total revenue by the demand forecasts.

To this end, MG is seeking assistance in preparing its demand forecasts for the next regulatory control period.

1.2 Rules' requirements

Rule 74 of sets out the requirements for preparing demand forecasts. It provides that:

> *(1) Information in the nature of a forecast or estimate must be supported by a statement of the basis of the forecast or estimate.*
>
> *(2) A forecast of estimate:*
>
> *(a) must be arrived at on a reasonable basis and*
>
> *(b) must represent the best forecast or estimate possible in the circumstances*

Rule 75 relates to inferred or derivative information and provides that:

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

In accordance with recent changes to the Rules, which place a greater emphasis on the importance of stakeholder engagement, MG may wish to engage with its customers and other stakeholders on its demand forecasts in the preparation of its Regulatory Proposal.

1.3 Output

The key work and deliverables are to prepare annual calendar year forecasts, for a 10 year period commencing 2017, for:

- natural gas consumption;
- natural gas demand; and
- customer numbers.

This should also include a forecast for the 2016 launch point.

The forecast requirements are set out in Section 5 below.

The report should set out:

- the forecasting method;
- model derivation i.e. functional form demonstrating how the demand forecasts were determined;
- key assumptions;
- sources for input variables (historical and forecast);
- explanatory variables – why some are included and others are excluded; and
- back-forecasts to verify the accuracy of the model.

The models used to prepare the forecasts should:

- be provided in a format and software which can be readily opened and operated by MG and the AER because transparency will be critical in the access review process. Excel is our preferred format;
- be structured in an understandable way – clearly separating:
    - assumptions, inputs, modelling and outputs;
    - inputs and calculations that relate to historical data and forecast data; and
    - sensitivity tests – these should be provided in separate tabs or files from the main top down forecasts.

Basic documentation should be provided to assist with operating and managing the model.

Consultants should describe how they are able to make the model transparent in order for the AER to run sensitivity analysis.

1.4 Forecast requirements

MG is seeking the consultant to prepare forecasts of:

- natural gas consumption by Tariff, Tariff band (i.e. usage block) and postcode for our region (inclusive and exclusive of unaccounted for gas (UAFG));
- Peak Day Demand (1 in 2 peak day) and Peak Hour Demand (1 in 2 peak hour) by Tariff (inclusive and exclusive of UAFG);
- Daily effective degree days (EDDs) index;
- net customer numbers by postcode and tariff; and
- annual Average Weighted Deviation Price (AWDP) which is used in the calculation of UAFG.

These forecasts should include high, medium and low scenarios. Forecast of consumption and demand should also be weather normalised[1].

MG's Tariff classification is summarised in Table 1.1 below. Further details can be found in the Multinet Gas 2016 Annual Tariff Report[2].

Table 1.1 Summary of MG's tariffs

Tariff classification	Definition	Basis for tariff
Tariff V Residential Metro	Residential Metro - Customers using less than 10,000 GJ per annum and less than 10 GJ MHQ	Fixed daily and variable charge (per GJ)
Tariff V Commercial Metro	Commercial Metro Customers using less than 10,000 GJ per annum and less than 10 GJ MHQ	Fixed daily and variable charge (per GJ)
Tariff V Residential Yarra Valley[3]	Residential Yarra Valley Customers using less than 10,000 GJ per annum and less than 10 GJ MHQ	Fixed daily and variable charge (per GJ)
Tariff V Commercial Yarra Valley[4]	Commercial Yarra Valley Customers using less than 10,000 GJ per annum and less than 10 GJ MHQ	Fixed daily and variable charge (per GJ)
Tariff V Residential South Gippsland	Residential South Gippsland Customers using less than 10,000 GJ per annum and less than 10 GJ MHQ	Fixed daily and variable charge (per GJ)
Tariff V Commercial South Gippsland	Commercial South Gippsland Customers using less than 10,000 GJ per annum and less than 10 GJ MHQ	Fixed daily and variable charge (per GJ)
Tariff D Metro	Metro Customers (inclusive Yarra Valley) using more than 10,000GJ a year or more than 10GJ MHQ.	Based on MHQ measured in (GJ) per hour.
Tariff D South Gippsland	South Gippsland Customers using more than 10,000GJ a year or more than 10GJ MHQ.	Based on MHQ measured in (GJ) per hour.
Tariff L	Customers using more than 1TJ per annum or less than 10TJ per annum and have less than and have a MHQ demand of less than 10GJ per hour.	Seasonal stepped usage change and two demand charges

[1] Include EDD (annual and peak day) standard used.

[2] Found at: https://uemg.com.au/media/46773/2016_mg_tariff_report.pdf.

[3] This should include the new connection at Warburton.

[4] This should include the new connection at Warburton.

MG is seeking the consultant to prepare the following forecasts:

(i) Consumption[5]

- For all tariff types:
  - annual consumption (GJ) for existing and new customers by base load and heating load (delineate by each category specified);
  - annual total consumption by tariff type and tariff band/usage block on a per month basis; and
  - annual total consumption by tariff type and by postcode.

Note that consumption forecasts for the following Tariffs should be based on billed linearised data:

- Tariff V – (i) Residential Metro (ii) Commercial Metro (iii) Residential Yarra Valley (iv) Commercial Yarra Valley (iv) Residential South Gippsland and (v) Commercial South Gippsland.

Consumption forecasts for the following Tariffs based on billed monthly data:

- Tariff L by usage band per month
- Tariff D – (i) Metropolitan and (ii) South Gippsland

(ii) Demand

- Tariff V and Tariff D:
  - MDQ TJ/day for Melbourne system withdrawal zone (SWZ) and South Gippsland; and
  - MHQ TJ/h for Melbourne SWZ and South Gippsland.
- For Tariff D (Metropolitan and South Gippsland separately) - annual total and monthly MHQ
- For Tariff L - annual total and monthly MHQ, and monthly rolling maximum demand on a 12 month basis.

(iii) Customer numbers

- For all Tariff types - annual new connections, disconnections/abolishments and net new customers (2018 split into first and second half of year).
- For all Tariff types – by postcode, annual total customer numbers (existing and net new customers) (2018 split into first and second half of year).

(iv) Weather

MG is also seeking a total annual and monthly forecast of the standard effective degree days (EDD) and peak day EDD together with an explanation of the forecast.

(v) Reconciliation to AEMO forecasts

The consultant should also provide a comparison and reconciliation of forecasts with those undertaken by the Australian Energy Market Operator (**AEMO**) with an explanation of the reasons for the differences.

[5] Units should be clarified for all consumption information and forecasts should clarify whether UAFG is included or excluded.

1.5 Key drivers of future gas demand and consumption

There are a range of factors impacting average future per customer demand, consumption and connection. Our demand forecasts should take these into account to ensure that, under a weighted average price cap, we have a reasonable opportunity to recover at least our efficient costs.

The approach to adjusting for these matters should be transparent and based on established principles/methods such as those used by AEMO in its National Gas Forecasting Report. The consultant should address the quantitative annual effect of the following (considering the impact of each at a Tariff category level) and any other impact that they identify as relevant:

- economic outlook for Australia, Victoria and MG's service area. This should address macroeconomic indicators including economic growth, population growth, new housing activity and the industrial outlook;
- price elasticity of demand;
- increasing retail/wholesale gas prices (including annual forecasts of retail/wholesale prices);
- cross price elasticity of demand/fuel substitution;
- increased penetration of competing energy sources and appliances;
- warming weather patterns (considering the monthly impacts), with a particular focus on winter in the MG region;
- government policy including incentives and energy efficiency initiatives;
- new technologies including appliance efficiency; and
- the introduction of cost reflective electricity network prices.

1.6 Data sources

MG will provide the necessary data about the business to inform the development of the forecasts and models. The consultant should provide a work plan, as part of its response to this RFP, which details timeframes and data requirements.

Consideration should be given to other data sources including:

- policy (e.g. environmental etc.);
- regulation;
- technology uptake (e.g. storage, EV);
- distributed generation uptake (e.g. solar PV);
- customer behaviour (elasticity, energy efficiency, demand management);
- electricity prices; and
- economic growth.

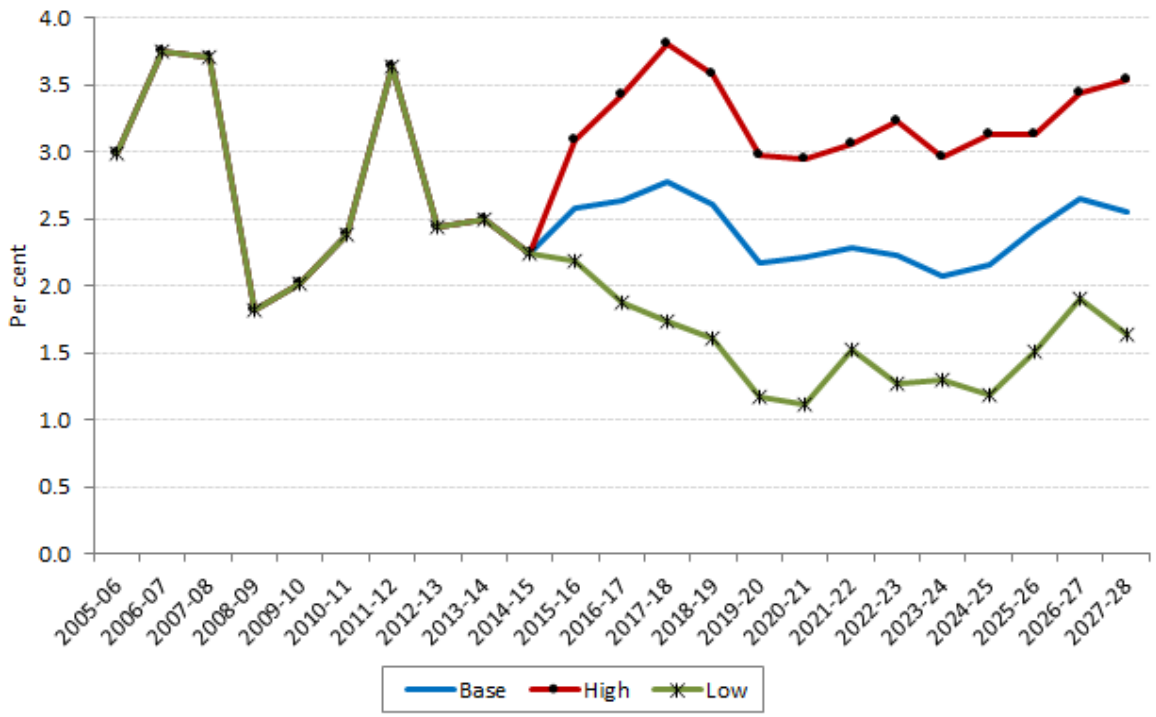
All data limitations or inconsistencies that may impact the quality of the analysis undertaken should be noted in the report.

2. The economic outlook for Australia to 2027-28

2.1 Introduction

This section provides an outline of the economic outlook for Australia to 2027-28. Figure 2.1 shows the outlook for Australian gross domestic product to 2027-28 by scenario. Table 2.1 shows the projected annual Australian GDP growth rates to 2027-28 for each of the scenarios. These economic forecasts were prepared in March 2016.

Figure 2.1: Australian GDP growth by scenario (annual per cent change)



Note: Financial years ending June.

Table 2.1 gives span growth rates across each scenario for Australian GDP growth. Figure 2.1 shows the graphical profile for the key high, low and medium scenarios. The cyclical profiles in Figure 2.1 reflect the cycle in the world economy.

Summary of national outlook

Up until recently, the Australian policy authorities expected Australia's long-term growth to be 3.5 per cent per annum. For the medium-term this has been revised down to 3.0 per cent. The reality is that it is likely to be closer to 2.0 than 3.0 per cent per annum.

This report expects "at best" a growth rate of 2.4 per cent. The contribution of private consumption expenditure and government consumption expenditure to economic growth will be half the contribution over the 2000 to 2012 period. This is due to household debt saturation and high, by recent historical standards, public sector deficits.

The positive contribution of dwelling investment to economic growth will end in 2017 and the contribution of total private investment will be near zero (that is, growing in line with GDP growth) for the post 2018 period.

The main driver of growth will be net exports flowing from the production flow-on effect from the recent mining boom and the general expansionary effects of a low exchange rate. However the stimulatory effects of a low exchange will be considerably less then what Australian policy authorities currently expect.

The meaning of "at best" indicates that the probabilities of an exchange rate crisis/banking crisis occurring sometime over the next few years is high with GDP falling by between 5 and 15 per cent. The "at best" means the outcome of this does not happen.

Population growth will slow to around 1.3 per cent per year as foreign immigration is cut back to between 180,000 to 200,000 per year as a result of a relatively low employment growth rate of 1.5 per cent per year.

The current account deficit will increase to 6% of GDP in the short-term and it will be difficult to reduce it from this level over the longer term. Unless there is a sharp improvement in Australia's terms of trade over the 2020s from what is expected in this reports projections, the modest 2.4 per cent GDP growth rate probably will not be feasible as net external debt as a per cent of GDP will approach 100 per cent.

Inflation will remain subdued on a long-run basis at around 2 per cent per annum.

Real interest rates are likely to increase in response to the widening current account deficit. However, in the absence of an exchange rate crisis, the deflationary impacts of interest rate rises will hold the nominal short-term interest rate to around 4 per cent.

Table 2.1 Australian GDP growth under each scenario (per cent)			
Financial year	**Base**	**High**	**Low**
2005-06	3.0	3.0	3.0
2006-07	3.8	3.8	3.8
2007-08	3.7	3.7	3.7
2008-09	1.8	1.8	1.8
2009-10	2.0	2.0	2.0
2010-11	2.4	2.4	2.4
2011-12	3.6	3.6	3.6
2012-13	2.4	2.4	2.4
2013-14	2.5	2.5	2.5
2014-15	2.2	2.2	2.2
2015-16	2.6	3.1	2.2
2016-17	2.6	3.4	1.9
2017-18	2.8	3.8	1.7
2018-19	2.6	3.6	1.6
2019-20	2.2	3.0	1.2
2020-21	2.2	2.9	1.1
2021-22	2.3	3.1	1.5
2022-23	2.2	3.2	1.3
2023-24	2.1	3.0	1.3
2024-25	2.2	3.1	1.2
2025-26	2.4	3.1	1.5
2026-27	2.7	3.4	1.9
2027-28	2.5	3.5	1.6
Compound average annual change			
2015-16 to 2027-28	2.4	3.3	1.5
2015-16 to 2020-21	2.5	3.3	1.5
2020-21 to 2027-28	2.3	3.2	1.5

2.2 The world economy

For reasons documented in previous reports, the outlook for the world economy is subdued with increasing downside risks around an already pessimistic outlook.

2.2.1 The aftermath of the GFC

It is becoming more widely admitted in economic policy institutions, especially the international policy institutions, that the introduction of austerity programs over 2011 and into 2012 was a mistake. In mid-2015 for the Eurozone the level of GDP is still below pre-crisis levels. For the countries that were subject to a crisis, such as Greece, Spain, Ireland, etc., it will be many years, and decades for Greece, before pre-crisis GDP levels are regained. For the OECD as a whole, despite a relatively strong US recovery, potential output in 2015 is approximately 10 per cent below what would have been the case if pre-crisis trend growth levels had been maintained. The main reason for this is the failure to maintain fiscal policy expansion for the time necessary to restore potential output to pre-GFC trend levels by 2014 at the latest and, therefore, avoid the fall-off in business capital investment that occurred. Because of high unused capacity ratios business has had little incentive to maintain a high level of investment and, therefore, capital stock growth at pre-GFC levels.

This opportunity has now been lost and although it is now more generally recognised in official circles that it was an opportunity lost, the political ideology that produced austerity in 2011 maintains an iron grip on politicians and domestic policy makers. Like the shock of World War II, that restored employment and growth by a massive expansion of fiscal policy, the introduction of aggressive coordinated policies to restore European growth in particular will have to wait until the potential threat from the far right and the general social instability caused by increasing long-term unemployment in the 20 to 40 age group moves to the centre of the political discourse.

2.2.2 Quantitative easing

With the constraints on fiscal policy post-2011, the monetary authorities moved to so-called qualitative easing or the buying by the Central Bank of public and private securities from the private sector. Outside the United States, that is, in the Eurozone, the United Kingdom and Japan, the focus has mainly been the purchase of government securities.

The scale of quantitative easing has created two problems. One problem lies in emerging markets and the other in developed economy markets and, in particular, the United States. The ultimate objective of qualitative easing was to drive down interest rates, increase the liquidity for new expenditures and drive down the exchange rate.

A fair proportion of the additional liquidity, as part of the mechanism for lowering exchange rates, was sent to emerging markets in search of higher returns. While some of the funds found their way into public debt, the majority flowed into private debt. As a result, business corporate debt in emerging economies has risen from 50 per cent of GDP in 2008 to 75 per cent of GDP by the end of 2014.

As the Asian crisis of 1997 showed, the growth in private debt is as important as the level of debt creating economic crises. Empirical research indicates that in 52 episodes in which the ratio of pre-debt to GDP increased by 20 percentage points or more over five years, growth on average fell by just under 3 percentage points in the three years after the debt ratio had peaked.[6] This would represent a decline in economic growth of between 50 and 60 per cent from current levels.

Those countries which are the most likely to be the crisis countries in a third world debt crises (that is the third crises since the 2008 GFC crisis and the Eurozone-Greek crises) are Brazil, Turkey, Malaysia, South Africa, India, Chile, Argentina and Russia.

A trigger for a third world debt crisis will be the ending of qualitative easing in the United Sates and the commencement of the upswing cycle in US interest rates due to start in December 2015. This will encourage the reversal of capital flows for those of the fragile eight economies with high current account deficits which could trigger a currency crisis and then a lending crisis with countries found to default on international obligations and/or be placed under IMF administration.

At present, Brazil looks the likely first candidate to be forced into IMF administration. Dysfunctional governance, the weakening of Chinese growth and falling commodity prices are likely to force Brazil into the continuation of a rolling recession in 2016. Although foreign exchange reserves are currently high, if capital flight took hold in both public and private debt, it will not be long before an IMF bail-out is required.

South Africa is in a similar situation in March 2016 with political dysfunctionality and rapidly deteriorating public sector and foreign balance sheets.

On the other hand, countries such as India are benefitting from lower oil and coal prices (because of the level of the high energy imports) and a return of the current account deficit to balance.

If the world is to have a third world economic crisis since 2007, it is most likely to occur in 2016 or 2017 while commodity prices are still falling. Other factors such as China undergoing extensive structural change and the considerable uncertainty over the quality of US political leadership from 2017 and the continued upswing in US interest rates add further weight to this timing assessment.

2.2.3 Subdued prospects for US growth

The United States growth has benefitted most from quantitative easing. This is now ending. Like emerging markets, the phase-down from quantitative easing is likely to cause difficulties for the US economy.

Over the last two years analysts have become increasingly concerned about the liquidity of the US corporate bond market which has also expanded rapidly under quantitative easing. As the corporate bond market has expanded, turnover rates have fallen, indicating that it has become increasingly hard to sell them. Liquidity has also fallen because banks are now banned from trading on their own account in corporate bonds as a result of regulation changes introduced post the GFC. Before the GFC banks stabilised the bond market from shocks by increasing the supply of liquidity or visa-versa to the market when demand shocks occurred.

[6] The Economist, "*The World Economy*", 14 November 2014.

In this context, if the rise in US interest rates is not fully built into current expectations, as assumed by analysts, then there could well be a hard exit out of corporate bonds. Given the limited liquidity in the market, will result in a sharp upward movement in yields which will flow on into depressing share prices forcing companies and households to curtail expenditures. It is not beyond the realms of probability that this could induce a recession which in turn would aggravate the severity of any emerging market crisis.

At the very least the rise in US interest rates will appreciate the currency and reduce household net worth, which will create a less then conducive environment for economic growth than what currently exists.

The quality of US political leadership beyond 2016 is also an issue. Currently the top 1 per cent capture 23 per cent of income and 50 per cent of wealth. These shares are likely to rise. If the Republican Party at its end by 2016 captures the Presidency and the two houses of Congress one was to expect tax and expenditure changes which will accelerate these trends. Recent research by the IMF and OECD estimates that the impact of the inequality of income in the United States has had a significant impact on reducing its long-term potential growth.

2.2.4 Chinese structural change and world trade growth

A subdued world economy will result in a subdued world trade growth. However, currently world trade growth has fallen to its lowest level compared to world GDP growth for the last four to five decades.

Generally, world trade growth is 1.5 to 2.5 times the world GDP growth. Over the last few years it has been approximately the same as the world trade growth.

Part of the reason for this has been an increase in protection, where countries have employed various instruments to protect local industry from import competition. However, a major reason has been the change in drivers of Chinese growth. When world trade was growing particularly strongly, China was importing components and raw materials and exporting value added components and finished products. That is, China was a strong driver of global supply chains.

As Chinese industry has diversified China has increasingly adopted import replacement strategies in terms of components and finished products to drive growth. This is a natural response to the deepening of the technological base of the economy and the current limits on Chinese share of world trade.

2.2.5 Long-term security issues: The 2020s

Currently, China's defence expenditure is similar to the US. The US defence expenditure is programmed to fall by 40 per cent as a share of GDP by 2025, while the Chinese will no doubt increase in an economy which will be growing at approximately 4 percentage points faster than the United States. The Chinese are currently developing an aircraft carrier construction supply chain which will enable them to create up to 1 aircraft carrier battle group a year from the mid-2020s.

This will have important implications for security in the region which, if not addressed, will reduce confidence in the long-term outlook, thereby reducing investment and economic activity in the short-term. To maintain reasonable regional growth rates over the 2020s this issue will have to be addressed over the next two to four years and an effective response implemented.

The current outlook for the world economy from the international economic agencies is a growth of 3.5 per cent or more for 2016. This is unlikely to be achieved with growth remaining near 3 per cent. That is, a growth ratio near the average outcome over the last four years and a long way from the 4 to 5 per cent growth rates of the 2001 to 2007 period.

If two or more emerging markets are subject to economic crisis in 2016, then world growth over 2016 and 2017 is likely to fall to 2.5 per cent.

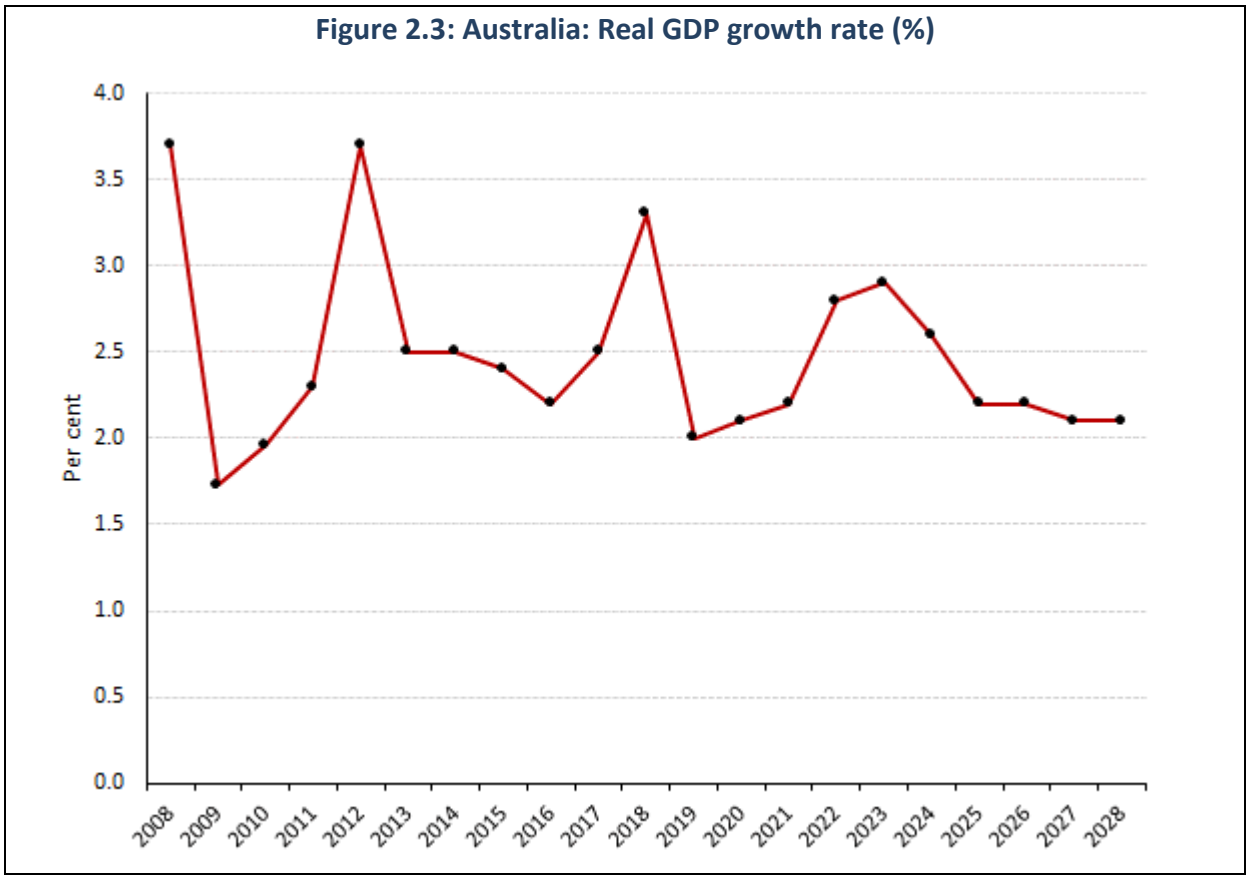
The overhang of damage inflicted on the world economy from the GFC austerity and now the withdrawal from quantitative easing is likely to force subdued growth in the world economy to the early 2020s.

Figure 2.2: World: Real GDP growth rate (%)

2.3 The economic outlook for Australia to 2028

The figure below shows the outlook for Australian gross domestic product growth to 2028.

Figure 2.3: Australia: Real GDP growth rate (%)



2.3.1 Gross Domestic Product (GDP)

Over the first five years of the past decade household consumption expenditure contributed 2.2 percentage points to Australian GDP growth. Even over the last five years of that decade which included the direct impacts of the GFC consumption growth contributed 1.7 percentage points to GDP growth. This was a period when household debt to income was still increasing with the new debt being large enough to make a positive contribution to growth. Between 2000 and 2005 the rate of household debt to income rose from 125 per cent of income to 165 per cent. The rise continued to 2010 to 181 per cent. A major part of this growth was households using the increasing value of their home equity to borrow and reduce their savings ratios.

From now on the debt ratio rise will be considerably slower although it will continue to increase steadily over the projection period. It will be driven by first home buyers taking on more debt relative to income and higher income-higher wealth households using their asset base for debt financing to invest in financial or physical assets. Debt saturation levels amongst middle income households will force a steady reduction in the use of debt to fund household consumption.

This effect can be seen in the current outcomes for the economy. Despite rapid rises in house prices and hence household net worth, consumption expenditure growth over 2014 and 2015 has been subdued. If households were in the position of the early 2000s, with greater debt carrying capacity, private consumption expenditure growth would have been 70 to 100 per cent greater. That is, in the vicinity of 4 to 5 per cent per annum.

The projected slow growth in debt to income ratio nevertheless will further reduce the scope for consumption growth, simply because of the scale of the debt and over a long-term basis household affordability is likely to further deteriorate also having a direct and indirect negative impact on consumption growth.

At best, Australian consumption expenditure growth's absolute contribution to GDP growth will remain close to current levels of between 1.0 and 1.2 per cent per annum. As there is no solution to the debt overhang, other than a crisis induced mass write-offs of household debt that could occur in a major crises that made the banks insolvent, the debt constraint will remain a negative to Australian growth prospects for the foreseeable future.

The contribution of export growth to Australian GDP growth should be a little better than the historical average of 0.6 percentage points per annum.

In the short term, over the 2016 to 2018 period, the production flow-on effect from the mining boom will still be making its presence felt. After that the impact of the low exchange rate will be positive. For this reason the contribution of export growth to Australian GDP growth is projected to increase to between 0.7 and 0.9 percentage points.

This, however, will be considerably less than what the policy authorities will be expecting from the lower exchange rate. The exchange rate will be important in stimulating demand components such as tourism expenditures and increases in utilisation rates in plants that currently have substantial unused capacity. However, for new capacity the impact will be far less than what is currently expected.

Business will take many years to forget the asset destruction induced by the high exchange rate of the 2006 to 2014 period. The exchange rate will have to stay low for a long period of time before business will be confident that it will continue to stay low. However, even when they commence analysing new investment opportunities, they will discover that the low exchange rate will substantially increase the costs for:

- overseas marketing;
- capital equipment; and
- technology costs,

which will significantly erode profit margins compared to the case where existing capacity can be used for expansion.

The current housing expansion will cease making a significant positive contribution to economic growth by 2017 and make a negative contribution to economic growth by 2018. Over the longer term, the dwelling sector will revert to its traditional long-term net contribution of growth of near zero.

The wind-down of mining investment will be the main reason for the high negative contribution to GDP growth over the 2014 to 2017 period from business investment. If account is taken of the import content of business investment, the net negative contribution of the decline in business investment is significantly less than the gross contribution.

Budget deficit constraints will restrain the contribution of current government expenditure to GDP growth at half the level of the past. That is, an average of 0.3 percentage points compared to 0.6 percentage points over the 2000 to 2012 period. Given the rapidly deteriorating fiscal deficit outlook due to the fall in the terms of trade, this constraint will continue to operate into the foreseeable future.

The bottom line is that, at best, Australian GDP growth will generally fall to within the range of 2.0 to 2.5 per cent per annum over the next 12 years.

Beyond 2017 the main driver of growth will be net trade which in turn will be driven by the low exchange rate.

2.3.2 The balance of payments

The balance of payments outlook for the Australian economy is given in the recent falls in commodity prices. The current account deficit, as a per cent of GDP, will return to the 6 per cent of GDP mark with the fall in the exchange rate by increasing foreign denominated currency foreign debt and debt service costs, along with the decline in the trade balance is contributing to the increase in the current account deficit.

The steady increase in net international debt towards 100 per cent of GDP over the projection period probably looks unfeasible, and therefore Australia will require a significant improvement in the terms of trade of trade from the early 2020s to render the projections more feasible. Given the world GDP growth rate outlook , this looks unlikely and will be reinforced by downward pressure on fossil fuel export prices as the world moves to a lower carbon trajectory. However Australia is likely to have major international debt problems before the mid to late 2020s.

2.3.3 Australia's international borrowing requirement

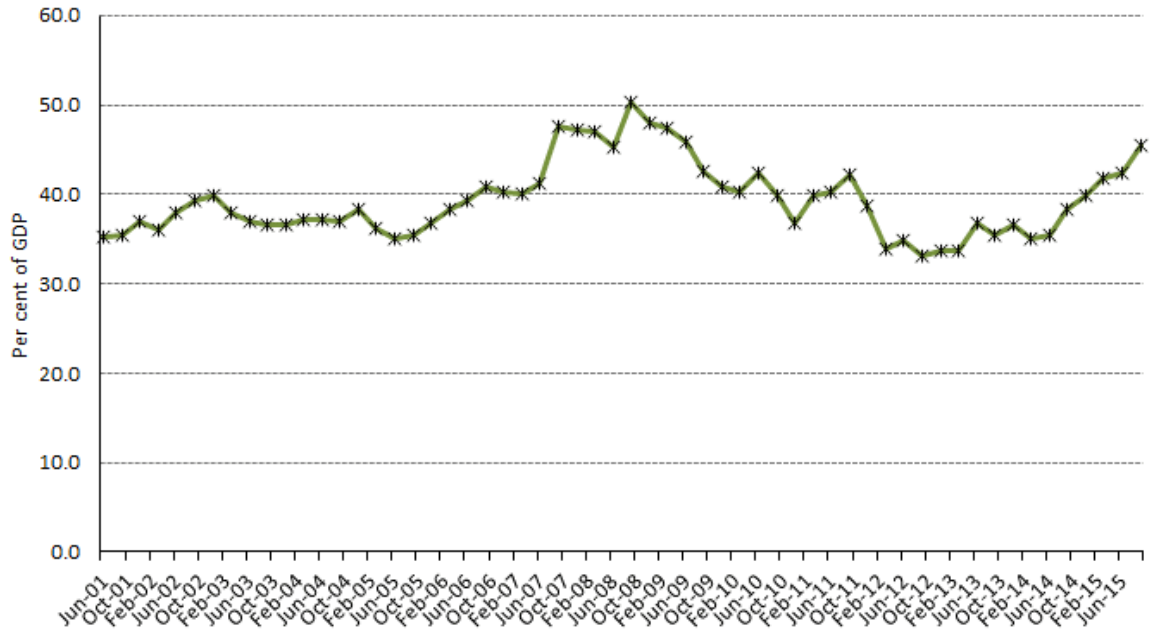
Figure 2.4 shows Australia's short-term borrowing requirement as a per cent of GDP. The short-term borrowing requirement is defined as the level of foreign debt that falls due over the next 12 months from a given quarter less current foreign reserves plus the expected current account deficit over the next 12 months.

It can be seen from Figure 2.4 that Australia's international borrowing requirement has gone from 35% of GDP in March 2014 to 46 per cent by the September quarter. It has returned to GFC peaks. In 2009 it was China's stimulus package that restored Australia's international borrowing requirement to sustainable levels by 2012. There is no prospect of this happening now and if anything the probability is a further deterioration so that by 2017, with further devaluation of the currency, the borrowing requirement will be about $900 billion, or just under $1 trillion if international reserves are excluded.

It's not hard to imagine any emerging economy's instability (that is a third world debt crises since 2007) over 2016 and into 2017 will further depress Australia's terms of trade as countries such as Brazil dumping commodities on international markets in the search for additional foreign exchange. In this case, with further exchange rate falls (from the levels predicted in this report), it would take Australia's international borrowing requirement towards 60 per cent of GDP. The rate for sustainability is an international borrowing requirement of less than 25 per cent for developed and major emerging economies and zero (that is, short-term debt equals foreign reserves) for developing economies.

At this point foreign investors would refuse to roll-over the debt without large-scale increases in interest rates. This would plunge the economy into a deep recession (up to 5 per cent fall in GDP) or, alternatively, suspecting they will not get their money back they would simply demand repayment. With foreign reserves of only about $80 billion, this would mean that Australia could only satisfy demands for a month and then would have to default on the debts, and since a significant proportion of the bonds are held by the banking system the banks would be rendered insolvent.

Figure 2.4: Australia's international borrowing requirement (per cent of GDP)



2.3.4 Population and employment

The way that Australia's net immigration intake is determined guarantees an 'equilibrium' unemployment rate of between 5.5 and 6.5 per cent. The rule is straight forward. At about 5.5% unemployment rate one additional working age migrant is let into the country for every employment growth in excess of the national increase in the population excluding the impact of foreign immigration. In addition, for each unemployment person above a 5.5 per cent unemployment rate one foreign worker is deducted. The rule is based on average data extending back 12 quarters or three years. It means that over time the unemployment rate will have a tendency to trend back to an unemployment rate of between 5.5 and 6.5 per cent by the adjustment of net foreign migration to the employment growth.

What this means is that the net foreign immigration rate is largely endogenous depending on the state of the labour market.

This means that over the next few years, due to subdued employment growth, the rate of net foreign arrivals will decline to 200,000 and then to 176,000 by 2020, reducing the population growth to 1.3 per cent by 2020. Given the longer term subdued outlook and a growth of 1.3 per cent in total hours worked between 2020 and 2028 the relatively low population growth rate will also be maintained for the 2020 decade.

2.3.5 Inflation, wages and interest rates

The inflation and wages growth will remain subdued. This in the main is because of the subdued economic conditions. It is also because of the now over-supply of tertiary qualified and quality trade qualified workers and the relative decline in employment positions requiring these qualifications. This is forcing more of the workforce to compete for low skilled/low paid employment opportunities which is lowering the overall growth in nominal and real wages with indirect feed-back effects constraining income growth for the skilled in skilled employment.

The high debt service costs of households is also forcing more workforce members to take whatever employment is available no matter what the $/hour rate. For this reason, as the projection indicates, the inflation rate is expected to remain at around 2 per cent.

There is an uplift in real interest rates from 2017 as a result of the worsening current account deficit rather than higher inflationary expectations. The policy authorities will no doubt be unwilling to raise interest rates too quickly because of the return effect on real household disposable income because of the high debt levels. Although household debt is significantly less than financial assets, the income gain from higher interest rates on financial assets is either locked up in superannuation funds or the bank accounts of higher income households who tend to save the extra income rather than spend it. Thus, in terms of the impact on consumption expenditure of an interest rates rise on a net basis is significantly deflationary.

2.3.6 The exchange rate

The sustained high current deficits, the return of the terms of trade to near pre-2005 levels and the subdued outlook for the world economy will ensure a low Australian exchange rate, that is, a rate over the medium-term that will be nearer 60 cents than 70 cents and remaining at relatively low for the projection period.

In an ideal world the exchange rate would be allowed to fall towards 50 cents or below. However, too low an exchange rate runs the risk of triggering an exchange rate crisis because of its impact on debt service costs would result the current account deficit reaching unsustainable levels very quickly and thereby triggering a crises.

However, the positive impact of the low exchange rate on economic growth will be significantly less than what the policy authorities are expecting. There has been too much asset destruction from the high exchange rate over the 2007 to 2014 period for business to react quickly and significantly in pulling in new capacity as a result of the now low, and expected to be lower, exchange rate.

Table 2.2 Formation of Australian GDP (per cent)									
	2013	2014	2015	2016	2017	2018	2019	2020	2021
International									
World GDP (fiscal year)	2.5	2.6	2.9	3.1	3.2	3.1	3.1	2.8	3.0
Demand									
Private consumption	1.6	2.6	2.7	3.1	2.4	2.3	2.2	3.0	2.6
Business investment	3.9	-3.8	-6.6	-10.1	-7.5	-0.2	15.2	0.4	0.5
Housing	-1.8	5.2	7.9	9.5	9.1	1.2	-1.9	-2.1	-0.1
Public consumption expenditure	0.7	1.5	1.3	3.2	2.3	1.9	1.8	1.8	1.9
Public capital expenditure	-0.1	-3.3	-6.0	-3.2	0.1	5.9	4.5	-4.8	-0.9
Total expenditure	1.6	1.3	0.8	1.2	1.3	2.0	3.4	1.7	1.9
GDP	2.4	2.5	2.2	2.6	2.6	2.8	2.6	2.2	2.2
External sector									
Current account deficit ($B)	-59.4	-51.1	-58.7	-81.3	-103.2	-103.6	-115.2	-127.0	-140.8
CAD as per cent of nominal GDP	-3.9	-3.2	-3.6	-5.5	-7.2	-6.9	-7.1	-7.5	-7.9
Labour market									
Employment	1.2	0.5	1.2	2.3	1.5	1.5	1.5	1.6	1.6
Unemployment rate (%)	5.4	5.8	6.2	6.1	6.1	6.1	6.0	5.9	5.7
Participation rate (%)	65.1	64.7	64.7	65.1	64.9	64.9	64.9	65.0	65.1
Finance									
90 day bank bill (%)	3.2	2.6	2.5	2.2	2.4	2.8	3.0	3.0	3.1
10 year bond rate (%)	2.9	3.8	3.0	2.8	3.3	3.7	3.9	3.9	3.8
$US/$A	102.7	91.9	83.7	71.9	68.5	64.3	63.6	64.6	65.5
Wages and prices									
Average weekly earnings	4.6	2.9	2.2	1.1	1.8	2.2	2.3	2.3	2.2
CPI	2.3	2.7	1.7	1.8	3.0	2.4	2.0	1.3	0.9
Population growth	**1.8**	**1.6**	**1.4**	**1.5**	**1.5**	**1.4**	**1.4**	**1.3**	**1.3**

Figure 2.5: Average weekly earnings and CPI rate (per cent)

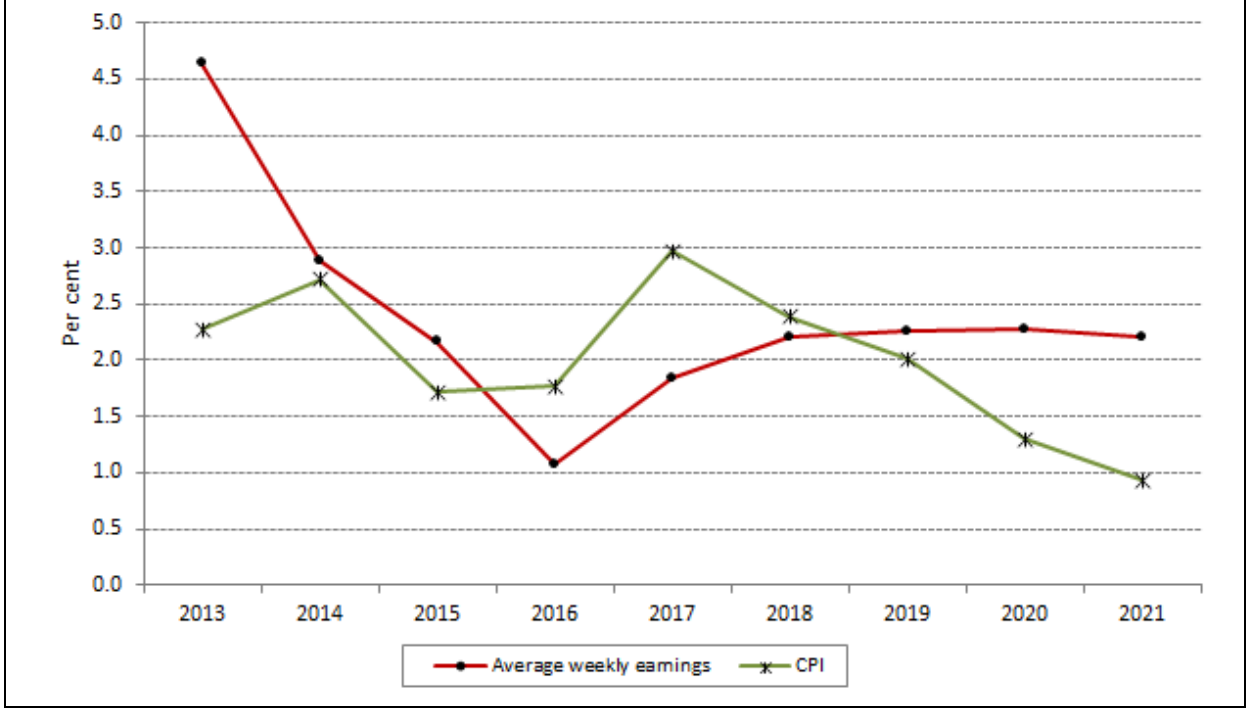


Figure 2.6: $A/$US

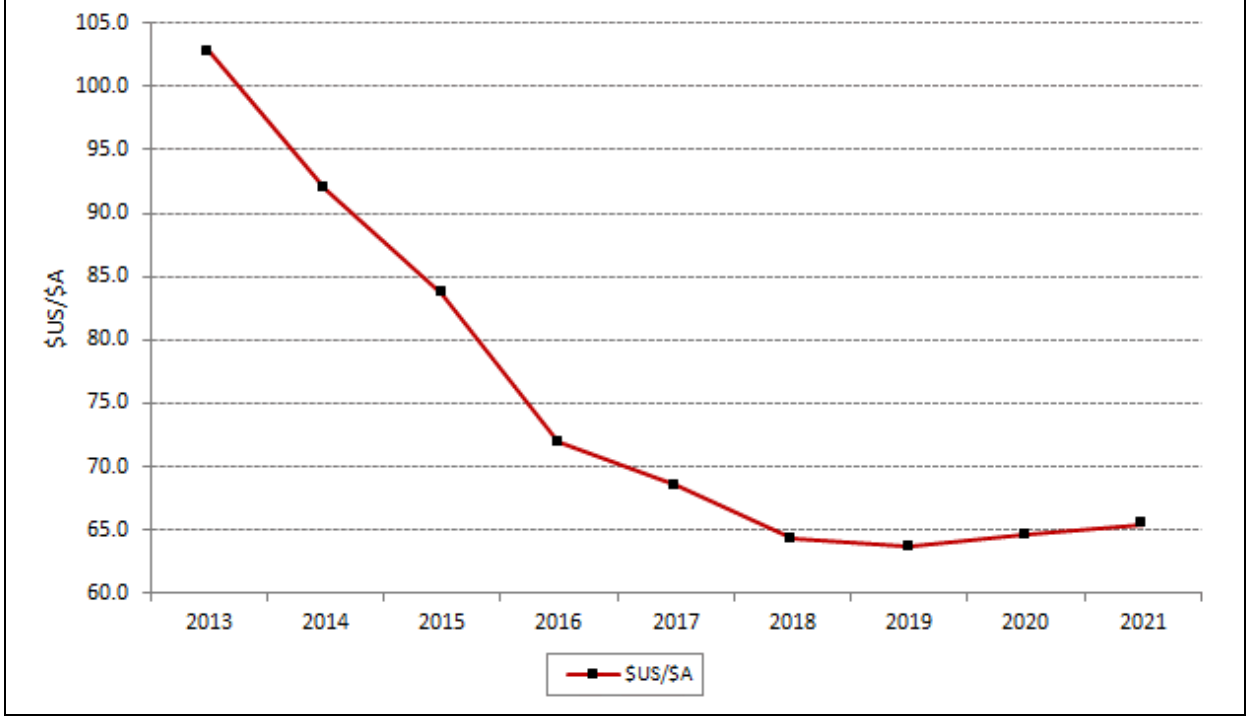


Figure 2.7: 90 day bill and 10 year bond rates

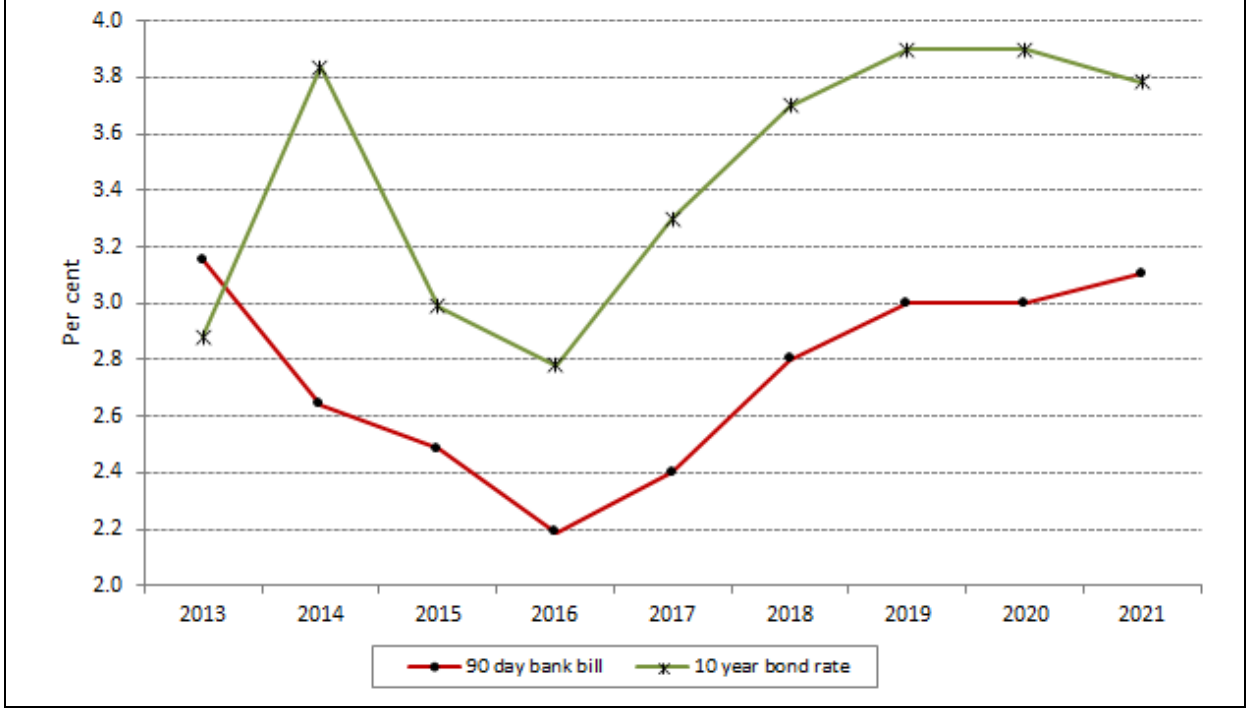
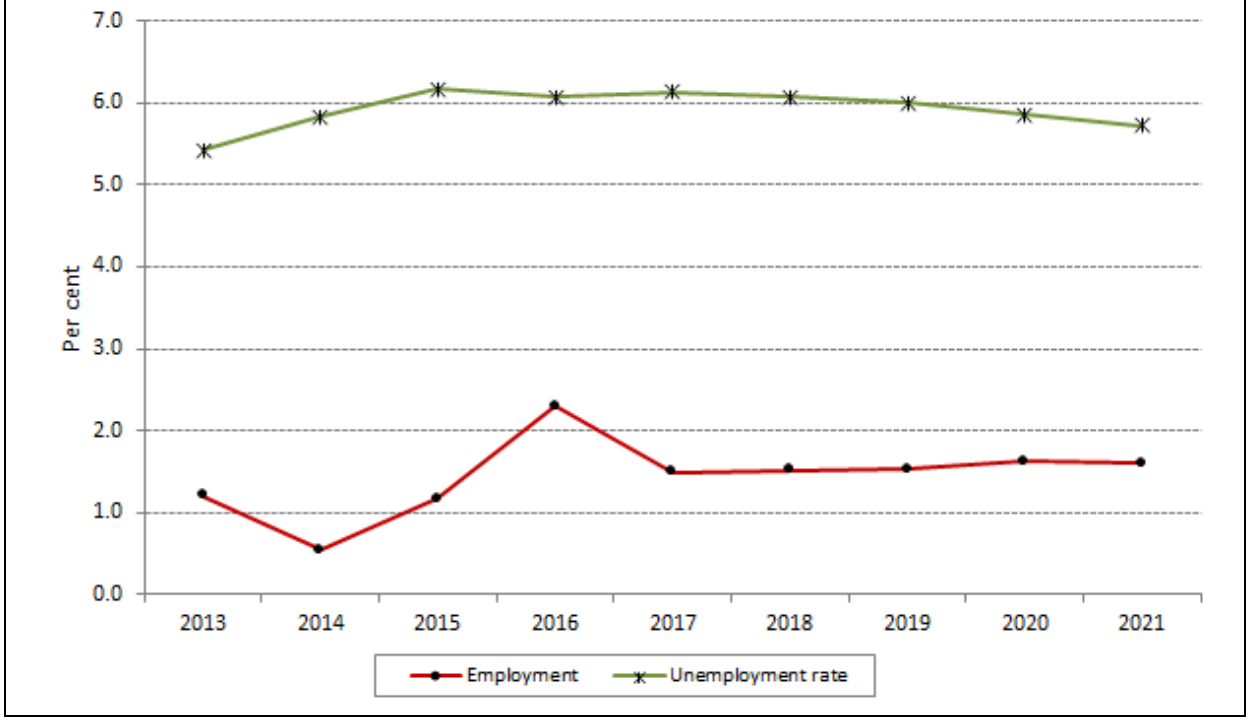


Figure 2.8: Employment and unemployment (per cent)



3. The outlook for Victoria to 2025-26

3.1 Introduction

This section outlines the economic outlook for Victoria to 2025-26.

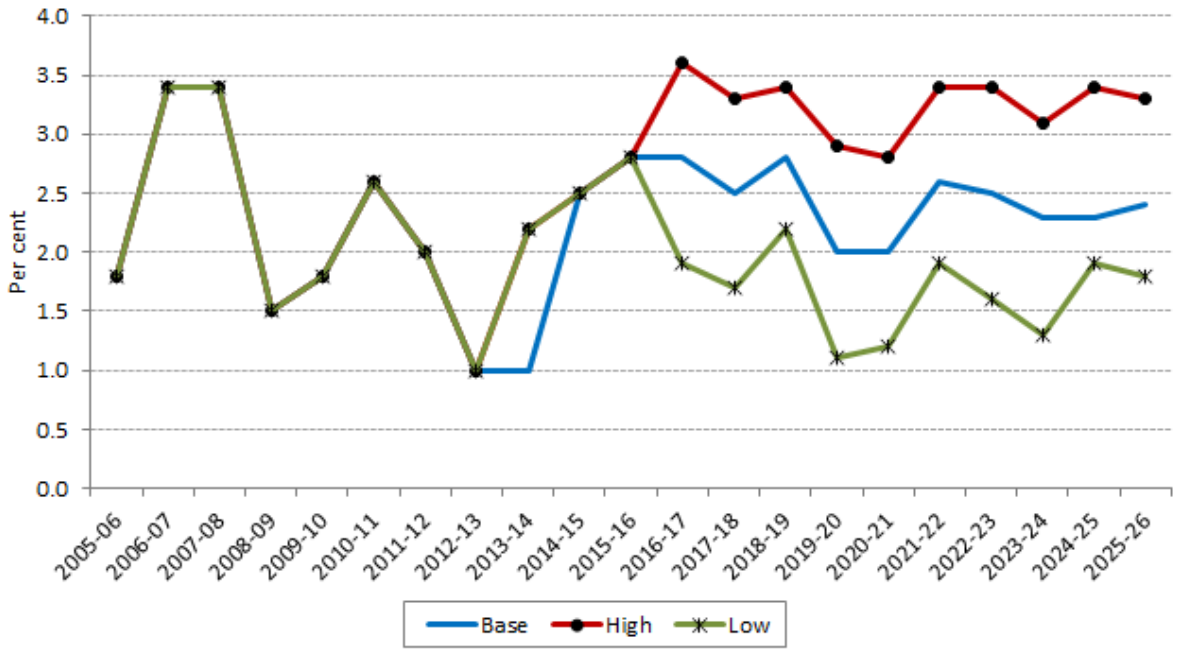
3.2 Summary of scenarios

Figure 3.1 shows the outlook for Victorian GSP growth over the period to 2025-26 by scenario. Between 2015-16 and 2025-26 Victorian GSP growth is projected to average:

- 2.4 per cent per annum under the Base scenario;
- 3.2 per cent under the High scenario; and
- 1.6 per cent under the Low scenario.

Table 3.1 shows the projected annual economic growth rates projected for Australia and Victoria by scenario for the period 2005-06 to 2025-26.

Figure 3.1: Victorian GSP growth by scenario – 2005-06 to 2025-26



Source: NIEIR and ABS.

Table 3.1 Projected Australian and Victorian GDP growth rate by scenario – 2005-06 to 2025-26						
	Australia			Victoria		
	Base	High	Low	Base	High	Low
Per cent change						
2005-06	3.0	3.0	3.0	1.8	1.8	1.8
2006-07	3.8	3.8	3.8	3.4	3.4	3.4
2007-08	3.7	3.7	3.7	3.4	3.4	3.4
2008-09	1.8	1.8	1.8	1.5	1.5	1.5
2009-10	2.0	2.0	2.0	1.8	1.8	1.8
2010-11	2.4	2.4	2.4	2.6	2.6	2.6
2011-12	3.6	3.6	3.6	2.0	2.0	2.0
2012-13	2.4	2.4	2.4	1.0	1.0	1.0
2013-14	2.5	2.5	2.5	2.2	2.2	2.2
2014-15	2.2	2.2	2.2	2.5	2.5	2.5
2015-16	2.6	2.6	2.6	2.8	2.8	2.8
2016-17	2.6	3.4	1.9	2.8	3.6	1.9
2017-18	2.8	3.8	1.7	2.5	3.3	1.7
2018-19	2.6	3.6	1.6	2.8	3.4	2.2
2019-20	2.2	3.0	1.2	2.0	2.9	1.1
2020-21	2.2	2.9	1.1	2.0	2.8	1.2
2021-22	2.3	3.1	1.5	2.6	3.4	1.9
2022-23	2.2	3.2	1.3	2.5	3.4	1.6
2023-24	2.1	3.0	1.3	2.3	3.1	1.3
2024-25	2.2	3.1	1.2	2.3	3.4	1.9
2025-26	2.4	3.1	1.5	2.4	3.3	1.8
Average annual compound growth rate (per cent)						
2015-16 to 2025-26	2.4	3.2	1.4	2.4	3.3	1.7
2015-16 to 2020-21	2.5	3.3	1.5	2.4	3.2	1.6
2020-21 to 2025-26	2.2	3.1	1.4	2.4	3.3	1.7

Source: NIEIR and ABS.

3.3 The base scenario outlook for Victoria to 2020-21

Table 3.2 presents selected economic aggregates for Victoria to 2020-21 for the Base scenario.

Table 3.2 Macroeconomic aggregates and selected indicators – Victoria (per cent change)

	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	Average annual compound growth 2015-16 to 2020-21
Private consumption	2.5	3.9	4.3	2.3	1.7	1.4	1.4	2.2
Private dwelling investment	5.9	10.5	2.6	-7.1	-7.0	-0.9	3.1	-1.9
Business investment	6.8	1.0	-11.2	-2.8	22.3	2.9	-1.6	1.9
Government consumption	1.0	2.5	1.5	2.2	1.7	1.4	1.3	1.6
Government investment	-6.8	1.8	-4.0	2.5	8.7	-1.4	-2.6	0.6
State final demand	2.6	3.6	1.4	0.9	3.3	1.3	1.0	1.6
Gross state product	2.5	2.8	2.8	2.5	2.8	2.0	2.0	2.4
Population	1.7	1.5	1.4	1.4	1.4	1.4	1.4	1.4
Employment	2.1	1.7	1.8	1.8	1.8	1.8	1.7	1.8

Source: NIEIR and ABS.

3.3.1 Gross State Product

Victorian Gross State Product (GSP) increased by 2.8 per cent in 2015-16, following growth of 2.5 per cent in 2014-15. In both years Victorian economic growth was around 0.2 percentage points above the Australian GDP growth rate.

These recent Victorian growth outcomes follow a period of very weak economic growth in Victoria between 2011-12 and 2013-14. Victorian GSP averaged only 1.3 per cent per annum over this period, 1.6 percentage points below the national GDP growth rate. Victorian growth over this period was impacted by the high exchange rate which reduced the competitiveness of the manufacturing sector. Industry closures were announced in metal product manufacturing (Alcoa Point Henry), petroleum and chemical manufacturing and textiles, clothing and footwear. In the transport equipment sector Ford, Holden and Toyota announced the closure of their motor vehicle assembly plant in 2013 and 2014.

Victorian GSP growth remains relatively robust through the 2016-17 to 2018-19 period reflecting:

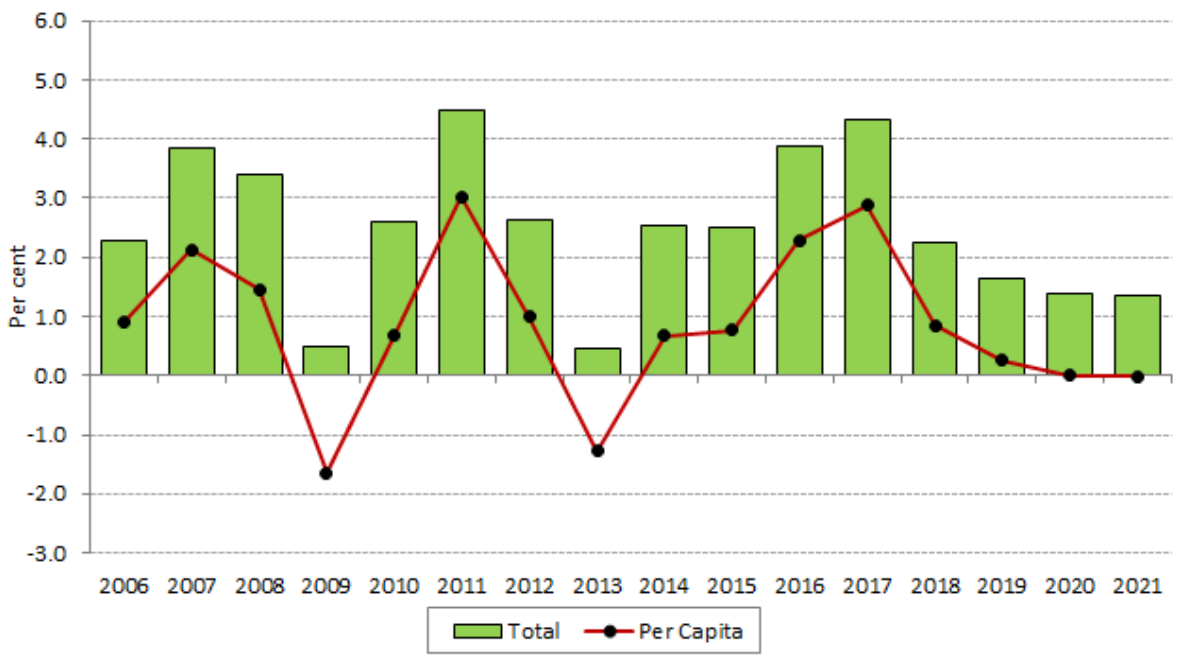
- steady growth in private consumption expenditure;
- initially a rise in private dwelling expenditure in 2016-17 but then declines over the next two years; and
- a surge in private business investment in 2018-19 following declines in 2016-17 and 2017-18.

3.3.2 Private consumption expenditure

Household expenditure growth in Victoria strengthened to 3.9 per cent in 2015-16, following growth of 2.5 per cent in 2014-15. In part this reflects stronger household disposable income growth, steady employment growth and low nominal interest rates.

Victorian household expenditure growth is forecast to remain strong through 2016-17, partly assisted by a fall in the household savings ratio. Average growth in private consumption expenditure is 2.2 per cent per annum over the 2015-16 to 2020-21 period.

Figure 3.2: Private consumption expenditure growth – Victoria



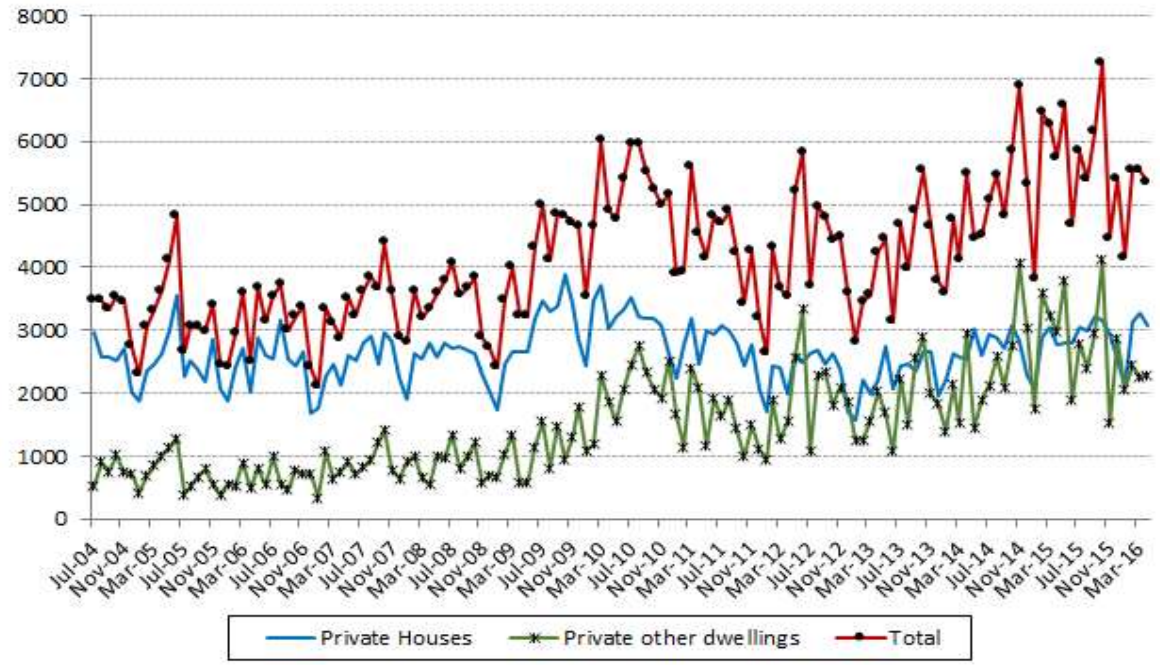
3.3.3 Private dwelling expenditures

Private dwelling expenditure in Victoria rose strongly over 2014-15 and 2015-16. This follows relatively flat levels of expenditure over the 2012 to 2014 period.

Private new dwelling approvals in Victoria in 2014-15 rose to nearly 67,000 dwelling units, compared to around 50,000 in 2011-12. New house approvals rose to around 33,000 units in 2014-15 while other dwelling approvals rose to 34,000 dwelling units. The increase in new house approvals was around 3,600 units while the increase in other dwellings (flats, townhouses, apartments) was 14,000 dwelling units.

Approvals have remained steady over 2015-16 which will support activity through to 2016-17. Expenditures on dwellings are expected to fall sharply over 2017-18 and 2018-19 by around 15 per cent.

Figure 3.3: Private new dwelling approvals – Victoria

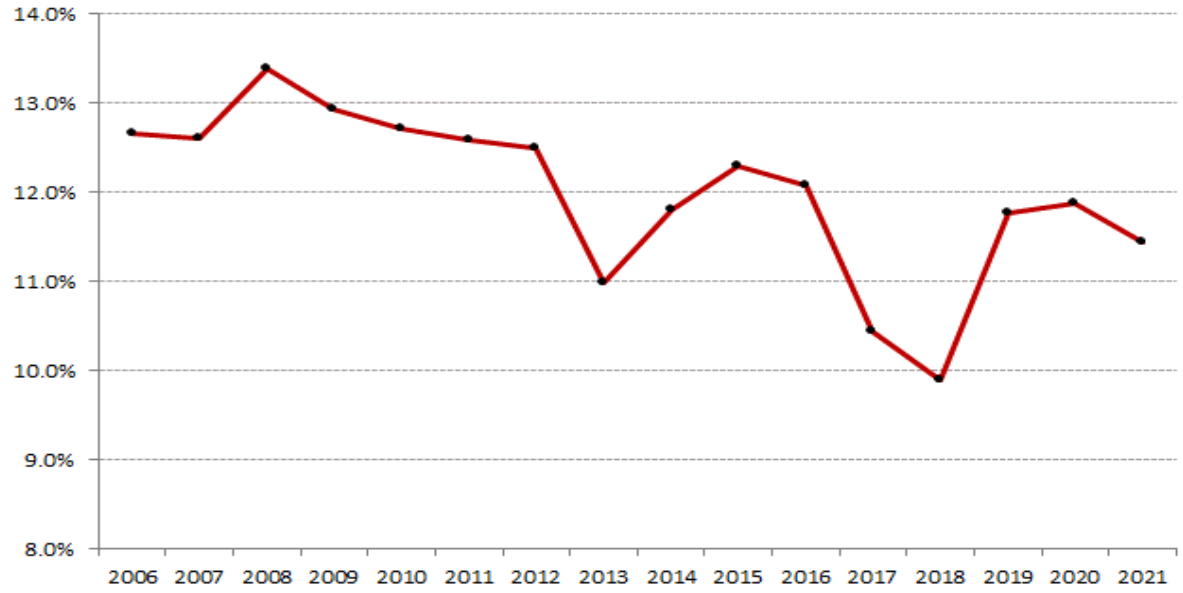


3.3.4 Private business investment

Victorian private business investment rose by 1.0 per cent in 2015-16, following strong growth in 2013-14 and 2014-15. Expenditure levels were around $44 billion in 2015-16, or around 12.3 per cent of Victorian GSP.

The continued decline in the Victorian manufacturing sector is placing downward pressure on private investment. Private business investment declines in 2016-17 and 2017-18 before rebounding in 2018-19. Expenditure levels reach $51 billion by 2020-21, supported by slowly rising tertiary sector investment expenditures.

Figure 3.4: Private business investment as a share of Victorian GSP



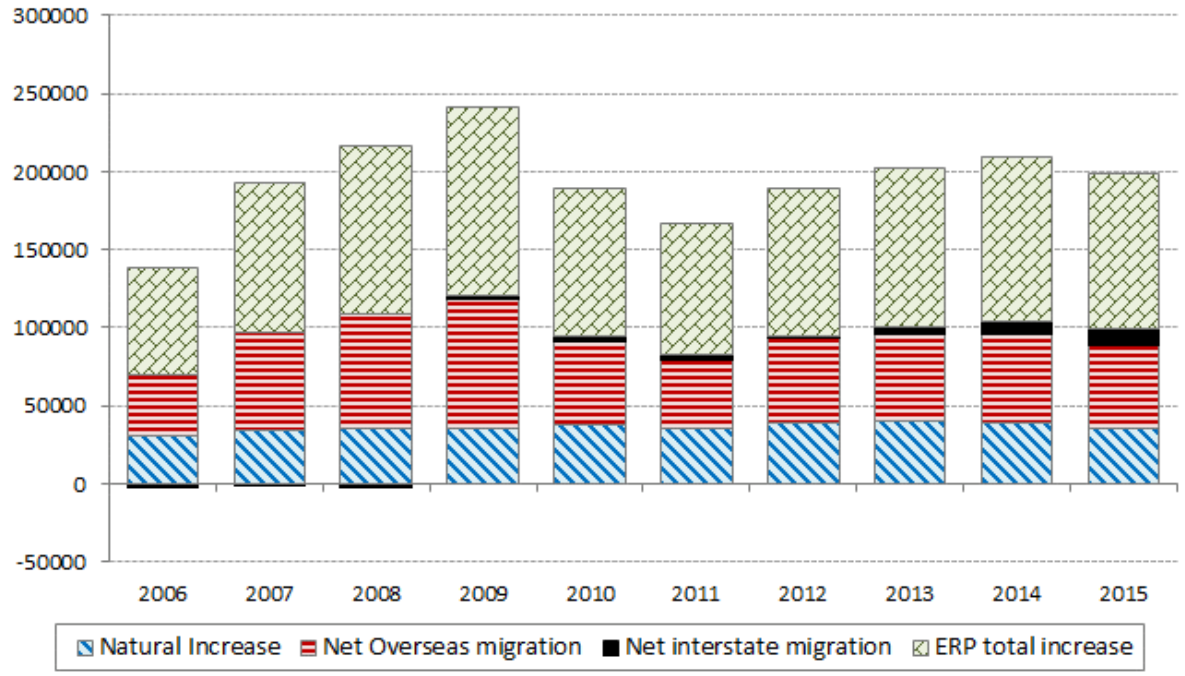
3.3.5 Population and employment

Victorian population growth has been very strong over recent years, supporting solid underlying economic growth in the State. Population growth over the five years to 2014-15 averaged 1.7 per cent per annum. Victorian population growth in 2015-16 is expected to be 1.5 per cent.

Population growth in Victoria over recent years reflects rising rates of natural increase and high levels of both net overseas and net interstate migration. On average, Victoria's population growth over the 2015-16 to 2020-21 period is 1.4 per cent.

The natural increase in population (births less deaths) in Victoria rose from around 35,000 persons in 2008-09 to nearly 40,000 persons in 2012-13. In 2014-15 the natural increase fell back down to around 35,000 persons in Victoria.

Figure 3.5: Components of population change – Victoria



Net overseas migration gains by Victoria have remained solid at around 55,000 persons since 2009-10. The very high levels of net overseas migration following the Global Financial Crisis (GFC) in 2007-08 and 2008-09 reflected expatriates returning from overseas.

Victorian net interstate migration gains have been positive and increasing since 2008-09. The net interstate migration gain by Victoria was around 10,200 persons in 2014-15 compared to around 1,500 in 2008-09. Victoria's gains over recent years partly reflects weaker economic and employment growth in Queensland and Western Australia.

Victorian employment growth strengthened to 2.1 per cent in 2014-15 and is expected to be 1.7 per cent in 2015-16. This growth in employment in Victoria follows a three year period of very poor labour market outcomes over the 2011-12 to 2013-14 period.

Employment growth in Victoria in 2011-12 and 2012-13 was only 0.8 per cent and growth in 2013-14 was 0.6 per cent. Employment growth over these years in Victoria were impacted by declines in manufacturing and construction employment, including industry closures and downsizing.

Over the last three years (2012-13 to 2015-16), there were significant increases in employment in the following industries:

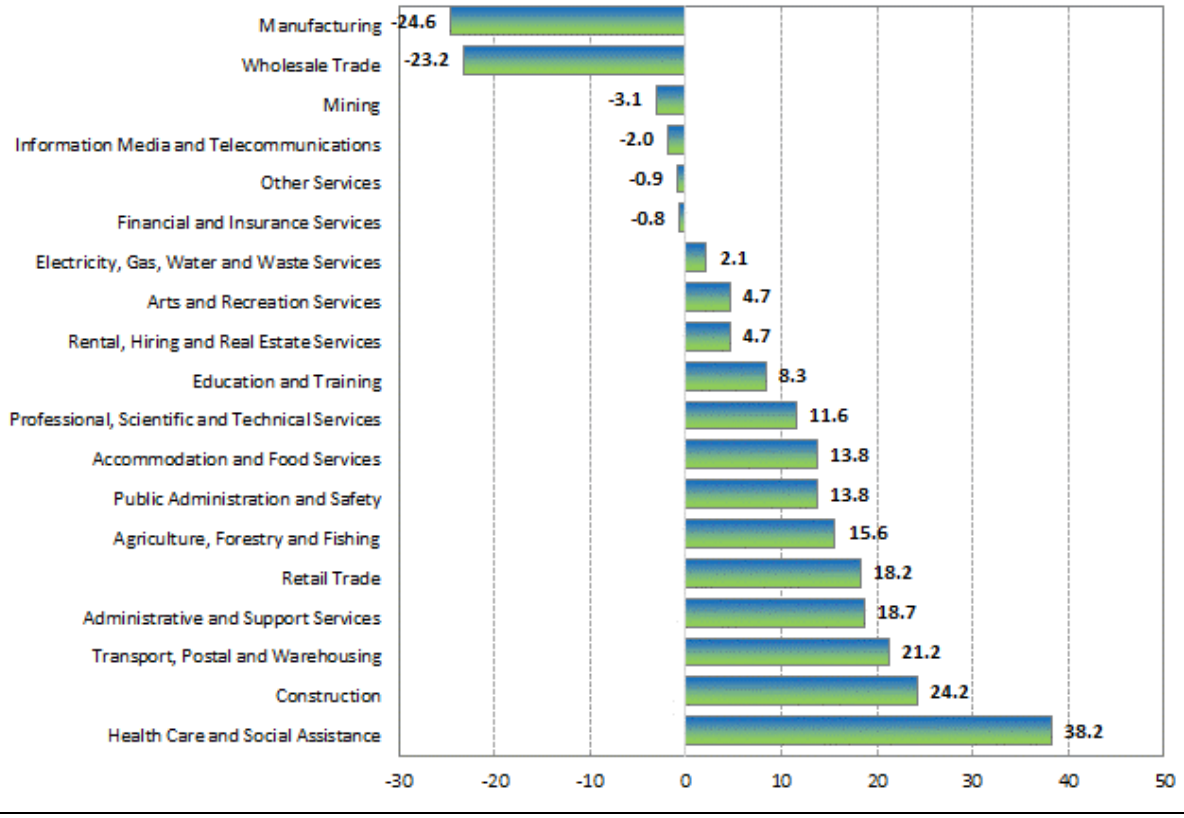
- Health care and social assistance (38,200);
- Construction (24,200);
- Transport, postal, warehousing (21,200); and
- Administrative services (18,700).

Over the same period there were significant contractions in employment in the following industries:

- Manufacturing (-24,600);
- Wholesale trade (-23,200); and
- Mining (-3,100).

Of the total increase in employment in Victoria over this period around 71 per cent of all new jobs were part-time employment.

Figure 3.6: Employment by industry – Victoria – Absolute change in employment 2012-13 to 2015-16



4. The outlook for the Multinet Gas region to 2026

This section outlines the baseline projections for population, gross regional product and other indicators for the Multinet Gas region to 2026.

4.1 The economic structure of the Multinet Gas region

Table 4.1 shows a snapshot of the Multinet Gas distribution area in terms of key economic indicators for 2014-15 compared to Victoria.

The main features of the Multinet Gas distribution region are:

- it has a resident population of 1.86 million persons representing 31.7 per cent of Victoria;
- it accounts for 32.3 per cent of total Victorian Gross State Product (GSP);
- it has 745,160 dwellings representing 30.7 per cent of total Victorian dwellings;
- it has large industry concentrations of wholesale and retail trade (40.9 per cent of Victoria), finance property and business services (35 per cent of Victoria) and public administration, defence and community services (32 per cent of Victoria);
- the primary industries (agriculture and mining) are quite small compared to Victoria; and
- the largest manufacturing industries in the Multinet Gas region are food, beverages and tobacco, basic chemicals and chemical product manufacturing, and machinery and equipment manufacturing.

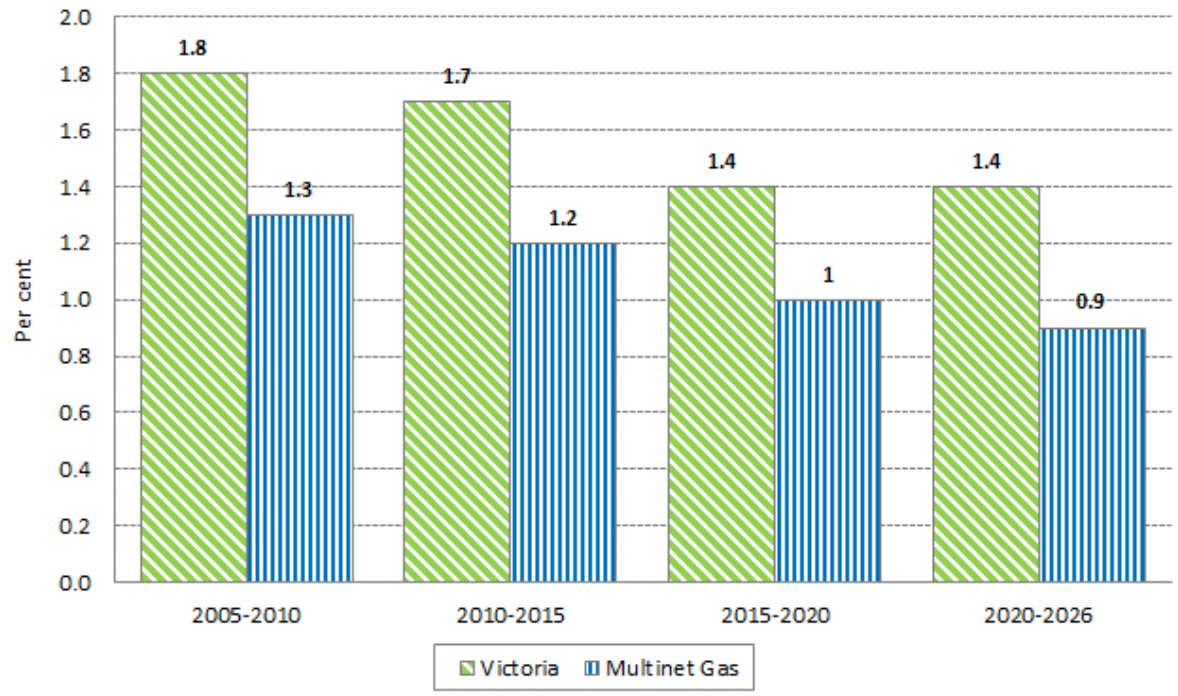
Table 4.1 Regional economic structure – total Multinet Gas region					
	Multinet Gas		Victoria		Per cent share
Population ('000)		1867.2		5898.5	31.7
Dwelling stock ('000)		745.2		2428.2	30.7
	2013-14 $m	Share of industry in MG GRP	2013-14 $m	Shae of industry in VIC GRP	Share of industry in VIC GSP (%)
Agriculture, Forestry and Fishing	795.4	0.8	9706.5	3.1	8.2
Mining	533.8	0.5	5994.3	1.9	8.9
Food Beverage, Tobacco Product Manufacturing	2027.4	2.0	7048.7	2.2	28.8
Textiles, Clothing and Footwear	283.7	0.3	906.1	0.3	31.3
Wood Product Manufacturing	300.8	0.3	929.8	0.3	32.3
Pulp and Paper manufacturing	389.6	0.4	945.8	0.3	41.2
Basic Chemical and Chemical Product Manufacturing	2071.4	2.0	6404.1	2.0	32.3
Non-Metallic Mineral Product Manufacturing	604.2	0.6	1772.6	0.6	34.1
Primary Metal and Metal Product Manufacturing	96.9	0.1	352.4	0.1	27.5
Fabricated Metal Product Manufacturing	733.0	0.7	2067.4	0.7	35.5
Transport Equipment Manufacturing	1030.0	1.0	3438.3	1.1	30.0
Machinery and Equipment Manufacturing	1345.1	1.3	2741.7	0.9	49.1
Other Manufacturing Furniture Leather	493.9	0.5	1066.3	0.3	46.3
Electricity Gas and Water Supply	2220.3	2.2	9201.4	2.9	24.1
Construction	7316.0	7.2	24430.8	7.8	29.9
Wholesale and Retail Trade	16022.8	15.8	39132.5	12.5	40.9
Transport and Communication Services	8667.0	8.5	30756.9	9.8	28.2
Finance, Property Business Services	30812.1	30.4	88042.8	28.0	35.0
Public Administration, Defence and Community Services	19019.3	18.7	59485.2	18.9	32.0
Recreational, Personal Services, Accommodation	6696.6	6.6	19612.4	6.2	34.1
Total	**101459.3**	**100.0**	**314036.0**	**100.0**	**32.3**

4.2 Population

Multinet Gas resident population in 2014-15 was 1.86 million persons. By 2019-20, total population in the Multinet Gas region is expected to reach 1.96 million persons and by 2025-26, 2.08 million persons. Population growth averages 1.0 per cent per annum between 2015-16 and 2025-26 in the Multinet Gas region compared to a Victorian population growth rate of 1.4 per cent over the same period.

Figure 4.1 shows projected population growth rates for Multinet Gas and Victoria.

Figure 4.1: Population growth – Victoria and Multinet Gas – selected spans

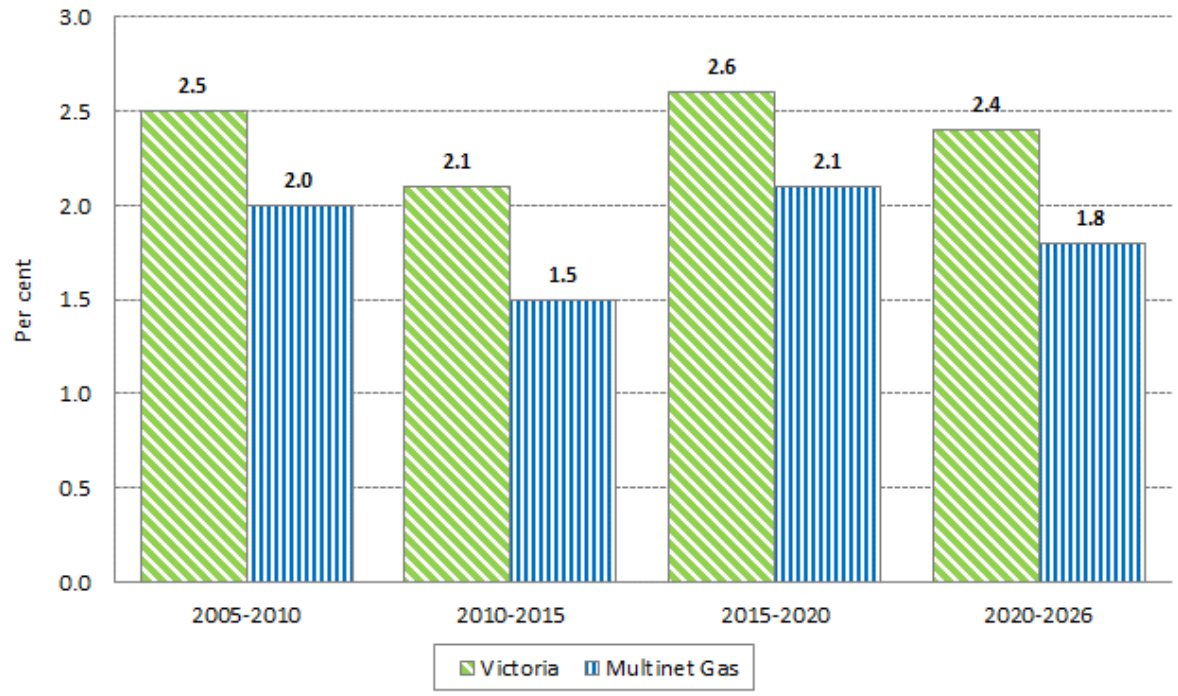


4.3 Gross Regional Product

Multinet Gas Gross Regional Product (GRP) growth is projected to average 2.0 per cent per annum over the 2015-16 to 2025-26 period. This is around 0.5 percentage points lower than the forecast Victorian Gross State Product (GSP) growth rate over the same period.

Figure 4.2 shows average annual growth rates for Victorian GSP and Multinet Gas GRP for selected spans to 2025-26.

Figure 4.2: Gross Regional Product growth – Victoria and Multinet Gas – selected spans

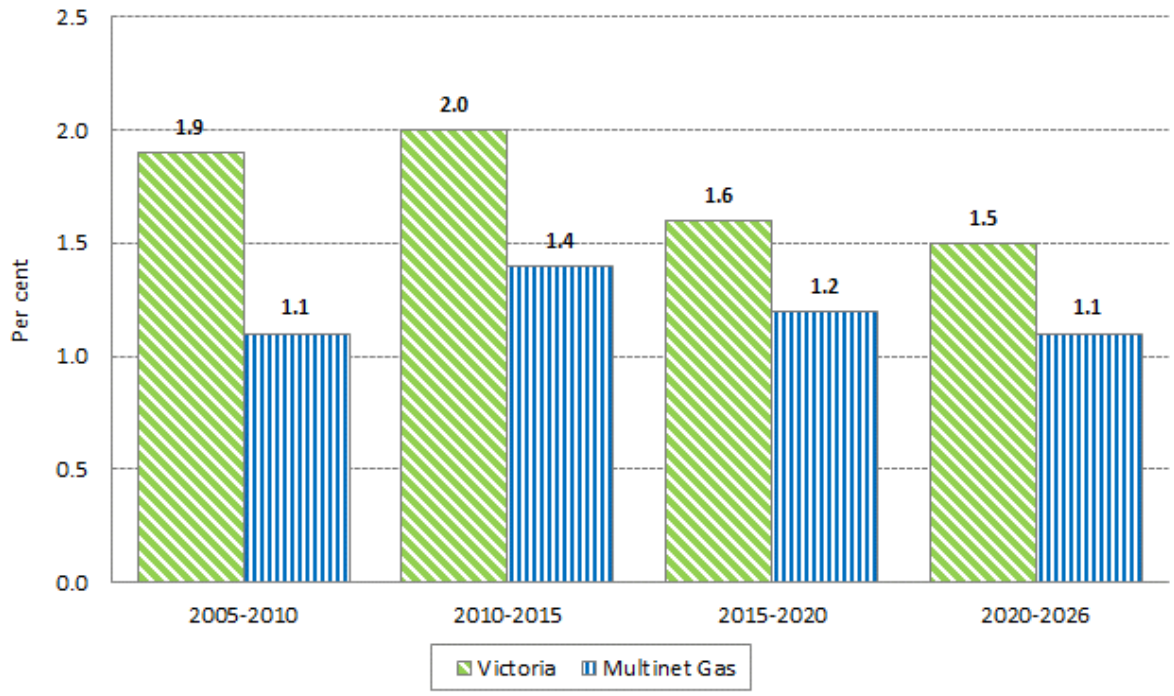


4.4 Dwelling stock

Multinet Gas regions dwelling stock is projected to increase by 1.1 per cent between 2015-16 and 2025-26. This compares to a projected growth rate of 1.5 per cent for Victoria over the same period.

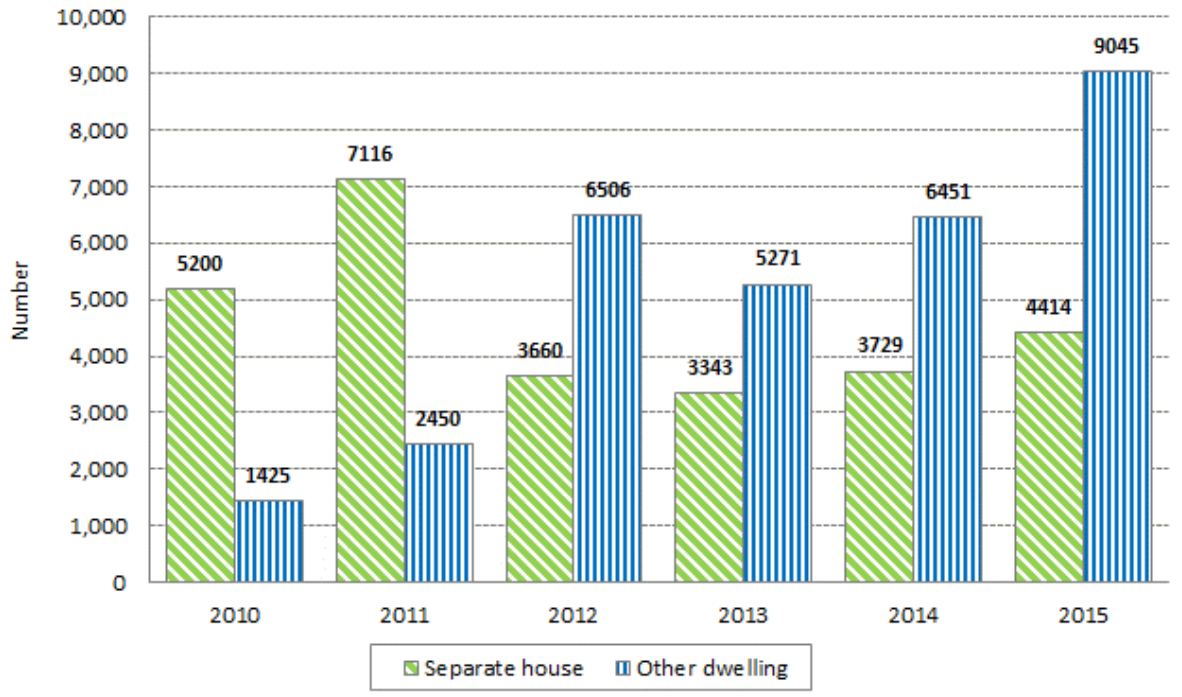
A significant proportion of new dwellings built in the Multinet Gas region are not houses but other dwellings, including apartments. Most apartments would not require a gas meter, but include reverse cycle heating.

Figure 4.3: Dwelling stock growth – Victoria and Multinet Gas – selected spans



The share of other dwellings, including apartments, in the Multinet Gas region has increased from 17.6 per cent in 2000 to 19.7 per cent in 2010 to 22.4 per cent in 2015. The split between houses and other dwellings growth in the Multinet Gas region is shown below from 2010 to 2015. This highlights the sharp shift from new separate houses to multi-unit dwellings.

Figure 4.4: Absolute change in dwelling stock by type – Separate houses and other dwellings – Multinet Gas region 2010 to 2015



5. Natural gas forecasting methodologies and modelling assumptions

This section outlines the methodologies employed and the key modelling assumptions used in developing Victorian natural gas consumption forecasts by tariff and class for Multinet Gas.

The centrepiece of the modelling methodology was the application of NIEIR's economic and energy (industry based) projection models.

Victoria's regional energy model is an economic and energy model. It is based on 11 Statistical Sub-Divisions and 31 Local Government Areas in greater Melbourne. The model produces forecasts of population, the dwelling stock growth and estimates of gross regional product for these Statistical Divisions and Local Government Areas. The allocation of these regions across the gas distribution businesses and by pricing zone is outlined in Appendix A.

The energy projections for Multinet Gas are directly linked to economic indicators for Multinet Gas.

5.1 Methodology – natural gas consumption forecasts

Natural gas consumption forecasts were prepared on a calendar year basis for Multinet Gas to 2026.

Calendar year forecasts were prepared for the following tariff groups for Multinet Gas (and pricing zone):

- Tariff D;
- Tariff V; and
- Tariff L.

Tariff D was disaggregated and forecast by ANZSIC sector as indicated in Table 5.1.

Multinet Gas provided the following information to NIEIR to develop the gas forecasts.

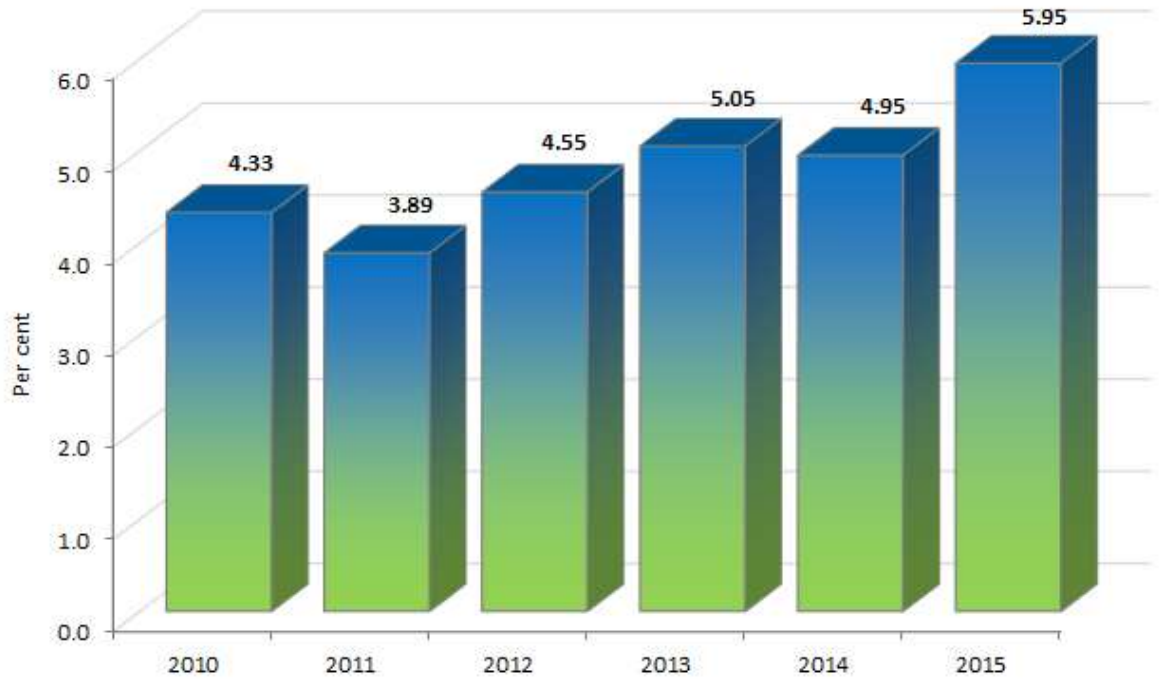
- Total daily gas usage for the Multinet Gas region from 2001 to December 2015.
- Total Tariff D daily usage, including UFAG estimates.
- Tariff D monthly usage by customer from 2005 to 2015.
- Customer numbers by tariff by month.
- New customer MIRNS from 2007 to 2014 and their billings history to the end of 2015.
- Actual annual MHQs by customer for 2005 to 2015.
- Other information describing the Multinet Gas network in Victoria.

Tariff V – Residential volumes and customers

Tariff V sales for each business were determined from the total boundary gas usage for Multinet Gas less Tariff D sales, including losses.

Figure 5.1 shows the Tariff V (Class B) loss factors provided by Multinet Gas.

Figure 5.1: Unaccounted for gas (UAFG) – Tariff V (Class B)



Billed information supplied on a billed linearised basis, was used to allocate Tariff V sales into residential and business sales.

The pricing zone Tariff V data was similarly derived by using the billed data by class to split up the total distribution Tariff V sales by class into pricing zones.

It is important to note that the residential and business Tariff V volumes will differ from those reported by Multinet Gas in their templates for the Commission. The templates may contain billed or billed linearised data.

Residential sales were forecast using an end-use type modelling approach. Average gas usages of new and existing customers were modelled separately. This allowed the major policy changes such as the 6-Star Standard for new homes and changes to Minimum Energy Performance Standards (MEPs) to be directly modelled.

NIEIR undertook a detailed analysis of residential customer accounts data from Multinet Gas distribution businesses. Samples were taken of both new and existing residential customers. The weather normalised new customer average usage was identified from the sample of new meters.

Section 4 of this report outlines in further detail the specific modelling methodology for projecting residential Tariff V usage.

Tariff V – Business volumes and customers

Multinet Gas supplied eight years of billing information for Tariff V customers. It was disaggregated into residential class and business class.

Given the short time series of annual billed data, NIEIR did not estimate new forecasting equations for Tariff V business sales. Instead, NIEIR used an existing commercial equation estimated previously using Department of Industry, Innovation and Science[7] energy consumption data for Victoria. This equation uses commercial output and real gas prices to drive Tariff V business sales by business.

Tariff D – Volumes, customers and MHQ

The forecasts for Tariff D for volumes, customers and maximum hourly quantity were prepared on an industry basis. Tariff D for each business was modelled on the basis of actual Tariff D usage plus losses.

NIEIR obtained individual Tariff D customer data from Multinet Gas. These customers were then ANZSIC or industry coded. In some cases, NIEIR drew on previous work in this area for AEMO and the individual businesses. Where zone based data was required, postcode identifiers were used to allocate Tariff D customers to each pricing zone.

Table 5.1 shows the Australian and New Zealand Standard Industrial Classification (ANZSIC) categories included in NIEIR's Victorian gas forecasting model. Table 5.1 also shows the concordance between customer class categories and ASIC industry categories. Gas consumption forecasts for Tariff D are based on econometric models which link Victorian gas consumption by industry to real output growth by industry, real natural gas prices and weather conditions. The Tariff D forecasts were also partly determined by the results of a survey of major Tariff D customers.

Table 5.1 Reconciliation of customer class categories with ASIC industries

Customer class category	ANZSIC
Residential[1]	
Commercial	Electricity, gas, water and sewerage Construction Wholesale and retail trade Transport and storage, communication services Finance, property, business services Public administration and defence and community services Accommodation, cafes, restaurants and recreation, personal and other services
Industrial	Agriculture, forestry, fishing, hunting Mining Food, beverages, tobacco manufacturing Textiles, clothing and footwear manufacturing Wood, wood products manufacturing, paper products manufacturing Chemicals, petroleum, coal manufacturing Non-metallic minerals manufacturing Basic and fabricated metal products manufacturing Transport and other machinery and equipment manufacturing Miscellaneous manufacturing

Notes: ASIC refers to Australian and New Zealand Standard Industrial Classification.
1. The farm class which excludes residential farm is included in the industrial sector.

[7] Office of the Chief Economist, Australian Energy Statistics.

The rationale for adopting an industry based approach for Tariff D is that the sectoral outlooks for each sector can then feed through and affects volume and MHQ movements over the forecast period. For example, if manufacturing is in decline and commercial is growing, these compositional changes are directly reflected in the forecast for Tariff D for Multinet Gas.

Projections of maximum hourly quantity (MHQ) for Multinet Gas were again derived on an industry basis. The projections of MHQ are linked to the energy growth by industry and a load factor by industry.

In a number of industries the change in MHQ will be closely related to energy use. These would typically only be in a small number of energy intensive industries that operate with very high capacity factors. The vast majority of Tariff D customers, however, would operate at much lower capacity factors.

5.2 Gas demand and weather conditions

Gas demand within any given year is highly sensitive to seasonal weather conditions. The residential segment of gas demand is particular sensitive to weather conditions as household end use in space heating and water heating is particular dependant on climate. Variations in weather patterns between years can lead to significant fluctuations in annual gas demand, which can obscure underlying trends in gas demand (e.g. economic, price, energy efficiency)

Because of the highly unpredictable nature of future weather conditions, it is conventional to prepare forecasts of gas demand assuming that typical or "normal" weather conditions will prevail over the forecasting period. That is the gas demand that is neither colder nor warmer than usual.

To develop forecasts on this basis, historical annual demand readings need to be adjusted for abnormal weather conditions – a process called weather normalisation. Once historical gas demand has been corrected for abnormal weather conditions, a more meaningful assessment of the historical drivers of gas demand can be performed and forecasts can also be brought back to a normal year of weather.

The weather normalisation of historical gas demand is typically undertaken in three steps:

(1) identify normal (standard) – year weather conditions;

(2) establish a relationship between gas demand and weather conditions; and

(3) combine information derived in (1) and (2) and compute weather normalised estimates.

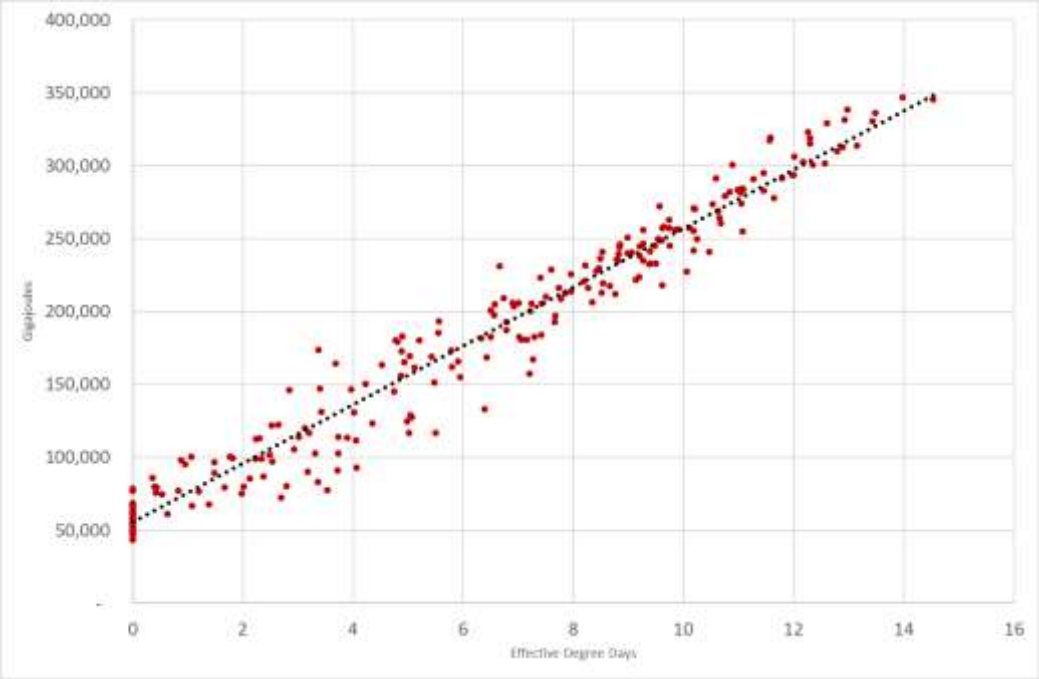
NIEIR primarily uses two weather related variables in the weather normalisation process:

- the Effective Degree Day Index; and
- the Summer Degree Day Index (Cooling Degree Day).

Figure 5.2 and 5.3 illustrate the relationship between daily gas demand (GJ) for the Multinet Gas Melbourne zone and Effective Degree Days and Summer Degree Days using 2015 as an example. These variables are explained within the following sections.

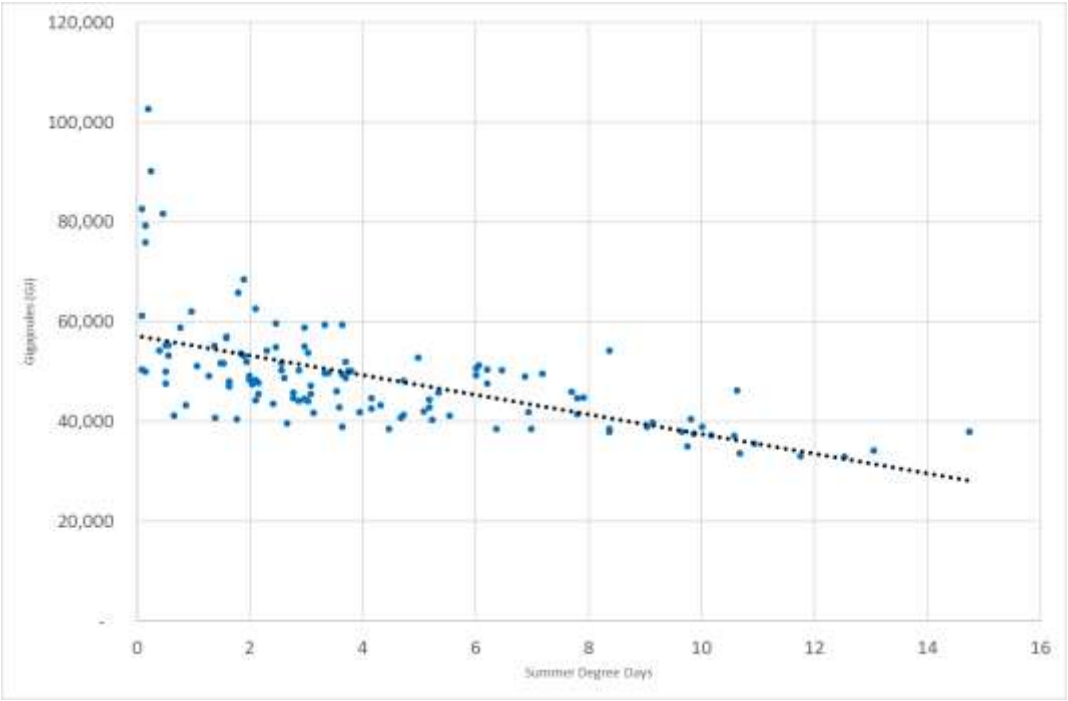
In early 2016, NIEIR completed a review of the Effective Degree Day (EDD) index and forecast standards for Victorian Gas Forecasting purposes. The review developed weather standards for annual gas demand and peak day gas demand, with a particular focus on the impacts of climate change on historical and forecast standards. This sections summarises components of this report and applies the findings to the Multinet Gas region. A complete treatment of the 1-in-2 Peak Day and 1-in-20 Peak Day standards can be found in the *NIEIR Review of EDD weather standards for Victorian Gas Forecasting* (April 2016) report.

Figure 5.2: Multinet Gas Melbourne daily Tariff V gas demand and the Effective Degree Day Index, 2015



Note: Days with average temperatures greater than or equal to 18 are excluded from this sample.
Source: Bureau of Meteorology, Multinet Gas and NIEIR estimates.

Figure 5.3: Multinet Gas Melbourne daily Tariff V gas demand and the Summer Degree Day Index, 2015



Note: Days with average temperatures less than or equal to 18 are excluded from this sample.
Source: Bureau of Meteorology, Multinet Gas and NIEIR estimates

5.2.1 Effective Degree Day Index

Temperature is one of the main drivers behind gas demand. As temperatures get colder, consumers use gas space heating and water heating more intensively to maintain a level of comfort indoors. To this end, Heating Degree Days (HDDs) are a popular index for analysing the impact of temperature on energy demand. Heating Degree Days are an index of the temperatures below a threshold value of 18 degrees, and are set to zero for temperatures above 18 degrees. HDDs continue to be used by AEMO for gas forecasting for states other than Victoria.

To improve the relationship between weather and gas demand, a composite index of weather was developed by the Victorian Gas and Fuel Corporation of Victoria in the late 1970's. The Effective Degree Day (EDD) index combines temperature, wind, sunshine and a seasonal variable into a single index of weather. This represents gas demand for heating being stronger on windier days, rather than on calmer days. Consumers also tend to use more heating on cloudier days, than sunnier days. The seasonal effect is a measure of consumer preference to use heating appliances more intensively during the later stages on winter, and minimally during the summer months.

As can be seen in Figure 5.2, daily gas demand and the EDD index follow each other closely.

Over the years, there have been a number of different EDD indices. For the 2018 to 2022 GAAR, NIEIR have elected to use the EDD_{312} index. In AEMO's 2012 *Review of Weather Standards for Gas Forecasting* report, EDD_{312} was found to provide the best model fit to Victorian gas demand over alternative indices (including HDDs mentioned above).

The general formulation of the EDD index is as follows:

Effective Degree Day =	Degree Days	(Temperature Effect)
	$+ \alpha_1$ * (Degree Days)* β_1(Wind Speed)	(Wind Chill)
	$+ \alpha_2$ * (Sunshine Hours)	(Sunshine)
	+ 2*Cosine $(2\pi(day - \beta_2)/365)$	(Seasonality)

Where the parameters for EDD_{312} (2012) are:

$\alpha_1 = 0.037$
$\alpha_2 = 0.144$
$\beta_1 = 0.604$
$\beta_2 = 190$

Degree $days_{312}$ are calculated by using a threshold value of 18 degrees Celsius such that:

Degree Day =	18 – $Temperature_{312}$ if $Temperature_{312} < 18$; and
	0 if $Temperature_{312} >= 18$

Both temperature and wind speed are weighted averages of 3 hourly intervals from 3am to 12am the following day for a total of 8 intervals per day. Sunshine hours are the daily amount of sunshine above a threshold sunshine intensity.

5.2.2 Data for the Effective Degree Day Index

NIEIR obtained data from the Bureau of Meteorology to construct the Effective Degree Day index back to 1970. This included 3 hourly wind readings from Moorabbin Airport and Laverton RAAF, and daily sunshine hours for Melbourne Airport.

From 1855 until 5th January 2015 the Melbourne Regional Office weather station served as Melbourne's official weather station. This was located within the Melbourne CBD near the intersection of La Trobe Street and Victoria Parade. The Melbourne Regional Office weather station was increasingly affected by the urbanisation of the surrounding area, with a potential urban warming bias.

The new Melbourne Olympic Park weather station opened in June 2013. By comparison, the Olympic Park weather station is located near the sporting precinct south of Melbourne close to the Olympic Park oval and the Yarra River, a much less urbanised environment.

3-hourly temperature readings were obtained for Melbourne Regional Office from 1970 until its closure on 5th January, 2015. Melbourne Olympic Park now serves as Melbourne's official weather station and is used within the EDD_{312} index from January 6th to present.

Melbourne Regional Office and Melbourne Olympic Park weather stations were run concurrently over an 18-month period from the start of June, 2013 to the 5th of January 2015. This overlap suggests that the Olympic Park weather station has typically cooler temperature readings than the Melbourne Regional Office temperature readings.

Analysis by NIEIR suggests that a correction to Olympic Park weather station temperatures is essential for Victorian Gas demand analysis and forecasting. This is to ensure the history supplied by the Melbourne Regional Office weather station is consistent with the new temperature supplied by the Melbourne Olympic Park weather station. AEMO have elected to apply a 1.028 correction to temperature readings for the purposes of the 2015 *National Gas Forecasting Report*, while data published through the Market Information Bulletin Board (MIBB) does not apply a correction to Melbourne Olympic Park temperature.

NIEIR have found that the percentage difference between Melbourne Regional Office and Melbourne Olympic Park varies by time of year. Overall, when temperatures are cooler and days are shorter, the difference between these weather stations is minimised at the average temperature. While when temperatures are warmer and days are longer, the difference between the weather stations is at its greatest at the average temperature. NIEIR have elected to apply a variable daily correction to the average temperatures to reflect this finding.

5.2.3 Summer Degree Days

The Effective Degree Day has been designed primarily to measure the weather conditions experienced during the non-summer months. Typically, temperatures during summer are great enough for the EDD index to be zero for most days. However, extremely hot (or conversely unusually cool) summers can also affect the level of gas demand; for instance, the need for water heating is reduced by hot weather conditions, with consumers more likely to have a cooler than normal shower on a hot summer day.

A counterpart index of summer weather conditions has been used in the normalisation process. The index is based on the popular 'cooling degree day' indicator, which measures the number of degrees above a threshold temperature. It is formulated as follows:

(Summer) Degree Days =	Temperature-18 if $Temperature_{312}$ > 18; and 0 if Temperature <= 18 Where:
Temperature =	the arithmetic mean of daily minimum and maximum temperatures.

Figure 5.3 shows a small downward trend in daily gas demand when temperatures get warmer, which provides some evidence for this behaviour. This also reinforces that the relationship between temperature and gas demand is non-linear with a kink in the relationship around 18 degrees Celsius. The gas demand-temperature relationship is greater in magnitude for temperatures below 18 degrees, than it is for temperatures above 18 degrees.

5.2.4 Weather standards

In 2015, the total number of Effective Degree Days was 1,456. The 2015 year was the coldest since 2003, which was due to an exceptionally cold Melbourne winter. This follows on from the warmest year since 1970, with 2014 recording a total number of 1,197 EDDs.

NIEIR have elected to use the long-term trend method for the development of annual gas standards for Victorian gas forecasting. The long term trend method is more representative of a standard year of weather. From 1970 to 2015 the total number of annual EDDs has trended downwards at a rate of 7.6 EDDs per annum as can be seen from Figure 5.2. This implies that under normal weather conditions, 2015 would have had 1,322 EDDs across the year. This steady decline is consistent with well-documented global and urban warming effects impacting Victoria's climate.

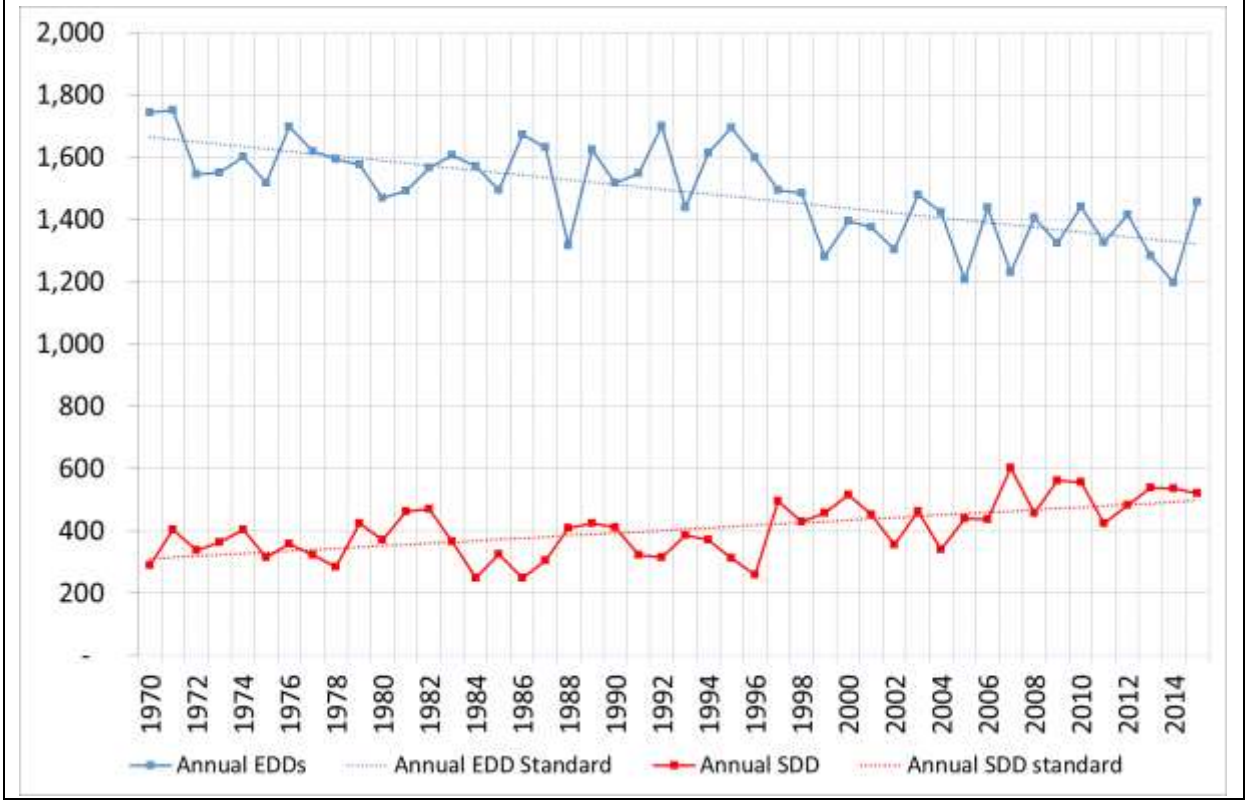
While it may appear that the warming trend has slowed down, or stopped over 2000 to 2015, this is unlikely to be the case over the long term. Melbourne's climate undergoes short and medium term trends in warming and cooling that can span 10 to 15 years. This is confirmed by analysing HDDs at Melbourne Regional Office since 1855. Prior to World War 2 Melbourne experienced 10 to 15 year cycles of warming followed by 10 to 15 years of cooling. Post-World War 2, Melbourne now experiences periods of extreme warming followed by shorter periods of no warming, or minimal warming. Melbourne currently appears to be within a period of minimum warming. This also demonstrates that over the short term climate can be volatile and extrapolating long term trends from short periods of time can lead to erroneous conclusions. As such, NIEIR uses the long term trend decline of 7.6 EDDs per annum to develop a rolling annual weather standard over the next 10 years.

Conversely, just as the warming effect acts to reduce the number of EDDs per annum, the warming effect will also increase the number of SDDs per annum. As can be seen from Figure 5.4, the number of SDDs has been steadily increasing over the 1970 to 2015 period at a rate of 4.1 SDDs per annum. Recent years have been slightly warming the average as measured by SDDs, this trend is dominated by warm summers as SDDs are typically zero during winter months. Over 2015, there were 522 SDDs, while under normal weather conditions there were expected to be 497 SDDs.

Forecasts of the annual EDD and SDD weather standard are contained in Table 5.2.

Table 5.2	Forecast Effective Degree Day and Summer Degree Day annual weather standards										
	2016	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
EDD312	1,314	1,306	1,299	1,291	1,284	1,276	1,268	1,261	1,253	1,245	1,238
SDD	501	505	509	513	518	522	526	530	534	538	542

Figure 5.4: Historical trends in Effective Degree Days (EDDs) and Summer Degree Days (SDDs)



5.2.5 Modelling gas demand and weather

Using daily data, the following model was estimated using regression analysis for each tariff:

Demand = constant
+ a * (Effective Degree Day)
+ b * (Summer Degree Day)
+ c * (Saturday flag, 1 if true; zero otherwise)
+ d * (Sunday flag,1 if true; zero otherwise)
..... (Other deterministic variables)
+ (error)

Where are constant, b, c, d ... are estimate coefficients.

Table 5.3 presents estimated coefficients from the regression analysis for Multinet Gas.

Table 5.3 Regression analysis for Multinet Gas*								
Tariff V								
Year	**Constant**	**HDD**	**CDD**	**Monday**	**Friday**	**Saturday**	**Sunday**	**R squared**
2001	60.5	16.8	-2.5	NA	NA	-6.7	3.6	0.97
2002	59.4	17.9	-2.1	NA	NA	-7.2	1.3	0.98
2003	58.5	18.6	-2.0	NA	NA	-9.1	-1.4	0.98
2004	58.1	19.1	-2.1	NA	NA	-8.5	1.5	0.98
2005	59.4	18.9	-2.2	NA	NA	-6.3	0.9	0.98
2006	57.7	20.1	-2.0	NA	NA	-8.3	0.4	0.98
2007	57.5	20.0	-2.2	NA	NA	-7.1	-7.9	0.98
2008	61.0	20.0	-2.6	NA	NA	-6.4	-7.4	0.98
2009	59.7	20.4	-2.2	NA	NA	-6.9	-11.0	0.98
2010	57.9	20.5	-2.3	NA	NA	-1.7	-6.7	0.99
2011	61.0	19.8	-2.8	NA	NA	-2.6	-9.8	0.98
2012	60.9	19.8	-2.6	NA	NA	-5.2	-5.6	0.98
2013	62.8	19.7	-2.6	NA	NA	-5.2	-6.6	0.98
2014	60.1	19.6	-2.0	NA	NA	-7.1	-6.5	0.98
2015	55.8	20.2	-1.7	NA	NA	-0.3	-4.5	0.98
Tariff D								
Year	**Constant**	**EDD**	**SDD**	**Monday**	**Friday**	**Saturday**	**Sunday**	**R squared**
2001	41.7	1.1	-0.6	-1.7	-5.3	-17.6	-13.9	0.79
2002	41.3	1.0	-0.3	-1.7	-4.4	-15.9	-13.2	0.77
2003	41.4	1.0	-0.3	-1.4	-4.8	-16.6	-13.4	0.78
2004	41.6	1.1	-0.3	-1.4	-5.4	-16.5	-13.5	0.79
2005	41.0	1.0	-0.7	-1.6	-4.9	-16.2	-13.5	0.82
2006	40.7	1.0	-0.4	-1.9	-4.5	-15.3	-13.2	0.78
2007	39.0	0.9	-0.4	-2.0	-2.7	-13.2	-14.1	0.80
2008	36.3	0.4	-0.4	-1.2	-2.6	-12.4	-13.0	0.76
2009	33.7	1.0	-0.3	-1.2	-3.1	-12.4	-13.0	0.83
2010	33.2	1.0	-0.1	-1.4	-3.2	-11.8	-12.3	0.84
2011	32.7	0.9	-0.2	-1.2	-3.0	-11.6	-12.0	0.81
2012	32.6	0.8	-0.5	-1.3	-3.0	-11.5	-11.9	0.82
2013	32.2	0.8	-0.3	-0.9	-2.2	-10.9	-11.9	0.79
2014	31.9	0.9	-0.2	-1.0	-2.9	-10.7	-11.6	0.80
2015	32.0	0.8	-0.4	-1.2	-2.5	-9.6	-11.1	0.81

Note: * Excludes South Gippsland.

5.2.6 Alternative Effective Degree Day indices and Multinet Gas Demand

In previous forecasts for Multinet Gas, NIEIR have used the EDD_{129} index for weather normalisation which was provided by Multinet Gas through AEMO's Market Information Bulletin Board (MIBB). As a part of the *NIEIR Review of EDD weather standards for Victorian Gas Forecasting*, EDD_{129} alongside alternative EDD indices, were re-derived from weather data provided by BOM and parametrised according to the equations on AEMOs website[8].

This included applying the necessary correction to the Olympic Park weather station which had not been applied to the data retrieved from the MIBB.

[8] For more details, see http://www.aemo.com.au/Gas/Planning/Victorian-EDD-Weather-Standards.

As concluded in AEMO's 2012 *Review of the Weather Standards for Gas Forecasting* report, EDD_{312} (2012) provided the best fit to Victorian Gas demand. NIEIR repeated the exercise for the Multinet Gas region, of which the results for Tariff V are reproduced in Table 5.4. This shows the R squared statistic for the weather normalisation regression models for each year since 2001 to 2015. The R squared statistics is a measure of the 'goodness of fit' of a model, it is defined as the proportion of the variance in the data that can be explained by the variables used in the model. The R squared statistic has a range of 0 to 100 per cent.

This exercise confirms that EDD_{312} (2012) is the most appropriate measure of weather to use for weather normalising Multinet Gas' gas demand. EDD_{312} (2012) represents an average improvement compared to HDD of 6 percentage points over 2001 to 2015. The average model fit over 2001 to 2015 of EDD_{312} (2012) is 97.9, while using EDD_{312} (2009) gives a fit of 97.6, EDD_{129} gives 97.2 and EDD_{66} has an average model fit of 96.5. This also reinforces that Tariff V gas demand is highly weather driven.

Table 5.4 Model fit (R squared) of Multinet Gas Tariff V gas demand to alternative degree day indices (per cent)

Year	EDD 312 (2012)	EDD 312 (2009)	EDD 129	EDD 66	HDD
2001	97.3	97.1	96.1	97.0	89.7
2002	97.7	97.4	96.4	96.9	89.9
2003	97.9	97.9	97.2	97.5	92.1
2004	97.9	97.5	96.9	97.1	90.8
2005	98.0	97.7	97.1	97.6	90.6
2006	97.9	97.4	96.3	97.1	90.8
2007	98.2	97.9	98.0	96.5	93.6
2008	97.7	97.4	97.5	95.7	92.2
2009	97.9	97.4	97.2	95.5	92.7
2010	98.7	98.4	98.4	97.2	94.6
2011	98.0	97.5	97.5	96.2	92.8
2012	98.3	97.8	97.6	96.6	93.4
2013	97.5	97.1	97.2	95.1	92.3
2014	97.9	97.6	97.5	96.2	91.6
2015	97.7	97.3	97.4	95.7	91.3
2001 to 2015 average	**97.9**	**97.6**	**97.2**	**96.5**	**91.9**
Improvement relative to HDD	**6.0**	**5.7**	**5.3**	**4.6**	**0.0**

5.2.7 Computing weather normalised estimates

The weather normalised estimates of annual gas demand are computed by fitting the following equation:

Weather normalised annual demand =
constant * (Number of days in the year)
+ a * (Annual number of Effective Degree Days in a normal year)
+ b *(Annual number of Summer Degree Days in a normal year)
+ c* (Number of Saturdays in the year)
+ d* (Number of Sundays in the year)
+ .....

Weather normalised estimates of gas demand for each tariff period (peak, off-peak and shoulder) are computed in similar manner:

Weather normalised tariff period demand =
constant * (Number of days in tariff period)
+ a * (Number of Effective Degree Days in tariff period in a normal year)
+ b *(Number of Summer Degree Days in tariff period in a normal year)
+ c* (Number of Saturdays in tariff period)
+ d* (Number of Sundays in tariff period)
+ .....

The gas demand due to abnormal weather conditions can be computed using the following equation:

Abnormal Gas Demand = Observed Gas Demand minus Weather Normalised Gas Demand

Table 5.5 presents observed and normalised annual gas flows for Multinet Gas.

Table 5.5 Observed and normalised annual gas flows for Multinet Gas

	Tariff V							
	Observed gas flows				Normalised gas flows			
Year	Peak	Off-peak	Shoulder	Total	Peak	Off-peak	Shoulder	Total
2001	22,579	12,540	8,705	43,825	24,523	11,858	8,377	44,758
2002	24,699	11,250	8,049	43,998	25,787	11,592	8,531	45,910
2003	26,720	11,005	9,657	47,381	25,872	11,432	8,891	46,194
2004	26,466	11,939	8,955	47,360	26,346	11,586	8,863	46,795
2005	24,890	10,573	7,760	43,223	26,370	11,684	8,756	46,810
2006	26,606	12,615	9,486	48,707	26,988	11,778	8,937	47,704
2007	27,049	9,518	6,949	43,517	26,971	11,145	8,758	46,875
2008	27,412	12,190	8,976	48,579	27,314	11,605	9,037	47,956
2009	26,142	10,834	9,613	46,588	27,175	11,318	9,181	47,674
2010	29,685	10,431	8,786	48,902	27,225	11,270	8,919	47,415
2011	25,715	11,194	9,781	46,690	26,833	11,455	8,750	47,037
2012	27,692	11,207	9,672	48,571	26,839	11,475	8,867	47,180
2013	24,955	11,741	9,478	46,173	26,659	11,729	8,989	47,377
2014	25,483	10,653	7,467	43,602	26,287	11,280	8,715	46,282
2015	28,867	11,711	8,031	48,609	26,194	11,131	8,624	45,950
	Tariff D							
	Observed gas flows				Normalised gas flows			
Year	Peak	Off-peak	Shoulder	Total	Peak	Off-peak	Shoulder	Total
2001	5,393	6,363	2,639	14,396	5,521	6,328	2,613	14,461
2002	5,366	6,397	2,628	14,391	5,425	6,398	2,654	14,477
2003	5,529	6,422	2,670	14,622	5,481	6,454	2,624	14,559
2004	5,602	6,549	2,586	14,736	5,595	6,503	2,580	14,678
2005	5,302	6,178	2,479	13,960	5,379	6,231	2,527	14,137
2006	5,374	6,294	2,600	14,268	5,394	6,246	2,574	14,213
2007	5,114	5,937	2,386	13,437	5,109	6,058	2,472	13,638
2008	4,294	5,801	2,090	12,186	4,293	5,781	2,094	12,168
2009	4,520	5,183	2,143	11,845	4,568	5,226	2,122	11,916
2010	4,672	5,223	2,099	11,994	4,551	5,267	2,105	11,923
2011	4,426	5,126	2,062	11,614	4,479	5,132	2,013	11,624
2012	4,341	4,953	2,112	11,405	4,304	4,964	2,079	11,347
2013	4,143	5,043	2,082	11,268	4,213	5,053	2,061	11,327
2014	4,318	4,965	1,998	11,281	4,356	4,997	2,058	11,411
2015	4,381	5,020	1,949	11,351	4,274	4,992	1,987	11,254

Notes:
1. Excludes South Gippsland.
2. Includes actual UAFG.

5.2.8 Long-term impact of global and urban warming on future annual gas demand

As noted above, weather conditions have been warming over recent decades. This has reduced the need for heating and in turn, reduced gas demand. If this trends continues (and current scientific opinion suggest it will), future demand for gas will be further reduced.

Estimates of the annual historical impact of global and urban warming on gas demand can be computed using the following formulation:

Annual impact of global and urban warming =
a * (change in annual number of Effective Degree Day in a normal year)
+ b * (change in annual number of Summer Degree Day in a normal year)

Using the above regression results and trend analysis of weather conditions, Table 5.6 presents indicative estimates of the annual historical impact of global and urban warming on gas demand for Multinet Gas.

Table 5.6 Annual historical impact of global and urban warming on gas demand (TJ)

	Multinet Gas	
	Tariff V	Tariff D
2001	-138.01	-10.67
2002	-145.62	-8.84
2003	-150.29	-9.25
2004	-154.00	-9.79
2005	-153.39	-10.23
2006	-161.48	-8.96
2007	-161.39	-8.82
2008	-163.38	-5.04
2009	-164.61	-8.68
2010	-165.56	-8.22
2011	-162.59	-8.15
2012	-161.83	-8.32
2013	-161.16	-7.36
2014	-157.73	-7.84
2015	-160.72	-7.89
Last 10 year average	-162.04	-7.93

Note: Excludes South Gippsland.

Based on these estimates, if this warming trend continues the level of annual gas demand for Multinet Gas in 2022 is likely to be (all other things constant) around 1.19 PJ lower than its level in 2015.

5.3 Survey of major gas customers' expected gas usage

Multinet Gas undertook a survey of expected gas usage from its top 30 industrial customers in July 2016. Information collated from this survey was used in adjusting and reviewing the NIEIR Tariff D forecasts for Multinet Gas.

5.4 Household gas usage in Victoria

The Australia Bureau of Statistics has collected information about household energy use for a number of years. The latest form of this survey has fallen within the *Environmental Issues: Energy Use and Conservation* catalogue, which has been published every three years since 2008. Comparable ABS surveys have been released for at least 20 years. The last issue was released in December 2014 which covered a snap shot of domestic appliance and energy use in March 2014. It is expected that this will be the last issue since the Federal government has wound back environmental reporting from the ABS.

Energy Use and Conservation captures a number of energy end uses by appliance and fuel type. While these are subject to ordinary problems associated with survey design between editions and normal sample errors, they do provide a useful overview of household energy trends across time and between Australian regions.

This section briefly overviews the penetration of appliances and energy use, with a particular focus on household gas technology in Victoria. Overall, residential gas consumption in Victoria has been growing slowly over the past five years with consumption levels around 107 PJs[9] in 2013-14. Table 5.7 summarises the penetration of energy fuel types into Victoria households from 2005 to 2014. This shows that all households at least have access to mains electricity, while the penetration of mains gas has been stable over the past 10 years at just above 80 per cent with a small increase in 2014 of 1.4 per cent compared to 2011. Over the same period, there has been a significant increase in households that are using LPG and/or bottled gas. Since 2005, households that use solar energy have increase from 7.4 per cent to 16.8 per cent in 2014. This includes solar use covered by photovoltaic systems and solar hot water technologies.

Table 5.7 Sources of energy used within households – Victoria

	2005	2008	2011	2014
Mains electricity	97.2	99.9	99.9	100.2
Mains gas	81.0	81.1	81.6	83.0
Solar	7.4	8.7	10.6	16.8
LPG/bottled gas	1.8	3.0	6.6	14.4
Other	17.5	15.4	16.9	17.1

The major residential end uses for gas are typically for appliances that are required to generate heat. This includes:

- cooking
- space heating; and
- water heating.

Table 5.8 summarises the fuels used for space heating in Victoria from 1994 to 2014. The penetration of space heaters has remained relatively stable during this time with close to 100 per cent of households using a space heating. However, there has been a steady increase in the number of household electing not to use a space heater. This category of household has grown from 0.6 per cent in 1994 to 3 per cent in 2014. This could reflect a response to the warming trend in Melbourne weather, and warmer than usual winters.

[9] Department of Industry (2015), Australian Energy Statistics.

Table 5.8 Penetration of space heating and fuel used for space heating – Victoria							
Penetration	**1994**	**1999**	**2002**	**2005**	**2008**	**2011**	**2014**
Has a space heater	99.4	98.8	99	98.1	97.4	97.8	97
No space heater used	0.6	1.2	1	1.9	2.6	2.2	3
Fuel							
Electric	12.5	11.9	12.9	14.7	18.5	18.8	20.9
Gas	71	71.6	72.7	71.2	68.1	68.5	64.3
Wood	14	13.9	12.4	11.2	8.9	8.9	10.2
Other	0.6	0.4	0.4	0.9	1.8	1.4	1.4

Historically, gas space heaters have been the most popular. Over the past 20 years electric space heaters have been growing in popularity, while usage of gas space heaters has been eroding in the household sector. The penetration of gas space heaters peaked in 2002 at 72.7 per cent and has now decreased by 8.4 per cent to 64.3 per cent in 2014. In contrast, Victorian households that used an electric heater as their main source of heating grew from 12.5 per cent in 1994 to 20.9 per cent in 2014. This could be due to the rise of efficient reverse cycle air conditioners that use heat pump technologies. This allows one unit to serve as both a cooler in summer and heater during winter.

Wood heaters have also fallen out of favour with 10.2 of Victorians using them as a main heater in 2014, compared to 14 per cent in 1994.

The substitution of gas to electric space heating is shown in Figure 5.5.

Figure 5.5: Main source of energy in space heating, Victoria – 1999 to 2014 (per cent)

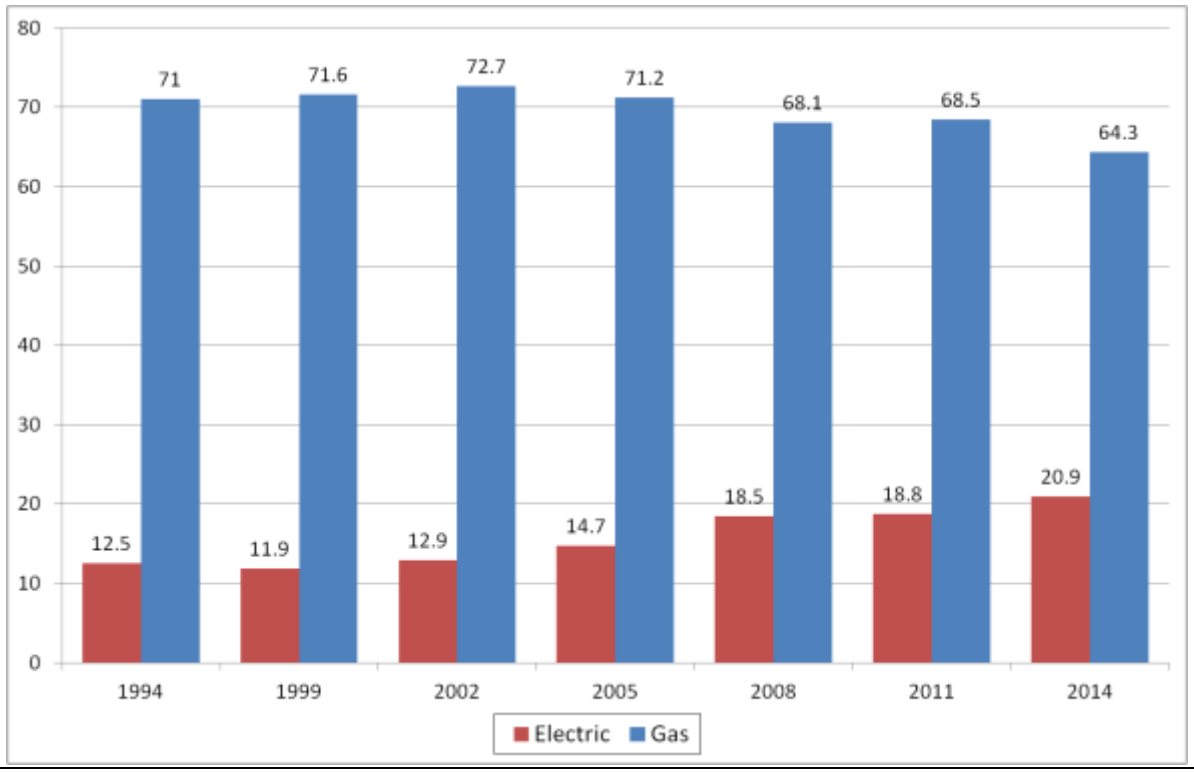


Table 5.9 shows that 74.9 per cent of Victorian dwellings have insulation in 2014. Over the past 20 years there seems to be an increasing proportion of households with insulation. According to the ABS publication, between 2011 and 2014 the number of Victorian dwellings with no insulation fell by 0.6 percentage points, or around 5,100 dwellings. However, a high proportion of households are uncertain about whether they actually have insulation installed.

Table 5.9 Insulation in dwellings – Victoria							
	1994	1999	2002	2005	2008	2011	2014
Dwellings with Insulation	69.5	71.3	72.1	72.3	73.8	76.5	74.9
Dwellings with no Insulation	17.0	12.4	12.1	9.2	8.5	7.8	7.2
Don't know	13.5	16.3	15.8	18.5	17.7	15.6	18.1

Gas usage is also declining in the kitchen. While gas still remains the preferred method for cook tops, it has fallen from a peak of 72 per cent in 2005, down to 66.5 per cent during 2011. Although much of this fall is due to the reclassification of LPG/bottled gas in 2011 from the 'gas' category to the 'other' category. Combined, mains gas and LPG/bottled gas have increased in popularity. It is likely that this is driven by increases in bottle gas, rather than mains gas, consistent with energy used in households in Table 5.10.

However, gas ovens have shown a decline in usage with the proportion of households using gas ovens gradually declining from 50.8 in 1994 to 361 in 2011. During the same time, the penetration of electric ovens has grown from 48.6 per cent up to 63 per cent of Victorian households.

Table 5.10 Source of fuel for cooking – Victoria						
	1994	1999	2002	2005	2008	2011
Cooktops						
Electric	36.5	32.2	29.7	27.1	32	28.1
Gas	63.5	67.3	69.6	72	67.4	66.5
Other	0	0.4	0.7	0.9	0.6	5.3
Ovens						
Electric	48.6	52.8	55.3	57.8	62.4	63
Gas	50.8	46.4	43.9	41.3	37.4	36.1
Other	0.6	0.8	0.9	1	0	0.9

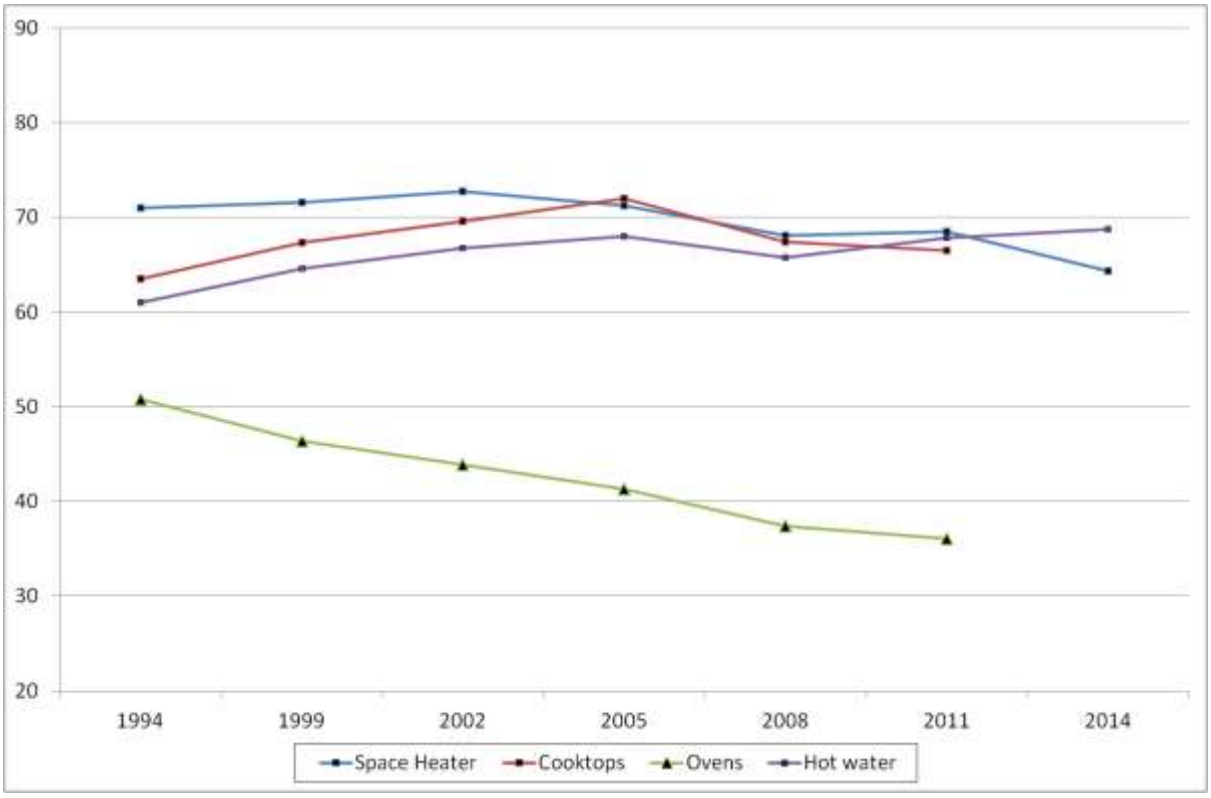
Table 5.11 shows the trends in water heating over the past 20 years. Gas water heaters remain the most popular type of water heater with around 68.7 per cent of households using them in 2014. This trend has remained stable over the past 15 years. Solar water heaters have recently gained increasing popularity as state and federal governments provide incentives for new installations and replacements.

Table 5.11 Sources of fuel for water heating – Victoria						
Penetration	**1999**	**2002**	**2005**	**2008**	**2011**	**2014**
Electricity	34.1	34.1	28.5	28.6	28.2	28
Mains gas	64.6	66.7	66.6	64.2	66	66.2
LPG	n.a.	n.a.	1.4	1.5	1.8	2.5
Total gas	64.6	66.7	68	65.7	67.8	68.7
Wood	1.4	0.6	0.6	n.p.	n.p.	n.p.
Solar	0.9	0.6	1	2.6	3.8	7.8
Other*	0.4	1.2	3.2	5.4	3.2	5

In Victoria, the penetration of gas technologies generally shows an increasing penetration up to around 2005, and a declining penetration up to the most recent 2014 survey with the exception of hot water, which has remained stable. This is despite an almost constant level of households connecting to mains gas. The appliance categories that gas is used within most commonly tend to have long asset life spans so evidence of fuel switching is gradual and occurs over a long period. Replacements typically occur in 10 to 15 years, water heater replacement can often occur at much greater lengths of time.

Figure 5.6 summarises the penetration of gas technology into Victorian households.

Figure 5.6: Penetration of gas appliances into Victorian households (per cent)



Source: ABS.

5.5 Average residential gas consumption

5.5.1 Background

This section outlines recent trends in average residential gas usage in Victoria. It includes an assessment of average residential gas usage for new and established customers in Victoria. This assessment is based on work completed for previous GAARs in Victoria and more recent data supplied by Multinet Gas.

Historically, average residential gas usage in Victoria rose very rapidly over the 1970s and 1980s. Gas usage rose on a per customer basis as households replaced electric hot water systems with gas hot water and space heaters (originally oil) were replaced with gas room heaters and/or gas central heating systems.

In March 1991, government regulations were introduced into Victoria specifying minimum insulation levels for all new homes and extensions. For existing dwellings with gas heating, the savings of 25 to 30 per cent in space heating gas usage from ceiling insulation was sufficient incentive to drive ceiling insulation into the existing stock of dwellings.

As indicated in Figure 5.7, average residential usage in Victoria increased to around 59 GJ per dwelling by 2000, from 57.4 GJ in 1990. Mandated and voluntary installation of insulation over the 1990s had a very significant impact on the growth in average use per dwelling. Increases in the efficiency of water and space heating appliances also had a significant impact on constraining the growth in average use by residential customers.

Since 2000, overall residential average usage has fallen from around 59 GJ per customer to 55.6 GJ per customer in 2010. By 2014, overall average usage fell to 52.8 GJ per dwelling on a weather normalised basis. The 5-star standard for new homes came into effect from 1 July 2005. The 5-star standard applied to all new houses and apartments and requires a:

- 5-star energy rating for the building fabric; and
- either a rainwater tank for toilet flushing; or
- solar hot water system (Class 1 buildings only).

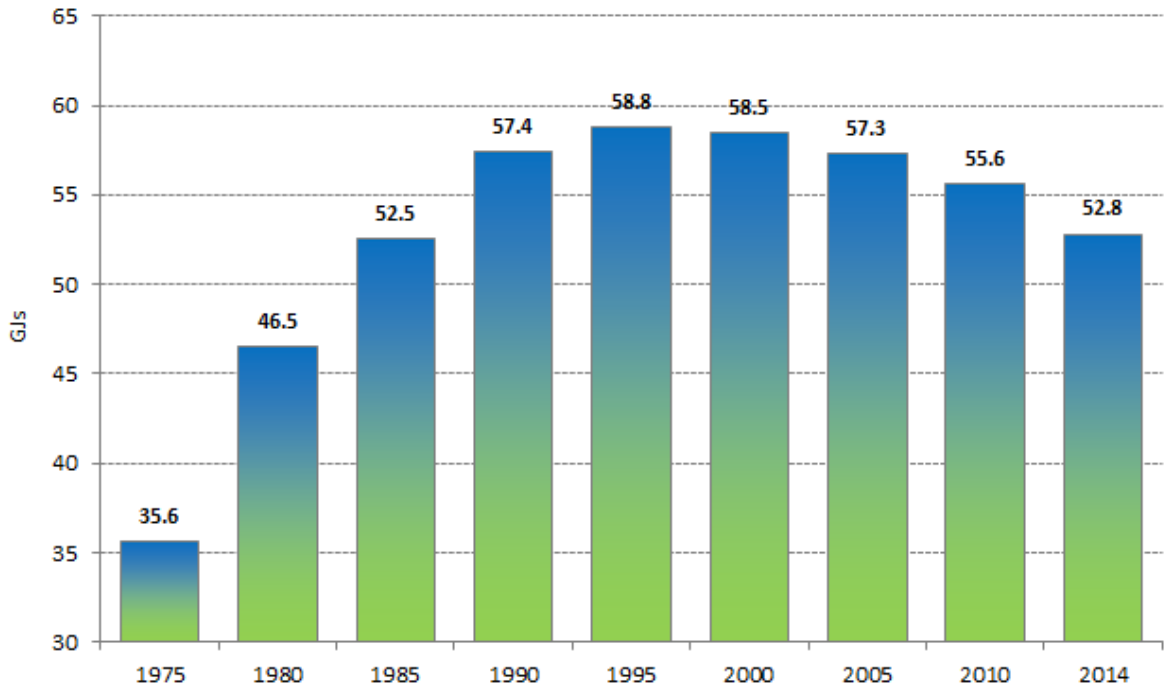
The theoretical savings from the 5-star energy rating were not insignificant, at around 20 GJ per annum.

The slowing in Victorian average residential gas usage over the last two decades needs to be seen against the fact that average floor areas of new dwellings had been increasing rapidly. Table 5.12 shows estimated floor areas for houses, other dwellings and total dwellings for Victoria for selected years.

Floor areas for houses have risen significantly since 1984-85. Floor areas reflect the total building area so unheated areas, such as double garages and second floor external patios, etc. could bias these data in terms of heating loads. Floor areas for other dwellings also increased up to 2000 and were 133 square metres in 2012-13.

Since 2008-09, floor areas for new houses have fallen back slightly in Victoria.

Figure 5.7: Average residential customer gas usage – Victoria (selected years)



Note: Normalised average usage from 2000 to 2010. Actual prior to 2000.
Sources: Statistics, Gas Fuel Corporation of Victoria, 1984, 1990.
GAAR information provided by Multinet Gas, Envestra and SP-AusNet 2006.
Gas Industry Statistics, AGA, selected years.
GAAR information provided by Multinet Gas, Envestra 2010 and estimate SP-AusNet, 2010.
AEMO NGFR, 2014, 2015 – Interpolation using total Tariff V.

Table 5.12 Victorian average floor areas new dwellings by type (m^2)

	House	Other	Total[(1)]
1984-85	163.6	100.7	153.1
1993-94	177.4	115.3	170.2
1999-00	212.1	134.9	194.2
2004-05	238.8	139.6	209.5
2008-09	252.8	139.0	224.8
2010-11	247.1	128.5	212.1
2012-13	243.0	132.6	198.9

Note: (1) Total weighted by completions of houses and other dwellings in Victoria.
Source: ABS 8781.0 Building Approvals, Selected Issues and ABS 8752 June 2013.

5.5.2 Gas consumption by new and established residential customers in Multinet Gas

Introduction

As part of preparing forecasts for the Gas Access Arrangement Review (GAAR), NIEIR undertook a detailed assessment of new and established customers for Multinet Gas.

The objective of examining new customer usage was to identify what average usage is for new customers up to 2014. The objective of examining existing customer usage was to identify existing customer usage and assess trends in average existing customer usage.

For established customers, average usage was based on existing customers prior to 2015. The sample size was extraordinarily large, at around 220,000 customers across two distribution businesses (DBs). This represented 18 per cent of total residential gas customers for Multinet Gas.

For new customers, the priority was to identify average residential usage for new customers, the launch point for the forecast. Average customer usage for each year between 2006 and 2014 for customers connected between 2006 and 2014 were analysed. All new active residential meters for Multinet Gas were used for these years. The assessment of average usage for new customers was not based on a sample, but all new residential meters.

Methodological approach and raw data used

NIEIR collected billings information from Multinet Gas. This included information on:

- MIRN;
- meter installation date;
- year of consumption;
- postcode;
- tariff and class; and
- volumes.

As noted above, the objective of analysing the billings information was to:

- identify average usage for new residential customers up to 2014; and
- identify any trends in established residential customer usage.

New customer usage

Table 5.13 shows new residential average customer usage for 2015, on a weather normalised basis, for meters installed from 2006 to 2014. In this table, the years refer to the years that new meters actually became active.

Table 5.13 New residential customers for Multinet Gas – average usage 2015 (excluding losses), weather normalised

	2006	2008	2012	2014
Multinet Gas	56.9	54.8	48.5	42.6

As indicated in Table 5.13, average usage for new customers has been declining significantly. This fall reflects a number of factors:

- a higher share of other dwellings (i.e. multi-units, apartments, etc.) being completed in Victoria;
- the significant impact of 5-star (and 6-star) building standard phasing in post 2005 (compliance issues could have generated the phase in effect rather than a step change);
- ongoing improvements in the energy efficiency of new gas appliances; and
- a shift away from the rainwater tank option following the end of the drought to a much higher share opting for solar-gas hot water under the mandated 5-star standard.

It is significant to note that despite average usage for new dwellings declining over the 2006 to 2012 period, it did not fall by as much as anticipated by regulatory impact statements and government studies associated with the 5-star standard. In its regulatory impact statement, the Plumbing Industry Commission (2004) reported weighted average annual gas savings of 23.6 GJ for houses with 5-star and a rainwater tank. Total savings for a house with solar-gas hot water were reported at 33.6 GJ of gas per annum.

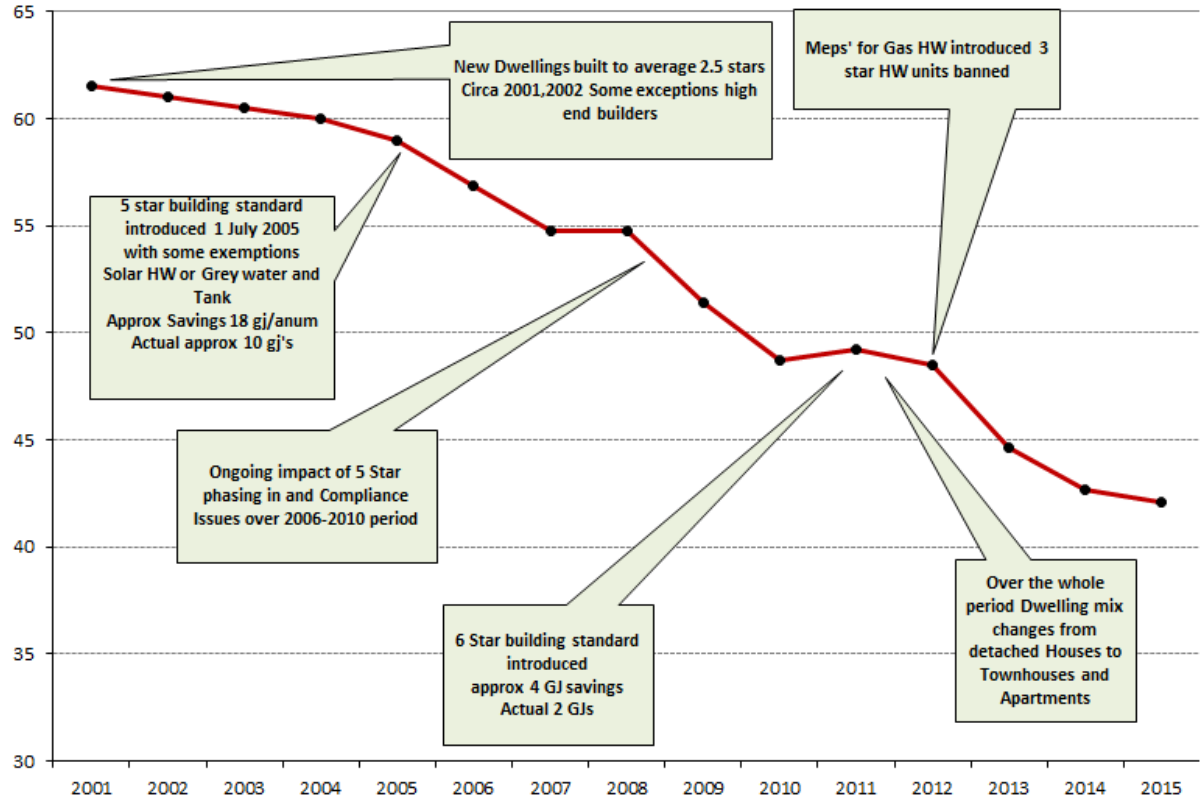
Based on the analysis above, the observed actual decline for new dwellings associated with building shell improvements related to 5-star was around 9 to 10 GJs per annum (comparing 2006 with 2012). This lower reduction in gas usage probably reflects two important factors:

(i) possible compliance issues associated with ensuring actual 5-star ratings for new dwellings are achieved; and

(ii) the increase in average floor areas of new dwellings completed in Victoria between 2005 and 2010 of around 10 square metres, or 5 per cent.

Figure 5.8 shows average residential gas use for new customers from 2001 to 2015 for Multinet Gas. The figure incorporates information on changes to MEPS and building standards over the period. A dominant influence over the whole 15 year period is the shift away from separate houses to multi-unit dwellings and apartments.

Figure 5.8: Multinet Gas average residential use – new dwellings (GJ/dwelling)



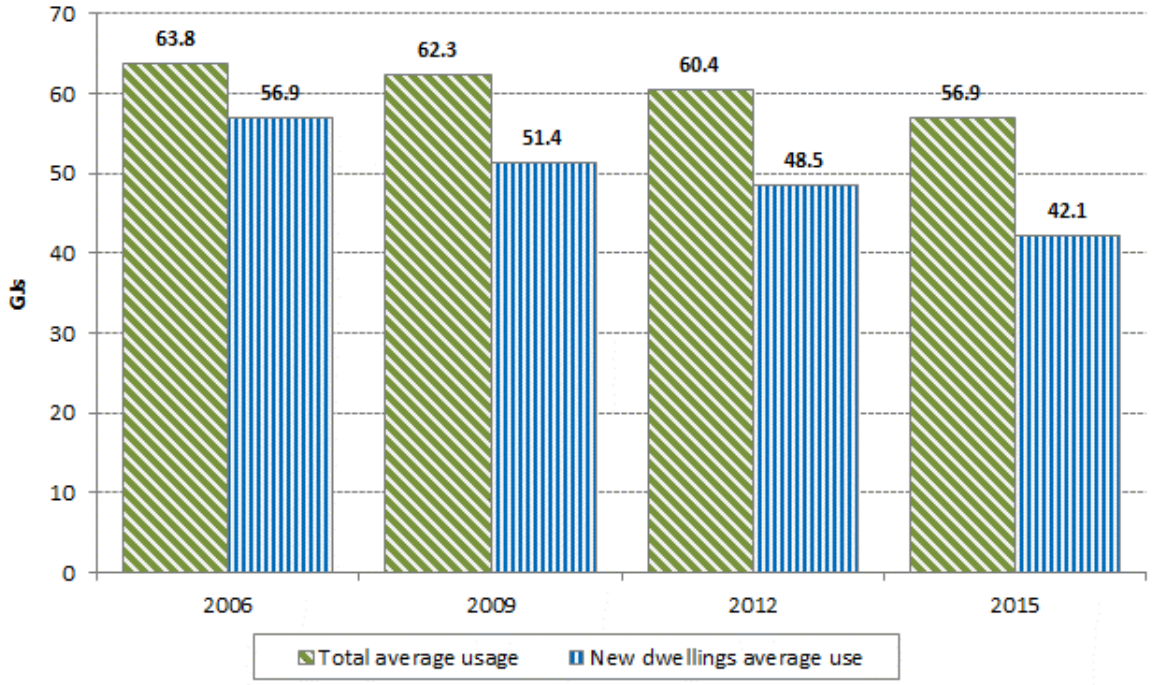
Sources: Regulatory impact statements, ABCB 2009, 2003, 2008, MG data (2016).
MG data and NIEIR analysis.

Figure 5.9 shows average usage for all dwellings and new dwellings for 2006, 2009, 2012 and 2015 for Multinet Gas.

The downward trend in established dwellings usage reflects a number of factors, including:

- the inclusion each year of new dwellings which use much less natural gas than existing established dwellings;
- socio-demographic factors such as falling household size;
- established dwellings replacing old gas appliances and equipment (hot water, space heating) with more efficient ones; and
- perhaps more importantly, behavioural changes such as increased use of reverse cycle air conditioning and reduced hot water usage and higher penetrations of solar-gas water heaters in existing dwellings.

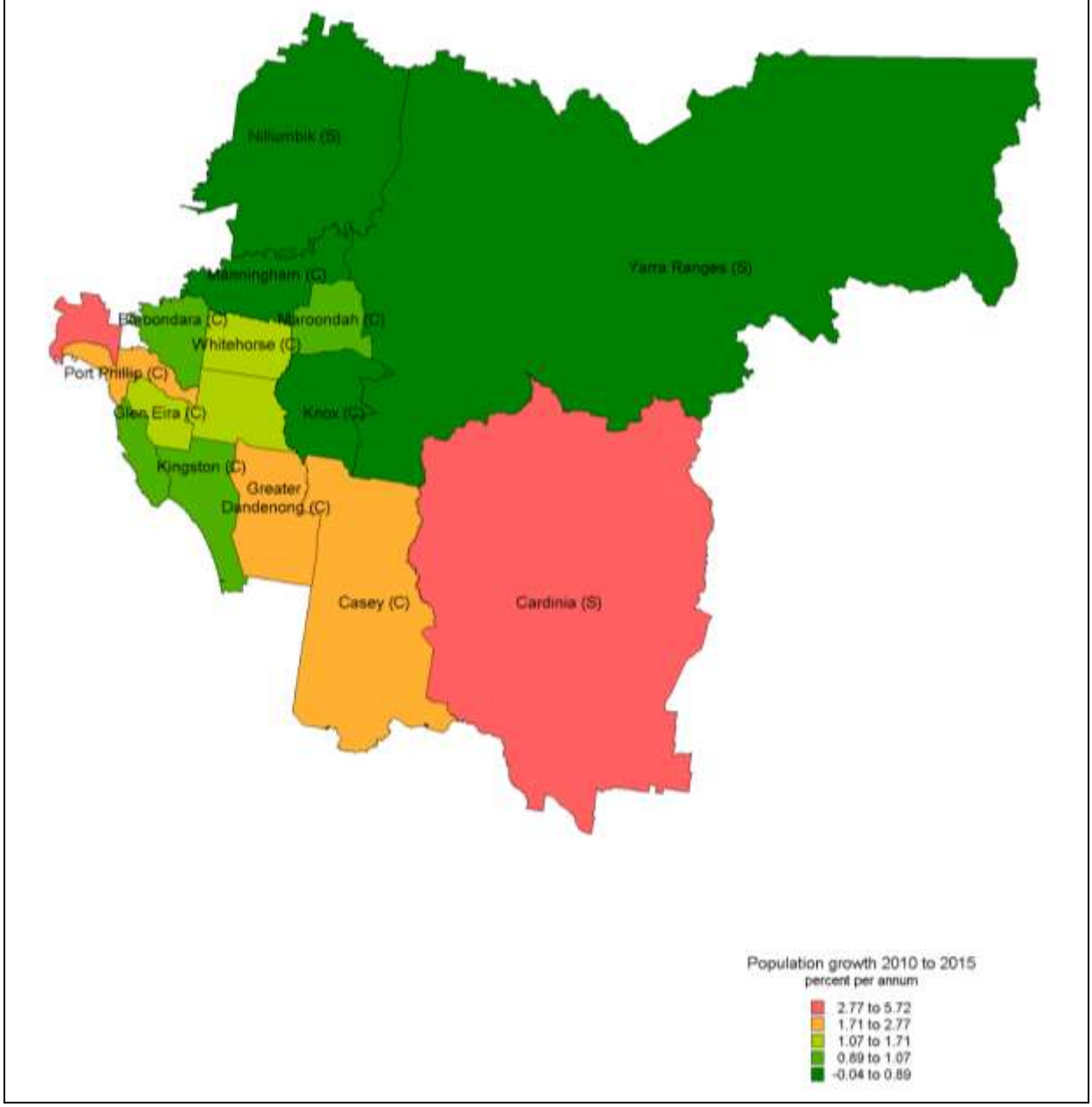
Figure 5.9: Average existing and new residential gas use – Multinet Gas weather normalised – 2006, 2009, 2012 and 2015



5.6 Multinet Gas distribution area

Unlike the other distribution businesses, scope for organic growth within the Multinet Gas distribution area is largely limited. The distribution area encompasses a part of Melbourne that is very well-developed, with around 745,000 established dwellings. There is limited land availability for new housing estates, and most new developments tend to be smaller dwellings or townhouses that use electricity for heating and cooling. It does not include the housing growth corridors in northern and western Melbourne and in southern Melbourne. Figure 5.10, which shows the relatively slow growth in population in recent years for the Multinet Gas area, highlights this point.

Figure 5.10: Map of recent population growth diversity in Multinet Gas distribution area



5.7 Natural gas prices outlook

5.7.1 Background

Victorian gas prices comprise of a number of components. These include the following:

- A wholesale component;
- A transmission component;
- A distribution component;
- An environmental component (which would have included policies like the carbon tax); and
- A retail component.

Figure 5.11: Estimated composition of Victorian residential gas prices – 2015

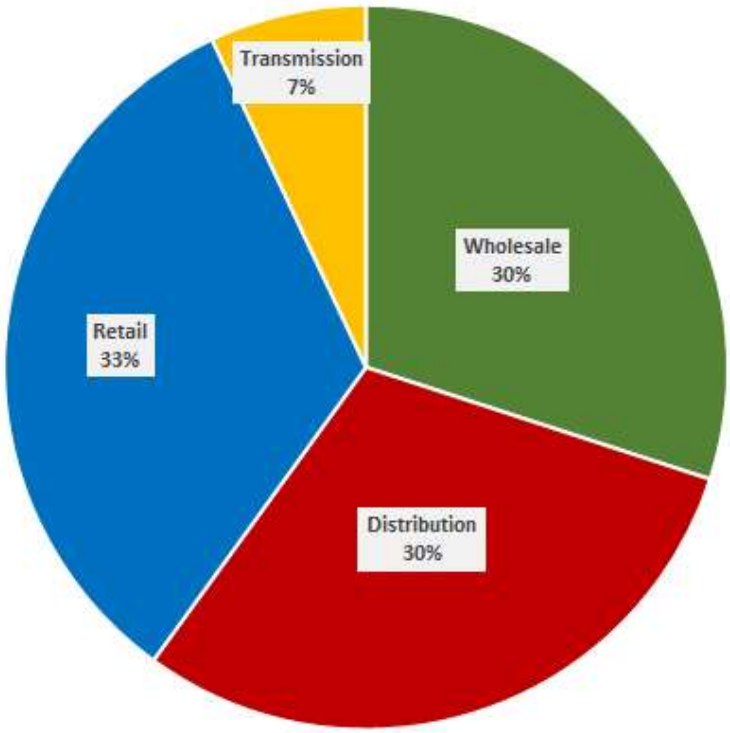


Figure 5.11 shows the estimated composition of Victorian residential gas prices in 2015. For large industrial customers the retail and distribution components of the gas price are reduced significantly. The average residential price was around $20 GJ in 2015 while large industrial customer prices could be as low as $5 to $6 per GJ, depending upon the transport margin.

Historically, supply contracts existed between the Gippsland Basin producers and Gascor. These were traditionally large long-term contracts to ensure supply to Victorian residential, commercial and industrial customers. The Gascor contracts were grandfathered to the retail entities (AGL, Origin and Energy Australia) following privatisation of the Victorian gas industry in 1999.

Between 2005 and 2010, gas production commenced from a number of new fields including Minerva, Casino and Yolla. Additional contractual gas purchase agreements were entered into by Victorian retailers.

5.7.2 The outlook for wholesale gas prices in Victoria

With the development of LNG projects on the eastern seaboard around 2012, prices under new contracts rose significantly with insufficient new productive capacity being developed to source the large demands from LNG projects in Gladstone, Queensland.

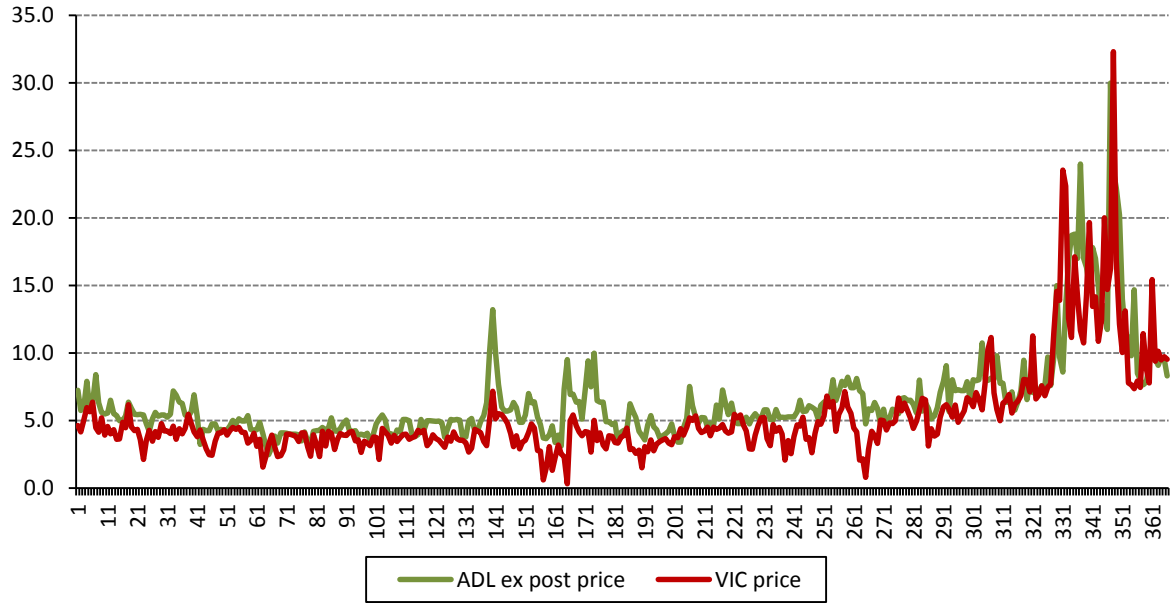
Wholesale prices by some commentators were expected to double, basing this on deriving a "net back" price from the LNG plant. This would have implied Victorian wholesale prices of around $8 to $9 per GJ between 2017 and 2019. This is no longer the case.

Falls in natural gas usage over the 2012 to 2015 period have provided some relief on price increases. Increased wind and solar generation has displaced gas fired generation and there were also significant large industrial closures on the eastern seaboard. International oil prices have also fallen significantly, easing the upward pressure on domestic natural gas prices. LNG prices are also linked heavily to the oil price.

In May 2016, Alinta announced the closure of the Northern and Thomas Playford coal fired power stations. This implied that South Australian electricity demands would be met from gas (2,800 MW) and renewable generators (1,500 MW) in South Australia. The interconnector capacity between South Australia and Victoria consisted of the Heywood line (460 MW) and Murraylink (220 MW). The Heywood line was upgraded over 2015 and 2016 by 190 MW. South Australia also has approximately 600 MW of small scale rooftop solar.

The sharp increase in gas prices in Victoria over June and July 2016 partly reflects the impact of spikes in electricity wholesale prices and gas wholesale prices in South Australia. This reflected poor availability from wind generators in South Australia, and low solar generation. This was exacerbated by various planned outages of the Heywood interconnector in July 2016 for the 190 MW upgrade by ElectraNet. Wholesale gas prices averaged around $16 per gigajoule over July 1 2016 to July 15th 2016, and peaked at around $30 within this period. Wholesale gas prices have since eased significantly in August 2016. Figure 5.12 shows gas spot prices for South Australia and Victoria from August 2015 to July 2016.

Figure 5.12: Adelaide and Victorian gas spot prices – 1 August 2015 to 31 July 2016



Source: AEMO.

In June 2016 the South Australian Government announced funding for ElectraNet to explore further interconnection possibilities between South Australia and the Eastern states. This is in addition to the upgrade of the Heywood interconnector commissioning in 2016. Further upgrades would allow higher exports of renewable energy into the eastern seaboard States, as well as greater security of supply to South Australia, which has a large intermittent wind generation. This would place further downward pressure on gas prices as gas generation would be displaced.

The NIEIR outlook for gas prices is shown in Table 5.14. The outlook is shaped by the following factors:

- to some extent continued perceptions of a relatively tight demand supply balance on the eastern seaboard with the ramp up of LNG exports partly offset by reduced gas use from power generation. Given the low oil price however, contact prices are more likely to be driven by the cost of supply rather than market perceptions. A number of retail and large customer contracts are expected to expire over the 2017 to 2020 period. Upward pressure from supply side factors contributes around $1.60 to the increase in gas prices from 2015 levels;
- the easing in the South Australian electricity demand supply imbalances is expected to lead to a significant fall in gas prices over 2017 from the very high levels in 2016. The total decline is nearly $2 per gigajoule in 2017. This will continue to a lesser extent post 2017 as further interconnector upgrades are commissioned; and
- a small $10 carbon tax or equivalent is factored to be reintroduced in 2021. This increases gas prices by around $0.70 per gigajoule.

Table 5.14 Deviation price forecasts – yearly average (2015 $/GJ)

	Base	High	Low
2007	5.2	5.2	5.2
2008	3.6	3.6	3.6
2009	2.6	2.6	2.6
2010	2.5	2.5	2.5
2011	3.3	3.3	3.3
2012	4.6	4.6	4.6
2013	4.3	4.3	4.3
2014	3.6	3.6	3.6
2015	4.2	4.2	4.2
2016	6.9	7.3	6.7
2017	5.2	6.0	4.8
2018	5.2	6.2	4.6
2019	5.2	6.3	4.4
2020	5.3	6.5	4.4
2021	6.3	7.6	5.4
2022	6.3	7.7	5.4
2023	6.4	7.7	5.4
2024	6.4	7.8	5.4
2025	6.4	7.8	5.4

5.7.3 Retail price assumptions to 2026

Table 5.15 shows the projections of residential and commercial gas prices to 2025-26.

Table 5.15 Victorian gas prices (2014-15 $/GJ)

	Residential	Business	Total
2009-10	19.0	7.4	13.2
2014-15	21.3	8.3	14.8
2015-16	21.4	8.5	15.0
2016-17	22.1	9.3	15.7
2017-18	22.7	10.1	16.4
2018-19	23.4	10.8	17.1
2019-20	24.1	11.5	17.8
2020-21	25.3	12.8	19.1
2021-22	25.5	13.1	19.3
2022-23	25.6	13.3	19.4
2023-24	25.7	13.5	19.6
2024-25	25.9	13.7	19.8
2025-26	26.1	13.9	20.0

Source: NIEIR.

6. The impact of national and state greenhouse and energy policies on Victorian gas usage

6.1 Introduction

There are a number of complementary energy and greenhouse gas abatement policies which currently, and in the future, will impact on Victorian gas usage. National and State government initiatives such as subsidies and rebates are enabling changes in gas demand in both residential and commercial sectors. Policies and market mechanisms described in detail further in this chapter are the driving forces in reducing average gas use.

Gas usage is also impacted by many other trends, such as technological improvements, which are enabling uses of co-generation and tri-generation in commercial and multi-apartment residential buildings, technology is also assisting with appliance efficiency which is another key component of gas use reduction.

Victorian average gas use per year per residential customer has been dropping historically and is forecast to continue to decline. Changes in water heating and space heating by households are particularly pertinent to the declining average gas use.

Some of the key impacts on water heating are from:

- improvements in gas appliance efficiency mainly driven by Minimum Energy Performance Standards (MEPS);
- water conservation initiatives impacting on hot water loads (e.g. low flow shower heads);
- shifts to solar hot water and heat pumps for water heating.

Impacts on residential demand for gas for space heating is affected by:

- increasing market penetration of reverse cycle air conditioners (RACs) which are used for heating as well as cooling; and
- improved envelope thermal efficiency of existing and new dwellings due to changes to building standards and shell upgrades (e.g. 5-star, 6-star).

In modelling gas demand, residential policy impacts are usually separated into their impacts on new and existing dwellings, since this allows the quantitative impact of individual policies to be assessed.

Table 6.1 National key policy impacts on Victorian natural gas demand		
Policy	**Measures**	**Impact on gas demand**
Emissions Reduction Fund	Government funds projects that reduce carbon emissions through a reverse auction process. Majority of projects related to vegetation and waste management.	Minimal impact on gas consumption due to project mix.
Renewable Energy Target	Small-scale Renewable Energy Target offers incentives to install solar hot water and heat pump hot water.	Reduces electricity and gas consumption for hot water. Potentially increases in gas if gas boosted solar replaces electric hot water.
Minimum Energy Performance Standards (MEPS)	4 star minimum MEPS for gas hot water. Gas space heater MEPS under consideration.	Removes least efficient gas storage hot water systems from new hot water market. MEPS for air conditioners also encourage fuel switching.
Energy Labelling	Australian Gas Association (AGA) administers gas energy labelling. Coverage on most gas appliances. E3 runs the electricity appliance energy labelling.	Encourages adoption of more efficient appliances, reduces energy consumption.
Commercial Building Disclosure Program (CBD)	Disclosure of energy efficiency information required when commercial buildings are leased or sold with floor area of greater than 2000 m^2. Threshold lowered to 1000 m^2 in July 2017.	Encourages energy efficiency in commercial sector. Expansions will require additional 1000 Australian buildings to disclose energy efficiency information.
Clean Energy Finance Corporation (CEFC)	Provides finance exclusively to renewable energy, low emissions and energy efficiency projects.	Projects reduce energy consumption, usually in government, commercial and industrial sectors.
Australian Renewable Energy Agency (ARENA)	Government support for renewable energies.	Direct impact on network gas demand minimal. Most projects aimed at large scale renewable and research and development.
Clean Energy Innovation Fund (CEIF)	New $1 billion fund to finance clean energy projects/new businesses that are beyond R&D stage. Jointly managed by CEFC and ARENA.	Encourages shift to renewables, energy efficiency and low carbon. Similar in scope to CEFC and ARENA.
Ministerial Council on Energy (2010-12)	Phase-out of electric resistance hot water.	Various incentives to switch away from electric resistance hot water.
National Strategy on Energy Efficiency (2009)	All gas appliances across all sectors. National standards.	Impact uncertain and difficult to quantify.
National Energy Productivity Plan (2015)	Target 40 per cent improvement in energy productivity by 2030.	Strategy to direct other programs.
Energy Efficiency Opportunities Act (2006)	Targeted at large energy users.	Large energy user's efficiency measures by site. Program closed in 2014

Table 6.2 Victorian key policy impacts on Victorian natural gas demand		
Policy	**Measures**	**Impact on gas demand**
6-star building standards	Requirements to improve buildings thermal performance and energy consumption (insulation, building design. Required to install rainwater tank or solar hot water system.	Reduces average consumption for new dwellings.
Victorian Energy Efficiency Target (VEET)	Incentives to replace inefficient gas and space heaters with more efficient models and technologies. Incentives to replace inefficient electric appliances with high efficiency gas appliances.	Activities that increase and activities that decrease gas consumption. Net impact on gas is close to zero.
Showerhead Exchange Program	Free 3 star WELS low flow shower heads to replace old shower heads.	Reduce gas consumption for hot water heating.
Other state-based incentive and rebate programs	Cash rebates for installing solar hot water and gas space heating.	Usually small programs but with some impacts on gas use. Most now closed.
Victorian Emissions Reduction Target	Announced June 2016. Emissions reduction target of net zero by 2050 with interim targets every five years.	
Victorian Renewable Energy Target	Renewable Energy Targets of 25 per cent by 2020 and 40 per cent by 2025.	
Victorian Energy Efficiency and Productivity Strategy	April 2016 announced programs include: ■ retrofitting public housing stock and homes for people with health conditions; ■ energy efficient assessment program for small and medium business; and ■ home energy efficiency rating tool.	

6.2 Water heating in Victoria

For new Class 1 dwellings in gas available areas, they must be fitted with either a solar water heater or a plumbed water tank under the 5-star standard introduced in 2005. Over the 2006 to 2011 period, surveys (BIS, ABS) have indicated that around 50 per cent of new residences in gas available areas choose the solar hot water option. As the drought has eased in Victoria, it is now estimated that around 70-80 per cent of new residences are choosing the solar hot water option over the rainwater tank plumbed for sanitary use.

For existing dwellings, the Federal and State Governments have worked to phase out electric hot water systems. In gas reticulated areas of Victoria, the phase out of resistance hot water is not likely to have a significant effect given the dominance of gas for water heating in Victorian residences. For existing residences located off the gas distribution system in Victoria, this ban would reinforce bottled gas use for water heating. Older Victorian residences with resistance electric hot water could connect to solar-electric, solar-gas or straight gas.

For existing dwellings in Victoria, solar gas water heating units are replacing straight gas water heaters and electric heaters. Table 6.3 reproduces the summary of financial incentives available to install a solar hot water system in Victorian households. Currently, all of the cash rebate programs have closed to new applications and remaining incentives continue to be available through the Federal Renewable Energy Target and the state Victorian Energy Efficient Target.

Table 6.3 Summary of incentives for solar hot water systems in Victoria for private homes

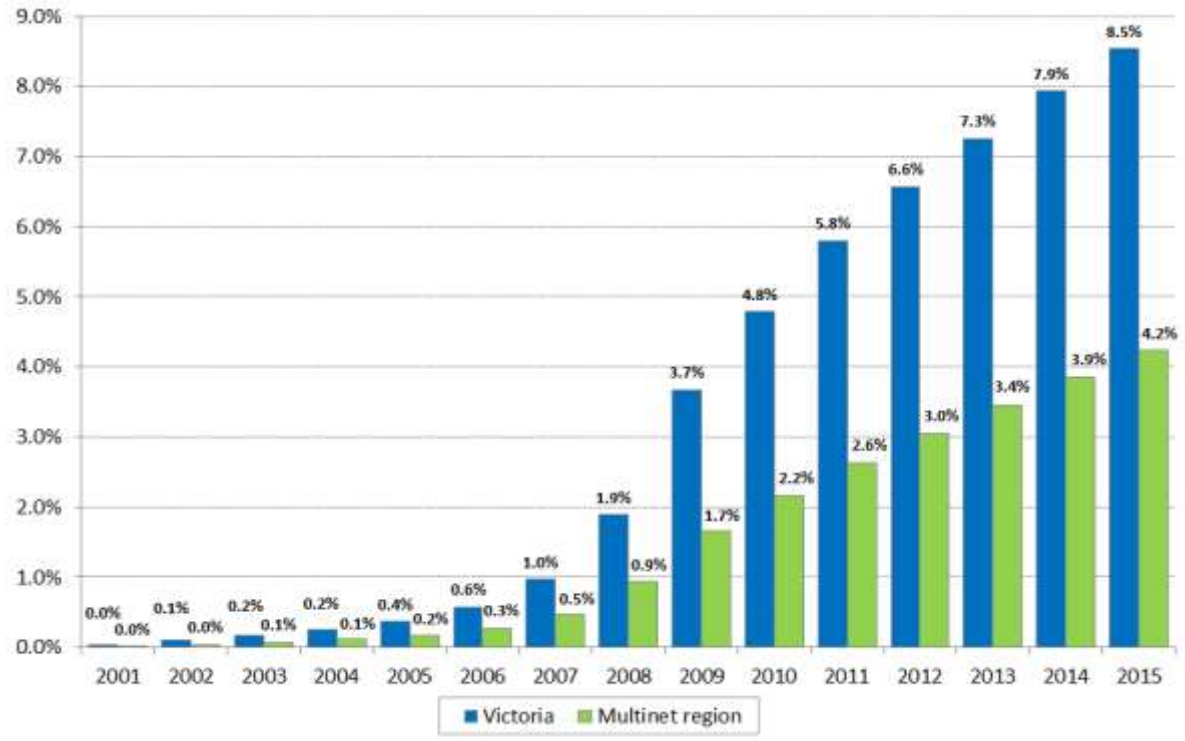
Incentive	Small-scale Technology Certificates (STCs)	Victorian Energy Efficiency Certificates (VEECs)
Replacing a natural gas or LPG water heater with a gas-boosted solar system	Yes	Yes
Adding a solar water heater to an existing natural gas or LPG water heater, as a preheater	No	Yes
Adding solar panels to an existing off-peak electric water heater either with a pump or by thermosiphon as a retrofit kit	No	Yes
Replacing an existing solar, wood, briquette or oil fuelled water heater with gas-boosted or electric solar system. Must be natural gas boosted if available in the street. Existing LPG boosted solar water heaters can only be replaced with gas boosted systems.	Yes	No
Replacing an electric water heater with gas-boosted or electric-boosted solar system or a heat pump system	Yes	Yes
New homes and buildings installing a gas-boosted or electric solar system	Yes	No
New or existing buildings installing a solar water heater	Yes	No

Source: Sustainability Victoria, http://www.sustainability.vic.gov.au/services-and-advice/households/energy-efficiency/at-home/hot-water-systems/solar-hot-water-government-incentives.

The incentive to switch from a purely gas or electric hot water system toward a solar hot water system for existing dwellings will also depend on the availability of roof space and the amount of sunshine in the region. Solar hot water installations are also driven by the number of new dwellings and residential estates within the region. Multinet Gas services the east and south east of Melbourne, which typically has less sunshine than the regions north of the Melbourne CBD and less new dwelling constructions.

Figure 6.1 shows the penetration of solar hot water systems into all of Victoria compared to the Multinet Gas region. Solar hot water penetration has been accelerating from low levels prior to 2006 up until recently. Around 8.5 per cent of Victorian dwellings have a solar hot water system on their roof. While in the Multinet Gas region, only 4.2 per cent of dwellings have solar hot water. Multinet Gas appears to have been installing solar hot water at a discount of around 50 per cent compared to the whole of Victoria.

Figure 6.1: Penetration of solar hot water systems into Victoria and Multinet Gas (per cent of dwellings)



Source: Clean Energy Regulator (CER), ABS, NIEIR.

Low flow shower heads

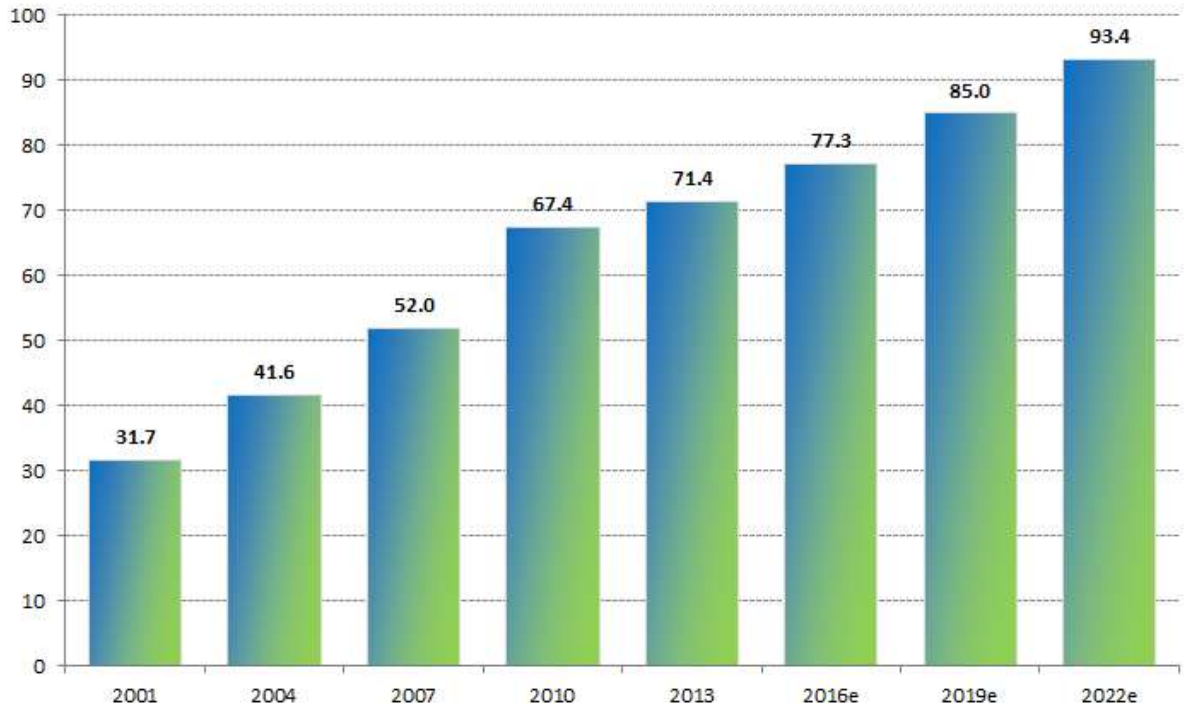
Upgrading from an inefficient shower head to a 3 star WELS rated shower head can reduce water consumption in a shower from 15 to 20 L per minute down to below 9 L per minute. Low flow shower heads reduce water use per shower and therefore the amount of hot water and gas use in dwellings with gas hot water.

All new Victorian homes, including flats, must have water efficient showers and taps (low flow) to comply with Victoria's 6-star Building Standard. In existing homes, Figure 6.2 shows the penetration of water efficient shower heads and taps has been steadily increasing over time, with free or subsidised exchange programs being offered by Victorian Water Authorities.

The Victorian state government offers free water efficient shower heads through the Showerhead Exchange Program which can be accessed by households through local water authorities. Similarly, businesses and households can install a low flow shower head through the Victorian Energy Efficiency Target.

Most new shower heads sold in Australia are compliant with a 3-star WELS rating. On this basis, any remaining higher flow shower heads will eventually be replaced with a more efficient low flow shower head, and household penetration will approach 100 per cent.

Figure 6.2: Penetration of water efficient shower heads – Victoria



Note: (e) denotes extrapolated estimate.
Source: *Environmental Issues: Water Use and Conservation*, March 2010, ABS, Table 9.

6.3 Minimum Energy Performance Standards (MEPS) and energy labelling

MEPS and energy rating labelling have been applied in Australia to a range of appliances and equipment since the late 1980s, the range being continuously expanded and the MEPS upgraded. The MEPS have been developed in cognisance with world best practice which has strongly influenced the energy performance of appliances in Australia as many appliances are imported. (However, without MEPS, sub-standard appliances could have been "dumped" in Australia.)

Since 2012, the Greenhouse and Energy Minimum Standards (GEMS) applied a national framework to regulate standards for the energy efficiency of products and energy labelling in Australia. The framework unified State and Territory legislations to give a consistent, national approach to setting and improving the energy efficiency of appliances and other products.

MEPS are based on the costs and benefits of enhancing energy performance of the items to which they are applied. They represent the minimum allowable energy efficiency. Introduction and upgrading is subject to rigorous analysis in Regulatory Impact Statements (RISs). MEPS are closely associated with energy labelling and rating.

Historically, MEPS/GEMS have focused on creating energy efficiency improvements in appliances and products that use electricity. However, there has recently been an interest in expanding the standards to gas products. Governments are working with the gas industry to revise the energy label and MEPS requirements for gas appliances. Although there are no current MEPS for gas space heaters, the introduction of MEPS for gas space heaters in the future is possible.

The following reports/notices have been released for gas products over the last five years:

- *Research Report: Gas Space Heaters – Performance Testing & Energy Labelling* (published 2015 September);
- *Product Profile: Gas Space & Decorative (Fuel Effect) Heaters*, (published 2012 April);
- *Gas Appliance Energy Efficiency Labelling*, (published 2012 April);
- *Product Profile: Outdoor Radiant Gas Heaters, Report No 2010/07* (published 2010 September);;
- *Regulatory Impact Statement – Proposal to introduce a Minimum Energy Performance Standard for Gas Water Heaters, Report No 2009/22* (published 2009 October); and
- *Consultation Regulatory Impact Statement of Proposal to Introduce a Minimum Energy Performance Standard for Gas Water Heaters, Report No 200807* (published 2008 August);

Source: http://www.energyrating.gov.au.

Gas water heaters and space heaters are required to carry an energy label and domestic gas water heaters also have MEPS requirements. However, the energy labelling for gas products is run outside the governments E3 program and instead run by the gas industry body, The Australian Gas Association (AGA). Product labels under the AGA can display a maximum of 6 stars, even though manufacturers are now producing select ranges that exceed this level.

E3 is considering introducing Zone Energy Rating Labels (ZERL) that incorporate the efficiency of products within alternative temperature climates. All water heating, space cooling and space heating products would be required to carry a ZERL. Climactic conditions especially affect solar, heat pump and air conditioner technologies. Solar hot water is reliant on the amount of irradiation within a region, and heat pump technology on the ambient temperature outside.

Water heating

Prior to GEMS, the Council of Australian Governments (COAG) ruled to regulate water gas heaters, New South Wales and Queensland followed. Minimum Energy Performance standards have been in place following a regulatory impact statement produced in 2009.

Currently, *GEMS (gas water heaters) Determination 2013* now provides national minimum energy efficiency and product performance requirements for gas water heaters. This requires gas domestic outdoor water heaters to have at least a 4 star minimum standard from May, 2013. An increase from a 3 star standard to a 4 star standard represents an annual reduction in gas for water heating of around 2 GJ.

The table below summarises the energy label standards used for gas hot water. The standards are expressed in terms of expected annual gas usage for each star rating to provide a fixed amount of water heating energy.

Star	Gas hot water (MJ/annum)
1	28,900
2	26,877
3	24,854
4	22,831
5	20,808
6	18,785

The introduction of the 3-star standard effectively removed the least efficient gas storage hot water systems from the market. According to the E3 database on new product MEPS and energy labelling[10] and the Regulatory Impact Statement on gas hot water heaters[11], most gas storage hot water heaters on the market in 2016 are rated to either a 4 or 5-star standard.

In the Multinet Gas distribution region around 75 per cent (ABS, Energy Use and Conservation, 2014) or more of dwellings use gas for hot water heating. This is around 506,000 customers who would have a mix of 1 to 6-star gas hot water heaters. Existing customers in Multinet Gas with existing hot water systems rated between 1 and 3 stars would be required to replace these under the new MEP's (2013) with a minimum saving of 2 GJ per annum (3 star to 4 star), but potential up to 10 GJ per annum (1 star to 6 star).

Assuming an asset life of 15 years for hot water systems, this would imply around 34,000 units being replace each year for Multinet Gas. A 4 GJ saving would imply a reduction in residential gas use of around 135 TJ per annum for Multinet Gas. An 8 GJ saving per appliance would imply an annual saving of 270 TJ per annum for Multinet Gas.

The MEPS requirements did not have as much of an impact on gas instantaneous hot water heaters. Most gas instantaneous heaters already exceeded a 3-star standard, and the efficiency of these models continues to improve, while gas storage hot water heaters do not. Some gas instantaneous water heaters on the market today even exceed a 7-star equivalent rating, and a revision to the energy rating/labelling system is under consideration to reflect these high efficiency models (including HE gas space heating models).

[10] Accessed from http://www.energyrating.gov.au/.

[11] *Regulatory Impact Statement, Proposal to Introduce a Minimum Energy Performance Standard for Gas Water Heaters*, 29 October 2009, E3.

Space heating

Minimum energy performance standards and energy labelling for gas spacing heaters were implemented in the 1980's by the industry body, the Australian Gas Association (AGA). These standards have not been updated since then, and MEPS have not been implemented by the Australian government (E3 program). Whilst there is no regulatory review for gas space heaters underway, a number of research reports and discussion papers have been prepared by E3.

The potential energy savings of introducing MEP's for space heating appliances are very significant. For example, the potential savings in gas usage for gas ducted heater from moving from a 3 star to a 5 or 6-star energy rating are between 22 and 30 per cent. Table 6.4 shows comparative savings for selected ducted gas space heating appliances surveyed from manufactures websites in April 2016.

Given the very high energy savings from potential MEP's on gas space heating appliances, it seems likely they will be introduced in the future.

Table 6.4 Gas ducted space heaters by star rating

Brand by Star Rating	Model	MJ/ Hour	Output	Star rating
3 Star				
Braemar	TH330	122	28	3.7
Braemar	TH3X25	100	23	3.7
Braemar	TH315	60	14	3.7
Bonaire	MB3-14	60	14	3.0
Brivis	CC315N	70	15	3.0
Brivis	CC325N	130	23	3.1
4 Star (13% saving on 3 Star or $200 p.a.)				
Bonaire	MB4-30	130	30	4.0
Brivis	SP430VN	130	30	4.2
5 Star (22% saving on 3 Star or $350 p.a.)				
Braemar	TH523	88	23	5.6
Bonaire	MB5-21	90	20	5.0
Brivis	BX520	90	20	5.1
Brivis	BX526	120	30	5.0
6 Star (30% saving on 3 Star or $480 p.a.)				
Braemar	THM623	88	22.5	6.0
Brivis	SP623EN	90	23	6.0
7 Star (approximately 40% saving on 3 Star or $610 p.a.)				
Braemar	TQS730	100	26.6	7.0

6.4 Victorian Energy Efficiency Target

The Victorian Energy Efficiency Target (VEET) scheme is a white certificate program that provides incentives for residential and business consumers to install energy efficient technologies that impact gas and electricity demand. These technologies, such as LED down lights, reduce the amount of carbon equivalent emissions (CO_2-e) generated over the asset lifetime compared with less efficient technologies, such as halogen down lights. This reduces residential and commercial energy demand compared to business as usual. A post-modelling adjustment may be required where part or all of the future developments of VEET are outside the scope of econometric modelling.

The VEET scheme has been through a first phase covering 2009 to 2011, and a second phase covering 2012 to 2014. The annual targets are set at the beginning of each phase, with the first phase years targeting 2.7 million tonnes CO_2-e and the second phase years targeting 5.4 million tonnes CO_2-e. The former Coalition government intended to close the scheme at the end of 2014, but extended the scheme into 2015 for a transitional year with a target of 2.0 million tonnes CO_2-e. However, the newly elected Labor Government announced in December 2014 that the scheme would run in 2015 at the full 5.4 million CO_2-e target. In August, 2015 the Victorian government announced the scheme will continue to run for a 5 year phase from 2016 to 2020 with increasing targets.

Table 6.5 provides a comparison of the targeted certificate creation to the achieved levels of certificate creation within a given calendar year. The first phase of the scheme broadly reached the targets. The second phase started with 8.7 million certificates registered, but some were related to 2011 activities/relevant entity liabilities. The following 2013 and 2014 years had less certificates created than target that corrected for the oversupply created during 2012. Over 2015 certificates created were around targeted certificates.

Table 6.5 Overview of Victorian Energy Efficiency Target, Victoria region

Year (millions)	2009	2010	2011	2012	2013	2014	2015	2016
Victorian Actual certificates	3.66	2.28	1.80	8.71	5.23	3.45	5.50	0.59
Victorian Target certificates	2.70	2.70	2.70	5.40	5.40	5.40	5.40	5.40
Activity Category (per cent)[1]								
Water heating	15.0	17.2	17.1	4.9	4.8	6.0	3.5	2.7
Space heating and cooling	0.6	1.7	6.0	2.7	2.2	2.1	1.4	0.7
Space conditioning	1.5	0.0	0.1	2.4	11.1	6.5	0.5	0.5
Refrigerator/freezer	0.1	0.7	1.6	0.9	2.4	1.5	0.9	0.7
Shower rose	3.6	2.3	4.7	2.2	6.8	4.1	1.3	1.3
Lighting	79.2	78.0	38.4	7.6	22.0	76.7	90.9	91.9
Standby Power Controllers	0.0	0.0	32.1	79.2	50.2	1.4	0.2	0.9
Other	0.0	0.0	0.0	0.0	0.5	1.8	1.3	1.4
	100.0	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Sector (per cent)[2]								
Residential	100.00	100.00	100.00	98.07	93.60	87.13	88.29	87.57
Business	0.00	0.00	0.00	1.93	6.40	12.87	11.71	12.43

Notes: 1. Activity proportions for Victoria are derived from certificates register.
2. Residential and business proportions are derived from activities register.
All years are calendar years.

Source: Essential Services Commission, Register of Victorian Energy Efficiency Certificates, accessed April 2016.

The first phase of the scheme was restricted to only the residential sector, and was dominated by lighting related activities. This comprised of replacing inefficient incandescent light bulbs with compact fluorescent lighting (CFLs). Lighting made up about 80 per cent during the first two years. Water heating related activities accounted for about 17 per cent of certificates registered with households replacing electric water heaters with gas or solar boosted water heaters. The majority of these installations were for the replacement of electric storage heaters for electric boosted solar hot water systems, rather than impacting gas water heating.

Standby power controllers were introduced in 2011 and comprised of about 32.1 per cent of the third year of VEET. Standby power controllers are a power board that turns off the power to appliances when they are not in use, this saves energy on the residual amount of energy used for appliances on standby. The technology proved popular during the first two years of the second phase of VEET in 2012 and 2013 making up 79.2 per cent and 50.2 per cent of the scheme respectively. However, there had been speculation about whether the standby power controllers actually achieved the theoretical CO_2e savings once they were installed. A proportion of controllers were removed once they were installed. In response to criticism, and upon review of the activity, the Essential Services Commission in late 2013 discounted standby power controller abatement factors by 55 to 62 per cent[12]. Since then, standby power controllers have only been a marginal activity.

The late second phase saw a return to lighting based activities with 22 per cent of the scheme in 2013 and 76.7 per cent in 2014. The 2015 and 2016 years comprise of about 90 per cent lighting related activities. Second phase lighting is increasingly comprised of LED lighting replacing less efficient lights. These include replacing halogen down lights with LED down lights.

The second phase also expanded VEET to include the small business sector. Most residential activities were offered to businesses as well. There are currently a few exclusive activities for businesses including replacing refrigerated display cabinets and commercial lighting upgrades. Business represents an increasing proportion of total certificates with an average of 12.3 per cent in the business sector across 2014 to 2016.

The historical data presented within this section has been accessed from the registers publically available from the VEET website. The certificate register contains information on the number of certificates created for each activity and the current status of the certificates. The activities register contains activities performed within each postcode and the related certificates created; it can also be filtered into business and residential sectors. Table 6.6 provides an indication of the proportion of scheme total certificates created within the Multinet Gas distribution region. Note that this includes all certificates created which relates to both electricity and gas demand.

The Multinet Gas region makes up 31.6 per cent of certificates registered on average over the 8 years VEET has operated. This includes below average years in 2010 and 2011 when lighting was the main activity, and an above average 2015 with Multinet Gas generating 37.3 per cent of certificates. The Multinet Gas region has tracked total Victorian trends quite closely with most of the scheme standby power controllers and lighting.

[12] *Information Bulletin – Adjustment to abatement factors for advanced AV and IT standby power controllers (06/09/2013),* Essential Services Commission.

Table 6.6 Overview of Victorian Energy Efficiency Target, Multinet Gas region								
Year (millions)	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**
Victoria Actual certificates	3.66	2.28	1.80	8.71	5.23	3.45	5.50	0.59
Victoria Target certificates	2.70	2.70	2.70	5.40	5.40	5.40	5.40	5.40
Activity Category (per cent of Victoria)[1]								
Water heating	2.7	2.6	2.7	0.9	0.9	1.1	0.7	0.7
Space heating and cooling	0.0	0.1	0.2	0.2	0.2	0.3	0.3	0.1
Space conditioning	0.2	0.0	0.0	1.4	4.4	1.2	0.1	0.1
Refrigerator/freezer	0.0	0.4	0.7	0.3	0.5	0.4	0.2	0.2
Shower rose	1.0	0.8	0.4	0.3	1.3	0.7	0.3	0.2
Lighting	29.6	19.7	4.7	2.7	8.5	27.1	35.4	32.8
Standby Power Controllers	0.0	0.0	18.3	27.0	16.4	0.1	0.0	0.1
Other	0.0	0.0	0.0	0.0	0.2	0.6	0.4	0.3
Multinet Gas certificates (per cent of Victoria)	**33.6**	**23.4**	**27.0**	**32.8**	**32.4**	**31.6**	**37.3**	**34.6**
Sector (per cent)[2]								
Residential	33.6	23.4	27.0	32.3	30.1	25.5	32.2	30.1
Business	0.0	0.0	0.0	0.5	2.4	6.1	5.2	4.5
Multinet Gas certificates (per cent of Victoria)	**33.6**	**23.4**	**27.0**	**32.8**	**32.4**	**31.6**	**37.3**	**34.6**

Notes: 1. Activity proportions for Victoria are derived from certificates register.
2. Residential and business proportions are derived from activities register.
All years are calendar years.

Source: Essential Services Commission, Register of Victorian Energy Efficiency Certificates, accessed 12 May 2015.

6.4.1 VEET impacts on Multinet Gas' gas consumption

While certificates created within the Multinet Gas postcodes make up about a third of all certificates created across Victoria, the vast majority of these are currently related to lighting and hence electricity usage only. In 2015, Multinet Gas had a greater proportion of lighting related activities than the state average with close to 95 per cent of the scheme within the region. Multinet Gas is also overrepresented for business related installations in 2015. The remainder of activities has been analysed by NIEIR for impacts on gas consumption.

VEET contains both activities that can either reduce gas consumption, or increase gas consumption. The main sources of reduction in gas consumption include replacing a gas storage water heater with solar, replacing gas space heaters with high efficiency models and improving the buildings thermal shell. As gas is often seen as a more energy efficient alterative to electricity for select applications, such as water heating, VEET also contains incentives to substitute between electricity, gas and solar. This includes replacement of electric water heaters for gas storage, gas instantaneous or solar.

Table 6.7 contains a decomposition of the net impacts on gas consumption for the Multinet Gas region. The most relevant series for energy are those that are derived from certificates, which are closely related to total energy savings over the activities life.

For the majority of years, the decreases to gas consumption are largely offset by increases to gas consumption. This is especially true of 2015 and 2016 with a net impact close to zero. The biggest net reductions are attributable the 3 years across 2012 to 2014 when the weather sealing activity was prominent. This net reduction due to thermal improvements in existing buildings should also be further discounted for share of heating used within Multinet Gas households, and energy savings due to reduced cost of air conditioning during summer.

Table 6.7	VEET net impacts on gas consumption, Multinet Gas region							
	2009	2010	2011	2012	2013	2014	2015	2016
Per cent of Victoria								
Increase	1.2%	1.8%	2.2%	0.9%	0.9%	1.0%	0.6%	0.5%
Decrease	1.5%	1.1%	0.6%	1.8%	5.8%	2.1%	0.6%	0.4%
No impact	30.8%	20.6%	24.2%	30.1%	25.6%	28.2%	36.0%	33.5%
Net Impact	-0.3%	0.7%	1.6%	-0.9%	-4.9%	-1.1%	0.0%	0.2%
Total certificates								
Increase	44,376	40,137	40,513	75,954	48,646	35,998	32,143	3,235
Decrease	56,550	24,976	11,391	156,914	304,171	73,470	32,506	2,221
No impact	1,128,536	469,496	436,008	2,619,738	1,341,191	972,413	1,982,649	197,323
Net Impact	-12,174	15,161	29,122	-80,960	-255,525	-37,472	-363	1,014
Total installations								
Increase	1,047	822	1,217	1,920	1,347	1,035	951	81
Decrease	26,860	7,760	4,172	37,190	92,412	24,582	10,040	733
No impact	142,019	45,299	60,907	311,187	161,617	47,840	100,093	13,678
Net Impact	-25,813	-6,938	-2,955	-35,270	-91,065	-23,547	-9,089	-652

In summary, a separate adjustment for the impacts of VEET on gas consumption is difficult to justify as most of the scheme is related to electricity and the historical net impact on gas consumption is close to zero.

6.4.2 Future of the Victorian Energy Efficiency Target

In August 2015, the Victorian minister for energy and resources announced the new targets for VEET. The scheme will also continue for a five-year phase from 2016 to 2020 with an increasing target. The 2016 target will be the same as 2015, at 5.4 million certificates, gradually rising up to a target of 6.5 million certificates in 2020[13]. However there still remain some key uncertainties in the continuation and the activities that will be used to meet annual targets.

Firstly, another State election will be held during the next phase. If a Coalition government were to be elected it is uncertain whether they would continue the scheme beyond 2020.

[13] http://www.premier.vic.gov.au/targets-to-achieve-victorias-energy-efficient-future.

Secondly, the VEET scheme in the next few years will exhaust many low cost activities that have dominated the scheme to date (lighting, standby power controllers). Therefore any similar or increased annual target will have to be met with higher cost activities. This could create a scenario where demand for higher cost activities is not sufficient to meet the annual target, creating a shortfall. If energy retailers are unable to surrender the required amount of certificates each year, they must pay a penalty price. The consolation paper modelling shows that a significantly increased target could push up the price of VEECs, in some scenarios the price exceeds the penalty price. Hence there will be little incentive to meet annual targets.

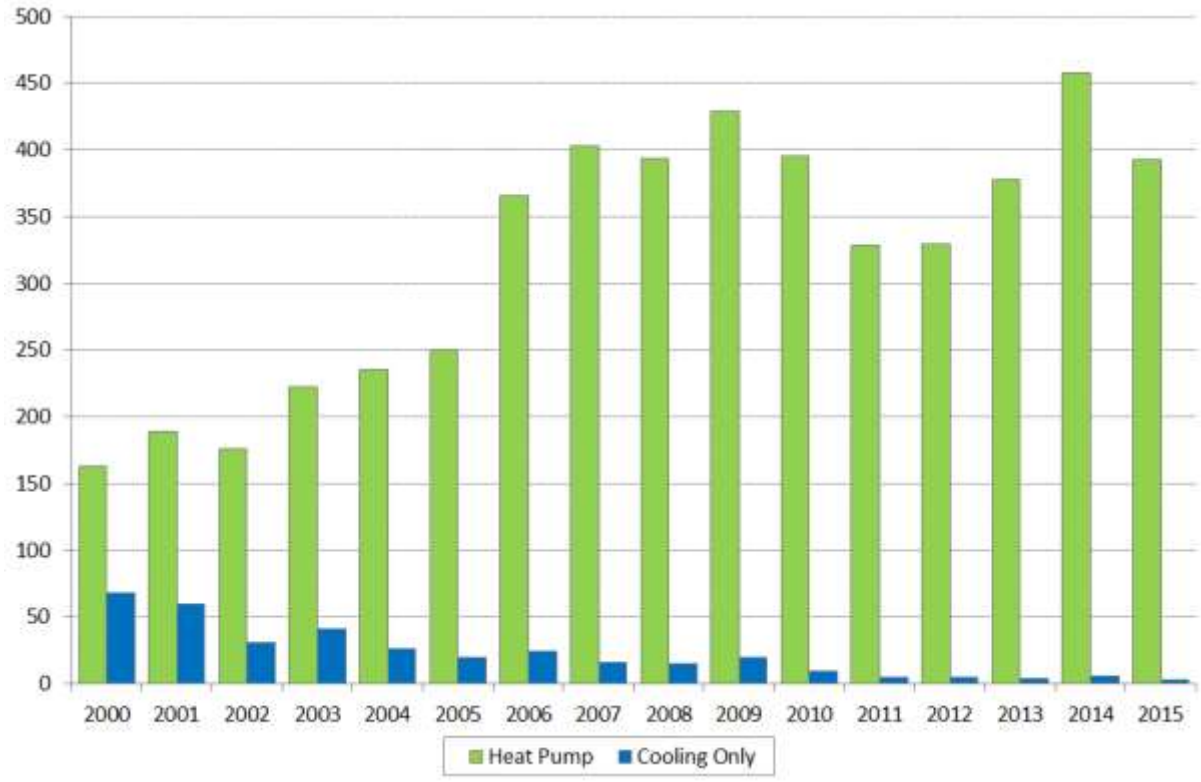
In order to meet expanded targets the scheme must focus on areas that are currently underrepresented, especially if the current market for low cost activities shows signs of saturation. The consultation paper outlines potential avenues for expansion:

- opening up the scheme to large business customers;
- introducing a sub-target for low income households; or
- implementing new activities and/or revising existing activities.

6.5 Penetration of reverse cycle air conditioners (RACs) in Victoria

Reverse cycle air condition penetrations are increasing and they are increasingly used for space heating as well as space cooling. This largely reflects the shift to apartment and townhouse construction in Victoria, and in particular in Melbourne CDB and surrounds and the inner suburbs of Melbourne. This trend is reducing residential per connection gas usage for space heating. Sales of air conditioners in Victoria continue at a strong rate, with the vast majority being capable of heating as well as cooling. Cooling only systems are currently a small minority of total annual sales.

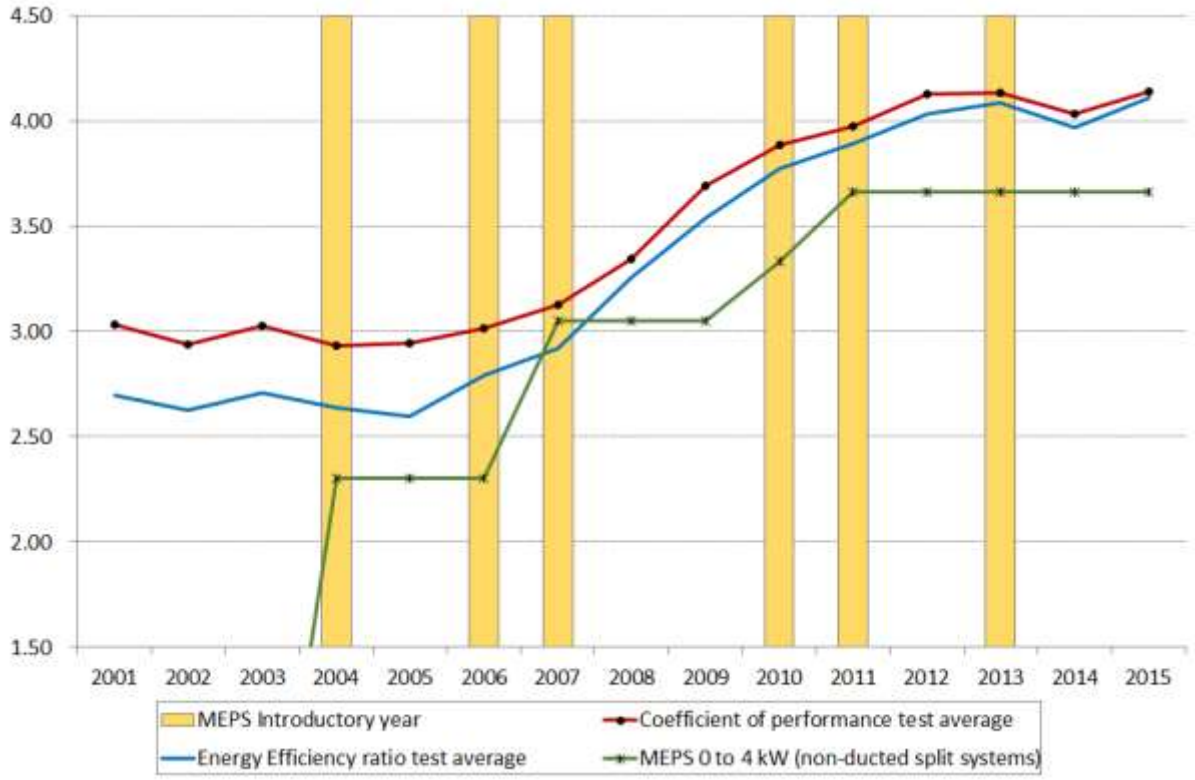
Figure 6.3: Victorian annual air-conditioner sales – calendar year (MW)



Note: Estimated from actual air conditioning sales data for Victoria.

Heat pump technology is increasingly becoming more efficient. Heat pumps allow more heating or cooling energy output than electrical input. This changes the economics of space heating between gas and electric heaters, which also depends on relative gas and electricity prices. As shown by figure 6.4, the average efficiency of non-ducted split systems has improved remarkably over the past 10 years, since the introduction of MEPS for air conditioners in 2004. Other system types also have similar efficiency gains, which make electric space heating an attractive alternative to gas space heating.

Figure 6.4: Efficiency of non-ducted split systems 0 to 4kW



Source: energyrating.gov.au

6.6 Residential Building Standards

In Australia, model energy performance codes come under the Building Council of Australia, 2010, a national body. States and Territories do, however, depart from national model codes.

The impact on the energy system of codes for new buildings depends on:

- the design (levels, features) of the codes;
- the departure from previous building codes and practices;
- the number and area/volume of the new buildings compared with the building stock in the area; and
- the rigour with which they are implemented.

When a new code is introduced the entry of new buildings into the stock of those built to the new code may take up to a year from approval/permitting to the new design to completion of the first buildings built to the new code. In **Victoria** energy performance requirements for new residences were first introduced in 1992: to about a 2-star standard. Since then the **average** performance of new residences gradually increased to about 3 stars by 2003 when the 4-star standard was introduced. And in the absence of the 5 (2005) and 6-star (2011) the average continued to improve as consciousness of energy performance importance increased and as building practices improvements entered the market place. Due to non-compliance with the new codes the average star rating of new Victorian residences in 2013 is likely closer to 5 to 5.5 stars however.

Note that annual additions to the residential building stock vary between about 1 to 2 per cent. The energy impact is probably higher due to:

(i) increases in net space conditioned area;

(ii) higher comfort levels demanded in new residences (temperatures, hours of space conditioning); and

(iii) generally higher intensity (space conditioning, lighting, appliances) energy use in newer residences.

Analysis of new buildings often suggests a significant step change in energy use as new building codes are introduced. Our analysis indicates, however, this is not the case: changes are more gradual as thermal performance would improve in the absence of the standards and as there are lags in 100 per cent introduction of the new standards.

A major issue for energy performance, noted globally by the IEA, is compliance with building standards. That is, new buildings are **designed** to comply but building practices often fail to deliver design outcomes. In the United Kingdom a detailed study in 2009 found that less than 50 per cent of new residences met the mandatory energy performance standard. A similar study in Australia undertaken by CSIRO has produced a similar result. The implication of this is that the savings indicated by new building code Regulatory Impact Statements (RISs) need to be discounted.

6.6.1 6-Star Building Standard

Since 1 May 2011, all new homes, home renovations, additions, alterations and relocations in Australia have been required to comply with the 6-Star Building Standard under the Building Code of Australia. This follows on from the 4-Star introduction in 2004 (from 2.2 Star in 1992) and 5-Star in 2005 (extended to renovations in 2008).

In Victoria the 6-Star Building Standard applies to the thermal performance of the envelope/shell of a home, renovation or addition, and also requires the installation of a solar hot water system or a rainwater tank for toilet flushing and a lighting intensity (W/m^2) standard.

A 6-star home is projected to use 24 per cent less energy for heating and cooling compared to a 5-star home.

However, from the experience with the 5-star rating, it is reasonable to assume that this theoretical saving should be heavily discounted to account for non-compliance mainly due to incorrect installation of insulation and a lack of attention to air sealing.

Additionally, given 6-star is mostly related to building envelope (shell), it relates to cooling as well as heating. All else being equal, this reduces the usage of gas space heaters. Offsetting this energy efficiency improvement to some extent is the increasing home net conditioned area, and increased comfort desires.

The introduction of more stringent building standards for new homes from a 6-star standard to a 7-star standard or above may be possible in the future. This would involve further improvements to floor insulation to reach 7 star.

6.7 Commercial mandatory disclosure (CMD)

Commercial mandatory disclosure (CMD) now generally known as Commercial Building Disclosure (CBD), introduced in all States and Territories through COAG/Ministerial Council on Energy, applies to energy performance certification for all office building space of greater than 2,000 m^2 when it is leased or sold. Liable building owners are required to obtain a Building Energy Efficiency Certificate (BEEC). A BEEC consists of a National Australian Building Environment Rating System (NABERS) rating; information about the energy efficiency of the office lighting, contained in the Tenant Lighting Assessment (TLA); and generic guidance on how the energy efficiency of the office could be improved. NABERS star ratings must also be included in sale or lease advertisements for covered floor spaces.

The BEEC enables potential purchasers or lessees to include consideration of a building's energy efficiency as part of their decision-making processes. In so doing, the CBD program provides the market with information that would, over time, encourage energy efficiency improvements to be made voluntarily. By encouraging the market to appropriately value energy efficiency, rather than forcing the adoption of particular energy efficiency measures, the CBD program is a light-handed form of regulation.

Over 200 assessors are rating office space (leased or sold) of greater than, or equal to, 2,000 m^2. To date over 10 million m^2 have been rated using the NABERS tool.[14] Ratings (star system) have been improving as CBD is implemented. Thus, from a range of press reports surveyed by NIEIR, the following impacts have been reported. Mirvac's building portfolio has an average rating of 4.3 stars. The Dexus Property Group now has an average star rating of 4.3 compared with 3 when it began NABERS rating three years ago: target is 4.5 by December. Investa, now at an average of 4.2, is aiming for an average 4.5 star rating. The Bendigo Bank is aiming for a 5 star rating on all space occupied by the Bank on the basis of positive results from CBD applied and followed up on at Bank HQ.

The evidence is that CBD is having a substantial impact on energy performance in the commercial office sector and over the 2012 to 2022 period will reduce sectoral energy demands below those previously anticipated.

A 2014-15 Review of the CBD (Final Report released in March 2015), indicated the following.

1. The Commercial Building Disclosure program is an appropriate program that complements a suite of related government policies and programs, including the Emissions Reduction Fund (ERF).
2. The CBD program has been effective in inducing positive behaviour change in relation to commercial building energy efficiency in affected buildings, resulting in significant benefits.
3. The CBD program is expected to deliver further benefits in energy reduction and greenhouse gas abatement.
4. CBD remains the principal Commonwealth Government program for driving energy efficiency improvements in the office sector.
5. There are several viable options for the future funding of the CBD program.
6. Future evaluations of energy efficiency programs would benefit from improved data relating to pay-offs of energy efficiency upgrades and workforce productivity improvements.

[14] Note that the NABERS Energy rating and greenhouse gas emissions reported on a **Building Energy Efficiency (BEEC)** register will not take into account GreenPower purchases. This is because a decision to purchase GreenPower does not reflect the energy efficiency of a building and GreenPower purchases may change over time. GreenPower purchases will, however, be acknowledged on the BEEC. The NABERS Energy rating that must be disclosed in any advertisement and on the Building Energy Efficiency register cannot take into account any GreenPower purchases. Source: http://www.cbd.gov.au/Intro.RateYourBuilding.aspx.

Changes to the Commercial Building Disclosure program were announced in June, 2016. These include lowering the floor area threshold from 2,000 m^2 down to 1,000 m^2, which is expected to impose disclosure requirements and reduce energy consumption upon an additional 1,000 commercial properties across Australia[15].

[15] http://cbd.gov.au/changes-to-the-commercial-building-disclosure-program.

6.8 Industrial/Business programs

Introduction

Over the period to 2026 gas use will be affected by:

- price increases due to carbon pricing and non-carbon pricing factors;[16]
- structural change influenced by carbon pricing and global competition;
- equipment efficiency and technology improvements; and
- specific measures (MEPS, energy efficiency such as the federal Energy Efficiency Opportunities Act (EEOA), and Climate Change measures.

Each of these factors will dampen BAU growth in gas use, the extent depending on actual changes occurring. Most of the foreseen changes are incorporated into NIEIR's modelling framework.

Efficiency improvements result from price increases, stock turnover at constant prices (autonomous energy efficiency improvement: AEEI) and specific measures.

These policy initiatives have the potential to reduce distributor demands over the projection period. Brief outlines of the initiatives are presented below.

The **Energy Efficiency Opportunities Act (EEOA)**, which was terminated in 2014, required entities using >5 PJ of energy per year to conduct energy audits on their operations and report on EEOs with up to a 3 year payback. Implementation of these opportunities was not, however, mandated.

Monitoring of the EEOA program indicates that it may have accelerated EEO identification and implementation, but the beyond BAU impact of the EEOA is uncertain. That is, EEOA additionality is uncertain as projects reported under EEOA may have been undertaken without the EEOA. The EEOA was terminated in 2013: some EEOA projects may have an impact (no data) post-2015.

Under the CEF Act, the **Clean Energy Finance Corporation (CEFC)** has a $10 billion budget to contribute to investment in renewable energy, low pollution (cogeneration, trigeneration) and energy efficiency technologies. CEFC is expected to provide support through loans, loan guarantees and equity investments.

On 22 March 2016, the Federal Government announced it would reverse the previous intent to terminate the Clean Energy Finance Corporation (CEFC) and the Australian Renewable Energy Agency (ARENA) and establish a $1 billion ($100 million per year over 10 years) Clean Energy Innovation Fund (CEIF).

The CEIF is intended to complement the CEFC and ARENA by targeting projects such as large-scale solar with storage, off-shore energy, biofuels and smart grids. ARENA will be given an expanded focus beyond renewable energy to include energy efficiency and low emissions technology projects and will move from a grant-based role to a predominantly debt and equity basis under the CEIF, which will be funded from the CFFC's $1 billion allocation.

Implications of policy change:

(i) a move away from the Abbot constrained support for positive climate change policies; and

(ii) assured support for longer term clean energy projects.

[16] **NOTE** the carbon pricing design includes compensation (but with energy efficiency improvement (EEI) inducements) to energy intensive trade exposed industries (EITEIs) which may enable growth in these sectors.

But no clear plan for a transition away from high greenhouse gas intensive (GHGI) electricity generation.

The **Emissions Reduction Fund** (ERF) is being implemented by the Federal Government. Via a reverse auction (lowest bids win) process greenhouse gas abatement (GHGA) projects are subsidised. In the first two auctions (in 2015) winning bids were dominated by land use change, forestry and farming projects, but over time energy efficiency projects are likely to be funded resulting in lower energy demands – mostly in electricity. Most of the projects are also located in New South Wales and Queensland, with few having an impact in Victoria.

The third auction took place in late April, 2016 and the mix of projects was similar to the first two auctions. ERF auctions should be monitored to assess their potential impacts on energy demands. The CEFC, ARENA, CEIF and the ERF could potentially attract significant investment in projects (renewables, cogeneration/trigeneration and energy efficiency) which reduce distributor revenues through "behind the fence" supply and demand actions.

Surveys of liable EEOA parties and CEFC, ARENA, CEIF and ERF recipients in each distributor area would be needed to quantify the EEOA and CEFC impacts on gas demands and then to consider the extent to which these projects were **additional**, that is, beyond BAU trends.

7. Natural gas sales and customer number forecasts to 2026 – Multinet Gas region

7.1 Introduction

This section presents natural gas demand forecasts by class and tariff to 2026 for the Multinet Gas distribution region. Forecast numbers were prepared on a calendar year basis to 2026.

Forecasts of natural gas sales, customer numbers and MHQ are presented for the following:

- Tariff V by class; and
- Tariff D by class and industry.

7.2 Overall trends in Multinet Gas volumes

Figures 7.1 and 7.2 show Multinet Gas volumes for Tariff V and D from 2001 to 2015. These volumes are calendar year volumes and are weather normalised. They are for Multinet Gas Melbourne.

From Figure 7.1, total Tariff V volumes rose from 43.7 PJs in 2001 to peak at 45.9 PJs in 2008, but fell thereafter to 44.7 PJs in 2012 and 42.8 PJs in 2015.

For Tariff D, from Figure 7.2, volumes reached 14.7 PJs in 2004 before falling to 12.1 PJs in 2008 and 11.3 PJs in 2012 and 11.3 PJs in 2015.

Figure 7.1: Tariff V Multinet Gas Melbourne – weather normalised (TJs)

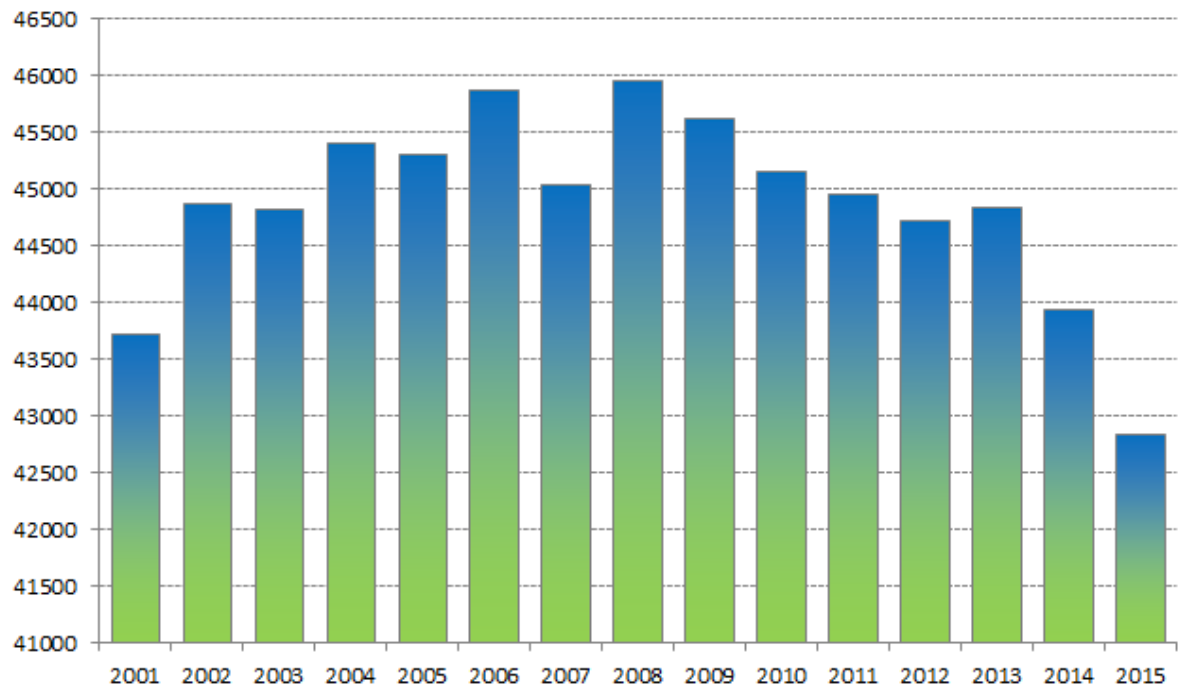
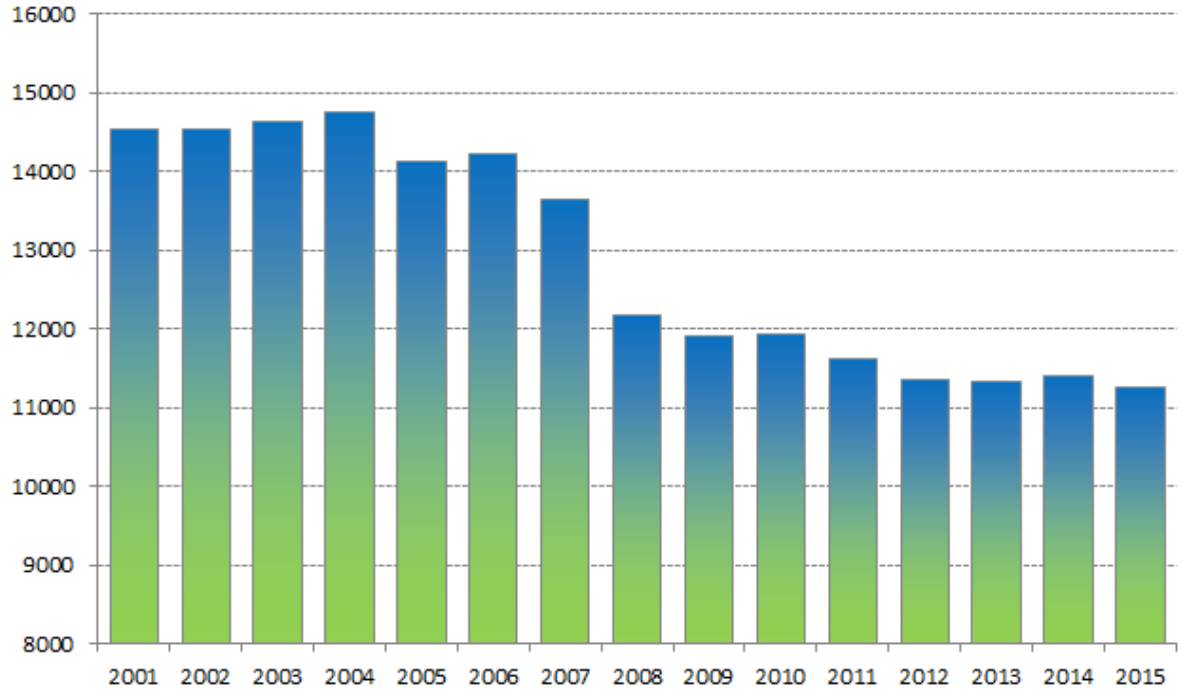


Figure 7.2: Tariff D Multinet Gas Melbourne – weather normalised (TJs)



7.3 Natural gas sales forecasts for Multinet Gas to 2026

The forecasts for each metric are presented for:

(i) total Multinet Gas;

(ii) Multinet Gas-Melbourne;

(iii) Yarra Valley; and

(iv) South Gippsland.

The commentary below focuses on Total Multinet Gas. Projections for Melbourne, Yarra Valley and South Gippsland are tabulated separately.

Table 7.1 shows forecasts of natural gas sales by tariff and class on a calendar year basis to 2026 for the Multinet Gas distribution region. Tables 7.2 and 7.3 show customers by tariff and class and MHQ for Tariff D. The Tariff D volume forecasts include unaccounted for gas or losses. The Tariff V forecasts are shown on a class basis, excluding unaccounted for gas. The loss factor for Tariff V used for Multinet Gas was 6.0 per cent. Tariff L volumes, customers and MHQ for Multinet Gas Melbourne are also shown in Table 7.13.

Tariff V

Tariff V volumes for Multinet Gas represent around 69 per cent of total volumes in 2015. As indicated in Table 7.1, total Tariff V volume growth is forecast to be -1.1 per cent per annum over the 2016 to 2026 period. The slow residential volume growth in the Multinet Gas region reflects slow customer growth, the impact of the 6-star efficiency standard, MEPS and gas price increases.

Residential volume growth on a weather normalised basis is -1.0 per cent per annum over the 2016 to 2026 period. Residential volumes for Multinet Gas represent around 69 per cent of total gas sales.

Average residential usage for both existing and new dwellings is projected to continue to fall over the projection period. The customer numbers forecasts developed take into account both net and gross customer movements.

Total average residential usage falls from 56.8 GJ per dwelling in 2015 to 55.1 GJ by 2018 and 48.6 GJ per dwelling by 2026. New customer usage falls from nearly 41.0 GJ per dwelling in 2016 to 38 GJ per dwelling by 2026. These movements in average consumption reflect:

(i) the shift in the dwelling stock from separate houses to multi-unit dwellings and apartments;

(ii) the volume reductions associated with higher gas prices projected;

(iii) the warming trend for Tariff V; and

(iii) the impact of Federal and State greenhouse and energy policies outlined in Chapter 6 of this report.

Figure 7.5 shows the percentage growth in volumes by class and tariff over the 2016 to 2026 period for Multinet Gas. Figure 7.6 shows total volume growth by class and tariff over the same period.

Business Tariff V gas consumption represented around 1.0 per cent of total Multinet Gas sales volumes in 2015. Forecast growth over the 2016 to 2026 period is -1.8 per cent per annum. Tariff L volumes fall by 0.7 per cent per annum over the same period.

Figure 7.3: Total average residential gas usage per customer – Total Multinet Gas (GJs)

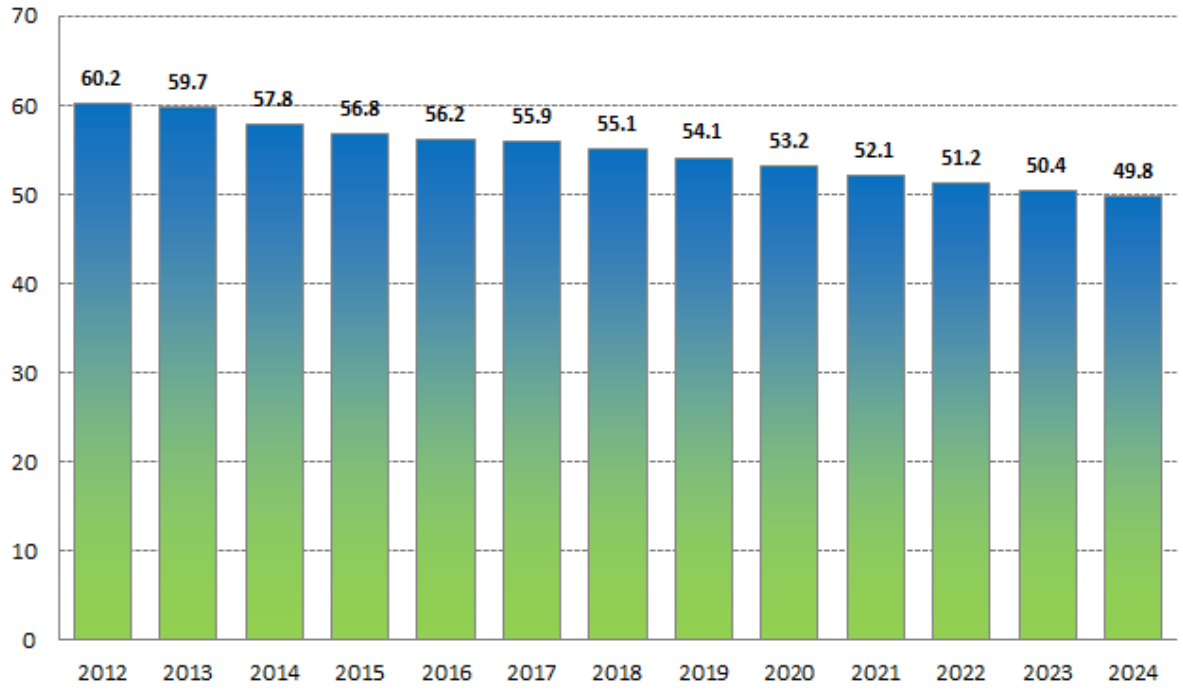
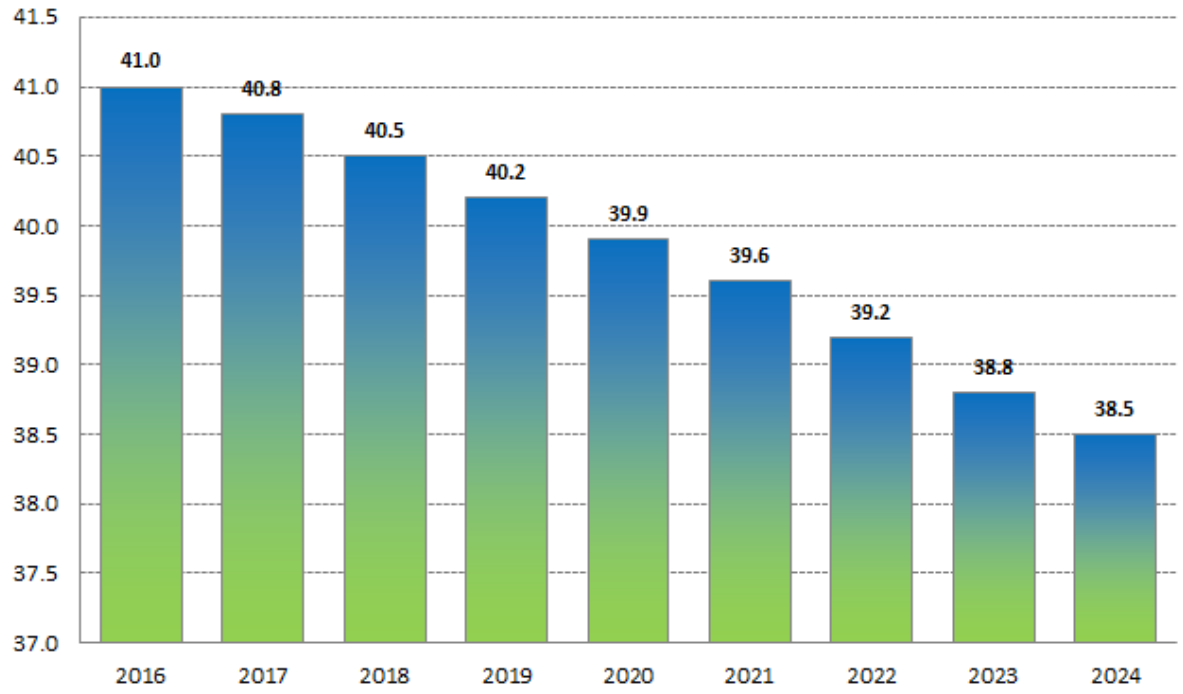


Figure 7.4: Total new residential usage per customer – Total Multinet Gas (GJs)



Tariff D

Industrial Tariff D natural gas consumption from the Multinet Gas region falls by 1.0 per cent per year. There have been a number of major customer losses over recent years in Victoria. Many manufacturers have either closed their Victorian production facilities altogether, or shifted their operations overseas, to countries like China.

Projections of Tariff D volumes, customer numbers and maximum hourly quantities are presented in Table 7.4 on an industry basis.

The projections for Tariff D to 2026 reflect a number of alternative sources of information:

- short term expected changes in gas use collated from a survey of major Tariff D customers by Multinet Gas; and
- the economic prospects for each sector, in terms of overall real output growth projections to 2026. These are produced as part of NIEIR's economic forecast.

A planned expansion by Burra Foods on the South Gippsland network is included in the forecast, but it is largely offset by reduced volumes from another customer on the network.

Figure 7.5: Natural gas sales by tariff and class – 2016 to 2026 – Base scenario (percentage annual growth)

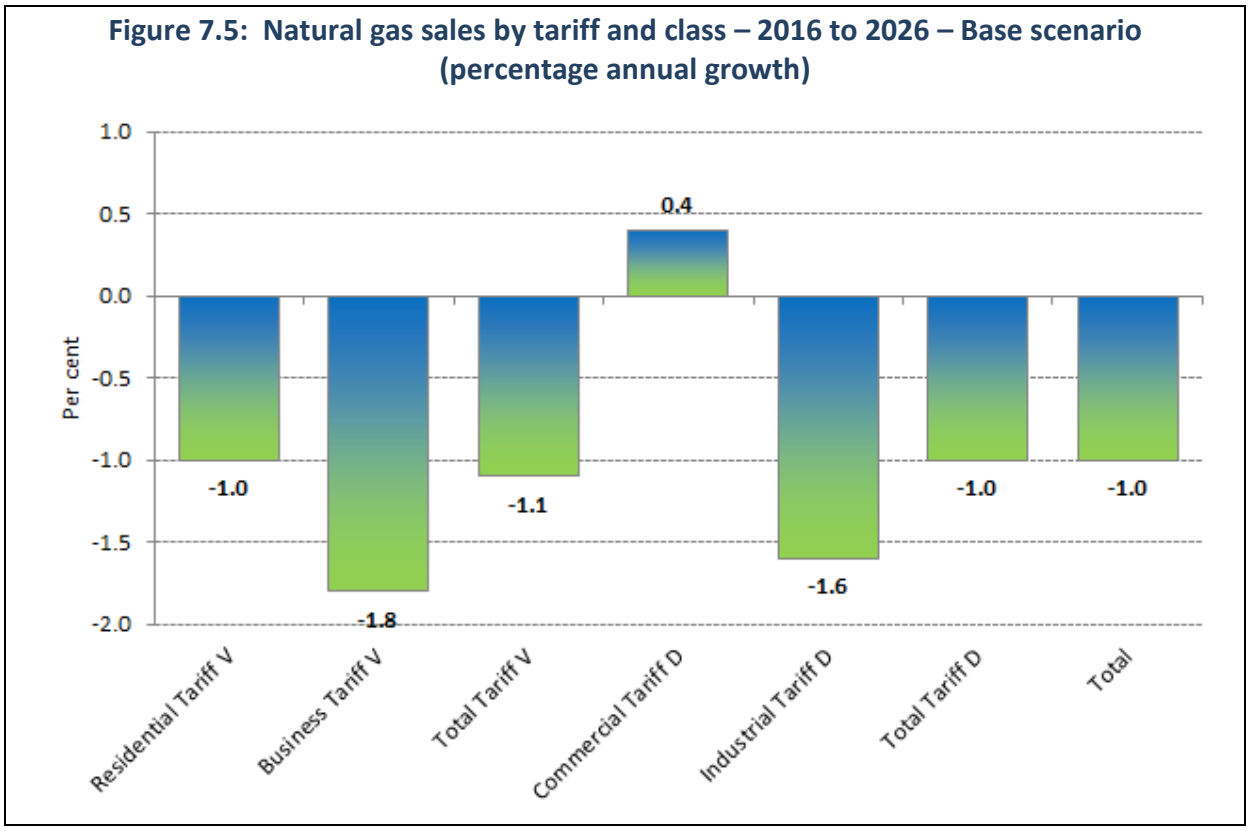
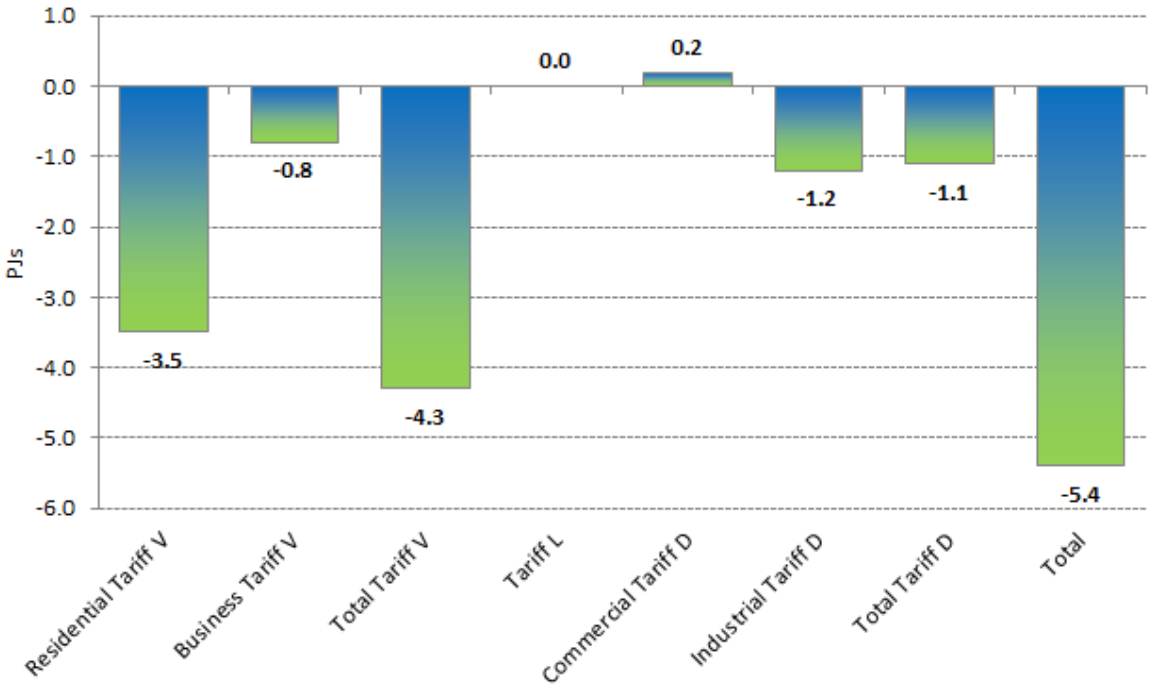


Figure 7.6: Natural gas sales by tariff and class – 2016 to 2026 – Base scenario volume growth 2016 to 2026 (PJs)

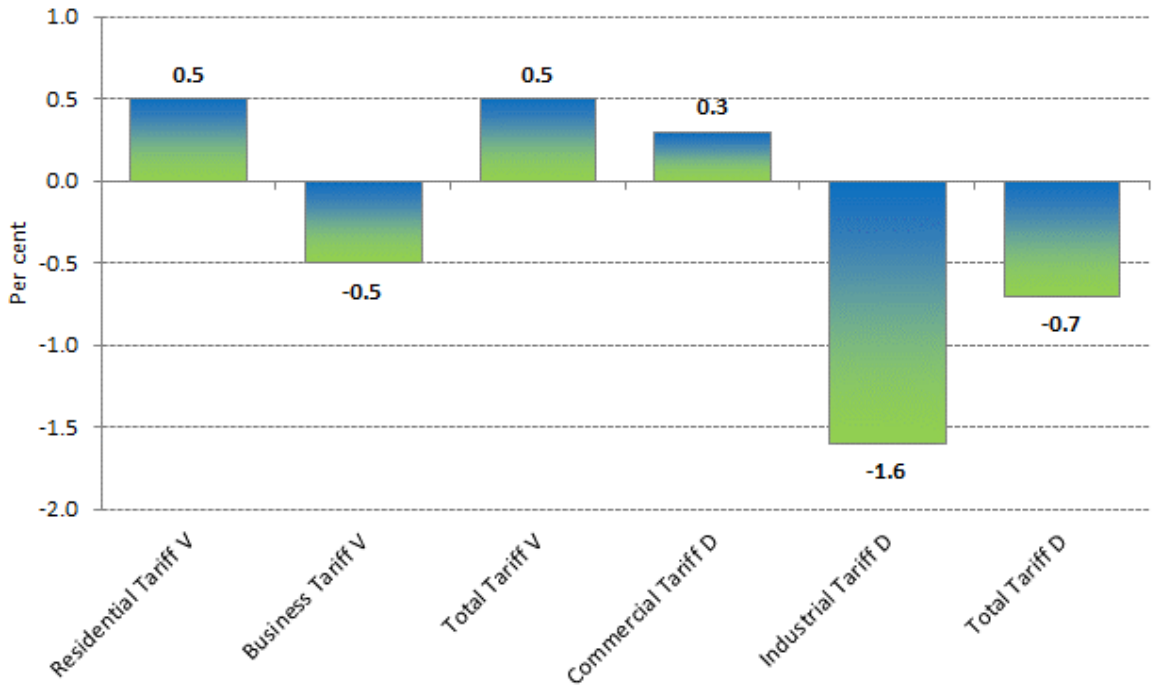


7.4 Customer number and MHQ forecasts to 2026

Table 7.2 presents average customer number forecasts by tariff and class to 2026, and Table 7.3 shows Tariff D maximum hourly quantity projections.

Figure 7.7 shows customer growth by tariff and class over the 2016 to 2026 period for the Multinet Gas distribution region. Figure 7.8 shows the average annual percentage change for Tariff D between 2016 and 2026 in total volumes, total customers and total MHQs.

Figure 7.7: Natural gas customer growth by tariff and class – 2016 to 2026 (percentage annual growth)



Note: Excludes Tariff L customers.

Figure 7.8: Tariff D volume, customer and MHQ growth – 2016 to 2026 (average percentage change)

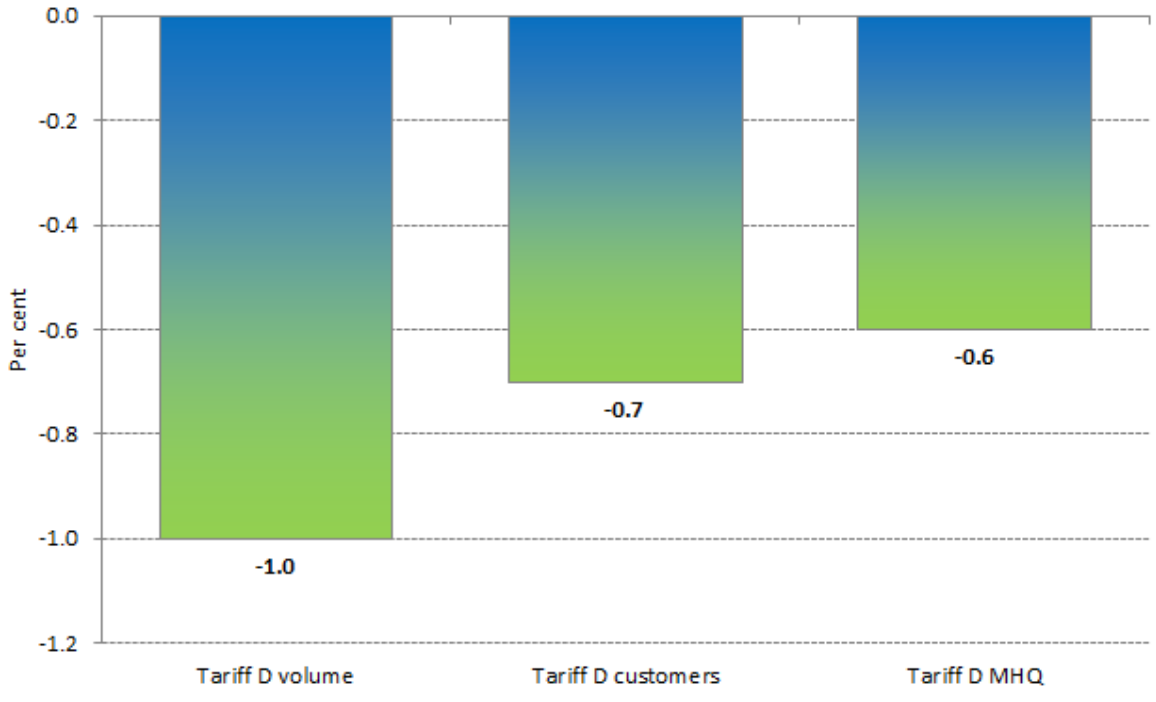


Table 7.1 Multinet Gas Total – volumes – weather normalised (TJs)																
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Average growth (%) 2016-2026	Volume growth 2016-2026
System Total	**56890.4**	**56287.2**	**55604.5**	**54848.5**	**54835.1**	**54273.0**	**53434.2**	**52608.1**	**51712.9**	**50943.1**	**50380.8**	**50011.2**	**49672.2**	**49391.0**	**-1.0**	**-5457.6**
Tariff V	**45240.4**	**44319.9**	**43315.6**	**43039.2**	**42983.8**	**42547.3**	**41942.6**	**41364.7**	**40689.1**	**40082.3**	**39618.6**	**39275.9**	**38968.2**	**38677.2**	**-1.1**	**-4362.0**
Residential Tariff V	*39792.1*	*38792.2*	*38357.4*	*38121.3*	*38071.7*	*37715.0*	*37231.1*	*36776.8*	*36241.3*	*35748.4*	*35373.3*	*35093.8*	*34836.7*	*34594.2*	*-1.0*	*-3527.1*
Existing Customers	39792.1	38792.2	38357.4	37867.7	37549.1	36930.2	36183.1	35470.5	34682.2	33947.2	33324.4	32813.9	32334.1	31860.3	-1.7	-6007.4
New Customers- cumulative	0.0	0.0	0.0	253.6	522.6	784.8	1048.0	1306.4	1559.1	1801.2	2048.9	2279.9	2502.6	2733.9	26.8	2480.3
Business Tariff V	5448.3	5527.7	4958.3	4918.0	4912.0	4832.2	4711.5	4587.9	4447.8	4333.8	4245.3	4182.1	4131.5	4083.0	-1.8	-834.9
Tariff L	73.5	78.3	78.7	67.3	68.4	68.4	66.6	66.4	65.8	65.0	64.4	63.8	63.1	62.5	-0.7	-4.8
Tariff D	**11576.4**	**11889.0**	**12210.2**	**11742.0**	**11782.9**	**11657.4**	**11424.9**	**11176.9**	**10958.0**	**10795.9**	**10697.8**	**10671.6**	**10640.9**	**10651.3**	**-1.0**	**-1090.7**
Commercial Tariff D	*3532.0*	*3517.5*	*3347.6*	*3417.4*	*3484.4*	*3513.9*	*3515.6*	*3510.2*	*3492.2*	*3493.4*	*3508.0*	*3536.5*	*3533.3*	*3571.0*	*0.4*	*153.6*
Electricity, Gas & Water (ex GPG)	8.8	52.8	34.9	35.2	35.6	35.6	35.3	34.9	34.5	34.2	34.1	34.0	34.1	34.1	-0.3	-1.1
Construction	180.0	180.2	184.8	189.7	194.9	198.1	199.8	201.1	202.6	204.2	206.6	210.0	214.2	218.3	1.4	28.6
Wholesale Trade & Retail Trade	220.5	212.8	227.3	232.3	237.6	240.4	241.3	241.3	240.1	240.9	242.6	245.0	248.2	251.7	0.8	19.3
Transport & Storage and Communication Services	10.7	12.3	15.7	16.1	16.5	16.7	16.8	16.8	16.8	16.9	17.0	17.2	17.5	17.8	1.0	1.7
Finance Insurance Property & Business Services plus distributed cogeneration assumption	123.5	176.6	97.2	104.2	107.1	108.9	109.9	110.8	111.5	112.5	114.0	115.9	96.6	97.1	-0.7	-7.1
Government Administration, Defence, Education, Health & Community Serv.	1748.3	1712.4	1615.6	1644.6	1672.7	1682.4	1679.0	1672.6	1658.3	1654.6	1657.5	1667.2	1660.6	1674.2	0.2	29.6
Accommodation, Cafes, Restaurants, Cultural & Recreat. Serv., Personal & Other Serv.	1240.1	1170.4	1172.2	1195.3	1220.1	1231.7	1233.5	1232.6	1228.3	1230.0	1236.3	1247.2	1262.1	1277.8	0.7	82.5
Industrial Tariff D	*8044.5*	*8371.5*	*8862.6*	*8324.6*	*8298.5*	*8143.5*	*7909.3*	*7666.7*	*7465.8*	*7302.5*	*7189.8*	*7135.0*	*7107.6*	*7080.3*	*-1.6*	*-1244.3*
Agriculture	83.9	76.4	104.7	107.7	110.4	111.3	111.2	110.9	110.0	110.0	110.7	112.1	113.8	115.6	0.7	7.9
Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Food, beverages, tobacco manuf.	1444.1	1677.6	2151.3	2174.2	2197.7	2186.4	2154.4	2125.9	2085.5	2059.1	2047.2	2048.5	2056.1	2064.7	-0.5	-109.5
Textiles, clothing & footwear manuf.	29.3	34.6	40.1	38.3	36.7	34.5	32.0	29.6	27.8	26.0	24.4	23.1	21.9	20.8	-5.9	-17.5
Wood and paper, wood products and paper product manuf.	1426.1	1317.8	1240.4	1102.5	1061.1	997.7	924.1	851.0	824.4	800.7	785.8	780.0	777.2	774.7	-3.5	-327.8
Chemicals, petroleum, coal manuf.	767.2	739.9	788.2	776.3	761.6	734.3	701.1	667.7	635.9	607.5	583.7	564.9	548.7	532.7	-3.7	-243.7
Non-metallic minerals manuf.	2746.8	2979.4	2999.2	2756.1	2800.6	2794.2	2756.8	2708.1	2663.1	2629.0	2608.0	2606.7	2615.9	2623.3	-0.5	-132.8
Basic & fabricated metal products manuf.	470.3	536.6	566.2	521.8	510.4	489.6	464.3	438.5	413.6	390.9	371.3	355.4	341.2	327.1	-4.6	-194.7
Transport & other machinery equip. manuf.	567.6	501.4	457.2	329.8	301.5	285.3	268.1	250.8	234.4	219.7	207.5	198.3	190.3	182.5	-5.7	-147.3
Miscellaneous manuf.	509.0	508.0	515.4	517.9	518.5	510.2	497.4	484.1	471.1	459.6	451.1	446.1	442.5	438.9	-1.6	-79.0

Table 7.2 Multinet Gas Total – customers – net customer growth (numbers)															
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Average growth (%) 2016-2026
System Total	**682734**	**687432**	**691129**	**693932**	**697317**	**700584**	**703940**	**707312**	**710449**	**713668**	**717155**	**720289**	**723266**	**726546**	**0.5**
Tariff V	**682452**	**687150**	**690845**	**693655**	**697038**	**700307**	**703667**	**707042**	**710183**	**713405**	**716893**	**720028**	**723006**	**726286**	**0.5**
Residential Tariff V	*666241*	*670964*	*674931*	*677975*	*681420*	*684783*	*688279*	*691752*	*695209*	*698507*	*702048*	*705212*	*708224*	*711548*	*0.5*
Existing Customers	666241	670964	674931	671778	668610	665428	662232	659021	655796	652558	649304	646038	642759	639467	-0.5
New Customers- cumulative	0	0	0	3044	6489	9852	13348	16821	20278	23576	27117	30281	33293	36617	28.2
Business Tariff V	*16211*	*16186*	*15914*	*15680*	*15618*	*15524*	*15388*	*15290*	*14974*	*14898*	*14845*	*14816*	*14783*	*14737*	*-0.6*
Tariff L	*16*	*16*	*15*	*14*	*14*	*14*	*14*	*14*	*14*	*14*	*14*	*14*	*14*	*14*	*0.0*
Tariff D	**266**	**266**	**269**	**263**	**265**	**263**	**259**	**256**	**252**	**249**	**248**	**247**	**246**	**246**	**-0.7**
Commercial Tariff D	*113*	*115*	*120*	*121*	*123*	*124*	*123*	*123*	*123*	*123*	*123*	*124*	*124*	*125*	*0.3*
Electricity, Gas & Water (ex GPG)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-0.1
Construction	3	3	3	3	3	3	3	3	3	3	3	3	3	3	0.5
Wholesale Trade & Retail Trade	15	15	16	16	16	16	16	16	16	16	16	16	17	17	0.6
Transport & Storage and Communication Services	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.6
Finance Insurance Property & Business Services plus distributed cogeneration assumption	3	3	3	3	3	3	3	3	3	3	3	3	3	3	-0.4
Government Administration, Defence, Education, Health & Community Serv.	49	50	52	52	53	53	53	53	52	52	52	53	52	53	0.1
Accommodation, Cafes, Restaurants, Cultural & Recreat. Serv., Personal & Other Serv.	42	43	44	45	46	46	46	46	46	46	46	46	47	47	0.4
Industrial Tariff D	*153*	*151*	*149*	*142*	*142*	*139*	*136*	*133*	*129*	*126*	*125*	*123*	*122*	*121*	*-1.6*
Agriculture	7	7	7	7	7	7	7	7	7	7	7	7	7	7	0.5
Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Food, beverages, tobacco manuf.	32	32	32	32	32	32	32	31	31	31	30	30	30	30	-0.4
Textiles, clothing & footwear manuf.	6	6		6	6	5	5	5	4	4	4	4	4	4	-4.5
Wood and paper, wood products and paper product manuf.	13	13	13	12	12	12	11	11	11	10	10	10	10	10	-1.4
Chemicals, petroleum, coal manuf.	24	24	24	23	23	23	22	21	20	20	19	19	19	18	-2.5
Non-metallic minerals manuf.	15	15	15	14	14	14	14	14	14	14	14	14	14	14	0.0
Basic & fabricated metal products manuf.	22	22	22	20	20	20	19	19	18	17	17	16	16	15	-2.8
Transport & other machinery equip. manuf.	19	19	19	14	14	13	13	12	12	11	11	10	10	10	-3.8
Miscellaneous manuf.	13	13	13	13	13	13	13	12	12	12	12	12	12	12	-0.9

Table 7.3 Multinet Gas Total – MHQ																
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Average growth (%) 2016-2026	Volume growth 2016-2026
System Total	**3622.4**	**3784.9**	**3783.7**	**3723.3**	**3689.8**	**3672.3**	**3637.9**	**3598.8**	**3578.1**	**3544.7**	**3520.9**	**3508.1**	**3501.9**	**3498.7**	**-0.6**	**-224.5**
Tariff V	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Residential Tariff V	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Existing Customers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
New Customers- cumulative	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Business Tariff V	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Tariff L	*57.6*	*57.5*	*57.1*	*50.4*	*51.1*	*51.1*	*50.0*	*49.9*	*49.5*	*49.0*	*48.7*	*48.3*	*47.9*	*47.5*	*-0.6*	*-2.9*
Tariff D	**3564.8**	**3727.4**	**3726.6**	**3672.9**	**3638.7**	**3621.2**	**3587.9**	**3548.9**	**3528.6**	**3495.6**	**3472.2**	**3459.8**	**3454.0**	**3451.2**	**-0.6**	**-221.6**
Commercial Tariff D	*1348.0*	*1402.5*	*1431.2*	*1441.2*	*1449.3*	*1454.2*	*1455.6*	*1455.0*	*1454.5*	*1453.7*	*1455.0*	*1458.3*	*1461.0*	*1464.2*	*0.2*	*22.9*
Electricity, Gas & Water (ex GPG)	0.0	23.1	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	0.0	0.0
Construction	101.3	94.4	92.8	94.4	95.7	96.7	97.4	97.8	98.0	98.5	99.1	100.0	101.1	102.3	0.8	8.0
Wholesale Trade & Retail Trade	187.7	156.5	151.5	152.1	152.6	152.9	153.0	153.0	153.0	153.0	153.1	153.3	153.6	154.0	0.1	1.9
Transport & Storage and Communication Services	4.1	4.4	4.4	4.4	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	0.2	0.1
Finance Insurance Property & Business Services plus distributed cogeneration assumption	26.2	26.2	26.3	26.9	27.3	27.5	27.6	27.7	27.8	27.9	28.0	28.1	27.3	26.3	-0.2	-0.6
Government Administration, Defence, Education, Health & Community Serv.	623.7	623.0	639.1	642.9	645.8	647.2	647.2	646.2	645.6	644.5	644.4	645.2	645.4	645.9	0.0	3.0
Accommodation, Cafes, Restaurants, Cultural & Recreat. Serv., Personal & Other Serv.	404.9	475.0	500.1	503.6	506.5	508.4	509.0	508.8	508.7	508.5	509.0	510.3	512.1	514.3	0.2	10.7
Industrial Tariff D	*2216.8*	*2324.9*	*2295.4*	*2231.6*	*2189.4*	*2167.0*	*2132.3*	*2093.9*	*2074.1*	*2042.0*	*2017.2*	*2001.5*	*1993.1*	*1987.0*	*-1.2*	*-244.6*
Agriculture	56.5	53.6	60.3	60.7	61.0	61.1	61.1	61.1	61.0	61.0	61.0	61.1	61.3	61.6	0.1	0.9
Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Food, beverages, tobacco manuf.	422.6	514.6	532.8	537.0	538.8	537.1	531.9	524.8	521.2	514.3	509.9	507.9	507.7	508.2	-0.5	-28.8
Textiles, clothing & footwear manuf.	21.2	19.5	18.0	17.9	17.7	17.4	17.2	16.9	16.8	16.5	16.3	16.1	15.9	15.7	-1.3	-2.2
Wood and paper, wood products and paper product manuf.	269.4	240.4	239.1	223.6	211.6	202.5	191.7	182.7	178.1	174.1	171.0	169.3	168.6	168.2	-2.8	-55.5
Chemicals, petroleum, coal manuf.	258.8	285.0	292.5	291.2	289.3	286.6	283.1	279.3	277.4	273.8	270.5	267.8	265.4	263.3	-1.0	-27.9
Non-metallic minerals manuf.	603.1	602.6	605.6	578.8	566.3	566.3	560.7	552.7	548.3	541.0	536.0	533.9	534.6	536.2	-0.8	-42.6
Basic & fabricated metal products manuf.	155.5	206.0	165.4	161.4	158.3	155.9	152.7	149.4	147.6	144.2	141.2	138.5	136.2	133.9	-1.8	-27.5
Transport & other machinery equip. manuf.	297.1	269.4	235.9	215.0	200.7	195.2	190.5	185.6	183.0	178.3	174.0	170.4	167.5	164.7	-2.6	-50.3
Miscellaneous manuf.	132.6	133.8	145.8	146.1	145.8	144.9	143.3	141.5	140.6	138.8	137.4	136.4	135.8	135.3	-0.8	-10.8

Table 7.4 Multinet Gas Melbourne – volumes – weather normalised (TJs)																
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Average growth (%) 2016-2026	Volume growth 2016-2026
System Total	**56,244**	**55,418**	**54,171**	**53,384**	**53,335**	**52,759**	**51,916**	**51,083**	**50,190**	**49,417**	**48,844**	**48,455**	**48,092**	**47,787**	**-1.1**	**-5596.9**
Tariff V	**44,844**	**43,929**	**42,839**	**42,540**	**42,463**	**42,011**	**41,392**	**40,803**	**40,117**	**39,502**	**39,027**	**38,672**	**38,351**	**38,046**	**-1.1**	**-4494.0**
Residential Tariff V	*39,466*	*38,475*	*37,956*	*37,703*	*37,636*	*37,268*	*36,773*	*36,309*	*35,765*	*35,263*	*34,878*	*34,587*	*34,318*	*34,063*	*-1.0*	*-3639.7*
Existing Customers	39,466	38,475	37,956	37,464	37,144	36,527	35,784	35,075	34,293	33,563	32,944	32,435	31,957	31,484	-1.7	-5980.1
New Customers- cumulative	-	-	-	238	492	740	989	1,233	1,472	1,700	1,935	2,152	2,361	2,579	26.9	2340.3
Business Tariff V	*5,378*	*5,454*	*4,883*	*4,838*	*4,826*	*4,743*	*4,619*	*4,494*	*4,353*	*4,238*	*4,149*	*4,085*	*4,033*	*3,983*	*-1.9*	*-854.3*
Tariff L	*74*	*78*	*79*	*67*	*68*	*68*	*67*	*66*	*66*	*65*	*64*	*64*	*63*	*62*	*-0.7*	*-4.8*
Tariff D	**11,327**	**11,411**	**11,254**	**10,777**	**10,805**	**10,680**	**10,458**	**10,214**	**10,007**	**9,851**	**9,752**	**9,719**	**9,678**	**9,679**	**-1.1**	**-1098.1**
Commercial Tariff D	*3,532*	*3,518*	*3,348*	*3,417*	*3,484*	*3,514*	*3,516*	*3,510*	*3,492*	*3,493*	*3,508*	*3,537*	*3,533*	*3,571*	*0.4*	*153.6*
Electricity, Gas & Water (ex GPG)	9	53	35	35	36	36	35	35	35	34	34	34	34	34	-0.3	-1.1
Construction	180	180	185	190	195	198	200	201	203	204	207	210	214	218	1.4	28.6
Wholesale Trade & Retail Trade	221	213	227	232	238	240	241	241	240	241	243	245	248	252	0.8	19.3
Transport & Storage and Communication Services	11	12	16	16	16	17	17	17	17	17	17	17	17	18	1.0	1.7
Finance Insurance Property & Business Services plus distributed cogeneration assumption	124	177	97	104	107	109	110	111	112	113	114	116	97	97	-0.7	-7.1
Government Administration, Defence, Education, Health & Community Serv.	1,748	1,712	1,616	1,645	1,673	1,682	1,679	1,673	1,658	1,655	1,658	1,667	1,661	1,674	0.2	29.6
Accommodation, Cafes, Restaurants, Cultural & Recreat. Serv., Personal & Other Serv.	1,240	1,170	1,172	1,195	1,220	1,232	1,234	1,233	1,228	1,230	1,236	1,247	1,262	1,278	0.7	82.5
Industrial Tariff D	*7,795*	*7,894*	*7,906*	*7,359*	*7,320*	*7,166*	*6,942*	*6,703*	*6,514*	*6,357*	*6,244*	*6,182*	*6,145*	*6,108*	*-1.8*	*-1251.6*
Agriculture	84	76	105	108	110	111	111	111	110	110	111	112	114	116	0.7	7.9
Mining	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Food, beverages, tobacco manuf.	1,195	1,200	1,195	1,209	1,219	1,209	1,187	1,163	1,134	1,114	1,101	1,095	1,093	1,092	-1.0	-116.8
Textiles, clothing & footwear manuf.	29	35	40	38	37	34	32	30	28	26	24	23	22	21	-5.9	-17.5
Wood and paper, wood products and paper product manuf.	1,426	1,318	1,240	1,102	1,061	998	924	851	824	801	786	780	777	775	-3.5	-327.8
Chemicals, petroleum, coal manuf.	767	740	788	776	762	734	701	668	636	608	584	565	549	533	-3.7	-243.7
Non-metallic minerals manuf.	2,747	2,979	2,999	2,756	2,801	2,794	2,757	2,708	2,663	2,629	2,608	2,607	2,616	2,623	-0.5	-132.8
Basic & fabricated metal products manuf.	470	537	566	522	510	490	464	439	414	391	371	355	341	327	-4.6	-194.7
Transport & other machinery equip. manuf.	568	501	457	330	302	285	268	251	234	220	208	198	190	183	-5.7	-147.3
Miscellaneous manuf.	509	508	515	518	518	510	497	484	471	460	451	446	443	439	-1.6	-79.0

Table 7.5 Multinet Gas Melbourne – customers – net customer growth (numbers)															
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Average growth (%) 2016-2026
System Total	**675556**	**679814**	**682768**	**685094**	**688016**	**690857**	**693761**	**696700**	**699391**	**702158**	**705205**	**707898**	**710410**	**713222**	**0.4**
Tariff V	**675275**	**679534**	**682486**	**684819**	**687739**	**690582**	**693490**	**696432**	**699127**	**701897**	**704945**	**707639**	**710152**	**712964**	**0.4**
Residential Tariff V	*659185*	*663476*	*666705*	*669282*	*672273*	*675212*	*678257*	*681299*	*684311*	*687156*	*690258*	*692983*	*695530*	*698388*	*0.4*
Existing Customers	659185	663476	666705	663556	660393	657217	654026	650821	647601	644368	641121	637861	634589	631303	-0.5
New Customers- cumulative	0	0	0	2577	5568	8507	11552	14594	17606	20451	23553	26278	28825	31683	28.5
Business Tariff V	*16090*	*16058*	*15781*	*15537*	*15466*	*15371*	*15233*	*15133*	*14816*	*14740*	*14686*	*14656*	*14622*	*14576*	*-0.6*
Tariff L	*16*	*16*	*15*	*14*	*14*	*14*	*14*	*14*	*14*	*14*	*14*	*14*	*14*	*14*	*0.0*
Tariff D	**265**	**264**	**267**	**261**	**263**	**261**	**257**	**254**	**250**	**247**	**246**	**245**	**244**	**244**	**-0.7**
Commercial Tariff D	*113*	*115*	*120*	*121*	*123*	*124*	*123*	*123*	*123*	*123*	*123*	*124*	*124*	*125*	*0.3*
Electricity, Gas & Water (ex GPG)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-0.1
Construction	3	3	3	3	3	3	3	3	3	3	3	3	3	3	0.5
Wholesale Trade & Retail Trade	15	15	16	16	16	16	16	16	16	16	16	16	17	17	0.6
Transport & Storage and Communication Services	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0.6
Finance Insurance Property & Business Services plus distributed cogeneration assumption	3	3	3	3	3	3	3	3	3	3	3	3	3	3	-0.4
Government Administration, Defence, Education, Health & Community Serv.	49	50	52	52	53	53	53	53	52	52	52	53	52	53	0.1
Accommodation, Cafes, Restaurants, Cultural & Recreat. Serv., Personal & Other Serv.	42	43	44	45	46	46	46	46	46	46	46	46	47	47	0.4
Industrial Tariff D	*152*	*149*	*147*	*140*	*140*	*137*	*134*	*131*	*127*	*124*	*123*	*121*	*120*	*119*	*-1.6*
Agriculture	7	7	7	7	7	7	7	7	7	7	7	7	7	7	0.5
Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Food, beverages, tobacco manuf.	31	30	30	30	30	30	30	29	29	29	28	28	28	28	-0.5
Textiles, clothing & footwear manuf.	6	6	6	6	6	5	5	5	4	4	4	4	4	4	-4.5
Wood and paper, wood products and paper product manuf.	13	13	13	12	12	12	11	11	11	10	10	10	10	10	-1.4
Chemicals, petroleum, coal manuf.	24	24	24	23	23	23	22	21	20	20	19	19	19	18	-2.5
Non-metallic minerals manuf.	15	15	15	14	14	14	14	14	14	14	14	14	14	14	0.0
Basic & fabricated metal products manuf.	22	22	22	20	20	20	19	19	18	17	17	16	16	15	-2.8
Transport & other machinery equip. manuf.	19	19	19	14	14	13	13	12	12	11	11	10	10	10	-3.8
Miscellaneous manuf.	13	13	13	13	13	13	13	12	12	12	12	12	12	12	-0.9

Table 7.6 Multinet Gas Melbourne – MHQ																
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Average growth (%) 2016-2026	Volume growth 2016-2026
System Total	**3569.5**	**3626.9**	**3582.9**	**3521.5**	**3487.4**	**3469.8**	**3435.9**	**3397.6**	**3377.2**	**3344.6**	**3321.1**	**3308.0**	**3301.0**	**3296.9**	**-0.7**	**-224.6**
Tariff V	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Residential Tariff V	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Existing Customers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
New Customers- cumulative	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Business Tariff V	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Tariff L	*57.6*	*57.5*	*57.1*	*50.4*	*51.1*	*51.1*	*50.0*	*49.9*	*49.5*	*49.0*	*48.7*	*48.3*	*47.9*	*47.5*	*-0.6*	*-2.9*
Tariff D	**3511.9**	**3569.4**	**3525.8**	**3471.1**	**3436.3**	**3418.7**	**3385.9**	**3347.7**	**3327.7**	**3295.6**	**3272.4**	**3259.7**	**3253.1**	**3249.4**	**-0.7**	**-221.7**
Commercial Tariff D	*1348.0*	*1402.5*	*1431.2*	*1441.2*	*1449.3*	*1454.2*	*1455.6*	*1455.0*	*1454.5*	*1453.7*	*1455.0*	*1458.3*	*1461.0*	*1464.2*	*0.2*	*22.9*
Electricity, Gas & Water (ex GPG)	0.0	23.1	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	0.0	0.0
Construction	101.3	94.4	92.8	94.4	95.7	96.7	97.4	97.8	98.0	98.5	99.1	100.0	101.1	102.3	0.8	8.0
Wholesale Trade & Retail Trade	187.7	156.5	151.5	152.1	152.6	152.9	153.0	153.0	153.0	153.0	153.1	153.3	153.6	154.0	0.1	1.9
Transport & Storage and Communication Services	4.1	4.4	4.4	4.4	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	0.2	0.1
Finance Insurance Property & Business Services plus distributed cogeneration assumption	26.2	26.2	26.3	26.9	27.3	27.5	27.6	27.7	27.8	27.9	28.0	28.1	27.3	26.3	-0.2	-0.6
Government Administration, Defence, Education, Health & Community Serv.	623.7	623.0	639.1	642.9	645.8	647.2	647.2	646.2	645.6	644.5	644.4	645.2	645.4	645.9	0.0	3.0
Accommodation, Cafes, Restaurants, Cultural & Recreat. Serv., Personal & Other Serv.	404.9	475.0	500.1	503.6	506.5	508.4	509.0	508.8	508.7	508.5	509.0	510.3	512.1	514.3	0.2	10.7
Industrial Tariff D	*2163.9*	*2166.9*	*2094.6*	*2029.9*	*1987.0*	*1964.5*	*1930.2*	*1892.7*	*1873.2*	*1842.0*	*1817.4*	*1801.3*	*1792.2*	*1785.2*	*-1.3*	*-244.7*
Agriculture	56.5	53.6	60.3	60.7	61.0	61.1	61.1	61.1	61.0	61.0	61.0	61.1	61.3	61.6	0.1	0.9
Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Food, beverages, tobacco manuf.	369.7	356.6	332.0	335.2	336.4	334.6	329.8	323.6	320.3	314.2	310.1	307.8	306.8	306.4	-0.9	-28.8
Textiles, clothing & footwear manuf.	21.2	19.5	18.0	17.9	17.7	17.4	17.2	16.9	16.8	16.5	16.3	16.1	15.9	15.7	-1.3	-2.2
Wood and paper, wood products and paper product manuf.	269.4	240.4	239.1	223.6	211.6	202.5	191.7	182.7	178.1	174.1	171.0	169.3	168.6	168.2	-2.8	-55.5
Chemicals, petroleum, coal manuf.	258.8	285.0	292.5	291.2	289.3	286.6	283.1	279.3	277.4	273.8	270.5	267.8	265.4	263.3	-1.0	-27.9
Non-metallic minerals manuf.	603.1	602.6	605.6	578.8	566.3	566.3	560.7	552.7	548.3	541.0	536.0	533.9	534.6	536.2	-0.8	-42.6
Basic & fabricated metal products manuf.	155.5	206.0	165.4	161.4	158.3	155.9	152.7	149.4	147.6	144.2	141.2	138.5	136.2	133.9	-1.8	-27.5
Transport & other machinery equip. manuf.	297.1	269.4	235.9	215.0	200.7	195.2	190.5	185.6	183.0	178.3	174.0	170.4	167.5	164.7	-2.6	-50.3
Miscellaneous manuf.	132.6	133.8	145.8	146.1	145.8	144.9	143.3	141.5	140.6	138.8	137.4	136.4	135.8	135.3	-0.8	-10.8

Table 7.7 Multinet Gas Yarra Valley – volumes – weather normalised (TJs)																
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Average growth (%) 2016-2026	Volume growth 2016-2026
System Total	**247**	**233**	**283**	**292**	**301**	**306**	**309**	**313**	**314**	**316**	**319**	**323**	**328**	**332**	**1.3**	**40.5**
Tariff V	**247**	**233**	**283**	**292**	**301**	**306**	**309**	**313**	**314**	**316**	**319**	**323**	**328**	**332**	**1.3**	**40.5**
Residential Tariff V	*234*	*218*	*271*	*280*	*288*	*292*	*296*	*299*	*300*	*302*	*304*	*308*	*312*	*316*	*1.2*	*36.8*
Existing Customers	234	218	271	274	275	274	271	268	264	260	258	257	256	255	-0.7	-19.0
New Customers- cumulative	-	-	-	6	13	19	25	31	36	41	46	51	57	62	26.1	55.8
Business Tariff V	*13*	*14*	*12*	*12*	*13*	*13*	*13*	*14*	*14*	*14*	*14*	*15*	*15*	*16*	*2.7*	*3.7*
Tariff L															*0.0*	*0.0*
Tariff D	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**0.0**	**0.0**
Commercial Tariff D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*0.0*	*0.0*
Electricity, Gas & Water (ex GPG)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Construction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Wholesale Trade & Retail Trade	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Transport & Storage and Communication Services	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Finance Insurance Property & Business Services plus distributed cogeneration assumption	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Government Administration, Defence, Education, Health & Community Serv.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Accommodation, Cafes, Restaurants, Cultural & Recreat. Serv., Personal & Other Serv.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Industrial Tariff D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*0.0*	*0.0*
Agriculture	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Mining	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Food, beverages, tobacco manuf.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Textiles, clothing & footwear manuf.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Wood and paper, wood products and paper product manuf.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Chemicals, petroleum, coal manuf.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Non-metallic minerals manuf.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Basic & fabricated metal products manuf.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Transport & other machinery equip. manuf.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Miscellaneous manuf.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0

Table 7.8 Multinet Gas Yarra Valley – customers – net customer growth (numbers)															
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Average growth (%) 2016-2026
System Total	**4274**	**4412**	**4751**	**4899**	**5070**	**5208**	**5353**	**5491**	**5630**	**5759**	**5884**	**6014**	**6148**	**6282**	**2.5**
Tariff V	**4274**	**4412**	**4751**	**4899**	**5070**	**5208**	**5353**	**5491**	**5630**	**5759**	**5884**	**6014**	**6148**	**6282**	**2.5**
Residential Tariff V	*4236*	*4368*	*4705*	*4850*	*5019*	*5156*	*5301*	*5439*	*5578*	*5706*	*5831*	*5960*	*6094*	*6227*	*2.5*
Existing Customers	4236	4368	4705	4701	4697	4693	4688	4684	4679	4675	4670	4665	4660	4655	-0.1
New Customers- cumulative	0	0	0	145	314	451	596	734	873	1001	1126	1255	1389	1522	26.5
Business Tariff V	*38*	*44*	*46*	*49*	*51*	*51*	*51*	*52*	*52*	*52*	*53*	*53*	*54*	*54*	*1.1*
Tariff L	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0.0*
Tariff D	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0.0**
Commercial Tariff D	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0.0*
Electricity, Gas & Water (ex GPG)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Wholesale Trade & Retail Trade	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Transport & Storage and Communication Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Finance Insurance Property & Business Services plus distributed cogeneration assumption	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Government Administration, Defence, Education, Health & Community Serv.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Accommodation, Cafes, Restaurants, Cultural & Recreat. Serv., Personal & Other Serv.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Industrial Tariff D	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0.0*
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Food, beverages, tobacco manuf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Textiles, clothing & footwear manuf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Wood and paper, wood products and paper product manuf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Chemicals, petroleum, coal manuf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Non-metallic minerals manuf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Basic & fabricated metal products manuf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Transport & other machinery equip. manuf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Miscellaneous manuf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0

Table 7.9 Multinet Gas Yarra Valley – MHQ																
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Average growth (%) 2016-2026	Volume growth 2016-2026
System Total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Tariff V	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Residential Tariff V	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Existing Customers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
New Customers- cumulative	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Business Tariff V	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Tariff L	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Tariff D	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Commercial Tariff D	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Electricity, Gas & Water (ex GPG)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Construction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wholesale Trade & Retail Trade	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transport & Storage and Communication Services	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Finance Insurance Property & Business Services plus distributed cogeneration assumption	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Government Administration, Defence, Education, Health & Community Serv.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Accommodation, Cafes, Restaurants, Cultural & Recreat. Serv., Personal & Other Serv.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Industrial Tariff D	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Agriculture	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Food, beverages, tobacco manuf.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Textiles, clothing & footwear manuf.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wood and paper, wood products and paper product manuf.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chemicals, petroleum, coal manuf.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Non-metallic minerals manuf.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Basic & fabricated metal products manuf.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transport & other machinery equip. manuf.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Miscellaneous manuf.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 7.10 Multinet Gas South Gippsland – volumes – weather normalised (TJs)																
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Average growth (%) 2016-2026	Volume growth 2016-2026
System Total	**399**	**636**	**1,151**	**1,172**	**1,199**	**1,208**	**1,208**	**1,213**	**1,209**	**1,210**	**1,219**	**1,234**	**1,252**	**1,271**	**0.8**	**98.8**
Tariff V	**150**	**158**	**194**	**207**	**220**	**231**	**241**	**249**	**257**	**265**	**273**	**281**	**290**	**299**	**3.7**	**91.5**
Residential Tariff V	*92*	*99*	*130*	*139*	*147*	*155*	*162*	*169*	*176*	*183*	*191*	*198*	*207*	*215*	*4.5*	*75.8*
Existing Customers	92	99	130	130	130	129	128	127	125	124	123	122	122	121	-0.7	-8.3
New Customers- cumulative	-	-	-	9	17	26	34	42	51	59	68	76	85	93	26.1	84.2
Business Tariff V	*57*	*60*	*64*	*68*	*73*	*76*	*79*	*80*	*81*	*82*	*82*	*82*	*83*	*84*	*2.1*	*15.6*
Tariff L															*0.0*	*0.0*
Tariff D	**249**	**478**	**957**	**965**	**978**	**977**	**967**	**963**	**951**	**945**	**946**	**953**	**963**	**972**	**0.1**	**7.3**
Commercial Tariff D	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*0.0*	*0.0*
Electricity, Gas & Water (ex GPG)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Construction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Wholesale Trade & Retail Trade	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Transport & Storage and Communication Services	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Finance Insurance Property & Business Services plus distributed cogeneration assumption	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Government Administration, Defence, Education, Health & Community Serv.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Accommodation, Cafes, Restaurants, Cultural & Recreat. Serv., Personal & Other Serv.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Industrial Tariff D	*249*	*478*	*957*	*965*	*978*	*977*	*967*	*963*	*951*	*945*	*946*	*953*	*963*	*972*	*0.1*	*7.3*
Agriculture	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Mining	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Food, beverages, tobacco manuf.	249	478	957	965	978	977	967	963	951	945	946	953	963	972	0.1	7.3
Textiles, clothing & footwear manuf.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Wood and paper, wood products and paper product manuf.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Chemicals, petroleum, coal manuf.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Non-metallic minerals manuf.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Basic & fabricated metal products manuf.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Transport & other machinery equip. manuf.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0
Miscellaneous manuf.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	0.0

Table 7.11 Multinet Gas South Gippsland – customers – net customer growth (numbers)															
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Average growth (%) 2016-2026
System Total	**2904**	**3206**	**3610**	**3939**	**4230**	**4519**	**4826**	**5120**	**5427**	**5752**	**6066**	**6377**	**6708**	**7042**	**6.0**
Tariff V	**2903**	**3204**	**3608**	**3937**	**4228**	**4517**	**4824**	**5118**	**5425**	**5750**	**6064**	**6375**	**6706**	**7040**	**6.0**
Residential Tariff V	*2820*	*3120*	*3521*	*3843*	*4128*	*4415*	*4720*	*5013*	*5319*	*5644*	*5958*	*6269*	*6599*	*6933*	*6.1*
Existing Customers	2820	3120	3521	3520	3519	3519	3518	3517	3516	3515	3513	3512	3511	3510	-0.0
New Customers- cumulative	0	0	0	322	607	894	1199	1492	1798	2123	2437	2748	3078	3412	26.6
Business Tariff V	*83*	*84*	*87*	*94*	*101*	*102*	*104*	*105*	*106*	*106*	*106*	*106*	*107*	*107*	*1.3*
Tariff L	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0.0*
Tariff D	**1**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**0.1**
Commercial Tariff D	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0.0*
Electricity, Gas & Water (ex GPG)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Wholesale Trade & Retail Trade	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Transport & Storage and Communication Services	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Finance Insurance Property & Business Services plus distributed cogeneration assumption	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Government Administration, Defence, Education, Health & Community Serv.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Accommodation, Cafes, Restaurants, Cultural & Recreat. Serv., Personal & Other Serv.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Industrial Tariff D	*1*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*0.1*
Agriculture	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Mining	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Food, beverages, tobacco manuf.	1	2	2	2	2	2	2	2	2	2	2	2	2	2	0.1
Textiles, clothing & footwear manuf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Wood and paper, wood products and paper product manuf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Chemicals, petroleum, coal manuf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Non-metallic minerals manuf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Basic & fabricated metal products manuf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Transport & other machinery equip. manuf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Miscellaneous manuf.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0

Table 7.12 Multinet Gas South Gippsland – MHQ																
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Average growth (%) 2016-2026	Volume growth 2016-2026
System Total	**52.9**	**158.0**	**200.8**	**201.8**	**202.4**	**202.5**	**202.0**	**201.2**	**200.9**	**200.0**	**199.8**	**200.1**	**200.9**	**201.8**	**0.0**	**0.1**
Tariff V	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Residential Tariff V	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Existing Customers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
New Customers- cumulative	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Business Tariff V	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Tariff L	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Tariff D	**52.9**	**158.0**	**200.8**	**201.8**	**202.4**	**202.5**	**202.0**	**201.2**	**200.9**	**200.0**	**199.8**	**200.1**	**200.9**	**201.8**	**0.0**	**0.1**
Commercial Tariff D	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Electricity, Gas & Water (ex GPG)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Construction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wholesale Trade & Retail Trade	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transport & Storage and Communication Services	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Finance Insurance Property & Business Services plus distributed cogeneration assumption	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Government Administration, Defence, Education, Health & Community Serv.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Accommodation, Cafes, Restaurants, Cultural & Recreat. Serv., Personal & Other Serv.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Industrial Tariff D	*52.9*	*158.0*	*200.8*	*201.8*	*202.4*	*202.5*	*202.0*	*201.2*	*200.9*	*200.0*	*199.8*	*200.1*	*200.9*	*201.8*	*0.0*	*0.1*
Agriculture	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Food, beverages, tobacco manuf.	52.9	158.0	200.8	201.8	202.4	202.5	202.0	201.2	200.9	200.0	199.8	200.1	200.9	201.8	0.0	0.1
Textiles, clothing & footwear manuf.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wood and paper, wood products and paper product manuf.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chemicals, petroleum, coal manuf.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Non-metallic minerals manuf.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Basic & fabricated metal products manuf.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transport & other machinery equip. manuf.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Miscellaneous manuf.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 7.13 Tariff L – Business Melbourne														
	2013	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**
Volumes – Energy	73.5	78.3	78.7	67.3	68.4	68.4	66.6	66.4	65.8	65.0	64.4	63.8	63.1	62.5
Customers	16	16	15	14	14	14	14	14	14	14	14	14	14	14
MHQ	57.6	57.5	57.1	50.4	51.1	51.1	50.0	49.9	49.5	49.0	48.7	48.3	47.9	47.5
MHQ Peak Period	47.0	54.2	53.2	44.6	45.6	46.7	45.3	44.9	44.7	44.4	44.0	43.6	43.3	43.0
Energy														
Peak	31.5	36.4	37.2	30.7	31.8	31.8	30.8	30.9	30.6	30.1	29.9	29.6	29.3	29.0
Off-Peak	26.9	28.3	28.0	24.3	24.6	24.5	24.0	23.9	23.6	23.4	23.2	22.9	22.7	22.5
Shoulder	15.1	13.5	13.4	12.3	11.9	12.0	11.8	11.7	11.6	11.5	11.4	11.3	11.1	11.0
Total	**73.5**	**78.3**	**78.7**	**67.3**	**68.4**	**68.4**	**66.6**	**66.4**	**65.8**	**65.0**	**64.4**	**63.8**	**63.1**	**62.5**
Bands														
Peak														
< 5 GJs per day	7.9	8.2	7.6	6.9	6.9	6.8	6.7	6.7	6.6	6.6	6.5	6.4	6.4	6.3
> 5 GJs per day	23.6	28.2	29.7	23.8	24.9	25.0	24.1	24.2	23.9	23.6	23.4	23.2	22.9	22.7
Total	**31.5**	**36.4**	**37.2**	**30.7**	**31.8**	**31.8**	**30.8**	**30.9**	**30.6**	**30.1**	**29.9**	**29.6**	**29.3**	**29.0**
Off-Peak														
< 5 GJs per day	10.7	10.9	10.7	9.4	9.4	9.4	9.2	9.2	9.1	9.0	8.9	8.8	8.7	8.6
> 5 GJs per day	16.2	17.5	17.3	14.9	15.1	15.1	14.7	14.7	14.5	14.4	14.2	14.1	13.9	13.8
Total	**26.9**	**28.3**	**28.0**	**24.3**	**24.6**	**24.5**	**24.0**	**23.9**	**23.6**	**23.4**	**23.2**	**22.9**	**22.7**	**22.5**
Shoulder														
< 5 GJs per day	4.2	4.0	3.7	3.5	3.4	3.4	3.3	3.3	3.3	3.2	3.2	3.2	3.1	3.1
> 5 GJs per day	10.9	9.5	9.7	8.8	8.6	8.6	8.5	8.4	8.3	8.2	8.2	8.1	8.0	7.9
Total	**15.1**	**13.5**	**13.4**	**12.3**	**11.9**	**12.0**	**11.8**	**11.7**	**11.6**	**11.5**	**11.4**	**11.3**	**11.1**	**11.0**
Grand total	**73.5**	**78.3**	**78.7**	**67.3**	**68.4**	**68.4**	**66.6**	**66.4**	**65.8**	**65.0**	**64.4**	**63.8**	**63.1**	**62.5**

Table 7.14 Multinet Gas Total – MHQ<50																
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Average growth (%) 2016-2026	Volume growth 2016-2026
System Total	**3126.4**	**3234.6**	**3144.8**	**3109.5**	**3082.1**	**3066.9**	**3039.2**	**3006.5**	**2989.4**	**2961.2**	**2940.7**	**2929.3**	**2923.0**	**2919.1**	**-0.6**	**-190.5**
Tariff V	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Residential Tariff V	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Existing Customers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
New Customers- cumulative	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Business Tariff V	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Tariff L	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Tariff D	**3126.4**	**3234.6**	**3144.8**	**3109.5**	**3082.1**	**3066.9**	**3039.2**	**3006.5**	**2989.4**	**2961.2**	**2940.7**	**2929.3**	**2923.0**	**2919.1**	**-0.6**	**-190.5**
Commercial Tariff D	*1208.3*	*1238.4*	*1271.1*	*1275.7*	*1282.8*	*1287.1*	*1288.4*	*1287.9*	*1287.4*	*1286.7*	*1288.0*	*1290.9*	*1293.1*	*1295.9*	*0.2*	*20.2*
Electricity, Gas & Water (ex GPG)	0.0	23.1	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9	0.0	0.0
Construction	84.8	78.1	76.7	78.0	79.1	79.9	80.5	80.8	81.0	81.4	81.9	82.6	83.5	84.5	0.8	6.6
Wholesale Trade & Retail Trade	205.3	156.5	151.5	152.1	152.6	152.9	153.0	153.0	153.0	153.0	153.1	153.3	153.6	154.0	0.1	1.9
Transport & Storage and Communication Services	4.1	4.4	4.4	4.4	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	0.2	0.1
Finance Insurance Property & Business Services plus distributed cogeneration assumption	26.2	26.2	26.3	26.9	27.3	27.5	27.6	27.7	27.8	27.9	28.0	28.1	27.3	26.3	-0.2	-0.6
Government Administration, Defence, Education, Health & Community Serv.	538.1	517.0	534.9	535.8	538.2	539.4	539.4	538.6	538.1	537.1	537.1	537.8	537.9	538.3	0.0	2.5
Accommodation, Cafes, Restaurants, Cultural & Recreat. Serv., Personal & Other Serv.	349.9	433.3	460.4	461.6	464.2	465.9	466.5	466.3	466.2	466.0	466.5	467.7	469.3	471.3	0.2	9.8
Industrial Tariff D	*1918.1*	*1996.1*	*1873.6*	*1833.9*	*1799.3*	*1779.8*	*1750.7*	*1718.6*	*1702.0*	*1674.4*	*1652.7*	*1638.4*	*1629.8*	*1623.2*	*-1.2*	*-210.7*
Agriculture	56.5	53.6	60.3	60.7	61.0	61.1	61.1	61.1	61.0	61.0	61.0	61.1	61.3	61.6	0.1	0.9
Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Food, beverages, tobacco manuf.	419.7	456.6	430.3	434.9	436.4	434.6	429.6	423.0	419.6	413.1	408.9	406.7	406.1	406.2	-0.7	-28.7
Textiles, clothing & footwear manuf.	21.2	19.5	18.0	17.9	17.7	17.4	17.2	16.9	16.8	16.5	16.3	16.1	15.9	15.7	-1.3	-2.2
Wood and paper, wood products and paper product manuf.	174.5	201.7	165.4	158.5	149.9	143.5	135.9	129.5	126.2	123.4	121.2	120.0	119.5	119.2	-2.8	-39.3
Chemicals, petroleum, coal manuf.	258.8	249.9	259.3	256.7	255.0	252.6	249.6	246.2	244.5	241.3	238.5	236.0	234.0	232.1	-1.0	-24.6
Non-metallic minerals manuf.	410.1	405.6	393.3	382.7	374.5	374.5	370.8	365.5	362.6	357.8	354.4	353.1	353.6	354.6	-0.8	-28.2
Basic & fabricated metal products manuf.	155.5	206.0	165.4	161.4	158.3	155.9	152.7	149.4	147.6	144.2	141.2	138.5	136.2	133.9	-1.8	-27.5
Transport & other machinery equip. manuf.	289.1	269.4	235.9	215.0	200.7	195.2	190.5	185.6	183.0	178.3	174.0	170.4	167.5	164.7	-2.6	-50.3
Miscellaneous manuf.	132.6	133.8	145.8	146.1	145.8	144.9	143.3	141.5	140.6	138.8	137.4	136.4	135.8	135.3	-0.8	-10.8

Table 7.15 Multinet Gas Total – MHQ>50																
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	Average growth (%) 2016-2026	Volume growth 2016-2026
System Total	**455.9**	**531.4**	**581.8**	**563.3**	**556.6**	**554.3**	**548.7**	**542.4**	**539.1**	**534.5**	**531.5**	**530.5**	**531.1**	**532.2**	**-0.6**	**-31.2**
Tariff V	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
Residential Tariff V	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Existing Customers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
New Customers- cumulative	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Business Tariff V	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Tariff L	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Tariff D	**455.9**	**531.4**	**581.8**	**563.3**	**556.6**	**554.3**	**548.7**	**542.4**	**539.1**	**534.5**	**531.5**	**530.5**	**531.1**	**532.2**	**-0.6**	**-31.2**
Commercial Tariff D	*157.2*	*164.1*	*160.1*	*165.5*	*166.5*	*167.1*	*167.2*	*167.1*	*167.1*	*166.9*	*167.1*	*167.5*	*167.8*	*168.3*	*0.2*	*2.8*
Electricity, Gas & Water (ex GPG)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Construction	16.5	16.4	16.2	16.4	16.6	16.8	16.9	17.0	17.0	17.1	17.2	17.4	17.6	17.8	0.8	1.4
Wholesale Trade & Retail Trade	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transport & Storage and Communication Services	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Finance Insurance Property & Business Services plus distributed cogeneration assumption	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Government Administration, Defence, Education, Health & Community Serv.	85.6	106.0	104.2	107.1	107.6	107.8	107.8	107.6	107.5	107.3	107.3	107.5	107.5	107.6	0.0	0.5
Accommodation, Cafes, Restaurants, Cultural & Recreat. Serv., Personal & Other Serv.	55.1	41.7	39.7	42.1	42.3	42.5	42.5	42.5	42.5	42.5	42.5	42.6	42.8	43.0	0.2	0.9
Industrial Tariff D	*298.7*	*367.3*	*421.7*	*397.8*	*390.1*	*387.2*	*381.5*	*375.3*	*372.1*	*367.6*	*364.4*	*363.1*	*363.3*	*363.8*	*-0.9*	*-33.9*
Agriculture	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mining	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Food, beverages, tobacco manuf.	2.9	58.0	102.5	102.1	102.4	102.5	102.2	101.8	101.6	101.2	101.0	101.2	101.6	102.1	-0.0	-0.0
Textiles, clothing & footwear manuf.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wood and paper, wood products and paper product manuf.	94.9	77.2	73.7	65.1	61.6	59.0	55.9	53.2	51.9	50.7	49.8	49.3	49.1	49.0	-2.8	-16.2
Chemicals, petroleum, coal manuf.	0.0	35.1	33.3	34.5	34.3	34.0	33.5	33.1	32.9	32.4	32.0	31.7	31.4	31.2	-1.0	-3.3
Non-metallic minerals manuf.	193.0	196.9	212.3	196.0	191.8	191.8	189.9	187.2	185.7	183.2	181.5	180.8	181.1	181.6	-0.8	-14.4
Basic & fabricated metal products manuf.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transport & other machinery equip. manuf.	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Miscellaneous manuf.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Appendix A: Reconciliation of ABS Divisions and Local Government Areas with gas distribution regions

Table A.1 Melbourne LGAs and Multinet Gas Distribution Zones		
SD Name	**Company zone**	**Weight based on new pop**
Bayside (C)	Multinet Gas	1.00
Boroondara (C)	Multinet Gas	1.00
Cardinia (S)	Multinet Gas	0.27
Casey (C)	Multinet Gas	0.21
Glen Eira (C)	Multinet Gas	1.00
Greater Dandenong (C)	Multinet Gas	0.64
Kingston (C)	Multinet Gas	1.00
Knox (C)	Multinet Gas	1.00
Manningham (C)	Multinet Gas	1.00
Maroondah (C)	Multinet Gas	1.00
Melbourne (C)	Multinet Gas	0.17
Monash (C)	Multinet Gas	1.00
Nillumbik (S)	Multinet Gas	0.04
Port Phillip (C)	Multinet Gas	1.00
Stonnington (C)	Multinet Gas	1.00
Whitehorse (C)	Multinet Gas	1.00
Yarra Ranges (S)	Multinet Gas	0.76

Appendix B: The price elasticity of natural gas demand

B.1 Introduction and background

This chapter contains an overview of NIEIR's approach to incorporating own-price and cross-price elasticities for natural gas demand that were used to estimate price impacts for forecasts of Multinet gas consumption.

Selection of appropriate own price elasticities for Multinet are based on an extensive literature survey of Australian and International energy empirical studies and NIEIRs own econometric analysis of Australian energy data.

The structure of this chapter is as follows:

- **Section 2 defines the concept of price elasticities;**
- **Section 3 reviews empirical estimates made overseas and in Australia; and**
- **Section 4 contains the price elasticities.**

B.2 The own and cross-price elasticity of natural gas demand – a note on definitions

Typically, a price increase of a good leads a reduction of the demand of the good (gas). The magnitude of this reduction depends on the own-price elasticity of demand, defined as the percentage change in the quantity of natural gas demanded in response to a 1.0 percentage point change in the price of natural gas.

For substitute goods (electricity), cross-price elasticities are used to measure the responsiveness of demand for one product to changes in the price of another. The higher the cross-price elasticity the greater will be the substitutability of products.

The own-price elasticity of demand is closely related (though not equal) to the slope of the demand function, which reflects current preferences (consumer demand), technology (producer demand of intermediate goods), and availability of substitute goods. Theoretically, since all these basic characteristics can change, especially in the long run, the changes in prices generally have a larger impact in the long run than in the short run, i.e. the long-term elasticity is generally higher than the short-term one.

Furthermore, in the short run, energy consumers are assumed to have a fixed capital stock, whilst in the long run energy consumers are assumed to change their stock of energy consuming appliances and equipment.

The majority of empirical studies in this area report that the demand for natural gas is price inelastic in both the short and long run. This means that a 1.0 per cent change in the gas price will lead to a less than 1.0 per cent change in the quantity of gas demanded.

It should be noted that the application of price elasticity estimates to predict consumer behaviour has various limitations.

First, the magnitude of the price change influences the consumer response, because the price elasticity is a marginal measure and not generally constant along the demand curve. Therefore the magnitude of the demand response to a price change depends on the actual price of the good and on the magnitude of the price change. At a low price level the effect of a price increase will be relatively smaller than at a high price level.

Second, the effect of a per cent increase in the energy price is not equal to the equivalent effect of a per cent decrease in the energy price. This elasticity asymmetry is due to, for example, the irreversibility of efficiency improvements. People invest in energy conservation when prices are high in the expectation that prices will stay at that level or become even higher. When prices nevertheless start falling, there is usually no reason to remove the energy saving equipment that has been installed.

Third, the source of a price increase affects consumer responses. It has been found that consumers respond differently to changes in prices if these are perceived as permanent more than temporary.

In summary, there is not a unique price elasticity of natural gas but rather a range of price elasticities. In the following sections we assess the most likely range of price elasticities based on the existing literature.

B.3 A review of empirical estimates of the own and cross-price elasticity of natural gas demand

Since the 1970's, a range of studies aimed to estimate price elasticities for energy. The increases of oil prices between 1973 and 1979 may have exacerbated this research on energy price elasticities. Price elasticities of energy have been estimated for several countries in different years, with static or dynamic models, using different demand function specifications, data and estimation techniques. Empirical models of gas consumption generally fall into the following groups:

(i) single equation models which seek to directly identify the determinants of gas consumption;

(ii) industry based consumption models benchmarked on production function theory; and

(iii) end-use type models which are mainly based on the end-use efficiency of alternative appliances/end-uses, appliance penetration rates, and overall stock growth.

Empirical estimates of the price elasticities of demand for natural gas differ significantly. The different results reflect a number of important factors including:

(i) alternative theoretical approaches (e.g. alternative production function models);

(ii) whether they are based on time-series, cross sectional, or time-series cross sectional data;

(iii) estimation technique (e.g. ordinary least squares or systems estimator);

(iv) the periodicity of the data and measurement errors in the data;

(v) the choice and calculation of explanatory variables;

(vi) the sample period (the historical period over which the elasticity was calculated); and

(vii) the level of aggregation of data and analysis (e.g. State, country or across multiple countries).

All these factors contribute to significant variations in the reported price elasticity of gas demand. It is difficult to decide which approach provides the most reliable estimates. Ideally, information is needed on the whole demand curve. This is, however, impossible. The best one can do is to consider all the estimates provided by different approaches and link them to concrete methods, data and assumptions used. Subsequently, one can assume that the 'real' price elasticity will fall somewhere inside the range of estimates.

Australian empirical estimates of the short run, long run and cross-price elasticity of gas demand by sector are presented in Tables B.1, B.2 and B.3 respectively. Note that the time period definitions of long run and short run can differ between studies.

- **Brain and Schuyers reported short run price elasticities of between -0.1 for the industrial sector and -0.4 for the residential sector. Brian and Schuyers report energy demand equations and price elasticities across a range of disaggregated Australian industries.**
- **Woodland (1993) for two-digit ASIC industries in New South Wales the elasticity ranged between -1.2 and -1.4. The results of Woodland are not supported by the international literature. Woodland used cross sectional observations in his analysis.**
- **The AGA (1996) presented selected price elasticities of Australian energy demand prepared by ABARE. This study generally reported lower price elasticities than those reported by early Australian research and overseas research.**
- **Akmal and Stein (2001) reported a -0.70 long run elasticity for the residential sector using national level Australian data from 1969 to 1998. They estimated a set of own and cross-price elasticities for residential energy using a single equation approach. In contrast, Akmal (2002) used an alternate methodology of a system of equations on the same set of data to find a residential long run elasticity of -0.59.**
- **Harman and Anderson (1999) also find a -0.65 long run elasticity for the residential sector using the same data as above.**

Table B.1 Australian empirical estimates of the short run own-price elasticity of gas demand

	Residential	Commercial	Industrial
Brain and Schuyers (1981)	-0.39	-0.17	-0.13
DRE (1985)	-0.30		
ABARE (1992)	-0.30		
Kalt (1993)	-0.27	-0.37	-0.37
Woodland (1993)			-1.2 to -1.4
AGA (1996)	-0.27	-0.09	-0.29
DOE (1998)			-0.1 to –0.4
Harman and Anderson (1999)	-0.54		

Table B.2 Australian empirical estimates of the long run own-price elasticity of gas demand

	Residential	Commercial	Industrial
Brain and Schuyers (1981)	-1.80	-0.45	-0.44
Turnovsky (1982)			-1.45
Rushdi (1986)	-1.53		
GASCOR (1990)			-1.0
ABARE (1992)	-0.30		
Kalt (1993)	-0.79	-0.82	-0.82
AGA (1996)	-0.78	-0.10	-0.30
DOE (1998)			-0.1 to –0.4
NIEIR (1998)	-0.22	-0.15	-0.34
Harman and Anderson (1999)	-0.65		
Akmal and Stern (2001)	-0.70		
Akmal (2002)	-0.59		

Table B.3 Australian empirical estimates of the cross-price elasticity of gas demand						
	Residential		Commercial		Industrial	
	SR	LR	SR	LR	SR	LR
Brain and Schuyers (1981)	0.08*	0.77*	-0.51*	-1.10*	-0.19*	-0.12*
AGA (1996)		0.83*		-0.37*		0.00*
		-0.08^		0.16^		0.07^
DOE (1998) – industrial	0.02 to -0.18*; -0.03 to -0.53^; 0.09 to 0.75#; -0.01 to -0.69!					
CREEDAC (1999)	-0.7*					
ABARE (1991)	Aggregate gas demand LR 0.82					
Akmal and Stern (2001)		0.870*				
		-0.186^				

Notes: Δ Price; * = electricity; ^ = other fuels; # = petroleum; ! = coal.

Overall, the studies reviewed reveal the long run price elasticity of gas has declined over time. We believe this reflects the change in the structure of energy demand by sector. Most overseas and Australian studies estimated elasticities over a period when oil products were still used in significant quantities in non-transport end-uses. The oil shock of 1978-79 seems to have altered energy demand within Australia. As shown in Akmal and Stern (2001), the growth rate of electricity consumption slowed while the overall trend growth rate of gas consumption increased.

The Australian cross-price elasticities show that residential consumers are more able to substitute between types of energy in the long run than Industrial consumers. The reported long run cross-price elasticities for a change in gas demand for a 1 per cent increase in electricity prices range from 0.77 to 0.870 within the surveyed studies. While Industrial consumers gas demand are not overly responsive to changes in electricity prices with ranges between -0.18 and 0. This could reflect the higher barriers faced by industrial consumers in switching between energy consuming technologies relative to residential consumers.

NIEIR's recent energy modelling work based on time series models generally supports lower price elasticities of demand for gas than reported in the literature (excluding the AGA study results)[17]. Hence the price elasticities employed for the GAAR 2018 to 2022 period are discounted relative to the long-run price elasticities presented in the literature survey. This also takes into account the downward trend in gas own price elasticities (gas demand becoming more price inelastic).

A selection of results from overseas studies is reported in Table B.4, where selected overseas price elasticity estimates for gas are presented.

More recent international literature supports this finding, these show a more inelastic modern gas market than previous literature. Although these results could be understated due to the averaging that is needed to combine elasticities on such an aggregate level. For example, Krichene (2005) reports a long run elasticity of -0.06 across all sectors and Asche et al (2008) finds -0.10 for the residential sector for a selection of UE countries. However, while the North American market is slightly more elastic, the same downward trend is present across the literature.

[17] For example, by analysing gas demand by industry from data supplied by the Department of Industry, Innovation and Science.

Table B.4 The own and cross-price elasticity of gas demand – summary of selected overseas studies for aggregate and industry sectors				
Aggregate	**Sector**	**SR**	**LR**	**Cross Pelec**
World				
Krichene (2005)	Aggregate	-0.01	-0.06	
Industry/Manufacturing				
Canada				
Pindyck (1979)	Industry		-0.41	-0.96
OECD				
Liu (2004)	Industry	-0.067	-0.243	
United Kingdom				
Anderson et al (2011)	Industry	-0.121	-0.429	-0.009
United States				
Pindyck (1979)	Industry		-0.67	-0.43
Davis and Muehlegger (2010)	Industry		-0.709	

Table B.5 The own and cross-price elasticity of gas demand – summary of selected overseas studies for the residential sector				
Aggregate	**Sector**	**SR**	**LR**	**Cross Pelec**
RESIDENTIAL/COMMERCIAL				
Canada				
CREEDAC (1999)	Residential	-0.30	-1.0	-0.70
Pindyck (1973)	Residential		-1.0	-1.03
Netherlands				
Booij (1992)	Residential	-0.25 to -0.40		
Berkhout *et al.* (2004)	Residential		-0.19	
OECD				
Liu (2004)	Residential	-0.102	-0.364	
Bernstein and Madlener (2011) – 12 Countries	Residential	-0.24	-0.51	
UE				
Asche et al (2008) – 12 Countries	Residential	-0.03	-0.10	
United States				
Houthaker and Taylor (1970)	Residential	-0.15	-0.50	
Lin *et al.*(1987)	Residential	-0.15	-1.22	
Herbert and Kreil (1989)	Residential	-0.36		
Maddala *et al* (1997)	Residential	-0.092 to -0.177	-0.239 to -1.358	
Metcalf and Hassett (1997)	Residential	-0.47		
Joutz *et al* (2008)	Residential	-0.09	-0.18	
Davis and Muehlegger (2010)	Residential		-0.278	
Davis and Muehlegger (2010)	Commercial		-0.205	

B.4 Recommended price elasticities of natural gas demand

Based on our work in this area, and the review of overseas and Australian literature, the following own-price elasticities of gas demand were used for Multinet by sector. NIEIR have adopted a distributed lag structure for the short term price impacts. This reflects that consumers are slow to respond to price increases.

Table B.6 Short run and long run gas own price elasticities

	Residential	Commercial	Industrial
Short run own price elasticity			
t	0.05	0.03	0.07
t-1	0.10	0.08	0.12
t-2	0.10	0.07	0.10
t-3	0.03	0.03	0.03
Long run own price elasticity			
	0.28	**0.21**	**0.32**

These represent a slight decrease to own gas price elasticities used for previous access arrangements submitted by gas networks around Australia and accepted by the AER. This continues the downward trend found in own gas price elasticities found within the literature survey.

Across the three customer demand classes, gas demand is most responsive in the industrial sector, where a one per cent fall in price will result in an increase in natural gas demand in the long run by 0.32 per cent.

The residential sector is the next most responsive, where a one per cent fall in price will result in a 0.28 per cent increase in natural gas demand. The commercial sector is the least price responsive. This is most likely due to the small share of gas demanded by the commercial sector compared to total demand. Here a one per cent fall in price will lead to an estimated 0.21 per cent increase in natural gas demand.

The estimates of cross-price elasticities of gas demand to changes in the price of electricity show that the residential and commercial markets are quite responsive to the price of electricity. In contrast, industrial customers seem to adjust their gas demand only marginally to the price of electricity in the long run (at least this seems to be the Australian experience).

Price elasticities and demand responses depend on the actual price and the magnitude of the price change. The low price elasticities for gas mainly reflect the composition and turnover rates for gas consumption appliances and equipment. For example, in the residential sector the major gas consumption appliances are water heaters, space heaters and cooking. The average life of these appliances is well over ten years. Similarly, in the industrial sector, major gas consumption equipment, may only be replaced when the plant is expanding capacity. There are usually only limited opportunities for improving the energy efficiency of particular equipment.

Gas faces some competition from alternative fuels such as electricity, oil, coal and LPG. However, cross elasticities of demand are low in the short run, particularly in the household market. This is because consumers have, for example, sunk investments in central heating systems which are generally fuel specific. Cross-price elasticities tend to be higher for those, mainly industrial users, who can quickly and cheaply switch to alternative fuels. To reflect this inelastic response a cross price elasticity of 0.08 was used for the Multinet region, based on a survey of literature.

Addendum: The impact of marketing step change on Multinet volumes and customer numbers

The Victorian Gas Distributors jointly commissioned Axiom Economics to assess the quantitative impacts of a marketing operating expenditure step change (or increase). This work was commissioned after NIEIR finalised its forecast for Multinet Gas.

The marketing campaign for each business through advertising and appliance rebates was envisaged to help arrest the decline in average residential consumption.

The revised residential forecasts for Multinet Gas for the period 2018 to 2022, including and excluding the market step change, are provided below.

Multinet residential demand forecast – Excluding and including marketing step change					
Category	**2018**	**2019**	**2020**	**2021**	**2022**
Excluding marketing step change					
Net customer numbers	684,783	688,279	691,752	695,209	698,507
Consumption per connection (GJ) (weather normalised)	55.1	54.1	53.2	52.1	51.2
Total consumption (TJ) (weather normalised)	37,715	37,231	36,777	36,241	35,748
Including marketing step change					
Net customer numbers	685,064	688,840	692,594	696,332	699,910
Consumption per connection (GJ) (weather normalised)	55.2	54.3	53.5	52.6	51.8
Total consumption (TJ) (weather normalised)	37,810	37,421	37,061	36,620	36,222

Note: Figures may not reconcile exactly due to rounding.