Final Stage 1 report to

Essential Services Commission of South Australia

Review of demand forecasts for the Envestra gas distribution network in South Australia

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EXECUTIVE SUMMARY

Introduction

The Essential Services Commission of South Australia (the Commission) regulates third party access to the South Australian gas distribution networks through approval of Access Arrangements. Envestra, the natural gas distributor for Adelaide and other regions of South Australia, has submitted proposed Access Arrangements revisions covering the period 1 July 2006 to 30 June 2011.

The revisions include forecasts of gas demand for three Reference Tariffs, Domestic Haulage for residential customers Commercial Haulage for small business customers consuming less than 10 TJ pa and Demand Haulage for customers consuming more than 10 TJ pa. Demand forecasts are important in setting reference tariffs. The Commission has engaged McLennan Magasanik Associates (MMA) to evaluate whether the forecasts proposed by Envestra meet the required criterion, to be considered "best estimates arrived at on a reasonable basis.[1]"

MMA has reviewed the approach, methodology and assumptions used by Envestra in preparing its forecasts and evaluated whether they meet the requirements. Where this has not been the case MMA has been asked to make recommendations which, if adopted, would result in the forecasts being considered suitable for use.

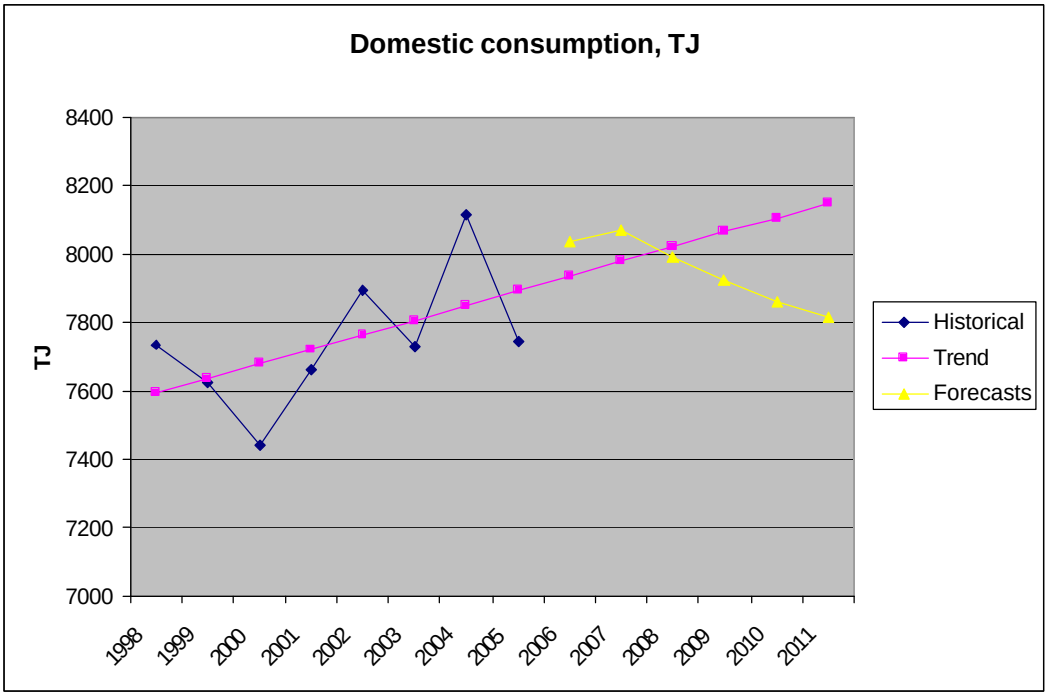
Envestra has forecast separately for four markets, domestic, commercial, small industrial and demand.

Domestic market

The history of the domestic market from 1998 to 2005 and a linear trend based on this history, together with the Envestra forecast for the domestic market are provided in Exec Figure 1. While growth in the market has been about 0.6% pa, Envestra is forecasting a turn-around over the forecasting period with usage, after an initial increase, reducing at 0.6% pa.

[1] This is referred to as the Code requirement.

Exec Figure 1 Historical, trend and Envestra forecast of the Domestic market



Envestra has forecast separately two components of the domestic market, customer numbers and average usage. Customer numbers are forecast to increase at about the same rate as seen over the past few years. MMA considers this to be reasonable given recent history and government policy on hot water systems which will tend to increase penetration by gas into new and existing homes.

Envestra is also forecasting a significant reduction in average usage by both established and (particularly) new homes. This is attributed to a number of factors including government policy increasing thermal rating in new houses to 5-star and an expected shift towards solar hot water systems.

MMA accepts that the average usage of Envestra customers has been reducing due to a number of demographic, economic and appliance factors. Further, MMA accepts that Government policy will have an impact on average usage, especially on new houses. However, MMA analysis using available data does not support the extent of reduction in average usage forecast by Envestra.

Thus, while MMA considers the approach and methodology used by Envestra in forecasting for the domestic market to be reasonable, and that the customer number forecasts are suitable, apart from some uncertainty about disconnection numbers, it does not consider that the average usage forecasts meet the Code requirements for "best estimates".

MMA recommendations to the Commission:

Recommendation 1: MMA recommends that the Envestra forecasts for the Domestic Haulage Reference Tariff as provided in the Access Arrangement be considered to not meet the Code requirement of "best estimates arrived at on a reasonable basis".

MMA makes the following recommendations about amendments that would need to be made to Envestra's forecasts before they could be considered to meet the requirements of the Code:

Recommendation 2: New township numbers would need to be included in Envestra's customer number and volume forecasts, both residential and small business.

Recommendation 3: Forecast disconnection numbers would need to be confirmed by Envestra and an acceptable basis for these forecasts provided.

Recommendation 4: If Envestra seeks to separately forecast average usage for established dwellings and new dwellings, the forecast for average usage by established dwellings would need further substantiation and linkage to reference material, in particular the derivation of assumed appliance or household efficiency trends and the income elasticity.

Recommendation 5: In order to allow the proper calculation of average usage for established dwellings over the past few years, the impact of below average usage in new dwellings needs to be taken into account by Envestra.

Recommendation 6: The reduction of average usage by established homes going forward should be the same as that over the recent past, except to the extent that acceptable justification is provided.

Recommendation 7: Forecasts for average usage by new dwellings clearly require considerable further substantiation and linkage to reference material.

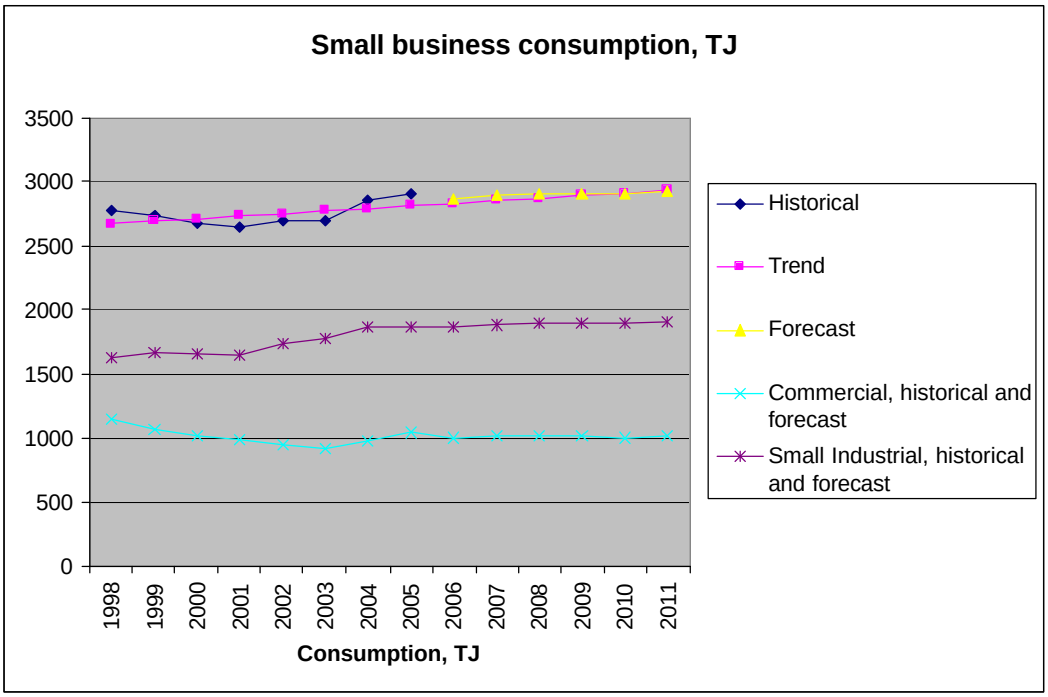
Recommendation 8: In the absence of acceptable substantiation by Envestra it is recommended that the only changes to average usage of new homes be the move to 5-star thermal rating, a limited move to solar-gas hot water systems and the assumption that AAA showerheads will be required in plans for new homes from 1 July 2006 (with appropriate implementation time).

Recommendation 9: In the absence of information from Envestra allowing average usage by established and new homes to be properly understood and disaggregated, it is recommended that the existing trend for all homes (ie 0.7% to 0.8% pa) be continued with additional reductions for the move to 5-star thermal rating, a limited move to solar-gas hot water and AAA showerheads.

Small business market

The history of the small business market from 1998 to 2005 and a linear trend based on this history and the Envestra forecasts for the small business market are provided in Exec Figure 2.

Exec Figure 2 Historical, trend and Envestra forecast of the Small Business market



Historical growth of the small business market over the period 1998 to 2005 has averaged 0.7% pa. However, there appears to be two phases to this growth, the first from 1998 to 2001 when consumption was falling by about 1.7% pa and the second from 2001 to 2005 when there was growth of about 2.5% pa. Envestra is forecasting an initial drop in consumption in 2006 followed by growth at about 0.3% pa to 2011. Over the period 2005 to 2011 growth is forecast to average 0.1% pa.

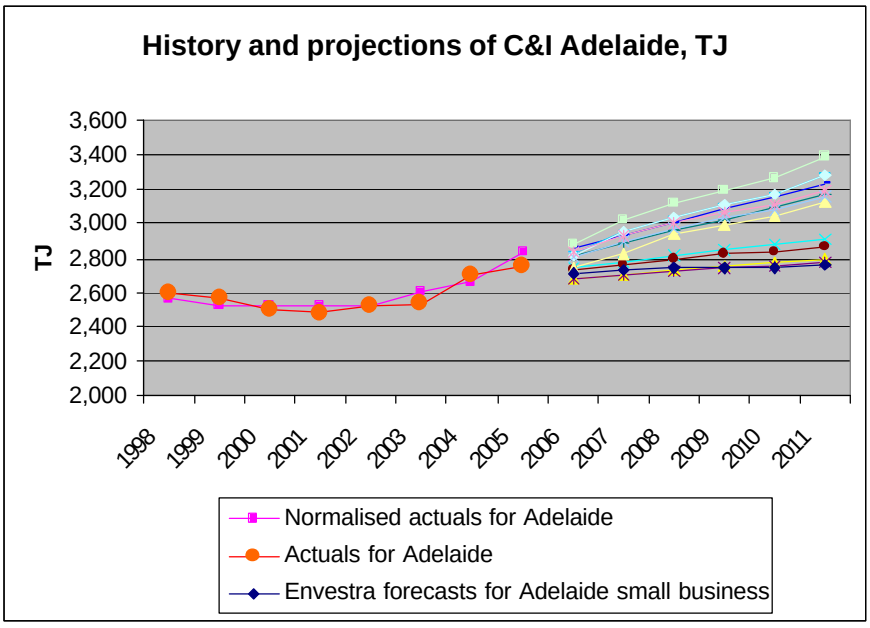
Envestra has forecast growth in the small business market separately for the sectors named commercial (< 1 TJ) and small industrial (1-10 TJ). The methodology used by Envestra has been different for both sectors.

Envestra has assumed that the commercial sector is weather sensitive and has normalised for weather. It has then assumed that the key drivers for the sector are the trend reduction in average usage seen over the period 1999 to 2005 and the change in forecast commercial output multiplied by an estimated elasticity of 0.8.

Envestra has assumed that the small industrial sector is not weather sensitive and has not normalised for weather. It has assumed that the key driver for the sector is the change in forecast industrial output multiplied by an estimated elasticity of 0.13.

MMA has significant concerns about the forecasting methodology adopted by Envestra in this market. MMA considers that the two sectors should be forecast together as the disaggregation, based on annual consumption levels, results in movements between the two sectors which are artificial and un-helpful. MMA believes that the entire market is weather-sensitive and that the normalisation is significantly greater than that estimated by Envestra. MMA has not seen any justification for the use of average usage as a driver in the commercial market, and has reservations that the information behind the trend used is actually real. MMA has not seen any support for the elasticities used. As well, the Envestra forecasts produce outcomes which fall at the bottom of a range of forecasts considered plausible, but not necessarily reasonable, by MMA and illustrated in Exec Figure 3.

Exec Figure 3 Historical, trend and Envestra and other forecast of the Small Business market



Furthermore, the customer number growth forecast for this market appears anomalously high and distributed differently to recent history.

Thus MMA considers that neither the approach nor the assumptions used by Envestra in forecasting for the small business market meet the requirements under the Code.

MMA recommendations to the Commission:

Recommendation 10: MMA recommends that the Envestra forecasts for the Commercial Haulage Reference Tariff as provided in the Access Arrangement be considered to not meet the Code requirement of "best estimates arrived at on a reasonable basis".

MMA makes the following recommendations about amendments that would need to be made to Envestra's forecasts before they could be considered to meet the requirements of the Code:

Recommendation 11: Envestra should analyse and forecast the small business market as a whole, not divide it into commercial and small industrial.

Recommendation 12: Envestra should either weather normalise the small business market and carry out its analysis on the weather normalised market as a whole or carry out further analysis to demonstrate that this should not be the case. In either case further analysis of the extent of weather sensitivity of the small business market is required.

Recommendation 13: Envestra should select a forecasting methodology which it can demonstrate balances the recent history with changes to key drivers. MMA considers that a time or economic based trend, based on weather normalised historical data, would be appropriate.

Recommendation 14: Envestra should confirm the validity and consistency of the data provided, especially for the years 1998, 1999 and 2005.

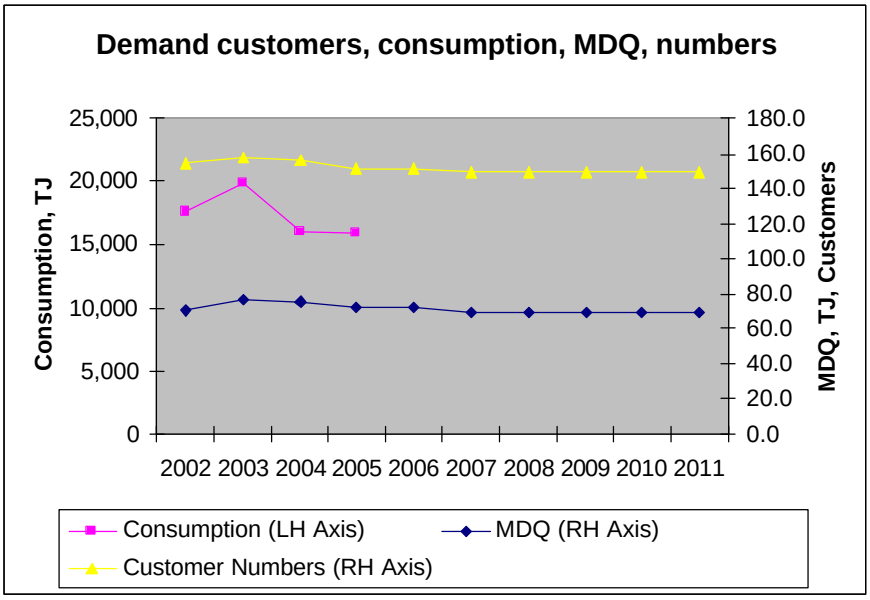
Recommendation 15: If Envestra elects to forecast using commercial and/or industrial outputs as a key driver it should derive appropriate elasticities from available data rather than assume them.

Recommendation 16: Average usage for the small business market as a whole has remained reasonably constant over the past several years. Envestra should assume that the average usage will stay constant in deriving its net customer numbers.

Demand market

The limited historical information provided by Envestra for the demand market is summarised in Exec Figure 4. The charging parameter for this market is the contracted maximum daily quantity (MDQ). Also provided are the Envestra forecasts of MDQ and customer numbers.

Exec Figure 4 Historical, trend and Envestra forecast MDQ and customer numbers and historical consumption for the Demand market



Consumption in 2005 had reduced by [confidential] from that in 2002 due to the closure of the Mobil refinery. Despite this, contracted MDQ had increased by 4% over the period. Envestra is forecasting that MDQ will reduce in 2005/06 and then stay constant, and that customer numbers will drop by two.

Envestra has commented that forecasting consumption and MDQ for demand customers is difficult, with no obvious correlation with macro-economic drivers and subject to large increases or decreases as a result of new plants, expansions, curtailments, closures and relocations. As a result it has adopted a "pragmatic" approach in its forecasting. It has used the starting MDQ levels and adjusted them only for known changes (in this case three curtailments).

While MMA accepts that forecasting is difficult, especially by zone, it considers that a "pragmatic" method such as that proposed by Envestra should be adopted only after exhausting other possibilities. Thus MMA considers that the approach used by Envestra in forecasting for the demand market does not meet the requirements under the Code. MMA notes also that despite the closure of the Mobil oil refinery, [*confidential information removed]*, the MDQ contracted in 2005 is still greater than that in 2002. The method adopted by Envestra would not recognise the potential for such growth in MDQ.

MMA recommendations to the Commission:

Recommendation 17: MMA recommends that the Envestra forecasts for the Demand Haulage Reference Tariff as provided in the Access Arrangement be considered to not meet the Code requirement of "best estimates arrived at on a reasonable basis".

MMA makes the following recommendations about amendments that would need to be made to Envestra's forecasts before they could be considered to meet the requirements of the Code:

Recommendation 18: Envestra should be asked to prepare consistent historic consumption information for the period 1998 to 2005. Envestra should also be asked to attempt to get MDQ data going back to 1998 as well.

Recommendation 19: Envestra should hold discussions with its largest 10 to 20 customers, or the retailer to these, to ascertain gas consumption and MDQ expectations and likelihood of expansions, closures and relocations over the next 5 – 6 years. Envestra should document the outcomes of these discussions and also prepare a summary spreadsheet of the expectations for both consumption and MDQ.

Recommendation 20: Envestra should prepare a summary of consumption by all other customers from 1998 to 2005 and attempt to relate these to either time or economic parameters. Forecasts of consumption can then be prepared.

Recommendation 21: Any changes in the load factors of these other customers should be taken into account in preparing MDQ forecasts.

Unaccounted for gas

Envestra is projecting a modest decrease in UAFG, at a rate of 15 TJ/year. MMA's indicative analysis of historical trends in UAFG suggests that this forecast is reasonable.

1 BACKGROUND

1.1 Introduction

The Essential Services Commission of South Australia (the Commission) regulates third party access to the South Australian gas distribution networks, essentially under the National Third Party Access Code for Natural Gas Pipeline Systems (the Code). The Commission succeeded the South Australian Independent Pricing and Access Regulator (SAIPAR) as the local regulator in 2003.

Third party access to the Envestra gas distribution network is currently available under Access Arrangements (AA) approved by SAIPAR, which remain in force until 30 June 2006. Envestra has submitted its proposed AA revisions for the new regulatory period commencing on 1 July 2006. The revised AA must be approved by the Commission according to procedures and criteria set down in the Code.

Under the Code, demand forecasts are required to be "…best estimates arrived at on a reasonable basis". The Commission has commissioned McLennan Magasanik Associates (MMA) to review the demand forecasts provided by Envestra and comment on whether it considers they meet the above criterion. If MMA considers that the forecasts produced by Envestra do not meet the criterion then MMA is required to highlight what it considers to be the deficiencies and make recommendations as to how these should be addressed.

This report is laid out as follows:

- Chapter 1 briefly introduces the assignment, explains why demand forecasts are important, sets out the criteria against which MMA has reviewed the Envestra demand forecasts, describes the process undertaken for the review and lists the conventions adopted in the report.
- Chapter 2 provides a review of historical growth of the domestic, small business and demand segments of the gas market in South Australia and an overview of the Envestra forecasts.
- Chapter 3 reviews the key drivers that are likely to impact on the gas forecasts for each of the markets.
- Chapter 4 reviews the Envestra methodology and forecasts for the residential market.
- Chapter 5 reviews the Envestra methodology and forecasts for the small business market.
- Chapter 6 reviews the Envestra methodology and forecasts for the Demand market and its forecasts for unaccounted for gas (UAFG).

1.2 Role of demand forecasts

Demand forecasts play a significant role under the combined building block and tariff basket regulatory approach expected to apply over the next period:

- Firstly, the level of demand acts as a divisor of regulated revenue in setting actual tariffs.
- Secondly, demand levels act as input into assessing the capital and operating costs required over the regulatory period.

Under the price cap regulatory approach distribution businesses (DBs) benefit from actual demand exceeding forecasts and are adversely affected if demand is less than forecast. As a result DBs have an incentive to understate their demand expectations when submitting AAs for regulatory approval[1].

Envestra has provided demand and customer number forecasts covering the period 1/7/2005 to 30/6/2011[2]. MMA's brief has been to review the forecasts and to assess whether in its opinion the forecasts can be said to represent …"best estimates arrived at on a reasonable basis" as required under Section 8.2 of the Gas Code.

The Code requirements for "…best estimates arrived at on a reasonable basis" appear to have two requirements:

- That the approach and methodology adopted are reasonable.
- That any assumptions used should be the best available.

In accordance with this understanding, in reviewing the growth forecasts MMA has asked the following questions:

- Is the approach taken the best that could be reasonably expected?
- Are the assumptions made the best that could reasonably be expected?
- Is the information / data that is used the latest obtainable and reliable?
- Is there a balance between the use of "historical trends" and "key drivers" in forecasting?
- Is the methodology properly applied?

1 Depending on tariff structures there may also be other incentives for DBs, for example maximising new customer connections or system MDQ in order to maximise capital expenditure.

2 Although the forthcoming regulatory period covers the years 2006/07 to 2010/11, forecasts are also required for the year between the last "actuals" in 2004/05 and the start of the forecast period.

The review has been largely based on desktop research, clarification of forecasting methodologies, parameters, assumptions, issues and drivers and discussion with Envestra and Origin Energy Asset Management (OEAM)[3].

The review has to draft report stage been carried out as follows:

- Envestra provided its forecasts and some accompanying information in its Access Arrangement Information.
- MMA formulated a series of detailed questions related to historical information, forecasting methodology and key parameters and assumptions. These were sent by the Commission to Envestra.
- Responses to many of the questions were supplied to MMA, generally in the form of spreadsheet tables. In several cases Envestra responded that it could not provide the information sought.
- MMA clarified several issues relating to information supply and forecasting in a telephone conference with Envestra and OEAM.
- Based on its analysis MMA has prepared a draft report providing a review of Envestra's demand forecasts and containing a series of recommendations on whether the Envestra forecasts meet the requirements of the Code and related to the methodologies and assumptions.

The future course of the review is expected to be:

- Envestra will be given a chance to respond to the MMA review and recommendations.
- There will be a further round of consultation between Envestra and MMA. This may result in agreement being reached between Envestra and MMA on some issues and differences remaining on others. It may also allow MMA to hold discussions with the largest users if required.
- After Envestra's final comments the Commission with the assistance of MMA, will determine whether the forecasts, as revised, are considered "best estimates arrived at on a reasonable basis".
- If the Commission does not consider this to be the case it will ask MMA to prepare forecasts which MMA considers to be "best estimates arrived at on a reasonable basis".

[3] OEAM personnel carry out a number of functions for Envestra.

The approach taken in this review has been similar to that applied in many similar independent reviews of demand forecasts for regulators of gas assets in recent years. The companies have initially been asked to provide their forecasts together with appropriately disaggregated historical, methodological and forecast information. Through a process of questions, answers and discussions with the companies and research and consideration of historical results and key drivers the consultant has formed an independent view as to whether the forecast methodologies and key assumptions can be considered to meet the requirements of the Gas Code. If the forecasts do not meet the requirements of the Gas Code the consultant is expected to prepare independent forecasts.

1.3 Conventions followed and reliance

All the analysis has been carried out using financial year data. Unless otherwise specified all results and tables refer to financial years. The convention followed in the report has been to refer to the financial year as either both the years covered or as the year which contains the 30th June. Thus, the financial year commencing 1 July 2003 and concluding on 30 June 2004 is referred to in the text as either 2003/04 or 2004.

It is understood that Envestra reports all gas consumption by non-daily metered users, i.e. all residential, commercial and small industrial users, on a billings basis. Reported annual consumption is the sum of gas metered/billed in that year and user numbers are the number of users who were metered/billed in that year (Envestra Forecasts of Demand. Appendix 1). Envestra notes that this is consistent with the annual tariff adjustment process and therefore is appropriate for demand forecasting purposes. MMA accepts that billings based consumption is appropriate for calculating tariffs from allowed revenue in the regulatory process. Consistent use of billings based consumption should not have any significant impact on forecasts. A minor impact on weather normalisation of historical data is discussed in APPENDIX A .

We have in some cases derived relationships which use logarithmic functions. Generally we use the natural logarithm (ln) for these relationships but sometimes refer to them as log.

[*Confidential Information removed*]

Tables and percentages may not appear to completely reconcile in some cases. This could be for a number of reasons including rounding and use of trend estimates.

We have generally relied on the historical data provided by Envestra. While we have reviewed the forecasts we have generally not reviewed the historical data and have commented only where data appear anomalous.

2 HISTORICAL REVIEW AND FORECAST OVERVIEW

2.1 Envestra reference tariffs

Envestra provides network haulage under three reference tariffs:

- Under its Domestic Haulage tariff about 350,000 domestic customers, over 95% in Adelaide, consumed about 7700 TJ of gas in 2005
- Under its Commercial Haulage tariff about 8,500 small business customers, about 93% in Adelaide, consumed some 2900 TJ of gas in 2005.
- Under its Demand Haulage tariff, about 150 customers (each consuming more than 10 TJ pa) consumed about 16 PJ in 2005 and contracted about 73 TJ of maximum daily quantity (MDQ) capacity.

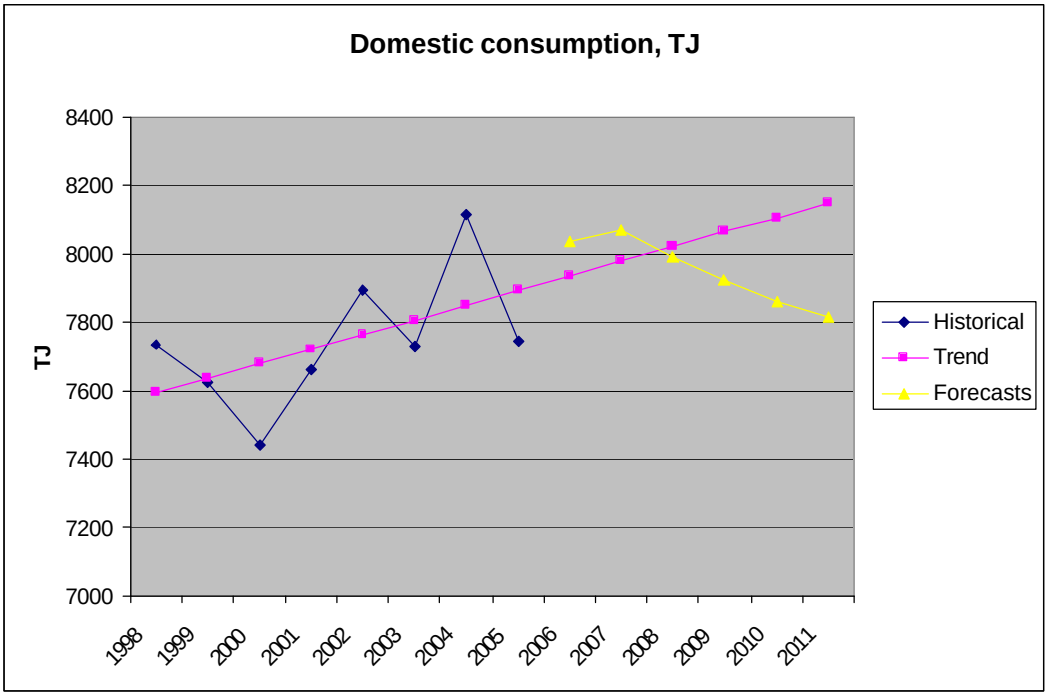
Charging under the first two reference tariffs is based largely on fixed daily charges and consumption and revenue is therefore determined by consumption and customer numbers. Envestra has provided a history of customer numbers and consumption for these customers from 1998 and also forecasts of these parameters to 2011.

Charging under the Demand Haulage tariff is based on the maximum daily quantity (MDQ) contracted by the large customers. Envestra has provided only limited historical consumption and MDQ data for Demand customers and has forecast only the MDQ.

2.2 Domestic market

The domestic market consumed 7744 TJ in 2005, a drop of some 4.5% from the previous year. Historical consumption in the residential market over the period 1998 to 2005 is shown in Figure 2.1.

Figure 2.1 Historical, trend and Envestra forecast of the Domestic market



The domestic market shows significant annual variability, typical of a market with weather sensitivity. Overall, however, the market is seen to have slowly trended up over the period 1998 to 2005, with an annual growth rate of about 0.6% pa.

Also shown in Figure 2.1 are the linear growth trend based on historical data and the Envestra forecast. Envestra is forecasting the market in 2006 to commence at a level somewhat higher than the trend value but then to decline at a rate of about 0.6%pa.

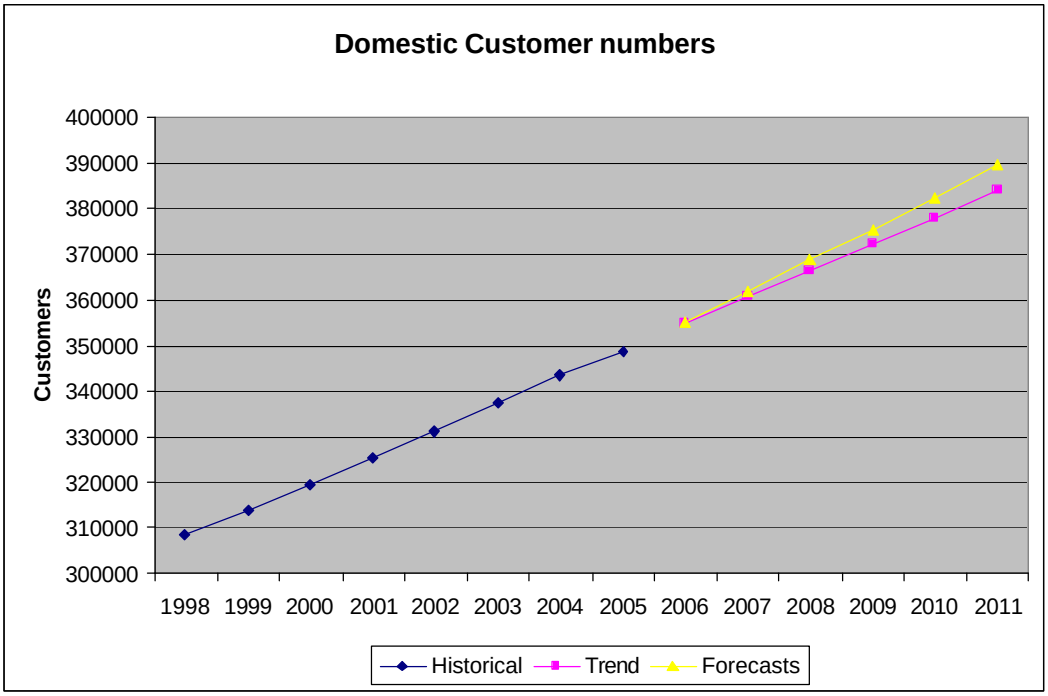
The domestic market is generally reviewed according to changes in the two components that make up consumption, customer numbers and average usage per customer.

2.2.1 Customer numbers

Domestic customer numbers on the Envestra network over the period 1998 to 2005 are provided in Figure 2.2. Also shown in the Figure are the linear growth trend and the Envestra forecast.

Over the period 1998 to 2005 net domestic customer numbers have grown by about 5700, about 1.8%, pa. Envestra is forecasting customer numbers to grow at about the same rate, 1.8% pa.

Figure 2.2 Historical, trend and Envestra forecast of domestic customer numbers



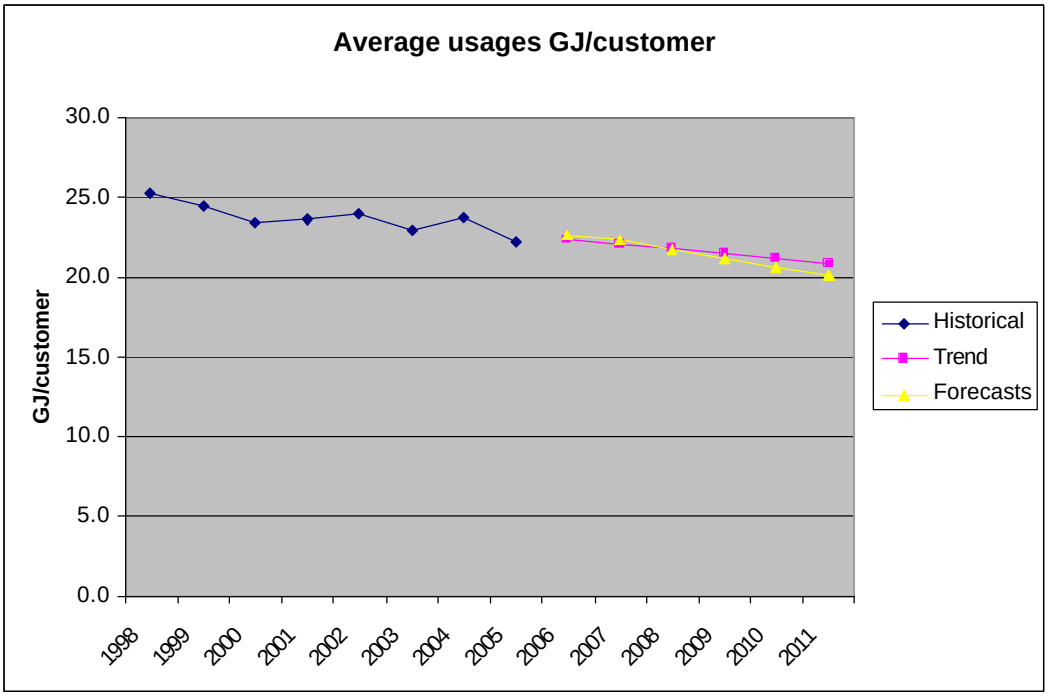
2.2.2 Average usage per customer

The change in average annual usage per domestic customer over the period 1998 to 2005 is provided in Figure 2.3. Also shown in the Figure are the linear growth trend and the Envestra implied forecast of average use.

Over the period 1998 to 2005 trend average usage per domestic customer has reduced at -1.25% pa[4]. Envestra is forecasting average usage per customer to be about the same in 2006 as 2005, and then reduce at a rate of about 2.4% pa thereafter.

4 Note that this is before weather normalisation. Weather normalised average usage has declined at about 0.8% pa (see Section 3.4.1).

Figure 2.3 Historical, trend and Envestra forecast of average usage per domestic customer



2.2.3 Domestic market, combination of customer number and average usage changes

As mentioned in Section 2.2, the trend growth rate of the domestic market has averaged about 0.6% pa. This was made up of a customer number growth rate of 1.8% pa combined with a reduction in average usage of about -1.2% pa.

Over the period 2006 – 2011 Envestra is forecasting a domestic growth rate of – 0.6% pa, made up of customer number growth of 1.8% pa and average usage growth of -2.4% pa.

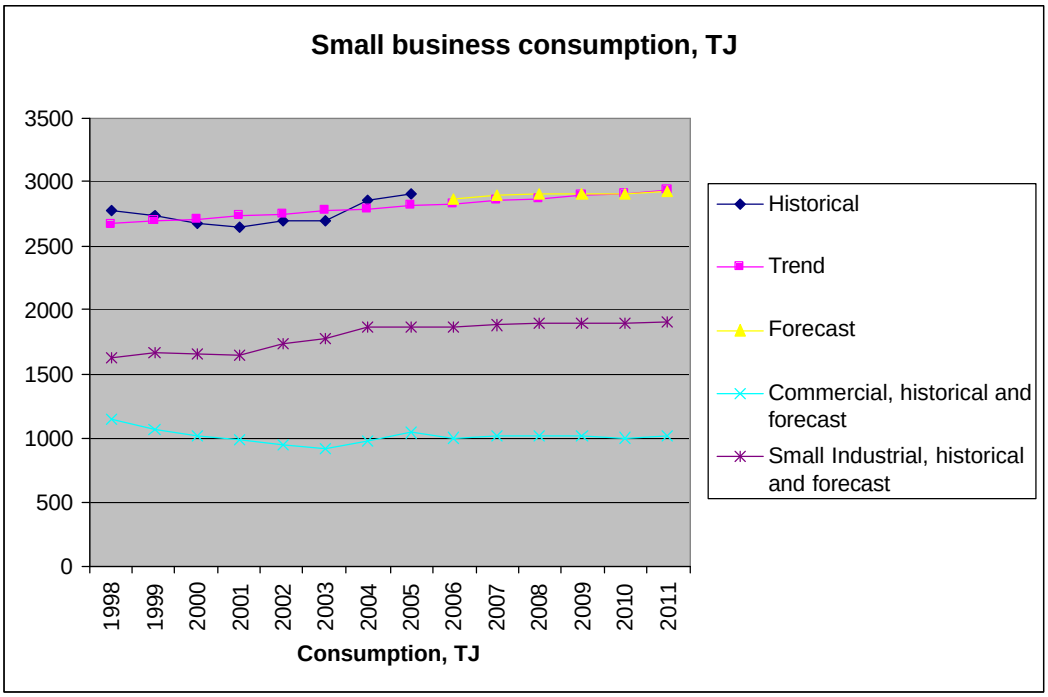
Envestra's forecast methodology clearly needs to explain and justify the significant further reduction in average usage.

2.3 Small business market

2.3.1 Consumption

The small business[5] haulage market consumed 2911 TJ in 2005. Historical consumption in the small business market over the period 1998 to 2005 is shown in Figure 2.4. Also shown in the Figure are the linear growth trend based on data from 1998 to 2005 and the Envestra forecast for the small business market.

Figure 2.4 Historical, trend and Envestra forecast for the Small Business market and its components



Historical growth of the small business market over the period 1998 to 2005 has averaged 0.7% pa. However, there appears to be two phases to this growth, the first from 1998 to 2001 when consumption was falling by about 1.7% pa and the second from 2001 to 2005 when there was growth of about 2.5% pa.

Envestra is forecasting an initial drop in consumption in 2006 followed by growth at about 0.3% pa to 2011. Over the period 2005 to 2011 growth is forecast to average 0.1% pa.

Envestra has provided history for, and forecast separately the commercial and small industrial sectors of the small business market. Graphs of the history and forecasts of

[5] We refer to it as the small business market because Envestra hsas divided the Commercial tariff into commercial (customers consuming < 1 TJ pa) and small industrial (customers consuming between 1 and 10 TJ pa with resultant ambiguity about the use of the term commercial. In future we refer to the < 10 TJ market as "small business" or "C&I" and the < 1 TJ market as commercial.

these two sectors are also shown in the above Figure. As can be seen from the Figure, the drop in 2006 is attributed to the commercial sector (a drop of around 4% over the 2005 year) which then grows at 0.3% pa, significantly higher than the growth rate of -1.4% pa seen over the 1998 to 2005 period.

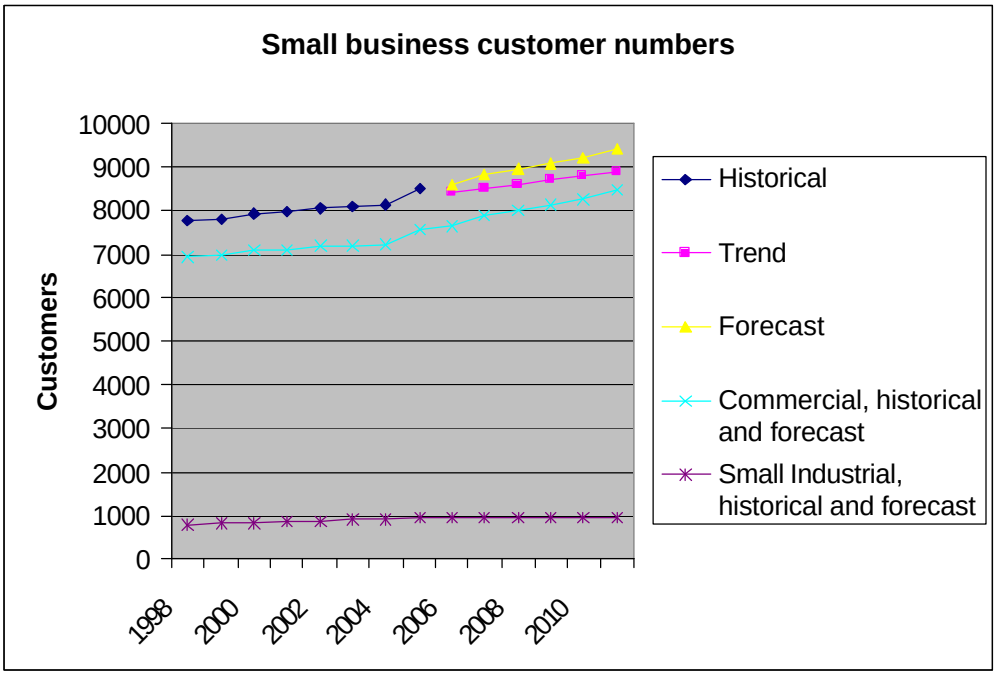
The small industrial sector, which grew at about 2% pa over the period 1998 – 2005, is forecast to grow at about 0.3% pa from 2005.

Envestra's forecast methodology clearly needs to explain the initial drop of consumption in 2006 and then why the forecasts of growth appear to be so different to historical trends.

2.3.2 Customer numbers

Historical customer numbers for the small business market as a whole over the period 1998 to 2005 are shown in Figure 2.5. Also shown in the Figure are the linear growth trend based on data from 1998 to 2005 and the Envestra customer number forecast for the small business market.

Figure 2.5 Historical, trend and Envestra forecast customer numbers for the Small Business market and its components



Historical growth of small business customer numbers over the period 1998 to 2005 has averaged 107 customers or 1.3% pa. Growth in the last year of the period, 375 customers, was exceptional, being more than 3 times the growth in any of the previous years of the period. Envestra is forecasting growth of 1.7%, or 150 customers, pa over the forecast period 2005 - 2011. This is a 40% increase in the growth rate over the previous period.

Envestra has provided history for, and forecast separately, customer numbers for the commercial and small industrial sectors of the small business market. Graphs of the history and forecasts of these two sectors are also shown in the above Figure.

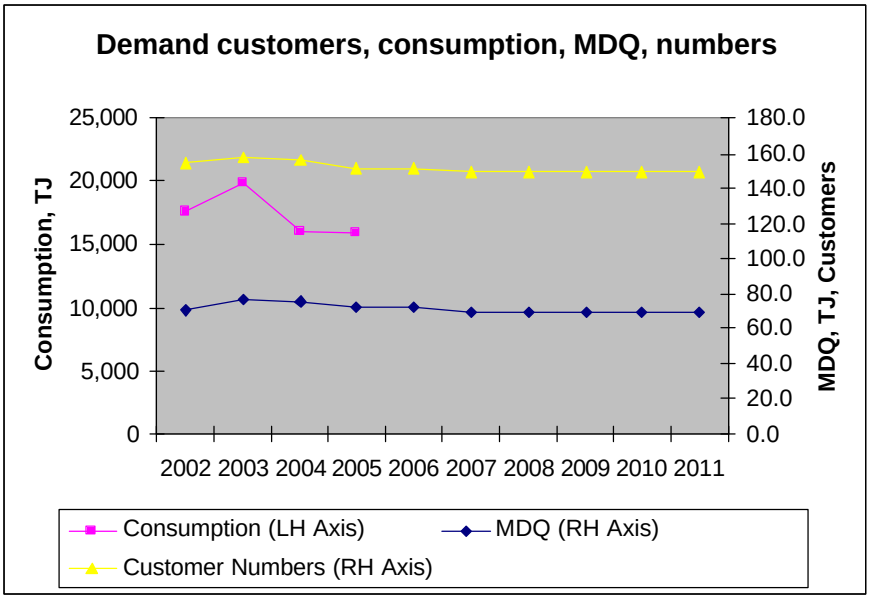
As can be seen from the figure, the increase in growth rate of customer numbers is all attributed to the commercial sector. While small industrial customer numbers, which had been growing at a rate of 2.5% pa over the period 1998-2005, are forecast to grow at only 0.3% pa, commercial customer numbers, which had been growing at 1.2% pa, are forecast to grow at 1.9% pa.

Envestra's forecast methodology needs to explain the higher customer number forecasts and the change in growth rates for the different sectors.

2.4 The demand market

Envestra has provided only very limited historical information for the demand market. Consumption, MDQ and customer number data have been provided for the period 2001/02 to 2004/05, by zone and region. Envestra has stated that it did not have MDQ data going back before this period and it could not provide earlier consumption data because of concerns about consistency[6].

Figure 2.6 Historical, trend and Envestra forecast MDQ and customer numbers and historical consumption for the Demand market



The history provided by Envestra allows some observations to be made. Consumption in 2005 had reduced [*confidential information removed*] due to the closure of the Mobil

6 Envestra did subsequently provide further historical consumption data. This data was indeed inconsistent and was not of any use in the form provided.

refinery. Despite this, contracted MDQ had increased by 4% over the period while customer numbers fell by three. Envestra is forecasting that MDQ will reduce in 2005/06 and then stay constant, and that customer numbers will drop by two.

Envestra's forecasting methodology must be assessed against the lack of historical data or consideration of demand drivers used.

3 KEY DRIVERS

Key drivers for forecasting gas demand include both macro- and microeconomic parameters, weather and government policy. As the state of the economy is considered to be a significant macro driver for the network as a whole an economic overview for South Australia and the Adelaide region is initially provided. Following that specific key drivers are considered for both the residential and non-residential sectors.

3.1 Economic parameters

3.1.1 Overview

In assessing general economic trends, MMA has utilised Econtech's Australian State and Industry Outlook dated 8 July 2005, and three reports by the National Institute of Economic and Industry Research (NIEIR)[7]. MMA has also utilised various economic and demographic indicators from the Australian Bureau of Statistics (ABS) including Gross State Product (GSP), historical population and housing statistics.

Between 1998 and 2005, NIEIR reports that the South Australian economy grew by about 2.7% pa, lower than the Australian economic growth rate of 3.5%[8].

Econtech has forecast domestic demand in Australia to weaken in 2005/06 due to slower growth in private consumption and a further weakening of the housing market. However, the external sector is expected to rebound. High commodity prices and a downward correction in the AUD should stimulate an improved contribution of net exports to growth in the years ahead. This should benefit South Australian manufacturing and support South Australia's economic growth.

Econtech forecasts the South Australia Gross State Product to grow by 3.0% per annum compared to the Australian GDP average growth of 3.3% pa over then next six years to 2011. NIEIR's forecast for South Australia's economic growth between 2005 and 2011 is somewhat lower, 2.4%pa, compared with their forecast of Australian economic growth of 2.9%. South Australia's economic performance is expected to be constrained by its slow population growth. This means that economic growth is likely to be lower than the national average and that construction occupies a diminished role in the South Australian economy.

Table 3.1 provides a summary of South Australia economic growth outlook to 2011 from Econtech and NIEIR.

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7 NIEIR's Economic Outlook for NEM States to 2014/15 (May 2005), NIEIR's draft report, "Forecasts of natural gas sales and customer numbers for standing contract customers in South Australia" dated April 2005, prepared for the Commission and NIEIR forecast information provided to Envestra.

8 NIEIR, *Forecasts of natural gas sales and customer numbers for standing contract customers in South Australia,* Draft report prepared for ESCOSA, April 2005 and information prepared for Envestra..

Table 3.1 South Australia Economic Outlook (% Growth)

	Actual	Est	Forecast					
Fin Year ending June	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**
Private consumption	4.3	3.3	2.6	2.2	1.7	1	1.2	1.8
- On Dwellings	18.1	0.7	0.9	4.2	-1.3	-1.8	2.8	-1.2
- On other Building & Structures	10.1	-14.8	4.1	7.9	4.1	2	1.4	1
- On Machinery & Equipment	8	9.5	3.5	3.7	4	2.1	1.5	1.2
GSP	4.4	1.9	3	3.8	3.9	2.6	2.6	2.4
Employment	1.3	1.7	0.6	1.3	0.8	0.1	-0.2	-0.2
Population*		0.4	0.5	0.5	0.4	0.4	0.5	0.4
Dwelling stock growth – Adelaide *		1.1	0.8	1.0	1.0	0.8	1.0	1.1

Source: Econtech, Australian State & Industry Outlook, 8 July 2005. NIEIR, Information provided to Envestra for dwelling stock and population

3.1.2 Population growth

Population in South Australia has consistently grown more slowly than the rest of Australia over the last few decades. South Australia's population growth has been supported by increases in incoming overseas migration. Natural population increase has however declined significantly and losses in interstate migration have constrained population growth. According to the ABS, as at June 2002, South Australia had an estimated resident population of 1,520,242; some 7.8% of total Australia estimated resident population.

By June 2006, the South Australia population is projected to reach 1,540,795 about 7.5% of Australia's population. Between 2005 and 2011, South Australia is expected to experience a population growth rate of around 0.4% pa, significantly slower than the expected Australian average growth rate of 1% over the same period.

Within South Australia, Adelaide is expected to remain the fastest growing region with annual population increases of around 0.5% pa. This is in contrast to the negative growth expected in a number of other population centres including Peterborough, Port Pirie and Whyalla.

3.1.3 Private consumption expenditure

Private consumption expenditure in South Australia rose by a 4.3% in 2003/4. This is slightly lower than the Australian average of 5.6%. The rise in expenditure was

supported by the strong growth in housing construction (18.1%), low nominal interest rates and stronger employment and income growth. These factors more than offset the negative impact of the drought.

The strong growth in private consumption expenditure is forecast to slow over the next six years to 2011. Higher nominal interest rates and the fall in housing construction together with high household debt levels will constrain South Australia's private consumption expenditure growth to around 1.7% pa.

3.1.4 Dwellings investment

Private dwelling investment in South Australia rose by 18.1% in 2003/04. The boom in housing construction in South Australia was initially driven by the First Home Owner's Grant and low nominal interest rates. The resumption of population growth in South Australia over recent years and stronger levels of investor activity have supported growth over the recent past.

While South Australia has avoided the large slow down in residential investment affecting Victoria and NSW in 2004/05, nevertheless, private new dwelling investment in South Australia is forecast to also slow to around 1% over the next six years to 2011.

3.1.5 Private business investment

Private business investment in building and structures increased by over 10% for South Australia, while investment in machinery and equipment rose by 8% in 2003/4. Business investment in South Australia is expected to be supported by ongoing investment activity in the mining and manufacturing sectors.

Expenditure on machinery and equipment will be supported by the high Australian dollar and falling prices of information technology products and sustained high commodity prices. Any fall in commodity prices and further appreciations in the Australian dollar, however, could choke off growth in investment in South Australia over the medium term.

Business investment in machinery and equipment is expected to grow by 3% pa and business investment in buildings and structures by about 4% pa between 2006 and 2011.

3.1.6 Employment

South Australia's employment growth has been slightly lower than overall Australian employment growth over the last few years. Employment growth in South Australia was 1.3% in 2003/04 compared to the Australian average of 1.6%. In 2005/06, slower growth in employment is expected as GSP growth slows. South Australia's employment growth is forecast to slow to around 0.5% over the next six years to 2011 as employment growth returns to its normal growth path leading the South Australian employment rising to above the Australian average.

3.1.7 Summary

South Australian Gross State Product is forecast to grow by 2.4% pa (NIEIR) or 3.0% pa (Econtech) over the next six years to 2011, compared to a growth rate of 2.7% pa between 1998 and 2005, meaning that forecast growth is expected to be similar to that experienced over the earlier period. Population growth is expected to continue it recent trend of slow growth with the rate of growth averaging around 0.4% pa. Dwelling investment is forecast to fall from the high rates of growth recently to a more sustainable level of around 1% pa.

3.2 Residential drivers

Many factors impact on the gas residential market. In the context of this review these can be divided into two components, those that impact on the number of gas customers, and those that impact on the average usage per customer.

3.3 Impacts on residential customer numbers

3.3.1 Population and dwelling changes

Over the period 1996/97 to 2003/04 population in South Australia is estimated to have grown at about 0.5%[9] pa. The comparable Adelaide growth was about 0.5% pa population growth and 1.1% dwelling growth[10].

The years 2003-2005 were a period of relatively strong dwelling growth, especially in apartments and town houses. As has been discussed in Section 3.1, the level of building activity is expected to decline somewhat from these levels and to result in average growth a little lower than that over the previous period. A dwelling growth rate of about 1% pa in the key Adelaide market is forecast by NIEIR[11], a little slower than the 1.2% pa growth rate seen over the period 1998 to 2005.

Estimating growth of electricity customers within a region is relatively straight-forward. As virtually all dwellings within a region consume electricity, the number of electricity customers corresponds well with the number of dwellings. The growth in electricity customer numbers should similarly correspond well with the growth of dwellings. Thus the expected growth rate in customer numbers would be expected to be about 1% pa.

Such an approach is not necessarily appropriate for forecasting residential gas customer numbers. Firstly, some of the state does not have gas reticulation. Secondly, gas is a discretionary fuel and not all customers within a reticulated area will connect to gas. Thirdly, there is likely to be movements between fuel choices in existing houses, thus some customers may elect to go from "all electricity" to connecting to gas as well.

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9 'Regional Population Growth', 3218.0, ABS, 2002, 2003 and 2004

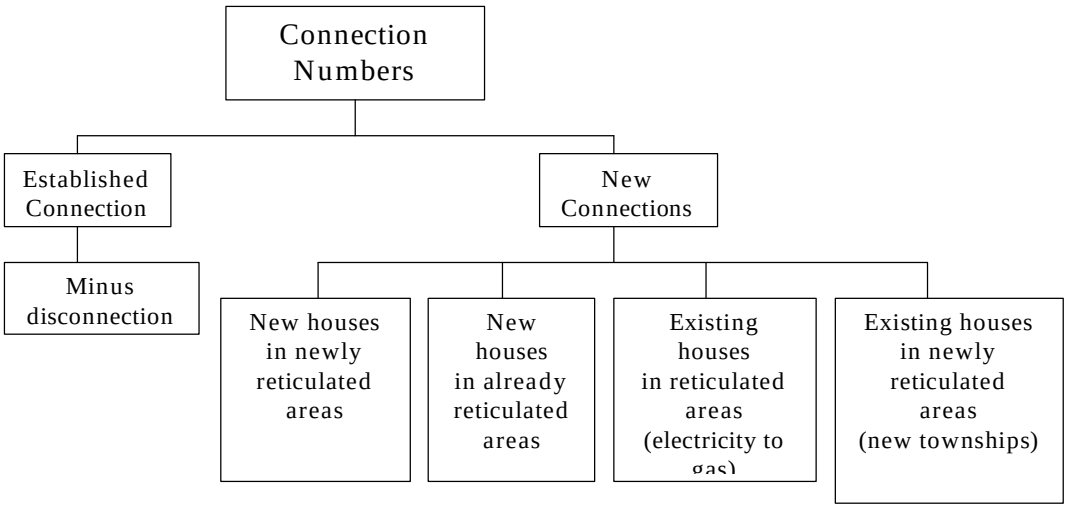
10 MMA analysis of building approvals using 90% conversion factor of approvals to buildings, with no time lag. Approval data obtained from 'Building Approvals', 8731.0, ABS. Dwelling stock from the 2001 ABS census used as the base year.

11 NIEIR information provided to Envestra.

As discussed in Section 2.2.1, Envestra has been adding customers at a rate of about 5700 customers per year, a growth rate of 1.8% pa which is higher than the growth rate for Adelaide and SA as a whole.

Potential sources for new customer numbers are provided in Figure 3.1. There are four sources of new connection growth, each with its own usage characteristics[12].

Figure 3.1 Residential customer connections



Reasons why the customer number growth rate for Envestra could be higher than for the state or Adelaide region as a whole include:

- That a greater proportion of new customers is connecting to gas than is currently connected. Envestra has estimated that about 70% of dwellings on "line of mains"[13] are actually connected. A higher proportion of new houses connecting will result in a growth rate of customers faster than that of new dwellings. Envestra has provided some evidence to support the belief that the penetration rate for new dwellings in reticulated areas has been increasing and is now very high[14].
- That there are a significant number of "electricity to gas" conversions. That is, existing houses who are on line of mains but have not previously been gas customers choosing to convert to gas.

12 For example, while new houses tend to purchase all appliances at once, existing houses generally start with one appliance and then the appliance penetration increases over time.

13 That is in a gas reticulated area.

14 According to Envestra "Average residential gas consumption in South Australia" Table 2, penetration of gas into the new home market has increased from about 87% in 1997/98 to 96% in 2004/05. Envestra has stated that this is analysis is based on survey data..

- New reticulations into existing areas. Envestra has identified three townships, Tanunda, Montaro and McLaren Vale, as being reticulated over the coming regulatory period. It is unclear whether similar new township reticulations have been added in the current regulatory period.

Envestra has, unfortunately, not been able to provide any data as to the historical distribution of its new connections between these categories.

Given the expectation that dwelling growth rates in reticulated areas will be a little slower over the coming period than over the previous period, one would expect net new customer connections to lie between the forecast dwelling growth rate, 1% pa, and a growth rate slightly below that seen in the previous period unless there is a change in connection drivers.

3.3.2 Government initiatives

A Government initiative announced on 2 June 2005[15] is likely to lead to an increase in gas connections. Under the initiative, electric hot water systems will be effectively banned from new homes and homes undergoing major renovations which include augmentation of their hot water capacity, in areas which have gas reticulation. Hot water systems choices under these circumstances are restricted to solar, gas or heat pump.

A component of this announcement which warrants special attention is its restriction to areas with gas reticulation. The Government appears to have taken into account that the capital cost of solar and heat pump systems, even after taking into account rebates and RECs payments) are significantly higher than those of gas (see discussion in Exhibit 3-1) in not extending this requirement to areas without gas reticulation.

As a result of this announcement we consider it likely that some homes undergoing renovation which require an augmentation of hot water systems will convert from electricity to gas, leading to an increase in connections on line of mains for the estimated 30% of householders who are in reticulated areas but are not connected, and the limited proportion of those connected to gas who do not use gas hot water.

3.4 Impacts on average residential usage

As outlined in Section 2.2.2, average usage per residential customer over the past 7 years has been reducing at an apparent trend rate of -1.25% pa. without weather normalisation Envestra has forecast that the downward trend will accelerate.

A multitude of factors impacts on average usage per residential customer. Some of these are considered below.

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15 News release from the Premier M Rann and Minister for Environment and Conservation, J Hill, "SA confronts climate change threat", 2 June 2005.

3.4.1 Weather

Gas demand in the domestic and small commercial/industrial customer segments is strongly influenced by weather conditions from day-to-day and from year-to-year. Year-to-year variations in weather can clearly be identified as one of the causes of the variation in average usage seen in Figure 2.3.

In view of the impossibility of accurately forecasting future weather conditions, in preparing gas forecasts the industry standard procedure is to:

- Weather normalise historical actual gas demand, so that underlying trends apart from weather can be identified.
- Prepare forecasts assuming that normal (average or trend) weather conditions will prevail, so that actual future demand variations due to weather variations from normal will have an equal probability of being positive or negative.

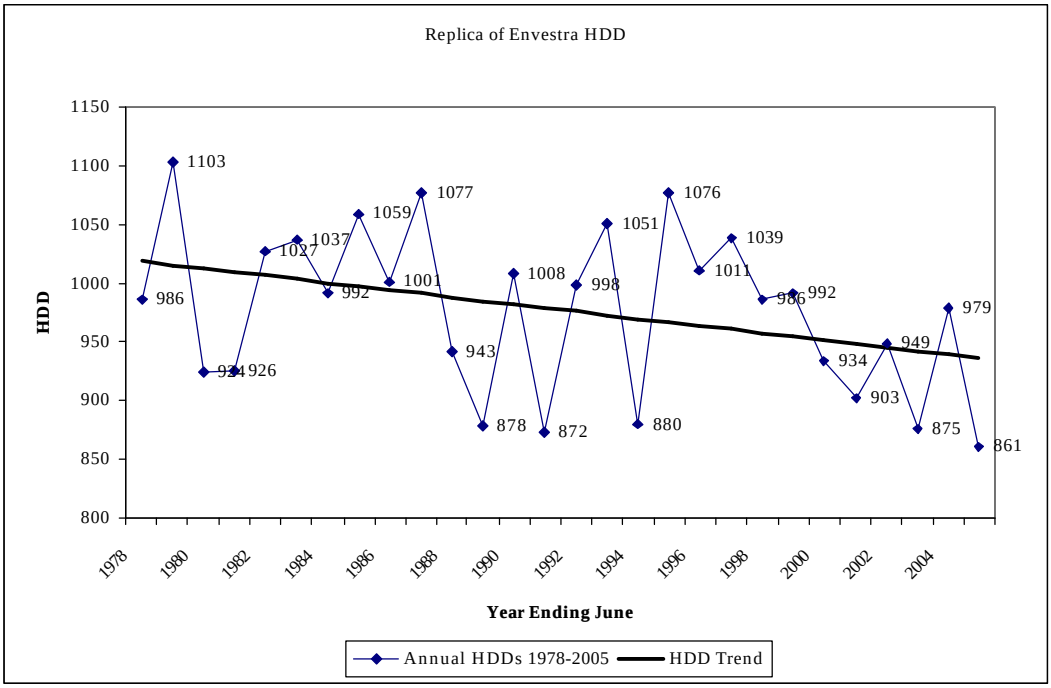
Weather trends in gas markets which are largely related to heating are often monitored, and compensated for, using a heating degree day (HDD) index. The heating degree day value for any given day is the amount by which the average daily temperature falls below a reference temperature (often 18C)[16]. Annual HDDs are the sum of the daily HDDs. Envestra uses the HDD index in its weather normalisations and forecasting.

3.4.1.1 Weather trend

Envestra has identified a trend in the annual HDDs as contributing to the reducing usage of appliances with a heating component. MMA has replicated the Envestra analysis with the resultant annual HDDs and trend shown in Figure 3.2.

[16] For example, a day with an average temperature of 14C will have a HDD value of 4. Note that if the average daily temperature is greater than the reference temperature then the HDD for that day is zero.

Figure 3.2 Annual HDDs, actuals and trend



A downward trend in HDDs has been identified by Envestra for the Adelaide area. Similar trends have been identified in other major cities and accepted as a driver of consumption. MMA considers the use of such a trend, estimated to result in a reduction of 3 HDDs pa[17], as appropriate.

3.4.2 Weather normalisation and recalculation of average usage changes

Envestra has applied a weather normalisation model to the residential market and provided the resultant weather normalised historical consumption to MMA. Although MMA has taken a slightly different approach to weather normalisation, as discussed in 6.4, the results for the residential market are not materially different.

The key results to emerge from the weather normalisation are:

- That the domestic usages in the starting year need to be normalised. This year was significantly warmer than the (trend) weather normal HDDs.
- That the trend weather normalised reduction in average usage over the period 1998-2005, which had been estimated without weather normalisation to be -1.25% pa (see Section 2.2.2), could now better be estimated at -0.7 to -0.8% pa.

[17] Out of an average 930 HDDs or so, a reduction of some 0.3% each year.

- The trend reduction in average value by this value incorporates the impact of annual change in HDDs due to the warming trend. The warming weather trend contributes some 0.1% to 0.2% pa to the annual reduction.

Without any changes to drivers other than those apparent over the recent period, including weather, we would expect that the average usage in 2005/06 would be calculated by weather normalising (which will result in an increase in average usage as 2004/05 was a very warm year in HDD terms) and then continuing the trend reduction in average usage by about 0.7% to 0.8% pa.

3.5 Demographics and dwellings

A number of demographic and dwelling factors impact on average energy usage. Some of the key ones, and their likely impact on average usage, are listed below:

- Household size, the number of persons per household, is reducing. This tends to reduce average usage per customer as households with fewer people tend to use less energy for cooking, hot water and heating.
- Urban consolidation. Presumably in part because of a reduction in household size, Australians are taking increasingly to living in flats and townhouses. This suggests a reduction in floor space that needs conditioning (heating/cooling).
- Increasing floor space. Despite the above, there has been a trend towards increasing floor space both in new homes[18] and existing homes through extensions. This suggests an increase in floor space that needs conditioning.
- Increased thermal efficiency, suggesting less need for conditioning.

3.6 Appliance penetration

There is anecdotal evidence that the penetration and pattern of usage of gas appliances may be changing. For example there is some evidence:

- That Australian preferences are moving towards gas cook-tops with electric ovens.
- That more solar hot water systems are being installed.
- That reverse cycle air conditioners are being increasingly purchased and used for heating as well as cooling.

These trends all suggest a reduction in penetration and usage of gas appliances.

While these trends may well be correct, their materiality and impact on the gas market up to now and going forward needs to be carefully assessed.

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[18] See for example Australian Bureau of Statistics, publication 1301.0, "Construction Artice Australian home size is growing", Year Book Australia, 2005.

Some information about household appliance usage by state is available in the ABS publication 4602.0 dated November 2002[19]. The publication compares data from similar surveys in 2002, 1999 and, for some questions, 1994. Some of the information of interest is provided in Table 3.2 and Table 3.3.

Table 3.2 Information about appliance penetration in South Australia, %

South Australia	Jun-94	Mar-99	Mar-02
Gas as a source of energy in dwellings			64.40%
Main source of energy used in cooking		47.60%	49.70%
Main source of energy used in heating water	47.70%	47.00%	49.20%
Main source of energy used in space heating	33.30%	32.30%	32.70%
Proportion with Reverse cycle / heat pump	52.90%	35.40%	50.50%

Source ABS 4602.0, March 2002

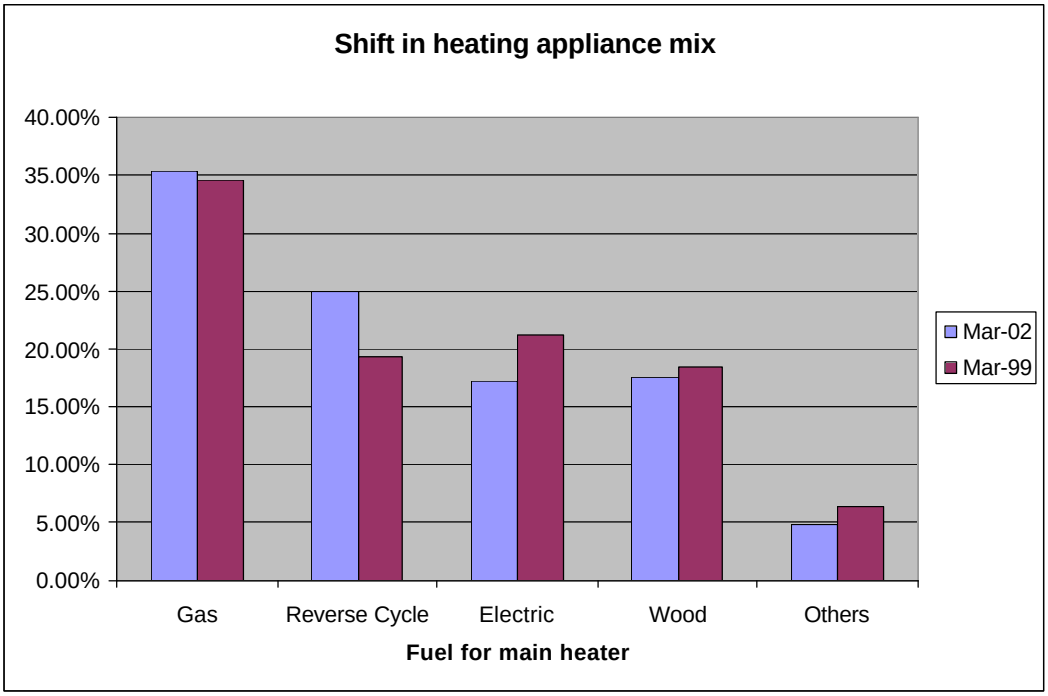
Although these statistics do not all show obvious trends[20] they do show that over the period 1999 to 2002 the proportion of households which used gas as a main source of energy in cooking, heating water and space heating at least held steady.

This statistic is especially interesting for the heating market where reverse cycle air conditioning penetration has certainly increased over the period 1999 to 2002. However, as can be seen from Table 3.3, this appears to have taken market share away from electricity, wood and other fuels rather than from gas.

19 Australian Bureau of Statistics, publication 4602.0, "Environmental issues, people's views and practices" March 2002, released in December 2002. Although newer 4602.0 publications are available this is the latest available on this theme.

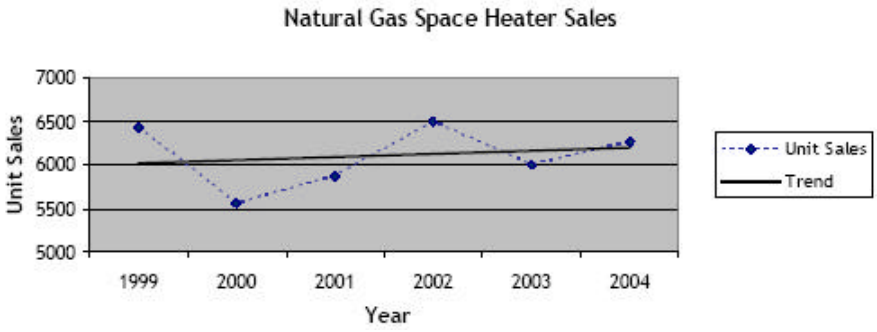
20 For example LPG is likely to be included with natural gas and they do not take into account changes to gas penetration over time..

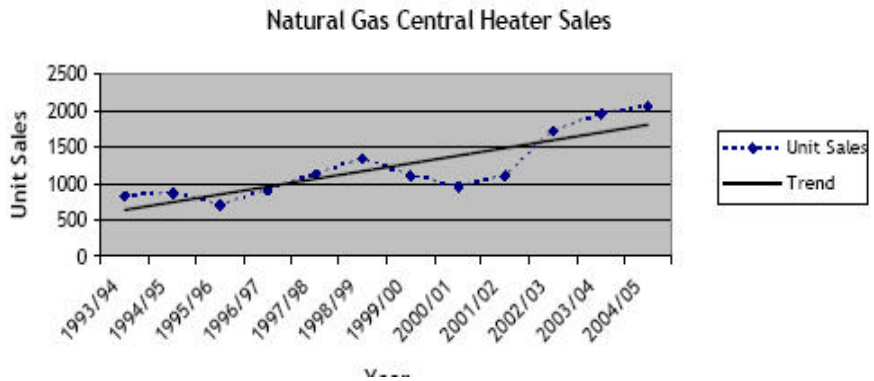
Figure 3.3 Shift in heating appliance mix,



Source ABS 4602.0, March 2002

Indeed, two graphs provided by Envestra as evidence that heating sales are stagnant (reproduced below) actually suggest that gas heater sales in combination, over the period 1999 to 2004 have actually increased at a rate faster than the rate of customer growth.





Source Envestra Average residential gas consumption in South Australia, page 11.

Although such statistics are by no means conclusive, and more recent trends may have changed, they indicate that care must be taken in forecasting significant shifts in penetration without providing supporting analysis.

Envestra has also expressed serious concerns about the potential for electric and gas boosted solar hot water systems to erode the market share of gas hot water systems. The evidence with regard to solar heaters displacing gas is discussed in Section 4.4.5.

3.6.1 Energy usage in appliances

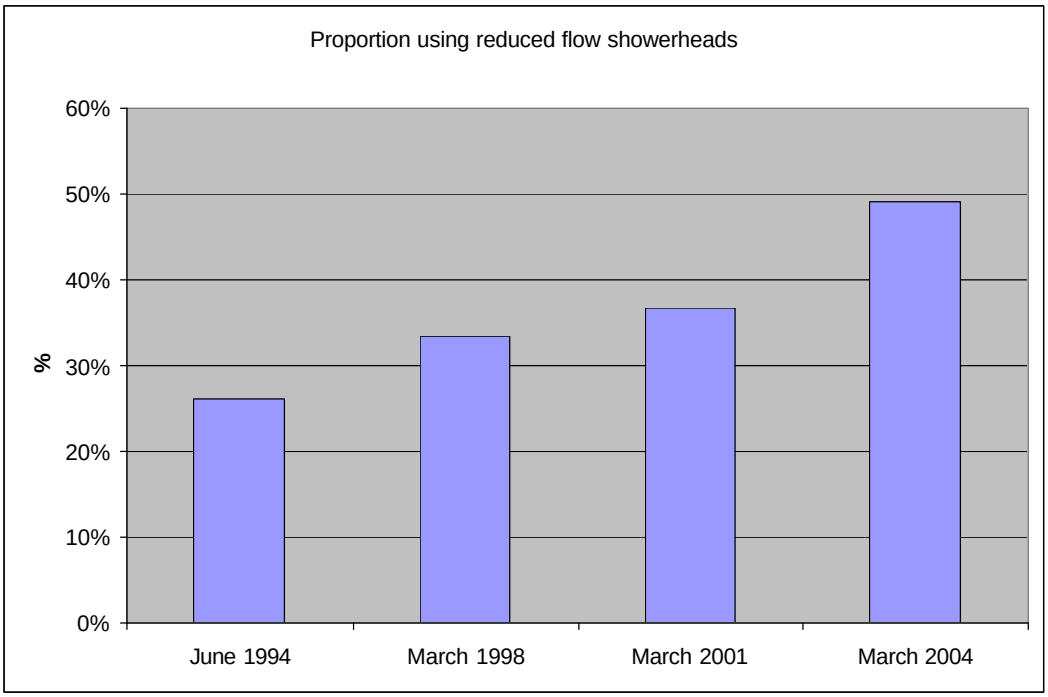
As for appliance penetration, there is similarly evidence to support the contention that energy usage in appliances is changing over time.

- A significant change is in the area of hot water systems. There is strong evidence, Australia-wide, that new homes especially are shifting away from storage towards modern instantaneous hot water systems. Modern instantaneous systems offer a number of advantages to homeowners and builders, including space savings, and are rapidly eroding the storage market share[21]. This shift is significant in terms of hot water usage. Whereas a gas storage hot water system in South Australia may use 20 GJ pa of gas, an instantaneous system, being more efficient, might use only 15 GJ pa. The shift to instantaneous systems is likely to have had a significant impact on average hot water systems load in both existing and new homes.
- Water efficient appliances. Australia has experienced a decade of drought and concerns have been raised about the sustainability of water supply into many areas including South Australia and Adelaide in particular. A partial response to this has been a move towards increasing efficiency of water appliances in the

[21] For example, a studty by BIS Shrapnel in 2000 quoted in "Driving energy efficiency improvements to domestic gas appliances" , discussion paper by the Sustainable Energy Authority of Victoria, July 2003 found that about two thirds of hot water system sales in South Australia in that year were of the instantaneous type.

home, especially showerheads. The trend towards efficient showerheads is illustrated in Figure 3.4.

Figure 3.4 Proportions of homes in South Australia with reduced flow showerheads



Source ABS 4602.0, March 2004

Penetration of efficient showerheads has been increasing by about 2 to 3 percentage points per year. As showers are significant contributors to hot water usage, a reduction of water usage in showerheads results in a reduction of hot water usage. The shift from a standard to AAA showerhead is estimated to result in a saving of hot water usage of about 17%. The energy savings would be approximately proportional in instantaneous hot water systems, but less than proportionate for storage systems. Half of the savings would have been achieved already through the move to efficient showerheads seen above, and the trend is expected to continue.

- Heating. Envestra has provided two graphs relating to gas heating. As discussed previously these show that combined gas heater sales are increasing. They also show that central heater sales are growing more rapidly than space heater sales, suggesting that average usage per heater, with all else being equal, should be increasing. However, this must be tempered by the consideration that home heating requirements may also be changing due to changing Government policy (see Section 3.9).

- Solar hot water systems. To the extent gas hot water systems are replaced by solar, either electric or gas-boosted, this has the potential to significantly reduce average gas sales. However, solar hot water systems are generally more expensive to purchase than gas hot water systems. Despite savings in operating costs, the payback period is such that many people will be deterred from switching to solar. This is especially so because no rebate is payable for switching from gas to electric boosted solar. Without a rebate, the likelihood of a switch is low as payback periods are long, over 7 years. While a rebate is payable for a move from gas to gas-boosted solar, there is still little incentive to change given that the payback period remains long. As evidence, less than 5% of the 8578 rebate applications approved between July 2001 and end June 2005 were for gas-boosted solar – 403 approved installations. Given current Government policy, see Section 3.3.2, we believe that any assumption about major erosion of hot water market share by solar requires justification. Although there may be gas-boosted solar installations being installed without a rebate application, we consider this relatively unlikely.

Exhibit 3-1 Economics of hot water systems

Capital costs are the key consideration for new home developers and many home owners. Generally, for items such as hot water systems, developers and home owners will minimise their outlays within the constraint of ensuring that systems provide the level of utility required and that regulations are met.

If electric hot water systems are precluded from being installed, as seems to be the intention according to Government policy (Section 3.3.2), then we estimate the following costs additional to that of installing a gas hot water system in areas with gas reticulation:

- New homes, or renovations when a gas system is currently in place: Additional costs range from about $1100 for gas-solar to $2500 for heat pump.
- Renovations when an electric system is currently in place: Additional costs range from about $600 for electric-solar, $1100 for gas-solar and $1800 for heat pump.

If we assume that a gas hot water system uses 15 GJ of gas while a solar-gas boosted system uses 6 GJ then, at a marginal gas price of $16/GJ the payback period will be almost 8 years. We consider it unlikely that many people will take up the gas-solar option. This is borne out by rebate experience to date.

If a solar-electric hot water system is used, it will not be eligible for a rebate in a new home if gas reticulation is available. This means that it will have a payback period of over 7 years. As for the gas-boosted solar, we consider it unlikely that many people will seek this alternative. If it is a renovation, and the existing hot water system is electric then a rebate is applicable. In this case a payback period of less than 5 years is applicable and the home-owner may elect to use this option. This may ultimately limit the number of homes undergoing renovation which convert from electric to gas. But this would not have an impact on the gas consumption of these homes.

3.7 Comfort

Despite household sizes reducing, there is evidence to show that the sizes of houses are increasing, either as new houses are built[22] or renovations made. This, together with an increase in household disposable income, has manifested itself elsewhere as a trend towards increased appliance usage and / or purchase of appliances for new applications - such as in spas, connections for barbecues and pool heating. This will tend to increase average usage.

3.8 Appliance efficiency

Appliances are becoming more efficient. The pace has been slow in most cases, apart from the move towards instantaneous hot water systems which appears to have been rapid. We expect the pace of energy efficiency improvements to continue. The introduction of Minimum Energy Performance Standards might increase the pace, although there is no evidence that this will be material in the next regulatory period, while the virtual completion of the move to instantaneous gas heaters may mean the pace of change will slow.

3.9 Government policy

Government policy related to sustainability is important to gas usage in South Australia. The South Australian Government believes that gas has a definite role to play in a sustainable environment and has announced policies in three areas that will impact on energy usage.

- The Government has moved to increase the thermal standard for new housing in South Australia from the minimum of four stars introduced on 1 January 2003 to a minimum of five stars to be introduced on 1 July 2006. Both these steps are likely to result in a reduction of the heating used by new houses.
- The Government has extended rebates for solar hot water systems for a further four years but has continued to confirm that it sees gas systems as being equivalent to electric-solar systems.
- The Government has effectively banned electric hot water systems in new homes and major home extensions where gas reticulation exists.

While the first policy described above is expected to reduce average usage for new houses, the impact of the other two policies is expected to be relatively limited. There are expected to be few replacements of gas units by solar units in existing or new homes, and those that are replaced may be balanced by increased usage by existing homes.

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22 See for example Australian Bureau of Statistics, publication 1301.0, "Construction Artice Australian home size is growing", Year Book Australia, 2005.

3.10 Residential trend overall

A large number of factors are involved in assessing expected movements in average residential usage, some positive, some negative. The only real information at hand about the balance of the trends is the measurement of actual consumption on an annual basis after weather normalisation. While it may also be possible to further decompose the movements, for example trends in average usage by established households and new households, this should be based on evidence and after careful analysis.

As has been discussed in Section 3.4.1, the weather normalised trend for average usage by all domestic consumers over the past seven years has been an annual reduction by about 0.7% or 0.8% pa. This trend would have taken into account all of the factors discussed above acting on both established and new homes. For example, it would have taken into account the warming weather trend.

For forecasting purposes it would appear reasonable to assume the continuation of the same trend except where there are significant changes in key trends from those seen over the past seven years. Only significant changes to the above factors should be factored in additionally to the existing trend.

At this stage the only significant additional or changed drivers we see impacting on average usage over the coming regulatory period are:

- The change to the thermal rating of houses.
- A small increase in solar-gas hot water systems at the expense of gas.
- A likely move to make AAA showerheads mandatory in new houses some time over the regulatory period.

3.11 Small business

Under small business we include commercial and small industrial customers. Historical movements of the class as a whole have been reviewed in Section 2.3. As seen from the Figure 2.4, there appears to have been two separate periods applicable to the market, a decrease in usage from 1998 to 2001 of about -1.7% pa followed by a period of annual increases (averaging 2.5% pa) from 2001 to 2005. Overall growth over the period has averaged 0.7% pa.

The key drivers for the small business market are likely to be:

- Movement between classes.
- Weather
- Economic factors
- Appliance efficiency

The movement between classes impacts on the others and is dealt with first here.

3.11.1 Movement between classes

Envestra has provided information for the small business market divided into commercial and small industrial customers. However, these are classified by Envestra on the basis of annual consumption, not on the basis of whether they actually are commercial or industrial customers. Thus, a customer which is classified as "commercial" by Envestra will change to being classified as "small industrial" if it increases consumption to over 1 TJ and vice versa. This is despite even the demand (> 10 TJ) customer category having a significant number of customers who would normally be classified as commercial (hospitals, universities, hotels etc).

Thus the history of commercial customers provided by Envestra presumably contains the impact of movements between the commercial and small industrial customers. For a market which is growing this would tend to understate the growth in the commercial market and overstate the growth in the small industrial market.

The small industrial classification suffers the same problem – but on both the upper and lower ends of the consumption scale. Thus, small commercial customers which consume more than 1 TJ become "small industrial" while small industrial which consume more than 10 TJ become "large industrial" or demand customers, and vice versa. According to Envestra, over the years 2003/04 and 2004/05 there was a material amount of movement between the Volume and Demand tariffs, with 11 Volume tariff customers moving to the Demand tariff and the same number moving the other way.

However, despite the number of customer movements being the same, approximately double the volume of consumption moved from Volume to Demand tariffs (some 150-200 TJ) as did from Demand to Volume tariffs. The movement of a net 100 TJ is equal to about 3% of the market and will certainly affect the analysis.

Because of the uncertainty as to which customers actually are commercial and which small industrial, and the potential distortions caused by such movements between classes, MMA considers it more appropriate to consider the small business class as a whole.

We consider it likely that the movement between volume and demand tariffs will result in an understatement of the actual growth in the small business market. As customers become larger and consume more than 10 TJ they will tend to move to the Demand category[23]. This results in growth in the market being "capped".

Although such capping does not provide a full picture of the underlying state of the market, it does provide a real picture of the Volume tariff market, which does need to take into account such movements.

[23] Although there is movement both ways, experience has shown that the net movement in consumption terms favours movement from Tariff V to Tariff D.

Although the capping is representative and needs to be taken into consideration in forecasting, it may well be that the early years of the regulatory period resulted in anomalous amount of movement. This could perhaps explain the early losses in the small business market, followed by a number of years of increases.

3.11.2 Weather

Weather is likely to play a part in the volumes consumed by the small business market.

Envestra has assumed that weather has an impact only on the small commercial market and appears to have pro-rated the weather effect according to consumption, meaning that most of it is allocated to the residential market, with the commercial (and hence small business market in total) only impacted by about 10%.

MMA analysis suggests that the weather impact on the small business sector as a whole may be more significant than this, with an indicative assessment being that some 25% of the weather impact is attributable to the small business sector (see APPENDIX A).

If this estimate is correct then it has an impact on the estimated underlying growth rates for the small business market. This is an important consideration given the forecasting methodology used by Envestra (see Section 5.1).

As can be seen in Figure 3.2, the two early years of the period (1998 and 1999) had years which were colder than the weather trendline, while those after it were all warmer than these. Given that 2003 and 2005 were very warm years, proper weather normalisation is important and, together with Volume to Demand tariff movement, may help explain some of the apparent anomaly of falling usage in the first three years, followed by rising usage.

3.11.3 Economic

Economic factors are likely to be the strongest drivers of consumption by both small business and large demand customers. Consideration of the historical data for the small business market provided in Section 2.3.1 shows two apparently separate parts to the graph, the first with reducing volumes from 1998 to 2001, the second with consumption increasing from 2001 to 2005.

It is not clear why this should be the case. The growth in GSP was very similar over both periods. Yet the growth rate in small business sales was -1.7% pa over the period 1998-2001 and +2.5% pa between 2001 and 2005.

It may be that the results from either, or both, of the periods are anomalous. In discussions, Envestra has expressed more confidence in the more recent historical information. It may also be that significant movements between the Volume and Demand tariffs took place in the earlier period. On the other hand, there is also some uncertainty about the information provided for the most recent period, for example the

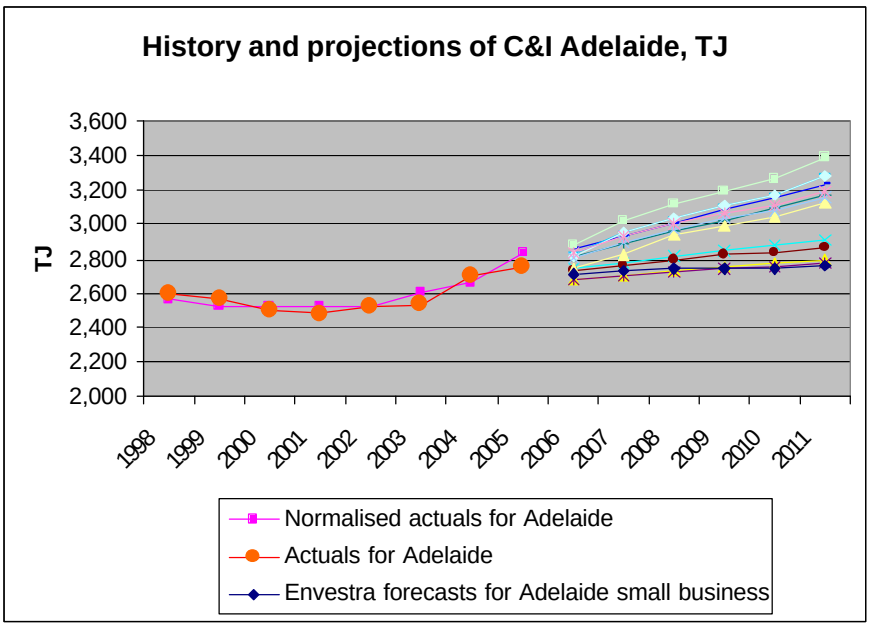
very sharp increase in customer numbers in 2005 raises issues about consistency of customer number accounting.

There are a range of ways in which growth for the markets might be analysed:

- With and without weather normalisation
- With a relationship to economic factors, such as GSP or commercial or industrial output[24] or growth with time[25].
- Analysing using the period 1998 or 1999 to 2005 or 2001 to 2005 as the base.

A range of outcomes are possible. Many of these are provided in Figure 3.5 for the Adelaide C&I market[26]. The only graphs labelled are the historical actuals and MMA weather normalisations and the Envestra forecasts. As can be seen, the Envestra forecasts are at the bottom end of the range of projections considered by MMA[27].

Figure 3.5 History of C&I consumption, Adelaide, TJ and various projections to 2011



24 Commercial and industrial outputs for Adelaide and regional centres were provided by NIEIR to Envestra. Unfortunately, the historical outputs provided only covered the period 2001 to 2005, not 1998 to 2005. Therefore any analyses based on these data were only from that period.

25 Note that in the following Figure we have used the NIEIR GSP growth forecast, which forecasts, on average, growth of some 0.6% pa less than the Econtech GSP forecasts.

26 The Adelaide C&I market makes up some 94% of the total C&I market.

27 It should be noted that while the range of forecasts considered are all plausible, they may not all be considered reasonable.

The main issues are whether to use the period 1998-2005 or 2001-2005 as the basis for comparison (this makes a difference of about 300-400 TJ in the year 2011) and whether to use the MMA weather normalisation (this makes a difference of about 60-120 TJ in the final year). Using relationships between the available commercial and industrial output data provided by Envestra results in projections towards the higher end of the range by 2011.

3.11.4 Efficiencies

The State and Federal Governments have announced initiatives to improve efficiencies in both the Government Sector and the large user sectors over 0.5 PJ. While these measures are expected to have some impact, they will largely not focus on this sector and will probably be felt towards the end of the period.

3.12 Customer number growth

Small business customer numbers are generally considered to grow either as a function of time (eg an increase of 90 customers per year) or with economic growth. The historical growth rates, in numbers and %, for the commercial, small industrial and small business customers are provided in Table 3.3

Table 3.3 Historical and Envestra forecast of small business customer numbers

	1998-2005	1998-2005	2005-2011	2005-2011
	Numbers	%	Numbers	%
Small Business	107	1.3%	152	1.7%
Commercial	86	1.2%	149	1.9%
Small industrial	21	2.5%	3	0.3%
GSP		2.8%		2.4% to 3.0%

Over the period 1998 to 2005 small business customer numbers grew at about 107 per year. This number is exaggerated by the apparently anomalous growth of 375 customers in the 2004/05 year. If this year is excluded then the average growth was 63 customers per year. Growth was made up by 80% commercial customers and 20% small industrial. GSP growth over the same period was about 2.7%.

Looking forward we would expect that the customer number growth would be about the same, on average, as it has over recent years. The economy is expected to grow at about the same rate as over the past period (2.4% pa (NIEIR) to 3.0% pa (Econtech)) and no other key driver appears to have changed significantly[28].

[28] Unless the anomalously high growth of customer numbers has an unexplained rationale.

It is not clear which change in drivers accounts for the Envestra forecast that the customer number growth rate will increase by 42% and that this will be made up almost entirely by new commercial customers.

3.13 Demand

Envestra has provided very limited "consistent" information for its Demand customer market, consumption and MDQ only for the period 2002-2005. Envestra has also provided an "unreliable" data set which it had previously submitted to the Commission. However, the data in this data set are indeed inconsistent and do not appear suitable for forecasting reasons.

The key drivers of change in demand customers appear to be the following:

- Economic drivers. Given that the major customers are mainly industrial, forecast growth in industrial output in the Adelaide region would appear to be a good indicator of likely future gas consumption.
- Load factor[29]. The relationship between consumption and MDQ changes over time, due to factors such as different rates of growth of customers and movement of V to D customers.
- New users, closures, expansions and curtailments by the largest customers. A very good example of the impact of the largest customers is the closure of the Mobil Oil Refinery in November 2003 with a loss of

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[*Confidential Information removed*]

- Consumption and MDQ forecasts for demand customers are often difficult, especially when regions and zones have to be forecast as well. In other jurisdictions the following approach has been used:
- Discussions and individual forecasts of consumption and MDQ for the top 10 to twenty consumers. These consumers potentially have a very significant impact and discussions often help elucidate plans for the future.
- Analysis of historical consumption for remaining demand customers and forecasting based on either time or economic trends.
- Linking of MDQ forecasts with consumption forecasts through load factor changes.
- Taking account of known closures and curtailments, new plants and expansions.

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29 Here defined as the relationship between the average daily quantity divided by the maximum daily quantity.

4 REVIEW OF ENVESTRA'S RESIDENTIAL FORECASTS

4.1 Envestra's approach to forecasting

Envestra has forecast growth in the residential market through looking at the two components which are changing:

- Residential customer numbers
- Average usage per residential customer.

4.1.1 Customer numbers

Envestra has forecast net residential customer numbers essentially by assuming that customer number growth in the coming period will be about the same as that in the current period.

Envestra has assumed that:

- Growth in new connections will be according to the dwelling growth rate forecast by NIEIR forecasts.
- Total growth in residential customer numbers will follow the historical trend. Therefore, growth in new connections to existing dwellings is the difference between the historical trend forecasts and the NIEIR forecasts of net new dwelling growth.
- Disconnections will be about 1650 per year, presumably based on the average over the past few years. Note that this assumed disconnection rate is according to assumptions derived from the forecasts in Access Arrangement Information (AAI) and spreadsheets provided by Envestra. However, according to the AAI page 5, Envestra has forecast that the number of disconnections over the period (presumably 5 years) will be approximately 4500. This issue needs resolution.
- Growth in new townships, Tanunda, Montaro and McLaren Vale of about 700 customers from 2006/07 to 2010/11.

4.1.2 Average usage

Envestra has calculated average usage by:

- Weather normalising as discussed in Section 3.4.1 to determine the current average use for established residential users. This was calculated to be about 23 GJ per customer in 2005.
- Forecasting average usage for established users (those at end 2005 minus disconnections). Established users are forecast to reduce average usage over the period 2005 to 2011 from 23.0 GJ to 21.2 GJ an average reduction of 1.4% pa. This

reduction is calculated for Adelaide, the main centre[30], by multiplying the previous years average usage by

(1-H)* (1-E)*(1+KY) where:

- H is an annual reduction of 0.16% pa due to the warming trend
- E is an annual reduction averaging out at 1.9% pa due to "efficiency gain" (of appliances, dwellings etc)
- Y is the annual increase in GSP per person in SA (from NIEIR forecasts) multiplied by an elasticity factor K of 25%, resulting in an average increase of 0.4% pa.

- Forecasting average usage for new dwellings. New dwellings are forecast to have a starting average usage in 2005 which is 80% that of the average usage in established dwellings in the same region. This is then forecast to reduce at 2% pa due to efficiencies (appliances, housing etc) in every year except 2007/08 when the efficiency is expected to reduce by 15%. The average efficiency gain is thus forecast to be 4.2% pa. New homes in Adelaide are forecast to reduce average consumption from 17.8 GJ pa in 2005 to 13.7 GJ pa in 2011, an overall reduction of 23% over the period. (Note: there is a discrepancy between Envestra's spreadsheet assumptions, reported above, and the values actually used in their forecast, as shown in Figure 4.1. The cause of this discrepancy is discussed in Section 4.4.2.)
- New townships. These are forecast to increase average usage from 18 – 29 GJ per user pa over the period 2007/08 to 2010/11. No explanation for the numbers has been provided.

4.2 MMA assessment of methodology

With regards to the approach and methodology, MMA considers that:

- Consideration of the domestic market on a stand-alone basis is reasonable. This is normal practice across all utilities.
- The use of customer numbers multiplied by average usage is a reasonable method for determining domestic load. This is normal practice across utilities.
- The division of residential into established, new connections and new townships is reasonable provided there is sufficient data to support the disaggregation. While the "new connections" division is sometimes further subdivided into new houses and new connections to existing houses (or further), this is not necessarily required.

[30] Other smaller cantres have only an annual efficiency change and income change.

- The use of external forecasters to provide forecasts of net new dwellings in the region is reasonable.
- The use of market evaluations, either internal or external, to be reasonable for estimated new township customer numbers.
- The use of trend or average numbers for estimating disconnections and new connections on line of mains is reasonable – unless there are changes to key drivers.
- Weather normalising to establish appropriate starting average usage is appropriate.
- Having different average usages for established and new users is reasonable.
- Having different drivers and changes for established and new users is reasonable.

Thus MMA considers the approach and methodology taken by Envestra for the domestic market to be reasonable and appropriate for the market.

Given that the approach and methodology are considered reasonable, the next criterion that must be addressed is whether the assumptions used are "best estimates". This issue is addressed below for customer numbers and then average usage.

4.3 Customer numbers

4.3.1 Growth rate

Envestra is forecasting that domestic customer numbers will grow at about 1.8% pa. The forecasts do not include those for the new townships to be reticulated. Envestra needs to include new township numbers in its forecasts. When these are added, the net residential customer number growth rate is about 1.9% pa.

Recommendation. Forecasts of new township customer numbers and consumption should be included in the Envestra residential and small business forecasts.

Envestra has forecast a residential customer number growth rate, apart from new town reticulations, of 1.8% pa. As Adelaide's net dwelling growth over the coming regulatory period has been estimated by NIEIR at about 1% pa, the growth rate forecast for additional new connections beyond just this growth is about 0.8% pa. This is a little faster than the growth rate assessed for such connections over the current period.

As discussed in Section 3.3, Envestra has not been able to provide any disaggregation of customer number growth over the past few years. However, given the fact that the customer number growth rate over the period 1998-2005 significantly exceeded that of new dwelling growth, it appears reasonable to assume that there was either connection

of existing homes, either within existing or newly reticulated areas and/or a high proportion of new homes was connected.

Given the thrust of Government policy in the area (see Sections 3.3.2 and 3.9) we consider it likely that most new homes within reach of reticulation will be connected to gas and there will be some slight increase of connections due to home renovations. Therefore, although the forecast growth in residential connections appears a little optimistic, MMA considers it reasonable.

4.3.2 Disconnections

Disconnection numbers are important because of the need to determine gross new connection numbers from net residential number forecasts for capital expenditure forecasts. In its forecasts Envestra has apparently estimated residential disconnections to be 1650 per year however, in its AAI it has stated that disconnections will be approximately 4500 over the period[31].

If the forecast disconnections average 1650 per year the proportion of disconnections to residential customer numbers would be about 0.47%, which is higher than the 0.33% rate achieved by AGLGN in NSW[32] (although the proportion is forecast to drop over time as disconnection forecasts are held approximately constant while the customer base increases). If the forecast disconnections average 900 per year then the proportion, at about 0.24% pa, is lower than the AGLGN number. The average of the past three years' disconnections would give a result of 1260 disconnections, which, at about 0.35% is similar to the AGLGN proportion.

As the forecast disconnections are important in determining capital expenditure, MMA considers that the actual disconnections number used should be confirmed, and the basis for this number justified.

Recommendation. Forecast disconnection numbers need to be confirmed and an acceptable basis for these forecasts provided.

4.4 Average residential usage

4.4.1 Weather trend and normalisation

As discussed in Section 3.4.1, MMA has accepted the warming trend estimated by Envestra and also the weather normalisation used by Envestra for 2005, the starting year.

4.4.2 Break-up

Envestra has prepared separate forecasts for three domestic market sub-sectors: established dwellings, new dwellings and new townships. Established dwellings

31 AAI page 5, this is taken to mean 4500 over 5 years, or an average of 900 per year.

32 MMA draft report to the Independent Pricing and Regulatory Tribunal of NSW, "Review of demand forecasts for the AGL Gas Network", April 2004, page 9.

includes only customers already connected in 2004/05, adjusted for disconnections, and new dwellings is comprised of new homes and new connections to existing dwellings. The number of customers anticipated in new townships is low, less than 2% of total new connections.

Envestra's forecasts of average usage in established and new dwellings, together with the overall average, are compared to projections of the historic trends in Figure 4.1. The overall average declines at a significantly faster rate (2.4% pa) than the trends established by projecting either the Envestra trend (0.7% pa) or the MMA trend (0.8% pa).

Note re misallocation of volumes within the residential sector.

The values shown here have been derived from Envestra's forecast tables and are clearly different to the assumptions presented in the text of their reports. For example, new dwellings average usage shown here is 13.8 GJ in 2006 compared to the 17.4 GJ stated by Envestra in Attachment 2. Average Residential Gas Consumption in South Australia.

Material provided by Envestra on 31st October 2005 (dated 28th October 2005) reveals a number of apparent discrepancies in the allocation of volumes to the established and new dwelling sectors. The new dwelling customer numbers in any year are given by:

New dwelling customers

= total customers at the end of the year - established customers at the end of the year

= total customers at the end of the year – (established customers at the beginning of the year – disconnections)

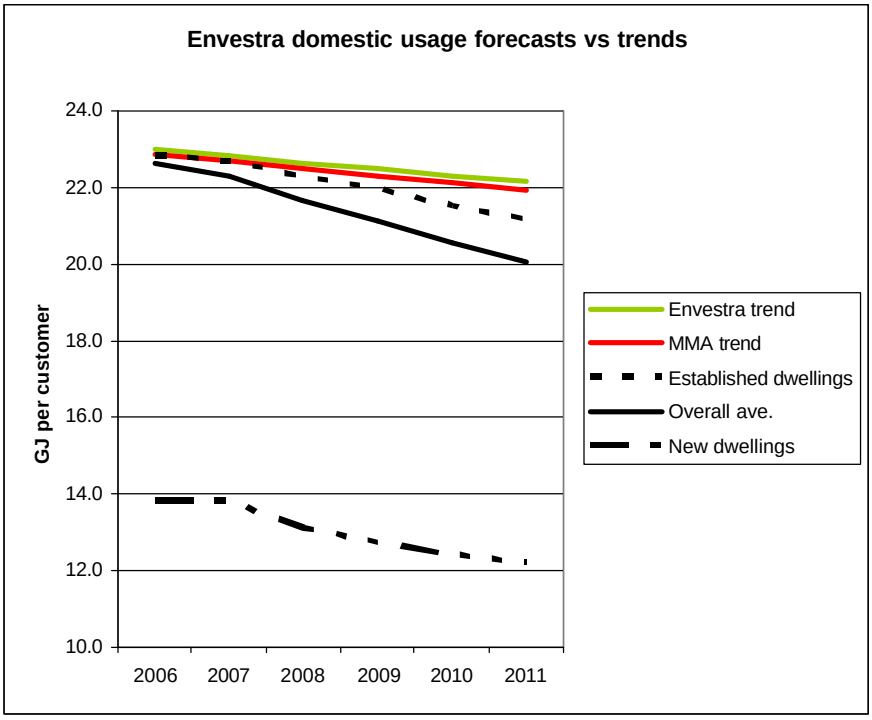
= total customers at the end of the year – total customers at the beginning of the year +disconnections)

= net customer growth + disconnections

However in Envestra's forecasts new dwelling volumes appear to be calculated from net customer growth only, with a consequent understatement of new dwelling average usage. The volumes attributable to disconnections are incorrectly allocated to established homes and established home average usage is consequently overstated.

The impacts of these misallocations are discussed further below. While they do not materially alter the total forecast volumes they result in a misrepresentation of average usages in the information provided with the Access Arrangements.

Figure 4.1 Envestra domestic average usage forecasts vs trends



The established and new dwelling forecasts both contribute to the faster decline in average usage as both are below trend. Envestra's qualitative explanations for the declines in each sector are assessed below.

4.4.3 Established dwellings

Envestra explanation

Average usage incorporates trends in increasing appliance / user efficiency, HDDs and an income response. Envestra has provided details of the assumptions but not their derivation.

MMA assessment

Higher efficiency appliances and homes

Envestra assumes substantial improvements in established homes gas usage efficiency, averaging 1.9% p.a. in Adelaide and 1% elsewhere (refer to Envestra Excel workbook "SA Demand Forecast Information (28-10-05)). The derivation of these figures has not been provided and it is not clear why there should be such a discrepancy between Adelaide and elsewhere.

The AGO[33] reports increases in appliance efficiency rating from 55.8% in 1991 to 60% in 1998 for new gas heaters (0.6% p.a.) and from 69.7% to 75% for new gas water heaters (0.8% p.a.). In its high efficiency scenario projections AGO suggests that new heater efficiency ratings will improve at 1.2% pa and new water heater efficiency ratings will improve at 0.5% p.a. over the medium term. In its other scenarios the improvement rates are lower. Absent more recent data the above improvement rates are the most aggressive that can be substantiated.

Translating these into improvements in efficiency ratings in established dwellings is difficult, since the efficiency of the existing stock is unknown. However on average the rate of improvement in established dwellings cannot exceed the rate of improvement in new appliances. This can be demonstrated by a simple calculation: if a type of appliance is replaced every 10 years, if replacements are of the most efficient type and new appliance efficiency rating grows at 0.5% p.a., then every year 10% of appliances are replaced with new appliances 5% more efficient (10 years of efficiency growth). Consequently the efficiency rating of the established homes stock increases by 10% x 5% = 0.5%, the same growth rate as new appliances, even though the actual efficiency of the existing stock is lower than that of new appliances.

Based on the AGO estimates, assuming 9 GJ of heating load and 12 GJ of water heating load, the efficiency rating improvement in established homes would be 0.7% p.a., relative to an average efficiency of approximately 65%. In terms of improvement in gas usage efficiency this is equivalent to 1.1% p.a. (0.7%/65%), considerably lower than Envestra's estimate for Adelaide.

HDDs

Envestra assumes an HDD decline of 3 HDDs per year, which results in a 0.16% p.a. decline in average usage (refer to Envestra Excel workbook "SA Demand Forecast Information (28-10-05)"). MMA has confirmed the HDD decline and estimated a 0.13% p.a. decline in average usage. The difference in estimates does not have a material impact on the forecast.

Income Response

Envestra's income response is based on an assumed income elasticity of 0.25, i.e. for every 1% increase in household income, existing home gas usage increases by 0.25%. Use of this elasticity is a valid methodology only if the elasticity was derived in a model that also takes account of HDDs and appliance efficiency trends i.e. the derivation matches the use of the parameter. In view of the uncertainty regarding the historical trends in appliance efficiency, deriving such a model would be difficult. It is not valid to borrow elasticities from other models, eg a model incorporating price and income effects.

[33] Australian Residential Building Sector Greehouse Gas Emissions 1990-2010. AGO 1999.

As noted above, Envestra has stated that the elasticity estimate was based on subjective assumptions. MMA understands that NIEIR and ABARE gas demand models take income into account but we are unaware of the income elasticities used in these models.

4.4.4 Established homes summary

The Envestra forecast of average usage in established homes declines at a rate of 1.5% p.a. (or 1.8% p.a. if the misallocated volumes from disconnections are removed) compared to historical trends of 0.8%. The most significant factor in this decline is the assumed trend in appliance efficiency in Adelaide. If Envestra's assumptions regarding this trend were replaced by MMA's estimate, the decline in established homes usage would be 0.7% p.a. (or 1.0% if corrected for the misallocation), which matches the historical trend more closely.

A potential factor is that the historical trends presented above are for averages including new dwellings, so if these have been contributing to the downward trend, ie new home usage has been lower than existing home usage, the historical trend for established dwellings should be higher (ie less reduction in average usage) than the average trend. Equally, if new home usage has been higher than existing home usage, the opposite would apply. Envestra has recently (4th November) provided information that suggests that new dwellings consumption is currently 19 GJ pa hence it appears that the former is correct i.e. the historical trend for established dwellings should not be reducing as rapidly as suggested by the average trend. MMA has not yet had the opportunity to assess the true historical trend for established dwellings.

Overall, Envestra has proposed what appears to be a significant increase in reduction in average usage for established homes relative to recent experience, without any real justification. The reduced HDD trend identified by Envestra has presumably already been incorporated in the current period. So also have the changing demographic parameters, while the economic driver is expected by NIEIR to grow somewhat more slowly than over the period 1998-2005, but more quickly than over the period 2001-2005[34]. There appears to be no evidence to suggest that the efficiency of existing homes or existing appliances is changing significantly more or less quickly than it has over the past few years.

Envestra has made much of the move to solar hot water from gas. However, MMA's assessment of the economics and thrust of Government policy suggests that there is little economic or Government driven reason for any such move. This is supported by the number of rebates actually paid for solar-gas hot water, which are very limited, less than 200 approved rebates in the past year. Although there are significantly more rebates paid for electric-boosted solar systems, as pointed out by Envestra, these would not have impacted gas usage as no rebates for electric boosted solar systems are payable in gas-

[34] And if Econtech's forecasts are used the economic growth would be about the same or a little higher than that seen from 1998 to 2005.

reticulated areas. Similarly, although MMA accepts that there has been an increase in reverse cycle air-conditioning, any effect of this move is likely to be included in the current trend for reducing average usage.

In conclusion, MMA accepts that there has been a trend towards reducing average usage in established houses. Furthermore, MMA accepts that the trend is likely to continue over the coming regulatory period. However, MMA does not consider it reasonable to accept that the trend will accelerate without substantial evidence based justification.

Recommendation. If Envestra seeks to separately forecast average usage for established dwellings and new dwellings, the forecast for average usage by established dwellings would need further substantiation and linkage to reference material, in particular the derivation of assumed appliance or household efficiency trends and the income elasticity.

Recommendation. In order to allow the proper calculation of average usage for established dwellings over the past few years, the impact of below average usage in new dwellings needs to be taken into account.

Recommendation. The reduction of average usage by established homes going forward should be the same as that over the recent past, except to the extent that acceptable justification is provided.

4.4.5 New dwellings

Envestra explanation

The average volume of gas used by new homes is significantly less than in current established homes because of:

- Higher efficiency appliances
- Higher thermal efficiency of dwellings
- Lower number of gas appliances
- Policy initiatives favouring solar hot water, encouraging water conservation and higher minimum efficiency performance standards for appliances.

MMA assessment

These factors are analysed in further detail by Envestra in "Average Residential Gas Consumption in South Australia" (Attachment 2 to Envestra's Network Development Paper).

Higher efficiency appliances

Envestra has assumed a 2% p.a. efficiency gain in new homes in each year except in 2007/08, when 15% is assumed (refer to Envestra Excel workbook "SA Demand Forecast Information (28-10-05)). The 13% additional gain in 2007/08 is due to the switch from

four-star to five-star home thermal efficiency requirements and is discussed in the following section.

The 2% efficiency gain is presumably due to increasing appliance efficiency. As noted in the previous section, AGO estimates of appliance efficiency improvements do not support this rate of gain. Given the lower heating load in new homes compared to established homes, the rate of efficiency gain in new homes is likely to be lower than in established homes, because the potential gains in heating appliances are greater than those for water heating. The overall efficiency gain in new homes is therefore likely to be less than 1% p.a.

Thermal efficiency of dwellings

Since 1 January 2003 new homes in South Australia have been required to meet the four-star rating for thermal efficiency. From 1 July 2006 the five-star rating will be mandated. Envestra has provided estimates of the impact of these new standards on gas consumption for heating, assuming that prior to 2003 the average new home was of a two-star rating (Table 5 in Attachment 2). For a two-star home Envestra estimates average consumptions of 13.5 GJ p.a. for a space heater and 42 GJ p.a. for a central heater. Combined with new homes penetrations of 28% for space heaters and 5% for central heaters these result in heating use per new home connection of 5.9 GJ p.a. MMA has no information that suggests these figures are incorrect.

The current Adelaide heating/cooling usage settings (expressed in MJ/m2) for star-ratings in NatHERSv 2.32 (Nationwide Home Energy Rating Scheme) are presented in Table 4.1. MMA estimates of heating usage in four- and five star homes, based on assuming the same proportional change as in the NatHERS setting, confirm the Envestra estimates.

Table 4.1 New Home Heating Consumption

Home rating	**NatHERS setting (MJ/m2)**	**Estimated gas heating usage per new home connection (GJ p.a.)**	
		Envestra	MMA
Two-star	350	6	5.9
Four-Star	250	4.2	4.2
Five-Star	210	3.3	3.5

However, while there is expected to be an impact of the move to increased thermal rating from four-star to five star, the indicative expected change is likely to be of the order of 0.7 GJ/20 GJ = 3.5%, not the 13% or so modelled by Envestra.

Lower number of gas appliances

Envestra has not provided any quantitative evidence that fewer gas appliances will be installed in new homes in future.

Policy initiatives favouring solar hot water, encouraging water conservation and higher minimum efficiency performance standards for appliances.

The South Australian Government has provided rebates of $500 or $700 (depending upon the size of the installation) for the installation of solar hot water systems in new and existing homes. The energy/GHG efficiency of gas hot water systems is recognised in the fact that the rebates are not available for electric boosted or heat pump systems that replace existing gas systems or in a new home that has access to reticulated gas. It is therefore unlikely that gas water heating will lose significant market share to electric boosted solar and the key issue for gas is the penetration of gas boosted solar at the expense of conventional gas systems.

Table 4.2 details the solar rebate approved applications since 2001/02, showing that: existing homes account for more than 75% of applications and electric boosted account for more than 90%. The inevitable conclusion is that the majority of applications are for electric boosted solar to replace existing electric water heaters or in new homes in areas without gas reticulation.

For 2004/05 the split of gas boosted was 149 to new dwellings and 43 to existing dwellings. The penetration of gas boosted solar in new gas homes is therefore very low, 149 out of more than 6,000 new home gas connections, ie 2.5%.

The rate of replacement of gas by gas boosted solar is even lower - MMA estimates that there are approximately 300,000 gas water heaters in South Australia, which are replaced on average every 15 years, generating a replacement market of 20,000 per year, of which solar-gas captured 43 or 0.2%.

Table 4.2 Solar rebate applications

	2001/02	2002/03	2003/04	2004/05
Total	957	2,365	2,526	2,730
New homes	132	359	468	636
Existing homes	825	2,006	2,058	2,094
Electric boosted	910	2,288	2,402	2,523
Gas boosted	28	71	112	192
Other	19	6	12	15

Envestra however appears to assume that gas boosted solar penetration in new gas homes will grow substantially. For example, in a table in the Residential Average Usage

report it suggests that there is a real possibility of solar-gas penetration increasing very significantly, to 50% in 2009/10. In light of the above data, the economics discussed in Exhibit 3-1 and the absence of any concrete incremental policies favouring solar over gas, the Envestra figures are implausible.

Envestra has not detailed any specific assumptions regarding the impact of Minimum Efficiency Performance Standards (MEPS). New MEPS for gas water heaters and heaters are proposed to be introduced in 2006 and 2008 respectively. Most gas appliances currently on the market comfortably exceed the current MEPS and until the new MEPS are defined it will not be possible to estimate the impact on gas appliance efficiency trends.

However, given that most new hot water systems in new homes are already instantaneous (which are significantly more efficient than storage hot water systems) we do not foresee significant improvements from MEPS in this area.

MMA considers that there is a good possibility that AAA showerheads will within the next few years be mandated in new homes in South Australia, as they have in Queensland and Victoria. MMA estimates that the requirement for AAA showerheads in all new homes will reduce gas usage in new homes by of the order of 1 GJ per household[35].

New dwellings gas usage

Envestra has provided estimates of gas usage in new dwellings over the past three years (workbook "SA average consumption 2002-03 to 2004-05") reproduced in Table 4.3 and Table 4.4– note that the weather normalised values are MMA estimates as Envestra's workbook incorrectly multiplies the normalised values by 0.96). The full year weather normalised values suggest that new dwellings over the past few years used about 19.2 GJ pa.

Table 4.3 New dwellings gas usage (GJ)

Connected	2002/03	2003/04	2004/05
2002/03	13.27	19.13	19.06
2003/04	n/a	13.54	18.42
2004/05	n/a	n/a	7.78

Table 4.4 Weather normalised new dwellings gas usage (GJ)

Connected	2002/03	2003/04	2004/05
2002/03	13.81	18.77	19.80

[35] Assuming that the proportion of new homes with AAA showerheads is already 50%, the same as that within the state as a whole.

2003/04	n/a	13.28	19.14
2004/05	n/a	n/a	8.09

Note after MMA weather normalisation

Envestra estimates that new dwelling usage in 2005/06 will be 17.4 GJ, made up of 13 GJ of water heating, 2 GJ of cooking and 2.4 GJ of heating. The last figure appears to be inconsistent with Envestra's estimate of heating load for four-star homes, ie 4.2 GJ (Table 4.1). If the latter were used then the Envestra estimate for 2005/06 would be about 19.2 GJ, which is supported by current new dwellings usage.

Clearly the Envestra estimate requires further justification. Moreover, the new homes average usage in the 2005/06 forecast tables is 13.8 GJ, which is inconsistent with Envestra's figures presented in the texts of its reports. This appears to be due to the misallocation of volumes due to disconnections, to established homes instead of new homes, as discussed in Section 4.4.2.

New homes summary

Envestra has assumed that new homes in 2004/05 used 80% of the average usage of all houses in that year and that there would be continued "efficiency" reductions of 2% pa in each year apart from 2007/08 when the efficiency increase is expected to be 15%, presumably largely due to the new 5-star thermal rating requirement for new houses.

Although Envestra has raised a number of reasons for the significant efficiencies assumed, none are expected to result in reductions of the scale envisaged. Nor has Envestra provided any evidence for its assumptions about starting usage in new homes in 2004/05.

MMA accepts that there will be some reductions in average usage of new homes due to the introduction of five star thermal rating and AAA showerheads, perhaps introduced in 2006/07 with impact felt in 2007/08 as well. There may also be a slight impact due to increased solar-gas penetration, although any assumed increase materially above current levels would need to be justified. MMA considers that any efficiency gains assumed beyond this require substantiation.

Recommendation. Forecasts for average usage by new dwellings clearly require considerable further substantiation and linkage to reference material.

Recommendation. In the absence of acceptable substantiation by Envestra it is recommended that the only changes to average usage of new homes be the move to 5-star thermal rating, a limited move to solar-gas hot water systems and the assumption that AAA showerheads will be required in plans for new homes from 1 July 2006 (with appropriate implementation time).

Recommendation. In the absence of information from Envestra allowing average usage by established and new homes to be properly understood and disaggregated, it

is recommended that the existing trend for all homes (ie 0.7% to 0.8% pa) be continued with additional reductions for the move to 5-star thermal rating, a limited move to solar-gas hot water and AAA showerheads.

4.5 Residential conclusions

MMA considers that the methodology used by Envestra in its forecasting for the residential sector is reasonable. Further, MMA considers that, apart from some uncertainty about disconnection number forecasts, the residential customer number assumptions made by Envestra meet the criteria set out under the Code.

However, MMA does not consider that the assumptions used by Envestra in its calculation of average usage are best estimates. In order to meet the requirements MMA considers that Envestra would have to amend its forecasts based on the recommendations set out in the previous sections.

5 SMALL BUSINESS (C&I)

5.1 Envestra's approach to forecasting

Envestra has forecast growth in the small business market through forecasting separately:

- The commercial sector, defined by Envestra as non-residential customers who consume less than 1 TJ pa.
- The small industrial sector defined by Envestra as non-residential customers who consume between 1 TJ and 10 TJ pa.

For the commercial sector Envestra has:

- Assumed that the Commercial sector is weather sensitive and has weather normalised usage in the commercial sector in Adelaide[36].
- Assumed that average usage per commercial customer will follow the reducing trend (about -1.7% pa) experienced over the period 1999 to 2005.
- Scaled up the reduced consumption by the forecast change in commercial output (from NIEIR) multiplied by an elasticity of 0.8.
- Calculated the customer numbers by dividing the new consumption by the trend average usage.

For the small industrial sector Envestra has:

- Assumed that the small industrial sector is not weather sensitive and has not weather normalised usage.
- Assumed that average usage per small industrial customer will stay at 2004/05 levels, despite average usage over the period 1999 to 2005 trending upwards at 0.4% pa.
- Scaled up the consumption by the forecast change in industrial output (from NIEIR) multiplied by an elasticity of 0.13.
- Calculated the customer numbers by dividing the new consumption by the (constant) average usage.

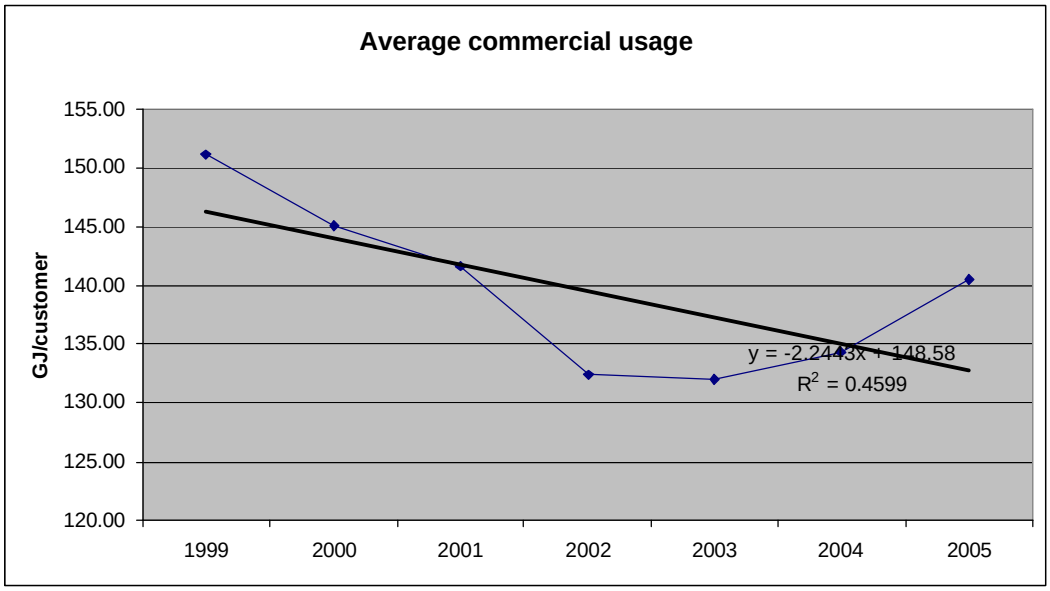
5.2 MMA assessment of methodology

MMA has some fundamental concerns with the approach and methodology applied by Envestra in this market. MMA considers that:

[36] Usage outside Adelaide was not weather normalised.

- The division of the small business market into commercial and small industrial sectors is not appropriate for the reasons discussed in Section 3.11.1. In essence the division is unwarranted in part because the customers are not really classified by type of company but according to consumption band. More importantly, the division means that there will be an impact of movements between classes, which is artificial and can be avoided by combining the two.
- The assumption that the small industrial market is not weather-sensitive is unwarranted without further testing of the assumption. Analysis by MMA suggests that the small business market as a whole is significantly more weather sensitive than suggested by Envestra (see Section 3.11.2). MMA has requested data from Envestra which would allow the sensitivity of this market to be further tested, but Envestra has stated that it cannot provide this.
- The tying of commercial sector sales to an average user driver does not appear warranted. The average usage data and trend after weather normalisation used by Envestra as a key driver in the sector is illustrated in Figure 5.1. The r^2 value is relatively low meaning that there is little certainty about the validity of the relationship. Indeed, as can be seen, the trend over the past few years has been upwards.

Figure 5.1 Average commercial usage, 1999-2005, GJ/customer and linear trend



- Envestra has not used a similar trend average-usage approach for the small industrial market. The reason for the approach taken not being uniform across both commercial and small industrial sectors is unclear.

- There is uncertainty about some of the data, especially the values from the earlier years and the apparently anomalously high customer number growth in the year 2004 / 05.
- According to Envestra its estimation of elasticities for the commercial and small industrial sectors is subjective. Based on the limited data available, MMA has assessed the elasticity of commercial consumption to a change in commercial output to be about 0.3 (with a very low r^2) while the elasticity of the small industrial sector to a change in industrial output is estimated to be 1.3 with a good r^2. Conversely, Envestra has estimated the commercial elasticity to be 0.8 and the small industrial elasticity to be only 0.13.
- Finally, the methodology appears to produce results which are at the bottom end of a range of forecasts considered by MMA. Figure 3.5 provides graphs of a range of plausible, but not necessarily realistic, outcomes dependant on variables such as period examined and expected driver. The Envestra forecast falls right at the bottom of the range. In terms of customer numbers, as shown in Table 3.3, the growth rates appear quite anomalous compared to recent history.

5.3 MMA conclusions and recommendations

MMA concludes that the Envestra forecasts of the small business market do not use a reasonable methodology and also do not meet the Code requirements of "best estimates arrived at on a reasonable basis". In order to meet the requirements MMA considers that Envestra would have to amend its forecasts based on the recommendations set out below.

Recommendation. Envestra should analyse and forecast the small business market as a whole, not divide it into commercial and small industrial.

Recommendation. Envestra should either weather normalise the small business market and carry out its analysis on the weather normalised market as a whole or carry out further analysis to demonstrate that this should not be the case. In either case further analysis of the extent of weather sensitivity of the small business market is required.

Recommendation. Envestra should select a forecasting methodology which it can demonstrate balances the recent history with changes to key drivers. MMA considers that a time or economic based trend, based on weather normalised historical data, would be appropriate.

Recommendation. Envestra should confirm the validity and consistency of the data provided, especially for the years 1998, 1999 and 2005.

Recommendation. If Envestra elects to forecast using commercial or industrial outputs as a key driver it should derive appropriate elasticities from available data rather than assume them.

Recommendation. Average usage for the small business market as a whole has remained reasonably constant over the past several years. Envestra should assume that the average usage will stay constant in deriving its net customer numbers.

6 DEMAND MARKET

6.1 Envestra's approach to forecasting

Envestra has forecast MDQ growth in the demand market by:

- Using MDQ by user at 30 June 2005 as the starting point
- Adjusted for known expansions, shutdowns or curtailments. Envestra was not aware of any major expansions but adjusted for curtailments at Mitsubishi Lonsdale and Ion automotive at Wingfield and Plympton.
- Assumed that other losses and gains will cancel out.

The resulting MDQ forecast has a drop from 73 TJ to 70 TJ in 2006/07 and then remains flat at this level.

6.2 MMA assessment of methodology

Envestra has justified the use of this "pragmatic" methodology on the basis that:

- Large industrial demand and MDQ is difficult to forecast both in quantum and timing.
- MDQ is poorly correlated with macroeconomic drivers.
- In any case, large increases and decreases in MDQ occur as a result of relocation, expansion or shutdown of businesses.

MMA accepts that there are difficulties in forecasting both MDQ and consumption of the demand market, especially by region and zone. Nevertheless, MMA considers that it is inappropriate to take a "pragmatic" approach in such situations, which has significant impact on large end-users, without at least first assessing how this problem has been tackled elsewhere and exhausting these possibilities. Some methods used elsewhere have been listed in Section 3.13. It is not clear that Envestra has exhausted these and other possibilities.

Envestra has not been able to provide a reasonably consistent history of consumption and MDQ going back more than three years. MMA considers this to be poor practice, and that the requirement for good forecasting practice justifies the effort required to gather such data.

Envestra has pointed to the loss of load at the Mobil refinery as an indicator of the uncertainties involved in forecasting. While this is correct, despite this loss [*confidential information removed*], the MDQ for the SA demand market actually increased between 2001/02 and 2004/05. This suggests an underlying strength which must be properly assessed before an assumption of no net growth in MDQ is assumed. Initial analysis of individual demand customer consumption and MDQ histories over the years 2002/03,

2003/04 and 2004/05 provides an indication of the reason behind the apparently anomalous outcome. While the number of customers who experienced consumption increases over the period were approximately balanced by those who experienced reductions in consumption, twice as many customers increased contracted MDQ over this period as those who decreased contracted MDQ. There appears to have been a move towards a reduced load factor over the period which, if a real trend, could see contracted MDQ continuing to climb despite consumption remaining flat.

6.3 MMA conclusions and recommendations

Although Envestra earns significantly less revenue from the Demand market than it does from the Volume market, the forecasts are still very important in determining pricing to end users. While agreeing that forecasting in this market is difficult, MMA does not consider that Envestra's current methodology for forecasting MDQ is reasonable. MMA recommends that Envestra be required to explore other methods before deciding on a final methodology and before MMA would consider that the method used meets the requirements of the Code. The following recommendations would result in a methodology that MMA considers would meet the requirement of the Code.

Recommendation. Envestra should be asked to prepare consistent historic consumption information for the period 1998 to 2005. Envestra should also be asked to attempt to get MDQ data going back to 1998 as well.

Recommendation. Envestra should hold discussions with its top 10-20 customers, or the retailer to these, to ascertain gas consumption and MDQ expectations and likelihood of expansions, closures and relocations over the next 5 – 6 years. Envestra should document the outcomes of these discussions and also prepare a summary spreadsheet of the expectations for both consumption and MDQ.

Recommendation. Envestra should prepare a summary of consumption by all other customers from 1998 to 2005 and attempt to relate these to either time or economic parameters. Forecasts of consumption can then be prepared.

Recommendation. Any changes in the load factors of these other customers should be taken into account in preparing MDQ forecasts.

6.4 Unaccounted for gas

Key drivers of unaccounted for gas (UAFG) are leakage and metering error. Envestra has not provided estimates of the proportion due to each source, however the South Australian Technical Regulator estimates it at 80% leakage and 20% measurement error[37].

[37] Annual Report of the Technical Regulator 2005

Historical UAFG reported by the Technical regulator show a decline up to 2002/03 followed by a sudden upswing to 2004/5 (Table 6.1). According to Envestra's Access Arrangement Information, the downward trend was due to replacement of 200km of mains annually up to 2002/03, under an accelerated mains replacement program. In 2003/04 the replacement rate was 50km and in 2004/05 it was 60km. Evidently, owing to increased leakage in the oldest mains, UAFG grew rapidly over the past two years.

Table 6.1 UAFG Actuals (TJ)

2000	2001	2002	2003	2004	2005
1329	1366	1182	1022	1493	1592

Envestra is projecting a modest reduction in UAFG after 2007, driven by an increase in the level of mains replacement, from 50 to 60 km/yr to 100 km/yr (Table 6.2). This is claimed to reduce UAFG by 15 TJ/yr, based on the average rate of leakage per km of cast iron and unprotected steel mains. It is also claimed that 75 km/yr of mains replacement is necessary to keep UAFG at a steady level, which together with the 15 TJ/yr reduction in UAFG at a 100 km/yr replacement rate implies that each additional km of mains replacement reduces UAFG by 0.6 TJ/yr

Table 6.2 UAFG Forecast (TJ)

2005	2006	2007	2008	2009	2010	2011
1606	1606	1606	1591	1575	1560	1545

The methodology is not explained in any detail. The historical UAFG levels support the concept that without mains replacement UAFG will increase. A simple model of the form

UAFG growth = A – B* length of mains replacement

can be derived from the historical values and used to test the above assumptions. The parameters A=399 TJ and B=2.36 TJ/km fit the data and imply that:

- each additional km of mains replacement reduces UAFG by 2.36 TJ/yr, a greater sensitivity than is implied by Envestra's assumptions
- the kevel of mains replacement necessary to keep UAFG steady is 169 km/yr, considerably more than the 75 km/yr that Envestra has estimated.

The parameter estimates are strongly influenced by the 471 TJ increase in UAFG in 2003/04 but since UAFG continued to increase in 2004/05 it can be assumed that this was not due to a one off gas loss in 2003/04.

If 169km/yr is required to keep UAFG steady, then with 100 km replacement per year UAFG could, according to MMA's indicative model, increase at a rate of 162 TJ/year rather than declining over the forecast period.

It is possible however that underlying parameters have changed in ways that make the above model less relevant for forecasting. For example the mains with the most rapid increases in leakage could now have been replaced, or changes in maintenance strategies since 2002/03 could have reduced future UAFG growth.

On this basis the Envestra forecast seems reasonable.

APPENDIX A WEATHER NORMALISATION

A.1 Weather normalisation

Gas demand in the domestic and small commercial/industrial customer segments is strongly influenced by weather conditions from day-to-day and from year-to-year. In view of the impossibility of accurately forecasting future weather conditions, in preparing gas forecasts the industry standard procedure is to:

1. Weather normalise historical actual gas demand, so that underlying non-weather related trends can be identified.
2. Prepare forecasts assuming that normal (average or trend) weather conditions will prevail, so that actual future demand variations due to weather variations from normal will have an equal probability of being positive or negative.

Envestra has used the heating degree day index (HDD) to weather normalise actuals and forecasts. Daily HDDs are defined by:

HDD = 18-T if T<18 and HDD = 0 if T=18, where T is the average daily temperature[38] in degrees Celsius.

Envestra has summed the daily HDDs through the year to derive annual HDDs. It is noted that this definition is not consistent with the use of billings based consumption however, since some of the consumption billed in first quarter of each year was actually consumed in the last quarter of the previous year and was therefore affected by the weather in that quarter[39]. The appropriate annual HDD value is therefore the sum of the daily values through the first three quarters of that year plus weighted values of daily HDDs in the last quarter of that year and (differently) weighted values of daily HDDs in the last quarter of the previous year.

Throughout this appendix simple annual HDDs have been used to maintain consistency with Envestra's analysis. However MMA has constructed billings related annual HDD values and the impacts of using Billings HDDs instead of simple annual HDDs are noted in various sections below.

HDDs as defined assume that gas demand is not influenced by temperatures above 18 C and that the variation below 18 C is linear, with no saturation effects. These assumptions are broadly met in practice and although some organisations have sought more complex

38 The average is typically defined as the average of the daily maximum and minimum.

39 This applies to quarterly billed customers. For monthly billed customers the final quarter in the previous year becomes the previous June.

weather indices involving other weather factors, such as sunshine and wind[40], HDDs are widely used for weather normalisation.

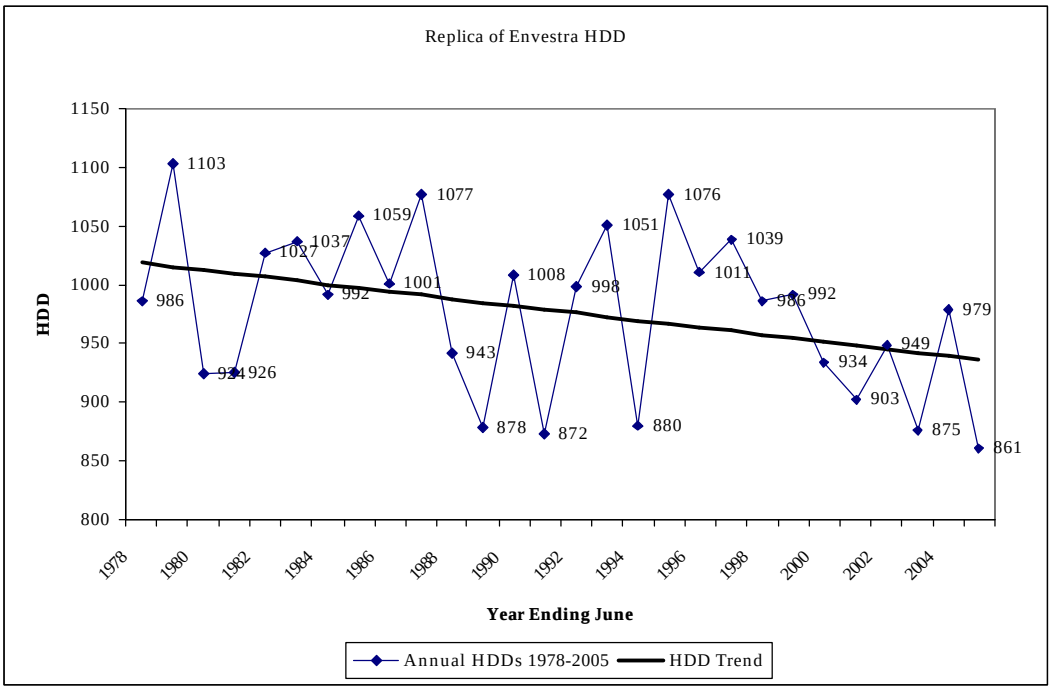
A.2 Weather trend

MMA has replicated Envestra's reported HDDs for the Kent Town (Adelaide) weather station from 1978 to 2005, with the exception of the final year, for which our figure is slightly lower, and estimated the strength of the downward trend evident in the data (Figure A-1). The trend is 3.05 HDDs per year and is marginally significant in statistical terms, with a T-statistic of 2.0. The trend value in 2005 is 936.2 HDDs, which will decline to 917.9 HDDs by the end of the regulatory period in 2011.

Envestra suggests that the downward trend is due to global warming but more detailed studies[41] of weather trends have found the urban heat island effect to be a more plausible cause of declining degree days in urban areas. This suggests that some caution should be used in applying the trend outside the Adelaide metropolitan area, though the effect of this on total demand is unlikely to be material as over 90% of small user demand is in the Adelaide area.

MMA therefore accepts the use of the trend for forecasting.

Figure A-1 Actual and trend annual HDDs



40 Effective degree days (EDDs) incorporating these factors have been developed by Vencorp for Victroria and by NIEIR for South Australia.

41 Annual Planning Review 2002-2006, VENCorp, November 2001.

Similar trends are found in the Billings HDD data.

A.3 Envestra weather normalisation

Envestra has estimated the HDD sensitivity coefficients of the Adelaide small user sector (<10TJ pa) for each year from 1997/98 to 2004/05, by means of eight separate[42] (one for each year) multiple regressions using daily demand[43], HDDs and other variables. The annual HDD coefficients are presented in Table A-1. Envestra allocates approximately 90% of the HDD coefficients to the domestic sector and 10% to the commercial sector and assumes that small industrial load is not weather sensitive. It is not clear whether this allocation is varied over time to reflect different growth trends in the residential and commercial sectors.

Envestra calculates weather normalised domestic and commercial gas consumption using the following formula, in which 't' denotes the relevant year:

Normalised gas consumption$_t$ = Actual consumption$_t$ – HDDcoefficient$_t$ x (Actual HDD$_t$ – Normal HDD$_t$)

Envestra has provided the normalised values resulting from these calculations as part of MMA's information request. MMA has also reproduced the calculations using the following assumptions: allocation of HDD coefficients to the residential and commercial markets are exactly 90% and 10% respectively; HDD coefficients are reduced by 10% to account for the UAFG included in the data used to derive the coefficients; Normal HDDs are the trend estimates in Figure A-1; the weather sensitivity of non-Adelaide load is proportional to Adelaide load weather sensitivity. MMA estimates of normalised consumption reproduce Envestra estimates to within 0.25% for the domestic sector and 1.5% in the commercial sector.

The MMA estimated weather normalisations are presented in average usage form, which must be used to establish starting points for use in forecasts, in Table A-1. It is clear that the Envestra weather normalisation methodology does not result in smooth trends in the normalised usage values, particularly for C&I customers, which means that the final year values may not be the most appropriate starting points for forecasts (refer to Figure A-2 and Figure A-3 for a graphical presentation).

[42] This is not stated in Envestra's forecast document but is evident from the variation of R-squared from year to year.

[43] It is understood that this is net system load, i.e total gas injections less the metered load of over 10TJ customers.

Table A-1 Envestra weather normalised average usage per customer, estimated by MMA (GJ)

	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05
HDD Coefficients (TJ)	4.6	4.7	4.6	4.6	4.4	4.9	4.4	4.9
Domestic Normalised Average Usage	24.70	23.84	23.50	24.09	23.78	23.73	23.21	23.09
Domestic Trend Average Usage	24.33	24.16	23.99	23.83	23.66	23.49	23.33	23.16
Domestic Weather Sensitive Usage	11.99	12.03	11.52	11.28	10.57	11.52	10.13	11.07
Domestic Base Load Usage	12.70	11.81	11.98	12.81	13.22	12.20	13.08	12.02
C&I Normalised Average Usage	356.7	347.6	337.3	333.9	333.7	337.4	348.8	346.3
C&I Trend Average Usage	345.5	344.7	343.9	343.1	342.3	341.5	340.7	339.9
C&I Weather Sensitive Usage	55.2	55.6	53.3	53.0	50.1	55.2	49.1	52.0
C&I Base Load Usage	301.5	292.0	284.1	280.8	283.7	282.2	299.7	294.3

MMA believes there are two reasons that may account for the non–smooth trends:

1. The HDD coefficients themselves do not display any clear trend, alternating between 4.4 and 4.9 over the past four years. It appears that variations in the coefficients may be related more to statistical variation than to market trends, as suggested by the linkage between lower coefficients and lower regression R-Squared values (Refer to Envestra Table 3.1).

2. The methodology does not seek to normalise or trend the non-weather sensitive load (base load) as shown by the year to year variations base load in Table A-1 (base load is calculated by subtracting weather sensitive load (HDD coefficient x Normalised HDDs) from normalised average usage.

These considerations suggest that trend estimates based on Envestra normalised values would be more appropriate starting points for forecasts (refer to Figure A-2 and Figure

A-3 for a graphical comparison of normalised and trend values). The trends show annual declines of 0.7% for the domestic sector and 0.2% for the C&I sector.

Repeating the above analysis of the residential sector using Billings HDDs produces similar outcomes.

A.4 MMA weather normalisation

In view of the impact of declining average consumption on gas demand, MMA has sought to validate the historical trends derived from the Envestra weather normalisation. This analysis utilises annual average usage data to estimate the coefficients in a model of the form:

$$\text{Average usage}_t = A + B \times \text{Year}_t + C \times \text{HDD}_t + D \times \text{HDD}_t \times \text{Year}_t$$

In this model A represents base load usage in year 0 (1998), B represents the annual trend in base load usage, C represents the weather sensitivity in year 0 and D represents the annual trend in weather sensitivity. The model is structured to directly normalise both base- and weather-sensitive load, rather than using a two stage process of weather normalisation followed by trending, as is necessary in the Envestra approach. As there are only eight data points it is unlikely that all four coefficients will be statistically significant - statistically significant estimates of A and C are essential for a model that can be used to weather normalise the data.

A.4.1 Domestic

For the domestic sector, models with coefficients A and C and at most one of B and D passed the significance test, i.e. the data is sufficient to estimate base load and weather sensitivity coefficients and the annual trends in either one of these but not both. The models with three coefficients have higher R-squared statistics than the two coefficient model and are preferred for that reason. A valid four coefficient model has been formed by averaging the coefficients of the three coefficient models. The coefficients and derived parameters are reported in Table A-2 and Table A-3.

Table A-2 MMA domestic weather normalisation model coefficients

	Coefficients			
R-Sq	**A**	**B**	**C**	**D**
0.84	14.46	-0.08	0.0104	-0.00008

Table A-3 MMA domestic model derived values, 2005

Normalised load/customer (GJ)			Per HDD (TJ)
Base load	**Weather sensitive**	**Average usage**	**Weather sensitivity**
13.90	9.15	23.05	3.41

The negative values of coefficients B and D imply that both base load and weather sensitive load per customer, and consequently normalised domestic average usage, are declining. The MMA model estimate of average usage in 2005 is marginally lower than the Envestra normalised and trend estimates. MMA's estimate of the HDD sensitivity of domestic load in 2005 is 3.4 TJ, compared to Envestra's implied value of 4 TJ (4.9 TJ less 10% for excluding UAFG and 10% for commercial). The annual decline in usage due to the declining trend in HDDs is 0.13% [(3 / 936)*(9.15 / 23.05)].

Repeating the above analysis of the residential sector using Billings HDDs produces similar outcomes, however the R-sq values are higher, confirming that the Billings HDDs are more strongly correlated with gas usage than the simple annual HDDS.

A.4.2 Commercial and Industrial

Analysis of average usage in the commercial sector by itself did not yield any statistically significant models. However for the combined commercial and small industrial sector a two coefficient model was estimated satisfactorily, albeit with a relatively low R-squared value (Table A-4 and Table A-5).

Table A-4 MMA C&I weather normalisation model coefficients

	Coefficients			
R-Sq	**A**	**B**	**C**	**D**
0.37	217.69	0	0.133	0

Table A-5 MMA C&I model derived values, 2005

Normalised load/customer (GJ)			Per HDD (TJ)
Base load	**Weather sensitive**	**Average usage**	**Weather sensitivity**
217.7	124.5	342.2	1.13

The MMA model estimates of normalised average usage in 2005 are lower than the Envestra estimate but higher than the Envestra trend value. The MMA estimate of the HDD sensitivity of C&I load in 2005 is 1.1 TJ, compared to Envestra's implied value of 0.4 TJ (excluding UAFG).

A.4.3 Total load <10TJ

Models of average usage for the combined <10TJ sector have been estimated principally to obtain a total weather sensitivity per HDD estimate to compare with Envestra's estimate. Observations on the analysis are as for the domestic models.

Total sector weather sensitivity is estimated to be 4.3 TJ/HDD, consistent with the Envestra estimate of 4.4 TJ/HDD for 2005 (excl UAFG). It is noted however that MMA's domestic and C&I models imply that this is split 75:25 to domestic and C&I rather than 90:10 as assumed by Envestra.

Table A-6 MMA <10TJ weather normalisation model coefficients

	Coefficients			
R-Sq	**A**	**B**	**C**	**D**
0.84	19.99	-0.10	0.0128	-0.00011

Table A-7 MMA <10TJ model derived values, 2005

Normalised load/customer (GJ)			**Per HDD (TJ)**
Base load	**Weather sensitive**	**Average usage**	**Weather sensitivity**
19.26	11.22	30.49	4.29

A.5 Comparison of estimated historical trends

Comparisons of Envestra's normalised average usage, the linear trends estimated from this and MMA's normalised average usage[44] are illustrated in Figure A-2 and Figure A-3, which show close agreement between the trend estimates based on Envestra's normalisation and MMA's normalisation model estimates.

[44] The domestic models are virtually indistinguishable and Model 2 is used

Figure A-2 Comparison of domestic average usage estimates

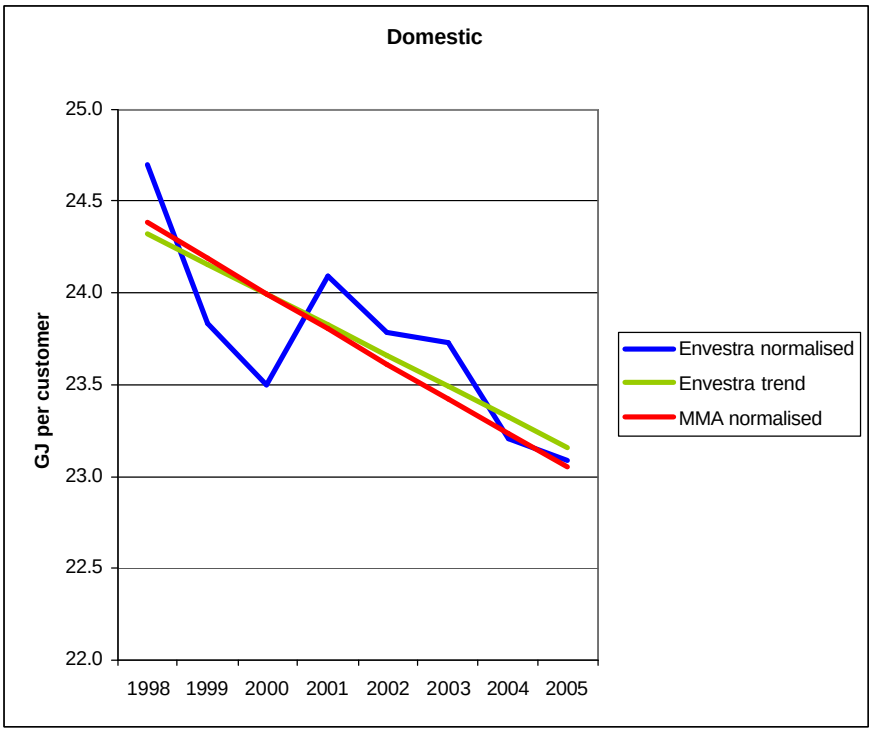


Figure A-3 Comparison of C&I average usage estimates