2013-2017 Gas Access Arrangement Review –

Access Arrangement Information

Appendix 4A:

Gas Demand Forecasting SP AusNet 2013-2017

Submitted 30 March 2012

Gas demand forecasting

SPAusNet, 2013-17

Prepared for SPAusNet

Centre for International Economics
Canberra & Sydney

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The Centre for International Economics is a private economic research agency that provides professional, independent and timely analysis of international and domestic events and policies.

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Executive summary

SP AusNet has commissioned the CIE to provide projections of demand for its Victorian gas distribution network for 2013 to 2017. This report sets out the approach that we have taken, the key assumptions that have been made and the projections.

Approach to demand forecasting

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

- Understanding the key drivers of demand and the magnitude of the impact of these drivers on demand using statistical analysis of SP AusNet's billing database.
- Projecting forward key drivers using publicly available estimates.
- Projecting forward demand using the relationships established between drivers and demand and the projections of key drivers. In undertaking projections we have continued on the time trends that have historically occurred because we consider that the policy drivers of energy efficiency will continue to be important in the 2013 to 2017 regulatory period.

The key findings of the analysis are as follows.

- Residential customer growth across SP AusNet's region, once network expansion has been separated out, closely matches net dwelling growth over the period from 2003 to 2010.
- New residential customers are using 2 per cent less gas in peak periods and 20 per cent less gas in off-peak periods than existing customers. This gap is expected to widen further as 6 star building standards are put in place. A higher share of new connections are units than for the existing connections, which also use less gas than single dwellings.
- Once weather, gas prices and other factors have been accounted for, there has been a trend decline in residential gas use per customer since 2003. We expect that this is largely due to the role of policies in improving energy efficiency and water efficiency. It is not possible to separately identify the impacts of each policy given the large numbers of policies that have and are continuing to impact on gas use.
- New commercial customers use almost double the gas of existing customers. However, the number of new commercial customers is relatively low and growth is slower than for residential customers.

Key assumptions in projecting forward demand

The main assumptions embedded in our demand projections are that:

- future residential gas connections will match future *net* dwelling growth, as projected made by Victoria Planning, and there will be no network expansion over the regulatory period. For new towns, future residential gas connections will be somewhat higher than dwelling growth, although the scope for continued high connection growth appears to be limited;
- the number of commercial customers in the West and Central tariff zones will grow at a rate that reflects the historic relationship between commercial and residential customers. This means that for each additional 1000 residential customers there will be 6 additional commercial customers;
- expected climatic conditions will match projections provided by CSIRO, with continued rise of expected temperature due to global warming;
- residential usage per customer will continue to decline because new dwellings are using substantially less gas than existing dwellings because of building standards and because energy efficiency policies will continue to put downward pressure on usage for existing connections;
- commercial usage per connection is expected to increase. This reflects higher use of new commercial customers, as historically all gas users were connected to the network while now only those wanting to use gas are connected. It also reflects substitution to gas from higher electricity prices. This will be somewhat dampened by slow economic growth over the next two years; and
- large customers will increase their maximum hourly gas demand in line with the Australian Energy Market Operator's projections of volume for all large Victorian gas users.

Demand projections

The aggregate growth rates in customer numbers and usage from 2011 to 2017 are shown in the table below.

1 Demand projections — growth

Customer segment	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Residential customer numbers	2.89	2.49	2.31	2.25	2.18	2.11	2.04
Commercial customer numbers	0.78	0.63	0.59	0.59	0.61	0.60	0.60
Residential usage	-3.91	1.07	0.94	0.62	0.59	0.26	0.22
Commercial usage	-0.26	1.99	1.20	1.24	0.56	0.02	-0.14
Tariff D (MHQ)	0.94	1.18	0.58	0.00	0.00	0.23	0.35

Source: The CIE.

The audited actual 2011 growth figures (which also account for 2011 actual weather conditions) will be available in April. Residential customer numbers and commercial customer numbers from end of June 2012 should be used instead of projections for 2012, once these are available.

Risks and sensitivities

There are many risks around projections including whether historical relationships continue and around future dwelling growth, prices etc. A major risk to the projections above is that there are substantial changes in gas wholesale prices above that embedded in the projections. If Victorian wholesale prices move towards Australian average prices, this would lead to an almost doubling of prices. Based on our estimates of the response of residential and commercial customers to gas prices, this could reduce usage by 5 to 10 per cent relative to base projections. This reduction would be greater if prices moved to match international prices.

1 Introduction

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

- Electricity transmission network – carrying electricity from power stations to electricity distributors across all of Victoria via 12,800 high voltage towers and approximately 6500 kilometres of transmission lines.
- Electricity distribution network — carrying electricity from the high voltage transmission grid to approximately 620 000 customers across eastern Victoria. This network spans approximately 46 000 kilometres across an area of 80 000 square kilometres.
- Gas distribution network — transporting gas to approximately 570 000 customers across central and western Victoria. This network spans approximately 9400 kilometres across an area of 60 000 square kilometres.[1]

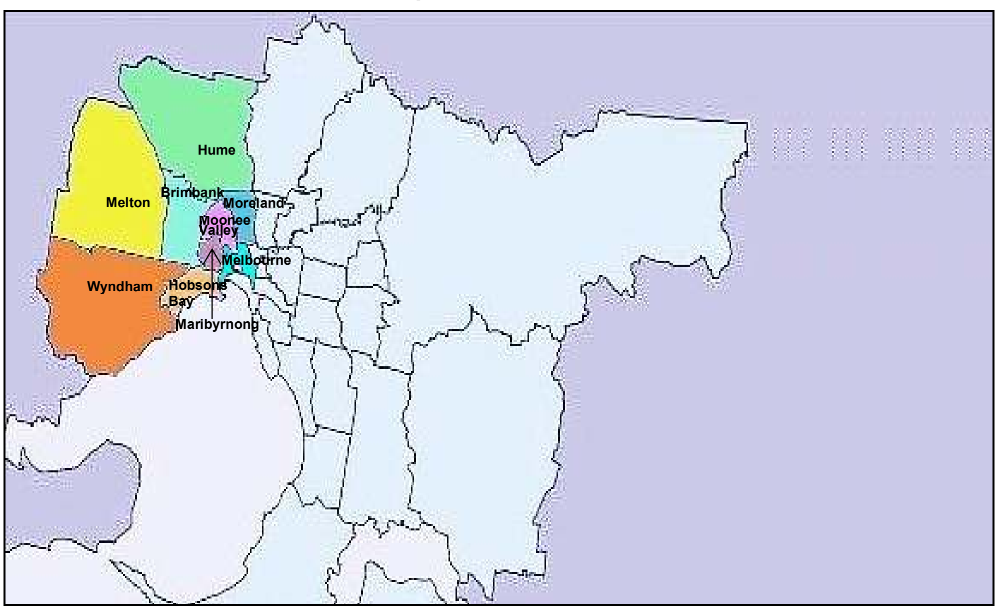
The focus of this study is on SP AusNet's gas distribution. Charts 1.1 and 1.2 provide maps of SP AusNet's area of operations for its gas distribution network outside of the Melbourne metropolitan area and within the Melbourne metropolitan area. Apart from SP AusNet, there are two other gas distribution network providers in Victoria — Alinta which operates in a part of the Melbourne area and Envestra which provides services in the central, northeast and eastern parts of Victoria. In most instances each Local Government Area (LGA) is serviced by a different gas distribution network, although there a small number of LGAs which are serviced by more than one network provider.

1 http://www.sp-AusNet.com.au/?id=22023012026C624F8D0B9B72DCA2575DE0036D105.

1.1 LGAs serviced by SP AusNet outside of the Melbourne Metropolitan Area

Notes: SP AusNet's area of operation includes the following LGAs *outside* the Melbourne Metropolitan Area: Ballarat (C), Campaspe (S), Central Goldfields (S), Colac-Otway (S), Corangamite (S), Glenelg (S), Golden Plains (S), Greater Bendigo (C), Greater Geelong (C), Hepburn (S), Horsham (RC), Macedon Ranges (S), Maribyrnong (C), Moorabool (S), Mount Alexander (S), Moyne (S), Northern Grampians (S), Southern Grampians (S), Surf Coast (S), Warrnambool (C), Yarriambiack (S).
Data source: Wikipedia (2011).

1.2 LGAs within Melbourne Metropolitan Area



Notes: *SP AusNet's area of operation includes the following LGAs within the Melbourne Metropolitan Area: Brimbank (C), Hobsons Bay (C), Hume (C), Melbourne (C), Melton (S), Moonee Valley (C), Moreland (C), Wyndham (C).*
Data source: Department of Planning and Community Development of Victoria (2011).

The role of demand forecasts

SPAusNet is regulated under the National Gas Law (NGL) and National Gas Rules (NGR), which underpin the Access Arrangement Guidelines as prepared by the Australian Energy Regulator (AER). One input into the access arrangement is demand forecasts, comprising forecasts of customer numbers and gas usage.

Demand forecasts:

- influence the notional revenue allowance through
  - operating expenditure projections;
  - capital expenditure projections and hence the regulatory asset base, which in turn impacts on depreciation and the return on capital;
- influence prices as prices are set so that demand multiplied by prices is equal to the notional revenue allowance; and
- could influence the determination of *beta* through the relationship between economic activity and demand, although this is not relevant for the businesses proposed access arrangements for 2013, as WACC parameters have already been set.

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

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

Demand forecasts and the previous regulatory period

For the current regulatory period, actual residential and commercial customer connections exceeded forecasts (table 1.3).

1.3 **Previous forecasts and actual outcomes — customer numbers**

Item	*Start 2008*	*Start 2009*	*Start 2010*	*Start 2011*
Residential customers				
SP AusNet forecasts[a] (no.)	522 314	535 192	548 490	561 839
Actual (no.)	522 338	538 758	555 881	574 130
Difference (per cent)	0.0	0.7	1.3	2.2
Commercial customers				
SP AusNet forecasts[b] (no.)	15 469	15 749	16 012	16 322
Actual (no.)	15 981	16 155	16 334	16 545
Difference (per cent)	3.3	2.6	2.0	1.4

a This was based on revised forecasts prepared by NIEIR following the ESC's August 2007 draft decision (p. 436). See letter from NIER to ESC (dated 26 October 2007), table 4. These revised forecasts were accepted by the ESC in its final decision.
b This was based on NIEIR (2008) Demand Forecasts Report, March (table 6.4).

Source: The CIE and as noted above.

Despite the higher number of connections than projected, usage was generally lower than projected once weather was accounted for (table 1.4). Projections for residential were very close to actual on a weather adjusted basis. Commercial usage was well below that projected for the previous regulatory period. Note that actual usage has been adjusted to 1321 EDDs as put forward in projections for the previous period.

1.4 **Previous forecasts and actual outcomes — usage**

Item	*2007*	*2008*	*2009*	*2010*
Total residential consumption (TJ)				
Actual — tariff reports (TJ)	25 444	28 750	28 624	30 109
Forecast (TJ)	27 592	28 092	28 542	29 000
Actual adjusted for weather (to 1321 EDD, TJ)	26 839	28 241	28 802	28 781
Actual relative to forecast (per cent)	-7.8	2.3	0.3	3.8
Actual adjusted for weather relative to forecast (per cent)	-2.7	0.5	0.9	-0.8
Total commercial consumption (TJ)				
Actual — tariff reports (TJ)	5 414	5 814	5 455	5 851
Forecast (TJ)	5 582	5 755	5 912	6 050
Actual adjusted for weather (to 1321 EDD, TJ)	5 580	5 756	5 473	5 703
Actual relative to forecast (per cent)	-3.0	1.0	-7.7	-3.3
Actual adjusted for weather relative to forecast (per cent)	0.0	0.0	-7.4	-5.7

Source: The CIE and ESC final determination (2007).

This project

The CIE has been engaged by SP AusNet to prepare independent forecasts for its Gas Distribution Network for the forthcoming 2013-17 Gas Access Arrangement Review (GAAR) and for general planning purposes. The current regulatory period expires on the 31st December 2012 with the next period commencing on 1st January 2013.

Demand and customer forecasting also enables SP AusNet to make decisions in regard to prudent capital investment and operational expenditure required over the 2013-17 regulatory period. These planning decisions are also informed by assessments at a smaller scale by network planners. This will assist SP AusNet in meeting the requirements under the National Gas Law (NGL), specifically s.23 that endeavours to:

> ... promote efficient investment in, and efficient operation and use of, natural gas service for the long term interests of consumers of natural gas with respect to price, quality, safety, reliability and security of supply of natural gas.

The overarching criteria for the preparation of demand forecasts is set out under National Gas Rule 74 Forecast and Estimates which states:

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

The forecast should meet, to the extent feasible, the following criterion that has been expressed by the AER in previous forecasting decisions in relation to best practices for a forecast model:[2]

- be accurate and unbiased
- incorporate key drivers, including weather
- incorporate policy impacts
- transparent and repeatable
- model validation and testing
- accurate and unbiased.

Other important principles are that the most recent input information is used and that assumptions are clear and have backing from independent reports or analysis.

Structure of this report

The structure of this report is as follows:

- Chapter 2 explains the CIE's general approach:
- Chapter 3 projects customer numbers for the residential sector;
- Chapter 4 projects customer numbers for the commercial sector;
- Chapter 5 projects customer usage for the residential sector;
- Chapter 6 projects customer usage for the commercial sector;
- Chapter 7 projects Tariff D/M maximum usage;

2 These have been articulated by ACIL Tasman (2010), *Victorian electricity distribution price review: review of electricity sales and customer number forecasts*, prepared for the Australian Energy Regulator, April.

- Chapter 8 summarises the base level projections, including providing tops down checks on the reasonableness of projections;
- Chapter 9 considers the risks surrounding projections and whether these risks are symmetric or should require adjustment to the base projections;
- Appendix A contains information on SP AusNet's billing database, which forms the primary tool through which gas use has been understood and hence projected:
- Appendix B contains information on government programs that may impact on gas use projections;
- Appendix C provides cross-checks on weather normalisation using daily data;
- Appendix D presents summary information from the Victorian Utility Consumption Household Survey; and
- Appendix E presented wholesale gas price projections.

2 The CIE's approach

This chapter outlines our approach to generating forecasts of customer numbers and usage for the period 2013-17.

What is required to be forecast

For the purposes of regulation, forecasts will have to match each category of use that SP AusNet has a different tariff for. SP AusNet's tariffs are segregated according to customer type, time of year and size of usage, as shown in table 2.1.

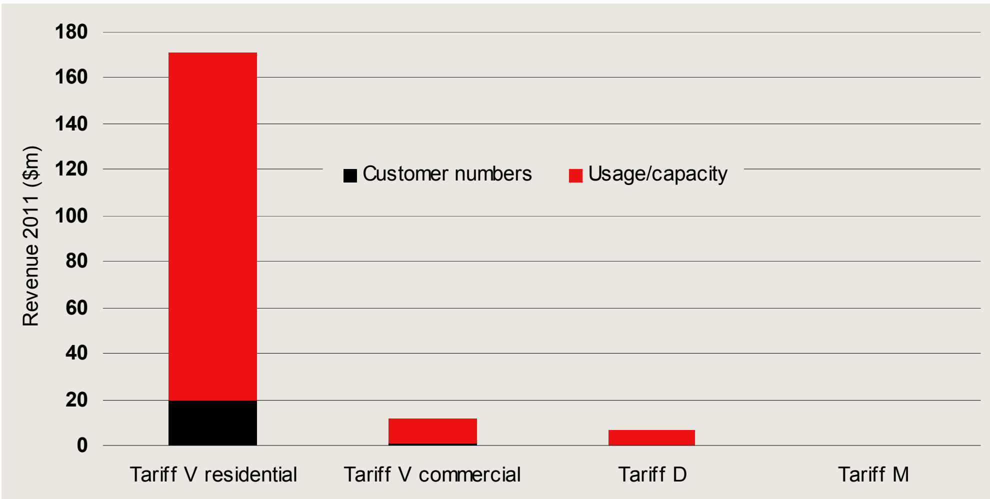
2.1 **Tariff types for SP AusNet**

Customer type	***Time of year***	***Regions***	***Tariff types***
Domestic	Peak — June to September Off-peak — all other months	West Central New towns West New towns Central	Supply charge per day connected Charges for usage based on blocks of: ▪ 0-0.1GJ/day ▪ 0.1-0.2GJ/day ▪ 0.2-1.4GJ/day ▪ >1.4 GJ/day
Commercial	Peak — June to September Off-peak — all other months	West Central New towns West New towns Central	Supply charge per day connected Charges for usage based on blocks of: ▪ 0-0.1GJ/day ▪ 0.1-0.2GJ/day ▪ 0.2-1.4GJ/day >1.4 GJ/day
Tariff M	All year	West Central New towns West New towns Central	Maximum hourly demand
Tariff D	All year	West Central New towns West New towns Central	Maximum hourly demand

Source: SP AusNet.

Residential gas users constitute 90 per cent of the revenue that SP AusNet derives from its Victorian gas distribution network. Of this, most revenue is from usage charges (chart 2.2). This breakdown suggests the most important areas to focus on for demand forecasting is Tariff V residential usage.

2.2 **Breakdown of SP AusNet's revenue related to Gas distribution network**



Data source: CIE analysis based on SP AusNet (2011) gas tariff model.

Principles of forecasting

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

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

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

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

- uncertainty around drivers of gas use, such as
  - climatic conditions;
  - economic activity; and

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

2.3 **Forecast error taxonomy**

Errors related to coefficients (deterministic terms)	*Errors related to error bounds (stochastic terms)*
1. Shifts in the coefficients of stochastic terms	6. Shifts in the coefficients of stochastic terms
2. Mis-specification of deterministic terms	7. Mis-specification of stochastic terms
3. Mis-estimation of the coefficients of deterministic terms	8. Mis-estimation of the coefficients of stochastic terms
4. Mis-measurement of the data	9. Changes in the variances of the errors
5. Errors cumulating over the forecast horizon	

Source: Hendry, D. and M. Clements (2001), "Economic forecasting: some lessons from recent research", *Economic modelling*, vol. 20(2), pages 301-329, March.

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

Basis of arriving at forecasts

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

1. Describing changes in gas use over the period for which data is available. This has typically been undertaken using statistical analysis of SP AusNet's billing database.
2. Understanding the drivers of these changes, particularly those drivers that can be projected forward.

3. Projecting forward using independent estimates of drivers and adjustments reflecting the impact of additional change not part of the historical time series, such as policies.
4. Reviewing projections against tops down checks such as population growth and growth in the Victorian economy.

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

Note that all statistical analysis has been in-sample — i.e. using historical data on usage and drivers and establishing relationships. We recognise that out-of-sample is preferably for forecasting, as stressed by ACIL Tasman[3]. In practice, any reasonable forecasting exercise will involve the use of both statistical models and judgement.[4]

The basic conceptual forecasting model that we work with is a set of dependent variables representing demand (a vector of customer numbers, customer consumption, etc) and their relationship to a set of demand driver variables. Mathematically, this can be represented as follows.[5]

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

Where

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

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

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

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

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

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

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

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

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

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

But also note that $\widetilde{X}$ can capture future drivers such as policy change, for which coefficients cannot be estimated statistically. We seek to identify the coefficients for these drivers using independent reports on the impacts of policy changes.

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

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

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

Possible drivers of gas demand

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

- population growth — the level of population growth is a major driver of the catchment for potential gas customers;
- expansions of SP AusNet's network;
- weather — consumption is impacted by temperature and other climatic conditions captured in measures of effective degree days;

- the age of the connection, with new customers potentially having different characteristics to existing customers;
- the composition of dwellings, with flats using considerably less gas than houses;
- government policies;
  - there are a range of policies at the Australian Government level and Victorian Government level that could impact on gas use, ranging from subsidies to a carbon tax; and
  - policies aimed at building design are likely to be particularly important for gas use;
- types of activities businesses are undertaking, such as growth or slowing in retail sectors; and
- prices of wholesale gas and alternative fuels such as electricity.

3 Residential customer numbers

The change in customer numbers will have a significant impact on the volume of gas that is forecast to be consumed into the future. The objective of this chapter is to generate forecasts of the growth in residential customer numbers over the forthcoming regulatory period. Forecasts of customer numbers for the commercial sector are presented in the next chapter.

The approach to generating forecasts of customer numbers (for both the residential and commercial sector) is to first identify the potential drivers of customer numbers using historical observations and consider the relative importance of each of these drivers. The challenge for this approach is that there is no single complete dataset (at a sufficiently disaggregated geographical split to account for regional differences within Victoria) of all possible drivers to test the relative importance of each of these factors using statistical methods. Therefore, the identification of the relative importance of the drivers necessarily involves a combination of trend analysis and some quantitative analysis.

Once the key drivers are identified the challenge is then to project forward how these factors are likely to change over the next regulatory period.

Snapshot of customer numbers

SP AusNet has provided information from its customer billing database from the start of 2003 to the start of 2011.[6] Some observations regarding the customer profile and trends are provided below.

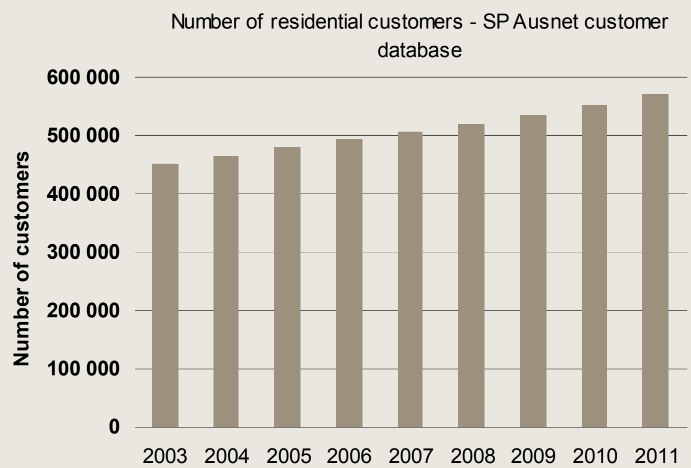
Growth in residential customer numbers

Over the period 2003 to 2011, the number of connected customers has increased by approximately 120 000. Over this period SP AusNet's residential customer base has increased from 450 000 to approximately 570 000, (a 27 per cent increase). Chart 3.1 illustrates the trend in this growth rate over the period. The growth rate in residential

6 There may be some minor differences between the numbers of customers reported in the tariff model to the billing database. The billing database reflects the number of customers at the start of the calendar year. The tariff model reflects an average of customer numbers throughout the year.

customer numbers over the 2003 to 2011 period has been relatively stable (slightly above or below 3.0 per cent increase).

3.1 **SP AusNet Residential customer numbers** 2003 to 2011



Growth rate (per annum)	
2004	3.3
2005	3.0
2006	2.8
2007	2.7
2008	2.7
2009	3.1
2010	3.1
2011	3.2
Average	3.0

Data source: The CIE.

Geographical distribution of residential customers

SP AusNet's network covers approximately 29 different LGAs. However, 80 per cent of these residential customers are located in 10 of these LGAs. Chart 3.2 presents the share of residential customers in each of these LGAs in 2003 and 2011. In 2003 the majority of residential customers were located in the Brimbank and Greater Geelong LGAs. By 2011 a larger proportion of residential customers were located in the Wyndham and Melton LGAs compared with that in 2003.

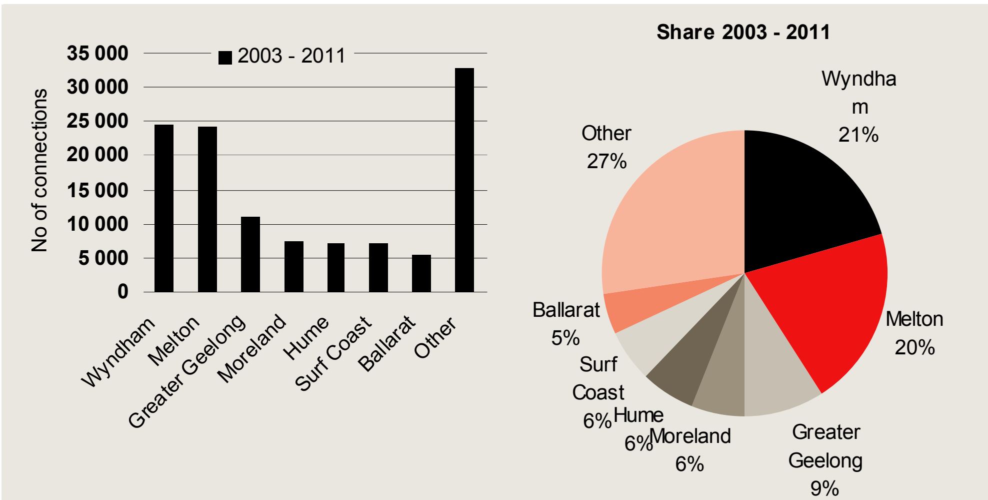
3.2 **Geographical distribution of Residential Customer base,** by LGA

Data source: The CIE.

Growth areas

As noted earlier, Melton and Wyndham have been the main growth areas for residential customers. There are a range of other LGAs which have experienced higher growth rates in customer numbers over the past 10 years. As Chart 3.3 illustrates, 70 per cent of the growth in residential customer numbers is located in seven of the 29 LGAs in SP AusNet's area of operation.

3.3 **Growth in Residential Customer Numbers** 2003-11 by LGA



Data source: The CIE.

Dwelling types

There are a range of different dwelling types amongst SP AusNet's customers. The majority of SP AusNet's customers are currently residing in single dwelling properties or houses (table 3.4). There are some minor differences between the different tariff regions — a higher proportion of customers in the 'new towns' tariff zones reside in houses. These patterns are broadly consistent over time as well. For example, in 2003 approximately 88 per cent of residential customers in the Central region resided in houses.

3.4 **Proportion of SP AusNet customers in single dwelling properties** 2011

Type	***Residential***
	Per cent
Central	86
West	87
NWest	96
NCentral	91
Total	87

Source: SP AusNet billing database

Drivers of residential customer numbers

There are a range of potential drivers of SP AusNet's customer numbers. Broadly speaking, for the residential sector, there are three main drivers:

- New dwellings due to population growth and other demographic factors such as changes in the number of persons per household.
- Existing dwellings which previously did not have access to the gas network now being able to connect. This is due to an expansion in the network assets that enables these connections.
- New connections (or disconnections) from existing dwellings in a network area, reflecting households that currently have access to the gas network but have chosen not to connect to the network at this stage. Similarly, it is possible that existing customers choose to disconnect their gas supply and rely on other sources of fuel to meet their needs. These decisions in turn could depend on factors such as the relative price of substitutes for gas as well as household income which could drive decisions to switch to gas (or from gas to other sources).

In SP AusNet's previous submission to the previous GAAR Price Review (2008-2012), for example, customer numbers were based on NIEIR's state and energy industry based projection models. The drivers embedded in the model were described as follows,

> 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 as distribution businesses and by pricing zone is outlined in Appendix A.

While the broad drivers of customer growth are reasonably well known there are no studies that we are aware of that seek to quantify (in a transparent manner) the relative importance of each of these factors in driving growth in customer numbers. There is no single robust and complete source of data that would allow us to empirically test the relative importance of each of these factors (which explains differences between customer types and geographical differences). Given this, our focus is mainly on trend analysis of the different drivers with some statistical analysis to understand the relative importance of the key drivers of customer numbers. Some of the sources of information utilised are presented in the box below. We use this information to examine the relative importance of each of the drivers.

3.5 Potential information sources

- SP AusNet customer billing database for the period 2003-2011. This allows analysis of customer numbers at a suburb, postcode and LGA level;
- 2006 Census data on the number of dwellings in each postcode (and LGA);
- Historical population and dwellings estimates for LGAs produced by the ABS (*3218.0 Regional Population Growth, Australia*). ABS population forecasts are only available on a 'whole of state' level (*3222.0 Population Projections, Victoria*);
- ABS data on historical dwelling approvals and completions. *Approvals* data is available on an LGA level (*8731.0 Building Approvals, Australia*). Data on the number of new dwellings *completed* is only available at an aggregate 'whole of Victoria' level (*8752.0 Building Activity, Australia*). Forecasts are not available for new dwelling approvals or completions;
- Historical data from the ABS on business 'counts' and information on the type of commercial operations (*8165.0 Counts of Australian Businesses, including Entries and Exits, Jun 2007 to Jun 2009*). Forecasts for this data is not available; and
- Victorian Department of Planning (VDP) dwellings forecasts for each LGA. Both historical and forecasts are provided for this series. The current projections were prepared in 2008, using the ABS 2006 Census data. The VDP is currently in the process of updating its dwelling projections which are expected to be available in mid-2012.

Growth in the number of dwellings

The number of new dwellings is expected to be a major driver of customer growth in SP AusNet's region. That is, additional dwellings will require to be connected to utility services such as electricity, gas and water. In areas where a gas network already exists it is reasonable to expect that some of proportion of new dwellings will choose to connect to the gas network.[7]

In its 2008 determination, the ESC supported the view that the number of new dwellings was a key driver of the growth in gas connections. In its draft decision the ESC concluded that

> Due to the high penetration of gas connections to new dwellings, the key driver for customer connections is the number of new dwelling completions within each distributor's zone. Commercial and industrial connections are generally proportionate to the new

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7 Between 90-95 per cent of existing dwellings in SP AusNet's area of operation are estimated to connected to its gas network, based on 2006 Census data and the ABS 2009 survey of Household Water, Energy Use and Conservation in Victoria.

dwelling completions, but represent a relatively minor proportion of total new connections.[8]

There are a range of possible sources of information to examine the relationship between new dwellings and growth in gas connections. The best source of data for the actual relationship is ABS data on dwelling approvals. For the purposes of forecasting, we can also look at the relationship with projections from Victoria planning.

Dwelling approvals

Dwellings approvals data is available on an LGA basis for each of the quarters from 2007 to 2010.[9] The most recent approvals data is available for December 2010.[10] However, new dwellings approved do not translate directly into buildings completed — some approvals are never enacted while for others there is typically some lag period. Box 3.6 explains our approach to estimating the number of dwelling *completions* using data on the number of dwelling *approvals*.

3.6 Approach to 'translating' dwelling approvals into new dwellings

We have used analysis of quarterly data from 1990 to 2010 for Victoria to consider the lag between dwelling approvals and dwelling completions and the share of dwelling approvals that result in completions. This has been undertaken using regression analysis. We cannot undertake analysis at a lower level of geographic aggregation because, while approvals data is available at a local government area level, completions data is not. It is also worth noting that approvals data at the local government area level is for financial years.

On average, 97 per cent of dwelling approvals translate into building dwelling. The lag between dwelling approvals and completions suggests that approvals in quarter 1 influence completions in each of the next five quarters, or an average of about 6 months. This means that the financial year approvals data at the local government area level will translate into a calendar year figure for completions.

Net new dwellings are equal to dwelling completions less dwelling demolitions. We use a demolition factor of 7.04 per cent of completions as used by the National Housing Supply Council.[11]

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8 ESC (2007), *Gas Access Arrangement Review 2008-2012 — Draft Decision*, August, p. 440.

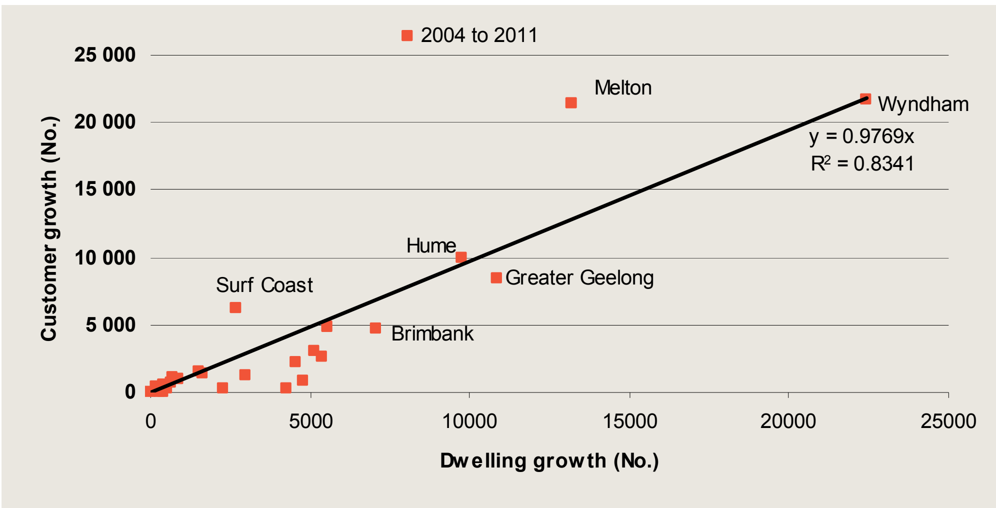
9 As noted earlier, data on the number of dwellings *completed* is only available for Victoria in aggregate.

10 ABS 2010, *State and Regional Indicators, Victoria,* December.

11 National Housing Supply Council (2011), *State of Supply Report 2011,* p. 53.

Chart 3.7 provides a statistical relationship between the growth in customer numbers at an LGA level compared with the growth in our estimate of number of new dwellings completed (excluding new town connections). There is a very strong relationship between the number of dwellings completed and the number of new connections. High growth suburbs of Melton and Wyndham have also been where SP AusNet has connected the most new customers. Note that there are differences in the geographic definition of LGAs and SP AusNet's areas. We have reduced dwelling growth for an LGA according to the share of the postcodes within each LGA that SP AusNet serves. There are likely to be remaining differences as gas distribution networks do not clearly align with postcode boundaries and nor do postcode boundaries clearly align with local government areas.

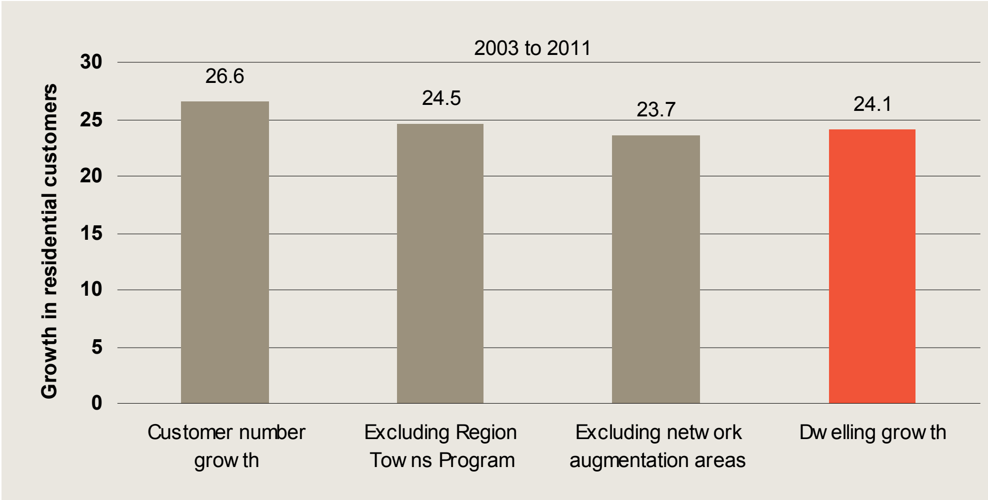
3.7 Dwelling growth and customer growth (West and Central regions only)



Note: 2004 is used for LGAs as there was a switch of customers between postcodes between 2003 and 2004.
Source: CIE analysis.

At an aggregate level the relationship between customer numbers growth and new dwellings is also evident. SP AusNet's customer numbers, once growth from new towns and augmentation areas have been excluded, have grown at a similar rate to the number of dwellings between 2003 and 2010 (chart 3.8). Net dwellings grew by 24.1 per cent between 2003 and 2011, while customer connections (excluding network expansions) grew by 23.7 per cent. On an annualised basis, both grew by 2.7 per cent.

3.8 **Net dwelling growth and customer growth, aggregate across area** 2003-11



Data source: The CIE.

Victorian VDP dwelling projections

For the purposes of forecasting it is necessary to use projections of new dwellings. We consider that the best source for these estimates is Victoria Planning and Community Development (VPD), which produces estimates of dwellings growth at an LGA level.[12] The VDP last prepared forecasts in 2008 including estimates for the period for 2007 to 2056. The information is based on the 2006 Census data on the number of dwellings with assumptions regarding population growth, changing demographic trends and other factors used as the basis for projecting forward dwellings growth. It aligns with Australian Bureau of Statistics population projections.

Chart 3.9 below compares the VDP projections of dwelling growth with increases in customer numbers. The charts indicate that in the residential sector, the planning estimates of dwellings growth is less than the growth rate in the number of customers. Over the period 2006 to 2011 the number of new residential connections has increased by about 78 000 customers. If new customers had grown at the same rate as VDP dwelling projections over this period then there would have been 63 000 customer connections. The majority of the difference between the VDP's estimates and actual customer numbers is due to the regional gas extension networks program which has resulted in over 8 500 new connections since about 2006.[13] There has also been some extension of SP AusNet's network — for example, the extension of the

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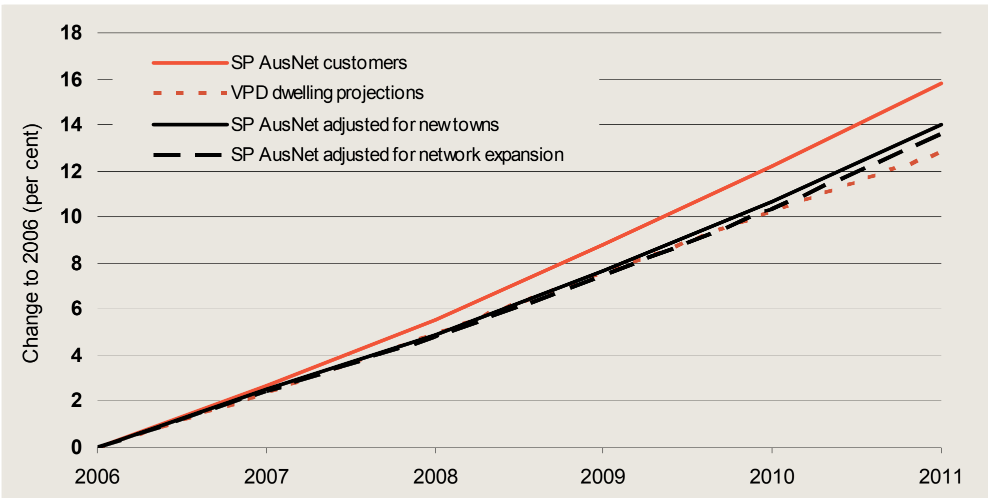
12 Dwelling projections at a whole-of-state level is available on VDP's website. Dwelling projections at an LGA level was provided separately from VDP.

13 ESC (2007), ESC (2007), *Gas Access Arrangement Review 2008-2012 — Draft Decision*, August, p. 443.

network servicing Bendigo to the neighbouring suburb of Ascot. Other network expansions have added approximately 2 300 new residential customer connections. After accounting for these differences, SP AusNet's number of new residential customers is around 66 000.

The remaining difference between VDP projections and SP AusNet customer number increases reflects that dwelling growth has been stronger than anticipated by VDP, largely as a result of population growth. This is discussed in greater detail later in this chapter.

3.9 **Forecasts and dwelling growth** 2006-11, SP AusNet areas of operation



Data sources: Information provided by Victoria Planning and Community Development; CIE analysis of SP AusNet customer databases.

Population growth[14]

Population growth is considered to be a key driver of customer numbers due to its impact on the number new dwellings created. While we recognise that population growth is likely to be one driver, comparison of historical trends in customer numbers and population growth are not well aligned.

As chart 3.10 indicates, the number of residential customers in SP AusNet's area has outstripped trends in population growth in the same regions. This suggests that population growth does not fully explain the changes in the number of residential customers. Part of this difference is a reduction in the number of people per dwelling, as well as the additional customer connections from new towns.

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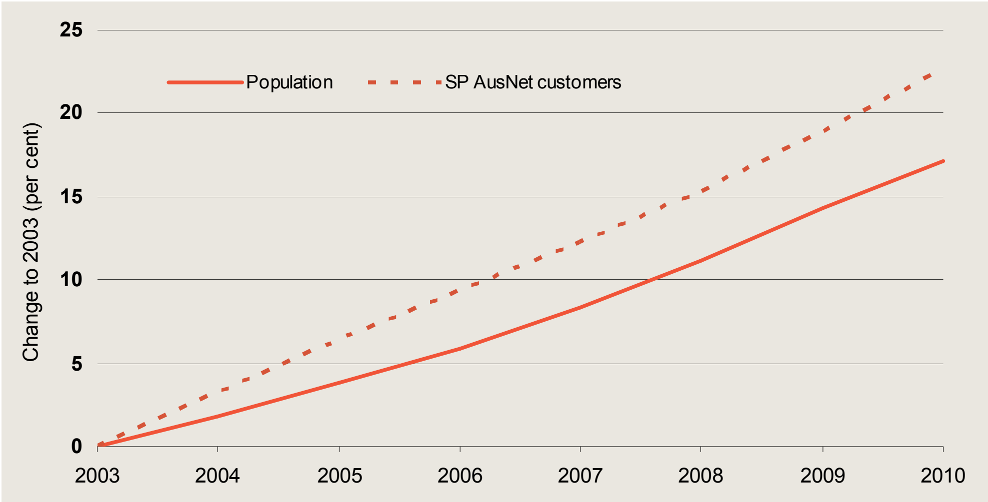
14 Population growth could also impact on the consumption per dwelling if there is limited information available. This is the subject of later sections.

3.10 **Historical population growth rates** 2003-10 SP AusNet regions



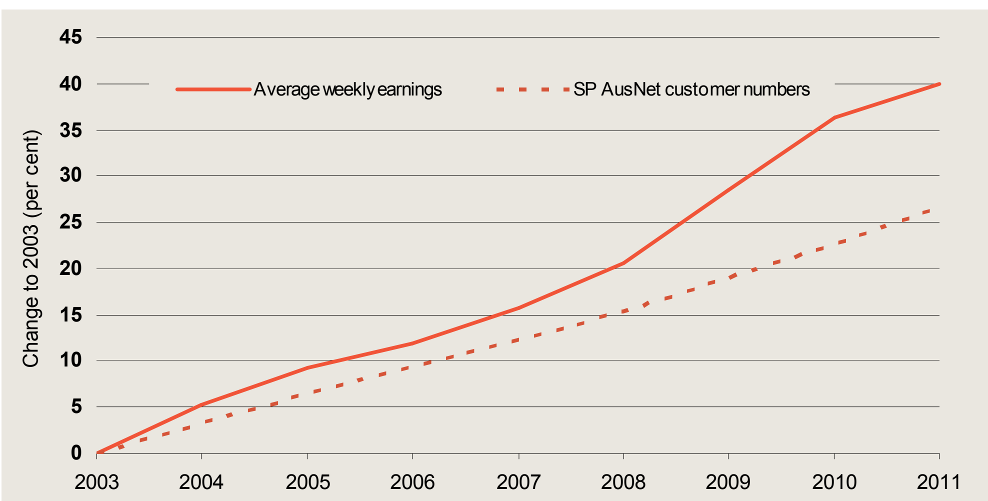
Data source: ABS Regional Population Growth Australia 3218.0. ABS data was matched to LGA's in SP AusNet's area of operation.

Growth in income

Changes in customer numbers can also be impacted by changes in household income. Rising household real income can be expected to result in an increased number of dwellings (and a consequent reduction in the number of persons in a household).

Chart 3.11 examines the historical trends in average weekly earnings compared with customer numbers. The historical trends suggest that dwelling growth is slower than income growth.

3.11 **Average weekly earnings** 2003-11



Data sources: The CIE and ABS.

Network expansion

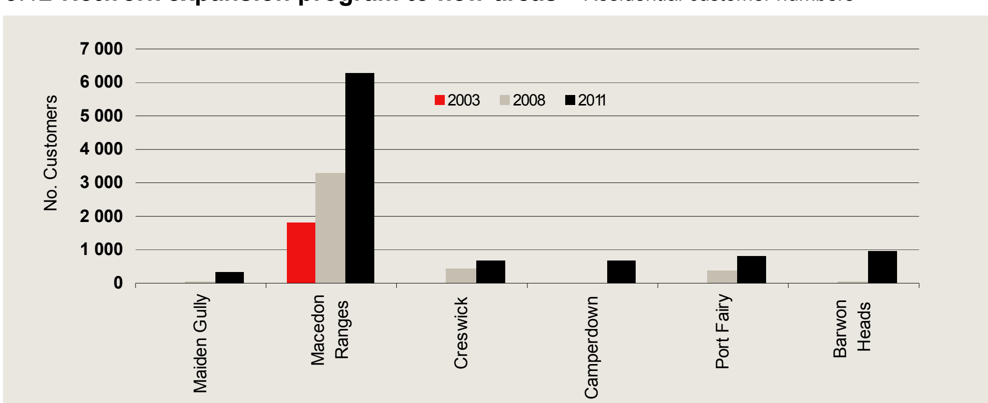
Another driver of customer numbers is the expansion of the gas network to new areas which previously did not receive mains gas supply.

In this regard, under the Gas to Regional Towns program, in 2003 the Victorian Government announced a program to extend the natural gas network to 34 towns throughout Victoria. The Government announced funding of $70 million to this program, with each of the distributors (SP AusNet, Envestra and Multinet) receiving a proportion of the total funding available. The funding included an upfront contribution to the initial capital cost of the project and a 'marketing subsidy' (of approximately $400 per household) to be used to encourage customer connections to the network.[15]

The Victorian Government contributed $30 million (with SP AusNet contributing an additional $40 million) to extend the gas connections to residents and businesses in key regional areas (Maiden Gully, Macedon Ranges, Creswick, Camperdown, Port Fairy and Barwon Heads).[16] To date there has been approximately 8 500 new customers connected to SP AusNet's network in these areas.

Chart 3.12 highlights the change in number of customers in these areas. In the case of Creswick, Camperdown, Port Fairy, Barwon Heads and Maiden Gully, no customers were connected to SP AusNet's network in 2003. Following the commencement of

3.12 **Network expansion program to new areas** Residential customer numbers



Data source: The CIE.

[15] ESC 2005, *SPI Networks Gas Extension Final Decision*, May.

[16] The network expansion was 'rolled-in' to the existing Access Arrangement, in accordance with the relevant distributor's Access Arrangement's extensions/expansions policy. http://www.esc.vic.gov.au/public/Energy/Regulation+and+Compliance/Decisions+and +Determinations/Gas+Extensions/.

the program in approximately 2006 there was a significant increase in the number of residential customers connected to SP AusNet's gas network.

Apart from the network expansion in the specific areas noted above, there are a range of other areas (Williams Landing, Port Arlington, Indented Head and St Leonards) where the increase in customer numbers is likely to be due to the network expansions. In these areas there were a total of 107 customers connected to the gas network in 2003 compared with approximately 4000 today. This network expansion is in response to customer demand and was not subsidised by Government programs.

New connections and disconnections from existing dwellings

Irrespective of growth in new dwellings, it is possible that SP AusNet's customer base will change over time as existing unconnected (or connected) households choose to connect (or disconnect) to the gas network. The reason for these changes could be due to a wide range of factors such as:

- changes in household preferences toward gas appliances. This change in the future as new technology (eg induction cook tops) becomes available; and
- changes in the relative price of electricity and gas which are substitutes for certain services.

There is limited historical time-series data that provides a clear basis for examining the changes in household behaviour that drive their decisions in regards to connecting or disconnecting to the existing gas network.

A recent ABS survey of household energy consumption found that 92.1 per cent of households in the Melbourne Metropolitan Region were connected to mains gas, although for the 'balance of Victoria' only 55.5 per cent of households were connected.[17] We have also used the 2006 ABS Census data and comparing this to SP AusNet's customer numbers dataset indicates that in 2006 approximately 95 per cent of dwellings in SP AusNet's area of operation were connected to its gas network. However, given that there was a non-response rate of approximately 7.5 per cent to the 2006 Census this would imply that the proportion of dwellings in SP AusNet's area of operation that is connected to its gas network is closer to 90 per cent.

The high proportion of existing dwellings in SP AusNet's area of operation that are already connected to gas suggests that there is limited scope for significant increase in customer numbers due to existing dwellings connecting to gas where it is currently available. The close match between actual dwelling growth and connections growth also supports this conclusion.

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17 ABS 2009, *Household Water, Energy Use and Conservation Victoria,* Cat. no. 4602.2, October.

Forecasts of customer numbers

The discussion above suggests that there are likely to be a wide range of factors that impact on the future changes in the number of customers connected to SP AusNet's gas network. Further, there is limited information available that would allow us to place specific 'weights' on each of the drivers discussed above. However, based on our analysis it does appear that:

- for the West and Central tariff regions, the growth in customer numbers is likely to be linked to growth in new dwellings; and
- in the 'new towns' tariff zones the increase in customer numbers is driven by existing dwellings choosing to connect to the network which is already in place (the timing of their decision is likely to be due to factors such as when old electric appliances are replaced).

West and Central tariff zones

As noted earlier, the VDP prepares forecasts of growth of new dwellings which would cover the regulatory period. The VDP forecasts provide an independent and unbiased source of information. These projections are based on[18]:

- ABS population projections;
- analysis of demographic data and housing development;
- Victoria's economic, social and demographic trends; and
- detailed knowledge from consultations with stakeholders including local governments.

VDP dwellings forecasts have been lower than actual new dwellings over the past five years across Victoria and within SP AusNet's area of operation (charts 3.13 and 3.14). This has largely reflected higher dwelling completions in 2010 and 2011.

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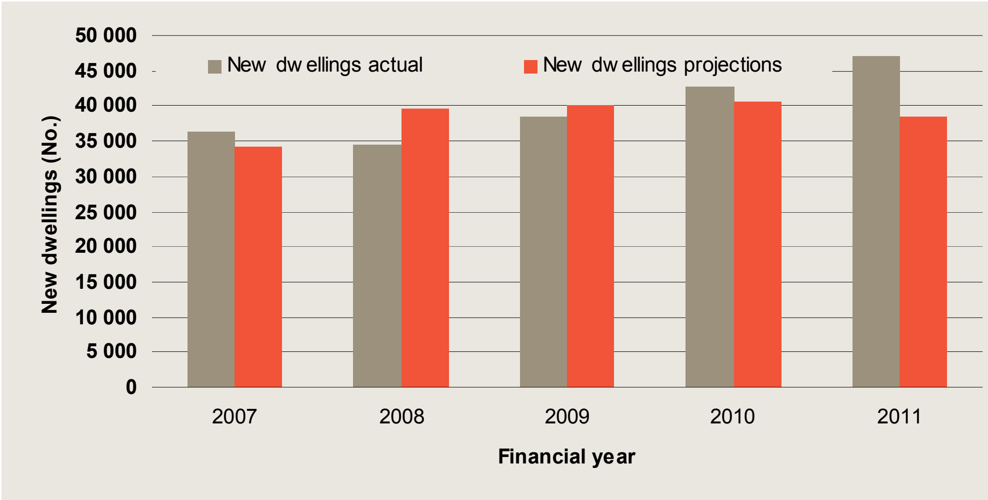
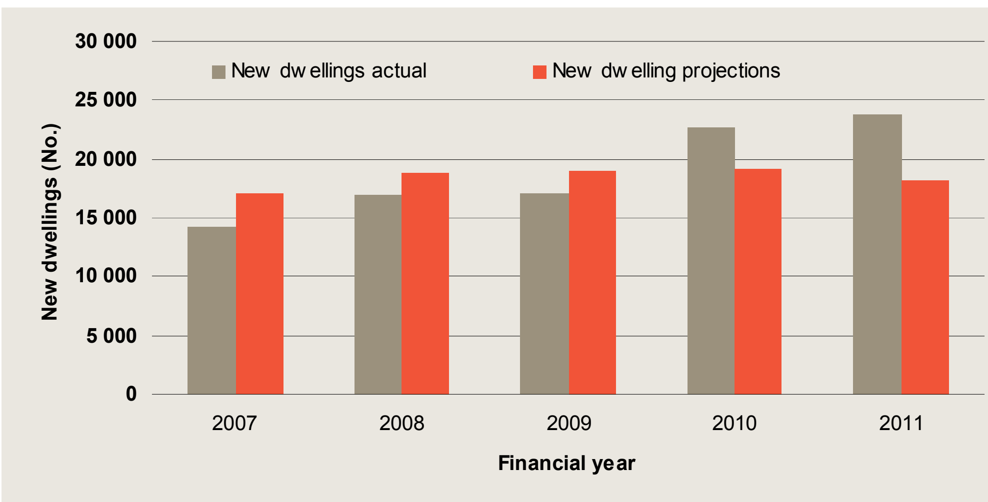
18 Victoria Department of Planning and Community Development 2009, *Victoria in Future 2008*, released September 2009.

3.13 **Dwelling projections and outcomes Victoria** 2006 to 2010



Data source: Victoria Planning and Community Development (2009), *Victoria in Future 2008*, detailed data files; ABS (2011), *Building Activity Australia*, Cat. no. 8752.0; National Housing Supply Council, *State of Supply 2011*.

3.14 **Dwelling projections and outcomes SP AusNet area** 2006 to 2010

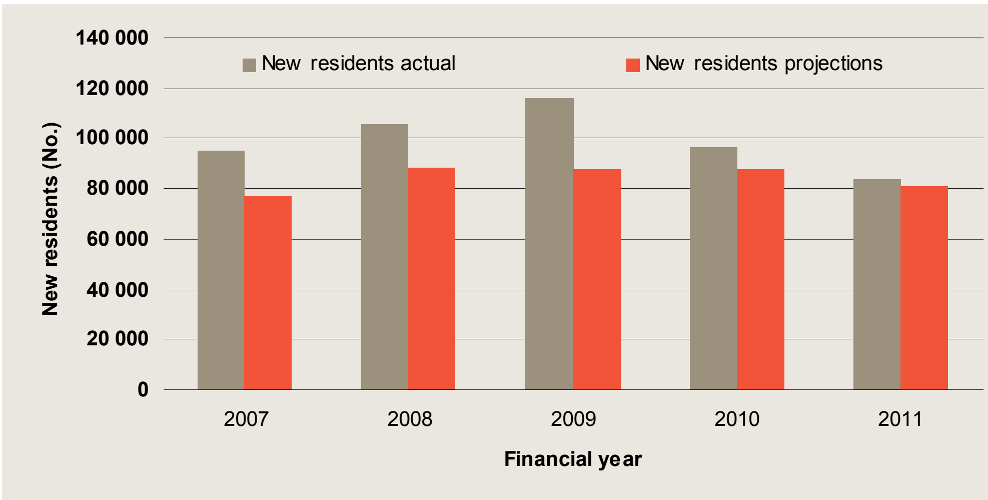


Data source: Victoria Planning and Community Development (2009), *Victoria in Future 2008*, detailed data files; ABS (2011), *Building Activity Australia*, Cat. no. 8752.0; National Housing Supply Council, *State of Supply 2011*.

There are two factors that underlay dwelling projections and outcomes. The first is population growth and the second the number of people per dwelling. Actual population growth exceeded expected population growth in each year from 2007 to 2011 (chart 3.15). This appears to have been the major driver in the number of new dwellings occurring, as a higher population led to greater demand for new dwellings. The timing of population and dwelling growth suggests that the impact from population was not immediate, but occurred after several years. Over 2006 to 2011, the number of people per dwelling was actually higher than expected, with population therefore more than explaining the deviation of dwelling projections from actual.

In recent years, population growth has only narrowly exceeded expected growth. This suggests that dwelling growth is also likely to be closer to projections in future years.

3.15 **Population projections and outcomes Victoria** 2006 to 2010



Data source: Victoria Planning and Community Development (2009), *Victoria in Future 2008*, detailed data files; *ABS Regional Population Growth Australia*, Cat. no. 3218.0.

We consider that the underlying VDP methodology should provide unbiased projections of new dwellings for each local government area that SP AusNet services. The VDP is preparing new forecasts which are likely to be available in August 2012. These will take account of new information that it has gained over the past 5 years to better understand the drivers of dwellings growth. Given this, the VDP forecasts would also provide the best forecasts of dwelling growth for the purposes of SP AusNet's upcoming regulatory review.[19]

For each year from 2013-17 we use VPD projections of dwellings growth for each LGA which (*in aggregate* across SP AusNet's area of operation) equates to growth of 2.5 per cent in 2013, 2.4 per cent in 2014, 2.4 per cent in 2015 and 2.3 per cent in 2016. At a tariff zone level, the growth rate in the Central region is close to the aggregate region growth rates. However, for the West tariff zone there are slightly lower projections of around 1.5 per cent per annum in each of the years.

In order to generate forecasts we use the customer numbers from SP Ausnet's tariff model for 2010, estimated actual connections for start of 2011 and start of 2012 and

[19] We have not considered any further network expansions which could attract new customers. At this stage, SP AusNet has not proposed any significant network expansions into existing areas that would result in new customers in these areas. Therefore, the forecasts produced below do not incorporate any new network expansions.

then project this forward using the dwelling growth rates noted above. Table 3.16 presents projections using this approach.

3.16 **Projected residential customer numbers** by Tariff Zone

Region	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*
	No.	No.	No.	No.	No.	No.
West	127 165	129 075	130 986	132 896	134 806	136 728
Central	456 266	467 646	479 035	490 427	501 670	512 823

Note: These numbers should be updated to reflect the VDP's revised forecasts available in 2012 and 2011 tariff model information.

Source: CIE estimate.

'New towns' tariff zones

In the 'new towns' tariff zones the growth in customer numbers is not driven by growth in new dwellings. Rather, the growth in customer numbers is dependent on the uptake of customer connections following the network expansion (which has been completed for several years).

In 2004 SP AusNet provided forecast estimates of the number of new customers in these towns that would connect to the network over the period from 2006 to 2025. These estimates took account of SP AusNet's historical experience of uptake rates in smaller towns where it had previously extended the network (eg Port Arlington and Indented Heads).

Chart 3.18 presents the original forecasts provided by SP AusNet (the red line). It highlights the pattern of uptake as well as the maximum number of customers estimated. The chart also presents the actual number of customers that have connected to the network between 2006 and the end of 2011. The actual uptake in connections is higher than originally estimated.[20]

We base our forecasts on SP AusNet's original estimates which were independently reviewed and accepted by the Essential Services Commission of Victoria. However, we adjust the original forecasts to take account of the higher actual number of customers that have connected to the network since the program commenced. Specifically, the approach that we have adopted involves the following steps.

- Maintaining the original projections of the maximum number of customers that were originally forecast to be connected to the network. The original estimates took account of the physical characteristics of each of the towns and the proximity of the existing dwellings to the network as well as the likely capital contribution

20 There is limited information available to help understand the reason for the faster uptake rate.

by the customer for the network connection.[21] The original forecasts also incorporate the Government subsidised connection costs which was believed to encourage a higher uptake in the initial years.

- Calculated the difference between the actual number of customers currently connected to the network and the original estimate of the maximum number of connections. We define this as the 'gap'.
- Estimate the proportion of 'gap' that will be reduced in each year over the regulatory period. Over the past 5 years, the 'gap' has been filled by approximately 30 per cent per annum. Given that the growth rates typically diminish into the future (the S-curve effect in charts below), we have assumed that 25 per cent of the gap will be reduced in each year of the regulatory period.[22]

Chart 3.18 presents revised forecasts (unshaded bar charts) utilising the original 2004 forecasts and adjusting for the difference between the actual and original forecasts number of customers between 2006 and 2012. Table 3.17 presents projections for 2012 to 2017.

3.17 **Projected residential customer numbers**, New Towns

	2012	*2013*	*2014*	*2015*	*2016*	*2017*
	No.	No.	No.	No.	No.	No.
New West	7 263	7 594	7 842	8 028	8 167	8 271
New Central	1 101	1 169	1 220	1 258	1 286	1 308

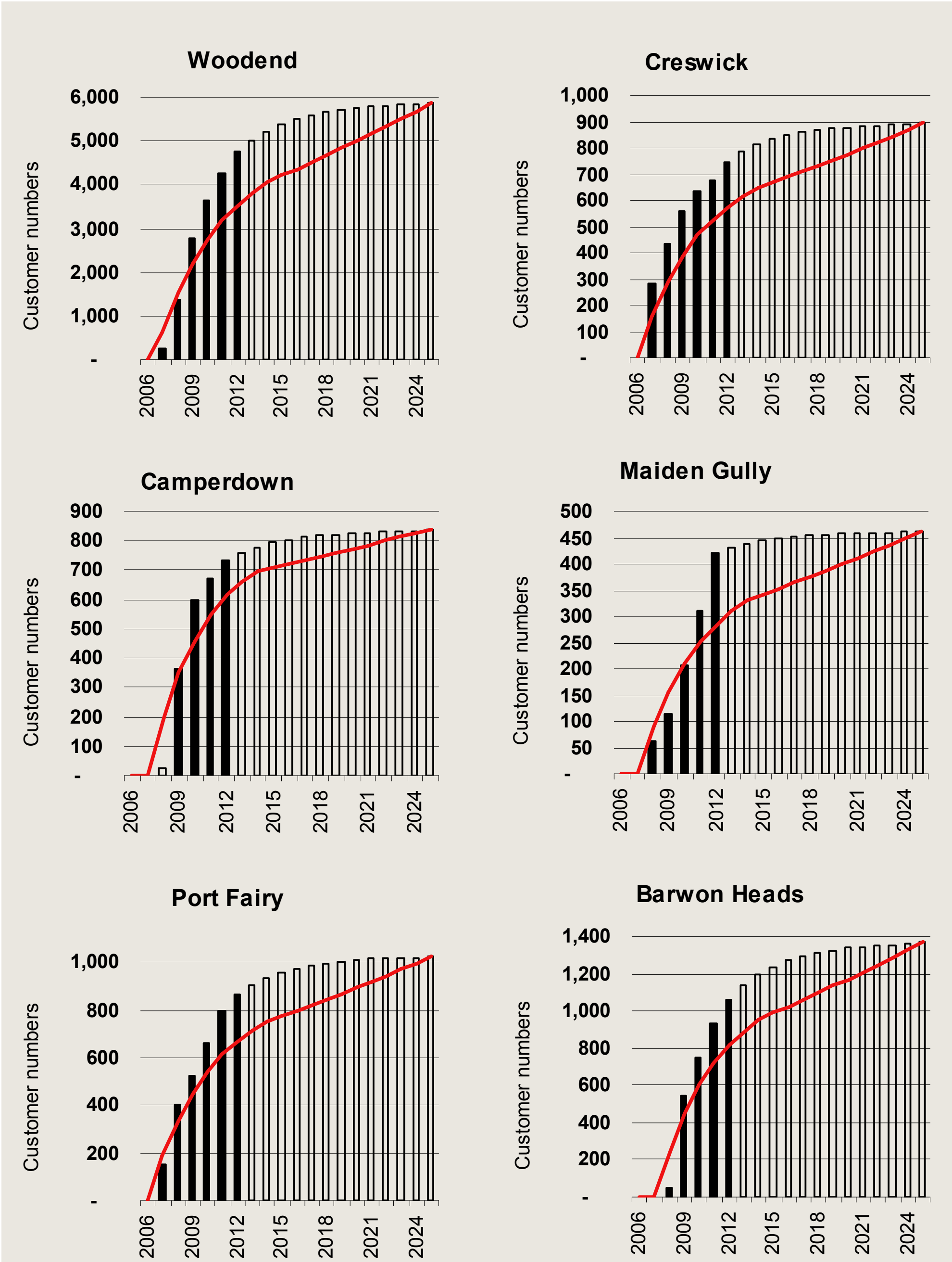
Note: These numbers can be updated to reflect the VDP's revised forecasts available in 2012.

Source: CIE estimate.

21 This cost is likely to be a key factor that limits the number of customers willing to connect to the network.

22 Given that there is not a long time series of data, we are not in a position to test, for example, the validity of the maximum number of customer connections embedded in SP AusNet's original forecasts.

3.18 **Residential Customers - Original and revised forecasts**



[a] Note: In the suburb of Maiden Gully some customers do not form part of the new tariff zone (ie the Regional Towns Extension Program) and are instead connected to the network through an extension from the existing Bendigo network, These customers are subject to a lower tariff than those customers in the same suburb that are part of the Regional Towns program. The chart labelled Woodend also includes the following suburbs: Macedon, Gisbourne, New Gisbourne, Riddells Creek, Romsey and Lancefield.

Data sources: SP AusNet and The CIE.

4 Commercial customer numbers

The objective of this chapter is to generate forecasts of the growth in customer numbers for the commercial sector over the forthcoming regulatory period. Similar to the previous chapter we seek to identify the potential drivers of customer numbers using historical observations and consider the relative importance of each of these drivers. Once the key drivers are identified the challenge is then to project forward how these factors are likely to change over the next regulatory period.

Snapshot of Customer Numbers

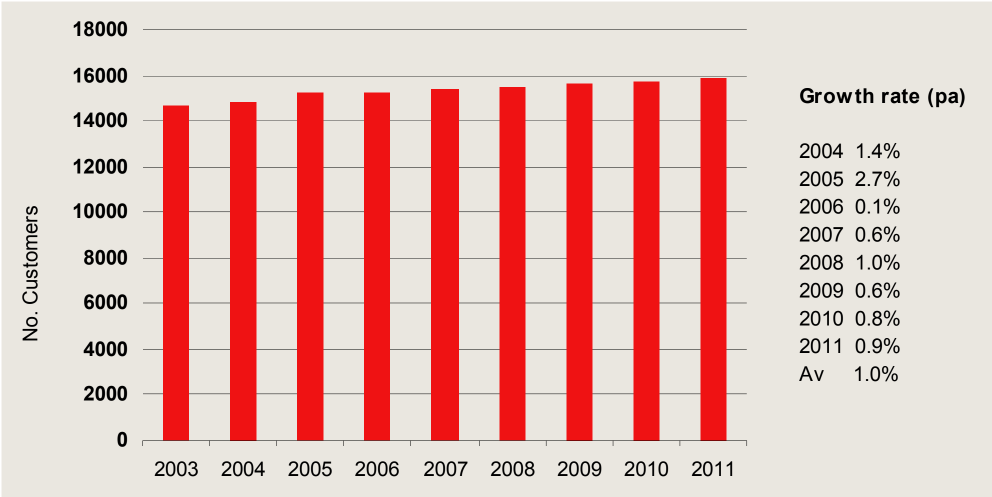
SP AusNet's customer billing dataset provides a useful basis to understand the customer profile and historical trends in customer numbers. Some observations are provided below.

Growth in customer numbers

Over the period 2003 to 2011 there has been approximately 1 225 new commercial customers connected to SP AusNet's gas network. Over this period SP AusNet's commercial sector customer base has increased from 14 639 to approximately 15 864, (an 8.4 per cent increase). The growth rate in customer numbers in the commercial sector has been significantly less than the rate in the residential sector, particularly for the past 5 years. Over the period 2003 to 2011 the growth rate in the number of commercial customers has been approximately 1.0 per cent per annum.

Note that in the first two years of the time series the growth rate in commercial customers was higher than in later years. This could reflect, for example, different customer connections policies related to commercial customers or the retailers different approaches to coding of commercial and residential customers.

4.1 **SP AusNet Commercial sector customer numbers** 2003 to 2011

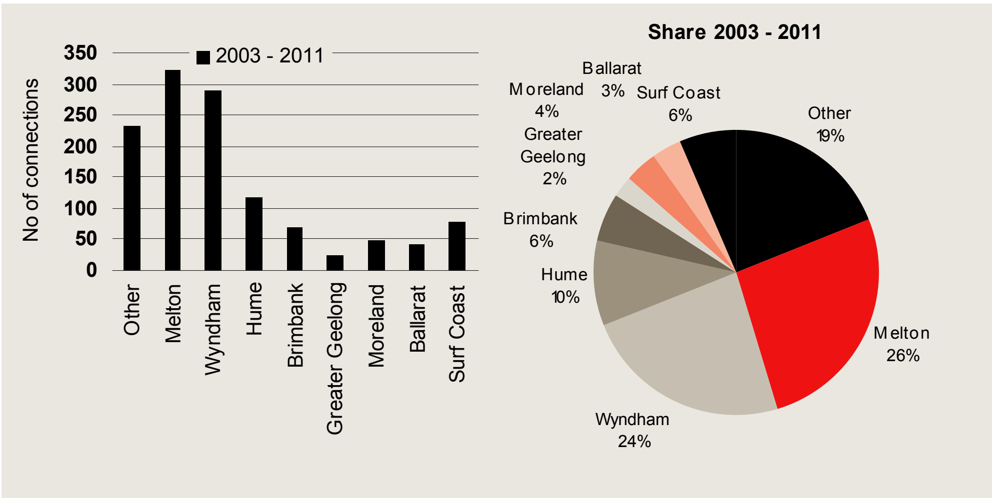


Data source: The CIE.

Geographical distribution of customers

The growth pattern of the commercial customer base is broadly consistent with the growth in the residential customer base. Both Wyndham and Melton, for example, have seen significant percentage increases in the number of commercial customers between 2003 and 2011. Close to 80 per cent of this growth has occurred in 8 LGAs (chart 4.2).

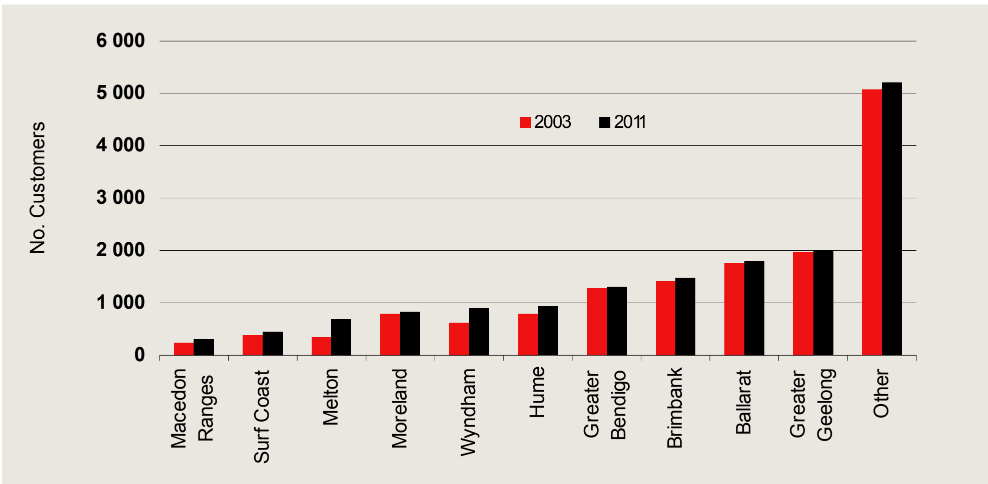
4.2 **Growth in Commercial Customer Numbers 2003-11** by LGA



Data source: The CIE.

While the growth has been predominantly in a few suburbs, this has not resulted in a major shift in the relative importance of each of the LGAs for commercial operations. For example, Wyndham and Melton still have a relatively small number of commercial customers compared with Ballarat and Greater Geelong which have historically carried the bulk of SP AusNet's commercial customer base. Chart 4.3 presents the number of geographical distribution of SP AusNet's commercial customer base in 2003 and 2011.

4.3 **Geographical distribution of Commercial Customer base** by LGA



Data source: The CIE.

Drivers of customer numbers

For the commercial and industrial sector the change in customer numbers could be linked to a range of different factors. For example, population growth can be expected to attract new businesses (eg restaurants and cafes) to service the new population. Broader economic factors such as trends in household earnings and economic growth can also influence business decisions to connect to the gas network. Similar to the residential sector, the growth in customer numbers could be the result of new businesses to the area requiring gas connection, existing businesses in the area connecting to the existing gas network (eg switching from other energy sources) and businesses connecting to gas following the expansion of the gas network.

Customer number estimates in SP AusNet's previous submission to the previous GAAR Price Review (2008-12) were based on NIEIR's state and energy industry based projection models. In regards to the commercial sector within the NIEIR's economic model,

> The energy projections for each business are directly linked to economic indicators for each business, although as noted above, many components of the forecast were made consistent with the VENCorp projection.[23]

In its 2008 determination, the ESC supported the view that the number of new dwellings was a key driver of the growth in gas connections. As noted previously, in its draft decision the ESC concluded that,

> Due to the high penetration of gas connection to new dwellings, the key driver for customer connections is the number of new dwelling completions within each distributor's zone. Commercial and industrial connections are generally proportionate to the new dwelling completions, but represent a relatively minor proportion of total new connections.[24]

The next sections seek to utilise available information to better understand the relative importance of each of the drivers.

Growth in the number of residential dwellings

As noted above the ESC indicated that commercial and industrial connections generally increase in some proportion to the new dwellings completions. For example, an increase in new dwellings (assuming that this is also associated with an increase in population in the area) will result in an increase in commercial businesses to service the increased population in the area.[25]

There has been a strong relationship between new residential customers and new commercial customers across the different local government areas that SP AusNet services (chart 4.4). The number of new commercial customers for an additional 1000 commercial customers averages 14 for 2003 to 2011. For 2005 to 2011, each additional residential customers resulted in an additional 8 commercial customers. Given the potentially different policies that appear to have resulted in a higher growth rate in commercial customer numbers in earlier years, it is more appropriate to consider the relationship between residential and commercial numbers from 2005 to 2011.

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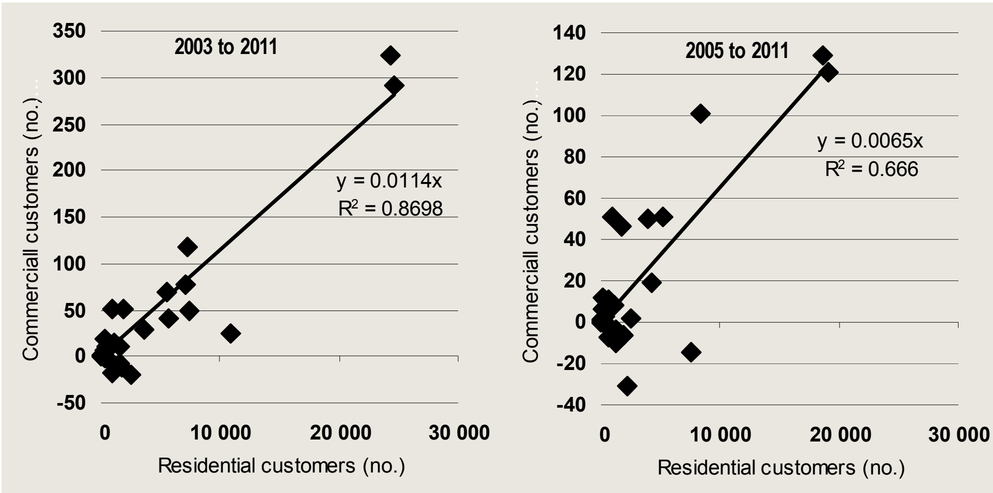
23 NIEIR (2007) *Demand Forecast Report - Natural gas forecasts and customer number forecasts for the SP AusNet distribution region to 2015*, March, p. 25.

24 ESC 2007, *Gas Access Arrangement Review 2008-2012 – Draft Decision*, August, p. 440.

25 Although this would depend on the types of businesses operating. For example, fast food outlets may already be established in an area and simply increase their turnover. There may be certain population thresholds which may be required before new businesses establish in competition to an existing business.

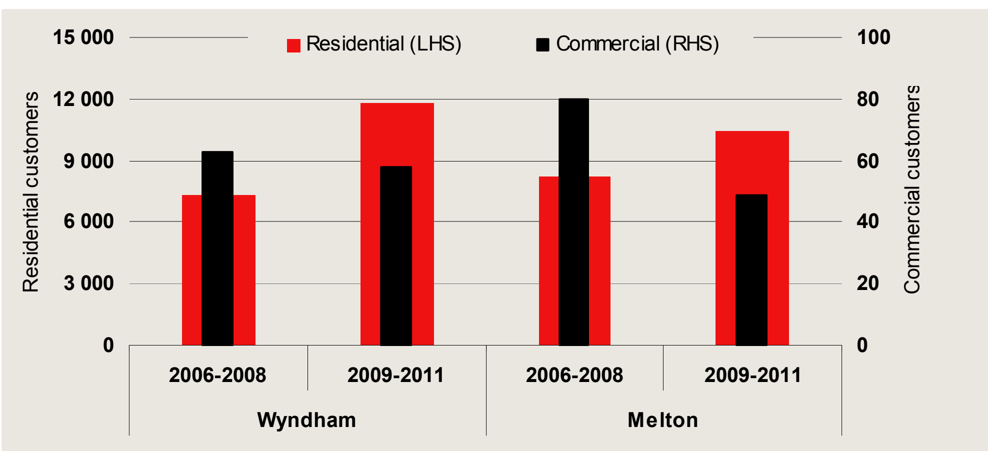
4.4 **Growth in residential and commercial customer numbers** by LGA



Data source: The CIE.

It is less clear that changes in the pattern of residential growth *within* an LGA changes the pattern of commercial growth. For example, there have been substantive increases in residential customer growth in Melton and Wyndham that have not been matched by increases in commercial connections (chart 4.5).

4.5 **Customer growth Melton and Wyndham**



Data source: The CIE.

We expect that both the pattern across time and across LGAs is informative in terms of the relationship between residential and commercial new connections. To provide a formal estimate, we estimate a pooled model of annual new commercial connections for each LGA against annual new residential connections for each LGA from 2004 to 2011. We allow for a different relationship for 2004 and 2005 than in later years.

Table 4.6 below presents the results of this regression analysis. We find that 1000 new residential connections are associated with 24 new commercial connections prior to 2005 and 6 connections after 2005[26].

These results are very similar to the cross-sectional patterns in chart 4.4.

4.6 Link between growth in residential and commercial customers

	Model using 2004 to 2011 new connections	
Dependent variable	Annual new commercial connections	
	Coefficient	t-statistic
New residential connections	0.024	21.0
New residential connections after 2005	-0.018	13.0
R-Squared	0.70	
Observations	214	

Source: The CIE.

Economic growth

Economic expansion is expected to be translated into an increase in the number of businesses operating in Victoria (and customers using gas). Table 4.7 presents the historical economic growth rates, compared with the growth rates in customer numbers. The table does not imply a strong year to year correlation between economic growth across Victoria and growth in customer numbers in SP AusNet's distribution area. While economic growth is expected to play some role in influencing the growth in SP AusNet's customer numbers the relationship is likely to be more complex.

4.7 Growth in commercial sector customer numbers

Year	*Growth in SP AusNet commercial customer numbers*	*Gross State Product*[a]
	(Per cent p.a.)	(Per cent p.a.)
2004	1.4	4.6
2005	2.7	2.7
2006	0.1	2.5
2007	0.6	3.6
2008	1.0	3.6
2009	0.6	0.9
2010	0.8	2.0

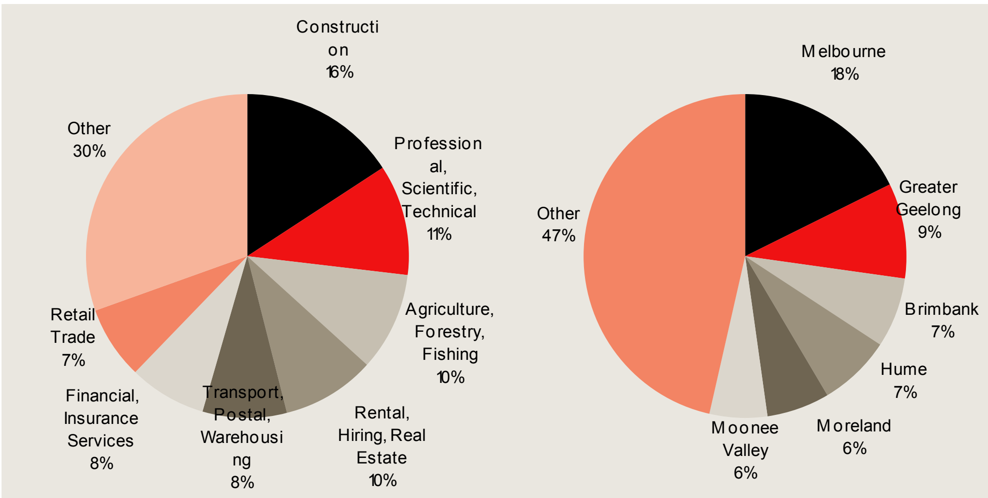
a All sectors chain volume measure.
Source: ABS (2011), Australian National Accounts: State Accounts, Cat. no. 5220.0.

Further, there is a diverse range of businesses operating in SP AusNet's area of operation. ABS data on the types of businesses operating in SP AusNet's area of

26 This reflects the sum of the two coefficients (0.024-0.018) multiplied by 1000.

operation is presented in chart 4.8. The Construction sector is the dominant sector, although it only makes up 16 per cent of the number of businesses operating in the region. Businesses that provide 'Professional, Scientific and Technical Services', for example, constitute 11 per cent of business types. Approximately 70 per cent of the number of businesses operating in SP AusNet's area can be grouped into the 7 categories presented in the chart. There are over 10 additional categories of businesses that make up the remaining 30 per cent of businesses.

4.8 **Business count, by business location and type** June 2007 to June 2009



Data source: ABS (2010), *Counts of Australian Businesses, including Entries and Exits, Jun 2007 to Jun 2009*, Cat. no. 8165.

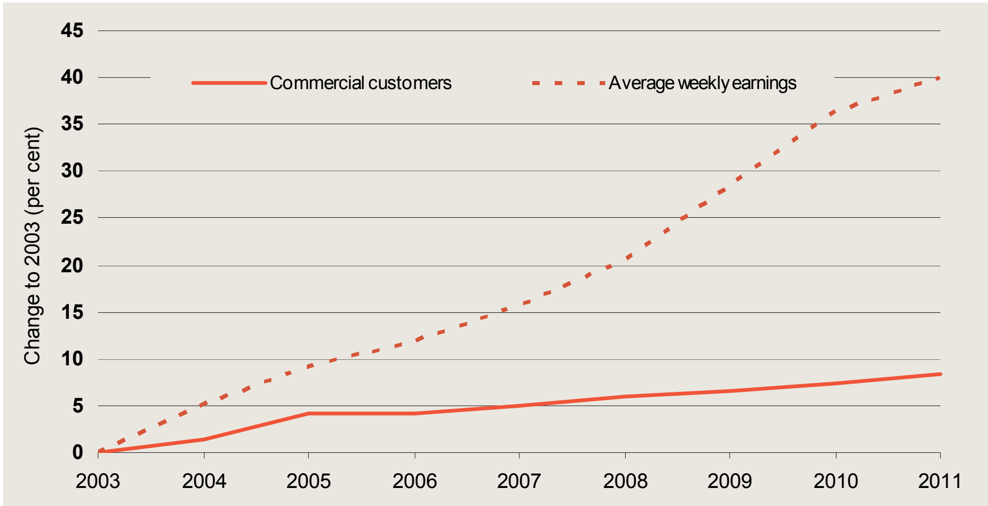
Chart 4.8 also indicates that businesses are spread relatively evenly throughout each of the LGAs where SP AusNet operates. While a large percentage (18 per cent) of businesses are located in the Melbourne LGA businesses are relatively evenly spread throughout the LGAs. Given the diversity of types and location of businesses operating in SP AusNet's area this makes it more challenging to understand the drivers of particular businesses activities. For example, some export focused businesses are likely to be more exposed to exchange rate movements. The retail sector, on the other hand, may be more exposed to the changes in local economic conditions.

Growth in household income

Changes in customer numbers can also be impacted by changes in household income. Rising household real income, for example, can be expected to result in an increase in household expenditure of goods and services.

Chart 4.9 examines the historical trends in average weekly earnings compared with commercial customer numbers. 'Average weekly earnings' has grown much faster than the number of commercial customers over this period.

4.9 **Average weekly earnings**



Data sources: The CIE and ABS.

Network expansion

Another driver of customer numbers is the expansion of the gas network to new areas which previously did not receive mains gas supply. As noted previously, under the Gas to Regional Towns program, in 2003 the Victorian Government announced a program to extend the natural gas network to 34 towns throughout Victoria, including Maiden Gully, Macedon Ranges, Creswick, Camperdown, Port Fairy and Barwon Heads. To date there has been approximately 170 new commercial customers connected to SP Ausnet's network in these areas.

New connections and disconnections from existing population

Irrespective of population growth it is possible that SP AusNet's customer base will change over time as the existing businesses choose to connect (or disconnect) to the gas network. The reason for these changes could be due to a wide range of factors such as changes in the relative price of electricity and gas which is a substitute for certain services.

There is limited historical time-series data that provides a clear basis for examining the changes in business behaviour that drive their decisions in regards to connecting or disconnecting to the existing gas network. There are a significant number of commercial customers that do not use gas in any one year, suggesting that there is scope for some businesses to disconnect that are not using gas.

Forecasts of customer numbers

The discussion above suggests that there are likely to be a wide range of factors that impact on the future changes in the number of customers connected to SP AusNet's gas network. However, the analysis supports the ESC's view that the growth in commercial customers in the West and Central tariff zones is linked to dwellings (and residential customer) growth, particularly in terms of the location of new commercial customers matching the location of new residential customers. It is not as clear that changes in the amount of residential development changes the number of commercial customers, as there have been areas where residential development has ramped up with no commensurate increase in commercial connections. This could reflect leads and lags between commercial development and residential development.

The statistical analysis undertaken indicates that for every 1000 new residential customers there are 6 new commercial customers that connect to SP AusNet's network. We use this relationship and the forecast growth in residential customer numbers in the previous chapter to establish the forecast growth in commercial customer numbers.

For the 'new towns' tariff zones, the increase in residential customer numbers is not driven by an increase in population (and dwellings) into an area. Rather it is based on the existing dwellings choosing to connect to the network. Given this, dwellings growth (and consequent growth in residential customer numbers) is not expected to be a driver of the growth in commercial customer numbers. To project commercial customer numbers in the 'new towns' we use a similar approach used for developing the forecasts for residential customer numbers in these areas, based on future commercial customer growth to meet the maximum take up approved by the ESC for 2025.

Table 4.10 presents the historical and revised forecasts of the number of commercial customers over the upcoming regulatory period.

4.10 **Projected commercial customer numbers** by Tariff Zone

	2012	***2013***	***2014***	***2015***	***2016***	***2017***
	No.	No.	No.	No.	No.	No.
West	6 082	6 094	6 105	6 117	6 129	6 141
Central	9 477	9 547	9 618	9 689	9 758	9 827
NWest	175	184	195	209	224	239
NCentral	11	12	13	14	15	16

Source: The CIE.

5 Residential sector — customer usage

The usage of residential customers has changed over the last 8 years. New residential houses and units tend to use less gas than existing dwellings of the same type, and the share of new units in new dwellings is higher than for the existing customer base. In addition, consumption of gas in existing dwellings is on a slow downward trend.

This chapter assesses these changes and why they have occurred and then uses this as a basis for projecting future gas use for existing and new residential customers. The first part of the chapter describes changes in gas consumption patterns, the second part applies formal statistical techniques and the third and fourth develop the projections.

Descriptive analysis

The use of gas by residential customers varies markedly across different customer types and has changed significantly since 2003. Some of these changes are difficult to discern from raw data because weather leads to substantial year to year volatility in consumption.

In assessing gas consumption there are three key patterns that emerge.

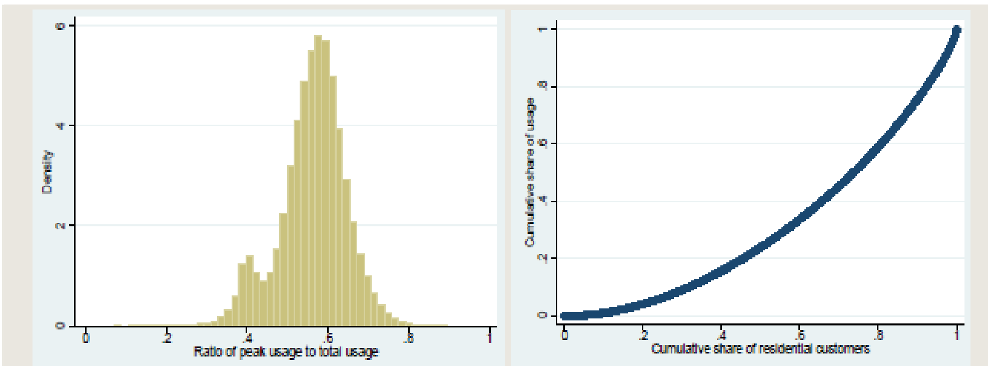
- Average gas use per connection appears to have fallen since 2003.
- The gas used by *new dwellings* appears to have peaked in 2005 and to now be substantially below the gas use of existing dwellings. This aligns with changes to building energy efficiency standards.
- There is markedly different gas use between different types of dwellings. Using billing data we can identify single dwellings and multi-unit dwellings. Multi-unit dwellings (mainly units/flats) use much less gas per dwelling. The composition of new dwellings is also shifting more towards these types of dwellings.

Characteristics of residential gas use

Most residential gas users use more gas in peak period. In chart 5.1 (left panel) we show the distribution of the ratio of peak usage to average usage for residential customers. A typical household would use about 60 per cent of their gas in the peak period of June to September, even though this is only one third of the days of the year. A small secondary peak can also be seen in the distribution. This is customers who use a similar amount of gas all year and are using gas for non-heating activities.

In the right hand panel of chart 5.1 we show the cumulative share of usage of residential customers arranged by size. The further this deviates from the 45 degree line the more different is the usage of residential customers. The chart suggests that residential customers while having different usage are not hugely different in the amount of usage. (This is not the case for commercial customers as discussed later.)

5.1 **Characteristics of residential gas use**

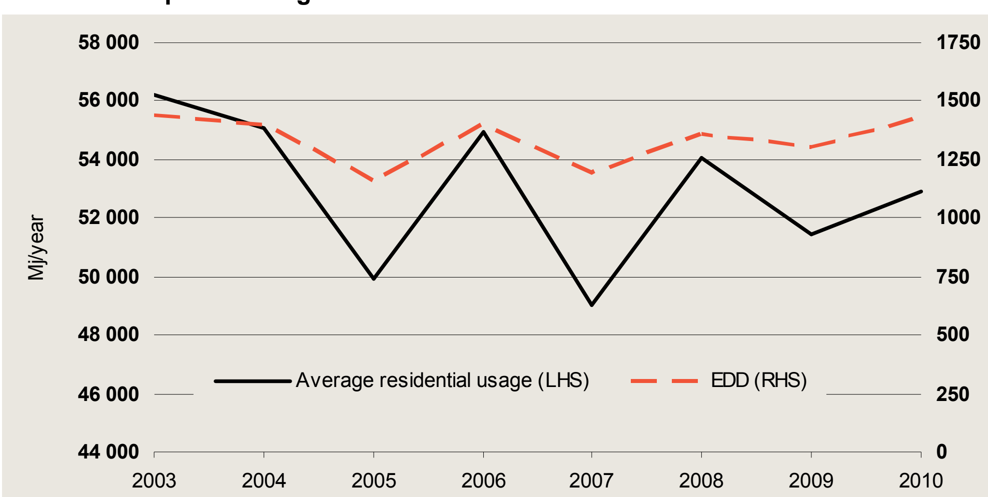


Data source: The CIE.

Trends in gas use since 2003

Average gas use has varied from year to year since 2003 but appears to be on a slow downward trend (chart 5.2). In 2010, average residential gas use was 6 per cent lower than in 2003, with similar weather conditions as measured by effective degree days. (Following formal statistical analysis we present weather normalised consumption, which shows this pattern more clearly.)

5.2 **Gas use per dwelling**

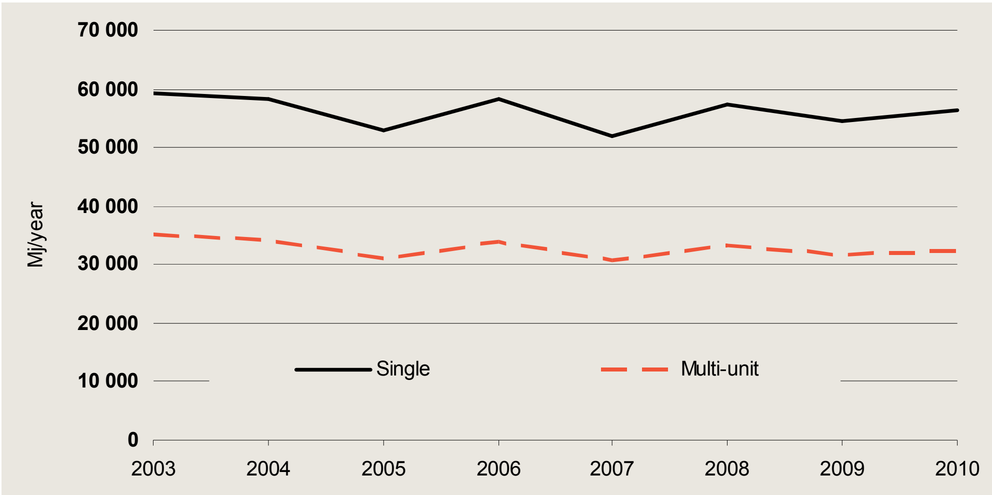


Data source: The CIE.

Gas use by dwelling type

Gas use differs markedly depending on the type of dwelling (chart 5.3). Multi-unit dwellings on average use around half the gas used in single dwellings.

5.3 **Gas use for single and multi-unit dwellings**

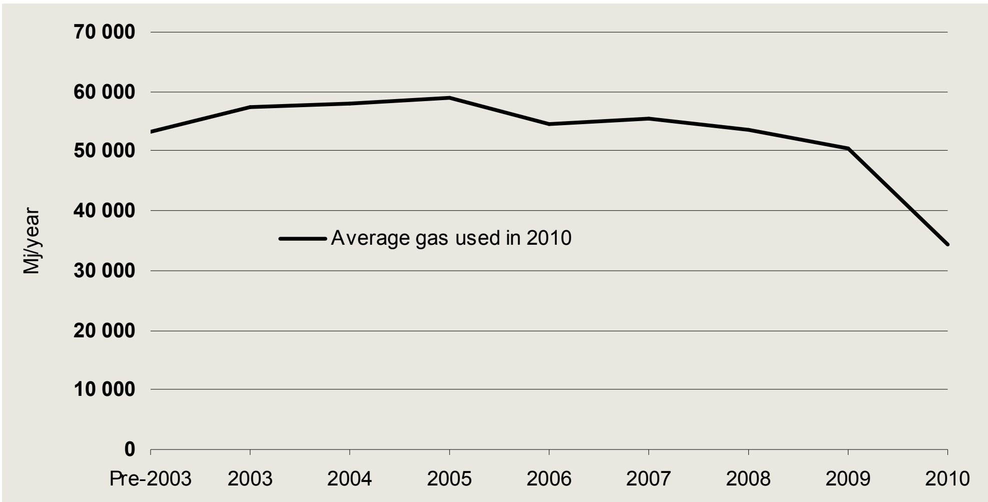


Data source: The CIE.

Gas use for new dwellings versus existing dwellings

The amount of gas used by a dwelling depends on when it was created. This is because new dwellings are in different locations and are built to different specifications. Dwellings built in 2006 and after appear to use less gas than those built in 2004 and 2005 (chart 5.4). This timeframe matches the introduction of 5 star energy efficiency requirements for buildings in Victoria. Note that the marked decline in 2010 reflects that these dwellings are not at full usage in 2010 as they were only connected in 2010. We have adjusted usage according to the number of days metered, but there is a period where customers are being metered prior to usage reaching its normal level. A similar pattern can be seen for previous years' consumption. That is, consumption in 2009 for connections made in 2009 is well below its 2010 level.

5.4 **Gas use for 2010 by year of gas connection**



Data source: The CIE.

Formal statistical analysis

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

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

Model form

There are three sorts of models that could be estimated for residential gas use making use of the billing data we have across dwellings and through time. (This data is known as panel data.)

- A fixed effects model — this model allows each household to have a different base consumption and then uses changes in this through time to assess the impact of variables that also change through time. This method is best for identifying impacts of variables that change through time, such as the weather or prices. It cannot be used for variables that remain the same for a dwelling such as the age of the building or type of dwelling.
- A random effects model — this model uses differences across households as well as differences through time to assess the impact of particular household characteristics and variables that change through time. It allows for households to

be systematically different through the error term rather than through a constant. It can be used to identify impacts of dwelling age and type for example.

- A pooled regression model — like a random effects model, this sort of model uses differences across households as well as differences through time to assess the impact of particular household characteristics and variables that change through time. However, it does not allow for households to be systematically different. This model is not pursued further as statistical tests indicate that it is a poor fit for the data.[27]

There are additional models not explored in this analysis using autoregressive components, such as lags of usage.

The explicit set up of the base model that we estimate is shown in the equation below.

$$\begin{aligned} q_{it} = \; & \beta_o + \beta_1.unit_i + \widetilde{\beta}_2.yearconnected_i + \mu_i \\ & + \gamma_1.year_t + \gamma_2.edd_t + \gamma_3.elecprice_t \\ & + \delta_1.price_{it} + \delta_2.retailer_{it} + \varepsilon_{it} \end{aligned}$$

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

The first row of explanatory variables is dwelling characteristics — whether the dwelling is a single dwelling or unit, a set of (0,1) dummy variables for the year in which the dwelling was connected and a dwelling specific error term.

The second row of explanatory variables is time specific characteristics, such as the year and effective degree days.

The third row of explanatory variables is characteristics that vary by both time and dwelling, which includes price, a dummy for whether the customer has changed from the standing retailer and an error term for that dwelling for that year.

If a fixed effects model is used then the first row becomes a constant estimated for each specific dwelling.

If a random effects model is used then the total error for each observation is $\mu_i + \varepsilon_{it}$, which allows for a specific error for each dwelling (distributed around zero) and an error for each dwelling and in each time period.

27 The Breusch Pagan test indicates that a random effects regression is a better fit than a pooled ordinary least squares regression.

Given that number of variables that we are interested in relate to dwelling specific characteristics, we use a random effects model as our base model. We then test whether the coefficients on time and time/household specific variables change if a fixed effects model is used.

We do not have income variables for each household or information on household size etc. Hence these cannot be included. It would be possible to include income variables or household size variables at a postcode level, although information would primarily be from the Census and hence only for one year within our time period. This may have implications for forecasting if we could identify new customers with different incomes than existing customers. A more pragmatic alternative would be to allow a dummy variable specific to each tariff class region and/or apply estimated changes to regions using some level of judgement. We test whether the former changes the results and also test whether there is a need to make locational adjustments because the pattern of new development differs from that of existing development.

Model estimation

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

The model is estimated in STATA, which is a data analysis and statistical software package.[28] STATA uses generalised least squares regression to estimate coefficients for panel regressions under random effects and fixed effects assumptions. We allow for error terms in regressions to be clustered in constructing the statistical significance of parameters.

For the exogenous variables we use dummy variables for the year of gas connection creation. (This variable is considered a proxy for year of dwelling creation.) A dummy variable takes either a value of 0 or a value of 1. For the dummy variable for year of connection for 2004 for example, all connections established in 2004 would have a value of 1 and all other connections would have a value of 0. We use a dummy for each year because we would not expect that the impact of year created would be linear. Note that all connections prior to 2003 are recorded in the billing database as 2002, hence strengthening the justification for using dummy variables.

We define *year* as year since 2003. We generally do not use a dummy variable approach for year because then we would not be able to differentiate between weather effects and any time trend in consumption. The use of year as a scalar variable implies that the effect is linear — i.e. each year on average leads to the same x per cent change in consumption. We test this as part of the sensitivity analysis to see if there is a non-linear pattern in consumption trends.

[28] See http://www.stata.com/ for more details.

We do not know the price paid by each customer. We have defined price as a price index for each region. The price index is based on standing offer tariffs reported by the Essential Services Commission of Victoria for consumption of 60 GJ. In addition, we include a dummy for the retailer on the presumption that a change in retailer will generally capture a price reduction as the customer moves off standing retail offers and onto a lower priced market offer. The retailer dummy is zero until a customer changes from the standing retailer and then is one. Note that some customers may not change retailer but move onto a lower priced market offer with their existing retailer. We cannot capture these changes with our dataset.

Model results

Our base model results for all residential dwellings and for single dwellings and multi-unit dwellings separately are shown in table 5.5. The parameter estimates show the impact of changing the explanatory variable on the natural log of consumption. For instance, a coefficient of -0.67 for units means that a unit otherwise similar to a house would have consumption of exp(-0.67) of the consumption of the house — ie 51 per cent of the consumption of an otherwise similar house.

Key findings are that:

- Once other factors are accounted for, units use about 50 per cent less gas than do single dwellings.[29]
- In 2006, there is a significant downward step in gas use from new dwellings. This likely reflects the adoption of 5 star energy efficiency standards. A dwelling built in 2006 uses about 12.4 per cent less gas than one built in 2005 (exp(-0.085-0.039)). The pattern of impact of year connected and usage is shown in chart 5.6.
  - Single dwelling use falls sharply for dwellings connected in 2006 and remains relatively constant thereafter.
  - Multi-dwelling use falls in 2006, 2007 and 2008, before stabilising. The overall reduction in use of new units is higher than for houses. This pattern may reflect longer lead times in multi-unit dwelling approvals that are subject to the 5 star building requirements and a greater existing inefficiency of multi-unit dwellings.
- Gas use trends downward by 0.7 per cent per year for all residential dwellings. This effect is larger for units, which fall by 1 per cent each year compared with single dwellings at 0.6 per cent.
- The estimated price elasticity is 0.17 for residential gas use. That is, a 1 per cent increase in price leads to a 0.17 per cent reduction in use. Moving to a new retailer

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29 The coefficient of 0.67 cannot be applied as a similar per cent difference as a log scale differs from percentage deviation as coefficients get larger.

is associated with a small increase in gas use that may also reflect the lower price from a market offer as against a standing offer.

- Higher effective degree days increases annualised gas use. An additional 10 effective degree days over a year would increase annual residential gas use by about 0.4 per cent. A comparable figure from daily regressions suggested that a 10 unit increase in annual effective degree days would increase consumption by 0.3 per cent a year (for both residential and commercial tariff V customers).

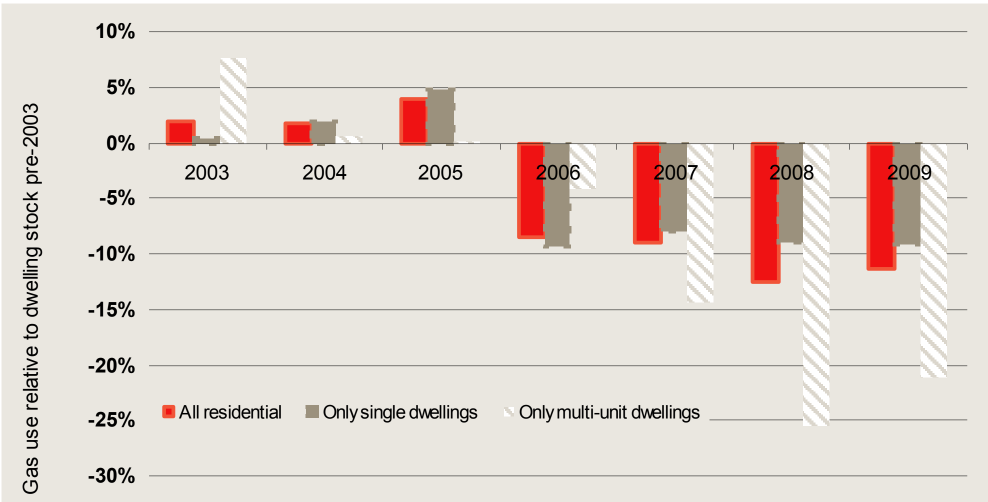
5.5**Models of residential gas use**

Sample	***All residential***		***Only single dwellings***		***Only multi-unit dwellings***	
Dependent variable	Log of annual gas use		Log of annual gas use		Log of annual gas use	
Exogenous variable						
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Constant	10.934	(158.6)	10.961	(151.3)	10.057	(46.3)
Unit dummy	-0.670	-(170.1)				
Year created						
2003	0.019	(2.8)	0.005	(0.7)	0.076	(4.3)
2004	0.017	(2.3)	0.019	(2.4)	0.005	(0.3)
2005	0.039	(5.1)	0.048	(5.9)	0.001	(0.0)
2006	-0.085	-(10.6)	-0.093	-(10.9)	-0.042	-(2.0)
2007	-0.090	-(11.2)	-0.079	-(9.3)	-0.143	-(6.3)
2008	-0.125	-(15.3)	-0.091	-(10.5)	-0.255	-(11.9)
2009	-0.113	-(13.0)	-0.092	-(10.1)	-0.210	-(8.4)
Year	-0.007	-(16.0)	-0.006	-(14.1)	-0.010	-(7.8)
EDD	0.0004	(203.6)	0.0004	(197.4)	0.0004	(58.1)
Price	-0.166	-(11.1)	-0.173	-(11.0)	-0.113	-(2.4)
Retailer dummy	0.006	(5.9)	0.006	(5.6)	0.005	(1.6)
Other statistics						
Number of observations	3955457		3458470		496987	3955457
Total R2	0.0636		0.0039		0.0036	0.0636

Note: Excludes data for the year in which the gas connection was created. Robust t-statistics in parentheses.
Source: The CIE.

The models above capture only a small share of the variation in the data, as would be expected given that we do not know a lot about a customer's characteristics, cannot account for holidays or when dwellings are not being used etc.

5.6 **Usage and gas connection creation**



Data source: The CIE.

Testing and cross-checks

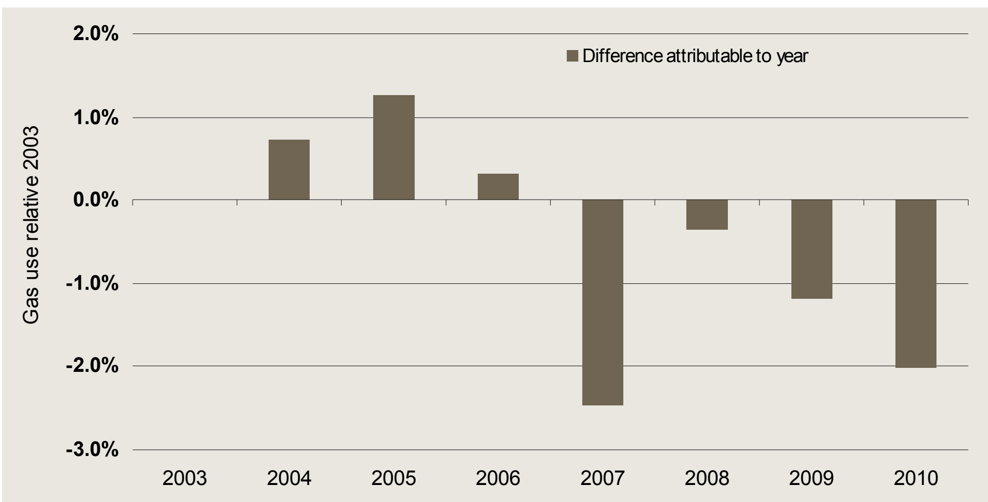
A number of cross-checks have been made on this model to test the sensitivity of estimates to changes in the model set-up. These are set out in table 5.8.

- Our base model is repeated as model A.
- In our base model we have excluded data for years that are the same as the year in which the connection was created. This is because it may take some time for usage to ramp up. In model B, we show the impact if this exclusion is not made and instead a variable for days metered is used.
- In model C we include days metered in our base model to see if this influences coefficients.
- In model D we exclude both the year in which a new connection is created and the following year from our regressions.
- For time varying effects, we can use a fixed effects model, where each dwelling is allowed a different base consumption. The estimated coefficients using this model are shown in model E.
- The year effects could be non-linear. To test this we estimate a year dummy and subtract the estimated base impact of changes in weather. This is done in model F.
- Tariff classes may impact on usage. To test this we include dummies for tariff class and show impacts on coefficients in model G.

The parameter coefficients are relatively resilient to changes in these model specifications.

- The decline in usage for new dwellings is evident in all model specifications. The size of the decline relative to the pre-2003 dwelling stock differs in magnitude from 6 per cent (for 2008, excluding the year of connection and subsequent year) to 15 per cent (for 2009, including all data and a days metered variable).
- The price elasticity remains fairly similar under all specifications. The coefficient is not much changed from allowing for fixed effects for each household.
- The annual yearly decline in usage ranges from 0.6 per cent to 0.9 per cent. This trend is not much changed from allowing for fixed effects for each household. In model F, which tests whether this decline is non-linear, it appears that the majority of the decline is from reduced usage after 2006 (chart 5.7).

5.7 **Non-linear patterns in residential usage**



Data source: The CIE.

5.8 Sensitivity tests on model

Sample	***Base model (A)***		***Including observations from same year and days metered (B)***		***Base model + days metered (C)***		***Base model excluding usage in year of creation and in following year (D)***		***Fixed effects for each dwelling(E)***		***Year dummies (F)***			***Tariff zone dummies (G)*** [b]	
Variables	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Year effect [a]	Coef.	t-stat
Constant	10.934	(158.6)	9.302	(132.9)	9.738	(136.4)	10.003	(110.4)	10.881	(157.9)	12.113	(62.8)		10.248	(121.3)
Unit dummy	-0.670	-(170.1)	-0.677	-(172.1)	-0.670	-(170.3)	-0.660	-(164.7)			-0.670	-(170.1)		-0.672	-(170.5)
Year created															
2003	0.019	(2.8)	0.062	(9.4)	0.034	(5.1)	0.039	(5.8)			0.018	(2.7)	0.000	0.018	(2.7)
2004	0.017	(2.3)	0.056	(7.5)	0.037	(4.9)	0.050	(6.6)			0.016	(2.1)	0.007	0.017	(2.2)
2005	0.039	(5.1)	0.075	(9.8)	0.059	(7.7)	0.071	(9.2)			0.040	(5.2)	0.013	0.040	(5.2)
2006	-0.085	-(10.6)	-0.034	-(4.4)	-0.052	-(6.6)	-0.033	-(4.2)			-0.083	-(10.4)	0.003	-0.071	-(8.9)
2007	-0.090	-(11.2)	-0.026	-(3.3)	-0.049	-(6.1)	-0.045	-(5.7)			-0.092	-(11.5)	-0.025	-0.068	-(8.4)
2008	-0.125	-(15.3)	-0.054	-(6.6)	-0.081	-(9.9)	-0.058	-(7.2)			-0.124	-(15.1)	-0.003	-0.110	-(13.5)
2009	-0.113	-(13.0)	-0.151	-(16.6)	-0.106	-(12.2)					-0.108	-(12.4)	-0.012	-0.105	-(12.2)
2010			-0.481	-(3.5)									-0.020		
Days metered			0.005	(252.4)	0.003	(63.6)	0.003	(25.0)							
Year	-0.007	-(16.0)	-0.008	-(19.6)	-0.007	-(17.8)	-0.009	-(20.6)	-0.006	-(15.3)				-0.006	-(14.6)
EDD	0.0004	(203.6)	0.0004	(194.4)	0.0004	(199.5)	0.0004	(207.8)	0.0004	(204.6)				0.0004	(203.7)
Price	-0.166	-(11.1)	-0.180	-(11.9)	-0.175	-(11.8)	-0.229	-(14.5)	-0.171	-(11.4)	-0.293	-(7.3)		-0.191	-(12.9)
Retailer dummy	0.006	(5.9)	0.005	(5.2)	0.007	(7.5)	0.010	(9.5)	0.001	(1.3)	0.006	(6.0)		0.006	(6.4)
Other statistics															
Number of observations	3955457		4029668		3955457		3409505		3955457		3955457			3955457	
Total R2	0.0636		0.0913		0.0661		0.0629		0.003		0.0637			0.0642	

[a] Year effect is the year dummy less the effect of weather from our base regressions to give a non-linear year trend relative to 2003. [b] Tariff zone dummies are similar for Central, West and Adjoining West. Adjoining Central, which has a small number of gas customers is associated with lower gas use.

Note: Robust t-statistics in parentheses. Dependent variable is log of annualised gas usage for all regressions.

Source: The CIE.

Do electricity prices drive gas consumption?

We have also tested for the inclusion of the price of electricity as a driver of residential gas consumption. The best price indicator for residential (and business) electricity is the real price derived from Essential Services Commission of Victoria reported standing offers for the Powercor region. This region corresponds most closely with the SP AusNet gas region. We find that the price of electricity is not a significant driver of residential gas consumption.

An alternative price measure is the ABS electricity price index for Melbourne, which is a component of the Consumer Price Index. We convert this into a real price change using the Melbourne total CPI. Using this measure, the price of electricity has a small negative relationship with gas demand. That is, a 10 per cent increase in the electricity price is associated with a 0.2 per cent reduction in gas consumption.

5.9 **Inclusion of electricity price in analysis**

Sample	***All residential***		***Using ESC standing offer prices***		***Using ABS Melbourne electricity price index***	
Dependent variable	Log of annual gas use		Log of annual gas use		Log of annual gas use	
Exogenous variable						
	Coefficient	t-stat	Coefficient	t-stat	Coefficient	t-stat
Constant	10.934	(158.6)	10.939	(131.8)	10.771	(132.6)
Unit dummy	-0.670	-(170.1)	-0.670	-(170.1)	-0.670	-(170.1)
Year created						
2003	0.019	(2.8)	0.019	(2.8)	0.019	(2.8)
2004	0.017	(2.3)	0.017	(2.3)	0.017	(2.2)
2005	0.039	(5.1)	0.039	(5.1)	0.039	(5.0)
2006	-0.085	-(10.6)	-0.085	-(10.6)	-0.084	-(10.6)
2007	-0.090	-(11.2)	-0.090	-(11.2)	-0.090	-(11.2)
2008	-0.125	-(15.3)	-0.125	-(15.3)	-0.124	-(15.2)
2009	-0.113	-(13.0)	-0.113	-(13.0)	-0.112	-(12.9)
Year	-0.007	-(16.0)	-0.007	-(13.9)	-0.007	-(16.1)
EDD	0.0004	(203.6)	0.0004	(178.9)	0.0004	(191.7)
Price	-0.166	-(11.1)	-0.167	-(7.6)	-0.133	-(7.7)
Retailer dummy	0.006	(5.9)	0.006	(5.9)	0.006	(5.7)
Electricity price			0.001	(0.1)	-0.019	-(4.4)
Other statistics						
Number of observations	3 955 457		3 955 457		3 955 457	
Total R2	0.0636		0.0636		0.0636	

Note: Excludes data for the year in which the gas connection was created. Robust t-statistics in parentheses.

Source: The CIE.

Other studies have found similarly mixed responses about the relationship between electricity prices and gas consumption.

- Akmal and Stern 2001 found that a 1 per cent increase in Australian residential electricity prices would lead to a 0.87 per cent increase in residential gas consumption.[30]
- Akmal and Stern 2001b found that the cross-price elasticities between electricity and gas were negative using national data and positive but not significant using state data.[31]

The time period for these studies is up till 1998, which does not overlap with the more recent period that we consider.

Recent changes in energy markets mean that gas and electricity are often provided by a single retailer. It is plausible that households react to 'energy' prices with lower consumption of electricity and gas, rather than switching between electricity and gas.

We consider that the evidence suggests that the most appropriate assumption for forecasting for residential gas use is to allow for no relationship between electricity prices and gas consumption.

Effects across different parts of the tariff structure

The changes in usage observed in aggregate are split in different ways across tariff blocks and peak and off-peak use. This has implications for revenue. We estimate patterns at the level of peak and off-peak consumption and for each block. Peak and off-peak estimations provides useful additional information to the base model. However, additional disaggregation into blocks provides less plausible results, with interactions between pricing variables and time trends likely occurring.

We show the estimation of peak and off-peak consumption in table 5.10. Key findings are as follows.

- The reduction in gas use from dwellings built in 2006 as against dwellings built in 2005 occurs for both peak and off-peak periods. However, peak consumption for dwellings built in 2005 is above peak consumption of the entire stock of dwellings, while off-peak is about the same. Hence relative to the entire stock of dwellings, consumption falls most in off-peak periods.
  - This is suggestive of building thermal efficiency having the greatest impact on shoulder periods and/or standards reducing the use of gas for hot water heating. Standards introduced in 2005 require a new dwelling to either have a rainwater tank or solar hot water system.

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[30] Akmal, M. and D. Stern 2001, 'Residential energy demand in Australia: an application of dynamic OLS', ANU working papers in Ecological Economics.

[31] Akmal, M. and D. Stern 2001, 'The structure of Australian residential energy demand', ANU working papers in Ecological Economics.

- The annual reduction in gas use is only evident in off-peak consumption. Off-peak consumption is estimated to have fallen by 1.6 per cent each year, while peak consumption is broadly unchanged.
- Weather effects are stronger for off-peak, suggesting that it may be shoulder periods where heating is turned off rather than in winter or where the largest weather variation occurs.
- The price elasticity is stronger in peak periods as against off-peak periods. However, given that the price index is not a specific price for peak and off-peak this may not be a good measure of actual behavioural response. The retailer dummy, which is also capturing a price effect is also stronger in peak periods.

5.10 **Analysis of peak and off-peak**

Sample	*Base model*		*Peak*		*Off-peak*	
Dependent variable	Log of annualised gas use		Log of actual gas use		Log of actual gas use	
Exogenous variable	Coef	t-stat	Coef	t-stat	Coef	t-stat
Constant	10.934	(158.6)	7.045	(80.5)	7.340	(111.7)
Unit dummy	-0.670	-(170.1)	-0.727	-(170.7)	-0.602	-(161.8)
Year created						
2003	0.019	(2.8)	0.060	(8.0)	-0.031	-(5.0)
2004	0.017	(2.3)	0.067	(7.9)	-0.033	-(4.8)
2005	0.039	(5.1)	0.086	(10.0)	-0.013	-(1.9)
2006	-0.085	-(10.6)	-0.010	-(1.1)	-0.161	-(22.1)
2007	-0.090	-(11.2)	-0.022	-(2.5)	-0.147	-(20.1)
2008	-0.125	-(15.3)	-0.046	-(5.2)	-0.191	-(25.5)
2009	-0.113	-(13.0)	0.007	(0.7)	-0.302	-(37.6)
Days metered in relevant period [a]			0.032	(89.0)	0.009	(147.8)
Year	-0.007	-(16.0)	0.001	(2.2)	-0.016	-(41.7)
EDD	0.000	(203.6)	0.0003	(132.6)	0.0006	(295.9)
Price	-0.166	-(11.1)	-0.278	-(16.8)	-0.094	-(6.8)
Retailer dummy	0.006	(5.9)	0.008	(7.4)	0.006	(6.5)
Other statistics						
No of obs.	3 955 457		3 939 862		3 954 580	
Total R2	0.0636		0.063		0.079	

[a] Days metered in relevant period included in peak and off-peak instead of seeking to make an annualised version of peak and off-peak consumption.

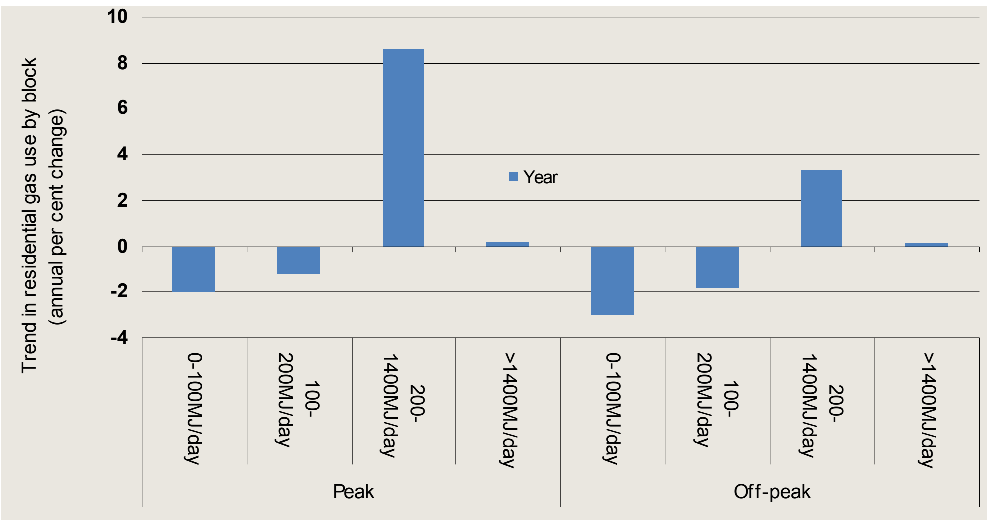
Note: Excludes data for the year in which the gas connection was created. Robust standard errors in parentheses.

Source: The CIE.

At a more detailed level, we can consider whether the changes have impacted on different blocks of consumption in different ways. For instance, if high gas users have changed their behaviour more than typical gas users then this will impact on the spread of change across the different tariff blocks. The results of this analysis are set out in detail in table 5.15. In the charts below we explain what these numbers mean.

Firstly, there is a pattern of increasing gas use for the larger blocks and decreasing gas use for smaller blocks, given the type of dwelling and other factors accounted for in the regression (chart 5.11). Smaller blocks in both peak and off-peak have declined at 1 per cent to 3 per cent each year, after accounting for other factors. In comparison, the 200-1400MJ/day block has increased by over 8 per cent per year in peak periods after accounting for other factors and 3 per cent in off-peak periods. (There is some interaction with prices that suggests that this figure is an overstatement but the general pattern remains.) This might reflect additional heating of single dwellings for gas use, while gas use for smaller users such as ovens and hot water systems is in decline.

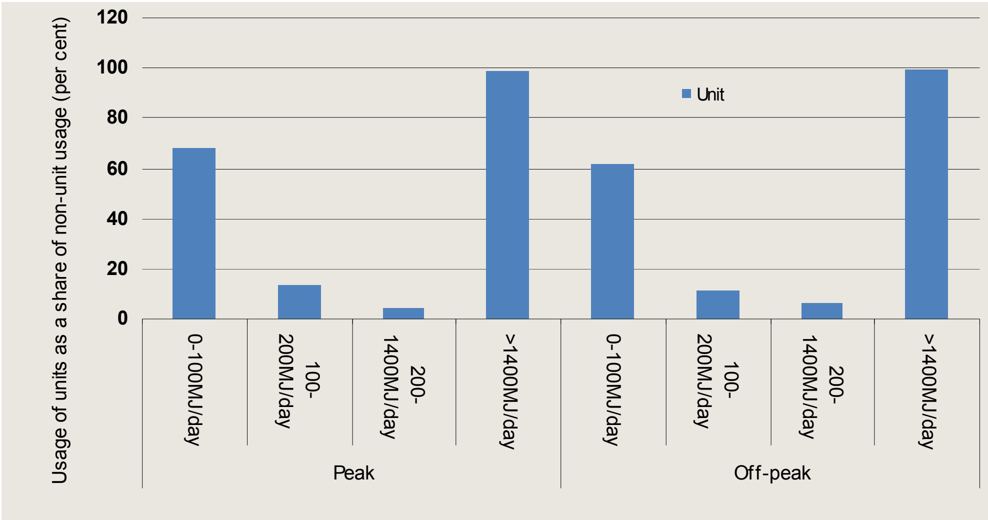
5.11 **Time trends in consumption by block**



Data source: The CIE.

In aggregate usage data, the effect of rising consumption of single dwellings in the larger blocks is partially offset by a higher amount of dwellings that are units as against single dwellings (chart 5.12). Units use only 4 per cent to 11 per cent of the consumption of single dwellings in the 200-1400 MJ/day block. Interestingly, in the greater than 1400 MJ/day block units use a comparable amount to single dwellings. This most likely reflects that some unit blocks are charged centrally for their consumption and that there are very few dwellings in total that use more than 1400MJ/day (less than 1 per cent of residential customers).

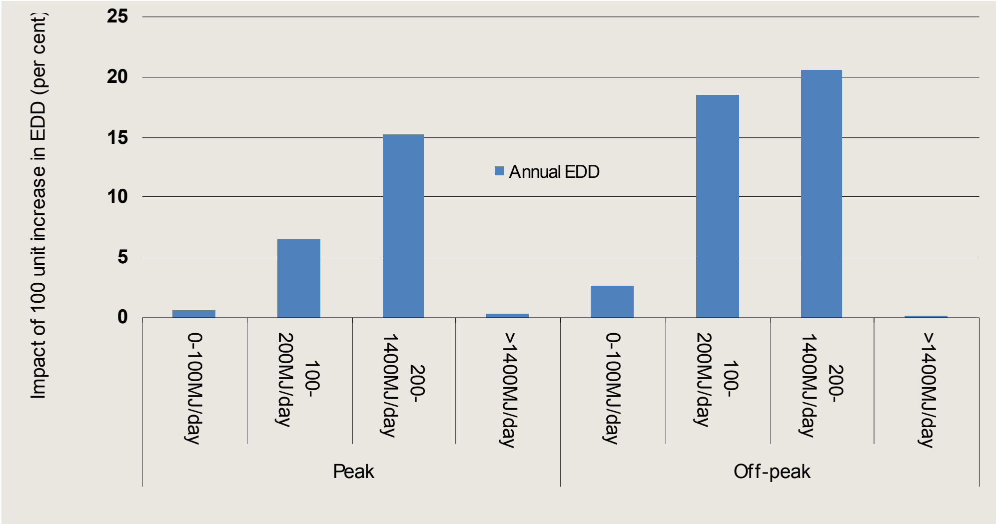
5.12 **Gas use of units relative to single dwellings by block**



Data source: The CIE.

The implied impact of weather conditions can also be estimated across the different blocks (chart 5.13). Note that annual effective degree days is used rather than a measure specific to the peak or off-peak periods. As expected, weather impacts are higher for the third largest block, because consumption in this block is more likely to be due to heating. For the largest block, weather makes little impact, suggesting that these customers may be using gas for pool heating or another activity not positively correlated with effective degree days. The impact of annual effective degree days is higher for off-peak consumption than for peak. It appears that in these shoulder periods people may be more likely to respond with heating, while in peak periods more households are using heating regardless of the temperatures. It may also be that a larger part of the variation in annual degree days occurs from off-peak climatic conditions. We have not tested this as yet.

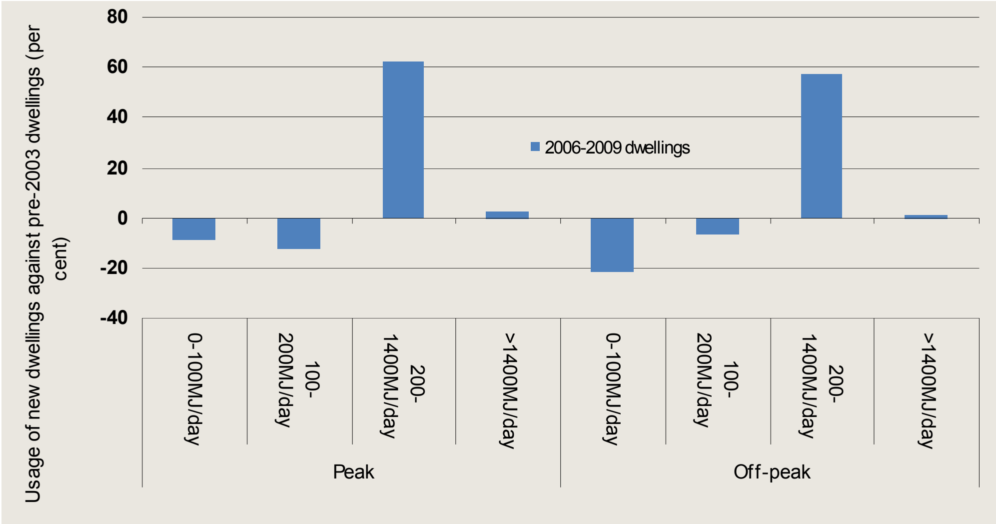
5.13 **Impact of effective degree days on usage by block**



Data source: The CIE.

New dwellings follow a similar pattern to the time trend for existing dwellings (chart 5.14). New dwellings have lower consumption for the 1st two blocks and higher consumption for the third block. This again suggests that it is activities such as using gas for ovens, cooking and hot water that are falling rather than for heating, and that there are quite different patterns across customers.

5.14 **New dwellings and usage by block**



Data source: The CIE.

Note that the billing database deviates from SP AusNet's tariff model because we have allocated customers to residential and commercial customer classes using their class in 2010. In practice, a number of customers earlier billed as residential were commercial customers.

5.15 **Analysis of residential blocks**

Sample	***Peak***								***Off-peak***							
Blocks	0-100MJ/day		100-200MJ/day		200-1400MJ/day		>1400MJ/day		0-100MJ/day		100-200MJ/day		200-1400MJ/day		>1400MJ/day	
Exogenous variable	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat
Constant	0.484	(3.9)	5.886	(19.9)	15.499	(41.5)	0.412	(10.0)	4.965	(47.8)	7.046	(25.9)	7.061	(22.0)	0.257	(9.1)
Unit dummy	-0.384	-(79.6)	-1.989	-(146.0)	-3.165	-(225.7)	-0.015	-(18.8)	-0.484	-(103.2)	-2.191	-(173.0)	-2.720	-(236.9)	-0.007	-(8.9)
Year created																
2003	0.000	(0.0)	0.029	(1.3)	0.809	(28.3)	0.018	(5.5)	-0.036	-(5.6)	0.100	(4.5)	0.747	(29.6)	0.010	(3.8)
2004	-0.042	-(5.4)	0.018	(0.7)	0.917	(29.4)	0.015	(4.9)	-0.064	-(8.5)	0.134	(5.5)	0.887	(32.0)	0.008	(2.8)
2005	-0.017	-(2.2)	0.060	(2.2)	1.016	(30.9)	0.022	(5.8)	-0.041	-(5.5)	0.190	(7.4)	0.976	(33.3)	0.009	(3.1)
2006	-0.058	-(7.1)	-0.117	-(4.5)	0.638	(19.9)	0.016	(5.5)	-0.160	-(20.5)	-0.068	-(2.7)	0.574	(20.2)	0.005	(2.3)
2007	-0.074	-(8.5)	-0.170	-(6.4)	0.567	(17.8)	0.019	(5.2)	-0.160	-(19.4)	-0.056	-(2.2)	0.573	(20.0)	0.014	(4.2)
2008	-0.130	-(13.9)	-0.186	-(7.0)	0.575	(18.3)	0.042	(8.7)	-0.228	-(26.5)	-0.017	-(0.7)	0.661	(23.2)	0.025	(6.0)
2009	-0.075	-(7.1)	-0.012	-(0.4)	0.717	(19.5)	0.035	(6.3)	-0.315	-(32.9)	-0.132	-(4.7)	0.477	(14.1)	0.016	(4.0)
Days metered in relevant period [a]	0.057	(153.9)	0.049	(95.0)	0.043	(76.2)	0.000	(7.5)	0.012	(105.8)	0.015	(88.7)	0.013	(72.8)	0.000	(1.1)
Year	-0.020	-(27.7)	-0.012	-(7.0)	0.086	(38.8)	0.002	(8.1)	-0.030	-(47.6)	-0.019	-(11.4)	0.033	(17.3)	0.001	(6.5)
EDD	0.0001	(17.2)	0.0007	(69.5)	0.0015	(127.1)	0.0000	(18.1)	0.0003	(94.3)	0.0018	(213.6)	0.0021	(199.3)	0.0000	(12.5)
Price	0.353	(14.0)	-1.037	-(16.5)	-3.579	-(45.0)	-0.102	-(11.6)	0.307	(14.1)	-1.331	-(22.9)	-1.786	-(25.9)	-0.058	-(9.6)
Retailer dummy	0.030	(19.4)	0.041	(9.5)	0.024	(4.4)	-0.003	-(5.1)	0.025	(18.8)	0.026	(6.5)	0.026	(5.3)	-0.001	-(2.8)
Other statistics																
Number of obs.	3987216		3987068		3986728		3987241		3986669		3773959		3474573		3982763	
Total R2	0.045		0.042		0.058		0.001		0.041		0.056		0.066		0.000	

[a] Days metered in relevant period included in instead of seeking to make an annualised version of peak and off-peak consumption.

Note: Excludes data for the year in which the gas connection was created. Robust standard errors in parentheses.

Source: The CIE.

Drivers of historical changes

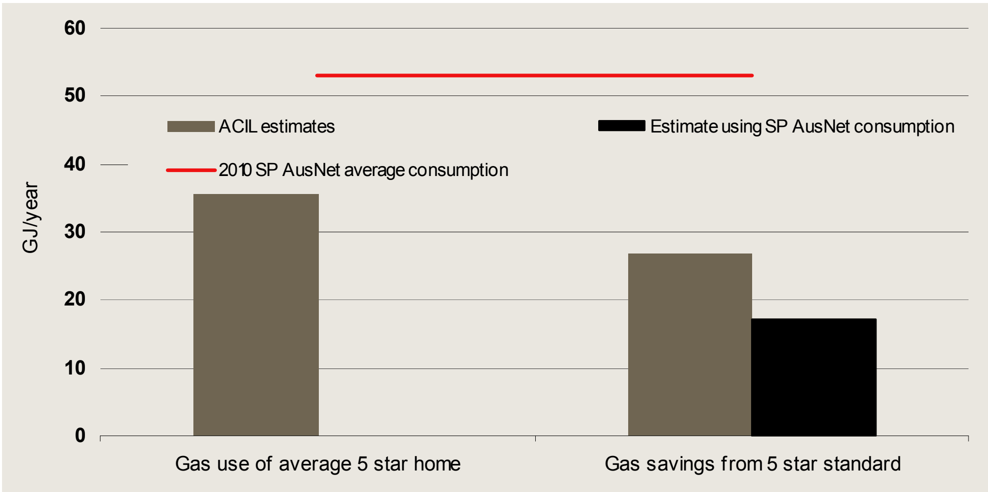
The formal characterisation of changes in usage above tells us what has changed and helps to understand some of the likely reasons for these changes. This provides a basis for understanding whether these changes will continue.

We consider that a large part of the changes in usage patterns that we see in the data can be explained by government policy changes.

- The gas used by new buildings (of the same type) is impacted by building size and energy efficiency. In July 2005, 5 start energy efficiency standards came into effect in Victoria.[32] ACIL Tasman estimated that these standards would save in the order of 27 GJ of gas per household per year, for comparable dwellings (chart 5.16). This is around half of the level of gas consumption per dwelling. The changes we find are much smaller, which likely reflects that dwelling characteristics of new dwellings are different to existing dwellings. Even after accounting for this, such as through considering the change in gas use for dwellings built in 2005 as against 2006, the estimated changes in gas use that we find are significantly more conservative than those from the impact study. We expect that the change that is seen in the data is because of the change in building standards given its close alignment to when standards were introduced.
- The gas used by existing buildings is impacted by many policies as discussed in Appendix B and potentially by household income, size etc. The reduction in usage that we see (after accounting for type of dwelling, age of construction and weather) likely reflects the impact of policies such as solar hot water system take up, low flow showerheads that reduce water use and hence gas used for heating water, greater efficiency of gas instantaneous hot water systems and potentially programs aimed at thermal efficiency improvements such as ceiling insulation. Over the last 8 years and particularly in recent years, these effects appear to have more than offset growing gas used from higher incomes.

32 ACIL Tasman 2008, *Evaluation of the Victorian 5 Star Building Standard*, prepared for the Department of Sustainability and Environment Victoria.

5.16 **Gas use of new dwellings and building energy efficiency standards**



Data source: The CIE; ACIL Tasman (2008), *Evaluation of the Victorian 5 Star Building Standard*, prepared for the Department of Sustainability and Environment Victoria.

Putting specific impacts around each policy intervention is difficult and is subject to considerable uncertainty. For the purposes of forecasting, the most important aspect is whether the patterns that we have seen historically are likely to continue.

These impacts are discussed in greater detail below.

Policy impacts

A variety of Commonwealth and State Government policies target decreased household energy consumption. These programs often support overlapping objectives and activities and are not subjected to rigorous cost-benefit analysis.

However, several government programs have been reviewed with an attempt to quantify the impact of the policy on gas consumption. Where they are available, these studies have concluded that each policy will have only marginal impacts on gas usage (table 5.17).

- Victorian Energy Efficiency Target (VEET) —places a legislative requirement on state energy retailers to meet energy savings targets through energy efficiency activities. A cost–benefit analysis was undertaken on the proposed VEET regulations in 2008. This study concluded that the scheme would lead to only a relatively small volume reduction in gas demand against the business-as-usual case[33] (1 per cent over 2009 to 2011). This was because 'the reduction in gas

[33] The business as usual (BAU) case made the following assumptions: The wholesale market price includes all policies which were formally in place as of November 2006. This includes: the Queensland 13 per cent Gas Scheme; NSW Greenhouse Gas Abatement Scheme; Commonwealth MRET Scheme; 5-star building requirements; and MEPS for relevant appliances. The BAU scenario did not include: the NSW Renewable Energy

demand induced through increased heating efficiencies is partially offset by the active switching of customers from electricity to gas (the VEET scheme rewards fuel substitution where it yields a greenhouse benefit)'.[34]

- Phase-out of electric resistance hot water systems — a cost–benefit analysis[35] undertaken on the phasing out greenhouse intensive water heaters found that the increase in gas demand from a higher rate of electric to gas water heater replacement in areas already reticulated would be largely offset by rises in the efficiency of all gas use across Australia. In Victoria the increased efficiency will probably outweigh the higher take up as Victoria has a much higher gas use already than elsewhere in Australia.
- 6 Star Standard building code — introduced from May 2011, the 6 Star Standard for new homes, alterations and additions applies to the thermal performance of a dwelling, plus the requirement to install a solar water heater system or a rainwater tank for toilet flushing in new homes. The CIE conducted a RIS of proposed amendments to energy efficiency requirements in the Building Code of Australia and found expected savings in gas consumption.[36] It was found that the improved thermal performance of households would lead to gas consumption savings of 6561MJ or $92 per year in Melbourne houses. Given average annual gas consumption of around 52GJ, this equates to a 12 per cent decline.
- Energy and water labelling and Minimum Energy Performance Standards (MEPS) — mandatory energy and water labelling for a range of electrical products aims to make consumers more aware of the energy efficiency of products. Certain products are subject to MEPS, which means that they have regulated minimum energy efficiency levels. A recent review concluded that gas consumption savings as a result of the water heating and space heating MEPS would equate to $510 and $326 million nationally.[37] In terms of gas consumption this is likely to be around a 1 per cent decrease for Victoria.

Target Scheme; the Clean Energy Target announced by the Commonwealth in September 2007; and a carbon price induced through a national ETS. The BAU also assumed that normal rainfall patterns resume.

34 Department of Primary Industries 2008, *Regulatory Impact Statement: Proposed Victorian Energy Efficiency Target Regulations*, September.

35 George Wilkenfeld and Associates 2010, *Regulation Impact Statement: for Decision Phasing Out Greenhouse-Intensive Water Heaters in Australian Homes*, prepared for the National Framework for Energy Efficiency, November.

36 Centre for International Economics 2009, *Final Regulation Impact Statement For Decision (Final RIS 2009-06): Proposal to Revise the Energy Efficiency Requirements of the Building Code of Australia for Residential Buildings — Classes 1, 2, 4 and 10,* December.

37 George Wilkenfeld and Associates 2010, *Regulation Impact Statement: National Legislation for Appliance and Equipment Minimum Energy Performance Standards (MEPS) and Energy*

5.17 **Table of policy impacts**

Policy	*Likely impacts*	*Magnitude of impacts*
Victorian Energy Efficiency Target	Decrease demand for gas	1 per cent decline (2009-11) Unknown future impacts
Phase-out of electric resistance hot water systems	No impact on demand for gas	na
6 Star Standard building code	Decrease demand for gas	12 per cent decline for new dwellings
Energy and water labelling and Minimum Energy Performance Standards	Stable demand for gas Australia Likely decrease demand for gas in Victoria	1 per cent decline

Note: Further information is contained in Appendix B.

Source: Various as set out in detail in Appendix B.

It is noted that a variety of other state and federal energy efficiency and clean energy policies are likely to impact on Victoria's residential demand for gas. For instance:

- Victorian Feed-in Tariff scheme
- Victorian Government Sustainability Fund
- Carbon Pollution Reduction Scheme and Clean Energy Finance Corporation
- Commonwealth Renewable Energy Target
- Green Loans Program, and
- Tax Breaks for Green Buildings program.

We have considered whether the impacts of these types of energy efficiency measures might be measurable using the household surveys of energy use conducted by the Victorian Department of Human Services. The results of analysing this survey are shown in Appendix D. It has not proven possible to isolate specific impacts of building type and characteristics in detail.

Forecasts of residential gas use

Our projections of gas use for 2013 to 2017 are based on the patterns in usage that we have observed above. We project forward per dwelling consumption for existing dwellings and new dwellings for each block and for peak and off-peak periods and then combine these estimates to form aggregate consumption numbers. This involves the following steps.

- Adjusting 2010 per dwelling consumption for each Tariff Zone and each usage block to reflect 'typical' climatic conditions. Typical climatic conditions are

labelling, prepared for the Department of the Environment, Water, Heritage and the Arts, January.

modelled using annual effective degree day measures from CSIRO projected forward with a continued decline in EDDs.[38] See table 5.18.

- Continuing a downward trend in per capita gas consumption, reflecting the continuation of government policies to improve appliance efficiency, building efficiency and increased take up of solar hot water. We use the same trends that have been observed historically for peak (0.1 per cent increase) and off-peak (1.6 per cent decrease) gas use
- Considering whether the location of new developments is likely to differ from recent development. We find that dwelling projections for recent years closely match dwelling projections in forecast years in terms of geographic spread of dwellings and hence do not adjust for this. If later projections from Victoria Planning and Community Development (expected in August) show a difference then an adjustment could be made.
- Generating a base measure of consumption for new dwellings based on the statistical analysis of new dwellings as against existing dwellings. The combined effect includes that new dwellings use less gas than an existing dwelling, given the type of dwelling and that the composition of new dwellings has more flats than the composition of existing dwellings and flats use less gas on average.
- Applying a further step down in gas use in 2012 for new dwellings as a result of the introduction of 6 star building standards for residential buildings that became mandatory in Victoria for new houses and apartments on 1 May 2011.[39] The exact size of the reduced gas use from the move to 6 star buildings is not known. The CIE has estimated the impact of 6 star energy efficiency standards as against 5 Star for the Australian Building Codes Board, as discussed above. A 12 per cent reduction is used in the projections.
- Applying an estimated price elasticity to prices based on our model for peak and off-peak price elasticities. Prices are increased to reflect projections of increases in prices from Australian Treasury.[40] Note that we have not sought to equalise Victorian wholesale gas prices with prices reported by Australian Treasury over the period of the regulatory determination. Currently Victorian wholesale prices are well below prices reported by Australian Treasury, suggesting that there is the potential for steep gas rises to match export parity prices. This means the implied wholesale prices are below those in Treasury modelling. We have applied a price

38 CSIRO 2007, *Projected changes in temperature and heating degree-days for Melbourne and Victoria, 2008-2012*, http://multinetgas.com.au/regulatoryIssues/downloads/RegulatoryEnviroment/GasAccessArrangements/CSIRO_Melb_EDD_2008-2012.pdf.

39 Victorian Building Commission website, http://www.buildingcommission.com.au/www/html/2565-faq---6-star.asp , accessed 15 October 2011.

40 Australian Treasury 2011, *Strong growth, low pollution: modelling a carbon price,* chart B2.

increase to household and gas prices based on a share of 20 per cent of the retail price being driven by wholesale prices. See table 5.18.

5.18 Independent projections for usage forecasts

Item	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*
EDD [a]	1 285	1 278	1 270	1 261	1 253	1 244	1 235
Wholesale gas price Victoria (real, $/GJ)	2.99	2.99	2.99	3.05	3.11	3.24	3.36
Australian Treasury wholesale gas price ($/GJ)	4.8	4.8	4.8	4.9	5.0	5.2	5.4

[a] 2011 and 2012 figures are from CSIRO advice to SP AusNet. [b] Australian Treasury 2011, *Strong growth, low pollution - modelling a carbon price*, chart B6, domestic Australian gas prices, NEM.

Source: As noted above.

The assumptions embodied in projections are set out in greater detail in table 5.19.

5.19 Residential assumptions for projections

Block	*EDD*	*Time trend*	*New dwellings*	*Units*	*Gas price*	*New building standards post 2012*	*New dwelling adjusted for unit stock - Central*	*New dwelling adjusted for unit stock - West*
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Peak 0 - 0.1	0.03	0.10	-2.05	-72.72	-27.80	-12.00	-6.51	-5.95
Peak 0.1 - 0.2	0.03	0.10	-2.05	-72.72	-27.80	-12.00	-6.51	-5.95
Peak 0.2 - 1.4	0.03	0.10	-2.05	-72.72	-27.80	-12.00	-6.51	-5.95
Peak > 1.4	0.03	0.10	-2.05	-72.72	-27.80	-12.00	-6.51	-5.95
Off Peak 0 - 0.1	0.06	-1.64	-21.34	-60.18	-9.45	-12.00	-5.39	-4.92
Off Peak 0.1 - 0.2	0.06	-1.64	-21.34	-60.18	-9.45	-12.00	-5.39	-4.92
Off Peak 0.2 - 1.4	0.06	-1.64	-21.34	-60.18	-9.45	-12.00	-5.39	-4.92
Off Peak > 1.4	0.06	-1.64	-21.34	-60.18	-9.45	-12.00	-5.39	-4.92

Note: For Central, units make up 13.7 per cent of the stock of dwellings in 2011 and 22.6 per cent of new dwellings. For West, units make up 13.3 per cent of the stock of dwellings in 2011 and 21.5 per cent of new dwellings. No change to usage is made for new dwellings in new towns except for the 6 star building standards.

Source: The CIE.

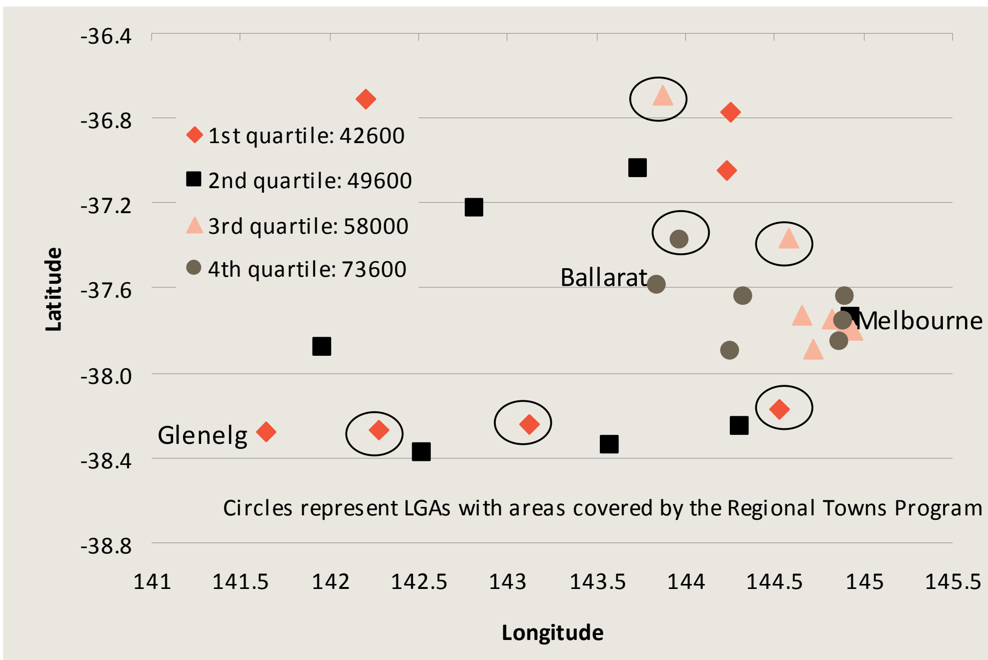
We apply the same changes to each block in peak and off-peak consumption. It is possible to apply more differentiated changes to each block using analysis presented above. However, analysis conducted on higher blocks using natural logs can skew downward the influence of larger users, providing a less accurate picture of overall changes in aggregate usage.

We apply these percentage changes to figures from the tariff reports of SP AusNet in table 5.22.

Location of development

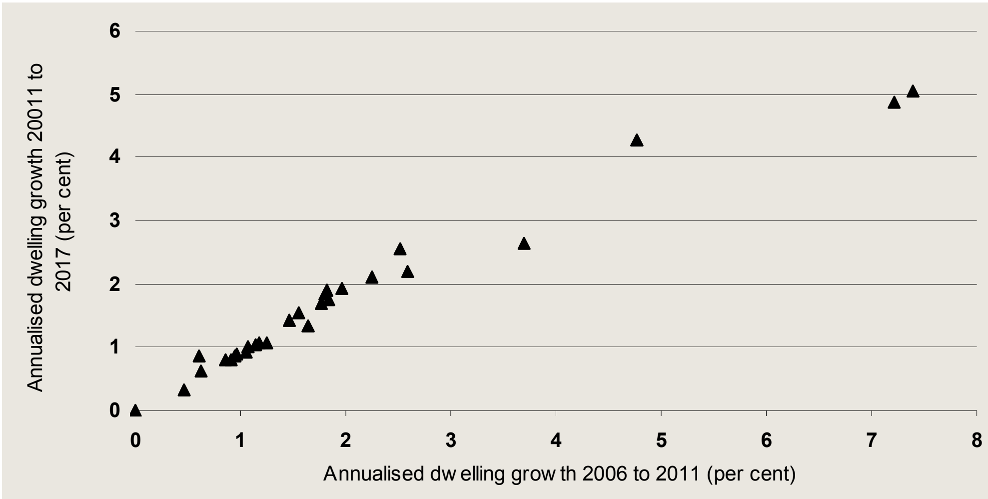
The projections above do not make allowance for a changing pattern of where development occurs. In terms of gas consumption, if a higher share of new residential dwellings is located in warmer coastal areas then gas use of new dwellings would be lower than currently captured in the projections (see chart 5.20). Current VDP dwelling projections suggest that is very similar pattern of development is expected for 2011 to 2017 compared with what was expected for 2006 to 2011, hence there is no need for an adjustment (chart 5.21). If updated VDP projections provide show a different pattern between recent dwelling completions and expected future completions then this would have to be revisited.

5.20 **Gas use for different LGAs**



Data source: The CIE.

5.21 **Dwelling projections** 2006 to 2011 and 2011 to 2017



Data source: The CIE.

5.22 **Residential projections**

Region/block	*Unit*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*
		Actual	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Tariff V - SP AusNet Central - Domestic									
Fixed Charge	No.	432 110	444 729	456 266	467 646	479 035	490 427	501 670	512 823
Peak 0 - 0.1	GJ	4 661 161	4 571 506	4 660 133	4 746 557	4 815 731	4 883 910	4 932 435	4 978 684
Peak 0.1 - 0.2	GJ	3 716 458	3 644 973	3 715 638	3 784 546	3 839 700	3 894 061	3 932 751	3 969 627
Peak 0.2 - 1.4	GJ	6 298 253	6 177 108	6 296 864	6 413 640	6 507 110	6 599 235	6 664 803	6 727 296
Peak > 1.4	GJ	75 468	74 017	75 452	76 851	77 971	79 075	79 860	80 609
Off Peak 0 - 0.1	GJ	6 320 041	5 856 509	5 836 974	5 813 104	5 780 323	5 745 848	5 701 200	5 654 148
Off Peak 0.1 - 0.2	GJ	1 541 953	1 428 862	1 424 095	1 418 272	1 410 274	1 401 863	1 390 969	1 379 490
Off Peak 0.2 - 1.4	GJ	515 641	477 823	476 229	474 281	471 607	468 794	465 151	461 312
Off Peak > 1.4	GJ	77 079	71 426	71 188	70 897	70 497	70 076	69 532	68 958
Tariff V - SP AusNet West - Domestic									
Fixed Charge	No.	122 289	124 972	127 165	129 075	130 986	132 896	134 806	136 728
Peak 0 - 0.1	GJ	1 328 922	1 295 071	1 311 508	1 325 344	1 334 412	1 343 305	1 347 261	1 351 049
Peak 0.1 - 0.2	GJ	1 058 898	1 031 925	1 045 023	1 056 047	1 063 272	1 070 359	1 073 511	1 076 529
Peak 0.2 - 1.4	GJ	1 704 252	1 660 840	1 681 920	1 699 664	1 711 292	1 722 698	1 727 771	1 732 628
Peak > 1.4	GJ	15 115	14 729	14 916	15 074	15 177	15 278	15 323	15 366
Off Peak 0 - 0.1	GJ	1 742 183	1 605 771	1 591 537	1 574 482	1 555 440	1 536 384	1 515 367	1 494 409
Off Peak 0.1 - 0.2	GJ	472 724	435 710	431 848	427 220	422 053	416 882	411 180	405 493
Off Peak 0.2 - 1.4	GJ	201 020	185 280	183 638	181 670	179 472	177 274	174 849	172 431
Off Peak > 1.4	GJ	25 114	23 147	22 942	22 696	22 422	22 147	21 844	21 542
Tariff V - SP AusNet Central - New Town Domestic									
Fixed Charge	No.	816	986	1 101	1 169	1 220	1 258	1 286	1 308
Peak 0 - 0.1	GJ	7 109	8 201	9 030	9 510	9 830	10 054	10 170	10 232
Peak 0.1 - 0.2	GJ	4 398	5 073	5 586	5 883	6 081	6 219	6 291	6 330
Peak 0.2 - 1.4	GJ	6 303	7 271	8 006	8 432	8 715	8 914	9 017	9 072
Peak > 1.4	GJ	491	567	624	657	679	695	703	707
Off Peak 0 - 0.1	GJ	7 101	7 773	8 396	8 674	8 814	8 862	8 832	8 754
Off Peak 0.1 - 0.2	GJ	1 524	1 669	1 802	1 862	1 892	1 902	1 896	1 879
Off Peak 0.2 - 1.4	GJ	1 452	1 589	1 717	1 773	1 802	1 812	1 806	1 790
Off Peak > 1.4	GJ	389	426	460	475	483	486	484	480

(Continued on next page)

5.22 **Residential projections** (continued)

Region/block	*Unit*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*
		Actual	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Tariff V - SP AusNet West - New Town Domestic									
Fixed Charge	No.	5 953	6 720	7 286	7 649	7 922	8 126	8 279	8 393
Peak 0 - 0.1	GJ	61 346	66 150	70 945	73 985	75 967	77 344	77 999	78 317
Peak 0.1 - 0.2	GJ	48 630	52 439	56 239	58 650	60 221	61 312	61 832	62 084
Peak 0.2 - 1.4	GJ	102 069	110 062	118 040	123 099	126 396	128 687	129 778	130 306
Peak > 1.4	GJ	625	674	723	754	774	788	795	798
Off Peak 0 - 0.1	GJ	72 043	73 717	77 555	79 348	80 114	80 205	79 718	78 887
Off Peak 0.1 - 0.2	GJ	24 729	25 304	26 621	27 237	27 499	27 531	27 363	27 078
Off Peak 0.2 - 1.4	GJ	16 478	16 861	17 739	18 149	18 325	18 345	18 234	18 044
Off Peak > 1.4	GJ	102	104	110	112	113	113	113	112
Total usage	GJ	30 109 072	28 932 374	29 242 468	29 516 339	29 700 634	29 875 690	29 953 308	30 018 282
Total customer numbers	No.	561 168	577 403	591 795	605 484	619 083	632 608	645 929	659 129
Per cent change									
Residential usage	Per cent	5.2	-3.9	1.1	0.9	0.6	0.6	0.3	0.2
Residential customer numbers	Per cent	3.2	2.9	2.5	2.3	2.2	2.2	2.1	2.0

6 Commercial sector — usage

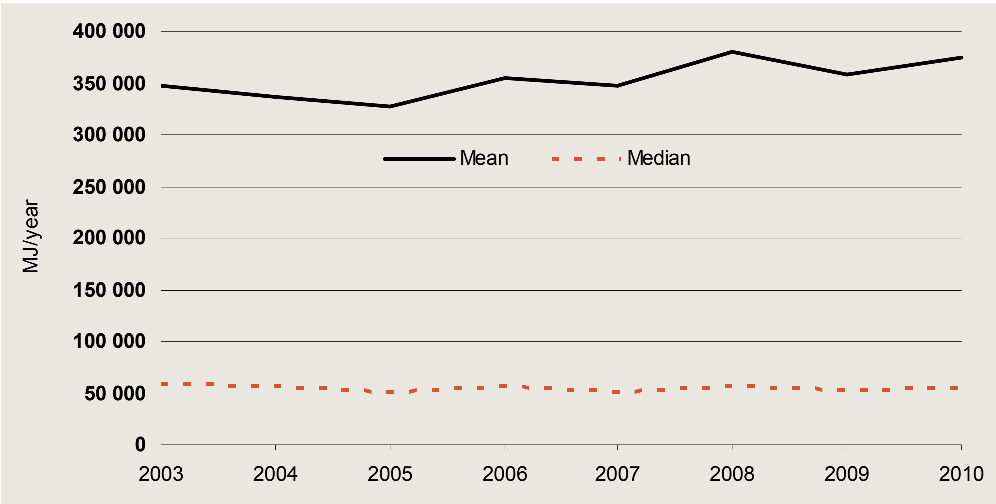
The commercial sector comprises non-residential customers that use less than 10 000 Gigajoules of gas in a 12 month period and less than 10 Gigajoules in an hour. The commercial sector is unlike the residential sector in that consumption patterns of different customers are very different. In particular, a small share of customers make up the majority of gas usage. Temperature and other weather conditions are also only important for some customers, with others using gas for activities that occur throughout the year and regardless of weather conditions.

The heterogeneity of commercial users is the main challenge in understanding drivers of consumption. This chapter put forward our methodology, explains changes in commercial sector usage and then provides forecasts of future commercial sector usage.

Characteristics of commercial sector consumption

Commercial customer usage is skewed with a larger number of very small customers and a small number of large customers. The average commercial customer uses around 350 GJ/year (chart 6.1). However, the median commercial customer uses only 50 GJ/year — slightly less than a single dwelling.

6.1 **Historical mean and median usage for commercial customers**

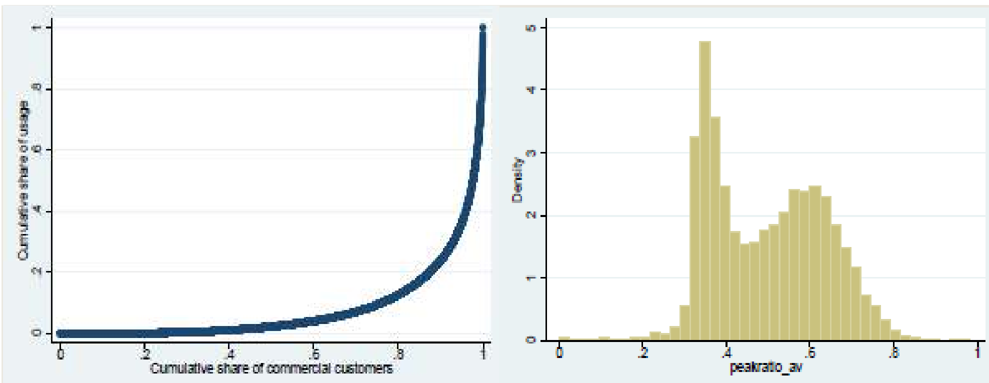


Data source: The CIE.

A large part of commercial sector gas usage is from a small number of customers. In chart 6.2 (left panel) we show the share of usage across the share of commercial customer numbers for 2010. The 10 per cent of largest users used more than three quarters of commercial gas.

Considering the consumption of customers in peak periods (June to September) as a share of total consumption we can also see that there are marked differences across customers. One group of customers uses about one third of gas in peak times, suggesting that gas use is not dependent on climatic conditions (chart 6.2, right panel). A second peak occurs more in line with residential gas use, where gas is at least partly used for heating.

6.2 **Usage patterns across commercial customers**



Data source: The CIE.

Looking at a distribution of usage we can also see the considerable skew in usage with very high usage customers and low usage customers. Note that there are also a significant number of commercial customers that use no gas in a given year — typically around 10 per cent — who are charged only a supply cost.

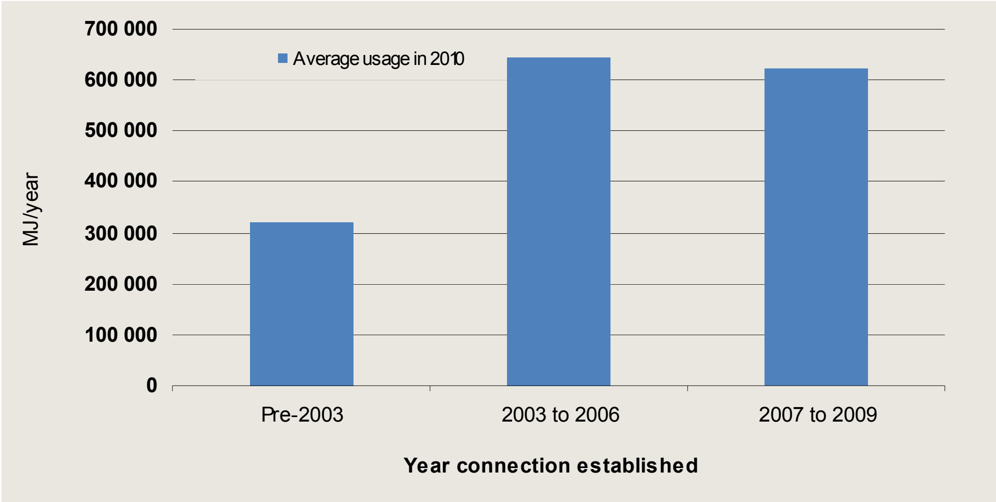
6.3 **Usage for commercial customers** 2010

Percentile	***Usage***	***Usage ratio to median***
	MJ/year	No.
0%	0	0.00
25%	12 096	0.22
50%	54 020	1.00
75%	204 400	3.78
100%	131 653 072	2 437.14

Source: The CIE.

Clear patterns also emerge between older and newer commercial sector customers. Newer customers on average use more gas than existing customers (chart 6.4). The lower figure in 2009 likely reflects that some of these customers have not moved into full use of gas since connecting — commercial customer gas usage is expected to take longer to reach a normal level post connection than for residential customers. In chapter 3 we found that commercial sector customer **numbers** grew more slowly than population growth. But these new customers use more gas than average existing customers. This reflects a smaller number of customers that use no gas for new customers. It also reflects a higher share of larger commercial customers in new customers versus existing customers.

6.4 **Average usage by customer connection year** 2010



Data source: The CIE.

The differences between commercial sector customers have implications for how usage is analysed.

It is preferable to analyse consumption in natural logarithm, because parameters then represent percentage changes. Further, we would expect a properly specified model to allow for percentage impacts for each firm to be the same rather than MJ impacts per firm. However, when usage data is skewed as is the case with commercial customers, the natural logarithm gives large customers the same weight as small customers.

There are a number of options that have been explored in detail. One option would be to use actual consumption (rather than log of consumption). This provides a poorly specified model as it then assumes that a small customer and large customer would face the change absolute change in usage from variables such as economic activity or price changes. This option can be improved by splitting the same into groups based on size. However, even within these groups there is considerable heterogeneity that undermines this approach.

Another alternative is to use natural logarithms and weight different customers according to their average usage in undertaking analysis. This is the approach that we pursue. It maintains the advantages of using the natural logarithm, while giving each customer a weight appropriate to their share of consumption.

Statistical analysis

Weighting customers

Each commercial customer is given a weight based on their average usage over the years that they were connected between 2003 and 2010.

In analysis undertaken on blocks and peak and off-peak, weights are recalculated to match the dependent variable. That is, if the dependent variable is peak consumption in the 0-0.1GJ/day block then we calculate a weight based on each customer's consumption in the peak 0-0.1GJ/day block.

Model form

Similar to the residential sector we then estimate a model of the natural log of usage against year of connection, effective degree days and a time trend. We experiment with including economic variables such as value added by sector.[41]

Because we are using a weighted regression we cannot use a random effects model. We therefore follow a two stage process of estimating a fixed effects model and then estimating a model of fixed effects based on characteristics of commercial connections.

The fixed effects model is:

$$\begin{aligned} q_{it} = {} & \mu_i \\ & + \gamma_1.year_t + \gamma_2.edd_t + \gamma_3.VA_t + \gamma_4.elecprice_t \\ & \beta_1.price_t + \varepsilon_{it} \end{aligned}$$

The dependent variable is the natural logarithm of the quantity of gas used by a commercial connection in year t (q_{it}).

The first row is the fixed effect for each customer.

The second row of explanatory variables is time specific characteristics, such as the year, effective degree days and electricity price.

The third row of explanatory variables is characteristics that vary by both time and connection. Gas price varies (somewhat) by connection as we have different prices for central and west regions.

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41 Note that value added by sector is a measure that is for all of Victoria rather than specific to the region serviced by SP AusNet. Value added by sector is also only available on a financial year basis. We have adjusted to a calendar year basis using patterns in Victorian state final demand, which is available quarterly. We also use state final demand directly in regressions. These have not been included in final models as this stage.

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

$$\mu_i = newconnection_i + region_i + \varepsilon_i$$

We use characteristics of newconnection and region, although newconnection is the only variable that we use for our final model.

Model estimation

The model is estimated in STATA using generalised least squares regression (see chapter 4).

We do not know the price paid by each commercial customer. The price information used is standing offer prices from the Essential Services of Commission of Victoria for a business with consumption of 500GJ per year and wholesale gas prices. Most commercial customers use significantly less gas than the 500 GJ. For larger customers, we expect that most will not be on standing offers. We have prices for central and west regions using this measure.

Our base model specification for commercial customers is shown in table 6.5. Alongside this is the model excluding those variables that are not statistically significant.

Key findings are that:

- Effective degree days and the price of gas are the only variables that are statistically significant in the first stage regression. The price elasticity suggests that a 1 per cent increase in the real gas price is associated with a 0.77 per cent reduction in use.
- While not statistically significant, the sign of the coefficient for value added and electricity price is as expected and of reasonable magnitudes.[42] A 1 per cent increase in value added compared with trend is associated with a 0.87 per cent increase in commercial gas use, while a 1 per cent increase in the electricity price is associated with a 0.26 per cent increase in gas use. There is minimal change through time in commercial gas use for a connection once other factors are accounted for.

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42 Variables are statistically significant if a normal standard error is used. The robust standard error is many times higher than the normal standard error for this analysis. This reflects that there is much less confidence in results once the possibility of clustering is allowed for in error terms.

6.5 Models of commercial gas use

Sample	*Full model*		*Parsimonious model*	
Dependent variable	Log of annual gas use		Log of annual gas use	
Exogenous variable				
	Coefficient	t-stat	Coefficient	t-stat
Constant	16.45	(13.62)	17.29	(17.73)
EDD	0.0002	(4.47)	0.0003	(3.70)
Year	-0.0014	-(0.15)		
Price (ln)	-0.77	-(1.99)	-0.71	-(3.18)
VA compared with trend (ln)	0.87	(0.78)		
Electricity price (ln)	0.26	(1.07)		
Other statistics				
Number of connections	15 649		15 649	
F-stat	4.77		7.92	

Note: Excludes data for the year in which the gas connection was created. Robust t-statistics in parentheses.
Source: The CIE.

We can break up commercial connections according to their average gas use (table 6.6). This shows whether there are different influences on demand for different sized gas users.

We can see that the impact of weather is smaller for larger customers — a primary reason for weighting regressions. There also appears to be a trend of reduced consumption for smaller customers but not for larger customers.

6.6 Base model for commercial use by size of gas usage

Sample	*1st quartile*		*2nd quartile*		*3rd quartile*		*4th quartile*	
Dependent variable	Log of annual gas use		Log of annual gas use		Log of annual gas use		Log of annual gas use	
Exogenous variable								
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Constant	4.16	(3.70)	9.08	(12.06)	11.25	(15.75)	17.20	(12.77)
EDD	0.0005	(7.06)	0.0005	(10.13)	0.0004	(8.74)	0.0002	(3.67)
Year	-0.0742	-(8.31)	-0.0299	-(4.63)	-0.0266	-(4.62)	0.0023	(0.22)
Price (ln)	0.89	(2.05)	-0.23	-(0.81)	0.06	(0.21)	-0.88	-(2.03)
VA compared with trend (ln)	-0.08	-(0.05)	1.05	(1.05)	1.21	(1.20)	0.86	(0.68)
Electricity price (ln)	0.12	(0.37)	0.43	(2.08)	-0.07	-(0.33)	0.29	(1.06)
Other statistics								
Number of connections	3 215		4 116		4 151		4 167	
F-stat	60.22		55.08		34.46		3.29	

Note: Excludes data for the year in which the gas connection was created. Robust t-statistics in parentheses.
Source: The CIE.

We also conduct a number of other cross-checks on the base commercial model. This includes using alternative measures of economic activity (value added in manufacturing and state final demand) and using ABS electricity prices for the consumer price index as a proxy for electricity prices. The results of the base model appear to be more plausible than from alternative models.

6.7 **Cross-checks on commercial model**

Sample	***Base model***		***Using value added of manufacturing***		***Using state final demand***		***Using ABS electricity price***	
Dependent variable	Log of annual gas use		Log of annual gas use		Log of annual gas use		Log of annual gas use	
Exogenous variable								
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Constant	16.45	(13.62)	16.45	(11.11)	16.63	(13.87)	16.50	(7.34)
EDD	0.0002	(4.47)	0.0002	(4.32)	0.0002	(4.16)	0.0002	(4.44)
Year	-0.0014	-(0.15)	-0.0037	-(0.40)	-0.0035	-(0.39)	-0.0064	-(0.86)
Price (ln)	-0.77	-(1.99)	-0.65	-(1.55)	-0.68	-(1.78)	-0.52	-(1.04)
VA to trend (ln)	0.87	(0.78)	0.21	(0.28)	-0.02	-(0.06)	0.01	(0.01)
Electricity price (ln)	0.26	(1.07)	0.14	(0.66)	0.13	(0.59)	0.01	(0.04)
Other statistics								
No. of connections	15 649		15 649		15 649		15 649	
F-stat	4.77		4.99		4.46		4.64	

Note: Excludes data for the year in which the gas connection was created. Robust t-statistics in parentheses.
Source: The CIE.

Analysis of blocks

At a more detailed level, we can consider whether the changes have impacted on different blocks of consumption in different ways. For instance, if high gas users have changed their behaviour more than typical gas users then this will impact on the spread of change across the different tariff blocks and peak and off-peak.

In tables 6.8 and 6.9 we show results for peak and off-peak blocks separately. We also undertake the second stage estimation on a block basis, as the consumption of new dwellings is expected to differ in systematic ways to existing dwellings across blocks.

We find some different patterns across blocks and peak and off-peak.

- As with residential gas usage, effective degree days has a stronger impact on off-peak consumption. This suggests that either a higher share of the variability in annual effective degree days occurs in shoulder periods or that behaviour is more likely to change in shoulder periods.
- It appears that there are downward trends in consumption in the lower blocks but upward trends for consumption of higher blocks. This indicates that small users are using less and large users are using more.
- Higher block use is more responsive to gas prices, reflecting that larger users are more responsive to gas prices. Similarly, higher blocks are more responsive to electricity prices.
- Higher blocks appear to be more responsive to value added, although this statistical robustness of this finding is low.

- New connections use more gas than existing connections. This is entirely concentrated in the largest block.

6.8 Peak commercial gas use

Sample	*0-0.1 GJ/day*		*0.1-0.2 GJ/day*		*0.2-1.4 GJ/day*		*>1.4GJ/day*	
Dependent variable	Log of annual gas use		Log of annual gas use		Log of annual gas use		Log of annual gas use	
Exogenous variable								
	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat
Constant	9.02	(49.0)	8.43	(37.0)	11.35	(43.7)	14.16	(13.9)
EDD	0.0000	(0.6)	0.0001	(4.5)	0.0002	(9.8)	0.0002	(3.9)
Year	-0.0119	-(8.2)	-0.0041	-(2.6)	0.0011	(0.5)	0.0194	(2.8)
Price (ln)	0.09	(1.2)	-0.02	-(0.2)	-0.35	-(3.3)	-0.99	-(3.0)
VA compared with trend (ln)	0.51	(2.0)	1.78	(6.4)	2.54	(7.2)	3.29	(3.0)
Electricity price (ln)	-0.02	-(0.4)	0.19	(3.3)	0.32	(4.3)	0.96	(4.4)
Other statistics								
Number of connections	15 370		13 042		11 295		3 971	
F statistic	50.12		32.51		32.11		8.49	
Second stage regression								
New connection	0.04	(18.0)	0.01	(3.7)	-0.04	-(17.5)	0.76	(307.2)

Note: Excludes data for the year in which the gas connection was created. Robust t-statistics in parentheses.
Source: The CIE.

6.9 Off-peak commercial gas use

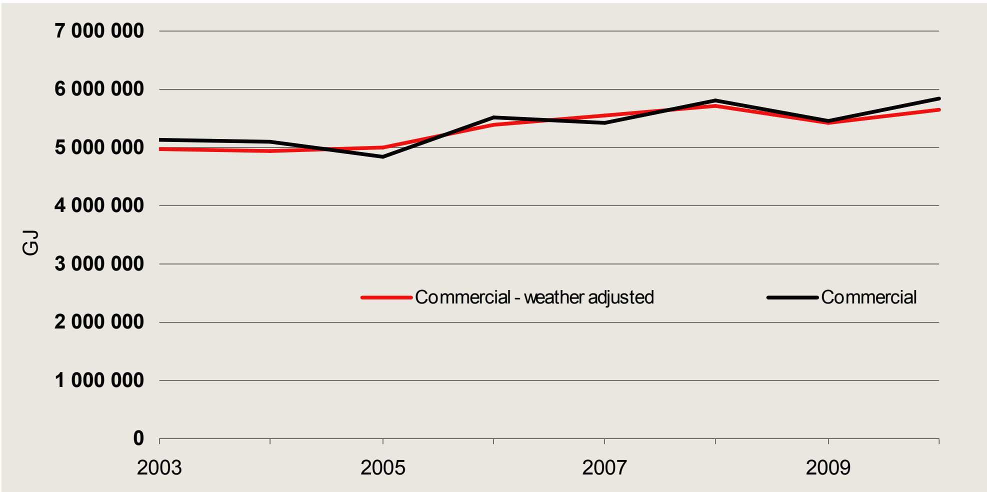
Sample	*0-0.1 GJ/day*		*0.1-0.2 GJ/day*		*0.2-1.4 GJ/day*		*>1.4GJ/day*	
Dependent variable	Log of annual gas use		Log of annual gas use		Log of annual gas use		Log of annual gas use	
Exogenous variable								
	Coef	t-stat	Coef	t-stat	Coef	t-stat	Coef	t-stat
Constant	9.87	(57.8)	10.28	(47.1)	13.09	(41.4)	15.25	(10.5)
EDD	0.0002	(16.2)	0.0003	(21.0)	0.0002	(10.8)	0.0003	(4.9)
Year	-0.0149	-(10.5)	-0.0066	-(3.8)	-0.0058	-(2.1)	0.0146	(1.3)
Price (ln)	0.01	(0.1)	0.08	(1.0)	-0.01	-(0.1)	-0.71	-(1.2)
VA compared with trend (ln)	0.67	(2.8)	0.43	(1.4)	0.10	(0.2)	2.24	(1.6)
Electricity price (ln)	-0.07	-(1.4)	-0.30	-(4.6)	-0.30	-(3.3)	0.50	(1.4)
Other statistics								
Number of connections	15 510		11 919		9 906		3 620	
F statistic	154.47		115.05		38.26		6.39	
Second stage regression								
New connection	0.03	(12.2)	-0.04	-(10.3)	0.02	(8.4)	0.86	(361.5)

Note: Excludes data for the year in which the gas connection was created. Robust t-statistics in parentheses.
Source: The CIE.

Tops down analysis

The total commercial usage can be adjusted for weather using the estimated coefficients for effective degree days as estimated above. The results of this weather normalisation are shown in chart 6.10. In 2009 there was a significant reduction in aggregate commercial gas use, after accounting for weather. This was in large part because the largest commercial customer moved to tariff D/M and hence this reduction will persist.

6.10 **Commercial customer usage adjusted for weather**



Data source: The CIE.

Forecasts of commercial gas use

We have constructed projections of commercial gas use based on a continuation of patterns observed to date in our base model. The basis of projections is as follows.

- New commercial customers are assumed to use the same amount of gas on average as customers connecting to the network since 2002.
- 2010 consumption has been adjusted to expected climatic conditions and used as the basis of projecting forward consumption. Typical climatic conditions are modelled using annual effective degree day measures from CSIRO projected forward with a continued decline in EDDs.[43] See table 6.11.
- Applying parameters from our base model on a continuing basis including for time trend, impact of value added and electricity and gas prices. See table
- Applying an estimated price elasticity to prices based on our model for peak and off-peak price elasticities. Prices are increased to reflect projections of increases in prices from Australian Treasury.[44] Note that we have not sought to equalise

43 CSIRO 2007, *Projected changes in temperature and heating degree-days for Melbourne and Victoria, 2008-2012*, http://multinetgas.com.au/regulatoryIssues/downloads/RegulatoryEnviroment/GasAccessArrangements/CSIRO_Melb_EDD_2008-2012.pdf.

44 Australian Treasury 2011, *Strong growth, low pollution: modelling a carbon price,* chart B2.

Victorian wholesale gas prices with prices reported by Australian Treasury over the period of the regulatory determination. Currently Victorian wholesale prices are well below prices reported by Australian Treasury, suggesting that there is the potential for steep gas rises to match export parity prices. This means the implied wholesale prices are below those in Treasury modelling. We have applied a price increase to businesses' gas prices based on a share of 30 per cent of the retail price being driven by wholesale prices. See table 6.11.

- Electricity price projections have been based on projections from Deloitte Access Economics for Victoria as a whole from 2011 to 2017 (including a price on carbon) and on actual electricity inflation for residential customers from 2010 to 2011. We do not have specific figures for business electricity prices. See table 6.11.
- The deviation of value added from trend is modelled using the output gap used in statistical analysis for 2010, rolled forward according to a trend increase in Gross State Product of 2.5 per cent and Victorian Treasury Gross State Product projections. See table 6.11.

6.11 **Independent projections for usage forecasts**

Item	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*
EDD [a]	1 285	1 278	1 270	1 261	1 253	1 244	1 235
Wholesale gas price Victoria (real, $/GJ)	2.99	2.99	2.99	3.05	3.11	3.24	3.36
Australian Treasury wholesale gas price ($/GJ)	4.8	4.8	4.8	4.9	5.0	5.2	5.4
Electricity price index[c]	107.1	112.9	115.7	119.0	119.3	120.1	120.0
Deloitte Access electricity price projections for Victoria, $/MWH with a carbon price[c]	219.3	231.2	237.0	243.7	244.3	245.8	245.8
Value added growth (per cent) [d]	2.50	2.25	2.25	2.75	2.75		
Output gap measure (per cent deviation from trend) [e]	-1.0	-1.3	-1.6	-1.3	-1.1	-1.1	-1.1

[a] CSIRO advice to SP AusNet. [b] Australian Treasury 2011, *Strong growth, low pollution - modelling a carbon price*, chart b6, domestic Australian gas prices, NEM. [c] Deloitte Access Economics 2011, Modelling the Clean Energy Future Policy, Victorian Department of Premier and Cabinet, http://www.climatechange.vic.gov.au/__data/assets/pdf_file/0018/125415/Modelling-the-Clean-Energy-Future-policy-2011.pdf. The index is based at 100 for 2010. The 2011 figure is June 2011 to June 2010 residential electricity price increase as part of the Australian bureau of Statistics Consumer Price Index. [d] Victorian Treasury Budget Update 2011, December. Note that projections are on a financial year basis, which aligns with the financial year basis for value added used in statistical analysis. [e] Output gap is based on the output gap from regression analysis of output against trend for 2003 to 2010, for 2010, rolled forward according to trend of 2.5 per cent and Victorian Treasury GSP projections. In 2016 and 2017 the output gap is kept constant.

Sources: As noted above.

6.12 **Commercial assumptions for projections**

Block	*Time trend*	*EDD*	*Price*	*New connection*	*VA*	*Electricity price*
	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
Peak 0 - 0.1	-0.14	0.02	-77.33	4.02	86.81	26.26
Peak 0.1 - 0.2	-0.14	0.02	-77.33	0.89	86.81	26.26
Peak 0.2 - 1.4	-0.14	0.02	-77.33	-4.30	86.81	26.26
Peak > 1.4	-0.14	0.02	-77.33	76.02	86.81	26.26
Off Peak 0 - 0.1	-0.14	0.02	-77.33	3.10	86.81	26.26
Off Peak 0.1 - 0.2	-0.14	0.02	-77.33	-4.49	86.81	26.26
Off Peak 0.2 - 1.4	-0.14	0.02	-77.33	1.99	86.81	26.26
Off Peak > 1.4	-0.14	0.02	-77.33	85.79	86.81	26.26

Source: The CIE.

Forecasts

The resulting projections of commercial usage are shown in table 6.13. It would be expected that, prior to the final regulatory decision, 2011 usage figures would be available and used instead of forecasts and end of June 2012 customer number figures would be available and used instead of forecasts.

6.13 Commercial projections

Block/area	***Unit***	***2010***	***2011***	***2012***	***2013***	***2014***	***2015***	***2016***	***2017***
		Actual	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Tariff V - SP AusNet Central - Commercial									
Fixed Charge	No.	9 325	9 409	9 477	9 547	9 618	9 689	9 758	9 827
Peak 0 - 0.1	GJ	85 272	84 619	85 956	86 682	87 446	87 617	87 315	86 882
Peak 0.1 - 0.2	GJ	70 597	70 035	71 126	71 710	72 325	72 450	72 185	71 811
Peak 0.2 - 1.4	GJ	422 896	419 346	425 718	429 057	432 580	433 171	431 432	429 052
Peak > 1.4	GJ	1 315 125	1 317 746	1 348 974	1 371 020	1 393 687	1 406 856	1 412 130	1 414 970
Off Peak 0 - 0.1	GJ	137 486	136 420	138 566	139 728	140 949	141 215	140 720	140 013
Off Peak 0.1 - 0.2	GJ	92 694	91 914	93 309	94 040	94 811	94 939	94 557	94 034
Off Peak 0.2 - 1.4	GJ	543 000	538 739	547 169	551 710	556 489	557 494	555 494	552 661
Off Peak > 1.4	GJ	1 460 454	1 466 187	1 503 224	1 530 115	1 557 706	1 574 671	1 582 735	1 588 004
Tariff V - SP AusNet West – Commercial									
Fixed Charge	No.	6 058	6 070	6 082	6 094	6 105	6 117	6 129	6 141
Peak 0 - 0.1	GJ	55 362	54 538	55 099	55 248	55 421	55 219	54 730	54 169
Peak 0.1 - 0.2	GJ	43 707	43 054	43 494	43 610	43 743	43 581	43 193	42 747
Peak 0.2 - 1.4	GJ	227 728	224 303	226 573	227 152	227 826	226 961	224 914	222 574
Peak > 1.4	GJ	505 432	498 942	505 187	507 623	510 271	509 467	505 994	501 841
Off Peak 0 - 0.1	GJ	77 243	76 091	76 873	77 080	77 320	77 037	76 353	75 569
Off Peak 0.1 - 0.2	GJ	46 159	45 465	45 925	46 042	46 179	46 003	45 588	45 114
Off Peak 0.2 - 1.4	GJ	240 880	237 285	239 716	240 358	241 100	240 212	238 074	235 626
Off Peak > 1.4	GJ	465 877	460 086	466 048	468 491	471 130	470 580	467 562	463 912
Tariff V - SP AusNet Central - New Town Commercial									
Fixed Charge	No.	8	10	11	12	13	14	15	16
Peak 0 - 0.1	GJ	97	115	129	142	154	163	172	180
Peak 0.1 - 0.2	GJ	80	95	107	118	127	135	142	149
Peak 0.2 - 1.4	GJ	325	387	435	478	517	549	578	606
Peak > 1.4	GJ	448	533	600	659	713	757	797	835
Off Peak 0 - 0.1	GJ	127	151	170	187	202	215	226	237
Off Peak 0.1 - 0.2	GJ	110	131	148	162	175	186	196	205
Off Peak 0.2 - 1.4	GJ	592	704	793	871	943	1 001	1 053	1 104
Off Peak > 1.4	GJ	700	832	937	1 029	1 114	1 183	1 245	1 304

Tariff V - SP AusNet West - New Town Commercial									
Fixed Charge	No.	134	158	175	184	195	209	224	239
Peak 0 - 0.1	GJ	1 422	1 645	1 832	1 934	2 051	2 185	2 311	2 435
Peak 0.1 - 0.2	GJ	1 192	1 378	1 535	1 621	1 719	1 831	1 936	2 040
Peak 0.2 - 1.4	GJ	6 643	7 684	8 558	9 036	9 582	10 209	10 794	11 374
Peak > 1.4	GJ	16 670	19 281	21 475	22 675	24 046	25 617	27 088	28 542
Off Peak 0 - 0.1	GJ	2 134	2 468	2 749	2 902	3 078	3 279	3 467	3 653
Off Peak 0.1 - 0.2	GJ	1 580	1 828	2 036	2 150	2 279	2 428	2 568	2 706
Off Peak 0.2 - 1.4	GJ	10 362	11 985	13 349	14 094	14 947	15 924	16 838	17 741
Off Peak > 1.4	GJ	19 054	22 039	24 547	25 918	27 485	29 281	30 962	32 624
Total commercial consumption	GJ	5 851 445	5 836 025	5 952 358	6 023 641	6 098 113	6 132 419	6 133 349	6 124 712
Total commercial customer numbers	No.	15 526	15 646	15 744	15 837	15 932	16 029	16 126	16 222
Per cent change									
Commercial usage	Per cent	7.3	-0.3	2.0	1.2	1.2	0.6	0.0	-0.1
Commercial customer numbers	Per cent	0.8	0.8	0.6	0.6	0.6	0.6	0.6	0.6

7 Tariff D and M customers

Snapshot of customer numbers

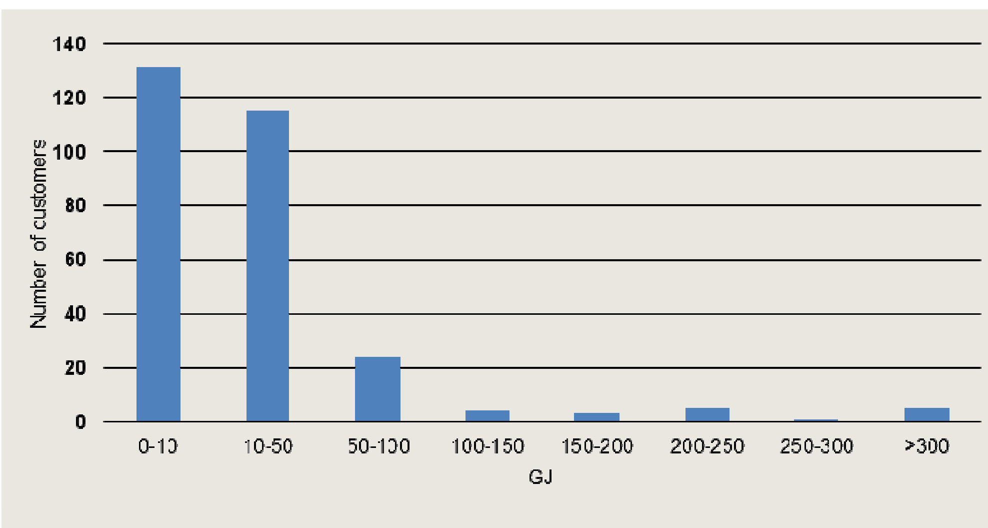
SP AusNet has provided information from its customer billing database from the start of 2003 to the start of 2011. Some observations regarding the Tariff D and M customer profile and trends are provided below.

Tariff D and M customers

Over the period 2003 to 2010 SP AusNet's Tariff D and M customer base decreased from 304 to 288 customers (a 5 per cent decrease). The average maximum hourly quantity per customer also decreased between 2003 and 2010 by 3 per cent. However, the maximum hourly quantity of the top ten customers increased by 5 per cent from 2003 to 2010. Sectors represented by the top ten customers include petroleum, oil, aluminium, steel and manufacturing.

Chart 7.1 presents the distribution of customers based on maximum hourly quantity in 2010. Eighty five per cent of customers were in the 0-50GJ band. The largest maximum hourly quantity by a single customer in 2010 was approximately 1000GJ.

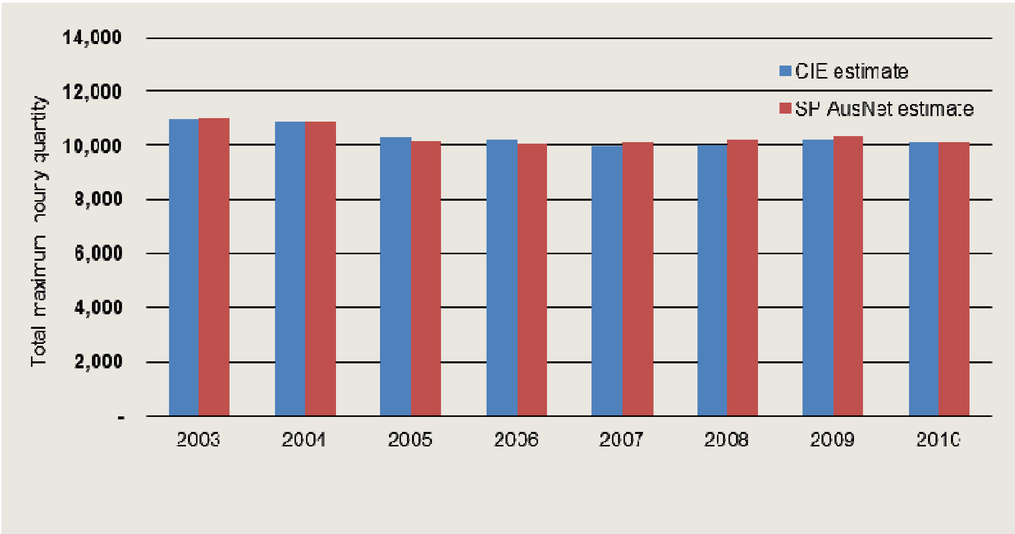
7.1 **Distribution of Tariff D/M customers by maximum hourly quantity in 2010**



Data source: The CIE.

Chart 7.2 presents assessment of trends in tariff D projections from our analysis of the billing data and tariff reports.[45] From 2003 to 2006, maximum hourly quantity decreased, before staying constant from 2006 to 2010.

7.2 **Total maximum hourly quantity**



Data source: The CIE.

Weather can lead to small changes in Tariff D consumption. For example, using daily Tariff D data, there is a relationship between effective degree days and consumption. It does not appear that this relationship applies to maximum hourly quantity, on which tariff D is billed, given the relatively constant total MHQ between 2006 and 2010.

It might be expected that economic activity would be a major driver of MHQ for tariff D customers. This relationship also appears weak, probably because an entire calendar year of low output is required to reduce maximum hourly quantity. For example, in 2008, MHQ was very similar to 2009 despite poorer economic conditions. Rather, tariff D consumption projections are likely to be more at risk from significant structural changes, such as changes in the manufacturing sector or use of substitute fuels such as waste.

Forecasts

Our projections of maximum hourly quantity for 2011 to 2017 are based on annual gas system demand forecasts for Tariff D assuming a medium economic growth

45 These do not exactly match because of customers exiting during a year.

scenario. These forecasts were prepared by the Australian Energy Market Operator (AEMO) for the Victorian Planning Report[46].

Note that we are applying volume projections to maximum hourly quantity. There are no strong discernible trends in the volume to MHQ ratio for SP AusNet's customers.

7.3 Tariff D and M projections

Region/ Block	*Unit*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*
		Actual	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast	Forecast
Tariff D - SP AusNet									
0 - 10	GJ	2 150	2 173	2 199	2 212	2 212	2 212	2 217	2 224
10 - 50	GJ	2 819	2 850	2 883	2 900	2 900	2 900	2 907	2 917
> 50	GJ	4 933	4 986	5 045	5 074	5 074	5 074	5 086	5 104
Tariff M - SP AusNet Central									
0 - 10	GJ	48	49	49	50	50	50	50	50
10 - 50	GJ	47	48	48	49	49	49	49	49
> 50	GJ	47	48	49	49	49	49	49	49
Tariff M - SP AusNet West									
0 - 10	GJ	20	20	20	21	21	21	21	21
10 - 50	GJ	19	19	19	19	19	19	19	19
> 50	GJ	0	0	0	0	0	0	0	0
Tariff D - SP AusNet New Town West & Central									
0 - 10	GJ	10	10	10	10	10	10	10	10
10 - 50	GJ	4	4	4	4	4	4	4	4
> 50	GJ	0	0	0	0	0	0	0	0
Tariff M - SP AusNet New Town Central									
0 - 10	GJ	0	0	0	0	0	0	0	0
10 - 50	GJ	0	0	0	0	0	0	0	0
> 50	GJ	0	0	0	0	0	0	0	0
Tariff M - SP AusNet New Town West									
0 - 10	GJ	0	0	0	0	0	0	0	0
10 - 50	GJ	0	0	0	0	0	0	0	0
> 50	GJ	0	0	0	0	0	0	0	0

Source: The CIE.

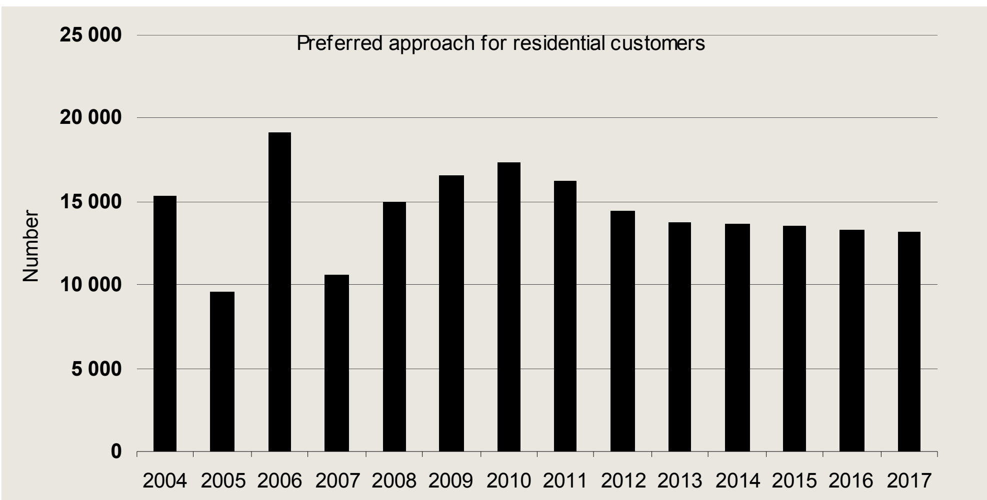
46 AEMO (Australian Energy Market Operator), 2010, Victorian Annual Planning Report Update: Victoria's Electricity and Gas Transmission Network Planning Document.

8 Summary of forecasts

In charts 8.1, 8.2, 8.3 and 8.4 we present a comparison of the projections as against actual outcomes and actual outcomes adjusted for weather.

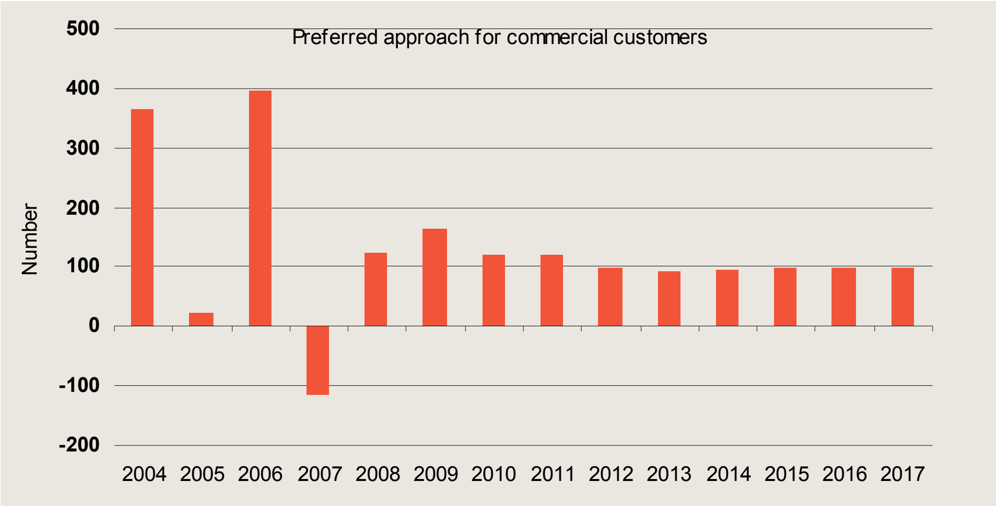
Our projections represent a tapering off of customer number growth to largely match projections of dwelling growth for residential customers. For commercial customers, the number of new connections continues at a rate of 6 connections per 1000 residential connections.

8.1 **Residential customer numbers** Tariff model



Data source: The CIE.

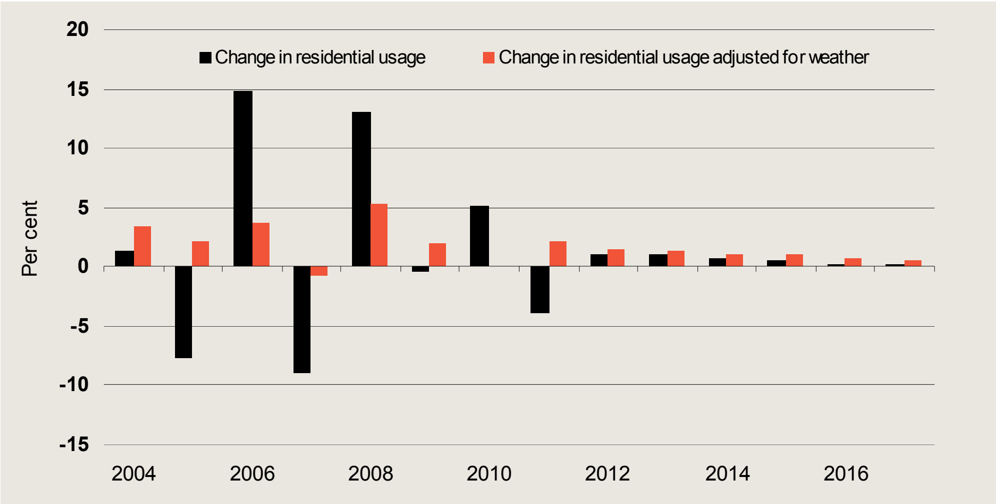
8.2 **Commercial customer numbers** Tariff model



Data source: The CIE.

Our residential usage projections are below historical increases in total usage and taper off towards the end of the regulatory period. This reflects a continued reduction in heating needs due to increasing average temperatures, reduced use by new dwellings, lower dwelling growth and falling usage as gas prices increase.

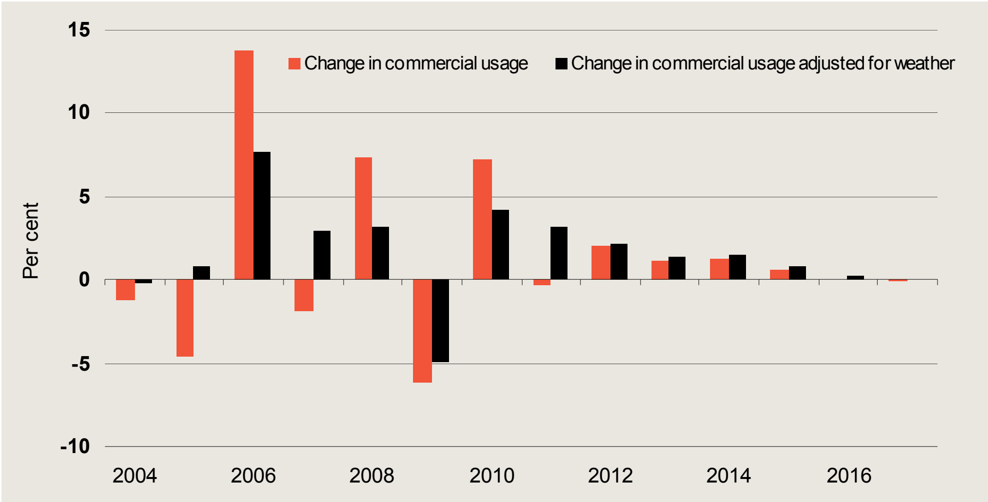
8.3 **Residential usage projections and historical outcomes** Tariff model



Data source: The CIE.

Our commercial usage projections are above historical growth rates, particularly in the near term due to additional commercial connections and rising electricity prices. As the number of new commercial connections falls, commercial usage also falls.

8.4 **Commercial usage projections and historical outcomes**



Data source: The CIE.

In table 8.5 we show a comparison of weather adjusted actual outcomes and projections.

8.5 **Comparison of weather adjusted actual outcomes and projections**

	2003-2010	***2010-2017***
	Per cent/year	Per cent/year
Residential usage	2.25	1.11
Commercial usage	1.97	1.32
Residential customer numbers	2.96	2.23
Commercial customer numbers	1.04	0.60

Source: The CIE.

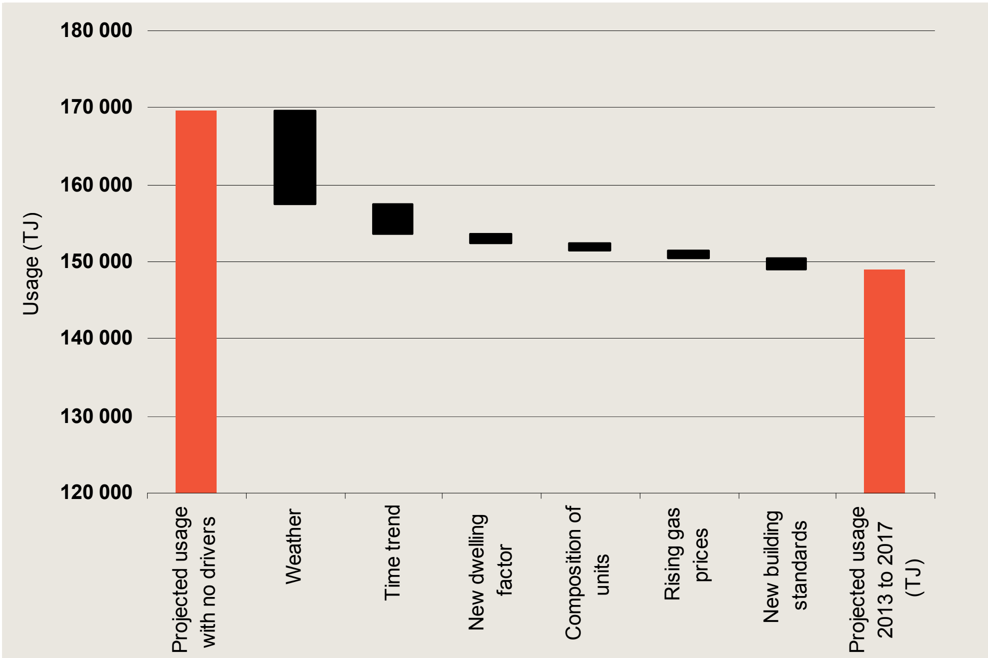
Drivers of projections

The main influences on projections of usage can be better seen by looking at how the inclusion of each driver changes outcomes.

In chart 8.6 we show total residential usage for 2013 to 2017 under the assumption that per connection use continues exactly as observed in 2010. We then adjust for each change one by one to get to the final projection.

The largest reduction from a continuation of observed per dwelling usage in 2010 is for weather (2010 was a relatively cold year). This accounts for a 7 per cent reduction. The continuation of time trends accounts for a 2.3 per cent reduction, allowing for the lower observed use of new connections a 0.8 per cent reduction, allowing for the greater composition of units a 0.6 per cent reduction, rising gas prices a 0.6 per cent reduction and new building standards a 0.8 per cent reduction in projections.

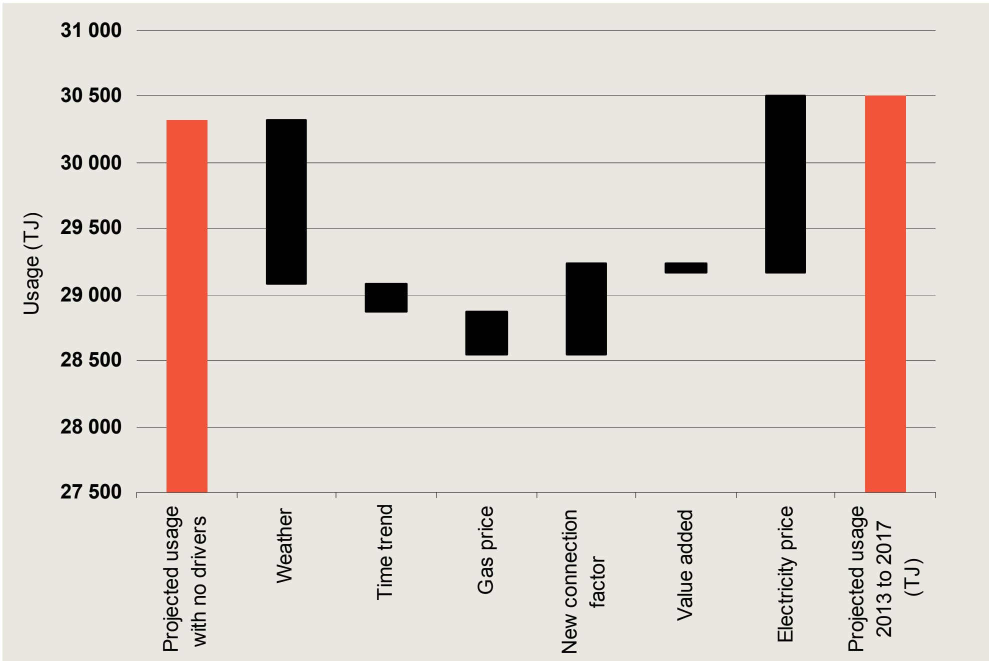
8.6 **Drivers of residential usage**



Data source: The CIE.

For commercial usage, a continuation of existing per connection usage would generate a projection below the projections that we present (chart 8.7). Adjusting for weather, time trend, and gas price reduces projections from a same per connection basis. However, allowing for higher use for new connections and rising electricity prices increases projected usage. The slightly lower value added growth than trend leads to a small reduction in usage. If the Victorian economy were to enter into a recession then it would be expected that this impact would be noticeable.

8.7 **Drivers of commercial usage**



Data source: The CIE.

9 Risks and sensitivities

There are a number of risks and sensitivities around the projections contained in this report. These can be broadly broken up into:

- risks that historical estimated relationships do not the true relationship, which are embedded in confidence intervals around parameters;
- risks that historical relationships will not continue in the future, including risks around policy; and
- risks around independent projections, such as of weather, dwellings, economic activity and gas prices.

Weather

The major risk to projections around SP AusNet's gas usage is weather. For example, if the lead up and exit from winter were warmer than normal, then gas volumes could be substantially lower than projected. And vice versa if conditions were colder.

The CSIRO's projections are expected long term projections of climatic conditions. Hence they will be unbiased estimates of weather conditions.

The relationship between effective degree days and gas usage is most likely linear. In this case there is no bias from weather conditions arising in the projections.

Note that it would be possible for SP AusNet to hedge its weather risk (at some cost).

Dwelling projections

Residential connection projections largely reflect new dwellings, as discussed in chapter 3, plus additional expansion from new towns.

Projecting dwelling growth relies on assumptions about population growth and demographics, as well as changes in household size. These patterns in turn are likely to be impacted by housing affordability issues, such as income, interest rates and dwelling prices.

For the projections in this report, we have used dwelling projections from the Victorian Department of Planning and Community Development (VPD). For the period 2006 to 2010, these projections have underestimated actual dwelling completions, as a result of higher population growth than expected. Population growth in Victoria appears to be moving back towards the level anticipated in VDP projections.

VDP projections from 2012 onwards may underestimate or overestimate actual dwelling growth in the future. There are two possibilities.

- Dwelling growth follows a mean reverting process whereby higher dwelling growth in one period means that there will be lower future dwelling growth. This would be the case if there was a stable household size for example.
- The projections are systematically biased downward. Hence lower projections than occurred between 2006 and 2010 would be an indicator that future dwelling growth would also be higher than projected by Victoria Department of Planning and Community Development.

It is not possible to discern which of these might be the case and hence whether future projections from this source are biased upwards or downwards or biased at all. The closer alignment of population movements with population projections in more recent years suggests that the main reasons for the discrepancy between forecasts and actuals will be less relevant.

The projections from the Victorian Government represent the best independent source of dwelling projections at a sufficiently disaggregated level. The Australian Bureau of Statistics projects population growth for Victoria as a whole. These projections match those of Victoria Department of Planning and Community Development (and form the basis of planning projections). Given these factors, we use these projections as the basis of our forecasts of new residential connections.

One feasible alternative to using Victoria Department of Planning and Community Development dwelling projections that we have explored in detail would be to use historical growth in connections. New residential connections from using this approach are shown in chart 9.1, along with our preferred approach. This approach provides higher dwelling forecasts than using our preferred approach.

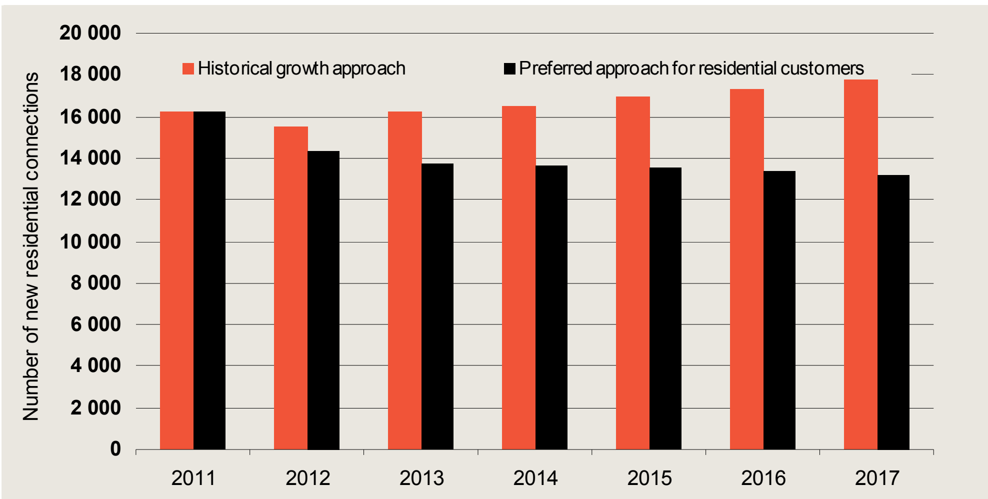
There are a number of reasons why we consider that using the historical average will not be appropriate.

- The historical average incorporates network expansion that is not anticipated for the next regulatory period and is not factored into capital expenditure projections. It would be possible to use a historical average adjusted to remove network expansion to address this issue.
- The underlying demographic patterns and household formation patterns in the VPD projections suggest that the number of new dwellings will decline through time. If this is the case, then a historical average will overstate dwelling growth.
  - The VDP projections expect that population growth for 2008, 2009 and 2010 would be higher than population growth thereafter.

– The VDP dwelling projections assume a gradual slowing in the reduction in the number of people per dwelling.

- The pace of recent increases in new dwellings reflects high levels of population growth in Victoria, particularly in 2007, 2008 and 2009. This has been mirrored across Australia, with population growth peaking in 2008 due to high levels of net overseas migration.[47] Net overseas migration has slowed considerably since this peak, as has the level of population growth. In 2008, net overseas migration to Victoria was 83 000 people, slowing to 47 000 by 2010.[48] This suggests that the historical period 2003 to 2010 may not be a good indicator of future population growth and hence dwelling growth.

9.1 **Residential connections under alternative methods**



Data source: The CIE.

It is expected that dwelling projections will be updated in August 2012 by the Victorian Department of Planning and Community Development. This would take account of expected future demographic change and shorter term information from local councils. These updates would be included in final demand projections.

There may also be shorter term information that could be incorporated into customer projections through their impact on dwelling growth, including interest rates and approvals.

One important driver of dwelling projections in the short term is interest rates. For instance, a 1 percentage point increase in interest rates has been found to lead to a

47 ABS 2011, Australian Demographic Statistics, p. 6.

48 ABS 2011, Australian Demographic Statistics, p. 11.

short term 0.4 per cent reduction in dwelling starts in Australia.[49] The dwelling projections made by Victoria Planning and Community Development are focused on longer term projecting and do not take much account these shorter term drivers.

Currently, mortgage interest rates are equal to their average since 2000.[50] The yield curve expects a small possible further reduction in interest rates.[51] Hence there is no strong argument that current interest rates will push dwelling projections lower or higher in the short term than those in Victoria Planning and Community Development projections.

There is also information on planning approvals that can give a short term indicator of dwelling activity. Typically a dwelling is completed between 6 months and a year and a half after it has been approved. On average, 97 per cent of dwellings approved are completed. The National Housing Supply Council considers that demolitions account for 7.04 per cent of completions.[52] Approvals data at an LGA level is currently available up to November 2011. Any value from this dataset would be restricted to a projection for the 2013 calendar year dwelling growth, using approvals data closer to the start of the review.

Commercial customer numbers

We have projected forward commercial customer numbers on the basis of the relationship between commercial connections and residential connections. An alternative that we have considered in detail is the use of historical trends. In 2004 and 2005 there was much higher growth in commercial customers than in more recent years. Statistically, this period represents a structural break between the relationship between commercial and residential customer growth. Hence any use of historical trends should also use the 2005 to 2011 period only.

In chart 9.2 we present commercial connections under our preferred approach and using a historical trend. There is almost no difference between these two methods.

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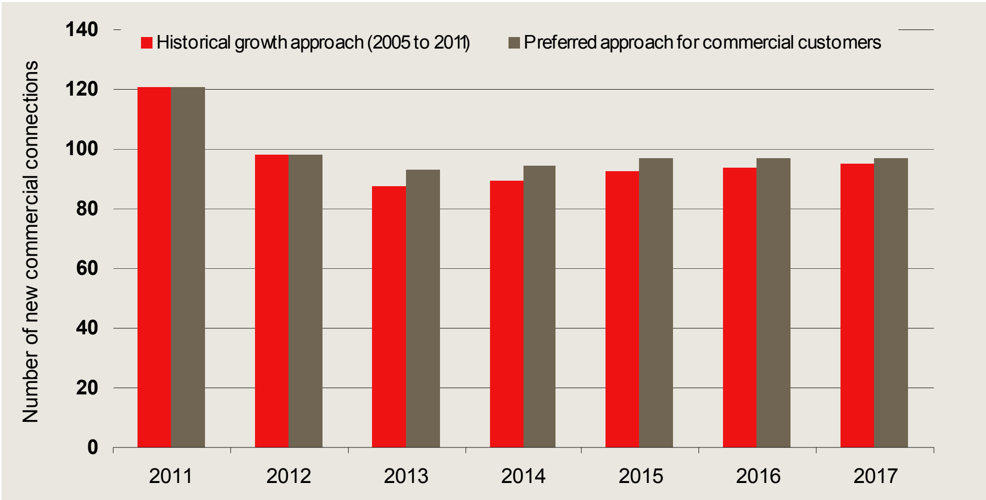
[49] Berger-Thompson, L. and Ellis, L. 2004, 'Housing construction cycles and interest rates', Reserve Bank of Australia Research Discussion Papers, 2004-08, October.

[50] See Reserve Bank of Australia Statistical Table, F5.

[51] See Reserve Bank of Australia Statistical Tables, F1 and F2.

[52] National Housing Supply Council 2011, State of Supply Report 2011.

9.2 **Commercial connections under alternative methods**



Data source: The CIE.

Trends in residential gas use and policies

There has been a slow downward trend in residential gas use per customer, once factors such as the composition of dwellings, weather and response to gas prices have been allowed for. This is not surprising given the focus of state and federal governments on reducing energy use and improving energy efficiency and number of programs that are operating in this space (see Appendix B). These programs appear to have more than reduced the expected increase in gas use as incomes rise. In electricity markets impacts are also starting to be observed, with lower electricity consumption per household.[53]

It is difficult to know the extent to which continued reductions in usage can be expected as a result of efficiency improvements. The projections above are based on a continuation of trends seen between 2003 and 2010. As noted in chapter 5, it appears as though the majority of this decline has occurred in more recent years within this period.

One method of seeking to understand whether the historical decline will continue would be to specifically analyse each policy (or other change) and its contribution to the change in gas use. This is not feasible with the number of policies simultaneously occurring and the lack of publicly available information on expected and/or observed impacts. It would also not account for the introduction of new policies not currently known.

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53 IPART 2010, 'Residential energy and water use in Sydney, the Blue Mountains and Illawarra Results from the 2010 household survey', Fact Sheet, December.

Instead, we take the view that the decline from 2003 to 2010 will continue through the forecast period. This reflects that many of the policies currently occurring will continue into the forecast period and there is evidence of continued new policies to reduce energy use.

Note that the actual historical confidence intervals around the time trend in gas use per residential connection are low. For off-peak, which is where the decline in gas use has been observed, the 95 per cent confidence interval for the reduction is from 1.5 per cent to 1.7 per cent reduction per year — i.e. a narrow range.

Economic activity

Economic activity can be a driver of gas use, although it is likely longer term structural changes that offer a more persistent risk to gas use. For commercial customers, we have incorporated economic activity as a driver of forecasts, although the statistical relationship is not particularly strong.

For residential we have not included an economic driver due to lack of data. It is likely that higher incomes are associated with higher gas use, although this cannot be discerned in customer data because customer income is not known. For the household survey analysis that we have undertaken, the income measure if very poor (see Appendix D).

Poor economic conditions may have some offsetting increases in demand through higher dwelling starts, as lower interest rates increase activity in this sector.

Currently, Victorian Treasury is projecting a 2.25 per cent increase in Gross State Product for 2011/12 and 2012/13 and a 2.75 per cent increase for the following two financial years. These figures are close to average growth in Victoria.

There are risks to the Australian economy arising from risks to the global economy. As the Reserve Bank of Australia has noted, global risks are currently tilted to the downside.[54] There are also plausible downside risks to the Victorian economy as the mining and related sectors of the Australian economy grow faster than other sectors, maintaining a high exchange rate.

We have not factored in an adjustment to forecasts to reflect the greater downside risks to economic activity and incomes. The magnitude of such an adjustment for the commercial sector usage would be in the order of a 0.87 per cent lower gas use for each 1 per cent reduction in Victorian Gross State Product relative to that projected by Victorian Treasury. There is substantial uncertainty around this estimate of the impact of economic activity on commercial gas consumption.

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54 Reserve Bank of Australia 2011, *Statement on Monetary Policy*, November, p. 65.

Gas prices

We have grown Victorian wholesale gas prices by growth in Australian Treasury projections of gas prices. Australian Treasury gas prices for the whole of Australia are well above Victorian wholesale prices. There is the potential for wholesale gas prices to rise much more quickly than anticipated in response to developments that more closely link Australian gas prices to export parity prices (see Appendix E). If this occurred we would expect to see a reduction in gas use relative to the projections put forward in this report.

One plausible scenario would be that Victorian wholesale gas prices would increase to the average level reported by Australian Treasury by the end of the regulatory period. In this case, wholesale gas prices would almost double and residential and commercial consumption would be expected to be more than 5 per cent lower than embodied in our projections.

A rapid increase in wholesale gas prices is the risk that is most readily identifiable in future gas usage projections. Potentially, this risk could be accounted for through an assessment of the probability of this event occurring and a weighted average of projections under baseline and projections under a rapid escalation of wholesale gas prices.

Appendices A to E

A SP AusNet's billing database

SP AusNet's billing database and city gate consumption form the basis of the analysis in this report. Data was provided for billing that took place in the period from 1 January 2003 to June 2011 for residential and commercial customers (excluding tariff D customers). The main information (of relevance to our analysis) provided in SP AusNet's billing database include the following items:

- consumption for each meter reading period;
- date covered by meter reading – both the 'start' and 'end' reading dates are provided;
- period which the consumption is billed and recorded in the billing database;
- customer number (known as Meter Identification Reading Number, MIRN)
- customer type (R is residential, C is commercial); and
- suburb and postcode where the consumption was recorded.

The database also includes a range of other information which we have not utilised in our analysis. For example, it includes information on the 'meter number' which is different to the customer number – in some cases a single customer may have several meters on their property (although some of these meters may no longer be used).

Converting data to meter reading period

The original billing data provided by SP AusNet was divided into the period which the consumption was *billed*. In some instances there was a relatively long lag between the date which the consumption was *metered* compared with the billing date. Further, the billing data also included some reported *adjustments* to a customer's bill from previous periods. The adjustments could, for example, relate to some discrepancies in previous bills issues that needed to be corrected.

For the purpose of demand forecasting in a particular period (and appropriate weather normalisation), the period in which the consumption occurred (ie the meter reading period) is of most relevance. This, for example, allowed consumption to be more accurately matched to the weather patterns prevailing during the consumption period.

To reflect this, we have 'converted' the billing dataset into a dataset that reflected the year in which the metered consumption occurred, rather than the year which the bill (or adjustments) was issued. The following adjustments were made to the original dataset provided:

- consumption from periods prior to 1 January 2003 were removed from the database; and
- where meter reading occurred across two calendar years then the consumption needed to be allocated between each of the years. Approximately 18 per cent of metered consumption in the original datasets related to transactions that were required to be reallocated between calendar years. We have pro-rated consumption between the two calendar years based on the number of meter reading days in each calendar year.

The revised dataset created (and used for the analysis in this report) was based on metered consumption in the calendar years 2003 to 2010. Consumption that took place prior to 1 January 2003 and after 31 December 2010 was excluded from the analysis.

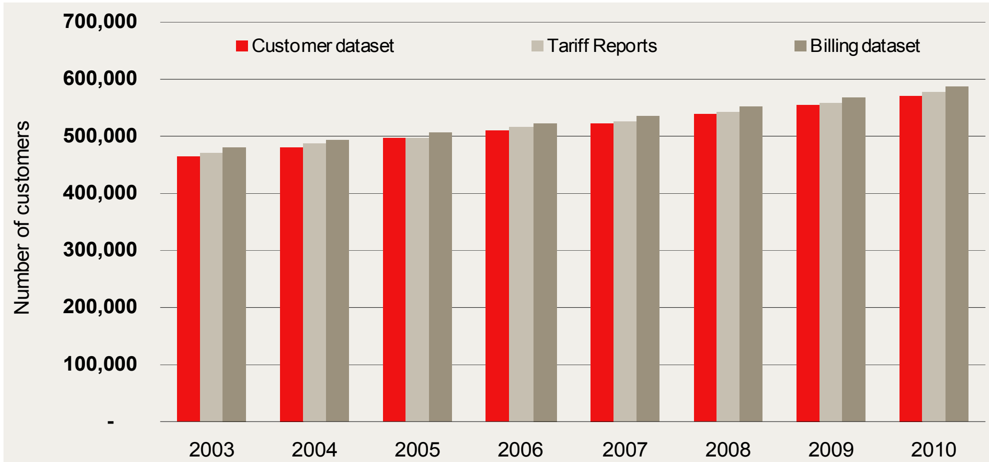
Quality Assurance Checks

A number of checks were undertaken to test the robustness of the revised dataset created (prior to weather normalisation of the consumption results). Our primary checks were against other data on customer numbers and consumption provided by SP AusNet. As noted below, the dataset is considered robust at an aggregate level but further refinement is required to provide a robust dataset at a more disaggregated level.

Comparison of customer numbers

In addition to the billing dataset, SP AusNet also provided a separate dataset on customer profiles as well as separate tariff reports for each year that included information on the number of customers in each year. Chart A.1 compares the customer numbers reported from these sources to the billing dataset.

A.1 **Customer numbers** number of unique MIRNs



Data source: SP AusNet.

While the three datasets provide broadly consistent numbers there are some differences. The customer numbers in the billing dataset are on average 2.5 per cent higher than the customer datasets. This minor difference is likely to reflect customer movements throughout the year. For example, in the billing dataset we report all customers that have been activate *at any time* during the year. The customer numbers presented in the tariff reports reflect some average number of customers over the year.

While on aggregate customer numbers are broadly similar across the three datasets, at a more disaggregated level the differences are greater. In particular, in 2003 the billing database classifies all customers as residential customers. For the same year, the other two datasets classify approximately 14 500 of the total 470 000 customers as business customers. For later analysis we have used the codes from the customer database unless these were not available, in which case billing database customer classifications were used.

Comparison of usage to original datasets

In this section we compare the total consumption for a given year in the revised database created (based on consumption in the meter reading period) against three sources of information provided by SP AusNet:

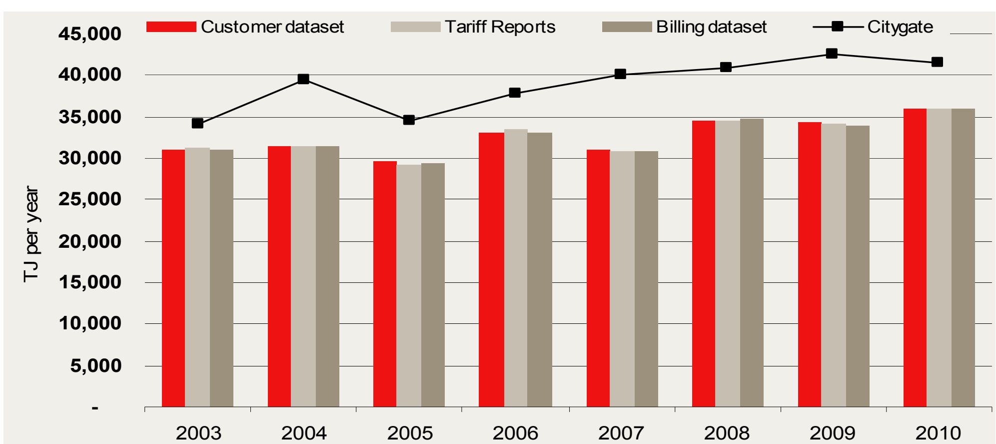
- the original billing database which was separated consumption according to the year which the consumption was billed;
- the annual tariff reports that formed the basis of the audited financial statements; and
- throughput data recorded at the citygate less reported throughput for tariff D customers.

In this step we checked to ensure that the total consumption across all years in the revised dataset matched that in the original dataset provided by SP Ausnet. This step confirmed that the revised dataset matched the original dataset in aggregate. The only difference between the total consumption in the two datasets was due to the exclusion of consumption prior to 2003 and after 31 December 2010 – in the original dataset provided total usage (including adjustments) was 271 831 TJ, compared with 260 591 TJ in the revised dataset (a 4.1 per cent difference).

Chart A.2 presents the total consumption for all customers in each year using the original database, the tariff reports and citygate throughput data. This indicates that there are some minor differences in each year in the level of consumption reported in the original database compared with the other sources of information. This reflects the adjustments that we have made to ensure that the consumption reported in the year only reflects the metered consumption in that year.

Chart A.2 also reports the throughput at the citygate for the same period. We would expect that the pattern of usage in each year to be similar to the pattern of end-point usage. This is the case for 2003 to 2006 where increases/decreases in end-point usage are broadly consistent with the pattern of throughput at the citygate. However, the pattern of end-point consumption and throughput at citygate from 2006 onwards are not well aligned. It will be important to gain further information from SP AusNet to understand the reasons that the annual consumption patterns may not reflect the annual throughput pattern.

A.2 **Total consumption per annum** TJ per year



Note: Citygate is all citygate throughput less tariff D throughput.
Data source: SP AusNet.

Conclusions

On the basis of the quality assurance checks undertaken, we believe that the revised dataset generated using the original billing data provides a robust dataset on which to conduct analysis.

B Government programs

There have been a wide range of Government programs in the energy sector in recent years and expected in the forecast period. These have been housed in two dominant themes related to energy type and energy efficiency. The major policies impacting on switching between energy types (and total use) are Clean Energy Future and the Mandatory Renewable Energy Target. Energy efficiency policies are collectively part of the National Strategy for Energy Efficiency.

This appendix details the various programs and their potential impact on gas use. For many of the programs there has been on assessment of impact and for no program is there a specific assessment of impact for the SP AusNet gas distribution area. We do not consider it feasible to specifically link in each policy to projections. Instead, the policy impacts are captured in a continuation of the time path of gas use experienced since 2003. A summary of the programs and their direction of impact is shown in table B.1.

B.1 **Summary of government programs**

	Impacts on gas use	*Separate impact included in projections*
Victorian Government		
Energy Efficiency Target	Unclear	No
Feed-in Tariff Scheme	Reduce — small impact	No
Sustainability Fund	Reduce — small impact	No
Solar hubs	Reduce — small impact	No
Zero emissions neighbourhoods	Reduce — small impact	No
Energy and water taskforce	Reduce — medium impact	No
Australian Government		
Clean Energy Future — price on carbon	Unclear	No
Clean Energy Future — funding for renewable technologies	Reduce — impacts unknown	No
Clean Energy Future — assistance for businesses	Reduce — impacts unknown	No
Mandatory Renewable Energy Target	Reduce — substantial impact	No
Electric hot water system phase out	Increase — substantial impact	No

(Continued on next page)

B.1 **Summary of government programs** (continued)

	Impacts on gas use	***Separate impact included in projections***
Energy labelling and Mandatory Energy Performance Standards	Reduce — substantial impact	No
Low carbon communities	Reduce — small impact	No
Energy Efficient homes package	Reduce — substantial impact	No
6 star building impact	Reduce — substantial impact	Yes
National Schools Solar Program	Reduce — small impact	No
Tax breaks for green buildings	Reduce — small impact	No
Cityswitch	Reduce — small impact	No

Sources: As noted in appendix below.

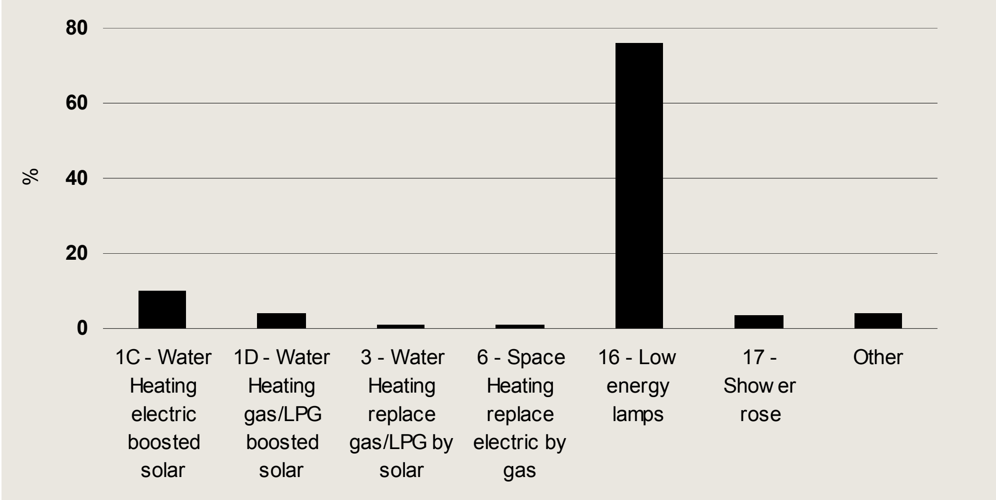
Victorian Government policies and programs

Victorian Energy Efficiency Target

Victorian Energy Efficiency Target (VEET) scheme places a legislative requirement on large Victorian energy retailers to surrender a specified number of energy efficiency certificates every year. Each certificate represents in tonne of greenhouse gas abated and is known as a Victorian energy efficiency certificate (VEEC). Accredited entities are entitled to create VEECs when they help residential consumers make energy efficiency improvements through specified Prescribed Activities.

Since inception on 1 January 2009 to July 2011, over 6.5 million certificates have been created. Around 75 per cent of these certificates were issued for the installation of low energy lights, while more efficient water heating and shower roses have also been a significant source (chart B.2). Prescribed Activities that created relatively few certificates included the installation of floor insulation, more efficient space heating, weather sealing and the purchase of more efficient refrigerator/freezers.

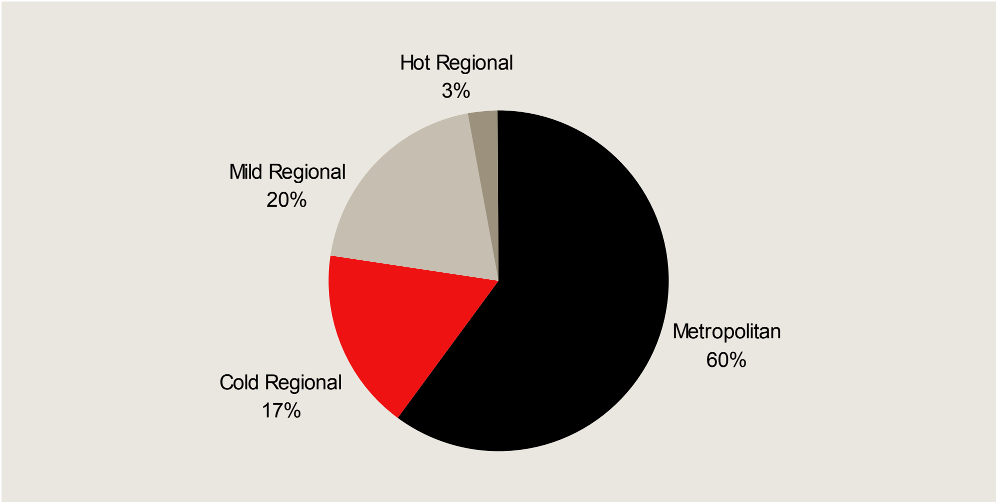
B.2 **Major sources of VEECs, Prescribed Activities**



Data source: Essential Services Commission, *Summary of VEET activity by postcode*, available from http://www.veet.vic.gov.au/Public/Public.aspx?id=VEECs and CIE calculations.

Around 60 per cent of VEECs were issued in Victorian Metropolitan areas, while mild regional accounted for 20 per cent, cold regional 17 per cent and hot regional 3 per cent (chart B.2). Within the SP AusNet distribution area, over 2 million VEECs have been issued as the result of 226 000 installations.

B.3 **Geographical distribution of VEECs**



Data source: Essential Services Commission, *Summary of VEET activity by postcode*, available from http://www.veet.vic.gov.au/Public/Public.aspx?id=VEECs and CIE calculations.

The VEET scheme is being extended to small to medium enterprises and the state target will double to 5.4 million tonnes of greenhouse gas abatement per annum from 1 January 2012 (applying to each calendar year until the end of 2014).

A regulatory impact statement was undertaken on the proposed VEET regulations by the Victorian Department of Primary Industries in 2008. The benefit–cost analysis within this report concluded that the scheme would lead to only a relatively small volume reduction in gas demand against the business-as-usual case[55] (1 per cent over 2009 to 2011). This was because 'the reduction in gas demand induced through increased heating efficiencies is partially offset by the active switching of customers from electricity to gas (the VEET scheme rewards fuel substitution where it yields a greenhouse benefit)'.[56]

Operating within the VEET scheme, the following rebates are currently offered by Sustainability Victoria:

- **Electric heater replacement discount** — $700 point-of-sale discount to eligible Victorian concession card holders that switch from an electric heater to an eligible high efficiency gas space heater (energy star rating of 4 or above).
- **Gas Hot Water Rebate** — $1000 rebate available to replace peak electric (day-rate) hot water systems with high efficiency gas hot water systems ($400 for a 5-star instantaneous or storage hot water heater (4+ star for internal systems); $700 for concession card holders, as above; $300 installation rebate for flat or apartments).
- **Solar Hot Water Rebate** — Rebate of $1500 in metropolitan Melbourne and up to $1600 in regional Victoria to replace existing hot water systems with solar hot water systems. Rebates vary for solar hot water systems depending on their: size (amount of water produced); and performance (solar contribution), as well as the cost of installation.
- **Whitegoods appliance rebate** — No Interest Loan Scheme (NILS) and Progress Loans program offers low income households $100 rebates on the purchase of either: washing machines with a minimum 3.5-star energy rating and 4-star water rating; and fridges with a minimum 4-star energy rating.
- **Showerhead Exchange Program** — allows households to replace an existing showerhead with a water-efficient, 3 star replacement showerhead.

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55 The business as usual (BAU) case made the following assumptions: The wholesale market price includes all policies which were formally in place as of November 2006. This includes: the Queensland 13 per cent Gas Scheme; NSW Greenhouse Gas Abatement Scheme; Commonwealth MRET Scheme; 5-star building requirements; and MEPS for relevant appliances. The BAU scenario did not include: the NSW Renewable Energy Target Scheme; the Clean Energy Target announced by the Commonwealth in September 2007; and a carbon price induced through a national ETS. The BAU also assumed that normal rainfall patterns resume.

56 Department of Primary Industries 2008, *Regulatory Impact Statement: Proposed Victorian Energy Efficiency Target Regulations*, September.

B.4 **VEET — summary of impact on gas demand**

The expected impact on gas use is a small reduction made up of:

- reduced usage from more efficient showerheads and hence less gas for water heating;
- reduced usage from replacement of gas water heating with solar water heating; and
- increased usage from replacement of electric water heating with gas water heating.

Victorian Feed-in Tariff scheme

Victoria legislated a net metered feed-in tariff scheme, which commenced in November 2009. Under the scheme households and businesses that install a renewable energy system are credited for the surplus electricity they generate and return to the electricity grid.

In September 2011, the minimum of 60 cents kWh premium feed-in tariff for small scale solar PV systems will be closed to new applicants (eligible customers in this category will receive this feed-in tariff rate until 2024). The premium feed-in tariff will be replaced with a Transitional Feed-in Tariff scheme. Customers will receive a reduced credit of 25 cents a kWh for their excess energy generated from 2012 to 2016.

A standard feed-in tariff is available for larger PV, wind, hydro and biomass renewable energy systems of over 5kW up to 100kW. The standard feed-in tariff provides household and business customers with a 'fair and reasonable' rate for electricity fed back into the state's electricity grid. This generally equates to the amount paid to consume electricity from the grid.

B.5 **Feed-in Tariff scheme — summary of impact on gas demand**

No impact assessment on the Victorian feed-in tariff has been undertaken. It is expected that this scheme will have marginal negative impacts on gas demand given the incentive it creates for households and businesses to install renewable energy infrastructure. This could mean that fewer households connect to gas for example.

Government Sustainability Fund

Funded from the Victorian Landfill Levy, the Victorian Government Sustainability Fund has supported 167 organisations to implement 254 projects and strategic initiatives in businesses, schools, local governments and community groups since inception. For instance, it has enabled the development of green precincts and greener buildings, supported trials of new technologies and trained tradespeople to assist households increase their sustainably.

Since the first round of funding was announced in 2005, the Sustainability Fund has provided over $167 million for sustainability projects across Victoria. A further $188 million has been provided in cash and in-kind contributions brought to supported projects.

B.6 Sustainability fund — summary of impact on gas demand

It is not expected that the Sustainability Fund will have significant impacts on gas demand within the SP AusNet distribution area over the forecast period.

Solar Hubs Program

The Solar Hubs Program (Solar Photovoltaics Community Hubs) aims to provide communities with access to more competitively priced solar power. There are five projects across Victoria developing solar hubs in each of their local communities and reducing the cost of individual rooftop solar system installations (table B.3).

B.7 Solar Hubs Program — current projects

Applicant	*Project*	*Location*	*Solar Installation*	*Funding*
			MW	$
Bendigo and Mount Alexander Sustainability Groups	Bendigo-Mount Alexander 1000 Solar Rooftops	Bendigo region	2.00	456 704
Mildura Development Corp	Mildura - a going solar community	Mildura	0.78	392 424
Energy Innovation Co-Op	Southern Solar Hub Project	West Gippsland	0.65	250 000
GV Community Energy	Solar Valley Hub	Shepparton region	2.17	600 000
Towong Shire	North East Solar PV Community Hub - Beyond Zero	North East Victoria region	4.24	500 000
Total			9.84	2 199 128

Source: Resource Smart Victoria, available at http://www.resourcesmart.vic.gov.au/for_businesses/rebates_and_grants_4670.html.

B.8 Solar Hubs program — summary of impact on gas demand

While the Solar Hubs Program promotes solar energy over gas, given the relatively small size of the current program we do not expect any significant impact on forward gas demand estimates. No formal impact assessment or regulatory impact statement is available

Zero Emission Neighbourhoods

Zero Emission Neighbourhoods (ZEN) is a $6 million grant program which aims to assist the development of up to six precincts that aspire to significantly reduce greenhouse gas emissions. This will be achieved through reducing the emissions from the way water, waste, energy and transport are used and managed within the ZEN precinct.

B.9 Zero Emissions Neighbourhoods — summary of impact on gas demand

Current research and feasibility projects suggest no significant impacts will result on gas demand over the forecast period.

Energy and Water Task Force

The Energy and Water Task Force provides a free home assessment and retrofit to low income households. An approved contractor will visit the home to assess and identify opportunities for improving energy and water use and a range of energy retrofit actions are undertaken. These may include sealing out draughts, fitting energy efficient light globes, fixing dripping taps and fitting water efficient shower roses.

Sustainability Victoria reports that on average households whose homes are retrofitted have gas savings of 16 per cent.[57]

B.10 Energy and Water Task Force — summary of impact on gas demand

The impacts on homes that obtain an assessment are expected to be substantial. The historical and projected uptake in SP AusNet's distribution area is not known.

57 Sustainability Victoria 2011 website, available at: http://www.sustainability.vic.gov.au/www/html/1464-energy-task-force.asp.

Federal Government policies and programs

Clean Energy Future

Under the Clean Energy Future Scheme, the largest Australian polluters will be required to buy and surrender permits for every tonne of carbon pollution produced. For the first three years, the carbon price will be fixed at $23 a tonne, rising at 2.5 per cent a year in real terms. From July 2015, an emissions trading scheme will operate, with the carbon price determined by the market.

Under this scheme $5 billion will be provided by the Australian Government for research and development, demonstration and commercialisation of renewable energy and energy efficiency technologies.

A carbon price is likely to make gas-fired electricity generators relatively more competitive than coal-fired baseload generators and therefore could increase demand for gas and gas wholesale prices.

B.11 **Clean Energy Future — summary of impact on gas demand**

The introduction of a carbon price is expected to have the following impacts on gas usage:

- increase the price of electricity by more than gas, potentially making gas more attractive. Note that with many customers being billed for energy, it is possible that higher electricity bills will lead to reduced gas use and statistical analysis found no strong relationship;
- increase the demand for gas by electricity generators, putting upward pressure on wholesale gas prices;
- reduce the cost of renewable energy alternatives through support for new technologies with potential reductions in demand for gas; and
- reduce energy use for businesses and households through energy efficiency initiatives, which could reduce demand for gas.

The net impact on gas use in SP AusNet's distribution area is not clear.

Renewable Energy Target

The Commonwealth Government Renewable Energy Target (RET) is a tradeable renewable energy certificates scheme implemented in August 2009 to deliver on the Government's commitment to ensure that 20 per cent of Australia's electricity supply came from renewable sources by 2020. The RET expands on the previous Mandatory Renewable Energy Target (MRET), which began in 2001. From January 2011, the RET has operated in two separated parts:

- Large-scale Renewable Energy Target (LRET) — supports the deployment of renewable energy projects like wind farms, and commercial solar and geothermal power stations; and
- Small-scale Renewable Energy Scheme (SRES) — provides support for installations of small renewable energy systems such as rooftop solar panels and solar water heaters.

The modifications effectively divide the scheme into a separate target of 41 000 GWh by 2020 for large-scale renewable technologies and an overall unchanged target of 45 000 GWh, with the difference expected to be met or exceeded by small-scale technologies.

Solar Credits provide additional support to install small-scale solar photovoltaics (PV or solar panels), wind and hydro electricity systems. In effect they multiply the number of small-scale technology certificates able to be created for eligible installations. The Solar Credits multiplier reduces over time, reflecting reductions in technology costs. The Commonwealth recently announced that the phase out of the Solar Credits multiplier will be brought forward by one year (from: 5 to 4 on 1 July 2011; 4 to 3 on 1 July 2012; 3 to 2 on 1 July 2013; and 2 to 1 from 1 July 2014).

B.12 **Renewable Energy Target — summary of impact on gas demand**

The Renewable Energy Target does not include gas. It would be expected to reduce gas demand through promoting solar hot water systems and PV systems to households and businesses.

Green Loans Program

The Green Loans program commenced in July 2009 with the aim of promoting energy efficiency initiatives in households by providing free home sustainability assessments (information and advice) on the actions householders could take to save energy and water.

Over 600 000 home assessments were conducted during the course of the Green Loans program, which closed on 28 February 2011.

B.13 **Green Loans Program — summary of impact on gas demand**

The Green Loans Program is expected to have reduced gas demand. There will be no impacts in the forecast period as the program is now closed. No assessment is available of the impact on gas use attributable to the SP AusNet region.

Electric hot water system phase out

The Australian Government and state and territory governments are working together to phase-out electric resistance hot water systems. During 2010, electric water heaters will not be installed in: any new detached, terrace or town house; or any existing detached, terrace or town house where there is access to piped natural gas (Stage 1). During 2012, electric water heaters will not be installed in: any existing detached, terrace or town house (Stage 2).

A benefit–cost analysis[58] undertaken on the phasing out greenhouse intensive water heaters reasoned that water heater purchases will respond to the withdrawal of electric water heaters from the market by either:

- preferring solar and heat pump water heaters, with high capital costs but also high energy cost savings; or
- preferring natural gas and LPG water heaters, with lower capital costs but also lower energy savings.

This RIS took into account the value of Renewable Electricity Certificates created by solar and heat pump water heaters, as these are legislated until 2030. It did not incorporate the value of any Commonwealth or State rebates.

The RIS concluded the increase in gas demand from a higher rate of electric to gas water heater replacement in areas already reticulated would be largely offset by rises in the efficiency of all gas use.

B.14 **Electric hot water system phase out — summary of impact on gas demand**

The phase out of electric hot water systems is expected to increase gas usage as some customers that are using electric systems use gas systems instead. The RIS expected that this increase in gas use would be offset by improvements in the efficiency of gas water heaters.

Energy and water labelling and Minimum Energy Performance Standards

Energy and water labelling is mandatory for a range of electrical products offered for sale in Australia. The labelling scheme aims to make consumers more aware of the energy efficiency of products and increase the take up of energy efficient appliances.

Certain products are subject to Minimum Energy Performance Standards (MEPS), which means that they have regulated minimum energy efficiency levels and use less

58 George Wilkenfeld and Associates 2010, *Regulation Impact Statement: for Decision Phasing Out Greenhouse-Intensive Water Heaters in Australian Homes*, prepared for the National Framework for Energy Efficiency, November.

energy than they otherwise would. Among the products covered by these performance standards are electric hot water systems. MEPS do not cover solar and heat pump hot water systems.

A Regulatory Impact Statement on MEPS and energy labelling legislation concluded that extra gas use as a result of the Equipment Energy Efficiency (E3) measures would equate to $226 million over 2009 to 2020 for Australia.[59] While water heater and space heater MEPS would save $239 million and $436 million in gas use respectively the Water Efficiency Labelling and Standards Scheme would save $220 million. This report also included an impact related to phasing out electric systems, suggesting that gas water heaters would consume an extra $1.16 billion of gas from 2009 to 2020 (table B.2).

B.15 **Projected costs and benefits, Australia, E3 measures impacting residential natural gas use**

	Undisc saving 2000-08	*Undisc saving 2009-40*	*Total saving 2009-40*	*Disc saving 2009-40*	*Disc cost 2009-20*	*Net benefit 2009_20*
	$m	*$m*	*$m*	*$m*	*$m*	*$m*
Water heater MEPS	1	782	783	326	88	239
Space Heater MEPS		1319	1319	510	75	436
WELS (hot water saving)	4	523	527	220		220
Extra gas use – WHs		-2820	-2820	-1160		-1160
Total Gas Savings	5	-197	-192	-104	162	-266

Source: George Wilkenfeld and Associates 2010, *Regulation Impact Statement: National Legislation for Appliance and Equipment Minimum Energy Performance Standards (MEPS) and Energy Labelling*, prepared for the Department of the Environment, Water, Heritage and the Arts, January.

B.16 **Labelling and MEPS — summary of impact on gas demand**

Labelling and MEPS would be expected to reduce demand for gas. Voluntary labelling currently applies to gas water heaters and gas heating. This is currently under review by the Australian Government. There are Australian Standards for gas cooking, gas heating and gas water heating appliances.

Note that the increased gas use from phasing out electric hot water systems has been discussed separately.

59 George Wilkenfeld and Associates 2010, *Regulation Impact Statement: National Legislation for Appliance and Equipment Minimum Energy Performance Standards (MEPS) and Energy Labelling*, prepared for the Department of the Environment, Water, Heritage and the Arts, January.

Low Carbon Communities

The Low Carbon Communities program provides funding to local councils, community organisations and low income households through three funding streams.

- $200 million Community Energy Efficiency Program (formerly the Low Carbon Communities Program) supports energy efficiency upgrades to council and community-use buildings, facilities and lighting.
- $100 million Low Income Energy Efficiency Program supports consortia of local councils, community organisations and energy service companies to trial energy efficiency approaches in low income households.
- $30 million Household Energy and Financial Sustainability Scheme assists low income households find more sustainable ways to manage their energy consumption.

B.17 **Low carbon communities — summary of impact on gas demand**

Low carbon communities would be expected to have small reductions in use of gas.

Energy Efficient Homes Package

Home Insulation Program

The Home Insulation Program (HIP) was announced in February 2009 and provided up to $1600 (reduced to $1200 in Nov 2009) to install ceiling insulation into households. Under the HIP, around 1.2 million households were insulated at a cost of around $1.45 billion. It is understood that 280 000 applications for insulation went through in Victoria.[60] The program was closed on 19 February 2010 due to escalating safety and compliance concerns.

Renewable Energy Bonus Scheme: SHW Rebate

The Solar Hot Water Rebate (REBS) is available to eligible home-owners, landlords or tenants to replace electric storage hot water systems with solar or heat pump hot water systems. Under REBS, eligible households can claim a rebate of $1000 for a solar hot water system or $600 for a heat pump hot water system. REBS replaced the former Solar Hot Water Rebate Program which was discontinued as of close of business 19 February 2010.

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60 AEMO 2010, *Victorian Annual Planning Report Update: Victoria's Electricity and Gas Transmission Network Planning Document*, p. 63.

B.18 **Energy efficiency homes — summary of impact on gas demand**

Energy efficient homes package would be expected to reduce use of gas by households. This reflects less gas required to heat a home to the same standard for insulated houses and increased uptake of solar hot water rather than gas.

National Solar Schools Program

The National Solar Schools Program offers eligible primary and secondary schools grants of up to $50 000 (GST exclusive) to install solar and other renewable power systems, solar hot water systems, rainwater tanks and a range of energy efficiency measures including: energy efficient lighting; skylights; ceiling fans; sensors; shade awnings; automatic doors and double glazing.

Since the program commenced in July 2008, 3800 schools have been awarded a grant, totalling more than $165 million in funding. Over 90 per cent of these projects include solar power systems. Of these, more than 2000 projects have been installed.

B.19 **National Solar Schools Program — summary of impact on gas demand**

The National Solar Schools Program would be expected to have small negative impacts on commercial gas use.

Tax Breaks for Green Buildings program

The Tax Breaks for Green Buildings program will apply from 1 July 2012. Under the program eligible businesses that invest in improving the energy efficiency of their existing buildings will be able to apply for a Tax Break. This will cover specified expenditure which is incurred as part of a qualifying retrofit of an existing office building, hotel or shopping centre.

The retrofit must be assessed by an accredited National Australian Built Environment Rating System (NABERS) assessor and achieve a significant improvement in energy efficiency.

B.20 **Tax breaks for green buildings — summary of impact on gas demand**

Tax breaks for green buildings would be expected to reduce gas use for commercial customers. There is no information available on expected uptake for this program.

6 Star Standard building code

From 1 May 2011, the 6 Star Standard was introduced in Victoria to align with the national energy efficiency measures in the Building Code of Australia (BCA).

The 6 Standard for new homes, alterations and additions applies to the thermal performance of a dwelling, plus the requirement to install a solar water heater system or a rainwater tank for toilet flushing in new homes. Options to improve a building's energy-efficiency include: orientation; insulation; draught-proofing; better window design; shading; and building fabric. Efficiency standards also apply to fixed lighting but not for plug in appliances provided by homeowners.

The CIE conducted a RIS of proposed amendments to energy efficiency requirements in the Building Code of Australia and found expected savings in gas consumption.[61] It was found that the improved thermal performance of households would lead to gas consumption savings of 6561MJ or $92 per year in Melbourne houses (table B.3).

B.21 **Decrease in thermal gas consumption in Melbourne**

	Annual decrease in gas consumption	*Annual savings per dwelling*	*Savings over dwelling lifetime*
	MJ	$	$ (present value)
House	6 561	92	1 331
Townhouse	2 728	38	553
Flat	2 613	37	371

Source: Centre for International Economics 2009, *Final Regulation Impact Statement For Decision (Final RIS 2009-06): Proposal to Revise the Energy Efficiency Requirements of the Building Code of Australia for Residential Buildings — Classes 1, 2, 4 and 10*, December.

B.22 **6 Star building standard — summary of impact on gas demand**

The 6 star building standard would be expected to reduce residential gas use for new dwellings by 12 per cent relative to the current 5 star standard. This impact has been directly factored into our projections.

CitySwitch

NABERS offers rebates of up to $9000 to office tenants who sign up to CitySwitch Green Office Victoria and commit to achieving and maintaining a 4 star NABERS energy rating. CitySwitch is a national program which provides office tenants with

61 Centre for International Economics 2009, *Final Regulation Impact Statement For Decision (Final RIS 2009-06): Proposal to Revise the Energy Efficiency Requirements of the Building Code of Australia for Residential Buildings – Classes 1, 2, 4 and 10,* December.

advice on actions to improve their energy efficiency. This offer was available until 30 June 2011, with 76 tenancies across greater Melbourne joining the program.

B.23 **City Switch — summary of impact on gas demand**

This program is expected to have negligible impacts on gas use.

C Cross-checks on weather normalisation

We have normalised data using annual effective degree days. As a cross-check, we have also checked system daily consumption against daily weather and tested the validity of the AEMO preferred effective degree day measure.

Constructing a weather variable

Gas consumption data is typically normalised to represent consumption for a typical year. This occurs so that forecasting can be based on standard weather assumptions. In the past, this has been done using effective degree day formulas that comprise the deviation of temperature from some base level, wind and sunshine. The EDD formula used by SP AusNet is set out below.

$$EDD = \max(0, DD + Windchill - Insolation + Seasonality)$$

Where subcomponents are calculated according to the following formulae.

$$DD = \max(0, 18 - \overline{temp})$$

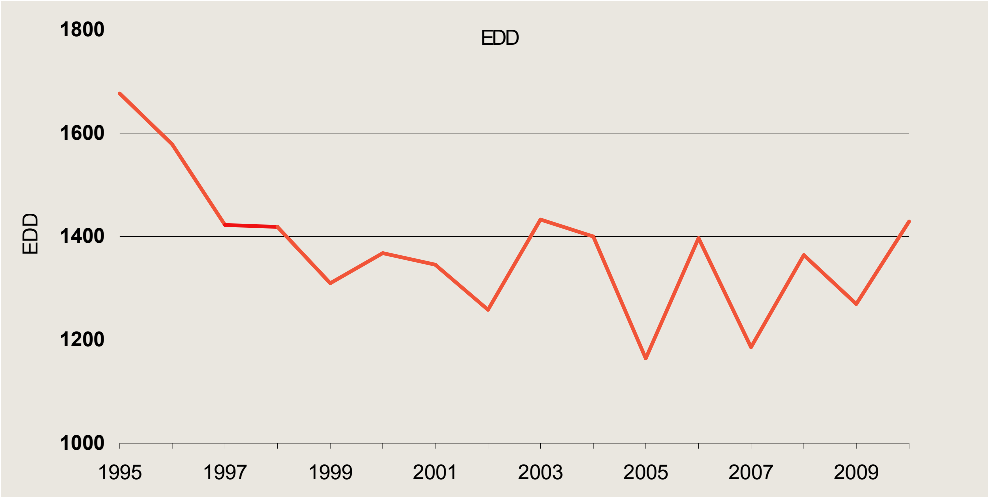
$$Windchill = \overline{windspeed}.\overline{temp}.0.038$$

$$Insolation = 0.18.sunhours$$

$$Seasonality = 2.\cos\left(2.Pi.\left(\frac{day - 200}{365}\right)\right)$$

Where $\overline{temp}$ is average temperature based on 3 hourly measurements, $\overline{windspeed}$ is average wind speed based on 3 hourly measurements, sunhours is the number of hours with sun and day is the number of days since the first day of the year.

C.1 **Historical weather conditions** effective degree days



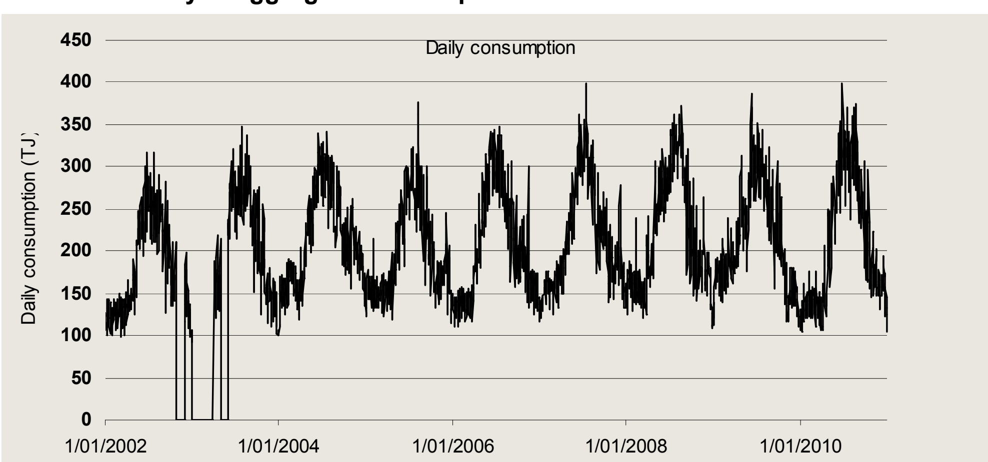
Data source: CIE analysis based on weather data provided by SP AusNet.

There are many possible ways of putting together different weather information to give an effective degree day measure, aside from that shown above. Some testing of the validity of the current formula is undertaken below.

Impact of effective degree days on consumption

Weather will impact on different customers differently depending on what they use gas for. Customers that use gas mainly for heating will have the biggest response to weather conditions.

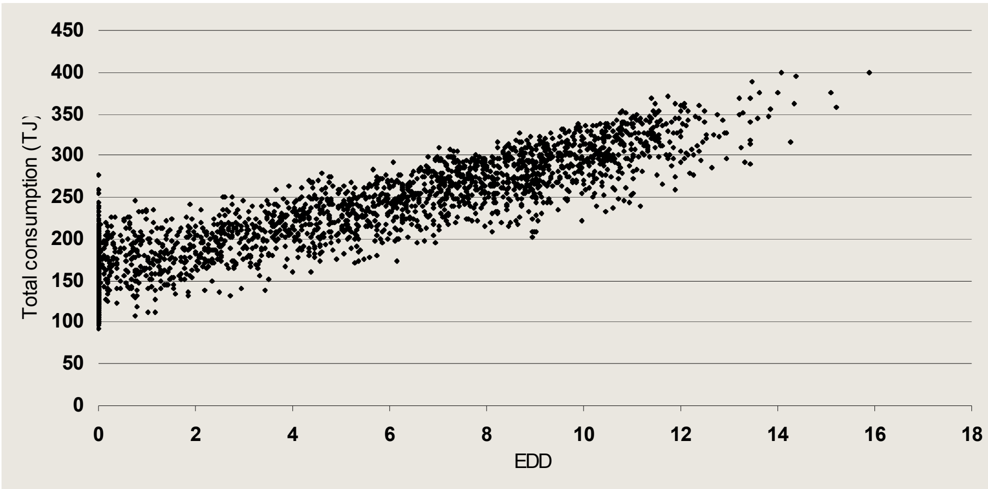
C.2 **Seasonality in aggregate consumption**



Data source: CIE analysis based on SP AusNet data.

The relationship between effective degree days and aggregate consumption from 2002 to 2010 is shown in chart C.3. An extra 1 degree day increases aggregate consumption by about 14TJ across all SP AusNet's customers[62], which is equivalent to about 7 per cent of average daily consumption.

C.3 **Effective degree days and aggregate consumption**

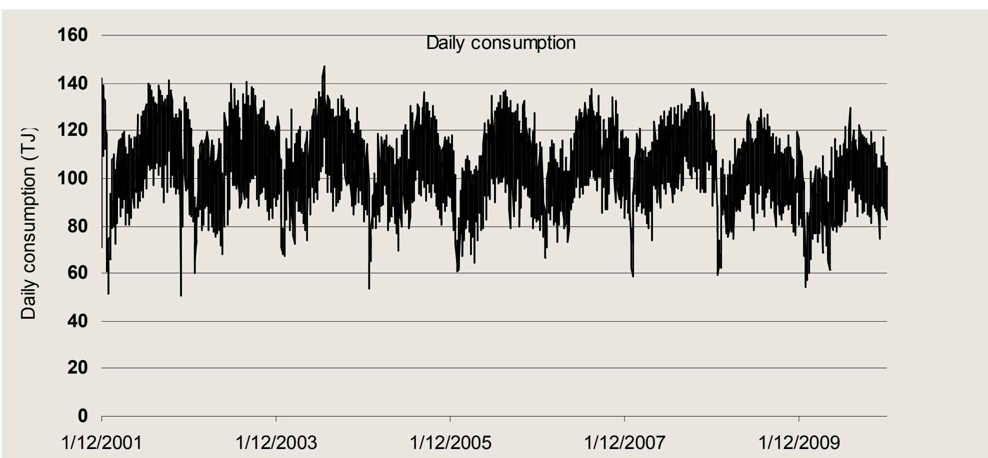


Data source: CIE analysis based on data provided by SP AusNet.

Tariff D customers

Highly disaggregated data is available for demand customers. These customers also exhibit a seasonal pattern, although this is not as strong as for aggregate consumption (chart C.4).

C.4 **Seasonality of tariff D consumption**

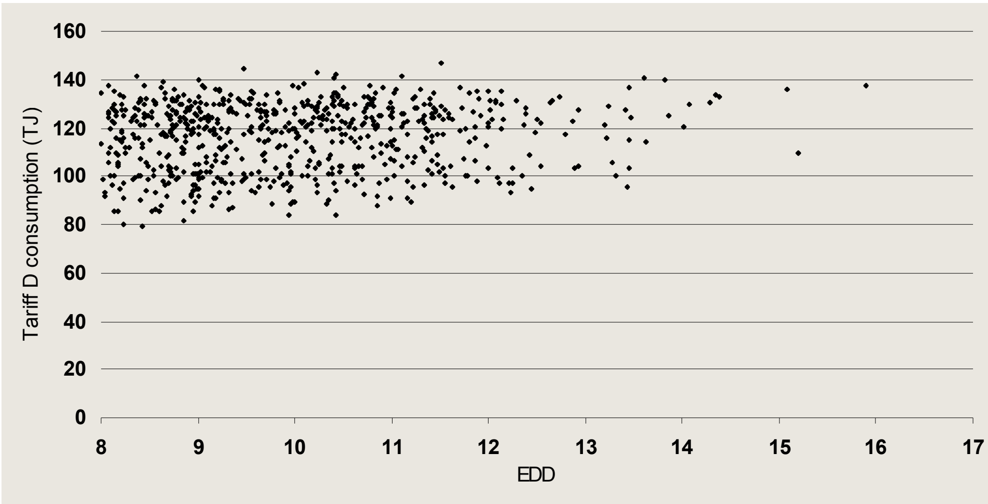


Data source: CIE analysis based on data provided by SP AusNet.

62 Based on ordinary least squares regression of consumption against effective degree days and not allowing for a time trend.

For these customers, the relationship is shown in chart C.5. There is a much weaker relationship between effective degree days and consumption for tariff D customers.

C.5 **Effective degree days and tariff D consumption**



Data source: CIE analysis based on data provided by SP AusNet.

Taking tariff D consumption off aggregate consumption gives the relationship for smaller customers (and losses). For these customers weather is a more important determinant of consumption with a 1 increase in effective degree day increasing usage by 11.7 per cent of daily average consumption.

The impact of a degree day for different customer types based on daily data is shown in table C.6. This is based on ordinary least squares estimates of daily consumption against effective degree days.

C.6 **Impact of weather for different customer types**

Measure	*All customers*	*Tariff D customers*	*Other customers*
Impact of one EDD on consumption (TJ/day)	14.1	1.9	12.2
Average daily consumption	209.9	105.9	104.0
Impact of one EDD as a share of average daily consumption (per cent)	6.7	1.8	11.7

Source: CIE analysis.

D Analysis of Victorian Utility Consumption Household Survey 2007

The 2007 Victorian Utility Consumption Household Survey[63] interviewed 2061 households across Victoria and supplemented survey responses with energy, water and council rate billing information.

Surveyed households reported total annual average gas consumption of 58 194MJ. Per dwelling usage during winter was significantly higher than the average during summer months (45.8GJ compared with 12.4GJ respectively). Models estimated in STATA using generalised least squares regression were able to explain only a relatively small percentage of the variation in the data. This indicates a range of behavioural factors outside of the survey that are important to a household's gas consumption decisions.

Those fundamental demographic factors that were revealed to be of significance are discussed below and shown in table D.3.

- Geographical location: the survey covered Melbourne, Geelong, Ballarat, Bendigo, Shepparton and other rural areas. While the major regional centres reported fairly consistent consumption per household, 'other rural' was significantly lower than the mean. Ballarat recorded the greatest usage per dwelling (57.5GJ) (chart D.1).
- Household size: the regression model based on the natural log of consumption found that for every additional person residing in a household around 17 per cent more gas was consumed. Further, for every additional bedroom that a house contained an extra 12 per cent of gas was consumed. The first additional bedroom led to a higher percentage increase that those following (chart D.2).
- Dwelling type: multi-unit dwellings covered by the survey use an average of 30 per cent less gas when holding all other fundamental variables constant. Separate houses consume an average of 61.2GJ of gas per year, while the average gas consumption of semidetached dwellings and units equates to only 40.4GJ.

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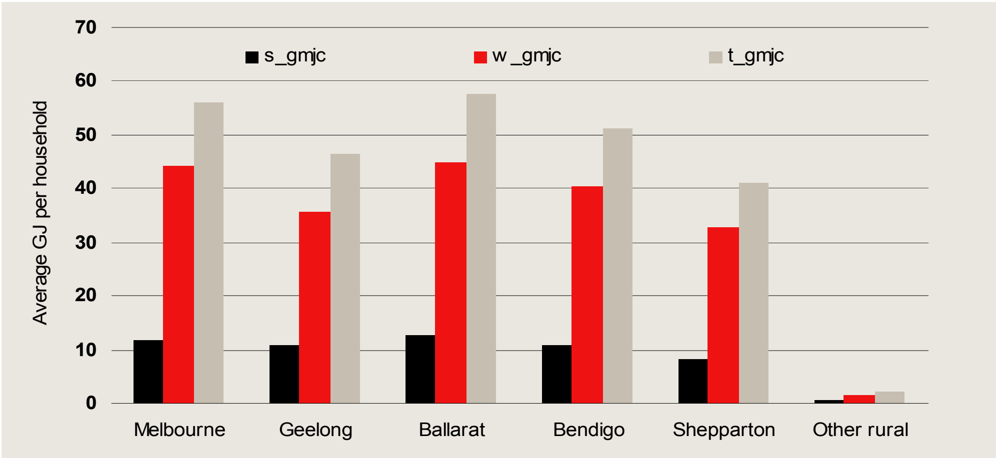
63 Roy Morgan Research 2008, *Victorian Utility Consumption Household Survey 2007: Final Report*, prepared for Victorian Department of Human Services, April.

D.1 **Average gas consumption, by area and season**

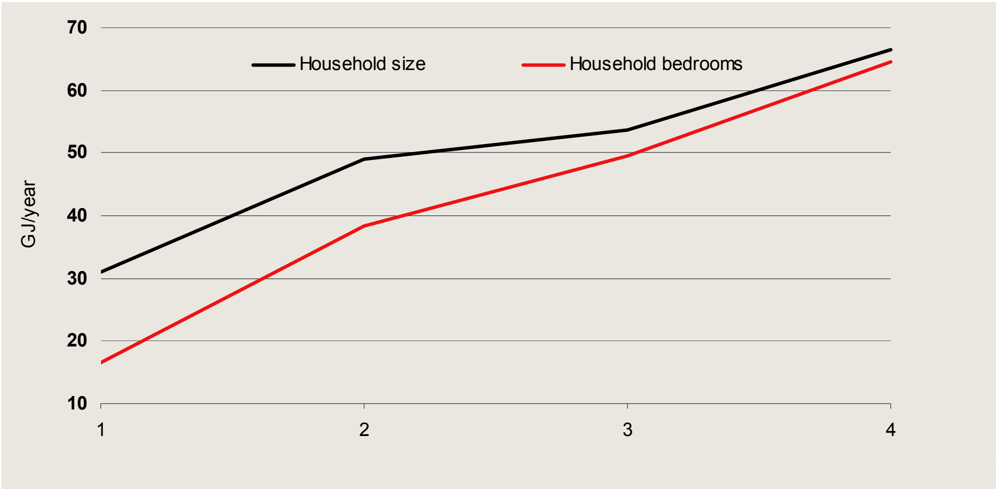


Data source: Victorian Utility Consumption Household Survey 2007 data and CIE calculations.

Beyond demographic factors that affect the size and location of households, several behavioural factors were shown to be significant in explaining variations in the data.

- Solar hot water heating: dwellings that have had a solar hot water system installed use 31.5 per cent less gas than other households using gas. Dwellings that had a solar hot water system installed used an average of 41.4GJ of gas per year, while dwellings without used 58.8GJ.
- Gas heating: as expected, households that use gas as their principal form of heating use significantly more gas than those who utilise other heating devices.

D.2 **Average annual gas consumption per household, by size and bedrooms**



Data source: Victorian Utility Consumption Household Survey 2007 data and CIE calculations.

D.3 Models of residential household gas use

	Annual gas use				*Log of annual gas use*			
	All variables		Fundamental variables only		All variables		Fundamental variables only	
	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat	Coef.	t-stat
Area								
Geelong	-10 886	-4.5	-12 098	-4.9	-0.133	-2.7	-0.168	-3.4
Ballarat	1 893	0.7	1 307	0.5	0.051	0.9	0.034	0.6
Bendigo	-5 238	-2.0	-5 175	-2.0	-0.067	-1.3	-0.064	-1.2
Shepparton	-15 271	-6.0	-16 454	-6.4	-0.280	-4.9	-0.313	-5.5
Other Rural	-12 892	-1.7	-18 844	-2.1	-0.237	-1.1	-0.405	-1.5
Household size	9 292	12.0	8 905	11.2	0.173	11.7	0.162	10.2
Household bedrooms	5 611	4.3	6 036	4.5	0.119	3.8	0.132	3.9
Units/ semidetached dwellings	-5 830	-2.6	-8 192	-3.6	-0.235	-4.1	-0.303	-5.0
Solar HWS	-12 177	-2.2			-0.315	-1.5		
Gas heating	25 047	11.9			0.720	9.2		

Source: The CIE.

Several other variables were found not to be significant.

- Household income: the model found no statistically significant results between gas usage and household income.
  - However, households with above average income consumed an annual average of 63.9 GJ of gas. On average, households with below average income consumed 9.1 GJ less gas per year.
- Household insulation: the model found no statistically significant results between gas usage and household insulation.
  - Households that reported having ceiling insulation used an average of 59.4GJ of gas per year. While those with only partial insulation used slightly more gas on average per year, those without ceiling insulation used less (52.0 GJ per year). However, the average annual household income of those without insulation was over 30 per cent lower than those with.

E Wholesale gas price projections

The forecasts for gas use set out in this report have been based on the assumption that wholesale gas prices in Australia will increase over the coming years in line with projections from Australian Treasury for Australian wholesale gas prices.[64] However, currently Victorian wholesale gas prices are substantially below export parity prices and there is the potential for much sharper rises in wholesale prices than factored into our forecasts.

Currently, wholesale gas prices in Victoria are hovering around $3 per gigajoule (GJ).[65] Reviews by SKM MMA indicate that well head prices for new contracts in the eastern states have held constant over the past decade, at around $3-$3.5 per GJ.[66] These prices are a result of long term pricing contracts that do not necessarily reflect current market conditions. Given this factor, there is reasonable consensus that historical trends will not be repeated and as new contracts are negotiated for both existing and new supplies, there is likely to be upward pressure placed on medium to longer term wholesale gas prices in Australia.

Upward pressure on future gas prices

The Australian wholesale gas market has historically been isolated from the international market. While Australia is currently the sixth largest LNG exporter, the majority of LNG exports originate from Western Australia. In contrast, suppliers in the eastern Australian markets face prohibitively high transport costs, limiting the amount of eastern production being exported (EnergyQuest 2009).[67]

It is the disconnection between the eastern Australian suppliers and international markets that has allowed domestic Australian gas prices to remain below international parity in the past. However, in recent years, there has been a movement in Australian gas prices towards international parity. In particular, increased

64 Australian Treasury 2011, *Strong growth, low pollution – modelling a carbon price*, chart b6, domestic Australian gas prices, NEM.

65 CIE analysis of data from the Australian Energy Market Operator for 2011.

66 SKM MMA 2011, Projections of greenhouse gas emissions for the stationary energy sector, prepared for the Department of Climate Change and Energy Efficiency.

67 EnergyQuest 2009, *Australia's Natural Gas Markets: Connecting with the world,* published in: The State of the Energy Market 2009.

international prices for LNG have improved the profitability of exporting LNG from eastern Australia.[68] To capitalise on this profitability there are currently four large scale export oriented coal seam gas (CSG) projects at the mature stage in eastern Australia. These projects are expected to range in size from 1.5 to 14 million tonnes of LNG production per year.[69] The development of these projects indicate that suppliers are expecting international demand for LNG to remain high into the future, and are willing to invest in these markets. As the projects come on line and suppliers are more easily and profitably able to divert gas from eastern Australia into the international market, Australian domestic gas prices are expected to more closely reflect higher international prices.

Based on these current observations, in their price projections, SKM MMA has assumed that eastern Australian gas prices will reach international parity by 2020 – over a period of nine years from 2011.[70] This assumption implies a 40 per cent increase in finalised gas prices across the east of Australia over the period. Beyond this point, the modelling undertaken by SKM MMA includes assumptions that eastern Australian price fluctuations would then match world price fluctuations.

The gas market in Western Australia is already closely linked to international markets, due to more favourable geography. Therefore, current movements in gas prices in Western Australia may be seen as predictors for the eastern markets in a few years. While contract prices are not publicly released, there are strong indications that in the more recent years that new well head prices for base load contracts in Western Australia have increased from around $5 per GJ in 2007 to over $6 per GJ in 2009. [71] Note that this is in comparison of current eastern prices at around $3.5 per GJ and lower in Victorian wholesale gas spot markets.

Further analysis of very recent contract negotiations out of Western Australia indicates that prices may be even higher. Based on publicly released volume and profit projections, ACIL Tasman has put together a likely range of these up to date prices. They are reporting that increases could be as much as 80 to 100 per cent above previous prices, with analysis indicating a range between $8.80 and $10.40 per GJ excluding delivery.[72]

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68 AER 2009, *The State of the Energy Market 2009.*

69 AER 2009, *The State of the Energy Market 2009.*

70 SKM MMA 2011, *Carbon pricing and Australia's Electricity Markets,* prepared for the Australian Commonwealth Treasury

71 SKM MMA 2011, *Projections of greenhouse gas emissions for the stationary energy sector,* prepared for the Department of Climate Change and Energy Efficiency.

72 ACIL Tasman 2010, *Gas prices in Western Australia: Review of inputs to the WA Wholesale Energy Market.*

The conclusions regarding Western Australian wholesale gas prices reached by ACIL Tasman included: [73]

- historic prices from existing supplies that are associated with long lived supply contracts have ranged up to $3.5 per GJ, excluding delivery basis, and were not linked to oil prices;
- more recently it is estimated that newly negotiated contracts from existing sources in Western Australia, have been priced at around $7.50-$8.80 per GJ excluding delivery, and do include linkage to oil prices;
- allowing for increased investment costs, contract negotiated for greenfield projects are estimated to be priced even higher at around $10.40 per GJ in 2010-11, excluding delivery, and linked with oil prices; and
- the estimated netback price for LNG is approximately $8 per GJ which provides an indication of the required domestic price of gas in Western Australia to allow for domestic competition — depending on oil price and the LNG pricing formula for the particular supply contract.

Further to increased competition from international markets, Australian domestic gas supplies are also likely to face increased competition at home. With announced carbon pricing policies set to come into effect soon, demand for gas fired electricity generation in particular is set to increase. This trend is currently being observed through an increase in investment in gas fired electricity generation in particular. The Bureau of Resources and Energy has reported that gas accounts two thirds of advanced non-renewable generation capacity projects.[74] This increased demand for gas fired electricity will place increased pressure on current supplies, and inturn on wholesale prices.

Mediating effects on future gas prices

While there is a consensus amongst modelling inputs that Australian wholesale gas prices are going to increase over the coming decades, there have been noted a number of mediating effects that should be considered in the near to medium term. These effects include[75] (Syed et al., 2010):

- possible extended lead times required to increase LNG export capacity which would limit growth in export capacity and slow the rate of price growth towards international parity;

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73 ACIL Tasman 2010, *Gas prices in Western Australia: Review of inputs to the WA Wholesale Energy Market*.

74 BREE 2011, *Major electricity generation projects*, November 2011.

75 Syed, A., Melanie, J., Thorpe, S. and Penney, K. 2010, 'Australian energy projections to 2029-30', *ABARE research report 10.02*, prepared for the Department of Resources, Energy and Tourism, Canberra, March.

- should the rate of development of CSG resources increase, additional non-conventional gas supplies could be able to slow the rate of growth in domestic prices; and
- the renegotiation of existing long term contracts may not reflect the prices that are being paid for newly negotiated contracts.

An alternative review of possible mitigating effects on wholesale gas prices in the future by the Australian Energy Regulator (AER 2009) has included the potential for short term mediating effects on gas prices such as 'ramp up' production prior to CSG projects coming on line.[76] As the liquefaction process will not begin until a sufficient number of well heads have been drilled (up to 500), 'ramp up' production from early heads could potentially supply a reasonable amount of additional gas to the domestic market prior to the projects diverting into LNG exports.[77] However, this is likely to remain a short term phenomena as all subsequent production would be diverted into more profitable export markets.

The increased connectivity of the eastern Australian market has also been mentioned as a possible mediating factor in price increases as it could allow for a diversity of supply options and increase competition. [78] However, this is also a double edged option as increased connectivity could also provide a wider range of suppliers with greater access to newly established export markets.

Therefore on balance it appears that while there are some meditating effects likely to be felt in the short term on the wholesale gas market, none of the effects are likely to endure. Australian domestic gas markets are most likely to continue their push upwards towards international parity in the medium and longer term.

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76 AER 2009, *The State of the Energy Market 2009.*

77 EnergyQuest 2009, 'Australia's Natural Gas Markets: Connecting with the world', published in *The State of the Energy Market 2009.*

78 EnergyQuest 2009, 'Australia's Natural Gas Markets: Connecting with the world', published in *The State of the Energy Market 2009.*