Demand, Energy and Customer Forecasts

CORE ENERGY GROUP

Envestra Limited – Gas Access Arrangement Review

Victoria and Albury Networks (2013 to 2017)

March 2012

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1. Executive Summary

1.1. Scope

This report has been prepared by Core Energy Group Pty Ltd ("**Core**") for the purposes of providing Envestra Limited ("**Envestra**" or "**ENV**") with an independent forecast of gas demand for the company's natural gas distribution networks in Victoria ("**VIC**") and Albury. Core understands that these projections (in report and model form) has been prepared as part of Envestra's Gas Access Arrangement Review ("**GAAR**") for the calendar 2013 to 2017 years ("**Review Period**") and will be submitted to the Australian Energy Regulator ("**AER**"). The Terms of Reference defined by Envestra to Core is set out in Attachment 1.

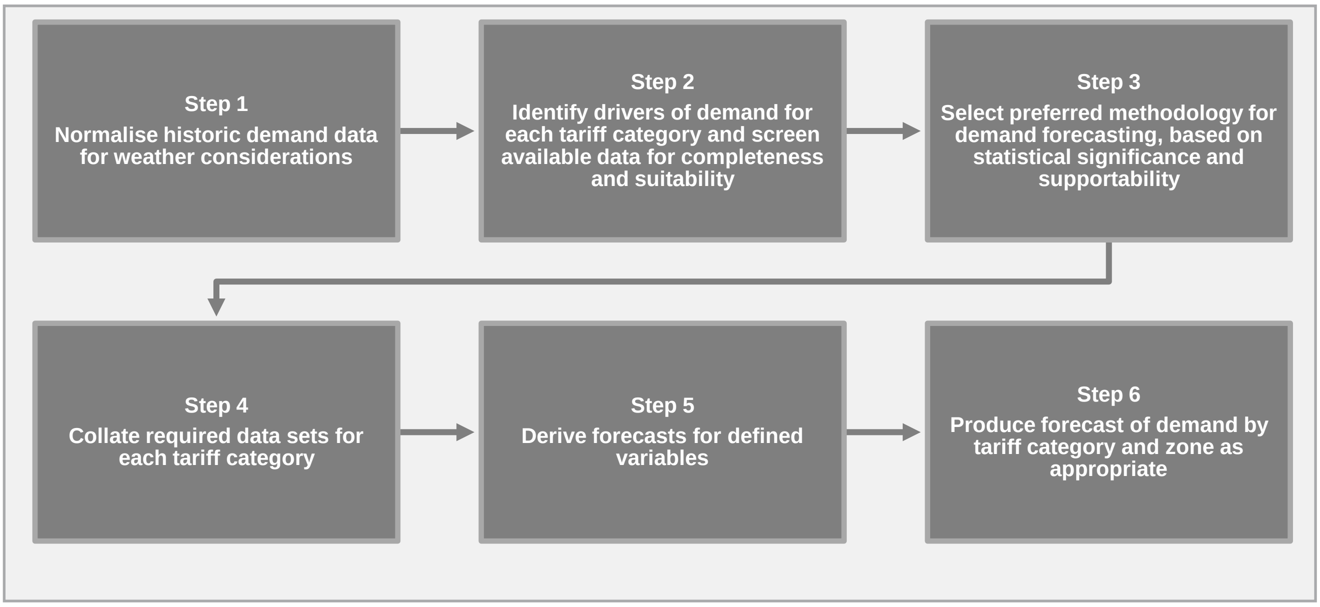
During this process Core has obtained specialist economic and statistical analysis advice from the South Australian Centre for Economic Studies ("**SACES**"). Curriculum Vitae for both Core and SACES team members are presented in Attachment 2. The report from SACES detailing the scope and results of work is included as Attachment 3 and is referenced throughout this report.

In addition, Core relied upon a report by the Commonwealth Scientific and Industrial Research Organisation ("**CSIRO**") in relation to the Weather Normalisation for the VIC region. This appears as an attachment to Envestra's Victorian Access Arrangement submission.

1.2. Methodology Overview

An overview of Core's methodology is provided in Figure 1.1, further details, on a tariff by tariff basis, are provided in Section 1.3. Core produced separate gas demand forecasts for Victoria and Albury. The Victorian forecast was then allocated between the different tariff zones as discussed in Section 4.

Figure 1.1: Core Methodology.



Source: Core Energy Group; 2012.

1.3. Summary of Approach by Tariff

Consistent with Steps 1 to 6 described in Figure 1.1, this Section provides a brief description of the approach adopted to forecast demand for the Review Period, by tariff category. The variables analysed and the associated sources are described in Sections 2 through 5 and 7.

In general terms, forecast demand for the Review Period for a particular region and tariff class, may be considered to be equal to forecast number of connections multiplied by forecast demand per connection.

For each of these variables a forecast is derived for the Review Period based on a range of factors and validated for reasonableness. The step-by-step approach used for each Tariff in VIC is summarised below[1]. For further detail refer to Section 4.

1.3.1. Tariff V Residential – Forecast Methodology

Tariff V Residential is defined as household gas demand. The primary drivers of household gas demand are the number of gas connections and the usage per connection. As such, Tariff V Residential projections are derived from the product of two forecasts – connections and demand per connection.

Gas connections are driven by the number of households within the network and the rate at which those households are ultimately connected to the gas network. Usage per connection is driven by weather, the economic status of households, retail gas prices and the actual take-up and efficiency of gas appliances.

Gross Household Disposable Income (“**GHDI**”) has been identified as an indicator of the economic status of households (see Section 3), whilst dwelling starts are an indicator of household numbers. After normalising gas demand for the effects of weather, regression analysis was used to determine the relationship between GHDI and any underlying trends on gas demand, which was then projected over the prescribed period. This gives rise to “base demand” which only accounts for factors and trends present historically. As such it was necessary to adjust for factors that are not accounted for in the historic trend, these are 6-Star Building Standards and the price elasticity effect of increases in retail gas price components.

The step-by-step methodology is as follows:

1. Normalise total historic demand for the effects of weather.
2. Forecast connection numbers based on the historical relationship between dwellings starts and the net change in connections[2].
3. Forecast demand per connection based on the historical relationship between demand per connection, GHDI per household and a trend.
4. Adjust demand per connection forecasts for factors which are not present in the historical trend, most notably, the demand response to:
    a. The introduction of the Clean Energy Bill 2011;
    b. Distribution network price increases;
    c. Wholesale gas price increases; and
    d. 6-Star Building Standards.
5. The product of Connections and Demand per Connection becomes Total Forecast Demand – Tariff V Residential.

[1] A slightly different approach was taken for Albury due to third party data limitations.
[2] Dwelling starts forecast was obtained from the Housing Industry Association (“**HIA**”).

6. Allocate demand to each tariff zone – see Section 1.3.4.

1.3.2. Tariff V Non-Residential – Forecast Methodology

Tariff V Non-Residential is defined as commercial and small business gas demand. The primary drivers of non-residential gas demand are the number of gas connections and the usage per connection. As such, Tariff V Non-Residential projections are derived from the product of two forecasts – connections and demand per connection.

Both gas connections and demand per connection are driven by the economic status of a region; however demand per connection maintains additional drivers, which are weather, retail gas prices and efficiency of gas usage.

Gross State Product ("**GSP**") has been identified as a key indicator of the economic status i.e. there is a relationship between economic activity and the number of small businesses as well as the gas demand of these businesses. After normalising gas demand for the effects of weather, regression analysis was used to determine the impact of GSP and any underlying trends on gas demand and gas connections. This relationship was then projected over the prescribed period, giving rise to "base demand" – projected demand based on historic trends. Base demand was then adjusted for factors that are not accounted for in the historic trend, which are the price elasticity effect s of increases in retail gas price components.

The step-by-step methodology is as follows:

1. Normalise total demand for the effects of weather.
2. Forecast connection numbers based on the historical relationship between total connections, GSP and a trend.
3. Forecast demand per connection based on the historical relationship between demand per connection, GSP and a trend.
4. Adjust demand per connection forecasts for factors which are not present in the historical trend, most notably, the demand response to:
    a. The introduction of the Clean Energy Bill 2011;
    b. Distribution network price increases; and
    c. Wholesale gas price increases.
5. The product of Connections and Demand per Connection becomes Total Forecast Demand – Tariff V Non-Residential.
6. Allocate demand to each tariff zone – see Section 1.3.4.

1.3.3. Tariff D Industrial – Forecast Methodology

Tariff D Industrial is defined as gas demand from industrial customers. These customers generally use a significantly higher load than Tariff V customers; however, total demand remains a function of demand per connection and the number of connections which is in turn related to the economic status of the region. Similar to other tariff classes, Tariff D demand per connection is also sensitive to weather; retail gas prices and the efficiency of gas usage, as well as the economic status of a region.

GSP has been identified as a key indicator of the economic status i.e. there is a relationship between economic activity and the number of small businesses as well as the gas demand of these businesses. After normalising gas demand for the effects of weather, regression analysis was used to determine the impact of GSP and any underlying trends on gas demand and gas connections. This relationship was then projected over the prescribed period, giving rise to "base demand" – projected demand based on historic trends. Base demand was then adjusted for factors that are not accounted for in the historic trend, which are the price elasticity effect s of increases in retail gas price components.

The step-by-step methodology is as follows:

1. Normalise total demand for the effects of weather.
2. Forecast connection numbers based on the historical relationship between total connections, GSP and a trend.
3. Forecast demand per connection based on the historical relationship between demand per connection, GSP and a trend.
4. Adjust demand per connection forecasts for factors which are not present in the historical trend, w most notably, the demand response to:
   a. The introduction of the Clean Energy Bill 2011;
   b. Distribution network price increases; and
   c. Wholesale gas price increases.
5. The product of Connections and Demand per Connection becomes Total Forecast Demand – Tariff D Industrial.
6. Total Forecast Demand is applied against the historical Load Factor to determine Forecast Maximum Hourly Quantity ("**MHQ**") – Tariff D Industrial.
7. Allocate demand to each tariff zone – see Section 1.3.4.

1.3.4. Demand by Tariff Zone – Forecast Methodology

The final stage of forecasting demand involves the allocation of total VIC demand by tariff to each individual tariff zone (described in further detail in Section 4.4), including:

- Central;
- North;
- Murray Valley; and
- Bairnsdale.

Forecast demand by tariff category for Albury was calculated separately using Albury specific data.

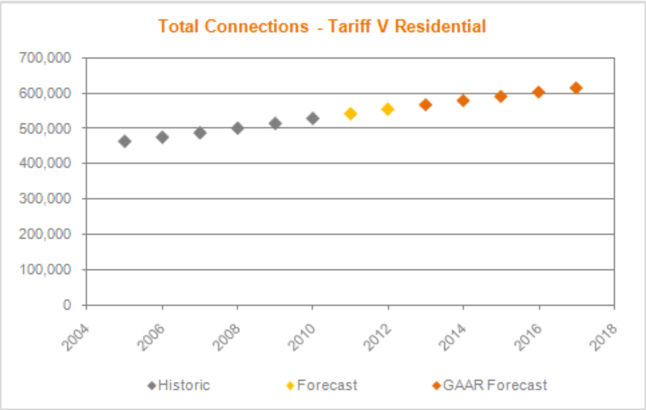
1.4. Forecasts

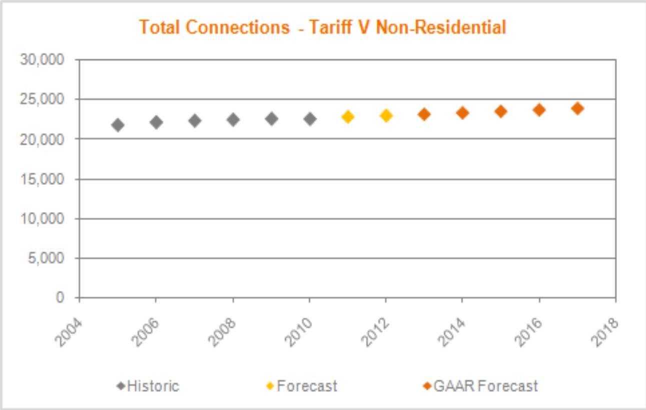
Individual forecasts were derived for connection and demand per connection. The product of these two forecasts provides the total demand forecast.

1.4.1. Customer Connections 2013 to 2017

The following provides the forecast customer connections for the 2013 to 2017 Access Arrangement period, by Tariff.

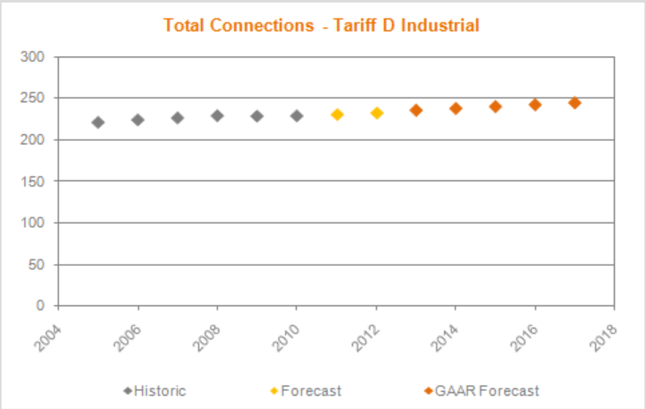
Figure 1.2: VIC Total Connections Tariff V Residential and Tariff V Non-Residential.





Source: Core Energy Group; 2012.

Figure 1.3: VIC Total Connections Tariff D Industrial.



Source: Core Energy Group; 2012.

The regional split of total connections, is summarised in Table 1.1.

Table 1.1: Forecast - Customer Connections.

Tariff V Residential Customers	2013	2014	2015	2016	2017
VIC – Central	488,218	498,313	508,302	518,373	528,430
VIC - North	68,118	69,527	70,921	72,326	73,729
VIC - Murray Valley	6,687	7,017	7,347	7,677	8,007
VIC – Bairnsdale	2,969	3,359	3,749	4,139	4,529
VIC – Total Tariff V Residential	565,992	578,216	590,319	602,515	614,695
Albury	19,746	20,068	20,394	20,726	21,064
Tariff V Non-Residential Customers	**2013**	**2014**	**2015**	**2016**	**2017**
VIC – Central	19,545	19,700	19,856	20,016	20,179
VIC - North	3,243	3,269	3,295	3,321	3,349
VIC - Murray Valley	308	312	316	320	324
VIC – Bairnsdale	68	73	78	83	88
VIC – Total Tariff V Non-Residential	23,164	23,355	23,545	23,740	23,940
Albury	891	894	897	899	902

Table 1.1: Forecast - Customer Connections - Continued.

Tariff D Industrial Customers	2013	2014	2015	2016	2017
VIC – Central	179	181	183	184	186
VIC - North	50	50	51	51	52
VIC - Murray Valley	4	4	4	4	4
VIC – Bairnsdale	2	2	2	2	2
VIC – Total Tariff D Industrial	235	237	239	242	244
Albury	8	7	7	7	7

Source: Core Energy Group; 2012.

The projected growth rate in connections for each tariff has been compared to the historic growth over the past five years in Table 1.2.

Historically, residential connections in VIC and Albury increased steadily at a Compound Annual Growth Rate ("**CAGR**") of 2.6 and 1.9 percent from 2005 to 2010. This increase was fueled by demand for new residential housing resulting from population growth. Looking forward, population growth is expected to continue, however, Core expects that changing dynamics in the type of dwellings demanded, namely a move towards multi-units / apartments (refer to HIA building forecast Section 5.1.6), will cause the CAGR for VIC and Albury to fall to 2.1 and 1.6 percent from 2013 to 2017.

Commercial and Industrial demand for gas connections has historically been strongly linked to economic conditions, with forecast growth predominantly a function of future VIC GSP forecasts. The CAGR for VIC Tariff V Non-Residential connections increases slightly from 0.7 percent in 2005 to 2010 to 0.8 percent in 2013 to 2017, whilst Albury Tariff V Non-Residential connections growth remains constant at 0.3 percent. Tariff D Industrial CAGR is projected to increase slightly for both VIC and Albury from 0.7 and -2.3 percent during 2005 to 2010 to 0.9 to -1.7 percent during 2013 to 2017. This improvement is the result of a move towards the long-term economic growth rate, which has moderated somewhat in recent times due to the impact of the global financial crisis and structured pressures arising from the strong Australian Dollar. VIC's heavy manufacturing base has meant that it has been strongly affected by these factors.

Table 1.2: Forecast - Customer Connections.

Customer Connections	CAGR	
	Actual: 2005 - 2010	Forecast: 2013- 2017
VIC		
Tariff V Residential	2.6%	2.1%
Tariff V Non- Residential	0.7%	0.8%
Tariff D Industrial	0.7%	0.9%
Albury		
Tariff V Residential	1.9%	1.6%
Tariff V Non- Residential	0.3%	0.3%
Tariff D Industrial	-2.3%	-1.7%

Source: Core Energy Group; 2012.

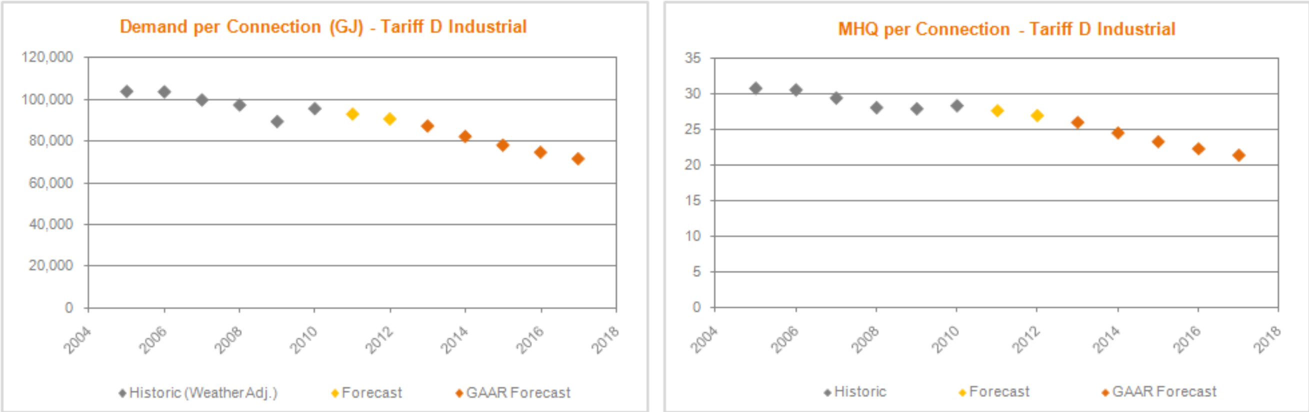
1.4.2. Demand per Connection 2013 to 2017

The following provides the demand per connection forecasts for the 2013 to 2017 Access Arrangement period, by tariff.

Figure 1.4: VIC Demand per Connection Tariff V Residential and Tariff V Non-Residential.

Source: Core Energy Group; 2012.
Note: "**GJ**" – Gigajoule and Adj. - Adjusted

Figure 1.5: VIC Demand and MHQ per Connection Tariff D Industrial.



Source: Core Energy Group; 2012.

The regional split of total demand per connection, is summarised in Table 1.3.

Table 1.3: Forecast Demand per Connection by Region.

Tariff V Residential Demand (GJ)	2013	2014	2015	2016	2017
VIC – Central	49	47	46	45	44
VIC - North	45	44	43	41	40
VIC - Murray Valley	35	34	33	32	31
VIC – Bairnsdale	27	26	25	24	24
VIC – Total Tariff V Residential	48	47	45	44	43
Albury	43	42	41	41	40
Tariff V Non-Residential Demand (GJ)	**2013**	**2014**	**2015**	**2016**	**2017**
VIC – Central	299	288	278	271	264
VIC - North	232	224	216	210	205
VIC - Murray Valley	169	163	158	154	150
VIC – Bairnsdale	1,016	979	947	921	899
VIC – Total Tariff V Non-Residential	290	279	270	263	257
Albury	282	273	266	261	256

Table 1.3: Forecast Demand per Connection by Region - Continued.

Tariff D Industrial Demand (MHQ)	2013	2014	2015	2016	2017
VIC – Central	24	23	22	21	20
VIC - North	32	31	29	28	27
VIC - Murray Valley	23	23	23	23	23
VIC – Bairnsdale	8	8	8	8	8
VIC – Total Tariff D Industrial	26	24	23	22	21
Albury	57	54	53	52	50

Source: Core Energy Group; 2012.

The projected growth rate in demand per connection for each tariff has been compared to the historic growth over the past five years in Table 1.4. Historically, weather normalised demand per connection has been falling across all tariff types. Core analysis indicates this is a result of numerous factors (refer to Section 3) most notably:

- Government policy aimed at increasing the energy efficiency of buildings;
- Government policy aimed at promoting solar hot water and increasing the energy efficiency of gas appliances generally; and
- Material shifts in appliance selection – move towards reverse-cycle air conditioners as a source of space heating.

New government policies and pricing events expected over the 2013 to 2017 period are projected to have a material impact on demand per connection. As such it is important to analyse underlying trends prior and post these impacts.

Prior to the impact of new policies and pricing events (Core's Base Forecast), a continuance of historic policies and consumer trends is projected to cause demand across all tariff classes to remain in a downtrend. VIC CAGR for Residential, Non-Residential and Industrial segments is projected to be -1.0, -0.6 and -2.4 percent from 2013 to 2017, respectively. Albury CAGR for Residential, Non-Residential and Industrial segments is projected to be -0.3, -0.4 and -0.5 percent for 2013 to 2017, respectively.

Post the impact of new policies and pricing events (Core's Final Forecast), demand per connection decline rates are expected to increase. The final demand per connection CAGR for VIC Residential, Non-Residential and Industrial segments is projected to be -2.9, -3.0 and -4.9 percent from 2013 to 2017, respectively. Albury CAGR for Residential, Non-Residential and Industrial segments is projected to be -1.7, -2.4 and -2.8 percent for 2013 to 2017, respectively.

Table 1.4: Forecast – Demand per Connection.

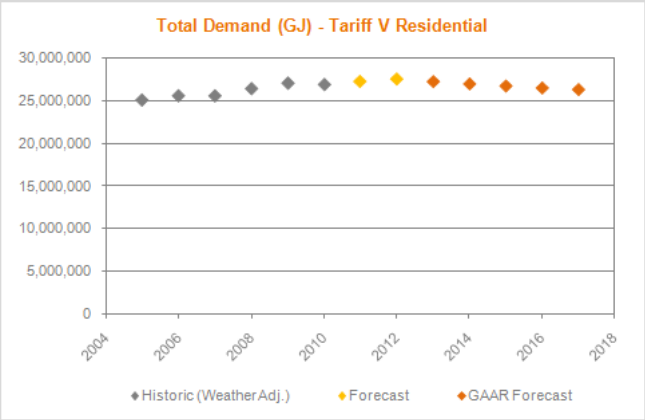
Demand per Connection	CAGR		
	Actual: 2005 – 2010*	Base Forecast: 2013- 2017	Forecast: 2013- 2017
VIC			
Tariff V Residential	-1.1%	-1.0%	-2.9%
Tariff V Non- Residential	-0.9%	-0.6%	-3.0%
Tariff D Industrial	-1.6%	-2.4%	-4.9%
Albury			
Tariff V Residential	-0.6%	-0.3%	-1.7%
Tariff V Non- Residential	-0.6%	-0.4%	-2.4%
Tariff D Industrial	-0.8%	-0.5%	-2.8%

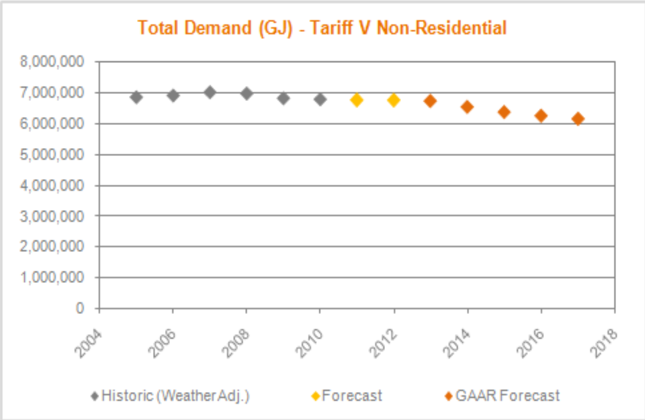
Source: Core Energy Group; 2012.
* Actual: 2005 – 2010 is based on weather normalised demand per connection.

1.4.3. Total Demand 2013 to 2017

The following provides the total demand forecasts for the 2013 to 2017 Access Arrangement period, by tariff.

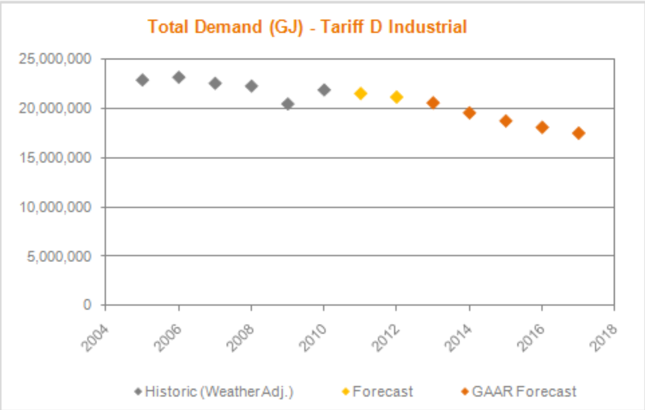
Figure 1.6: VIC Total Demand Forecast 2013 – 2017 Tariff V Residential and Tariff V Non-Residential.

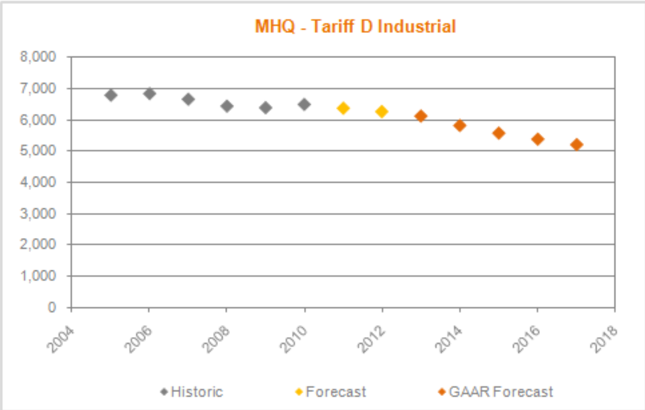




Source: Core Energy Group; 2012.

Figure 1.7: VIC Total Demand and MHQ Forecast 2013 – 2017 Tariff D Industrial.





Source: Core Energy Group; 2012.

The regional slipt of total demand is summarised in Table 1.5.

Table 1.5: Forecast Demand by Region.

Tariff V Residential Demand (GJ)	2013	2014	2015	2016	2017
VIC – Central	23,880,505	23,627,090	23,397,968	23,177,695	23,007,647
VIC - North	3,082,163	3,049,456	3,019,884	2,991,454	2,969,507
VIC - Murray Valley	233,595	237,525	241,363	244,897	248,647
VIC – Bairnsdale	79,165	86,788	94,009	100,781	107,352
VIC – Total Tariff V Residential	27,275,428	27,000,859	26,753,223	26,514,827	26,333,153
Albury	849,445	846,532	845,677	845,768	848,110
Tariff V Non-Residential Demand (GJ)	**2013**	**2014**	**2015**	**2016**	**2017**
VIC – Central	5,842,383	5,671,937	5,524,866	5,418,563	5,328,199
VIC - North	752,907	730,941	711,988	698,289	686,644
VIC - Murray Valley	52,208	50,960	49,903	49,188	48,597
VIC – Bairnsdale	69,093	71,475	73,841	76,480	79,126
VIC – Total Tariff V Non-Residential	6,716,590	6,525,313	6,360,599	6,242,520	6,142,565
Albury	251,032	243,987	238,317	234,359	231,037

Table 1.5: Forecast Demand by Region - Continued.

Tariff D Industrial Demand (MHQ)	2013	2014	2015	2016	2017
VIC – Central	4,382	4,163	3,985	3,844	3,716
VIC - North	1,621	1,540	1,474	1,422	1,375
VIC - Murray Valley	92	92	92	92	92
VIC – Bairnsdale	16	16	16	16	16
VIC – Total Tariff D Industrial	6,111	5,810	5,567	5,374	5,199
Albury	430	407	388	373	359

Source: Core Energy Group; 2012.

The projected growth rate in demand for each tariff has been compared to the historic growth over the past five years in Table 1.6. Historically, total demand from residential customers has shown growth. Core analysis indicates that this is attributable to strong connection growth, with offset from falling demand per connection. In contrast to this, Non-Residential and Industrial total demand for gas has fallen historically, largely due to falling demand per connection, which has outweighed the growth in connections.

New government policies and pricing events expected over the 2013 to 2017 period are projected to have a material impact on demand per connection. As such it is important to analyse underlying trends prior and post these impacts.

Prior to the impact of new policies and pricing events (Core's Base Forecast), growth in residential connections is projected to outweigh a reduction in demand per connection, causing total demand in VIC and Albury Residential to increase by a CAGR of 1.1 and 1.4 percent from 2013 to 2017, respectively. Non-Residential and Industrial total demand is projected to exhibit a greater influence from falling demand per connection, as connection growth is significantly lower in those segments. Non-Residential total demand for VIC and Albury has a CAGR of 0.2 and -0.1 percent respectively from 2013 to 2017 whilst industrial demand for VIC and Albury has a CAGR of -2.4 and -2.2 percent respectively from 2013 to 2017.

Post the impact of new policies and pricing events (Core's Final Forecast) total demand is projected to decline further as increased gas retail prices cause a reduction in demand per connection. The final total demand CAGR for VIC Residential, Non-Residential and Industrial tariffs is projected to be -0.9, -2.2 and -4.0 percent from 2013 to 2017, respectively. Albury CAGR for Residential, Non-Residential and Industrial tariffs is projected to be -0.1, -2.1 and -4.4 percent for 2013 to 2017, respectively.

Table 1.6: Forecast – Total Demand.

Total Demand	CAGR		
	Actual: 2005 – 2010*	Base Forecast: 2013- 2017	Forecast: 2013- 2017
VIC			
Tariff V Residential	1.4%	1.1%	-0.9%
Tariff V Non- Residential	-0.2%	0.2%	-2.2%
Tariff D Industrial	-0.9%	-2.4%	-4.0%
Albury			
Tariff V Residential	1.3%	1.4%	-0.1%
Tariff V Non- Residential	-0.3%	-0.1%	-2.1%
Tariff D Industrial	-3.1%	-2.2%	-4.4%

Source: Core Energy Group; 2012.
* Actual: 2005 – 2010 is based on weather normalised demand.

2. Weather Normalisation

- Gas demand is heavily influenced by the effects of weather. These effects must be isolated and removed to produce weather normalised demand. Once "normalised" the gas demand data may then be used for forecasting without influence from abnormal weather patterns.
- The methodology for the calculation of Degree Days ("**DD**") and Effective Degree Days ("**EDD**") used by Core is taken from the Australian Energy Market Operator ("**AEMO**") "*Retail Market Procedures (Victoria)*".
- In addition, Core has adopted the findings of the CSIRO in its report "*Projected changes in temperature and heating degree-days for Melbourne, 2012-2017*" as updated by CSIRO for the Review Period.

Historic analysis shows that the level of gas demand during a specific period is highly dependent on the weather conditions present during that period, where cooler temperatures cause an increase in gas heating demand. This creates challenges in identifying underlying trends in demand, as it is difficult to determine what portion of demand is attributable to an underlying trend and what is solely due to fluctuations in weather. As a result, gas demand must first be normalised for the effects of weather. This involves projecting a set of normalised weather parameters, which are applied against actual demand to determine weather normalised demand.

Core has performed a weather normalisation of gas demand for ENV's VIC and Albury gas distribution networks. This includes a normalisation of actual and projected EDD in VIC and DD in Albury, accompanied by a calculation of abnormal gas demand due to weather.

2.1. Methodology

2.1.1. Definitions

The definitions for EDD and DD are taken from the AEMO "*Retail Market Procedures (Victoria)*" and summarised below.

EDD = **DD (temperature effect)**

+ 0.038 x DD x average wind (wind chill factor)

- 0.18 x sunshine hours (warming effect of sunshine)

+ 2 x Cos $\left(\frac{2\pi(\text{day}-200)}{365}\right)$ **(seasonal factor)**

Where:

- DD is the degree day (see below calculation);
- Cos is cosine and EDD will be 0 if the calculated value is negative.

DD = **18 – T if T < 18**

0 if T > 18

Where:

- T is the average of 8 three-hourly Melbourne temperature readings (in degrees Celsius) from 3.00am to 12.00 pm inclusive as measured at the Weather Bureau Melbourne Station, Cos is cosine and EDD will be 0 if the calculated value is negative.[1]
- 18 degrees Celsius represents the threshold temperature for residential gas heating.

[1.] The above definition has been adjusted by Core to reflect the definition of EDD312. This was done to ensure consistency with the normalised EDD data provided by the CSIRO.

2.1.2. Victorian Network

Core's methodology for normalising gas demand in ENV's VIC network is as follows:

- Obtain actual EDD data for VIC from AEMO;
- Obtain normalised EDD data for VIC from the updated CSIRO report titled *"Projected changes in temperature and heating degree-days for Melbourne, 2012-2017"*. Normalised EDD data as calculated by CSIRO was used as this methodology is considered to be the most robust and is consistent with the last VIC access arrangement;
- Calculate abnormal EDD by comparing actual and normalised EDD;
- Use regression analysis to estimate the sensitivity of each tariff segment to EDD; and
- Multiply abnormal EDD by the sensitivity to EDD to determine abnormal gas demand attributable to weather.

2.1.3. Albury Network

Due to a lack of sufficient weather data available for Albury[3], DD was used to normalise gas demand rather than EDD.

Core's methodology for normalising gas demand in ENV's Albury network is as follows:

- Obtain historical weather data for Albury Airport Weather Station - 072160 from the Bureau Of Meteorology ("**BOM**");
- Calculate actual DD based on the definition provided by AEMO "*Retail Market Procedures (Victoria)*" and summarised in Section 2.1.1.
- Use regression analysis to obtain a normalised set of DD;
- Calculate abnormal DD by comparing actual and normalised DD;
- Use regression analysis to estimate the sensitivity of each tariff segment to DD; and
- Multiply abnormal DD by the sensitivity to DD to determine abnormal gas demand due to weather.

2.2. Results Overview

2.2.1. Victorian Network

Based on normalised EDD data provided by the CSIRO, Core's analysis indicates an average fall in EDD of 7.1 per year during the period 2005 to 2010 in VIC.

The following table provides a summary of the weather normalisation of gas demand in ENV's VIC Network.

[3] Hourly sunshine data for Albury was not available from the BOM.

Table 2.1: VIC Network Weather Normalisation of Gas Demand.

Weather Normalisation	Units	2005	2006	2007	2008	2009	2010
Effective Degree Days	(EDD)	1,170	1,404	1,198	1,369	1,285	1,415
Normalised Effective Degree Days	(EDD)	1,328	1,321	1,315	1,308	1,301	1,293
Abnormal Weather	(EDD)	(158)	82	(117)	61	(16)	122
Tariff D Industrial							
Sensitivity per connection	(GJ/EDD)	2.2035	2.2035	2.2035	2.2035	2.2035	2.2035
Average connections	(no.)	221	224	227	229	229	229
Abnormal demand	(GJ)	(77,058)	40,703	(58,301)	30,951	(7,843)	61,553
Abnormal percentage	(%)	-0.3%	0.2%	-0.3%	0.1%	0.0%	0.3%
Actual total demand	(GJ)	22,838,365	23,244,376	22,514,323	22,316,548	20,406,456	21,937,310
Normalised total demand	(GJ)	22,915,423	23,203,673	22,572,624	22,285,598	20,414,300	21,875,757
Actual demand per connection	(GJ)	103,380	103,731	99,401	97,346	89,209	95,761
Normalised demand per connection	(GJ)	103,729	103,549	99,658	97,211	89,243	95,493
Tariff V Residential							
Sensitivity per connection	(GJ/EDD)	0.0229	0.0229	0.0229	0.0229	0.0229	0.0229
Average connections	(no.)	464,974	476,402	488,509	501,199	514,179	527,984
Abnormal demand	(GJ)	(1,684,422)	898,706	(1,305,901)	702,759	(183,098)	1,473,351
Abnormal percentage	(%)	-6.7%	3.5%	-5.1%	2.7%	-0.7%	5.5%
Actual total demand	(GJ)	23,356,863	26,445,280	24,231,428	27,070,843	26,827,973	28,321,218
Normalised total demand	(GJ)	25,041,285	25,546,574	25,537,329	26,368,084	27,011,071	26,847,867
Actual demand per connection	(GJ)	50.23	55.51	49.60	54.01	52.18	53.64
Normalised demand per connection	(GJ)	53.86	53.62	52.28	52.61	52.53	50.85
Tariff V Non-Residential							
Sensitivity per connection	(GJ/EDD)	0.0734	0.0734	0.0734	0.0734	0.0734	0.0734
Average connections	(no.)	21,891	22,243	22,430	22,559	22,674	22,644
Abnormal demand	(GJ)	(254,474)	134,649	(192,415)	101,503	(25,910)	202,772
Abnormal percentage	(%)	-3.7%	1.9%	-2.7%	1.5%	-0.4%	3.0%
Actual total demand	(GJ)	6,602,822	7,047,968	6,827,475	7,082,557	6,796,666	6,990,507
Normalised total demand	(GJ)	6,857,296	6,913,319	7,019,890	6,981,054	6,822,576	6,787,735
Actual demand per connection	(GJ)	302	317	304	314	300	309
Normalised demand per connection	(GJ)	313	311	313	309	301	300

Source: Core Energy Group; 2012.

The weather adjusted figures above have exposed the following underlying trends in demand during the period 2005 to 2010:

- Tariff V Residential Demand per Connection decreased at a CAGR of -1.1 percent;
- Tariff V Non-Residential Demand per Connection decreased at a CAGR of -0.9 percent;
- Tariff D Industrial Demand per Connection decreased at a CAGR of -1.6 percent;
- Tariff V Residential Total Demand increased at a CAGR of 1.4 percent;
- Tariff V Non-Residential Total Demand decreased at a CAGR of -0.2 percent; and
- Tariff D Industrial Total Demand decreased at a CAGR of -0.9 percent.

The underlying trend decline in demand per connection observed in the historic data is explored further in Section 3.

2.2.2. Albury Network

Over the period 1994 to 2010, Core's analysis indicates a downward trend in DD of 10.3 DD per year.

The following table provides a summary of the weather normalisation of gas demand in ENV's Albury Network.

Table 2.2: Albury Network Weather Normalisation of Gas Demand.

Weather Normalisation	Units	2005	2006	2007	2008	2009	2010
Degree Days	(DD)	1,495	1,663	1,391	1,573	1,518	1,596
Normalised Degree Days	(DD)	1,559	1,549	1,538	1,528	1,518	1,507
Abnormal Weather	(DD)	(64)	114	(148)	45	0	88
Tariff D Industrial							
Sensitivity per connection	(GJ/DD)	12.0923	12.0923	12.0923	12.0923	12.0923	12.0923
Average connections	(no.)	9	9	9	9	9	8
Abnormal demand	(GJ)	(6,995)	12,411	(16,079)	4,862	40	8,552
Abnormal percentage	(%)	-0.3%	0.6%	-0.8%	0.2%	0.0%	0.5%
Actual total demand	(GJ)	2,156,307	1,945,731	2,104,909	2,087,535	1,956,901	1,859,352
Normalised total demand	(GJ)	2,163,302	1,933,320	2,120,988	2,082,673	1,956,861	1,850,800
Actual demand per connection	(GJ)	239,590	216,192	233,879	231,948	230,224	232,419
Normalised demand per connection	(GJ)	240,367	214,813	235,665	231,408	230,219	231,350
Tariff V Residential							
Sensitivity per connection	(GJ/DD)	0.0216	0.0216	0.0216	0.0216	0.0216	0.0216
Average connections	(no.)	17,103	17,493	17,865	18,212	18,493	18,812
Abnormal demand	(GJ)	(23,693)	42,999	(56,888)	17,537	156	35,846
Abnormal percentage	(%)	-3.0%	5.5%	-7.2%	2.2%	0.0%	4.3%
Actual total demand	(GJ)	753,995	818,073	728,087	810,548	836,990	866,552
Normalised total demand	(GJ)	777,688	775,074	784,975	793,011	836,834	830,706
Actual demand per connection	(GJ)	44.09	46.77	40.76	44.51	45.26	46.06
Normalised demand per connection	(GJ)	45.47	44.31	43.94	43.54	45.25	44.16
Tariff V Non-Residential							
Sensitivity per connection	(GJ/DD)	0.0746	0.0746	0.0746	0.0746	0.0746	0.0746
Average connections	(no.)	871	881	885	892	890	883
Abnormal demand	(GJ)	(4,175)	7,494	(9,750)	2,972	26	5,820
Abnormal percentage	(%)	-1.6%	2.9%	-4.0%	1.2%	0.0%	2.3%
Actual total demand	(GJ)	254,186	263,380	231,724	257,744	254,207	260,276
Normalised total demand	(GJ)	258,361	255,886	241,474	254,772	254,181	254,456
Actual demand per connection	(GJ)	292	299	262	289	286	295
Normalised demand per connection	(GJ)	297	290	273	286	286	288

Source: Core Energy Group; 2012.

The weather adjusted figures above have exposed the following underlying trends in demand during the period 2005 to 2010:

- Tariff V Residential Demand per Connection decreased at a CAGR of -0.6 percent;
- Tariff V Non-Residential Demand per Connection decreased at a CAGR of -0.6 percent;
- Tariff D Industrial Demand per Connection decreased at a CAGR of -0.8 percent;
- Tariff V Residential Total Demand increased at a CAGR of 1.3 percent;

- Tariff V Non-Residential Total Demand decreased at a CAGR of -0.3 percent; and
- Tariff D Industrial Total Demand decreased at a CAGR of -3.1 percent.

The underlying trend decline in demand per connection observed in the historic data is explored further in Section 3.

3. Drivers by Tariff

- Envestra's VIC and Albury network is classified according to three demand tariffs, namely Tariff V Residential, Tariff V Non-Residential, and Tariff D Industrial. Note that Envestra will be applying different tariffs to Residential and Non-Residential Tariff V for the first time from 1 January 2013.
- Core developed a comprehensive "map" of the possible drivers of the number of gas connections to the network and the drivers of demand per connection, by tariff category.
- This section of the Report describes the key factors which were identified as influencing future network demand.

As described as Step 2 in the forecast methodology it was necessary for Core to consider possible variables which may affect overall gas demand for the network by tariff category. These variables were identified based on Core's experience, together with literature reviews from previously-published access arrangements.

Once these factors were identified, data was sought to support the relationships between historic demand and the relevant factor. However, in order to derive an appropriate estimate of demand, only those factors with sufficient sample size and reliable data were ultimately used. More detailed analysis of the data sources is contained in Section 7 of this Report.

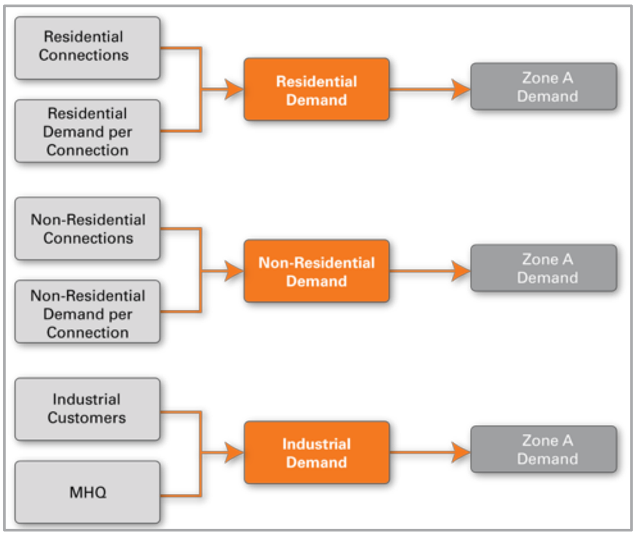
3.1. Tariff Classification

Demand is derived for the following Tariff zones, as defined by Envestra.

1. VIC – Central;
2. VIC – North;
3. VIC – Murray Valley;
4. VIC – Bairnsdale; and
5. Albury.

Figure 3.1 summarises the relationship between demand classes for each zone, using a hypothetical "Zone A" to represent each of the five zones listed above.

Figure 3.1: Demand Classification by Zone.

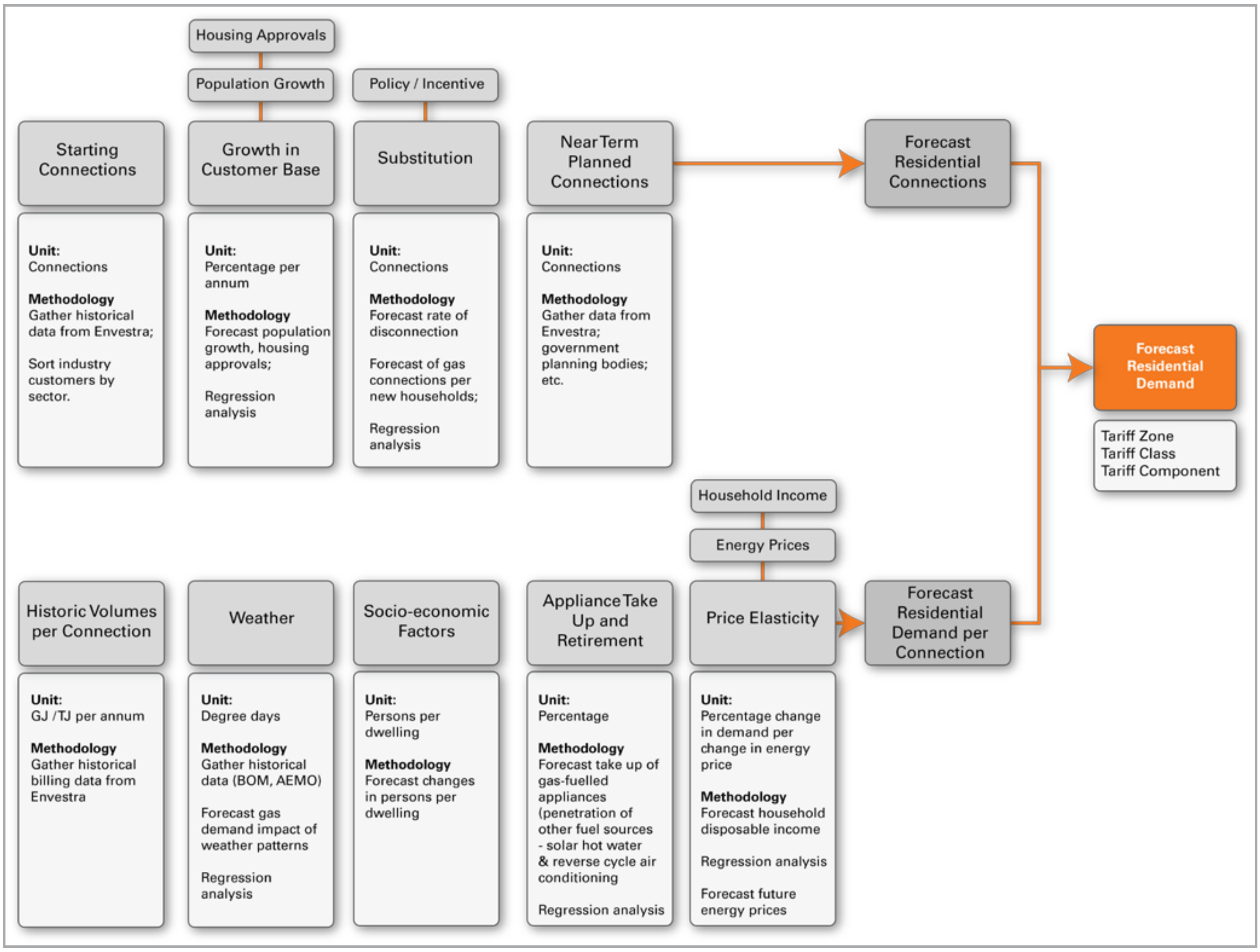


Source: Core Energy Group; 2012.

3.2. Drivers of Demand

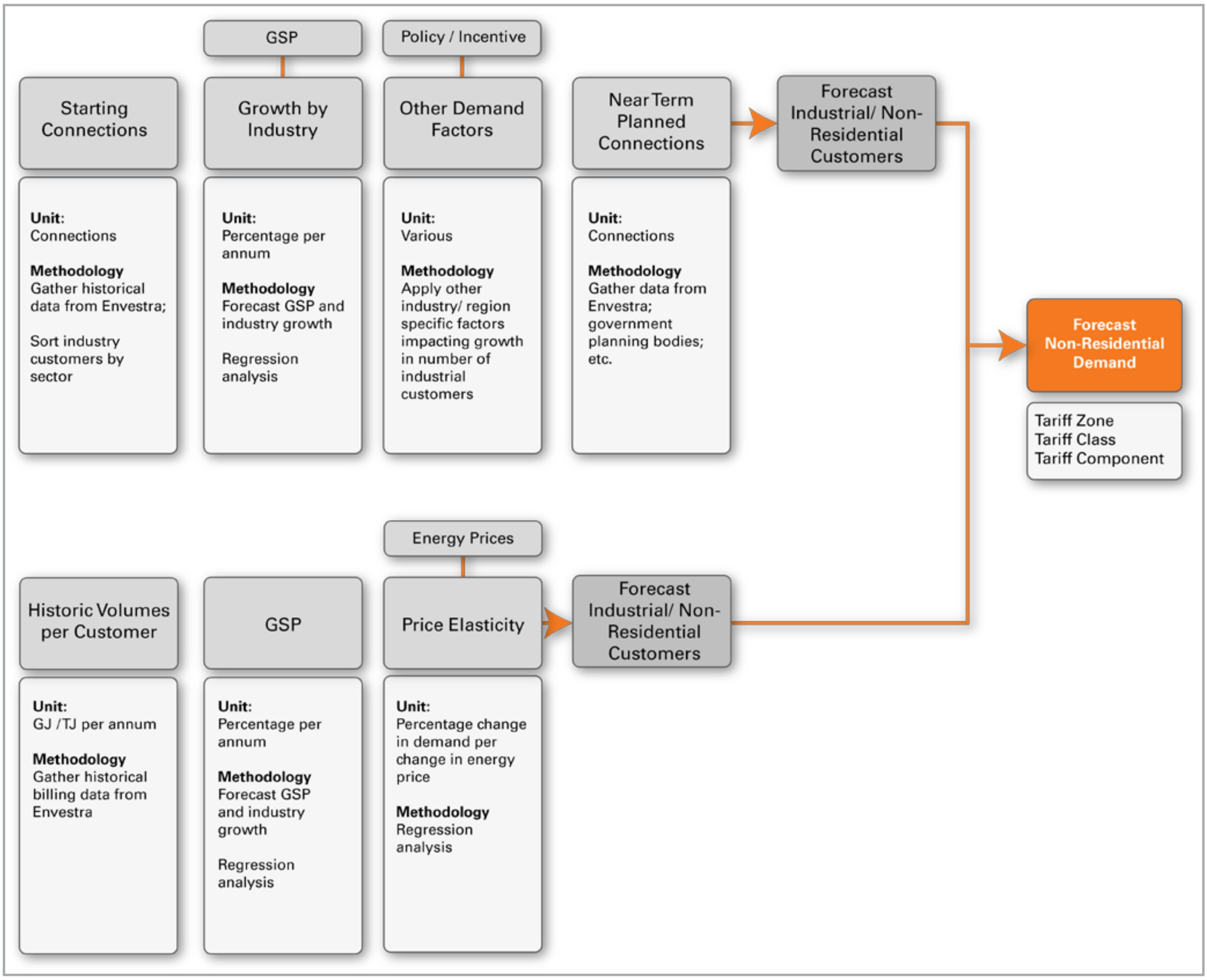
Core undertook an analysis of the possible factors influencing both the number of connections and the demand per connection. The results of the exercise are summarised in the following three figures.

Figure 3.2: Residential Demand Projections.



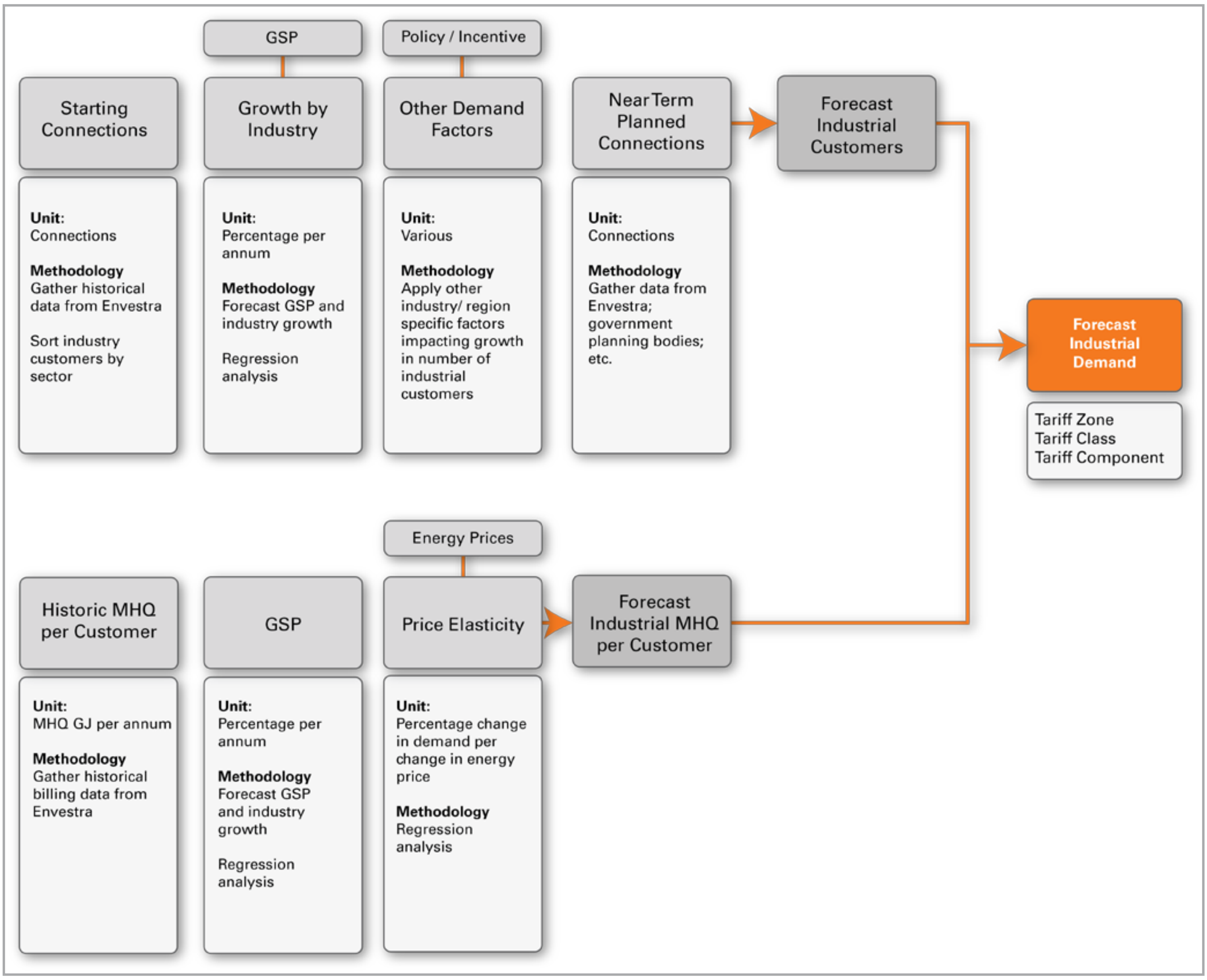
Source: Core Energy Group; 2012.

Figure 3.3: Tariff V Non-Residential /Small Industrial Demand Projections.



Source: Core Energy Group; 2012.

Figure 3.4: Tariff D Industrial Demand Projections.



Source: Core Energy Group; 2012.

3.3. Gas Demand Driver Analysis

In forecasting gas demand and customer numbers it is important to understand historical trends and if these trends are likely to continue over the forecast period as well as any new drivers that are likely to start-up over the forecast period.

Existing forces have resulted in what has historically been a trend decline in the level of gas demand per connection. These trends are discussed in further detail in Section 3.3.1. Furthermore, Core expects the declining trend in gas demand per connection to accelerate into the forecast period, largely due to the impact of retail gas price increases, which are discussed further in Section 3.3.2.

3.3.1. Existing Drivers

Core has identified the following forces which are currently impacting demand for distributed gas:

- Policy framework;
- Residential demand drivers; and
- Commercial / Industrial demand drivers.

Policy Framework

There are numerous Government initiatives currently in place that are likely to have an impact on future gas demand. These include but are not limited to:

- The National Strategy on Energy Efficiency;
- The Victorian Energy Efficiency Target (“**VEET**”) scheme;
- The introduction of a carbon price; and
- Various rebate and incentive schemes.

Core has performed a qualitative assessment of the above factors and their potential effect on future gas demand.

Although it is qualitatively possible to determine whether a specific policy is likely to increase, decrease or have no effect on gas demand, quantifying the exact effect poses a significant challenge. This can be attributed to difficulties in forecasting the actual take-up of policy incentives by households and the effect individual appliances have on household gas demand. As a result, the following section does not provide a definitive effect of government policies, but rather seeks to provide supporting evidence of why the trend decline in demand is occurring.

National Strategy on Energy Efficiency; July 2009

In October 2008, the Council of Australian Governments (“**COAG**”) agreed to develop a National Strategy on Energy Efficiency (“**NSEE**”) to accelerate energy efficiency efforts, streamline roles and responsibilities across levels of governments, and help households and businesses prepare for the introduction of a carbon price. The official NSEE was released in July 2009 with gas sensitive outcomes as summarised by the following table.

Table 3.1: National Strategy on Energy Efficiency Gas Sensitive Outcomes.

Outcome	Key Elements	Impact
Minimum Energy Performance Standards (“**MEPS**”) and Greenhouse and Energy Minimum Standards (“**GEMS**”)	▪ Establishment of national legislation for MEPS and labelling, and over time, a move to add GEMS. ▪ Acceleration and expansion of the current MEPS and labelling program.	Gas appliances to become more efficient – decrease in gas demand.
Phase-out of inefficient and greenhouse-intensive hot water systems	▪ A set of measures (including energy efficiency standards) to phase-out conventional electric resistance water heaters (except where the greenhouse intensity of the public electricity supply is low) and increase efficiency of other types. ▪ MEPS to regulate remaining technologies. ▪ The 10-year framework provides a staged approach to transition to low-emission water heaters, with the first phase focused on the phase-out of electric resistance water heaters commencing in 2010. The strategy includes further phases (in 2015 and 2020) where the minimum performance standard is strengthened, subject to regulatory impact analysis processes.	Phase-out of electric water heaters may increase penetration of gas water heaters – increase in gas demand.

Table 3.1: National Strategy on Energy Efficiency Gas Sensitive Outcomes – Continued.

Outcome	Key Elements	Impact
Building Energy Efficiency Standard	▪ All jurisdictions will work together to develop a consistent outcomes-based national building energy standard setting, assessment and rating framework for driving significant improvement in the energy efficiency of Australia's building stock. To be implemented in 2011. ▪ This measure will be used to increase the energy efficiency of new residential and commercial buildings and major renovations, with minimum standards to be reviewed and increased periodically, for example every three years.	Increased energy efficiency of homes will cause demand for gas space heating to fall – decrease in gas demand.
Increased energy efficiency of commercial buildings	▪ Significantly increase over time the stringency of energy efficiency provisions for all commercial buildings (Class three, and five to nine) in the Building Code of Australia ("**BCA**") – starting with the 2010 version of the BCA. ▪ A package of energy efficiency measures for implementation in 2010 – for new buildings and major new work in existing buildings, which meets a benefit to cost ratio of 2:1. Note the last BCA update included a package of commercial buildings energy efficiency measures with a benefit to cost ratio of 5:1. Tightening the energy efficiency measures such that the regulatory impact analysis of the energy efficiency package comes in at 2:1 represents a significant strengthening of standards. ▪ New efficiency provisions for heating, ventilation and air-conditioning systems and for artificial lighting.	Increased energy efficiency of commercial buildings will cause demand for gas space heating to fall – decrease in gas demand.
Mandatory disclosure of energy efficiency of commercial buildings	▪ Phase-in from 2010 the mandatory disclosure of the energy efficiency of commercial buildings. ▪ Phase one: implement a national mandatory disclosure scheme for large commercial office buildings (2,000 square metres ("**m^2**") or larger). ▪ Phase two: consideration of expanding mandatory disclosure to other building types, including hotels, retail, schools and hospitals.	Mandatory disclosure of commercial building energy efficiency is expected to create greater awareness and encourage further upgrades in efficiency – decrease in gas demand.
Increased energy efficiency of residential buildings	▪ Significantly increase the stringency of energy efficiency provisions for all new residential buildings in the BCA and broaden coverage of efficiency requirements. ▪ Minimum energy efficiency standards will be upgraded to 6-stars, or equivalent, nationally in the 2010 update of the BCA – to be implemented by May 2011 and reviewed regularly for potential upgrade thereafter. For example, 3-yearly from 2012.	Increased energy efficiency of residential buildings will cause demand for gas space heating to fall – decrease in gas demand.
Mandatory disclosure of energy efficiency of residential buildings	▪ Phase in mandatory disclosure of residential building energy, greenhouse and water performance at the time of sale or lease, commencing with energy efficiency by May 2011. ▪ Credible and meaningful information is to be publicly and readily available to market participants to assist them in making lease/purchase decisions.	Mandatory disclosure of residential building energy efficiency is expected to encourage owners to upgrade efficiency in order to maximise their sale/lease income – decrease in gas demand.
Energy efficiency audits of public housing	▪ States and territories to audit the energy efficiency of public housing stocks. ▪ All states and territories will conduct and make publicly available an independent audit of the energy efficiency performance of their public housing stocks. ▪ States and territories to consider implementing cost-effective upgrades.	Energy audits of public housing are expected to create greater awareness and opportunity to improve efficiency – decrease in gas demand.

Table 3.1: National Strategy on Energy Efficiency Gas Sensitive Outcomes – Continued.

Outcome	Key Elements	Impact
Incentives to undertake energy efficiency improvements in residential buildings	▪ Provide incentives for residential building owners to undertake energy efficiency improvements. ▪ Australian Government's Energy Efficient Homes Package including the Low Emission Assistance Plan for Renters, the Homeowner Insulation Program, and the Solar Hot Water Rebate. ▪ Range of state and territory programs designed to improve the energy efficiency of existing residential housing stock.	Increased energy efficiency of residential buildings will cause demand for gas space heating to fall – decrease in gas demand.

Source: Core Energy Group with data from the National Strategy on Energy Efficiency; July 2009.

Rebate and Incentive Schemes

Australia-wide rebate and incentive schemes which have the potential to affect gas demand are summarised below.

Table 3.2: Australia-Wide Rebate and Incentive Schemes.

Scheme	Description	Impact
Renewable power incentives	Households across Australia installing; a small scale solar, wind or hydro renewable electricity system or; a solar or heat pump hot water system; may be eligible for a benefit via Small-scale Technology Certificates and Solar Credits.	Penetration of gas hot water systems to fall as solar and heat pump take market share – decrease in gas demand.
Solar hot water or heat pump rebate	Households across Australia that replace an existing electric storage hot water system may be eligible for rebates of AUD1,000 for a solar hot water system or AUD600 for a heat pump hot water system under the Renewable Energy Bonus Scheme.	Electric storage hot water systems to be displaced by solar and heat pump – no effect on gas demand.
Home Insulation Packages	The initial Home Insulation Program ("**HIP**") was introduced in February 2009, under which 1.2 million households were insulated at a cost of ~AUD1.45 billion ("**bn**"). Emissions projections estimate the cumulative carbon abatement under the HIP from 2009-2020 will be 14.9 million tonnes of carbon dioxide equivalent ("**Mt CO_2-e**") avoided, 20,000 Gigawatt hours of electricity and 25 petajoules ("**PJ**") of natural gas[4]. The program was closed in February 2010.	Higher number of homes with insulation will cause a fall in gas space heating requirements – decrease in gas demand.
Commonwealth's Renewable Energy Target ("**RET**") scheme	The RET scheme provides support to households and businesses to install small-scale solar, wind and hydro-electricity systems through Solar Credits. Households and businesses can also receive support under the RET when they install a solar hot water system. Most installers will provide a discount based on the estimated output of the solar hot water system.	Solar hot water systems will begin to displace gas hot water systems – decrease in gas demand.
Energy Efficiency Opportunities program	The Energy Efficiency Opportunities program encourages large energy-using businesses to improve their energy efficiency. It does this by requiring businesses to identify, evaluate and report publicly on cost effective energy savings opportunities. Participation in Energy Efficiency Opportunities is mandatory for corporations that use more than 0.5 PJ of energy per year. There are more than 220 corporations (incorporating around 1200 subsidiaries) registered for the Energy Efficiency Opportunities program.	Encourages industrial gas users to continually improve the efficiency of their gas usage – decrease in gas demand.

Source: Core Energy Group; 2012.

A summary of VIC specific rebate and incentive schemes which have the potential to affect gas demand follows.

[4] Source: *Australia's emission projections (February 2010)* – Department of Climate Change and Energy Efficiency.

Table 3.3: VIC Rebate and Incentive Schemes.

Scheme	Description	Effect
Victorian Energy Efficiency Target (“**VEET**”) scheme	VEET was established under the Victorian Energy Efficiency Target Act 2007 (the Act) and is legislated to continue in three-year phases until 1 January 2030, placing a liability on large energy retailers to surrender a specified number or efficiency certificates every year. The purpose of the scheme is to reduce greenhouse gas emissions, encourage the efficient use of electricity and gas, and to encourage investment, employment and technology development in industries that supply goods and services which reduce the use of electricity and gas of consumers. Around 30 Prescribed Activities are currently included in the scheme, ranging from the installation of high efficiency hot water systems, air heater/coolers, lighting, draught proofing and window treatments through to the purchase of high efficiency appliances like refrigerators and televisions.	Continued improvement in the efficiency of new gas water heating and gas space heating appliances – decrease in gas demand.
Electric heater replacement discount	The Gas Heater Discount for Concession Card Holders provides an AUD700 discount to eligible VIC households that replace their electric heater with a new high efficiency gas space heater.	Gas space heating to replace a proportion of electric heaters – increase in gas demand.
Plumbing regulations – Solar hot water heaters	Plumbing regulations require builders to install a solar water heater or a rain water tank on new homes. The solar water heater must meet performance criteria and must be sized appropriately. In areas with gas reticulation, a solar water heater boosted with natural gas or a solar water heater that does not incorporate booster heating is required. Solar hot water systems must achieve a minimum energy performance of 60 percent solar gain as measured by the Australian Standard for solar hot water systems AS 4234-1994 "Solar water heaters - Domestic and heat pump - Calculation of energy consumption".	Solar hot water heating requirements for new homes will decrease gas water heating demand of new homes – decrease in gas demand
Gas hot water rebate	The Gas Hot Water rebate provides Victorian households with up to AUD700, to replace their existing wood-fired or peak-rate electric hot water heater with a natural gas or LPG hot water system.	Gas hot water heating to replace a proportion of peak-rate electric and wood-fired water heating systems – increase in gas demand.
Home and garden water rebates	The Living Victoria Water Rebate Program provides rebates to VIC households for water-efficient products such as washing machines, pool covers, dual-flush toilets, rainwater tanks, grey-water systems and water-efficient gardening products.	Water-efficient showerheads, washing machines and dishwashers to decrease demand for gas water heating –decrease in gas demand.
Home energy incentives	The Energy Saver Incentive helps VIC households save energy with a range of discounts and special offers on selected energy saving products and services including fridges, freezers, heaters and hot water systems.	Higher efficiency gas hot water and gas space heating – decrease in gas demand.
Showerhead exchange	Residents of VIC can swap their old showerhead for a water efficient showerhead under the Showerhead Exchange Program.	Higher efficiency showerheads to reduce hot water usage – decrease in gas demand.
Solar hot water rebate	The Solar Hot Water Rebate for metropolitan Melbourne provides up to AUD1,600 at point of sale to replace or improve existing hot water systems with a range of new gas and solar hot water solutions.	Both gas and electric hot water systems to be replaced by new higher efficiency gas or solar hot water heating – decrease in gas demand.
Energy Saver Incentive	Discounts and special offers are available on selected energy saving products and appliances from participating businesses.	Improved efficiency of gas appliances – decrease in gas demand.
GreenHouse Games	The GreenHouse Games is a competitive environmental challenge for households. Participation is organised through schools and kindergartens, workplaces, sporting clubs, community groups, and Scout & Girl Guide groups in Victoria. Households participate in an 8-week challenge by taking actions in their homes to reduce energy and water use and waste.	Improved household awareness of energy saving practices – decrease in gas demand.

Table 3.3: VIC Rebate and Incentive Schemes - Continued.

Scheme	Description	Effect
ResourceSmart Commercial Buildings Program	Aims to deliver greenhouse gas and water savings through specific support initiatives, while also building the capacity of the broader market to improve existing building performance in the longer term. Major property owners can partner with Sustainability Victoria through Sustainability Partnerships to deliver measurable carbon and water reductions. Greater reductions can be leveraged by Sustainability Victoria assisting owners with their strategic, operational and investment activities.	Improved efficiency of gas space heating in commercial buildings – decrease in gas demand.

Source: Core Energy Group; 2012.

Residential Demand Drivers

The level of residential gas demand per connection can be broken down into a function of the following factors:

- Gas cooking demand per household;
- Gas space heating demand per household; and
- Gas water heating demand per household.

The proceeding sections present a historical analysis of the above factors with the aim of explaining the observed trend decline in gas demand per household. This Section also details GHDI data, which is relied upon by Core for future demand projections.

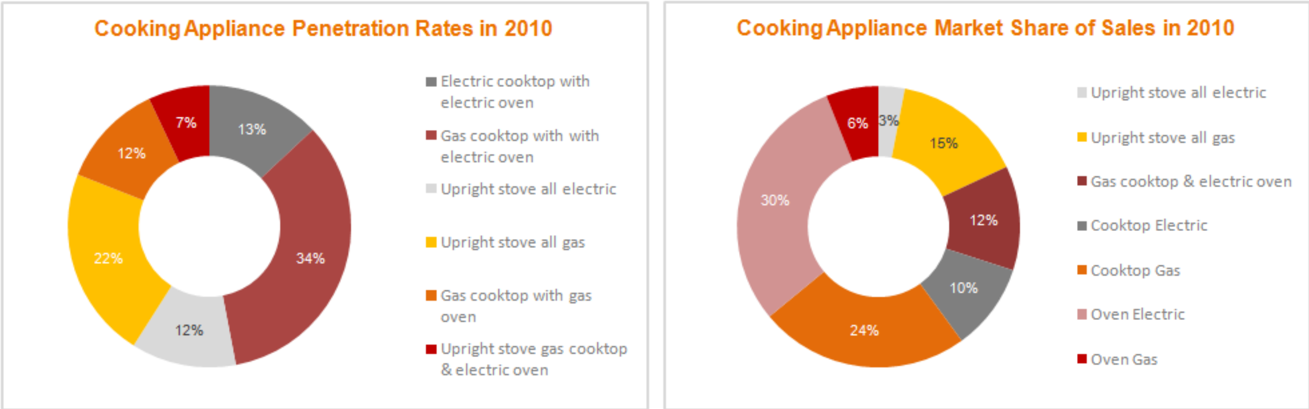
Cooking

The following provides an overview of the available statistics that relate to gas cooking.

Gas cook top penetration in VIC was 48 percent in 2010 while the market share of sales was 54 percent (see Figure 3.5). A larger share of sales than current penetration implies increasing gas cook top penetration, leading to increased gas demand. However, in light of the minimal gas usage of cook tops relative to space and water heating, the effect is likely to be negligible.

Gas oven penetration in VIC was 34 percent in 2010 while the market share of sales was 21 percent (see Figure 3.5). A smaller share of sales than current penetration implies decreasing gas oven penetration, leading to decreased gas demand.

Figure 3.5: Cooking Appliance Penetration and Market Share of Sales.



Source: BIS Shrapnel; The Household Appliances Market 2010; October 2010.

The average age of replaced cookers has averaged approximately 14 years over the period 2004 to 2010 (see Figure 3.6). This suggests that every year approximately 7 percent of cookers will be replaced by a newer and more efficient cooker, resulting in a decrease in average use per cooker.

Figure 3.6: Average Age of Replaced Cookers.

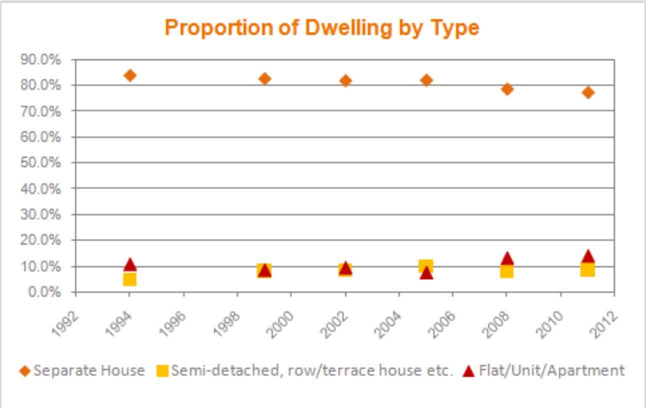
BIS Shrapnel; The Household Appliances Market 2010; October 2010.

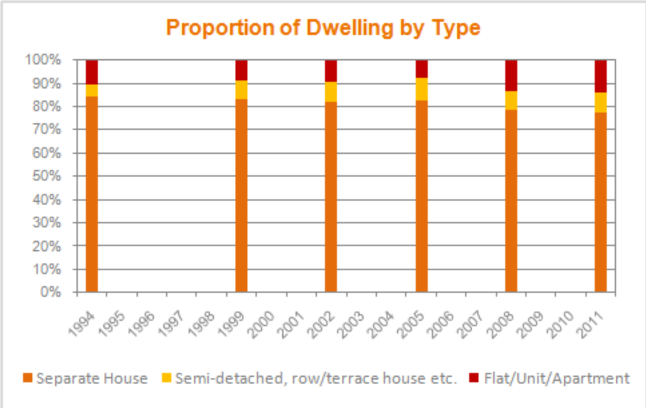
Space Heating

The following provides an overview of the available statistics that relate to gas space heating.

The proportion of dwellings classified as Flat/Unit/Apartment has been steadily increasing from 1994 to 2011 (see Figure 3.7). This is confirmed by the trend of increasing building approvals for these types of dwelling over the period (see Figure 3.8). Flat/Unit/Apartment type buildings typically do not have an individual gas connection, while those which do, tend to use less gas for space heating than other dwelling types as they have a significantly smaller floor area. The continuation of this trend is likely to cause a reduction in the average gas demand per connection of households.

Figure 3.7: Dwelling by Type.





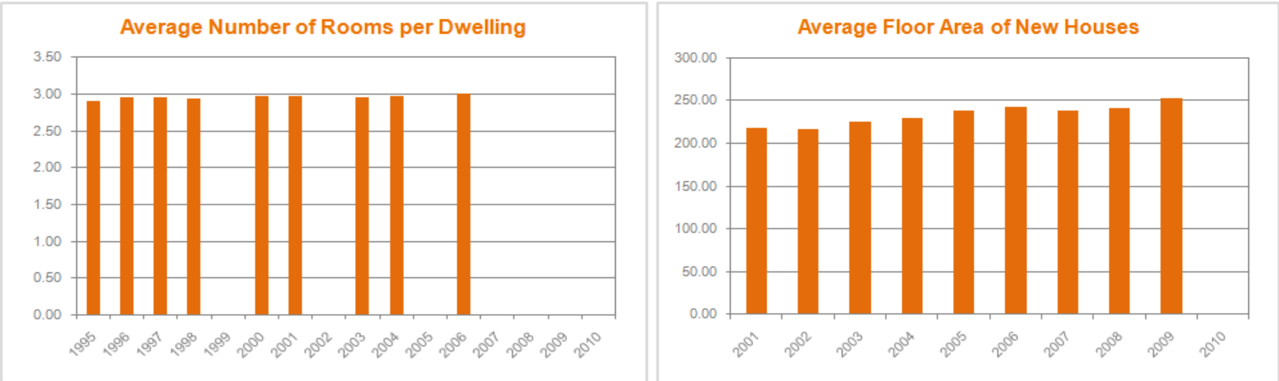
Source: Australian Bureau of Statistics ("**ABS**"); 4602.0.55.001 - Environmental Issues: Energy Use and Conservation; March 2008.

Figure 3.8: Buildings Approvals by Type.

Source: ABS; 8731.0 Building Approvals, Australia; January 2012.

The average number of rooms per dwelling has increased from 2.90 to 3.01 from 1995 to 2006, while the average floor area has increased from 217.3 square meters ("**m^2**") to 252.8 m^2 from 2001 to 2009 (see Figure 3.9). Since larger homes require additional gas space heating compared to smaller homes, this trend is likely to result in an increase in the average gas demand of households.

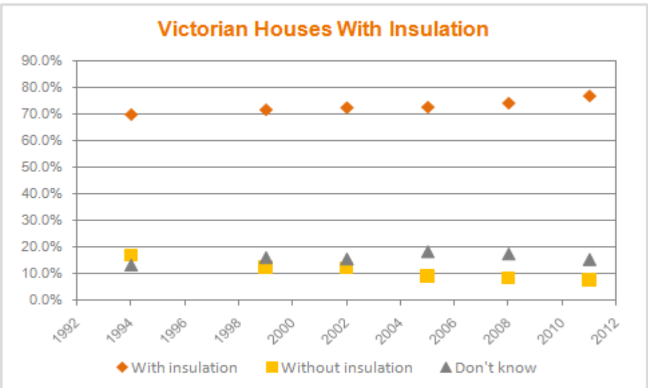
Figure 3.9: Average Number of Rooms per Dwelling and Average Floor Area of New Houses.



Source: ABS; 4130.0.55.001 - Housing Occupancy and Costs; October 2007, ABS; 8731.0 - Building Approvals, Australia, Feb 2010; Feature Article: Average Floor Area of New Residential Dwellings.

The number of VIC homes with insulation has increased from 69.5 to 76.5 percent from 1994 to 2011 (see Figure 3.10). Homes with insulation require less space heating in colder months to maintain sufficient temperatures. A continuation in the insulation trend is likely to reduce the gas space heating requirements of households.

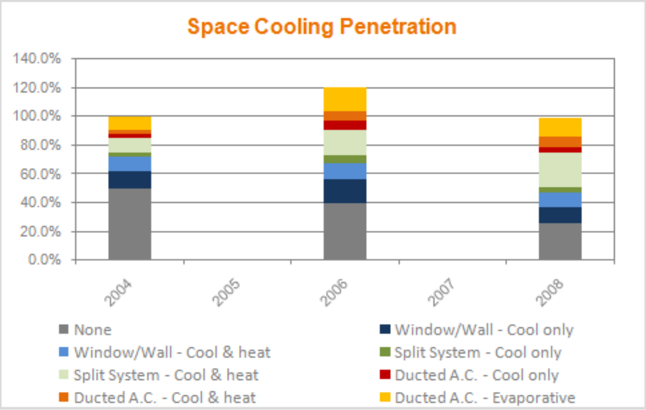
Figure 3.10: Victorian Houses with Insulation.



Source: ABS; 4602.0.55.001 - Environmental Issues: Energy Use and Conservation; Mar 2008.

The space cooling penetration of Split System – Cool & Heat and Ducted A.C. – Cool & Heat has increased from 10 to 24 percent and 3 to 7 percent, respectively, from 2004 to 2008 (see Figure 3.11). A continuation of this trend will reduce demand for gas space heating as electric cooling systems which double-up as heaters provide an alternative to gas space heating.

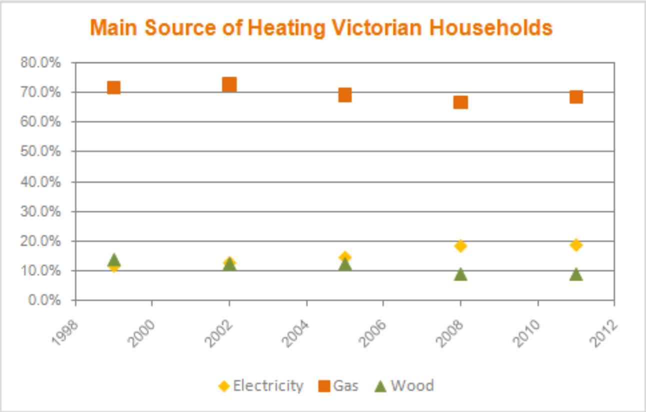
Figure 3.11: Space Cooling Penetration.

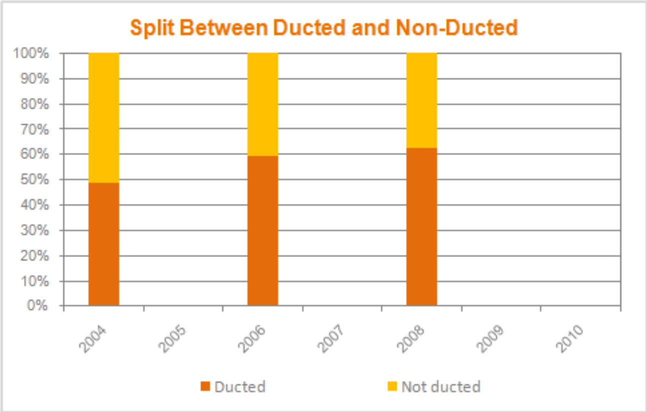


Source: BIS Shrapnel; The Household Appliances Market 2008; October 2008.

Gas as a main source of space heating in VIC has fallen from 71.5 to 68.5 percent from 1999 to 2011, while electricity as a main source of space heating has increased from 11.9 percent to 18.8 percent (see Figure 3.12). The emergence of reverse-cycle air conditioning, which can provide both cooling and heating, is gaining significant market share on other types of space heating, including gas space heating. Continued penetration increases of electric systems that combine both cooling and heating capabilities will reduce demand for gas space heating in the future.

Figure 3.12: Main Source of Heating Victoria and Split Between Ducted and Non-Ducted.

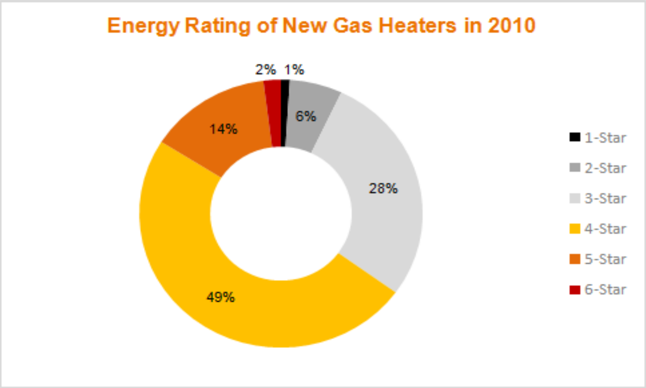




Source: ABS; 4602.0.55.001 - Environmental Issues: Energy Use and Conservation; Mar 2008, BIS Shrapnel; The Household Appliances Market 2008; October 2008.

The weighted average Energy Rating of new gas heaters in 2010 was 3.75 (see Figure 3.13). This represents 62.5 percent of the current 6-Star maximum and demonstrates that households are yet to take advantage of the full efficiency gains achievable by new appliances.

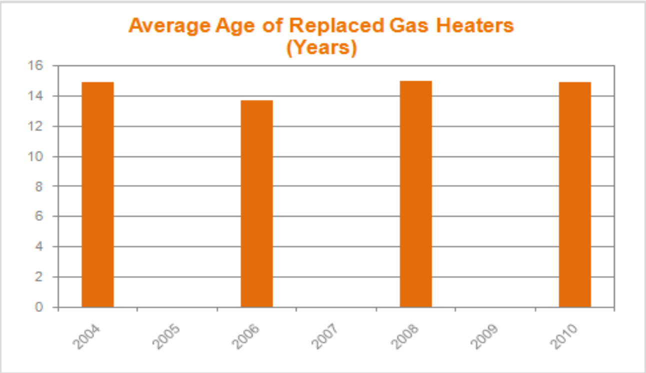
Figure 3.13: Energy Rating of New Gas Heaters.



Source: BIS Shrapnel; The Household Appliances Market 2010; October 2010.

The average age of replaced gas heaters was approximately 14 years over the period 2004 to 2010 (see Figure 3.14). This suggests that every year approximately 7 percent of gas heaters will be replaced by either a newer and more efficient gas heater, or an electric space heating appliance.

Figure 3.14: Average Age of Replaced Gas Heaters.



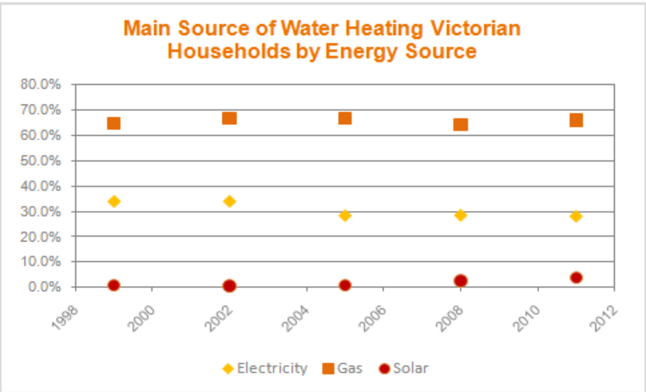
Source: BIS Shrapnel; The Household Appliances Market 2010; October 2010.

Water Heating

The following provides an overview of the available statistics that relate to gas water heating.

Gas percentage share of water heating in VIC has remained relatively flat from 1999 to 2011 (see Figure 3.15).

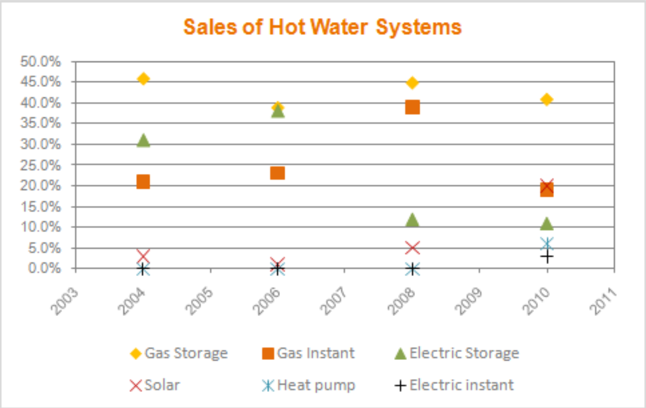
Figure 3.15: Main Source of Water Heating Victoria.



Source: ABS; 4602.0.55.001 - Environmental Issues: Energy Use and Conservation; March 2011.

Gas as a percentage of sales of hot water systems decreased from 67 to 60 percent from 2004 to 2010; while solar water heating share of sales increased from 3 to 20 percent from 2004 to 2010 (see Figure 3.16). Government incentives and rebates have caused a surge in solar water heating demand, and new residential buildings are also installing solar hot water systems in order to meet government requirements. This policy and resulting trend is likely to cause significant displacement of current gas and electric water heating in the future.

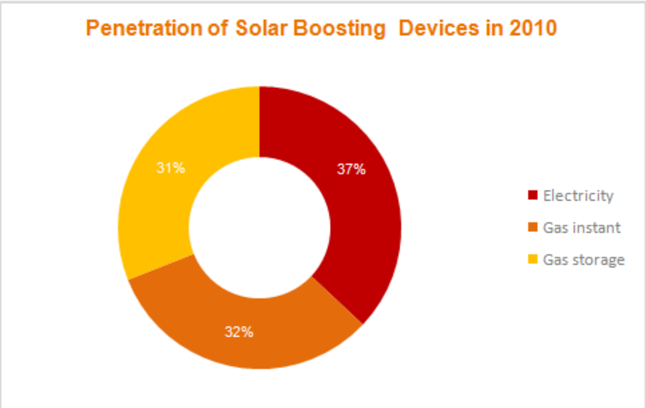
Figure 3.16: Market Share of Sales Hot Water Systems.



Source: BIS Shrapnel; The Household Appliances Market 2010; October 2010.

The penetration of gas solar boosting devices was 63 percent in 2010 (see Figure 3.17).

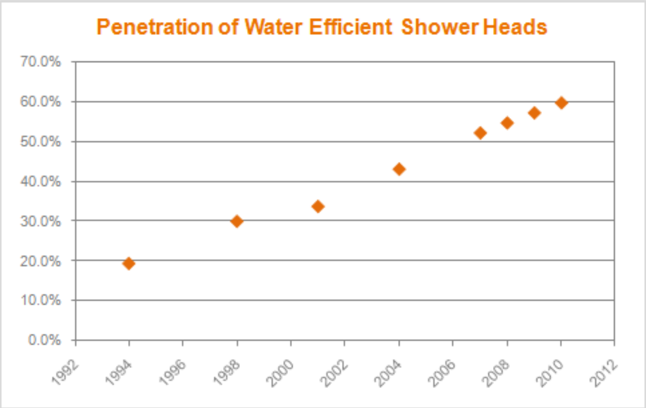
Figure 3.17: Penetration of Solar Boosting Devices.



Source: BIS Shrapnel; The Household Appliances Market 2010; October 2010.

The penetration of water efficient showerheads has increased from 19.5 to 59.5 percent from 1994 to 2010 (see Figure 3.18). A continuation of this trend is likely reduce household gas water heating demand via the reduction in hot water usage brought on by efficient showerheads.

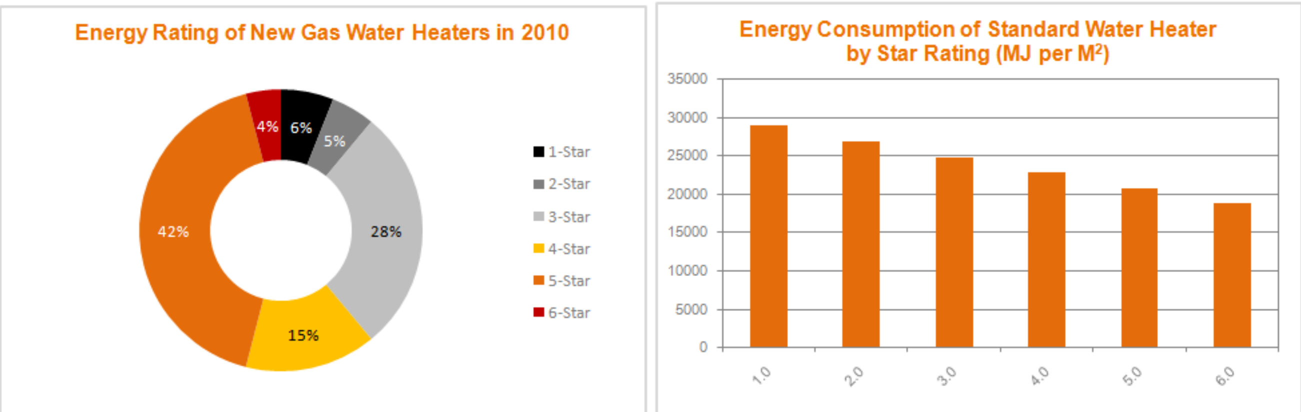
Figure 3.18: Water Efficient Shower Heads.



Source: ABS; 46020DO003 Environmental Issues: People's Views and Practices; March 2007.

The weighted average Energy Rating of new gas water heaters in 2010 was 3.94 (see Figure 3.19). This represents 65.7 percent of the current 6-Star maximum and demonstrates that households are yet to take advantage of the full efficiency gains achievable by new appliances.

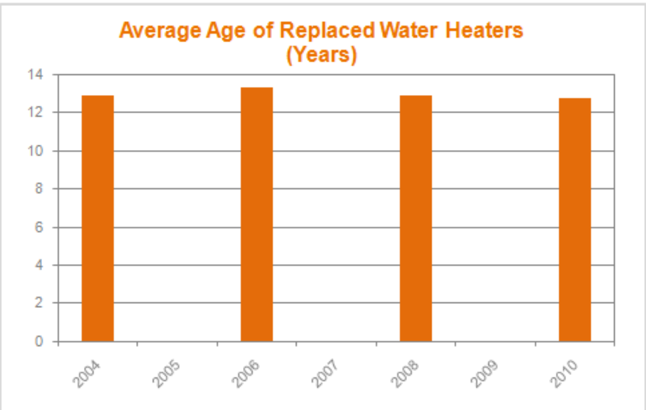
Figure 3.19: Energy Rating of New Gas Water Heaters and Energy Consumption of Gas Water Heaters by Rating.



Source: BIS Shrapnel; The Household Appliances Market 2010; October 2010, AGA; Energy Efficiency Ratings - Water Heaters.

The average age of replaced water heaters has averaged approximately 13 years over the period 2004 to 2010 (see Figure 3.20). This suggests that every year approximately 8 percent of water heaters will be replaced by a newer and more efficient water heater.

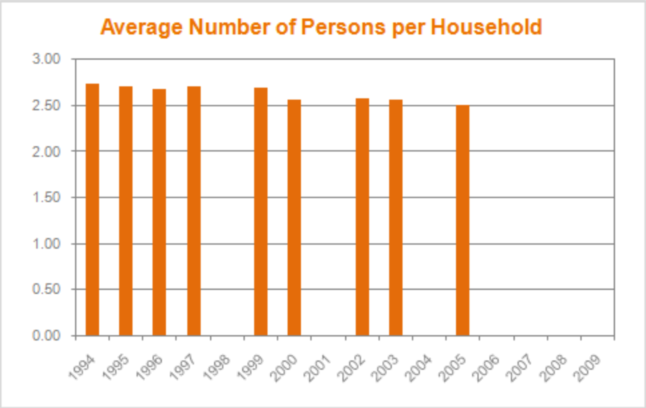
Figure 3.20: Average Age of Replaced Water Heaters.



Source: BIS Shrapnel; The Household Appliances Market 2010; October 2010.

The average number of persons per dwelling has decreased from 2.73 to 2.50 from 1995 to 2006 (see Figure 3.21). A continuation of this trend suggests a reduction in gas water heating demand per dwelling as fewer occupants will result in lower demand for hot water.

Figure 3.21: Average Number of Persons per Household.



Source: ABS; 4130.0.55.001 - Housing Occupancy and Costs; October 2007.

Demand per Connection

Using the weather sensitivity coefficients and the level of abnormal weather determined in Section 2 for VIC Tariff V Residential, Core has completed an additional analysis of weather normalised demand per connection by year of connection. The table below demonstrates that a house built in 2009 uses approximately 20 percent less gas than one built in 2005 and indicates that homes connected more recently consume on average less than those connected in the prior year. This can be explained by increasing energy efficiency standards of new homes relative to old, as well as, increasing efficiency of new appliances which are more prevalent among new homes.

Table 3.4: Weather Normalised Demand per Connection by Year of Connection.

Year of Connection	Weather Normalised Demand per Connection					
	2005*	2006*	2007*	2008*	2009*	2010*
2005	26.7	57.8	57.9	59.9	59.7	58.3
2006		20.9	53.6	55.8	56.4	55.9
2007			23.2	50.8	52.2	51.6
2008				20.2	51.1	51.4
2009					20.3	49.9
2010						23.4

Source: Envestra Limited.
* A full year of consumption does not occur in the year of connection.

GHDI

Increasing residential gas use is driven by higher disposable incomes which allow for the purchase and greater use of gas appliances by households.

An appropriate proxy for household incomes is VIC GHDI, as it is publicly-available from the ABS and geographically relevant to ENV’s VIC network. Historically, VIC GHDI has achieved a nominal compounded annual growth rate of 6.4 percent from 2001/02 to 2009/10, however, growth slowed to 2.7 percent in 2009/10, the lowest annual growth in the past 10 years (see Table 3.5). Although GHDI is expected to pick-up again in future periods, any temporary slow-downs in growth can be expected to directly impact the level of income available for gas appliances.

Core has identified GHDI as being a primary driver of future residential gas demand. As such projections of GHDI are used as a basis for projected demand per connection (see Section 4 for further information).

Table 3.5: GHDI 2001/02 to 2009/10.

Financial Year	Nominal GHDI Million Australian Dollars ("AUDM")	Growth Rate (% change)
2000/01	117,512	7.8%
2001/02	122,629	4.4%
2002/03	130,671	6.6%
2003/04	139,261	6.6%
2004/05	147,370	5.8%
2005/06	157,848	7.1%
2006/07	174,812	10.7%
2007/08	186,468	6.7%
2008/09	199,856	7.2%
2009/10	205,262	2.7%

Source: ABS; 5206.0 Australian National Accounts: National Income, Expenditure and Product

Commercial / Industrial Demand Drivers

The level of commercial and industrial gas demand can be broken down into a function of the following factors:

- Gas cooking demand;
- Gas space heating demand;
- Gas water heating demand; and
- Gas feedstock demand.

In comparison to residential gas demand, commercial/industrial demand includes the additional use of gas as a feedstock in industrial processes. Due to the lack of publicly available data on the breakdown of commercial/industrial gas demand, it is difficult to identify sub-trends within each use. However, taking a high-level view, Core expects continued growth in the VIC economy to increase gas demand, while improvements in efficiency provide an offsetting factor that will reduce gas demand. As a broad cross-check against this high level view, Core has undertaken a customer survey which is discussed in further detail on page 32.

GSP

Increasing commercial/industrial gas use is driven by economic growth. As the demand for goods and services within an economy increase, so do the gas requirements of the commercial/industrial users which provide those goods and services.

An appropriate proxy for economic growth is VIC GSP, as it is publicly-available from the ABS and geographically relevant to Envestra's VIC network. Historically, VIC GSP has achieved a real CAGR of 2.9 percent from 2001/02 to 2009/10, however, this rate has slowed significantly to 0.9 percent and 2.0 percent in 2008/09 and 2009/10, respectively (see Table 3.6). A continuation of this trend in lower economic growth may cause commercial/industrial gas demand to grow at a slower pace in the future than what has been experienced historically.

Table 3.6: Real VIC GSP 2001/02 to 2009/10.

Financial Year	Real GSP (AUDM)	Growth Rate (% change)
2000/01	225,975	1.5
2001/02	233,325	3.2
2002/03	241,263	3.4
2003/04	252,297	4.5
2004/05	259,130	2.7
2005/06	265,644	2.5
2006/07	275,084	3.5
2007/08	284,978	3.5
2008/09	287,619	0.9
2009/10	293,313	2.0

Source: SACES.

Core has identified GSP as being a primary driver of future commercial and industrial gas demand. As such projections of GSP are used as a basis for projected demand per connection (see Section 4 for further information).

Industrial Customer Survey

With the assistance of Envestra and Origin Energy, Core conducted a survey of Envestra's largest industrial gas users. This involved the mail-out of 37 surveys by Envestra in November 2011 and 55 surveys by Origin Energy in December 2011. The survey template used can be found in Attachment 5.

A response was received from a total of 25 customers by 30 January 2012, representing 30. 5 percent of 2010 industrial MHQ. Although the response rate did not provide a sufficient sample size to use as a forecasting basis, the results provide valuable insight into what industrial gas users expect their own gas demand to be in the future. In particular, the survey has alerted to the fact that a number of very significant gas users will be shutting-down their operations in the near future.

The table below provides the weighted average growth rate forecast by the survey respondents.

Table 3.7: Industrial Gas User Survey Results.

Survey Results	2012	2013	2014	2015	2016	2017
Demand per Connection Weighted Average Growth Rate (%)	-33.6	-14.9	0.41	0.29	0.23	0.4

Source: Core Energy Group; 2012.

3.3.2. New Drivers

Core has identified the following forces which are not currently driving gas demand, but which are expected to come into force over the projection period:

- The 6-Star building requirement (residential gas demand only); and
- Changes in gas price beyond the natural growth seen historically (residential, commercial and industrial gas demand).

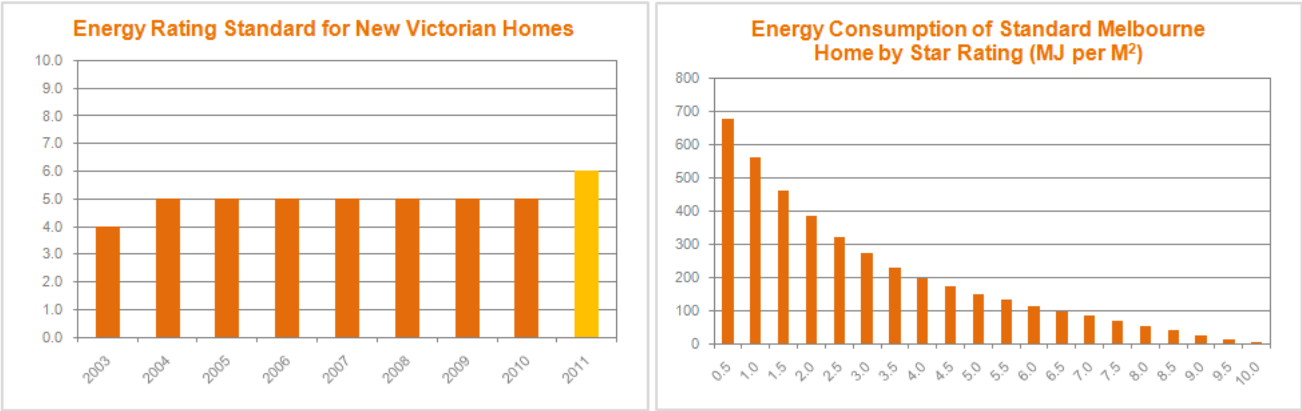
Each of these drivers is discussed in further detail below and each is quantified in Core's modelling (see Section 5).

The 6-Star Building Requirement

The Government mandated Star Rating requirement of new buildings in VIC was 4 in 2003 and 5 in 2004 to 2010 (see Figure 3.22). As of 1 May 2011, the new Star Rating requirement in VIC is 6[5], with the potential to reach up to 7 or 8 by the end of the 2013-2017 regulatory period. New South Wales ("**NSW**"), which is the relevant jurisdiction for ENV's Albury network, continues to use its Building Sustainability Index ("**BASIX**"), which is currently equivalent to a 4.8-Star Standard for new residential dwellings. The NSW government is currently consulting with the construction industry on the upgrade of BASIX to a 6-Star equivalent.[6] Core expects the upgrade to a 6-Star Standard in NSW to occur in 2013 and has modelled the impact on Albury gas demand accordingly.

Based on NatHERS Starbands, a standard Melbourne home is expected to use 23 percent less energy for temperature control when moving from a Star Rating of 5 to 6 (see Figure 3.22). This implies a significant reduction in the gas demand of new homes in the future.

Figure 3.22: Historical Energy Rating Standards and Energy Consumption by Rating.



Source: Make Your Home Green website, Nathers; Starbands.
Note: MJ refers to Megajoules.

Although building requirements have been in place historically, Core does not believe the impact of a move to 6-Star building requirements (introduced on 1 May 2011) has been recognised in the underlying trend. As a result, Core has modelled the expected impact of a higher household energy efficiency on residential gas demand per connection (Section 5).

Changes in Retail Gas Price

Over the projection period, Core expects to see a material increase in gas prices, unlike any increases seen in the previous review period, as a result of:

- The introduction of a price on carbon – expected in July 2012 (described further below);
- An increase in the wholesale price of gas as a result of several new forces (described further in Section 5.3):
  - The start-up on a Liquefied Natural Gas ("**LNG**") export market in 2014;
  - The completion of existing, lower cost, long-term gas contracts; and
  - A change in the extraction cost of gas resources.
- An increase in network charges (described further in Section 5.3).

Increases in gas price are expected to result in a decrease in gas demand per connection.

[5] Make Your Home Green website; Accessed November 2011

[6] http://www.envirotecture.com.au/basix-upgrade-around-the-corner-are-we-ready ; accessed 26 March 2012

Core has undertaken analysis of each of these price increases. This analysis, coupled with price elasticity data, is used in the model to quantify the demand side impact of price changes.

The Introduction of a Price on Carbon

The introduction of the Clean Energy Bill 2011 into law prescribes a cost of carbon in emissions at Australian Dollars ("**AUD**") 23 per tonne. According to calculations by the Australian Treasury, this is projected to increase the average household gas bill by 9 percent or AUD1.50 per week[7]. An increase in retail gas prices is likely to result in decreased gas demand as consumers look to minimise their costs.

The following presents a brief overview of events leading up to the passage of the Clean Energy Bill 2011:

- Twice in 2009 the Senate voted against Carbon Pollution Reduction Scheme ("**CPRS**") legislation;
- In April 2010, former Prime Minister Kevin Rudd announced the postponement of the proposed CPRS policy until at least 2013;
- On 27 September 2010, the Gillard Government established the Climate Change Committee[8] to examine potential options for the introduction of a carbon price and ETS;
- In February 2011, Prime Minister Gillard outlined the Government's plans for a carbon price mechanism. These plans specified a start date of 1 July 2012, with a fixed price period for three to five years before transitioning to a flexible price cap-and-trade emissions trading scheme[9];
- On 10 July 2011, the Federal Government released a carbon pricing scheme to reduce approximately 159 Million tonnes ("**Mt**") of total carbon dioxide ("**CO_2**") emissions by 2020. The carbon pricing mechanism will be implemented via a two-stage approach:
  - Commencing on 1 July 2012 with a fixed carbon price for the first three years. The carbon price will initially be set at AUD23 per tonne CO_2 and rise at 2.5 percent per annum; and
  - From 1 July 2015, the carbon price will transition to a fully-flexible price under an ETS, with the price set by the market.
  - The mechanism will extend to emissions sources from stationary energy, industrial processes and fugitive emissions and emissions from non-legacy waste.
- As part of the carbon pricing mechanism, the Federal Government has also proposed to setup the following authorities:
  - **Climate Change Authority** – an independent body to provide advice on the Australian Government's policies for reducing carbon pollution.
  - **Energy Security Fund** – **Payments to Close**: Coal-fired generators with emissions intensity greater than 1.2 tonnes of CO_2 per Megawatt-hour ("**MWh**") on an 'as-generated' basis will be eligible to participate in an expression of interest process with the Government, for up to AUD1bn in cash payments. The government will contract with the generators for closure of an agreed capacity in exchange for equivalent monetary value of administrative allocations and additional payment for closure.
  - **Clean Energy Finance Corporation** – To provide AUD10bn for investments in renewable energy, low-pollution and energy efficiency technologies.
  - **Australian Renewable Energy Agency** – To provide an estimated AUD3.2bn in funding to support research, development and commercialisation of renewable energy technologies.

[7] Australian Treasury Strong Growth, Low Pollution - Modelling a Carbon Price; July 2011.
[8] Source: Prime Minister of Australia; "Prime Minister Established Climate Change Committee"; 27 September 2010.
[9] Source: Prime Minister of Australia; "Climate Change Framework Announced"; 24 February 2011.

- The Government has suggested that, should the world implement a stabilisation target of 450 parts per million ("**ppm**"), Australia would target a 25 percent reduction in 2000 level emissions by 2020.
- The Australian Treasury has modelled a range of scenarios (Core Policy and High Price) in its carbon pricing modelling report, "*Strong Growth, Low Pollution: Modelling a Carbon Price*", providing a domestic sectoral outlook to 2050 for electricity generation, transport, agricultural and household.
- The Government has released the draft clean energy legislative documents outlining details into the implementation of the carbon pricing mechanism before introduction into Parliament in the second half of 2011.
- In October 2011 the Clean Energy Legislative Package was passed through both Houses of the Federal Parliament.

4. Forecasting Methodology

- The purpose of this Section of the Report is to provide detail of the methodology undertaken by Core in arriving at forecasts of gas demand and connections.
- In arriving at this methodology, Core has placed significant emphasis on developing a highly transparent and repeatable process, whilst considering those factors which are likely to impact demand and connections, as well as the quality and reliability of available data.
- SACES peer reviewed the Core statistical techniques used and provided feedback on the data sets selected and the final structure of the modelling.

It should be noted that this Section of the Report describes the methodology only. Data sources are defined in Section 7, whilst key assumptions made are discussed in Section 5.

The drivers and influences of gas demand differ for each demand class, as such a different methodology was applied to each. In forming the methodology for each demand class, Core has placed significant emphasis on the transparency and repeatability of the process, and has developed a methodology whose aim is to reliably forecast gas demand across a range of different networks, including ENV's VIC and Albury networks.

Ideally, a model would contain a variable for every factor significantly influencing gas demand, however, due to the limited availability of information on appliance usage and penetration in VIC, as well as only 6 years of actual gas demand observations, alternative methods were required. Given the constraints on available data, Core considers its methodology to be appropriate.

The precise effect of individual factors such as government policy, changing consumer attitudes and increases in efficiency are difficult to identify on a stand-alone basis, as such, Core has opted to represent the combined effect of all factors through a linear trend of weather adjusted historic data. This type of model contains the implicit assumption that all factors which have affected gas demand historically, will continue to affect gas demand in the future. Core believes this to be a reasonable assumption with the exception of four additional factors that have not been present historically but will become present over the forecast period, these are the demand response to:

- The Clean Energy Bill 2011 – the introduction of a price on carbon in July 2012;
- Distribution network price increases;
- Wholesale gas price increases – as a result of the introduction of a price on carbon (July 2012), the start up of an export industry (2014) and increases in the underlying extraction costs; and
- 6-Star Building Standards – introduced in May 2011, but not accounted for in the historic trend.

In addition to the linear trend, Core combined an income component for households and an economic growth component for commercial / industrial customers. This was done in the form of GHDI for households and GSP for commercial / industrial customers. These measures are appropriate as they are both publicly available from the ABS and geographically relevant to Envestra's VIC network. The following figure displays the model specification used for demand per connection.

Figure 4.1: Model Specification.

$$\text{Log(Demand per Connection}_t) = b_0 + b_1 \times \text{Log(Trend}_t) + b_2 \times \text{Log(Income}_t)$$

Where:

- Demand per Connection is the gas demand per connection for a given year;
- Trend is the year ie. 2005, 2006, 2007 etc.;
- Income is GHDI for Residential and GSP for Commercial/Industrial;
- t is the year of historic data;
- b_0 is the intercept term;
- b_1 is the coefficient on the trend; and
- b_2 is the coefficient on the income factor.

Source: SACES.

The combinations of a trend and GHDI / GSP represent Core's base gas demand forecast. This is then adjusted for the demand response of the factors mentioned previously to produce the final gas demand forecast.

The following summarises Core's methodology for each tariff type, identifying differences in approach between VIC and Albury where appropriate.

4.1. Tariff V Residential Demand

The following section provides a summary of the methodology used in arriving at a forecast for Tariff V Residential Demand. Note that due to inadequate data, and the relatively small size of the Albury network, where the VIC network forecast utilised HIA dwelling starts and GHDI per household, the Albury network forecast excluded those factors, and instead was based on a linear trend derived from weather adjusted historic data.

4.1.1. Methodology

Connections

The methodology adopted to arrive at forecast connections was:

1. Use regression analysis to determine the historical relationship between detached dwelling starts, other dwellings starts and the net change in total connections.
2. Forecast total connections by applying the historical relationship between detached dwelling starts, other dwelling starts and the net change in connections against HIA dwelling starts forecasts.

Demand per Connection

The methodology adopted to arrive at forecast demand per connection was:

1. Normalise total demand for the effects of weather using the methodology discussed in Section 2.
2. Divide total demand by number of connections to determine demand per connection.
3. Use regression analysis to determine the historical relationship between demand per connection, GHDI per household and a trend.

4. Forecast demand per connection by applying the historical relationship between demand per connection, GHDI per household and a trend against SACES forecasts for GHDI and ABS household forecasts.
5. Adjust demand per connection forecasts for factors which are not present in the historical trend, which are the demand response to:
   - The Clean Energy Bill 2011;
   - Distribution network price increases;
   - Wholesale gas price increases; and
   - 6-Star Building Standards.

Forecast Demand

The product of the Connections and Demand per Connection becomes Total Forecast Demand – Tariff V Residential.

4.2. Tariff V Non-Residential Demand

The following section provides a summary of the methodology used in arriving at a forecast for Tariff V Non-Residential Demand. Note that due to inadequate data, and the relatively small size of the Albury network, where the VIC network forecast utilised GSP, the Albury network forecast excluded it, and instead was based on a linear trend derived from weather adjusted historic data.

4.2.1. Methodology

Connections

The methodology adopted to arrive at forecast connections was:

1. Use regression analysis to determine the historical relationship between total connections, GSP and a trend.
2. Forecast total connections by applying the historical relationship between total connections, GSP and a trend against SACES forecasts for GSP.

Demand per Connection

The methodology adopted to arrive at forecast demand per connection was:

1. Normalise total demand for the effects of weather using the methodology discussed in Section 2.
2. Divide total demand by number of connections to determine demand per connection.
3. Use regression analysis to determine the historical relationship between demand per connection, GSP and a trend.
4. Forecast demand per connection by applying the historical relationship between demand per connection, GSP and a trend against SACES forecasts for GSP.
5. Adjust demand per connection forecasts for factors which are not present in the historical trend, which are the demand response to:
   - The Clean Energy Bill 2011;
   - Distribution network price increases; and
   - Wholesale gas price increases.

Forecast Demand

The product of Connections and Demand per Connection becomes Total Forecast Demand – Tariff V Non-Residential.

4.3. Tariff D - Industrial Demand

The following section provides a summary of the methodology used in arriving at a forecast for Tariff D Industrial Demand. Note that due to inadequate data, and the relatively small size of the Albury network, where the VIC network forecast utilised GSP, the Albury network forecast excluded it, and instead was based on a linear trend derived from weather adjusted historic data.

4.3.1. Methodology

Connections

The methodology adopted to arrive at forecast connections was:

1. Use regression analysis to determine the historical relationship between total connections, GSP and a trend.
2. Forecast total connections by applying the historical relationship between total connections, GSP and a trend against SACES forecasts for GSP.

Demand per Connection

The methodology adopted to arrive at forecast demand per connection was:

1. Normalise total demand for the effects of weather using the methodology discussed in Section 2.
2. Divide total demand by number of connections to determine demand per connection.
3. Use regression analysis to determine the historical relationship between demand per connection, GSP and a trend.
4. Forecast demand per connection by applying the historical relationship between demand per connection, GSP and a trend against SACES forecasts for GSP.
5. Adjust demand per connection forecasts for factors not present in the historical trend, which are the demand response to:
   - The Clean Energy Bill 2011;
   - Distribution network price increases; and
   - Wholesale gas price increases.

Forecast Demand

The product of the two becomes Total Forecast Demand – Tariff D Industrial which is then used to determine Forecast MHQ – Tariff D Industrial.

The methodology adopted to arrive at forecast MHQ was:

1. Determine the average historic load factor.
2. Forecast MHQ by applying the average historic load factor against forecast total demand.

4.4. Demand by Tariff Zone

The final stage of forecasting demand involves the allocation of total VIC demand by tariff to each individual tariff zone, including:

- Central;
- North;
- Murray Valley; and
- Bairnsdale.

The data for Albury was used separately to determine the forecast number of connections and demand for the Albury region, by tariff category.

4.4.1. Methodology

Connections

1. Determine the historical allocation of total VIC connections to each individual tariff zone.
2. Forecast connections for each individual tariff zone by applying the historical allocation to total VIC connections by tariff.

Forecast Demand

1. Determine the historical allocation of total VIC demand to each individual tariff zone.
2. Forecast demand for each individual tariff zone by applying the historical allocation to total VIC demand by tariff.

Murray Valley and Bairnsdale

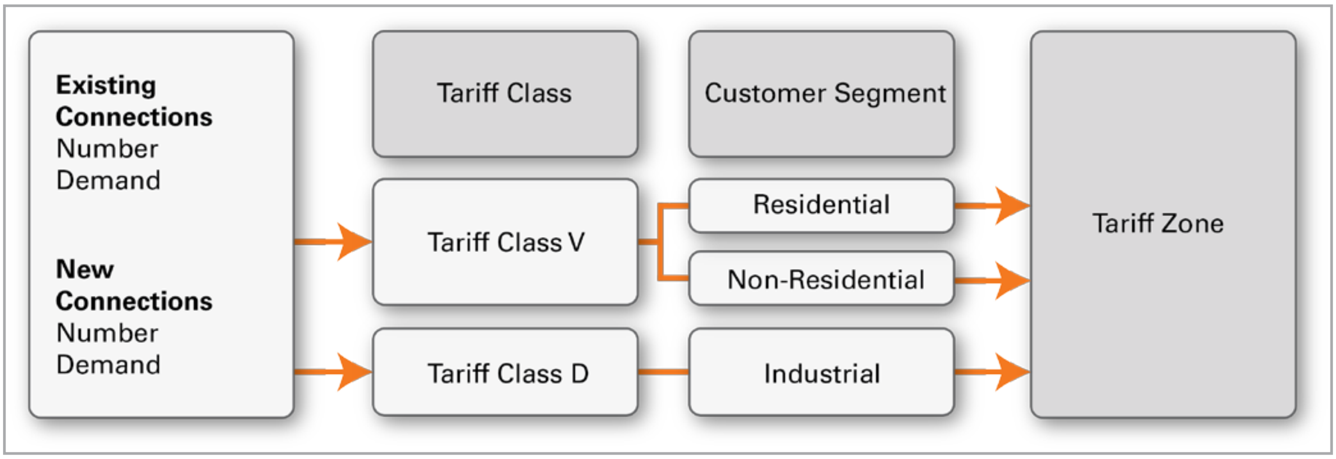
Core notes that due to the unique characteristics of the Murray Valley and Bairnsdale networks, new connections are largely the result of network expansions into already existing buildings, as opposed to newly built buildings, which the total VIC forecast is based upon. In order to account for this, Core has used Envestra projections of network expansion into Murray Valley and Bairnsdale to determine connections rather than the apportionment method described above. Central and North connections are then determined via the apportionment of Total Connections exclusive of Murray Valley and Bairnsdale. Total Demand for Murray Valley and Bairnsdale is determined by multiplying historical demand per connection adjusted for the growth in total VIC demand, by the connections forecast. Central and North demand is then determined via the apportionment of Total Demand exclusive of Murray Valley and Bairnsdale.

4.5. Model Outputs

Core has provided Envestra and made available to the AER, the Excel-based models and all underlying data that has been used to project gas demand and connections.

The model is structured in a way that projected customer numbers and demand will be sorted and filtered in a method similar to that illustrated in Figure 4.2 below.

Figure 4.2: Indicative Model Flow.



Source: Core Energy Group; 2012.

5. Forecast Assumptions

- After normalising historical demand for the effects of weather (Section 2), identifying the key drivers (Section 3) and determining a forecast methodology (Section 4) it was necessary to make a series of assumptions in regards to key drivers to arrive at the total demand forecasts.
- The purpose of this Section of the Report is to summarise the assumptions underpinning the forecast of gas demand and customer numbers.
- Experienced economics research group, SACES, have provided the analysis of the economic environment.
- HIA have provided forecasts of new dwelling starts for the Review Period, based on historic and member data, which is used in projecting new connections for Tariff V Residential.
- Core was required to make determinations of other variables effecting gas demand which:
  - Have not existed in past demand data (namely, retail gas price increases); and
  - Are expected to have a greater effect in the Review Period than has been evident in the past (namely, a step-change in wholesale gas prices due to structural changes occurring during the Review Period).

Core believes that our previous work and experience result in the qualifications required to undertake these determinations.

5.1. Economic Assumptions

5.1.1. Scope

The economic assumptions and statistical analysis input into the gas demand forecasts was provided by SACES, which is a self-funding, joint research unit of the University of Adelaide and the Flinders University of South Australia. SACES provides applied research, analysis and commentary on contemporary economic, social and public policy issues. A curriculum vitae for SACES is available in Attachment 2.

SACES' role in this project has been the review of the model used to produce the forecast connections and demand (based on historical trends in the data and other factors) and provision of certain 'macro' variables which influence demand for natural gas, which were used in the model.

The data series for which SACES produced projections are:

- GSP for VIC; and
- GHDI for VIC.

All of the model results and parameters were checked against historical data ranges and trends, and known underlying trends to ensure that sampling variation, or some other artefact of the underlying data, was not producing anomalous results.

In addition, SACES:

- Assisted Core in locating existing ABS data on appliance penetration for space heating and water heating. In SACES' view, whilst the data was useful for benchmarking the model it had insufficient observations to support projections in appliance penetrations (there are only two years' of data 2005 and 2008);
- Provided Core a summary of existing relevant estimates of the price elasticity of demand for gas for comparison with the modelling of gas demand (noting existing price elasticity will implicitly simultaneously account for relative price elasticities, changes in appliance penetration, and changes in incomes etc); and
- Contributed expert advice towards Core's modelling, statistical analysis and use of SACES projections.

The report from SACES in support of the above is included as Attachment 3.

5.1.2. Outlook - Global (2013 to 2017)

Recent uncertainty concerning sovereign debt repayments and budget sustainabilities has led to concern around global growth prospects in the short- to medium term. September 2011 International Monetary Fund projections have the global economy growing at approximately trend in 2012 (4.0 percent, down from 4.5 percent predicted in June 2011). However, of this growth, three-quarters is expected to come from emerging companies, while growth in the G7 economies is expected to be a modest 1.7 percent.

5.1.3. Outlook - Australia (2013 to 2017)

The Reserve Bank of Australia ("**RBA**") released its Statement on Monetary Policy on 10 February 2011. The statement included Gross Domestic Product ("**GDP**") growth of 2.5 percent for the year to September 2011.

According to the RBA, "*the outlook for mining investment remains very strong, with further announcements of new projects over recent months. In contrast, conditions are more subdued in some other industries, as the high level of the exchange rate, tight credit conditions for some sectors, the decline in public investment and changes in household spending behaviour continue to weigh on activity in the manufacturing, building construction and retail industries. More broadly, measures of consumer and business sentiment are around or a little below long-run average levels, in part reflecting concerns about developments overseas. The unemployment rate has been around 5.25 percent in recent months, after increasing in mid 2011.*"

The RBA further commented that "*over the year to the September quarter, consumer spending grew at an around trend pace and broadly in line with growth in disposable incomes. More recently, the available indicators suggest the pace of consumer spending has moderated, with growth in retail sales volumes and motor vehicle sales slowing in the December quarter. While consumer confidence has recovered somewhat following the sharp decline in mid 2011, it remains below its long-run average.*"

In relation to household incomes, the RBA stated that "*real household disposable income increased by 2.1 percent in the September quarter to be 4.5 percent higher over the year, with nominal incomes almost 7 percent higher over the year. Households have continued to devote a significant portion of their income to rebuilding assets and paying down debt – the household saving ratio has been around 10 percent over the past three years and well above levels recorded in the 1990s and early 2000s.*"

In terms of new dwellings, the RBA said "*growth in dwelling stock has been soft in most of Australia, with Victoria the exception, reflecting significant apartment building over the past year. While private residential building approvals remain around 14 percent below their decade average.*"

5.1.4. GHDI Forecast - VIC

Increasing residential gas use is driven by higher disposable incomes which allow for the purchase and greater use of gas appliances by households. An appropriate proxy for household incomes is VIC GHDI, as it is publicly-available from the ABS and geographically relevant to Envestra's VIC network.

Table 5.1: GHDI Forecast.

Economic Assumption	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
Gross Household Disposable Income (nominal AUDm) - VIC	222,742	234,647	250,681	266,029	283,144	300,912	319,986	340,152

Source: SACES.

5.1.5. GSP Forecast - VIC

Increasing commercial/industrial gas use is driven by economic growth. As the demand for goods and services within an economy increase, so do the gas requirements of the commercial/industrial users which provide those goods and services. An appropriate proxy for economic growth is VIC GSP, as it is publicly-available from the ABS and geographically relevant to Envestra's VIC network.

Table 5.2: GSP Forecast.

Economic Assumption	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18
Gross State Product (real AUDm) - VIC	301,005	308,044	316,735	325,413	334,174	343,252	352,672	362,354

Source: SACES.

5.1.6. HIA Building Forecast - VIC

The HIA is Australia's largest residential building organisation and provides an independent and reliable source for building start forecasts. The segregation of HIA forecasts by state also provides a forecast which is geographically relevant to Envestra's VIC network.

Table 5.3: HIA Building Forecast – VIC.

Economic Assumption	2011	2012	2013	2014	2015	2016	2017
Dwelling Starts - Detached	32,181	29,801	28,463	27,445	26,908	27,672	27,748
Dwelling Starts - Other	21,647	16,136	18,017	17,745	17,099	16,862	16,470
Total Dwelling Starts	40,287	39,375	40,225	41,456	46,030	59,476	40,287

Source: HIA.

5.2. Policy-Related Factors

There are numerous State and Federal Government policies which impact, or are likely to impact distributed gas demand. These policies were discussed in detail in Section 3. The majority of these policies have been in place over the last review period and are projected to continue into the 2013 to 2017 period. Core analysis indicates that the policy environment that has existed over the past seven years and that is projected to continue, is a key driver of the underlying decline in average consumption that Envestra has experienced. However, the introduction of the Government's Clean Energy Bill 2011 and 6-Star Building Standards are two new policies which have not existed historically. Envestra's customers will for the first time face a price on carbon, which Core has modelled as a price input into the projected retail gas price, while those customers building new homes, will experience lower gas heating requirements compared to existing homes.

5.2.1. 6-Star Building Standards

As discussed in Section 3, Core expects that the introduction of a 6-Star building standard will result in increases in efficiency and a decline in energy use. The following table provides estimates of the reduction in gas demand for VIC of new dwellings resulting from an increase to a 6-Star building standard in VIC.

Table 5.4: Impact of 6-Star Building Standard on the Gas Demand of New Dwellings in VIC.

Retail Gas Price Component	Reduction in Demand
House	6.561 GJ
Townhouse	2.728 GJ
Flat	2.613 GJ

Source: The Australian Building Code Board; Final Regulation Impact Statement for residential buildings (class 1, 2, 4 and 10 buildings); December 2009.

In regards to the Albury network, the Australian Building Code Board ("**ABCB**") published a Final Regulation Impact Statement in December 2009, which identified a 12 percent reduction in gas demand from shifting to a 6-Star standard in NSW[10]. Core has applied this 12 percent reduction to weather normalised 2010 demand per connection to determine the impact on gas demand in Albury.

Table 5.5: Impact of 6-Star Building Standard on the Gas Demand of New Dwellings in Albury.

Retail Gas Price Component	Reduction in Demand
House	5.299 GJ

Source: Core Energy Group 2012.

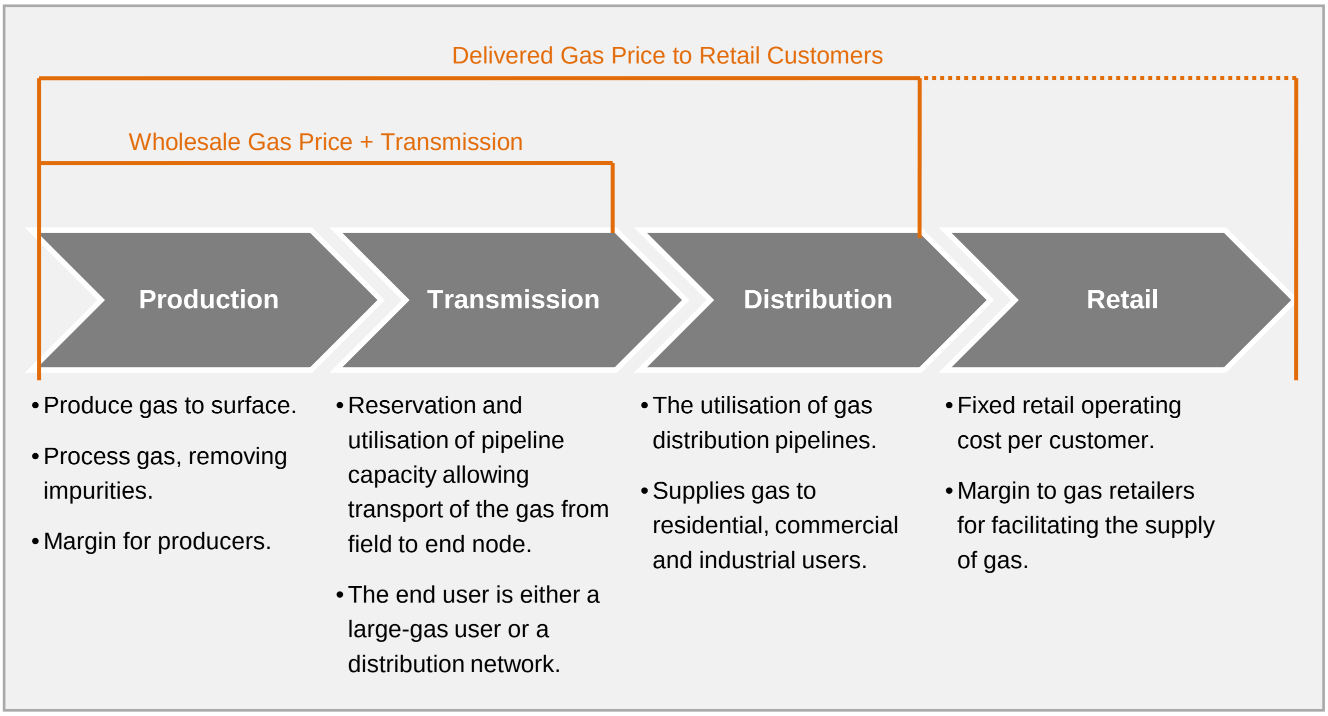
5.3. Changes in Retail Gas Prices

Changes in retail gas price are expected to result in a decrease in gas demand as consumers move to minimise costs at a rate equal to the price elasticity of gas demand. In order to demonstrate this Core has projected changes in retail gas price, discussed further below, and combined these projections with the projected price elasticity of gas demand for each Tariff (see Section 5.4).

The price paid by retail customers is made up of numerous components which are defined graphically in Figure 5.1.

[10] ABCB Final Regulation Impact Statement for Decision – Proposal to Revise the Energy Efficiency Requirements of the Building Code of Australia for Residential Buildings; December 2009; Table 6.2.

Figure 5.1: Delivered Price Components – Gas.



Source: Core Energy Group; 2012.

Table 5.6 provides Core estimates of the weighting of the components that make up retail gas prices for each tariff class in VIC. For the purposes of determining a weighting, wholesale and transmission costs are based on market contract rates, distribution costs are based on ENV tariff schedules and Retail costs are based on a fixed component per customer, as well as an operating margin. The average gas demand of each tariff class is then applied to the factors above to determine the indicative cost per GJ for each component. This is then used to determine a weighting.

The data indicates that increasing volumes cause the price components to be increasingly weighted towards the wholesale gas price. This is due to the fixed cost nature of distribution and the retail operating cost per customer, which gain significant economies of scale on a per GJ delivered basis as volumes increase.

Table 5.6: Retail Gas Price Components for VIC.

Retail Gas Price Components	Tariff V – Residential	Tariff V – Non Residential	Tariff D – Industrial
Wholesale + Transmission	45%	60%	90%
Distribution	35%	30%	5%
Retail	20%	10%	5%
Total Retail Gas Cost	**100%**	**100%**	**100%**

Source: Core Energy Group; 2012.

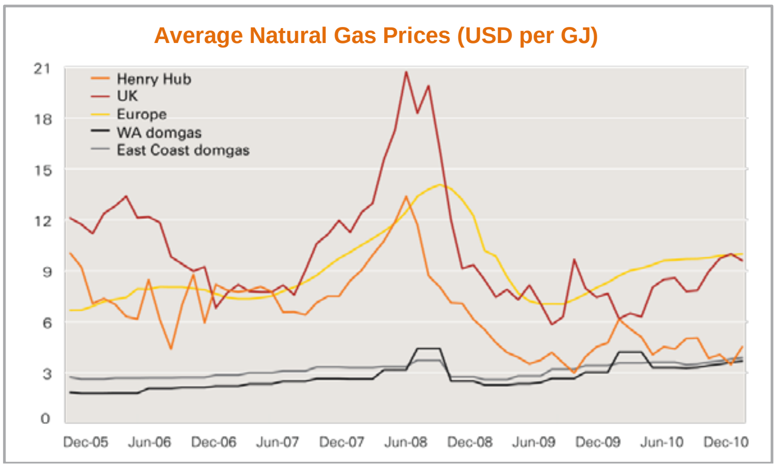
Over the 2013 to 2017 period Core expects to see price movement in each element that makes up retail gas price. This is expected to result in a step change in gas price and a resultant decrease in demand. Each component of the gas price increase is discussed in further detail in the following sections.

5.3.1. Wholesale Gas Price

It should be noted that this Section of the Report deals with increases in wholesale gas price, that is the price that gas producers sell gas ex-field. It does not consider any increases in transmission costs.

Australia has long enjoyed amongst the lowest energy costs in the world.

Figure 5.2: Global Gas Prices 2006 to 2010.



Source: Presented by Core Energy Group with data from the Government of Western Australia, Department of Mines and Petroleum; Western Australian Mineral and Petroleum Statistics Digest; 2010.

The interconnected nature of the eastern market dictates that demand, supply, cost and price factors must be analysed for the entire market in order to arrive at a view of prices in one specific supply hub or demand centre such as VIC. Specifically, a number of structural changes to the eastern Australian gas markets are known to be occurring during the Review Period, including:

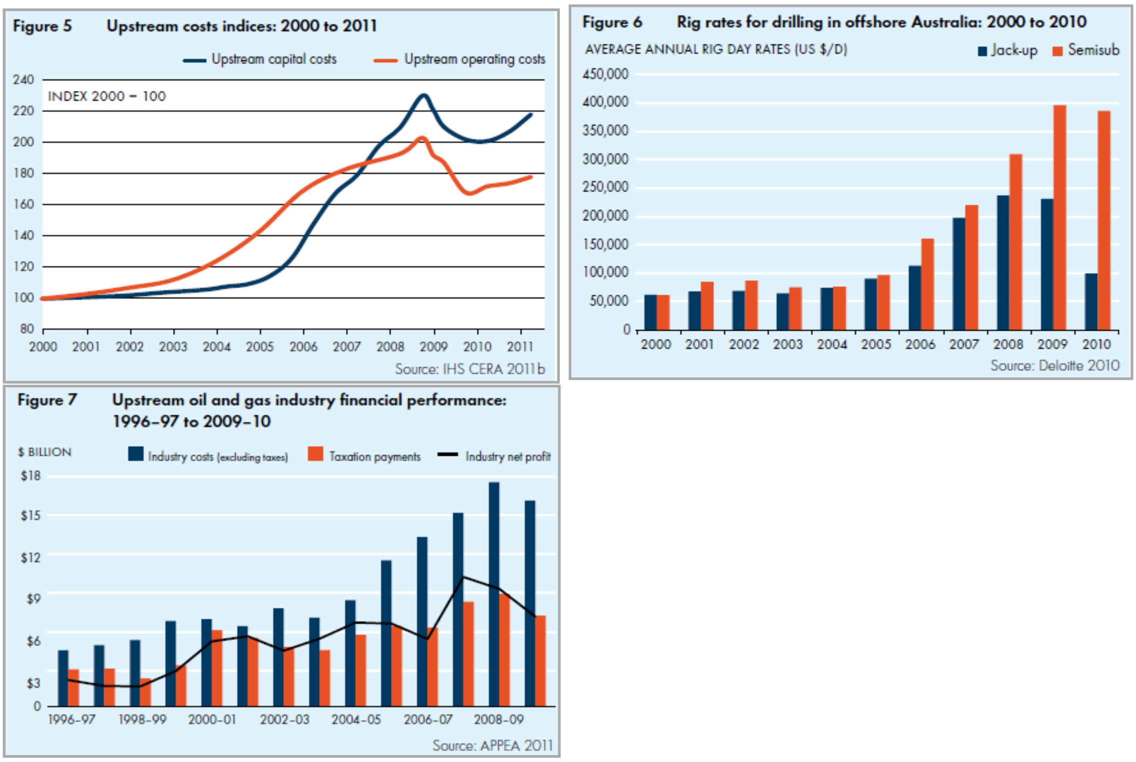
1. **Increases in production costs**: as a result of the decline of conventional gas reserves and increased supply required from other higher-cost unconventional reserves (for example Coal Seam Gas ("**CSG**") and Shale Gas) as well as skills shortages and increased cost of materials.
   - Increasing gas source complexity.
     - As with most energy sources, the easiest (and therefore cheapest) gas sources have been identified and extracted prior to the more complex gas sources. These sources are now depleting or fully contracted resulting in increased penetration from unconventional sources.
     - For example, over the past ten years CSG production has increased from less than 5 PJ per annum to more than 220 PJ per annum (in 2010) (APPEA; State of the Industry 2011 Report.).
     - The more complex the gas source, the more difficult the gas is to extract. For example facture stimulation and increased well depth are just some of the technological elements that are required to extract some of these gas deposits.
     - The more complex the environment, the higher the extraction cost is.
     - Additionally, ex-field costs are expected to increase as a result of the implementation of a price on carbon, changes to the tax system and environmental concerns and considerations.
   - Skills shortages and increasing costs of materials.
     - According to the Australian Petroleum Production and Exploration Association ("**APPEA**") State of the Industry 2011 Report:

       "Skills shortages, rising material costs and declining labour productivity also pose major challenges to the projects now under development and being planned. Surveys of employers in the resources and constructions sectors by the RMIT University have identified a large deterioration in labour productivity in those sectors over the past two

years. This has been due to several factors, including an inability to negotiate productivity improvements in exchange for wage increases, a decline in the ability of employers to engage directly with their workforce, low levels of workplace flexibility and difficulties encountered in the enterprise bargaining process."

> Furthermore, APPEA presented the following graphics relating to industry cost increases:

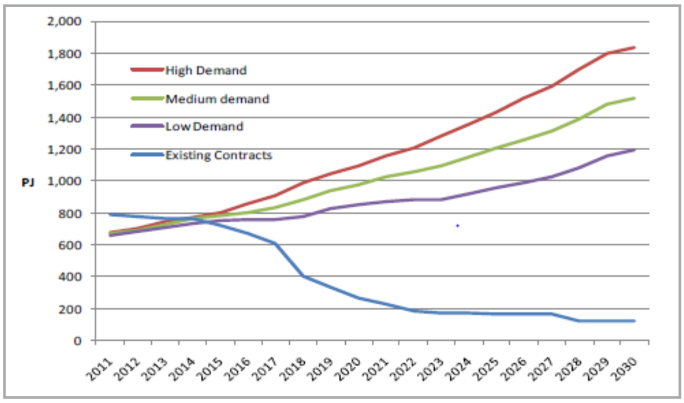
Figure 5.3: Industry Cost Increases.



Source: APPEA; State of the Industry 2011.

2. **Maturation of a number of long-term gas supply contracts between gas producers and retailers:** resulting in an increasing proportion of gas being supplied from new, and therefore higher cost (as described above) gas sources.
   - Core's databases, and other publicly available sources, indicated that historically, and currently, the eastern Australian gas market is supplied by long-term gas contracts. As such the price is set by these long term contracts.
   - These contracts are expected to conclude over the 2014 to 2017 period, resulting in an increased volume of supply from higher cost sources, as described above.

Figure 5.4: Eastern Australian Gas Contracts versus Gas Demand.



Source: SKM MMA; Annual Gas Market Review; 2011.

3. **An increase in the number of gas price reviews**: which may result in increases in contract price beyond natural escalation.
   - As shown above, a portion of the eastern Australian market will continue to be supplied by current contracts of the Review Period. As such, the wholesale gas price will be related to the contract price, which generally increases each year based on a Consumer Price Index ("**CPI**") related formula.
   - Outside of CPI related increases, the only way for contract price to increase is via a Price Review process, which can be called approximately every three years.
   - Core expects to see an increased number of Price Reviews called over the Review Period and as such Core's analysis indicates that we will likely see an increase in gas contract price beyond CPI.
4. **The commencement of a Liquefied Natural Gas ("LNG") export market on the east coast:** which is generally a high-value, oil-linked commodity.
   - As a result of LNG generally being a high value commodity, it presents a high value market for domestic gas players to try and access. As such producers are likely to try and achieve a higher price form domestic gas, as compensation for not selling gas into a LNG market.
   - Additionally the LNG industry will utilise large volumes of gas resources, likely decreasing supply competition and removing / lowering any downward pressure on gas prices.

These changes are consistent with the increase in gas prices seen in Western Australia over the previous six years.

Separately to this project, Core has projected increases in VIC wholesale gas prices to be approximately 19 percent over the 2013-2017 period. Core is aware of numerous other publicly released estimates of gas prices. Projected prices changes on percentage terms are summarised in Table 5.7, source documents associated with these third party documents are provided in Attachment 5 to this Report whilst a summary of key assumptions / details follows:

- Core Energy Group forecasts are based on a February 2012 Report entitled "Price Pathways". The price presented in Table 5.7 is a Reference Scenario, weighted average new and contracted supply) price delivered Melbourne (note Core did not project any increases outside of natural escalation in Pipeline costs, therefore all growth is attributable to the wholesale gas price.
- In January 2012, ACIL Tasman release a report for the Australian Energy Market Operator entitled Draft Fuel Costs Projections. The scope for this work covers fuel cost projections for natural gas; brown coal and bituminous (black) coal spanning the period 2012-13 to 2031-32. Fuel costs are provided for new entrants on a financial year basis in real 2012-13 dollars for various Scenarios. Note: Original data was in financial year, which Core has converted to calendar year for the purposes of this Report. Additionally, data was only available from the 2013 financial year.
- In the Australian Treasury's Strong Growth Low Pollution Future Report (July 2011) projections for non- National Electricity Market ("**NEM**") domestic gas prices were provided. Note: Original data was in financial year, which Core has converted to calendar year (by taking the average of two years) for the purposes of this Report.
- In September 2011 the Queensland Government released its Annual Gas Market Review ("**GMR**") completed by SKM and MMA. This Report provided three average gas contract price scenarios for the southern Australian states in aggregate. Note: In the GMR report the following statement was made with reference to gas prices: "*Current market price expectations and behaviour indicate the High scenario is likely to eventuate*.",

Table 5.7: Wholesale Gas Price Percentage Growth per Annum (Real) 2011 - 2017.

	2011	2012	2013	2014	2015	2016	2017	Total
Core Energy Group VIC Price – Reference	0%	0%	0%	1%	12%	1%	4%	**19%**
ACIL Tasman Melbourne – Scenario 1				3%	3%	3%	4%	**14%**
ACIL Tasman Melbourne – Scenario 2				5%	6%	6%	6%	**25%**
ACIL Tasman Melbourne – Scenario 3				4%	5%	5%	6%	**21%**
ACIL Tasman Melbourne – Scenario 4				4%	4%	5%	6%	**21%**
ACIL Tasman Melbourne – Scenario 5				5%	6%	7%	8%	**30%**
Australian Treasury – Non NEM Prices	0%	0%	1%	2%	3%	4%	4%	**15%**
GMR Southern States Average Contract Price – Low			-2%	1%	5%	2%	4%	**11%**
GMR Southern States Average Contract Price – Reference			-2%	0%	1%	2%	3%	**5%**
GMR Southern States Average Contract Price – High			-2%	0%	0%	1%	1%	**1%**

Source: Core Energy Group; 2012.
Note: ACIL data not available for the 2011, 2012 and 2013 years and GMR data not available in the 2011 and 2012 years.

As illustrated in Table 5.7, there is a high degree of variation in projected wholesale gas prices. Looking at the Reference / Most Likely scenarios alone (Scenario 3 for ACIL and High for the GMR) the range is 11 percent (GMR) to 21 percent (ACIL). Although Core remains of the opinion that its gas price projections are the most robust and accurate, for the purposes of this project, Core see's merit in relying upon an independent Government source – in this case the Treasury, for which forecast gas price increases are in the middle of the two extremes (see orange highlight in Table 5.7).

5.3.2. Carbon Price Impact on Retail Prices

The introduction of the Clean Energy Bill 2011 into law prescribes a cost of carbon in emissions at AUD 23 per tonne. In the case of the gas industry, the carbon emission cost obligations will be paid by gas retailers, and passed onto gas customers. According to Treasury calculations, the average household will pay an extra 9 percent or AUD1.50 per week by 2012-13 and an extra 11 percent or AUD1.80 per week by 2015-16 on top of their current gas bill as a result of a carbon price.

Table 5.8: Carbon Price Effect on Weekly Household Expenditure and Consumer Prices.

	In 2012-13		By 2015-16	
	AUD23 per tonne Carbon Dioxide Equivalent (“CO_2-e”)		AUD29 per tonne CO_2-e	
	AUD per Week	Percent	AUD per Week	Percent
Electricity	3.30	10	4.20	11
Gas	1.50	9	1.80	11
Food	0.80	< 0.5	1.10	< 1
Overall Effect	9.90	0.7	13.40	0.9

Source: Australian Treasury Strong Growth, Low Pollution - Modelling a Carbon Price; July 2011.
Note: Dollar per week impact is the average across households, not the impact on an average household. Effects on weekly expenditure are in 2012-13 dollars.

Since the wholesale gas component represents a higher proportion of retail gas prices for commercial / industrial customers, the effect on these customers will be even more severe than the estimation provided above.

5.3.3. Network Components

Envestra's network price changes are presented in Table 5.9. In determining the network price change, Core provided ENV with a demand forecast excluding the effect of network charges. This forecast was then used in ENV's tariff model to determine X-Factor (network price change) estimates for the 2013 to 2017 regulatory period, which are presented below.

Table 5.9: Industrial Retail Gas Price Impact.

Network Price Change	2013	2014	2015	2016	2017
Network Price Change VIC	13.47%	11.37%	6.37%	6.37%	6.37%
Network Price Change Albury	8.30%	6.20%	1.20%	1.20%	1.20%

Source: Envestra Limited.

The .final forecasts presented in Section 6 are inclusive of these network price increases.

5.3.4. Retail Gas Prices

As shown in Figure 5.1, the total Retail gas price consists of wholesale gas price, network charges and retail costs and margin.

- Core has calculated the expected increase in wholesale gas price, as modelled by Treasury, in Section 5.3.1.
- Treasury has projected the expected impact of the introduction of a price of carbon on retail prices, this was defined further in Section 5.3.2.
- Envestra has provided Core with estimates of increases in network charges in Section 5.3.3.

The above components give rise to a 32.6, 36.1 and 36.6 percent rise in retail gas prices for VIC Residential, Commercial and Industrial customers, respectively, over the 2013 to 2017 forecast period. For Albury, the components give rise to 23.5, 28.4, 34.7 percent rise in retail gas prices for Residential, Commercial and Industrial customers, respectively, over the 2013 to 2017 forecast period. This is presented in the following tables which summarise the real impact that each factor is expected to have on total VIC and total Albury retail gas costs by customer type.

Table 5.10: VIC Residential Retail Gas Price Impact.

Impact Retail Gas Price	2013	2014	2015	2016	2017
Carbon price impact	9.00%	0.66%	0.66%	0.66%	0.00%
Network charge increase	4.71%	3.98%	2.23%	2.23%	2.23%
Wholesale price increase	0.47%	0.93%	1.36%	1.76%	1.70%
Total Retail Gas Price Impact	**14.18%**	**5.57%**	**4.25%**	**4.66%**	**3.93%**

Source: Core Energy Group; 2012.

Table 5.11: VIC Commercial Retail Gas Price Impact.

Impact Retail Gas Price	2013	2014	2015	2016	2017
Wholesale gas price	12.00%	0.88%	0.88%	0.88%	0.00%
Network charges	4.04%	3.41%	1.91%	1.91%	1.91%
Carbon cost	0.63%	1.24%	1.82%	2.35%	2.26%
Total Retail Gas Price Impact	**16.67%**	**5.53%**	**4.61%**	**5.15%**	**4.18%**

Source: Core Energy Group; 2012.

Table 5.12: VIC Industrial Retail Gas Price Impact.

Impact Retail Gas Price	2013	2014	2015	2016	2017
Wholesale gas price	18.00%	1.32%	1.32%	1.32%	0.00%
Network charges	0.67%	0.57%	0.32%	0.32%	0.32%
Carbon cost	0.94%	1.86%	2.73%	3.53%	3.40%
Total Retail Gas Price Impact	**19.61%**	**3.74%**	**4.37%**	**5.17%**	**3.72%**

Source: Core Energy Group; 2012.

Table 5.13: Albury Residential Retail Gas Price Impact.

Impact Retail Gas Price	2013	2014	2015	2016	2017
Carbon price impact	9.00%	0.66%	0.66%	0.66%	0.00%
Network charge increase	2.90%	2.17%	0.42%	0.42%	0.42%
Wholesale price increase	0.47%	0.93%	1.36%	1.76%	1.70%
Total Retail Gas Price Impact	**12.37%**	**3.76%**	**2.44%**	**2.85%**	**2.12%**

Source: Core Energy Group; 2012.

Table 5.14: Albury Commercial Retail Gas Price Impact.

Impact Retail Gas Price	2013	2014	2015	2016	2017
Wholesale gas price	12.00%	0.88%	0.88%	0.88%	0.00%
Network charges	2.49%	1.86%	0.36%	0.36%	0.36%
Carbon cost	0.63%	1.24%	1.82%	2.35%	2.26%
Total Retail Gas Price Impact	**15.11%**	**3.98%**	**3.06%**	**3.59%**	**2.63%**

Source: Core Energy Group; 2012.

Table 5.15: Albury Industrial Retail Gas Price Impact.

Impact Retail Gas Price	2013	2014	2015	2016	2017
Wholesale gas price	18.00%	1.32%	1.32%	1.32%	0.00%
Network charges	0.15%	0.11%	0.02%	0.02%	0.02%
Carbon cost	0.94%	1.86%	2.73%	3.53%	3.40%
Total Retail Gas Price Impact	**19.08%**	**3.28%**	**4.07%**	**4.87%**	**3.42%**

Source: Core Energy Group; 2012.

5.4. Price Elasticity

In order to quantify the demand response to an increase in retail gas prices, Core sought to determine the price elasticity of gas demand for Envestra's VIC and Albury networks. This involved a literature review of past access arrangements and empirical studies, as well as the calculation of Core's own price elasticity estimate. The final price elasticity used is a long-term price elasticity which was confirmed through a literature review and Core calculations.

The following describes the conclusions drawn in regards to the price elasticity of Envestra's VIC and Albury networks.

5.4.1. Long-Term Price Elasticity

Core's final model for the gas demand forecast has adopted a long-term price elasticity consistent with Envestra's previous regulatory submission for South Australia, which was accepted by the AER[11]. This elasticity falls within an accepted range shown in '*Table 10.3, p103 of the AER Final Decision'*. A comparison between the long-term price elasticity estimates of -0.30, -0.35 and -0.35 for Residential, Non-Residential and Industrial tariffs to Core's short-term price elasticity estimates (refer to Section 4.4.2) of -0.27, -0.27 and -0.27 shows that this approach is reasonable.

The following tables summarise the price elasticity of gas demand used for each tariff segment in the final model.

Table 5.16: Price Elasticity Tariff V Residential.

Period	Elasticity (%)
Long-run price elasticity	-0.30

Source: AER; Final Decision Envestra Limited Access Arrangement Proposal For The SA Gas Network 1 July 2011 – 30 June 2016.

Table 5.17: Price Elasticity Tariff V Non-Residential.

Period	Elasticity (%)
Long-run price elasticity	-0.35

Source: AER; Final Decision Envestra Limited Access Arrangement Proposal For The SA Gas Network 1 July 2011 – 30 June 2016.

Table 5.18: Price Elasticity Tariff D Industrial.

Period	Elasticity (%)
Long-run price elasticity	-0.35

Source: AER; Final Decision Envestra Limited Access Arrangement Proposal For The SA Gas Network 1 July 2011 – 30 June 2016.

5.4.2. Short-Term Price Elasticity

For purposes of cross-checking the long-run price elasticity estimates suggested by a literature review, Core conducted a short-run price elasticity analysis. The specification used in determining short-run price elasticity follows.

$$\text{Log(Demand per Connection}_t) = b_0 + b_1 \times \text{Log(Price}_t)$$

Where:

- Demand per Connection is the gas demand per connection for a given year;
- Price is the typical gas bill in real terms as provided by the Essential Services Commission ("**ESC**") for a VIC household consuming 60 GJ per year for residential and for a VIC small business consuming 500 GJ per year for non-residential;
- t is the year of historic data;
- b_0 is the intercept term; and
- b_1 is the price elasticity coefficient.

Core's short-run price elasticity based on the above specification for each individual tariff category is summarised in Table 5.19 below. Note that the final model did not utilise short-run price elasticity as an input, instead it was used as a cross-check to confirm the reasonableness of long-term price elasticity estimates obtained through literature review.

[11] Refer to p.103 of Final Decision Envestra Limited Access Arrangement Proposal For The SA Gas Network 1 July 2011 – 30 June 2016, AER, June 2011

Table 5.19: Short-Run Price Elasticity.

Tariff	Short-Run Price Elasticity (%)
Tariff V Residential	-0.2738
Tariff V Non-Residential	-0.2727
Tariff D Industrial*	-0.2727

Source: Core Energy Group; 2012.
* Due to the lack of price data for industrial gas users, Tariff D Industrial price elasticity is assumed to be the same as Tariff V Non-Residential.

6. Demand and Customer Forecasts

- The purpose of this Section of the Report is to summarise modelling output. That is:
  - > Gas demand by class and region; and
  - > Connections by class and region.
- SACES peer reviewed the Core statistical techniques used, the data sets selected and the final structure of the modelling.

6.1. Tariff V Residential

Core sets out below the results of the forecast based on the methodology and data summarised in this report. The model which produces this output has been provided to the AER with complete transparency.

The forecast demonstrates a continuation of the historical trend decline in weather adjusted demand per connection (refer to Section 2.) with the future effect of a carbon price, network price increases, wholesale gas price increases and a 6-Star Building Standard further exacerbating this trend decline. Increasing total connections due to population growth provide an offsetting factor, however this is insufficient at withholding a net decrease in total gas demand of CAGR -0.9 percent for VIC and -0.1 percent for Albury from 2013 to 2017.

Table 6.1: Forecast Connections – Tariff V Residential.

Tariff V Residential Customers	2013	2014	2015	2016	2017
VIC – Central	488,218	498,313	508,302	518,373	528,430
VIC – North	68,118	69,527	70,921	72,326	73,729
VIC – Murray Valley	6,687	7,017	7,347	7,677	8,007
VIC – Bairnsdale	2,969	3,359	3,749	4,139	4,529
VIC – Total Tariff V Residential	565,992	578,216	590,319	602,515	614,695
Albury	19,746	20,068	20,394	20,726	21,064

Source: Core Energy Group; 2012.

Table 6.2: Forecast Demand per Connection – Tariff V Residential.

Tariff V Residential Demand (GJ)	2013	2014	2015	2016	2017
VIC – Central	49	47	46	45	44
VIC – North	45	44	43	41	40
VIC – Murray Valley	35	34	33	32	31
VIC – Bairnsdale	27	26	25	24	24
VIC – Total Tariff V Residential	48	47	45	44	43
Albury	43	42	41	41	40

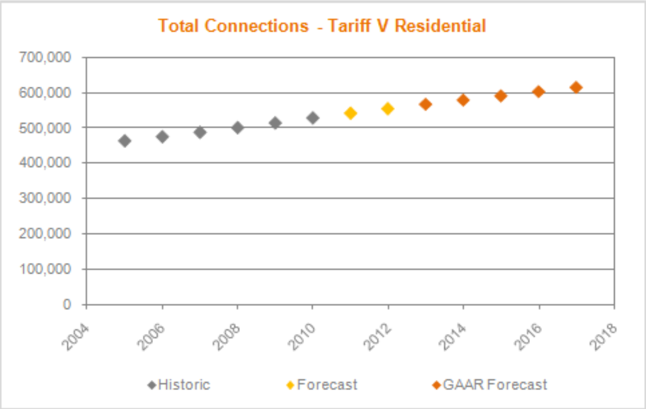
Source: Core Energy Group; 2012.

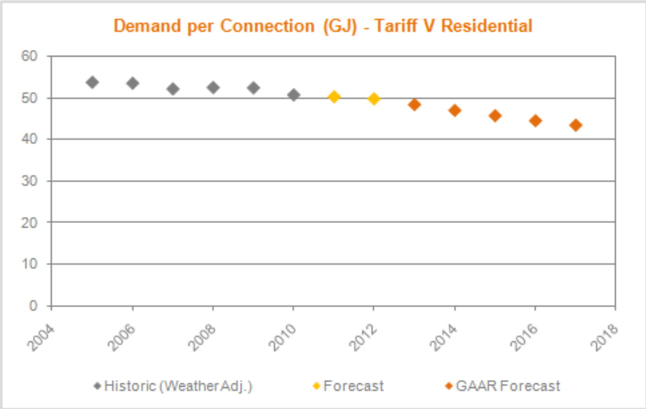
Table 6.3: Forecast Total Demand – Tariff V Residential.

Tariff V Residential Demand (GJ)	2013	2014	2015	2016	2017
VIC – Central	23,880,505	23,627,090	23,397,968	23,177,695	23,007,647
VIC – North	3,082,163	3,049,456	3,019,884	2,991,454	2,969,507
VIC – Murray Valley	233,595	237,525	241,363	244,897	248,647
VIC – Bairnsdale	79,165	86,788	94,009	100,781	107,352
VIC – Total Tariff V Residential	27,275,428	27,000,859	26,753,223	26,514,827	26,333,153
Albury	849,445	846,532	845,677	845,768	848,110

Source: Core Energy Group; 2012.

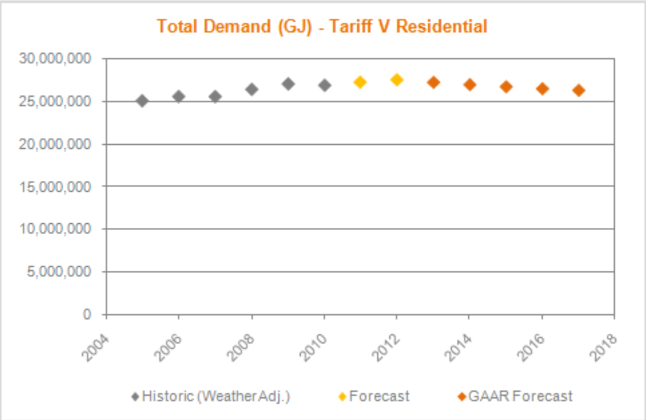
Figure 6.1: VIC Total Connections and Demand per Connection Tariff V Residential.





Source: Core Energy Group; 2012.

Figure 6.2: VIC Total Demand Tariff V Residential.



Source: Core Energy Group; 2012.

6.2. Tariff V Non-Residential

Core sets out below the results of the forecast based on the methodology and data summarised in this report. The model which produces this output has been provided to the AER with complete transparency.

The forecast demonstrates a continuation of the historical trend decline in weather adjusted demand per connection (refer to Section 2.) with the future effect of a carbon price, network price increases and wholesale gas price increases further exacerbating this trend decline. Increasing total connections due to improvements in the economy provide an offsetting factor, however this is insufficient at withholding a net decrease in total gas demand of CAGR -2.2 percent for VIC and -2.1 percent for Albury from 2013 to 2017.

Table 6.4: Forecast Connections – Tariff V Non-Residential.

Tariff V Non-Residential Customers	2013	2014	2015	2016	2017
VIC – Central	19,545	19,700	19,856	20,016	20,179
VIC – North	3,243	3,269	3,295	3,321	3,349
VIC – Murray Valley	308	312	316	320	324
VIC – Bairnsdale	68	73	78	83	88
VIC – Total Tariff V Non-Residential	23,164	23,355	23,545	23,740	23,940
Albury	891	894	897	899	902

Source: Core Energy Group;2012.

Table 6.5: Forecast Demand per Connection –Tariff V Non-Residential.

Tariff V Non-Residential Demand (GJ)	2013	2014	2015	2016	2017
VIC – Central	299	288	278	271	264
VIC – North	232	224	216	210	205
VIC – Murray Valley	169	163	158	154	150
VIC – Bairnsdale	1,016	979	947	921	899
VIC – Total Tariff V Non-Residential	290	279	270	263	257
Albury	282	273	266	261	256

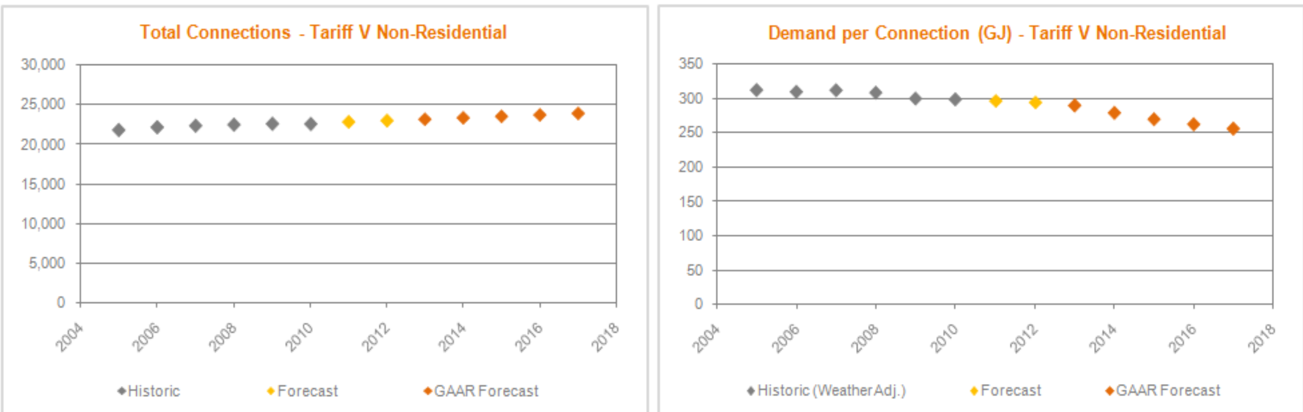
Source: Core Energy Group; 2012.

Table 6.6: Forecast Total Demand –Tariff V Non-Residential.

Tariff V Non-Residential Demand (GJ)	2013	2014	2015	2016	2017
VIC – Central	5,842,383	5,671,937	5,524,866	5,418,563	5,328,199
VIC – North	752,907	730,941	711,988	698,289	686,644
VIC – Murray Valley	52,208	50,960	49,903	49,188	48,597
VIC – Bairnsdale	69,093	71,475	73,841	76,480	79,126
VIC – Total Tariff V Non-Residential	6,716,590	6,525,313	6,360,599	6,242,520	6,142,565
Albury	251,032	243,987	238,317	234,359	231,037

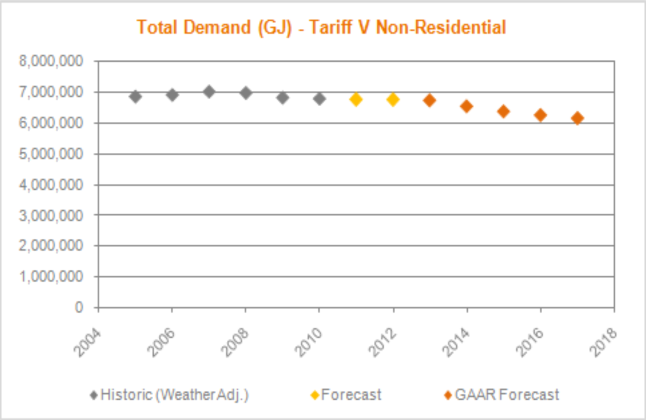
Source: Core Energy Group; 2012.

Figure 6.3: VIC Total Connections and Demand per Connection Tariff V Non-Residential.



Source: Core Energy Group; 2012.

Figure 6.4: VIC Total Demand Tariff V Non-Residential.



Source: Core Energy Group; 2012.

6.3. Tariff D Industrial

Core sets out below the results of the forecast based on the methodology and data summarised in this report. The model which produces this output has been provided to the AER with complete transparency.

The forecast demonstrates a continuation of the historical trend decline in weather adjusted demand per connection (refer to Section 2.) whilst the future effect of a carbon price, network price increases and wholesale gas price increases further exacerbating this trend decline. Increasing total connections due to improvements in the economy provide an offsetting factor, however this is insufficient at withholding a net decrease in total gas demand of CAGR -4.0 percent for VIC and -4.4 percent for Albury from 2013 to 2017.

Table 6.7: Forecast Connections – Tariff D.

Tariff D Industrial Customers	2013	2014	2015	2016	2017
VIC – Central	179	181	183	184	186
VIC – North	50	50	51	51	52
VIC – Murray Valley	4	4	4	4	4
VIC – Bairnsdale	2	2	2	2	2
VIC – Total Tariff D Industrial	235	237	239	242	244
Albury	8	7	7	7	7

Source: Core Energy Group; 2012.

Table 6.8: Forecast Demand per Connection (GJ) – Tariff D.

Tariff D Industrial Demand (GJ)	2013	2014	2015	2016	2017
VIC – Central	86,291	81,160	76,936	73,479	70,323
VIC – North	92,449	86,952	82,426	78,723	75,342
VIC – Murray Valley	93,920	93,920	93,920	93,920	93,920
VIC – Bairnsdale	53,772	53,772	53,772	53,772	53,772
VIC – Total Tariff D Industrial	87,451	82,374	78,192	74,768	71,640
Albury	225,111	216,646	210,146	205,254	200,840

Source: Core Energy Group; 2012.

Table 6.9: Forecast Demand per Connection (MHQ) – Tariff D.

Tariff D Industrial Demand (MHQ)	2013	2014	2015	2016	2017
VIC – Central	24	23	22	21	20
VIC – North	32	31	29	28	27
VIC – Murray Valley	23	23	23	23	23
VIC – Bairnsdale	8	8	8	8	8
VIC – Total Tariff D Industrial	26	24	23	22	21
Albury	57	54	53	52	50

Source: Core Energy Group; 2012.

Table 6.10: Forecast Demand – Tariff D.

Tariff D Industrial Demand (GJ)	2013	2014	2015	2016	2017
VIC – Central	15,459,080	14,680,121	14,048,992	13,548,913	13,095,105
VIC – North	4,611,097	4,378,751	4,190,499	4,041,337	3,905,976
VIC – Murray Valley	375,679	375,679	375,679	375,679	375,679
VIC – Bairnsdale	107,544	107,544	107,544	107,544	107,544
VIC – Total Tariff D Industrial	20,553,400	19,542,095	18,722,715	18,073,473	17,484,304
Albury	1,711,500	1,619,432	1,544,413	1,483,075	1,426,768

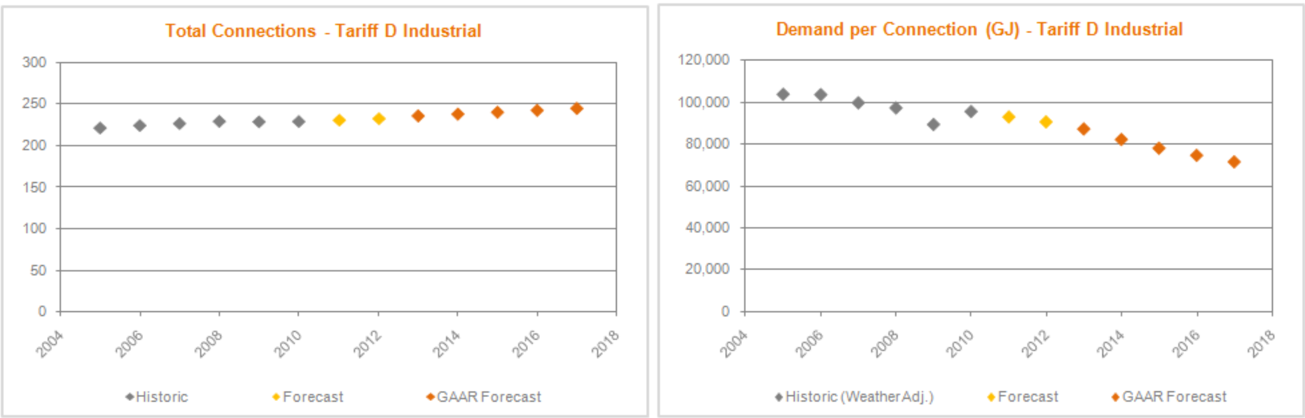
Source: Core Energy Group; 2012.

Table 6.11: Forecast Demand (MHQ).

Tariff D Industrial Demand (MHQ)	2013	2014	2015	2016	2017
VIC – Central	4,382	4,163	3,985	3,844	3,716
VIC – North	1,621	1,540	1,474	1,422	1,375
VIC – Murray Valley	92	92	92	92	92
VIC – Bairnsdale	16	16	16	16	16
VIC – Total Tariff D Industrial	6,111	5,810	5,567	5,374	5,199
Albury	430	407	388	373	359

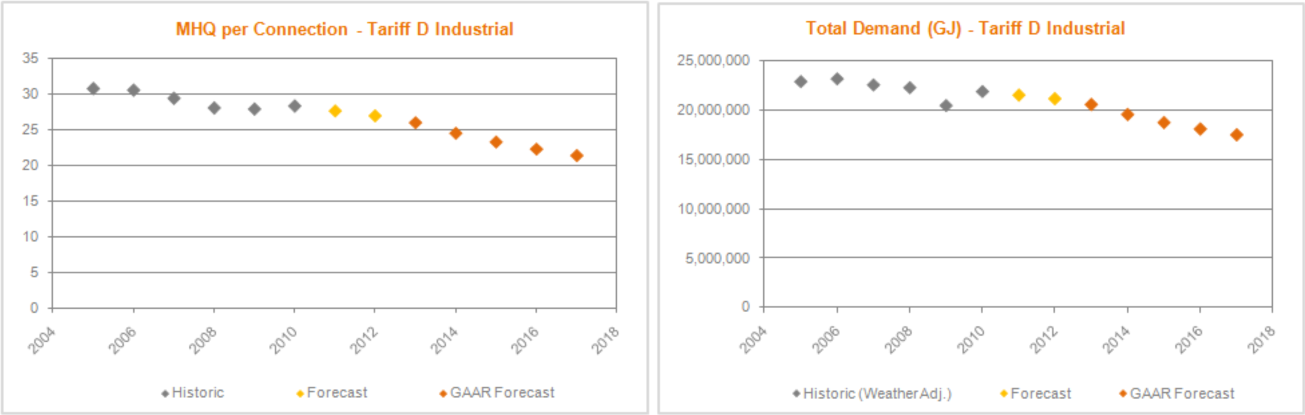
Source: Core Energy Group; 2012.

Figure 6.5: VIC Total Connections and Demand per Connection Tariff D Industrial.



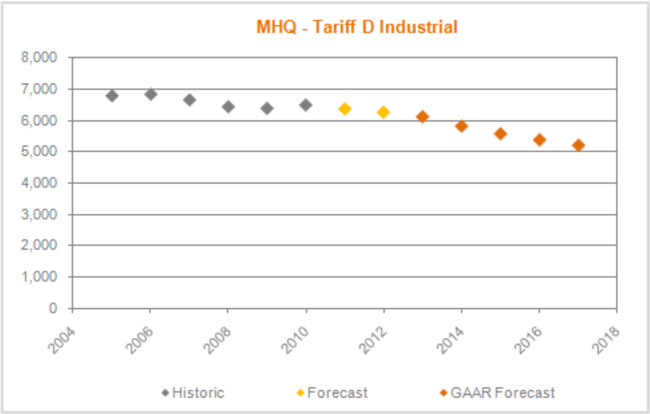
Source: Core Energy Group; 2012.

Figure 6.6: VIC MHQ per Connection and Total Demand Tariff D Industrial.



Source: Core Energy Group; 2012.

Figure 6.7: VIC Total MHQ Tariff D Industrial.



Source: Core Energy Group; 2012.

6.4. Forecast Validation

As a final cross-check, Core performed a forecast validation which confirmed that all forecasts were statistically robust.

7. Data Sources

- Having identified potential drivers of gas connections on the network and demand per connection (see Sections 2, 3 and 4), Core, SACES and Envestra then collated the historical and forecast data available in relation to each driver.
- These data sources were identified by the modelling team (Core, SACES) as being the most appropriate, based upon a range of criteria including relevance, reliability and availability.

7.1. Tariff V – Residential

The following table sets out the nature of the historic and forecast data relied upon by Core in deriving the Tariff V – Residential demand forecasts.

Table 7.1: Data Sources – Tariff V Residential.

Data Description	Source	Data Description
Historic Data		
Historic - gas demand by region	Envestra	▪ Daily demand by region - from 2005 to 2010.
Historic - connections by region	Envestra	▪ Total connections by region - from 2005 to 2010.
Historic - connections by age of connection	Envestra	▪ Connection numbers by year of connection were, separated from 2004 onwards between those in existence prior to 2004, and new connections established in 2005 to 2010.
Historic - GHDI - VIC	ABS 5220.0 Table 13 Series ID A2335042J	▪ Annual GHDI for VIC - from June 1990 to June 2010.
Forecast – households	ABS 32360DO001_20062031 Household and Family Projections, Australia, 2006 to 2031; August 2010	▪ Annual household numbers for VIC by ABS - from June 2005 to June 2010.
Historic – new dwelling starts	HIA	▪ Annual new dwelling starts - from 2005 to 2010.
Normalised – Effective Degree Days (“**EDD**”)	CSIRO	▪ Normalised EDD – from 2005 to 2017.
Historic – Actual EDD	AEMO	▪ Annual EDD – from 2005 to 2010.
Historic – Albury Temperature	Bureau of Meteorology (“**BOM**”); 072160 - Albury Airport Weather Station	▪ Average of 8 x 3-hourly temperature readings – from 1994 to 2010.
Forecast Data		
Forecast - GHDI	SACES	▪ Annual forecast by SACES of VIC GHDI - from June 2011 to June 2018.
Forecast – new dwelling starts	HIA	▪ Annual forecast by HIA of dwellings starts - from 2011 to 2017.

Table 7.1: Data Sources – Tariff V Residential – Continued.

Data Description	Source	Data Description
Forecast Data – Continued		
Forecast – households	ABS 32360DO001_20062031 Household and Family Projections, Australia, 2006 to 2031; August 2010	▪ Annual forecast by ABS of VIC households - from June 2006 to June 2031.
Forecast – effect of 6-Star Building Standard	CIE; Final Regulation Impact Statement for residential buildings (class 1, 2, 4 and 10 buildings), Table 6.2 p.80 ; December 2009	▪ CIE estimates of the effect on gas usage of a move from 5 to 6-Star Building Standards in VIC.
Forecast – new connections Murray Valley and Bairnsdale	Envestra	▪ Annual forecast by Envestra of new connections in Murray Valley and Bairnsdale – from 2011 to 2017.
Price elasticity of gas demand	AER; Final Decision Envestra Limited Access Arrangement Proposal For The SA Gas Network 1 July 2011 – 30 June 2016	▪ Long-run price elasticity of gas demand.
Retail gas price components	Core Energy Group	▪ Retail gas price components share of total retail gas price.
Forecast – carbon price impact on retail gas prices	Australian Treasury Strong Growth, Low Pollution - Modelling; July 2011; Table 5.19: Effects on weekly expenditure and the consumer price	▪ Australian Treasury estimates of the real carbon price impact on retail gas prices in 2012-13 and by 2015-16.
Forecast – network price	Envestra	▪ Annual forecast of the real change in network prices - from 2011 to 2017
Forecast – wholesale gas prices	Australian Treasury Strong Growth, Low Pollution - Modelling a Carbon Price; July 2011; Chart B6: Domestic Australian gas prices	▪ Annual forecast of the real change in wholesale gas prices -from 2011 to 2017.

Source: Core Energy Group; 2012.

7.2. Tariff V – Non Residential

The following table sets out the nature of the historic and forecast data relied upon by Core in deriving the Tariff V – Non Residential demand forecasts.

Table 7.2: Data Sources – Tariff V Non-Residential.

Data Description	Source	Data Description
Historic Data		
Historic - gas demand by region	Envestra	▪ Daily demand by region - from 2005 to 2010.
Historic - connections by region	Envestra	▪ Total connections by region - from 2005 to 2010.
Historic – GSP	SACES	▪ Annual GSP for VIC - from June 1990 to June 2010.
Normalised – EDD	CSIRO	▪ Normalised EDD – from 2005 to 2017.
Historic – EDD	AEMO	▪ Annual EDD – from 2005 to 2010.

Table 7.2: Data Sources – Tariff V Non-Residential – Continued.

Data Description	Source	Data Description
Forecast Data		
Historic – Albury Temperature	BOM; 072160 - Albury Airport Weather Station	▪ Average of 8 x 3-hourly temperature readings – from 1994 to 2010.
Forecast - GSP	SACES	▪ Annual forecast by SACES of VIC GSP - from June 2011 to June 2018.
Forecast – new connections Murray Valley and Bairnsdale	Envestra	▪ Annual forecast by Envestra of new connections in Murray Valley and Bairnsdale – from 2011 to 2017.
Price elasticity of gas demand	AER; Final Decision Envestra Limited Access Arrangement Proposal For The SA Gas Network 1 July 2011 – 30 June 2016	▪ Long-run price elasticity of gas demand.
Retail gas price components	Core Energy Group	▪ Retail gas price components share of total retail gas price.
Forecast – carbon price impact on retail gas prices	Australian Treasury Strong Growth, Low Pollution - Modelling a Carbon Price; July 2011; Table 5.19: Effects on weekly expenditure and the consumer price	▪ Australian Treasury estimates of the real carbon price impact on retail gas prices in 2012-13 and by 2015-16.
Forecast – network price	Envestra	▪ Annual forecast of the real change in network prices - from 2011 to 2017
Forecast – wholesale gas prices	Australian Treasury Strong Growth, Low Pollution - Modelling a Carbon Price; July 2011; Chart B6: Domestic Australian gas prices	▪ Annual forecast of the real change in wholesale gas prices -from 2011 to 2017.

Source: Core Energy Group; 2012.

7.3. Tariff D Industrial

The following table sets out the nature of the historic and forecast data relied upon by Core in deriving the Tariff D – Industrial demand forecasts.

Table 7.3: Data Sources – Tariff D Industrial.

Data Description	Source	Data description
Historic Data		
Historic - gas demand by region	Envestra	▪ Daily demand by region – from 2005 to 2010.
Historic – MHQ by region	Envestra	▪ Annual MHQ by region – from 2005 to 2010.
Historic - connections by region	Envestra	▪ Total connections by region – from 2005 to 2010.
Historic – GSP	SACES	▪ Annual GSP for VIC – from June 1990 to June 2010.
Normalised – EDD	CSIRO	▪ Normalised EDD – from 2005 to 2017.
Historic – EDD	AEMO	▪ Annual EDD – from 2005 to 2010.

Table 7.3: Data Sources – Tariff D Industrial – Continued.

Data Description	Source	Data description
Historic Data - Continued		
Historic – Albury Temperature	BOM; 072160 - Albury Airport Weather Station	▪ Average of 8 x 3-hourly temperature readings – from 1994 to 2010.
Forecast Data		
Forecast - GSP	SACES	▪ Annual forecast by SACES of VIC GSP - from June 2011 to June 2018.
Price elasticity of gas demand	AER; Final Decision Envestra Limited Access Arrangement Proposal For The SA Gas Network 1 July 2011 – 30 June 2016	▪ Long-run price elasticity of gas demand.
Retail gas price components	Core Energy Group	▪ Retail gas price components share to total retail gas price.
Forecast – carbon price impact on retail gas prices	Australian Treasury Strong Growth, Low Pollution - Modelling a Carbon Price; July 2011; Table 5.19: Effects on weekly expenditure and the consumer price	▪ Australian Treasury estimates of the carbon price impact on retail gas prices in 2012-13 and by 2015-16.
Forecast – network price	Envestra	▪ Annual forecast of the real change in network prices - from 2011 to 2017
Forecast – wholesale gas prices	Australian Treasury Strong Growth, Low Pollution - Modelling a Carbon Price; July 2011; Chart B6: Domestic Australian gas prices	▪ Annual forecast of the real change in wholesale gas prices -from 2011 to 2017.

Source: Core Energy Group; 2012.

Attachment 1: Terms of Reference

CORE ENERGY GROUP

1. Terms of Reference

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CONSULTANCY BRIEF – Request for Proposal

2013 – 2017 GAAR Demand, Energy and Customer Forecast

1. Objective of Consultancy Brief

Envestra is seeking to engage a suitably qualified independent party to undertake detailed Demand, Energy and Customer forecasts for its Gas Distribution Network for the forthcoming 2013 – 2017 Gas Access Arrangement Review (GAAR) and for general planning and forecasting purposes. The current regulatory period expires on the 31st December 2012 with the next period commencing on 1st January 2013.

Envestra 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). As an input into the access arrangement, the Distributors require robust (accurate) forecasts of Demand, Energy and Customers numbers for the forthcoming regulatory control period.

Forecasts provide a detailed view of the future demand on the Gas Network and assist the Distributors 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.*

It is critical that any forecast takes into account the economic environment that is likely to occur during the regulatory period (2013–2017) and that these effects are clearly evaluated and articulated. Demand and Customer forecasting enables the Distributors to make decisions in regard to prudent capital investment and operational expenditure required over the 2013-2017 regulatory period. While Energy forecasts, accurately allocated, into both tariff class and tariff component (blocks) enable the Distributors to set efficient tariffs.

The purpose of this brief is to outline;

- The Forecast Criteria that the forecast must abide by;
- The Outputs of the consultancy brief;
- Economic and Environmental Considerations;
- Desired Timeline.

2. Forecast Criteria

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.

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The forecast should meet, to the extent feasible, the following criterion that have been expressed by the AER in previous forecasting decisions in relation to best practices for a forecast model;

- Be accurate and unbiased;
- Transparent and Repeatable;
- Incorporate Key Drivers;
- Model Validation and Testing;
- Accurate and consistent at all forecast levels;
- Use of the most recent input information;
- Assumptions are clear and have backing;
- Weather Normalisation;
- Adjustments for Temporary Transfers; and
- Adjustment for discrete block loads.

3. Outputs of Consultancy brief

Forecasts and reports are required for Envestra. Distributor forecast and report should seek to quantify changes in the following outputs to 2017 (expressed as absolute forecasts and percentage change terms);

- Customer Numbers;
- Energy; and
- Demand.

The forecast outputs are to be segmented by;

- Tariff Zone; and
- Tariff Class (i.e Residential, Non-Residential and Large Industrial).

A detailed report which contains;

- Clear articulation of drivers behind each forecast output with detailed explanation of any forecast deviation from historic trends; and
- All assumptions and data relied upon, including sources of assumptions/ data and to the extent feasible Historic correlations between each economic and environmental driver and the outputs.

The consultant must at a minimum provide Envestra with access to the model used to prepare the demand, energy and customer number forecasts.

4. Considerations of Consultancy brief

Inputs that may be considered in creating the forecasts are;

- GSP;
- Inflation;
- Disposable Income;
- Housing Approvals;
- Population Growth;
- Alternative Energy Uptake;

- Appliance Uptake; and
- Price Elasticity.

Policy changes that have an impact on each economic drivers and forecasts may include:

- Energy Efficient Homes;
- Energy Efficient Appliances;
- Carbon Tax; and
- General Policy Changes.

The environment in which energy is consumed also needs to be considered and may include factors such as;

- EDD's (Effective Degree Day) and/or HDD (Heating Degree Days);
- Average Temperature;
- Alternative Energy uptake; and
- Occupants per House.

Any input used should be referenced to credible independent sources.

5. Information provided by Envestra

Envestra will work closely with the consultant to provide data/information to prepare demand, energy and customer number forecasts. The data may include;

MIRN – Billing Data

- Historic customer numbers, energy and demand segmented by;
- Tariff Zone; and
- Tariff Class (i.e Residential, Non- Residential and Large Industrial).

Attachment 2: Curriculum Vitae

CORE
ENERGY
GROUP

1. Core Energy Group

1.1 About Core Energy Group

Core is a private, boutique advisory firm established seven years ago by Chief Executive Officer (“CEO”), Paul Taliangis. Core specialises in providing advisory services to the energy industry, with a particular focus on the Australian gas sector.

Core has extensive experience in assisting listed and private organisations and Government agencies in the area of strategy formulation (which includes market analysis), valuation, and transactions.

1.2. Core Team

Work on this project would be led by Mr. Paul Taliangis with support from Miss Kristin Staritski, Mr. Andrew Lee, Mr. Ben Maddern and other Core team members as appropriate. Profiles for Paul, Kristin, Andrew and Ben are presented below.

Mr. Paul Taliangis

Paul is CEO and founder of Core Energy Group. Paul has formal economics, commerce and accounting qualifications and attended an extensive range of international executive development courses including at the Chicago Business School.

Paul’s 25 years of experience, including over 15 in the energy industry, has extended across Asia, New Zealand, Papua New Guinea, the United Kingdom and the United States of America. His areas of specialisation include strategic analysis, corporate advice, mergers and acquisitions, corporate finance, equity capital markets and day to day management of energy businesses. During this time Paul has led a long list of projects and transactions on behalf of smaller organisations through to large multinational corporations, involving all critical elements of the energy value chain - LNG, conventional and unconventional gas, oil / liquids, gas transmission and distribution, coal, energy services, electricity, renewable energy and retail.

Paul’s experience in the gas sector has included an eight year period with Santos in Australia and USA as senior executive in Corporate Development and Corporate Planning and over eight years as an independent adviser. Paul's advisory experience includes complex market and industry quantitative analysis, including demand, supply, cost, risk/ uncertainty and profit elements.

Miss Kristin Staritski

Krissy is a team leader in the Strategy division with Core Energy Group. Krissy graduated with an Honours degree in Chemical Engineering and a Bachelor of Finance from the University of Adelaide and has recently completed a Graduate Diploma in Applied Finance through FINSIA / Kaplan.

At Core Krissy has responsibility for domestic gas markets (including transmission and distribution networks), unconventional gas and Liquefied Natural Gas. Specific skills include project management, industry and sectoral analysis, modelling and client communication.

Mr. Adrian Bigaj

Adrian is an Energy Analyst at Core Energy Group. Adrian is a Chartered Financial Analyst Level III Candidate and has previously completed a Master of Commerce (Applied Finance) and a Bachelor of Commerce (Accounting & Corporate Finance) at The University of Adelaide.

At Core Adrian provides specialist input into analysis of the regulated elements of the gas market and provides support on a wide range of other gas market related projects.

1.3. Relevant Work Experience

Specific experience and capabilities relating to this project can be segregated into three categories:

1. Gas market and economic analysis.
2. Data management and modelling;
3. Reporting; and

Each of the above mentioned categories is discussed in further detail below.

Modeling Experience and Capabilities

Our relevant modelling expertise includes:

- The preparation of detailed enterprise valuations for a large number of energy companies for institutional and fund manager clients of our Corporate Finance Division.
- The preparation of a new long-term group financial model for ENV in March 2011.
- Detailed modelling and valuation analysis for ENV’s acquisition of Gas Networks in October 2010.
- Development of GENERSYS, a world class simulation system which generates integrated gas, electricity and transmission pipeline forecasts having regard to a wide range of key variables.
- The maintenance and development databases used as inputs to GENERSYS.
- Regression modelling and analysis of the gas distribution networks in each eastern Australian state as part of the AEMO 2009 and 2010 Gas Statement of Opportunities (“GSOO”). This work not only included regression analysis but also analysis of the impact of Government policy and other demand drivers.

Reporting Experience and Capabilities

Core has extensive experience with regards to the production of clear, concise and informative reports for a range of readers. Core’s specific experience is summarised below.

- Core led industry market studies – Numerous studies over a range of energy topics. These studies have been subscribed to be a wide range of industry participants including but not limited to large exploration and production companies, retail companies, generation companies and Government Bodies.
- Consultancy reports – Core has been commissioned by a range of companies to develop reports address specific energy related topics. Of most significance to this project is Core’s participation in AEMO’s 2009 and 2010 GSOO. As part of this

project Core modelled distributed gas demand for eastern Australia to 2030 and provided an accompanying report describing the assumptions made, the relationship between key variables, the key drivers and the results.

- Independent expert reports – Core has undertaken numerous independent expert reports. These reports are generally extremely detailed, structured and carefully worded in line with legal and regulatory requirements.

Further information of the breadth of this work and specific projects in each category is presented below

General Gas Market Experience and Capabilities

The following list summarises Core's relevant industry experience including studies, projects, modelling and consultancy work:

- Gas and energy market studies:
  - 2025 Energy Outlook Study (eastern Australia gas, electricity and LNG) (April 2011);
  - 2025 Unconventional Gas Outlook Study – The Next Wave? (2010);
  - 2020 East Coast Gas and Electricity Outlook Study (2010, 2009);
  - Asian LNG Outlook Study (2009);
  - Coal Seam Gas Outlook Study (2008);
  - 2020 Electricity Outlook (2008, 2007); and
  - Coal Seam Methane – Awakening Giant? (2006).
- Advisory and consultancy services:
  - AEMO GSOO Distributed Gas Forecasts (2010, 2009);
  - Advisor on a range of asset divestitures involving gas assets, pipelines for a range of leading energy companies.
  - Advisor to a range of organisations in relation to acquisitions involving gas interests including AGL, Santos, Toyota Tsusho, Envestra;
  - Review of pipeline capacity utilisation and scope for expansion for a major gas transmission company;
  - Gas market advisory work to the South Australian Government (Primary Industry and Resources South Australia ("**PIRSA**"));
  - Defence advisory roles with QGC and Origin; and
  - Strategic consulting projects with over 20 other companies on a confidential basis involving gas demand, supply, pricing, competition and market analysis.
- Expert reports:
  - Independent expert advice to major gas retailer in relation to two major gas contract negotiation which involved analysis of east coast demand, contracts, transportation tariffs and other related matters. This included a review of all major eastern Australia gas contracts under a discovery process;
  - Independent expert advice to a major electricity generator and Clayton Utz in relation to a major gas contract negotiation which involved analysis of East coast demand, contracts, transportation tariffs and other related matters
  - Expert advisor to major retailer in relation to takeover attempt by an international company on gas market related matters

  - Independent expert report for major infrastructure company as part of a program to refinance their business with a particular focus on the outlook for their coal seam gas assets which included a total market assessment.
- Modeling and valuation services
  - Valuation of Country Energy NSW gas network
  - Development of financial forecasting model for Envestra
  - Valuation of wide range of energy companies for leading Australian fund managers, including APA, Envestra, Spark, SP Ausnet, DUET, Woodside, Santos, Origin, AGL
  - Modelling gas transmission system capacity utilisation for major pipeline owner
  - Demand modelling for gas, coal, uranium, wind, electricity sectors

2. SACES

SACES is a joint research venture of the Adelaide and Flinders Universities. The Centre has two main areas of activity:

- The provision of applied economics skills on a consulting/contract research basis; and
- To review, research and report on economic and public policy issues of relevance to South Australia ("**SA**") and Australia.

It fulfils these tasks with a combination of dedicated full-time staff and with input from specialist academic staff within the Universities.

SACES was established in 1982 and since then has successfully completed over 1,000 research assignments working with Commonwealth and State Government agencies, the business sector, local government, rural and regional communities and peak organisations, and has been an active participant in the public policy debate.

2.2. SACES Team

Mr. Jim Hancock

Jim Hancock is Deputy Director at the Centre. He has an honours degree in economics from the University of Adelaide. He has more than 20 years experience in applied economic and statistical analysis, having spent the last 12 years at SACES and prior to that working as an economist and then manager in South Australian Treasury. Since joining the Centre he has worked on projects in a range of areas including macroeconomic performance and growth, cost-benefit analysis, econometric analysis of labour market programmes, environmental evaluations, competition policy, regulatory issues and public finance. At Treasury his work covered a range of areas including macroeconomic monitoring and forecasting, tax policy issues, evaluation methodologies and market structure issues. He is also a visiting lecturer in the School of Economics at University of Adelaide.

Mr. Steve Whetton

Steve Whetton is a Senior Research Economist at the Centre. He has an honours degree in economics from the University of Adelaide and an M. Sc (Economics) from the University of London and has been an economist at SACES for 9 years, and in the United Kingdom ("**UK**") government for 3 years. He has considerable experience in economic modelling having developed computer based models for the Northern Territory Labour Market and was instrumental in the national development of the star rating system for the Job Network. Steve's significant experience in undertaking public policy evaluations includes supervising several major national research and evaluation projects for DEWR, FaCS and NOIE and heading up the evaluation branch of the UK Health and Safety Executive. Whilst working at the UK Department of Trade and Industry he was the UK delegate to the OECD's Innovation and Technology Policy Working Group.

Ms Suraya Abdul Halim

Suraya is a Research Economist at the SACES. She has an honours degree in economics from the University of Adelaide and a Bachelor in Economics (Major: Quantitative Analysis and Mathematical Methods) from the University of Queensland. Since joining the Centre, she has worked on program evaluations and applied econometric analyses of public policy issues including macroeconomic issues (Economic Briefing Reports); labour market issues (innovation, migration, generic skills, literacy and numeracy, workforce participation, workers compensation); social issues (alcohol and gambling); and regional development.

Prior to joining the Centre Suraya was employed in the University of Adelaide as a Research Assistant and Tutor. Her duties included researching, collecting and organizing data for econometric modelling analyses related to the trade and development of APEC nations. Subjects taught include Business and Economic Statistics, Macroeconomics and Microeconomics.

2.3. Relevant Work Experience

SACES provides contract research and commissioned consultancy services across a broad range of applied economic issues. In addition to technical economics and statistical skills, the staff of the SACES have well developed capabilities in project management, data collection and surveying, the conduct of consultation processes, and most importantly the communication of research results to non-economist audiences. SACES draws on the academic staff of the Adelaide and Flinders Universities and other sub-consultants when this contributes to project outcomes.

SACES has extensive experience in both qualitative and quantitative techniques, obtained through the high level of skills of its staff, their training in statistical and quantitative fields, and the diversity of work experience using quantitative and qualitative analysis.

SACES routinely produces economic forecasts across a range of macroeconomic variables as part of its bi-annual economic briefing prepared for its corporate members.

Staff are highly skilled in the application of various quantitative analytical and economic modelling techniques, including econometric modelling, cost benefit analysis, financial analysis, cost effectiveness analysis, input output multiplier analysis, and statistical data analysis. The Centre has experience undertaking larger scale data collection, analysing large databases (including assuring confidentiality of sensitive data), and providing high quality reports. For example, SACES was responsible developing the original star ratings model used to adjust the performance of job network members for their client characteristics, and has subsequently undertaken six additional modelling projects for Department of Education, Employment and Workplace Relations (**"DEEWR"**). In the regulatory sphere recent projects include a Review of Proposed Indexation Methodology to Adjust Electricity Standing Contract Prices for the Essential Services Commission of South Australia (**"ESCOSA"**), and a number of economic evaluations of capital works projects for SA Water.

SACES has also been appointed to research and analysis panels by a number of Commonwealth agencies including Prime Minister and Cabinet, DEEWR, FaHCSIA, DIAC, Department of Health and Ageing and a number of state and territory agencies including the Victorian Department of Treasury and Finance.

Key Projects and Experience

SACES key projects and experience in economic, financial, financial modelling and regulatory advice follow:

- Financial and Economic Analysis of Kingscote Treated Water Storage. Report prepared for SA Water (in progress) by Jim Hancock, Anthony Kosturjak and Mark Trevithick.
- Financial and Economic Analysis of Playford North Recycled Water Scheme. Report prepared for SA Water (2011) by Jim Hancock, Anthony Kosturjak and Mark Trevithick.
- Review of Proposed Relative Price Movement ("**RPM**") Indexation Methodology for Adjusting Standard Contract Prices. Report prepared for ESCOSA (2010) by Libby Stephens and Jim Hancock.

- Financial and Economic Analysis of Muller Road and Regency Road Trunk Water Main Renewal. Report prepared for SA Water (2009) by Anthony Kosturjak and Jim Hancock.
- Independent Statistical Advice on the Development of a Funding Level Assessment Tool for Disability Employment Services. Report prepared for DEEWR (2009) by Jim Hancock and Steve Whetton.
- 2009 Financial and Economic Analyses of Wellington Weir. Prepared for SA Water (2009) by Jim Hancock and Anthony Kosturjak.
- Financial and Economic Analysis of Aldinga WWTP Upgrade. Prepared for SA Water (2008) by Jim Hancock and Anthony Kosturjak.
- Econometric Analysis of Provider Performance in Vocational Rehabilitation Services. For Department of Employment and Workplace Relations (2008) by Jim Hancock, Michael O'Neil, and Steve Whetton.
- Analysis of the Solid Waste Levy. Report prepared for the Local Government Association of South Australia (2008) by Jim Hancock.
- Comment on Cost of Capital Issues. Report prepared for Department of Treasury and Finance (2005) in the context of Electricity Distribution Price Review submission by Jim Hancock.
- The Market Risk Premium for Australian Regulatory Decisions. Report prepared for the Advocacy Panel (2005) by Jim Hancock.
- Review of the Efficiency of SA Water's Business Costs and Performance. Report prepared for South Australian Department of Treasury and Finance (2005) by Jim Hancock and Stephen Nelson.
- Comments on the ESCOSA Discussion Paper 'Electricity Distribution Price Review: Return on Assets'. Report prepared for the National Consumers Electricity Advocacy Panel (2004) by Jim Hancock.
- Estimating the Benefits of Electricity Reform. Report prepared for the South Australian Independent Industry Regulator (2001) by Jim Hancock.
- Cost-Effectiveness Analysis of Power Supply Options for the AP Lands. Report prepared for Division of State Aboriginal Affairs (2000) by Jim Hancock and Anthony Kosturjak.
- Report on CSG Standards and Compensation Payments. Report prepared for the Australian Communications Authority (2000) by Richard Damania and Jim Hancock.
- National Competition Policy Review of South Australian CTP Arrangements — Consideration of Public Benefit Issues. Report prepared for Department of Treasury and Finance (1999) by Jim Hancock.
- Energy Network Asset Valuation: Impact on Users. Report prepared for the Australian Cogeneration Association, the Australian Gas Users Group, the Energy Users Group (1998) by Jim Hancock.

Attachment 3: SACES Report

CORE ENERGY GROUP

1. Scope

The scope of work provided to SACES in the related engagement letter is as follows, with the “Subcontractor” being SACES.

The Subcontractor agrees to provide Core with support with regards to a forecast of demand project currently being undertaken for Envestra Limited, as described in the briefing document dated 19 September 2011. This support includes:

- Provision of forecast economic assumptions and data for use in demand forecasting;
- Review of Core model methodology and feedback on functionality, deficiencies and possible improvements; and
- Report summarising the above for inclusion in the final demand forecast given to Envestra.

2. Report Findings

2.1. Background

Core Energy and the SA Centre for Economic Studies (SACES) have been commissioned by Envestra to develop forecasts for gas demand for the gas distribution network covering Victoria and Albury (in NSW) to inform Envestra's submission to the 2013-17 Gas Access Arrangement Review.

This section reports the modelling undertaken by SACES to develop projections for key macroeconomic variables to be included in the demand modelling over the forecast period. As much of the ABS data used is for financial years this involved forecasting to 2017/18.

2.2. Data Used

The most important source for the analysis of macroeconomic trends is the Victorian State Accounts within the Australian National Accounts. Unfortunately the ABS significantly revised the method used to calculate GSP in 2006, and these changes were only backdated to the data for the 1989/90 financial year. This means that data on regional incomes is only available in comparable form from the 1989/90 financial year, restricting the analysis to a twenty one year period.

The datasets used in one or more of our models (described in Results, below) are:

- **Real Victorian GSP (chain volume measure) (1990-2010).**
  Source: 5220.0 - Australian National Accounts: State Accounts, 2009-10.
  This series is reported annually for the financial year to June 30.
- **Real Australian GDP (chain volume measure) (1990-2010).**
  Source: 5220.0 - Australian National Accounts: State Accounts, 2009-10.
  This series is reported annually for the financial year to June 30.
- **World GDP purchasing power parity (1990-2010).**
  Source: International Monetary Fund ("**IMF**"), World Economic Outlook Database, September 2011.
  This series converts the real the gross domestic product of each country to a common basis (current international dollars) using purchasing power parity ("**PPP**") 'exchange rates' and then aggregates them to give an estimate of world GDP.
- **Estimated Resident Population, Victoria (1990-2010).**
  Source: 3101.0 - Australian Demographic Statistics, March 2011.
  This series is reported as quarterly data. To construct the dataset, the June quarter estimates were selected to match the GSP and GDP estimates recorded at the end of the financial year.
- **Total Employed Persons, Victoria (1990-2010)**
  Source: 6202.0 - Labour Force, Australia, September 2011.
  This series is reported monthly. To construct the dataset, annual June estimates were selected to match the GSP and GDP estimates recorded at the end of the financial year.
- **Number of Dwelling Units, Victoria (Total houses) (1990-2011).**
  Source: 8731.0 - Building Approvals, Australia, September 2011.
  This series is reported as monthly flow data. To construct the dataset, moving average totals over the financial year are applied to the series and the average for the year to June was used to give financial year data.

- **Interbank rate cash rate (1990-2011).**
  Source: Reserve Bank Australia, Interest Rates.
  The RBA provides interbank rate at a daily and monthly series. The monthly series is calculated an unweighted average of daily figures for the month. To construct the dataset, annual June estimates were selected to match the GSP estimates recorded at the end of the financial year.

2.3. Results

There are a range of macroeconomic factors which can influence the level (and rate of change) of national and regional income. For example Dungey and Pagan (2000) use an 11 variable system in modelling the Australian economy 6 of which were significant in forecasting GDP, and Beechey et al. (2000) use a 10 variable system, 5 of which were used for GDP.

Unfortunately the short timespan available for GSP data (21 years), and the other key state income measures available through the national accounts, meant that it was not possible to run a model which had both a full set of potential variables and an appropriate lag structure. Instead a series of more limited equation systems, each comprising 3 to 5 variables, were tested.

Testing indicated that for most of the proposed variable combinations were not covariance stationary, but that there first differences were, a VEC model approach was used. A key advantage of the VEC structure is that it incorporates past values of the explanatory variables, which is useful in modelling necessary for modelling consumption as research consistently shows that past levels of consumption are important in explaining current consumption.

VEC models analyse the evolution of data series over time, and their relationship with one another. The results of a VEC model provide two sets of parameters, short-run adjustment coefficients, and long-run coefficients. The short run adjustment coefficients model how the variables adjust back to their long-run relationship in response to a shock. So if you were modelling consumption as a function of income, the short-run coefficients would tell you the rate at which consumption would adjust in response to a one-off increase in income. So if for example a major mineral discovery increased Tasmania's state income by 20 percent, the short-run coefficients would tell you the speed with which consumption spending would increase in response to this increased income as it returned to its long-run share of income. The second set of parameters identifies the nature of the long-run relationship between the variables. In many cases (such as modelling of consumption or income) the long-run parameters are of limited interest as the nature of the relationship between the variables is well understood. Instead it is adjustment coefficients which are of most interest as they shed light on how the economy will behave in the short run in response to shocks.

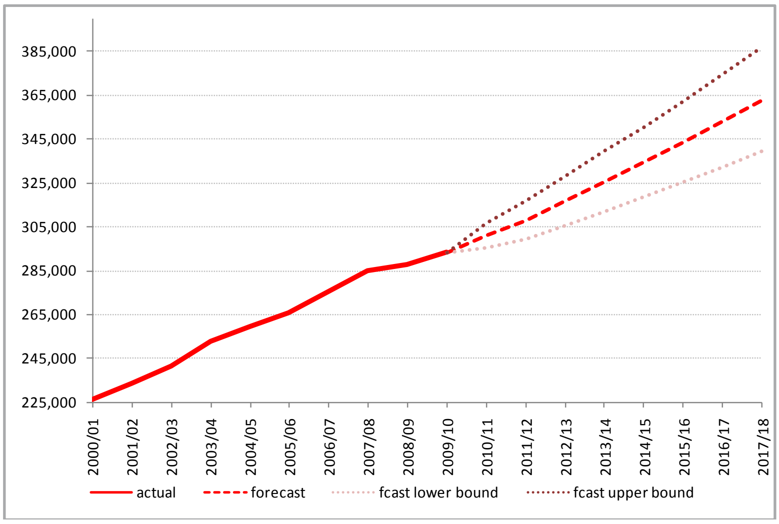
2.4. Gross State Product

The model specification that was preferred for forecasting Victorian GSP was a five equation system of the natural logs of Victorian Real GSP, Australian Real GDP, World Real GDP, Victorian Population, and Victorian Employment estimated using a VEC approach.

In this model each of the explanatory variables has a statistically significant impact on Victorian GSP. Further, statistical tests indicate that the system of equations is stationary with no unit roots; that it is not possible to reject the hypothesis that there is no autocorrelation; and that it is not possible to reject the hypothesis that the disturbance terms in the equations have a univariate normal distribution. These tests indicate that the specification is stable and that there is no evidence for any underlying problems with the data which would distort the model's coefficients.

The forecast path of Victorian GSP out to 2017/18, and the ten most recent years of actual data, are shown in Figure 1, with the annual changes shown in Figure 2. Our modelling suggests that Victoria will experience solid growth in GSP over the forecast period, but that this growth will be more moderate than had been the case in the early 2000s reflecting subdued growth in the global economy in the wake of the financial crisis in 2008, and the expected moderate growth in Australian GDP outside the mining states of Western Australia and Queensland.

Figure A3.1: Actual and projected Victorian Real Gross State Product, $'million real 2009/10 values.



Source: ABS 2011a, and SACES Modelling.

The forecasts produced from SACES's model are very similar to those produced by the Victorian Department of Treasury and Finance (2011), with the exception of 2011/12 where SACES's model suggests much weaker growth than the Victorian Treasury forecasts. We believe this difference can be explained by the deterioration in the international growth outlook since the Victorian State Budget was prepared in April 2011.

Table A3.1: Forecasts for Real Victorian GSP, Change on Previous Year.

	Actual Data[a] % change	SACES forecast % change	Vic Budget Forecast[b] % change
2001/02	3.20		
2002/03	3.35		
2003/04	4.47		
2004/05	2.67		
2005/06	2.48		
2006/07	3.49		
2007/08	3.53		
2008/09	0.92		
2009/10	1.96		
2010/11		2.62	2.50
2011/12		2.34	3.00
2012/13		2.82	2.75
2013/14		2.74	2.75
2014/15		2.69	2.75
2015/16		2.72	n/a
2016/17		2.74	n/a
2017/18		2.75	n/a

Source: SACES Modelling.
Note: [a] ABS (2010a)
[b] Victorian Department of Treasury and Finance

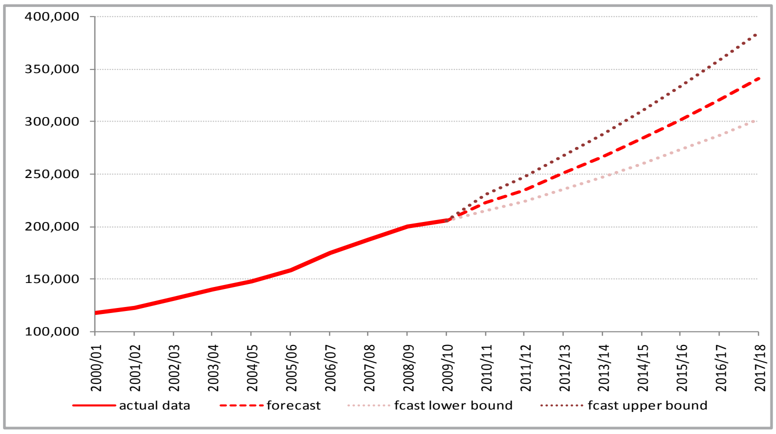
2.7. Household Gross Disposable Income

As an alternative approach to measuring the incomes of households gross disposable income was also modelled. This differs from most measures of income in the national accounts in that it is a nominal, rather than a real, variable. This means that it has not been adjusted to control for inflation. Hence the trend in this variable will be significantly higher as it includes inflation as well as growth in real incomes.

Victorian gross disposable income was modelled as part of a four equation system jointly with gross state product, employment, and population.

Whilst the resulting model was stable, the other variables were not as effective at explaining changes in gross disposable income as the variables in the GSP and population models reported above. This is likely to be due to the range of non-income factors that influence gross domestic income – such as changes to corporate and income taxation – which cannot easily be included in the model.

Figure A3.2: Actual and Projected Victorian Household Gross Disposable Income, $'million Nominal.



Source: ABS 2011b, and SACES Modelling.

Table A3.2: Forecasts for Victorian Household Gross Disposable Income, Change on Previous Year.

	Actual Data[a] % change	SACES Forecast % change
2001/02	4.35	
2002/03	6.56	
2003/04	6.57	
2004/05	5.82	
2005/06	7.11	
2006/07	10.75	
2007/08	6.67	
2008/09	7.18	
2009/10	2.70	
2010/11		8.52
2011/12		5.34
2012/13		6.83
2013/14		6.12
2014/15		6.43
2015/16		6.28
2016/17		6.34
2017/18		6.30

Source: SACES Modelling.
Note: [a] ABS (2011b).

3. References

- Australian Bureau of Statistics (2010a), 'Australian National Accounts: State Accounts', Table 3, Expenditure, Income and Industry Components of Gross State Product, Victoria, Chain volume measures and current prices, cat. no. 5220.0.
- (2010b), 'Australian National Accounts: State Accounts', Table 13. Household Income Account and Per Capita, Victoria: Current prices.
- 2011a), 'Australian Demographic Statistics', Table 4. Estimated Resident Population, States and Territories, cat. no. 3101.0.
- (2011b), 'Labour Force, Australia', September 2011, cat. no. 6202.0.
- (2011c), 'Building Approvals, Australia', September 2011, Table 02. Number of Dwelling Units Approved, by Sector, all series – Victoria, cat. no. 8731.0.
- Beechey, M., N. Bharucha, A. Cagliarini, D. Gruen and C. Thompson (2000), 'A Small Model of the Australian Macroeconomy', RBA Discussion Paper 2000-05.
- Dungey, M. and A. Pagan (2000), 'A Structural VAR Model of the Australian Economy', *Economic Record*, vol. 76, no. 235, pp. 321-342.
- International Monetary Fund (IMF, 2011), World Economic Outlook Database, September 2011.
- Kennedy, P. (2003), *A Guide to Econometrics, 5th Edition*, Oxford, UK: Blackwell.
- Reserve Bank of Australia (2011), 'Interest Rates'.
- SACES (2008), Social and Economic Impact Study into Gambling in Tasmania Volume 1. Report prepared for Tasmanian Treasury and available at their website.
- Victorian Department of Treasury and Finance (2012), Victorian State Budget 2011-12 – Budget Paper 2, Strategy and Outlook 2011-12.

Attachment 4: Industrial Customer Survey

CORE ENERGY GROUP

1. Survey Template

«Date»

«Name_2»
«Job_Title»
«Customer_Name»
«POST1»
«POST2»
«POST3»

Dear «Name_1»,

Regulatory Review of Gas Usage – «Network»

Connection Site: «Street» «Locale»

Connection Number (MIRN): «MIRN»

Envestra Limited ("**Envestra**") is the owner of the gas distribution network connected to your business. APA Group Limited ("**APA**") operates and maintains the network on behalf of Envestra and your gas supplier.

Envestra is required by the Australian Energy Regulator to forecast industrial demand for gas over the coming years. Envestra wishes to survey key gas users to gain more accurate data to make its forecasts. This information will also assist in planning for expansion and improvement across the gas network.

Accordingly, we request you provide us with your best estimate of likely future gas usage. You can respond to the survey by either:

- completing the attached sheet and returning it in the reply paid envelope; or
- email the information set out on the next page to survey@envestra.com.au

Your response will be kept confidential with only aggregated forecasts provided to the Australian Energy Regulator.

We appreciate your timely assistance. For further information, please contact

Peter Bucki on 08 8418 1112.

Yours sincerely

Andrew Staniford

Group Manager, Commercial

Survey Response – Gas Usage Forecast

Customer Name: «Customer_Name»
Connection Site: «Street» «Locale»
Connection Number (MIRN): «MIRN»
Gas Supplier: «Retailer»

Historic Usage

We include for your convenience a table of your past annual consumption from 1 January 2008.

Year ended	Maximum Hourly Quantity - GJ	% change on previous year
31 December 2008	«MHQ_GJ_2008»	«MHQ_Change__2008»%
31 December 2009	«MHQ_GJ_2009»	«MHQ_Change__2009»%
31 December 2010	«MHQ_GJ_2010»	«MHQ_Change__2010»%
31 December 2011 (est.)	«MHQ_GJ_2011»	«MHQ_Change__2011»%
2008 to 2011 (Average)		**«MHQ_Change__Average»%**

Forecast Usage

Taking into account historic gas usage, and planned future activity, please make an estimate of the rate of change (if any) to future gas usage in the table below. For example, if there is no expected material change in gas usage in the period below, input “0%” in each row. Alternatively, if gas usage is expected to increase by 1% per annum for the relevant years, input “+1%” in the row of the relevant years; or for a fall in gas usage by 2% per annum, input “-2%” for the relevant years.

Year ended	Gas Usage Forecast – Estimated percentage change compared to prior year
31 December 2012	
31 December 2013	
31 December 2014	
31 December 2015	
31 December 2016	
31 December 2017	

If there are any foreseeable significant changes to forecast gas usage, please provide a brief description (for example, significant plant expansion/contraction in commercial activity, forecast/ possible closure, new equipment etc.)

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Attachment 5: Third Party Gas Price Projections

CORE ENERGY GROUP

1. Introduction

Core's analysis of the eastern Australian gas market indicates that retail gas prices are likely to increase as a result of:

- an increase in the cost of supply as the cost of extracting gas increases;
- the introduction of a price on carbon;
- a stepped change in gas demand – LNG and domestic;
- the changing profile of the contract market;
- an increased concentration of ownership of resources;
- increased commitment of resources to LNG export; and
- upgrades to gas transmission and distribution networks.

Core has identified numerous publically available third party sources which support this view of increasing gas prices, including but not limited to:

- Santos Limited – Numerous Australian Securities Exchange ("**ASX**") submissions;
- Beach Energy – Numerous ASX submissions;
- SKM & MMA – Annual Gas Market Review ("**GMR**") for the Queensland Department of Employment, Economic Development and Innovation; September 2011;
- The Australian;
- ACIL Tasman – Fuel Cost Projections January 2012 draft report to AEMO; and
- The Australian Treasury.

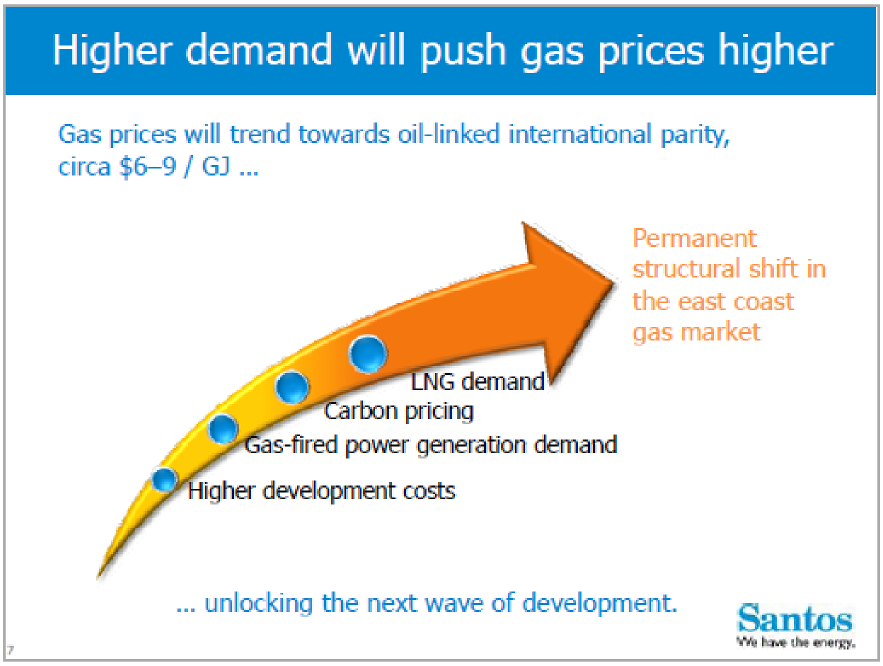
Further detail on each of these sources is provided in Section 2 of this Attachment.

2. Third Party Sources

2.1. Santos Limited

A recent Santos presentation suggested that gas prices (wholesale) would trend towards an oil-linked price or around AUD 6 to 9 per GJ.

Figure A5.1: Santos Gas Price Outlook.



Source: Santos Limited Presentation; September 2011.

2.2. Beach Energy

Beach Energy Managing Director Reg Nelson was quoted by the Australian as saying[12]:

> *“Eastern Australia will likely find gas to be in short supply over the coming financial year (2011-12) and most likely the following year, and this is before the impact of gas exports through LNG projects commencing,”*
>
> *“Beach has already been approached by companies offering oil-linked prices for conventional gas out of the Cooper Basin for large supply opportunities.”*

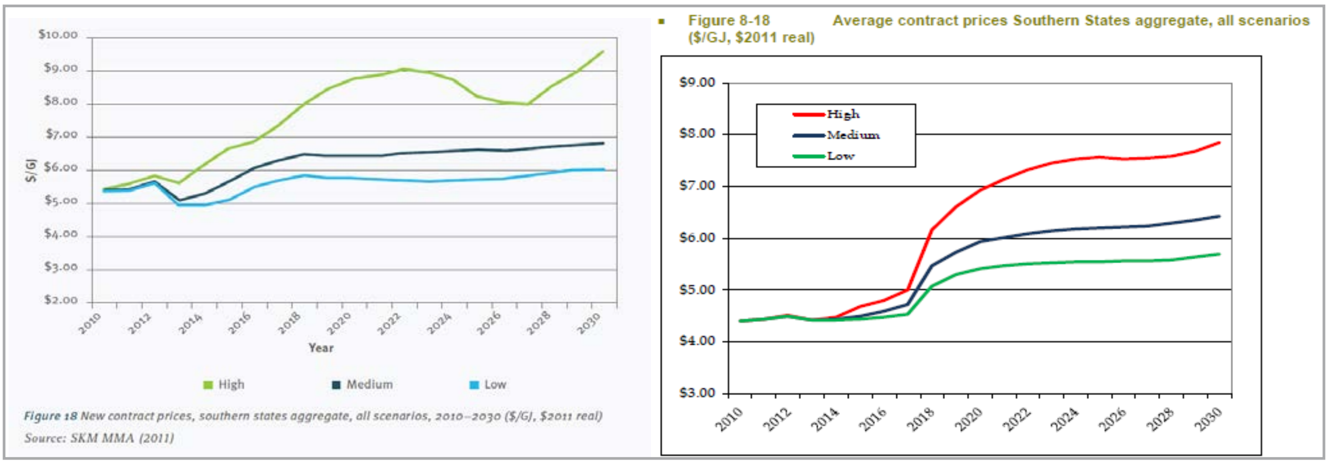
2.3. SKM & MMA – Annual GMR

SKM and MMA project an increase in contract (wholesale) gas price as well as average gas price for the aggregate of southern (non-Queensland) eastern Australian states. This is summarised in Figure A6.2. It should be noted that the in the GMR, it is suggested that the High Scenario is likely:

> *“Current market price expectations and behaviour indicate the High scenario is likely to eventuate.”*

[12] Source: The Australian article; 31 August 2011.

Figure A5.2: Extract from the Annual Gas Market Review.



Source: SKM MMA; Annual Gas Market Review for the Queensland Department of Employment, Economic Development and Innovation; September 2011.

2.4. The Australian

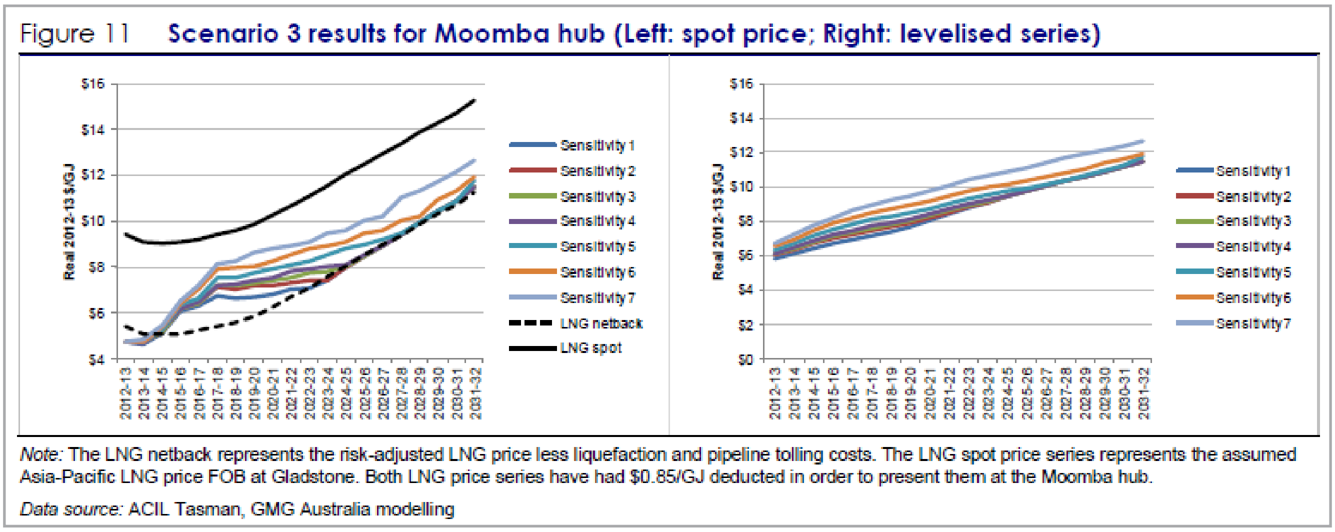
In November 2011, the Australian suggested that AGL secured a price of approximately AUD6 per GJ.

> *"AGL is believed to have secured a price of about $6 a gigajoule for gas that will be used to supply miner Xstrata's Mount Isa operations for 10 years from 2013.*
>
> *That price is up from present domestic Queensland gas prices of about $3.50 a gigajoule."*

2.5. IES Report to AEMO

In January 2012 ACIL Tasman produced a draft report for AEMO entitled "Fuel Cost projections". Planning Scenario forecasts with various sensitivities are summarised below.

Figure A5.3: ACIL Fuel Cost Projections.



Source: ACIL Tasman; Fuel Cost Projections – Draft Report; January 2012.

Furthermore, the ACIL report summarises fuel cost projections for various NEM zones. Results for VIC are summarised below for gas delivered Melbourne, Sensitivity 4 – Base Case over the period to 2017-18 (note full data set extends to 2031-32).

Table A5.1: Melbourne Levelised Price Projections (Real 2012-13 $ per GJ).

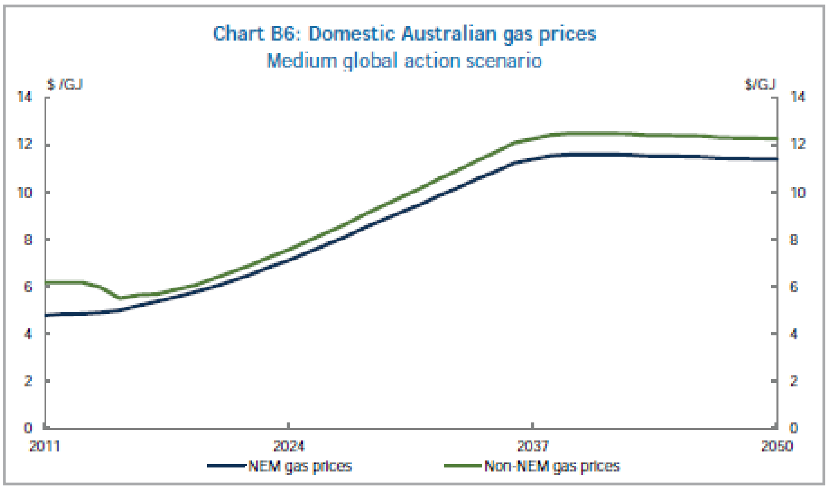
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Scenario 1	5.56	5.71	5.90	6.06	6.28	6.54
Scenario 2	6.16	6.46	6.81	7.20	7.64	8.11
Scenario 3	5.36	5.56	5.81	6.08	6.43	6.80
Scenario 4	5.23	5.42	5.66	5.92	6.25	6.59
Scenario 5	4.86	5.09	5.37	5.72	6.18	6.71

Source: ACIL Tasman; Fuel Cost Projections – Draft Report; January 2012.

2.6. Gas Price Projections – Treasury Related Reports

The Australian Treasury released projections of gas price as part of the analysis of the introduction of a carbon price. Consultancy reports produced for the Treasury relating to the carbon price also included projections of gas price.

Figure A5.4: NEM and Non-NEM Gas Price Projections - Treasury.



Source: Treasury; Strong Growth, Low Pollution; July 2011.