Confidential

Review of Demand Forecasts for Envestra Queensland

For the Access Arrangement period commencing 1 July 2011

Prepared for the Australian Energy Regulator

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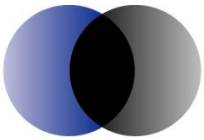

ACIL Tasman

Economics Policy Strategy

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Contents

1 Background 1

2 This report 1

2.1 Approach to the review 1

3 Scope of Envestra operations 2

3.1 Historical gas demand 3

4 Forecast methodology and assumptions 3

4.1 Forecast methodology for the 2011–16 access arrangement period 4

4.1.1 Econometric modelling 5

4.1.2 Volume Customers (Tariff V) forecasts 7

4.1.3 Demand Customers (Tariff D) forecasts 9

4.1.4 Other factors affecting the forecasts 10

4.2 Conclusions regarding key forecast assumptions 11

5 The forecasts 13

5.1 Use of trend extrapolation for forecast verification 13

5.2 Tariff V Customer forecasts 13

5.2.1 Customer numbers 13

5.2.2 Tariff V Customer gas demand 16

5.2.3 Tariff V average gas consumption 19

5.3 Tariff D customer forecasts 26

5.3.1 Tariff D customer numbers 26

5.3.2 Tariff D gas demand 28

5.3.3 MDQ forecasts for Tariff D customers 30

6 Conclusions 32

7 Bibliography 35

A Curriculums Vitae 1

B Establishment of Confidence Intervals around historical trend lines 1

List of figures

Figure 1 **NIEIR projections for Queensland gas prices** 11

Figure 2 **Historical and forecast customer numbers—Tariff V Total** 14

Figure 3 **Historical and forecast customer numbers— Tariff V residential** 15

Figure 4 **Historical and forecast customer numbers—Commercial & Industrial Tariff V** 16

Figure 5 Historical and forecast gas consumption — Tariff V customers 17
Figure 6 Historical and forecast demand— Tariff V customers, Brisbane 18
Figure 7 Historical and forecast demand— Tariff V customers, North Queensland 19
Figure 8 Actual vs forecast average gas consumption per Volume Customer 19
Figure 9 Actual vs forecast average gas consumption per Volume Residential Customer 20
Figure 10 Queensland Average Residential GJ pa: Forecast vs 90% Confidence Interval 21
Figure 11 Comparison of historical average residential consumption estimates 22
Figure 12 Comparison of historical and forecast average gas consumption, Brisbane residential customers, APT Allgas vs Envestra 23
Figure 13 Actual vs forecast average gas consumption per Volume Commercial Customer 25
Figure 14 Actual vs forecast average gas consumption per Volume Industrial Customer 25
Figure 15 Actual and forecast Tariff D Commercial customer numbers 26
Figure 16 Actual and forecast Tariff D Industrial customer numbers 27
Figure 17 Actual and forecast Tariff D Aggregate customer numbers 27
Figure 18 Tariff D aggregate demand forecast (Commercial and Industrial) 28
Figure 19 Historical and forecast demand— Tariff D customers, Brisbane 29
Figure 20 Historical and forecast demand— Tariff D customers, North Queensland 29
Figure 21 Tariff D Customer Maximum Daily Quantity (MDQ)—TOTAL 31
Figure 22 Tariff D Maximum Daily Quantity (MDQ)—Brisbane 31
Figure 23 Tariff D Maximum daily Quantity (MDQ)—North Queensland 32

List of tables

Table 1 Envestra Queensland gas networks — historical customer numbers, by class 3
Table 2 Envestra Queensland gas networks — historical customer demand (TJ), by class 3

1 Background

The Australian Energy Regulator (AER) engaged ACIL Tasman to review the adequacy and appropriateness of the methodology used by Envestra Limited ("Envestra") to develop forecasts of demand in its Queensland gas distribution networks for the access arrangement period commencing 1 July 2011, as set out in the proposed access arrangement information submitted by Envestra.

The *National Gas Rules* (NGR 72(1)(a)(iii)) require the access arrangement information provided by the service provider to include usage of the pipeline over the earlier access arrangement period showing:

- minimum, maximum and average demand
- customer numbers in total and by tariff class.

In making a decision whether to approve or not to approve an access arrangement proposal, the AER is required under rule 74 of the NGR to be satisfied that forecasts required in setting reference tariff(s) are arrived at on a reasonable basis and represent the best forecast or estimate possible in the circumstances.

The process followed by the AER for assessing proposed access arrangements and access arrangement revisions is set out in the Final Access Arrangement Guideline published in March 2009(AER, 2009).

2 This report

A key part of the information submitted by a service provider in support of a proposed access arrangement is a forecast of the level of demand for the reference services provided, over the course of the access arrangement period. This typically involves forecasting demand for services for a period of five years from the commencement date of the new access arrangement. It is important to ensure that the forecasts represent best estimates arrived at on a reasonable basis because:

- Demand forecasts may impact the forecast capital expenditure required to meet the new demand of prospective users or the increased demand of existing users and may therefore influence forecast revenue.
- Demand forecasts influence the tariffs set to meet forecast revenue in each year of the access arrangement period, and how this revenue is to be allocated between tariff classes for different reference services.

2.1 Approach to the review

In undertaking this review, ACIL Tasman has considered the following issues:

1. the adequacy of the overall approach and methodology
2. the reasonableness of the assumptions
3. the currency and accuracy of the data used
4. the account taken of key drivers
5. whether the methodology has been properly applied.

The review has been undertaken as desktop analysis into the methodology, data and parameters, and assumptions used to develop the demand forecasts. ACIL Tasman has used its own knowledge of Australian gas markets to test assumptions.

3 Scope of Envestra operations

The Envestra Queensland distribution business comprises around 15% of Envestra's total gas distribution business, and serves customers in Brisbane (north of Brisbane River), Ipswich, Rockhampton and Gladstone.

The network, which has been constructed over a period of more than 100 years, consists of a variety of pipe materials. The older parts of the network (pre-1970s) is mainly cast iron and unprotected steel. In the new parts of the network, polyethylene (PE) and nylon have been used as the predominant pipe material, with polyethylene pipes up to 100mm diameter being commonly used. PE is now also being used in sizes above 100mm diameter and in higher pressure applications. The type of pipe material dictates the maximum operating pressure of the constituent parts of the network. Since cast iron can only be operated at relatively low pressures compared to polyethylene, the on-going replacement of cast iron pipe with polyethylene pipe means that the capacity of the network is improving with time in many areas.

As at 30 June 2010, the total network length was 2,375 km of which 80% was PE/nylon, 13% cast-iron and unprotected steel, and 7% coated steel. In terms of geographical coverage, 76% of the network (by line length) is located within the Brisbane area, 12% in Ipswich, 10% in Rockhampton and 2% in Gladstone.

The network currently serves around 80,000 customers in the Brisbane and Ipswich area, and a further 3,500 customers in central Queensland (Rockhampton and Gladstone). Gas deliveries through the network currently total around 5.7 PJ/year of which some 96% is to customers in the Brisbane and Ipswich area.

3.1 Historical gas demand

The historical customer numbers for the Envestra Queensland distribution network are shown in Table 1.

Table 1 **Envestra Queensland gas networks — historical customer numbers, by class**

Year ended 30 June	2006	2007	2008	2009	2010
Residential	72,838	74,390	76,307	78,877	80,674
Small business	2,732	2,773	2,753	2,827	2,831
Volume Customer Total	75,570	77,163	79,060	81,704	83,505
Demand Customers	64	65	68	67	67
Total customers	**75,634**	**77,228**	**79,128**	**81,771**	**83,573**

Data source: (NIEIR, 2010b, p. 54)

Historical gas consumption, by customer class, is summarised in Table 2.

Table 2 **Envestra Queensland gas networks — historical customer demand (TJ), by class**

Year ended 30 June	2006	2007	2008	2009	2010
Residential	668	637	677	730	720
Small business	1,264	1,247	1,223	1,248	1,253
Volume Customer Total	1,932	1,885	1,900	1,978	1,972
Demand Customer Total	3,036	3,220	3,750	3,748	3,725
All Customers Total	**4,968**	**5,104**	**5,650**	**5,726**	**5,697**

Data source: (NIEIR, 2010b, p. 53)

4 Forecast methodology and assumptions

The demand forecasts contained in the revised access arrangement information (Envestra, 2010) have been developed by the National Institute of Economic and Industry Research (NIEIR) and are detailed in a separate demand forecasts study (NIEIR, 2010b) included as Attachment 13 – 1 to the access arrangement information.

As a general comment, there are a number of places in the NIEIR report that refer to South Australia, and which appears to reflect discussion drawn from the corresponding report on the South Australian system. Envestra has confirmed that all assumptions made by NIEIR in the Queensland demand report are relevant to Queensland and not to South Australia, and has advised that the report will be revised to correct these errors.

4.1 Forecast methodology for the 2011–16 access arrangement period

The market forecasts in the NIEIR report (NIEIR, 2010b) were developed using the methodology described below. The forecasts cover a period from 2011 to 2020 and are based on a combination of historical load data together with NIEIR's assessments of economic and government policy factors.

The scope of the NIEIR study, as defined by Envestra, was as follows:

- A description of the methodology used to forecast gas consumption for each market segment, and key assumptions used to prepare forecasts, including the source of base data used, and an overview of forecasting models used. NIEIR was asked to give particular consideration to the impact of substitute energy sources, government policy initiatives (e.g. rebate on solar water heaters) and global warming on gas consumption.
- An assessment of the expected industrial closures, manufacturing activity, investment levels and residential property prices in Queensland and the impacts they will have on demand for natural gas over the forecast period.
- Estimates of gas consumption for the financial years 2009-10 to 2019-20 for:
  - Domestic customers for the Brisbane Region (including Ipswich and suburbs north of the Brisbane River), and the Northern Region (serving Rockhampton and Gladstone);
  - Commercial and small industrial in the Brisbane Region and the Northern Region (serving Rockhampton and Gladstone); and
  - MDQ and annual volume forecasts for customers using greater than 10 TJ per annum (Tariff D) for the Brisbane Region and the Northern Region.
- Relevant commentary on the forecasts to interpret trends and to demonstrate consistency with expected movements in key economic variables.

The NIEIR forecasts were prepared in September 2010. Envestra provided NIEIR with the following data:

- Tariff V volumes and customer numbers by class and by region (Brisbane and Northern) on an annual basis from 2006-07 to 2008-09.
- Tariff D volumes billed for each customer for every month from 2004 to 2009.
- Daily sent out volumes of data for the period 1998 to 2009 by various meter points for the Queensland gas network.
- Other information describing the Queensland gas network and background papers. (NIEIR, 2010b, p. 24)

The methodology adopted by NIEIR consisted of a combination of:

- an econometric based approach for Tariff D and business Tariff V customers; and
- an end-use based approach for modelling residential sector sales.

NIEIR's Queensland gas model was used to forecast Tariff D sales, customers and MDQ. This is an industry based forecasting model based on estimated econometric equations.

An end-use model was developed by NIEIR to forecast residential sales. This model separated average residential gas usage into two components–hot water and cooking–reflecting the two main purposes for which natural gas is used by residential customers in the areas covered by Envestra's Queensland gas networks.

NIEIR states that the main strength of end-use modelling is that the specific Commonwealth and State policies that affect each of these end uses can be factored directly into the forecast. The end-use forecast was also reconciled against an econometric based forecast of residential gas sales. As noted by NIEIR, this combination of econometric and end-use modelling has been widely used in gas access arrangement decisions, including for the most recent Victorian Gas Access Arrangement Review.

The forecasting methodology is described in detail, together with the forecast results, in section 4 of the NIEIR report (NIEIR, 2010b, pp. 25-40).

4.1.1 Econometric modelling

The econometric component of the NIEIR forecast incorporates a cascading assessment of economic outlook, starting at a national level and moving progressively to state and regional economic projections. The forecasts of the Envestra natural gas (sales) volumes have therefore been developed within a regional economic model of the Queensland economy. This model utilises NIEIR's state forecast of gross state product (by industry) and disaggregates it to the Local Government Areas (LGAs) level. These forecasts have been mapped to Envestra's distribution regions classification. A concordance between the LGAs and Envestra's zones is presented as an appendix to the NIEIR report.

At a regional level, the NIEIR analysis takes into account projections of population, dwelling stock and industry growth by sector. The regional energy model then provides an assessment of natural gas and electricity consumption by industry sector, class and customer numbers.

National economic performance

NIEIR sets out is assumptions about major Australian economic aggregates in Table 2.1 of the demand report (NIEIR, 2010b, p. 3). On the key indicator of GDP, NIEIR is forecasting the following growth rates:

- 2010 – 11 3.4%
- 2011 – 12 3.8%
- 2012 – 13 2.6%
- 2013 – 14 1.7%
- 2014 – 15 2.5%

By way of comparison, recent Treasury forecasts of Australian GDP are as follows (Australian Treasury, 2010):

- 2010 – 11 3.0 %
- 2011 – 12 3. 75 %
- 2012 – 13 3.0 %
- 2013 – 14 3.0 %

The NIEIR forecasts of national GDP are therefore broadly in line with current official forecasts.

Regional economic performance

The Queensland gas distribution network includes the following regions:

- Brisbane region (including Ipswich and suburbs north of Brisbane River); and
- Northern region (serving Rockhampton and Gladstone).

Over the period to 2019–20, NIEIR is forecasting population growth averaging 2.3% per year in the Brisbane region and 1.0% per year in the Northern region, compared to a State-wide average of 2.1% per year.

In terms of dwelling stock, NIEIR is forecasting growth generally in line with population growth over the same period. They have therefore assumed an average 2.3% per year growth in the Brisbane region and 0.9% per year in the Northern region, compared to a State-wide average of 2.1% per year.

In terms of gross regional product growth, NIEIR is forecasting strong growth in the Brisbane region averaging 4.4% per year over the period to 2019–20, with growth in the Northern region at 2.7% per year, compared to a State-wide average of 3.8% per year.

By way of comparison, Queensland Treasury in its 2010 Economic Forecasts (Queensland Treasury, 2010) anticipates growth in Queensland Gross State

Product of 2.5% in 2011–12 and 4% in the two subsequent years. Queensland Treasury's corresponding forecasts for population growth are 2.25% per year from 2010–11 to 2013–14. The NIEIR forecasts are therefore not inconsistent with recent Queensland Treasury projections. Further supporting evidence for the NIEIR assumptions is provided by the Access Economics Business Outlook series (March 2009) which projects average growth in Queensland Gross State Product of 4.5% from 2011 to 2018, with private housing investment growing at 4.3% over the same period, and population growing at 2.0% (Access Economics, 2010).

4.1.2 Volume Customers (Tariff V) forecasts

The forecasts for Tariff V by class (residential, commercial and industrial) were developed for the two distribution network areas (Brisbane/Ipswich and Rockhampton/Gladstone).

Residential sector sales forecasts were developed initially using a regression model incorporating real household disposable income and real residential gas prices. The income and price elasticities for the residential model were based on NIEIR's Queensland gas model estimates. The Queensland gas volume data was not weather normalised because, given the absence of space heating load in the Envestra Queensland network, demand is typically not weather sensitive.

The residential forecasts derived from the econometric model were then adjusted to be consistent with a State-wide end-use model of residential gas usage. This model disaggregates average gas usage into existing and new customers and by end-use: hot water and cooking.

The end-use model makes specific assumptions regarding appliance lives, appliance efficiencies and the changing penetration of conventional and new technologies in the hot water segment. Key Commonwealth and State policy impacts were factored directly into the end-use model forecast.

Residential customer number forecasts were linked to NIEIR's forecasts of the dwelling stock for each of the two distribution network areas.

Forecasts for Tariff V (small commercial and industrial) were linked to a general equation for gas sales, where sales are related to gas prices and total commercial and industrial output for the distribution network areas.

Forecasting of average residential use

An important element in the forecast prepared by NIEIR for Envestra was an analysis of average residential gas usage. This included a historical analysis and an assessment of the key factors that will influence future usage per customer.

NIEIR points out that the analysis of average consumption of gas by residential customers is complex and that consumption is shaped by a large number of inter-related factors including:

- gas appliance penetration rates and their efficiency;
- existing and future Federal and State Government energy policy initiatives;
- fuel substitution between gas, electricity and solar combinations;
- changes in dwelling characteristics including building shell;
- socio-demographic changes; and
- the impact of weather on average usage, or weather normalisation issues (NIEIR should have noted that this is not a factor assumed to significantly impact consumption of gas by residential customers in Queensland).

Tables 4.2 and 4.3 present data (source not specifically attributed) on historical average residential gas use. The data shows a downward trend in average residential consumption from 10.7 PJ/year in 1999–00 to 8.9 GJ/year in 2008–09. The data also points to an even more dramatic reduction in average consumption depending on year of installation. According to this data, customers connected in 2003–04 or earlier use an average of about 11 GJ/a, while customers connected in 2007–08 consume only around 7 GJ/a.

NIEIR concludes that:

> "The decline in new dwelling usage over the 2003-04 to 2007-08 period is around 37 per cent."

This somewhat overstates the rate of decline, given that the starting point in 2003–04 represents the average consumption for all connections at that date, not only for new connections made in that year. Nevertheless, the data does demonstrate that average rates of residential consumption across all customers has been declining over the past decade, and that for new customers connecting to the system, average consumption is significantly below the average for older customer connections.

NIEIR provides high level commentary on:

a) market trends affecting the installation of existing gas appliances, including but not limited to, the impacts of installing alternative appliances such as reverse cycle air conditioning in lieu of gas heating, continuous flow gas systems in lieu of storage gas systems, solar or electrical systems, and the impacts of water conservation measures on the consumption of hot water;

b) government energy efficiency policies including the phasing out of conventional electric resistance waters heaters; federal rebates to replace electric resistance waters heaters with solar water heaters; State solar Hot Water Program (ended April 2010); eligibility of solar hot water and heat pump installations for renewable energy certificates

under the Renewable Energy Target; 5–Star building standards which require installation of solar (or high-efficiency gas) water heaters; minimum efficiency performance standards for gas hot water systems; and energy efficiency home rating schemes; and

c) implementation of the Government's Carbon Pollution Reduction Scheme (CPRS) including the impacts on fuel substitution, reduction in demand of increased cost of gas especially in the large industrial market, economics of small and large scale cogeneration and electricity production.

NIEIR has not provided information to separately quantify the impacts of individual policy initiative (for example, how much reduction in average residential consumption is driven by policies aimed at water conservation or energy efficiency).

NIEIR notes that the lower usage in new connections reflects higher efficiencies in water heating units, solar hot water penetration and water usage efficiencies, which it attributes in part to the introduction of the 5–Star Energy Standard in Queensland in 2006. Based on Envestra's analysis of new connection requests by appliance types and combination being installed, and expected consumption per appliance in Queensland, NIEIR has assumed consumption of 2 GJ/year for a cooker, 10 GJ/year for a high efficiency instantaneous hot water service and 4 GJ/year for a gas boosted solar hot water service.

NIEIR also notes the significance of the increased uptake of reverse cycle air conditioning (RCA) and concludes that "The high penetration of RCA in Queensland implies that gas space heating loads in Queensland are negligible". ACIL Tasman agrees that there has been a strong increase in reverse cycle air conditioning installations in Queensland, but notes that compared to southern States this has had little impact on the Envestra Queensland gas network because the space heating load for this network has never been significant.

4.1.3 Demand Customers (Tariff D) forecasts

Forecasts of gas (sales) volumes for Tariff D customers were developed at industry and regional levels. NIEIR assigned an industry classification to every Tariff D customer. The industry regression models relate Tariff D gas consumption to:

- the change in output for that industry within the zone; and
- the change in real gas prices for that industry (incorporating lags in real prices to proxy the long run price elasticity).

The output and price elasticities at the zone level were adjusted to reflect differences in the gas intensity between industries and regions.

The Tariff D forecasts by industry and zone were, therefore, determined by:

- the outlook for the industry growth in each of the zones; and
- the structural parameters and relationships embodied in NIEIR's industry based Queensland natural gas demand model.

4.1.4 Other factors affecting the forecasts

Wholesale gas prices

NIEIR projects that wellhead prices for gas in Queensland will rise as:

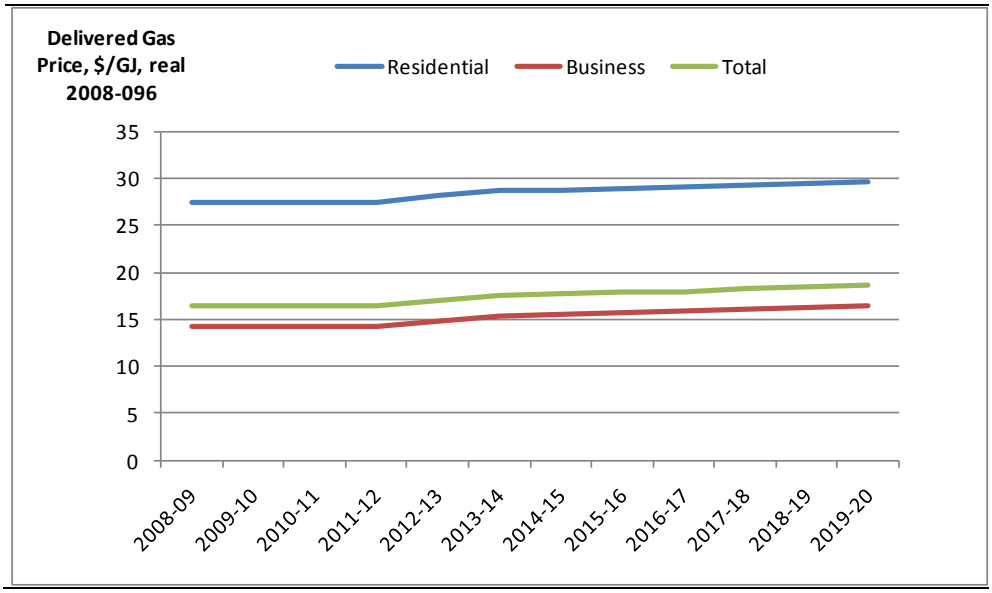
- costs for development of new reserves increase;
- a tendency for prices to rise towards international levels (adjusted for liquefaction, transport and regas costs) as export LNG plants are commissioned in Queensland. However because not all available gas can be exported there is likely to be a domestic/export gas wellhead price differential (as is the case with coal);
- a CPRS would increase gas prices depending on the CPRS design (caps, treatment of fugitive emissions); and
- electricity network prices are likely to rise significantly over the next 5 to 10 years and increase retail electricity prices relative to retail gas prices. Gas prices will increase over the next five years but gas is likely to increase its competitiveness over electricity.

ACIL Tasman agrees with NIEIR is assessment of key drivers on wholesale gas prices. We note that in Queensland particularly, wholesale gas prices represent only a small proportion of the delivered cost of gas to Volume customers because distribution costs are high, reflecting the low average gas use per customer.

Carbon pricing/emissions trading

NIEIR assumes that, despite the deferral of the Carbon Pollution Reduction Scheme (CPRS), some form of carbon pricing will be introduced leading to increases in electricity and gas prices. Carbon pricing is assumed to commence in 2014 with the price of carbon gradually increasing through to 2030. The resultant impact on delivered gas prices in Queensland is shown in Figure 1.

Figure 1 **NIEIR projections for Queensland gas prices**



Data source: (NIEIR, 2010, pp. 40, Table 4.9)

The gas prices projected by NIEIR show little change (in real terms) over the period 2004–05 to 2011-12. NIEIR forecasts that, under the influence of a delayed CPRS, gas prices in the residential sector will rise by some $1.40/GJ or 5.3 per cent between 2011-12 and 2015-16. The corresponding rise in the business sector is forecast to be $1.30/GJ or 10.2 per cent, with the average rise across all sectors being $1.30 or 8.9%.

ACIL Tasman considers that quantum and timing of the forecast gas price impacts are reasonable, bearing in mind the current uncertainty regarding the timing of introduction of carbon a carbon price mechanism, and the future carbon price trajectory. The fact that prices are forecast to begin rising before introduction of CPRS may reflect upward pressure on gas prices in anticipation of carbon pricing. This is reasonable, particularly for long term gas supply contracts that will span across the anticipated CPRS start date.

4.2 Conclusions regarding key forecast assumptions

In developing the demand forecasts, NIEIR has given consideration to the key drivers affecting future gas demand. Account has been taken of factors that might cause future gas demand growth to follow a different growth trajectory when compared to past experience. In terms of methodology we consider that the approach adopted by NIEIR is generally sound. However, main risks to forecast accuracy relate not to the methodology that has been followed, but to the assumptions regarding specific demand drivers and their impacts on demand. In this regard, the critical assumptions adopted by NIEIR include:

- the overall economic growth outlook in Queensland
- the impact of government policies and alternative technologies on gas demand and on average consumption per customer, particularly in the residential sector.

With regard to the economic growth outlook, NIEIR has adopted forecasts that are not inconsistent with recent Queensland Treasury projections and other independent sources.

The NIEIR report identifies a number of energy efficiency measures and policies on gas demand that have the potential to impact on gas demand. However, the bases for assumptions regarding the quantitative impacts attributed to particular interventions are generally not explained.

The forecasts of future delivered gas prices used by NIEIR incorporate the potential impact of carbon pricing, and in our opinion are reasonable.

In the following section we further examine the impacts of the assumptions used by NIEIR on the reasonableness of the forecasts, including statistical comparison of the forecasts with historical trends.

5 The forecasts

In this chapter we review the revised forecasts themselves, to consider whether the application of the methodologies and assumptions used by NIEIR and Envestra has produced forecast results that are reasonable in light of historical patterns of demand as well as current and anticipated influences on retail gas demand in Queensland. We consider separately the forecasts for the Volume and Demand sectors of the market.

5.1 Use of trend extrapolation for forecast verification

The NIEIR methodology looks to take into consideration the key drivers affecting future gas demand and factors that may cause future gas demand growth to follow a different trajectory from past experience. However a sound methodology alone does not ensure that the forecasts produced by application of that methodology are reasonable. The methodology needs to be supported by accurate data and appropriate assumptions in relation each of the input parameters.

In the following analysis we have used historical trend analysis as a cross-check on the results generated using the NIEIR methodology. ACIL Tasman recognises that forecasting on the basis of extrapolation of historical trends involves a risk of overlooking changes in market drivers that could result in future trends differing from historical trends. The fact that a forecast diverges from the historical trend cannot in itself be taken as proof that the forecast is unreasonable. Rather, such divergence should prompt us to ask whether there are good reasons for the projected break in trend.

Envestra has confirmed that the 2009–10 data presented by NIEIR is a forecast rather than actual historical data. This is because actual data for the 2009–10 year will not be finalised until around February 2011 due to the process involved in replacing estimated data with actual data. Envestra has undertaken to provide this information in response to the AER Draft Decision (including by way of an updated demand forecast).

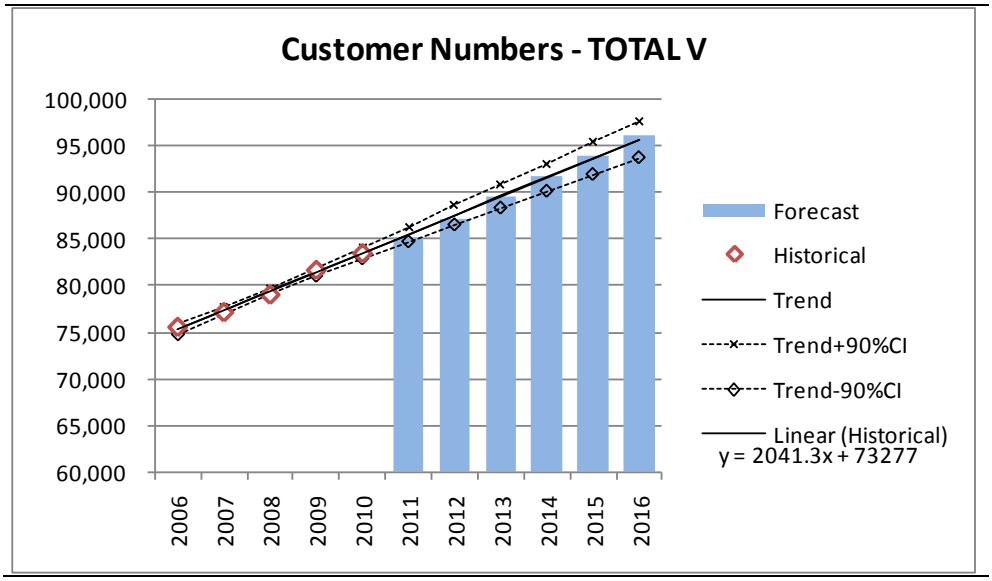
5.2 Tariff V Customer forecasts

5.2.1 Customer numbers

The forecast of total customer numbers for the Tariff V customer sector is summarised and compared with historical actual customer numbers in Figure 2. The historical data is tightly correlated. The forecast shows stronger growth

in customer numbers than in the past, with total customers across the forecast period at or slightly above a 90 per cent confidence interval around the trend line[1]

Figure 2 **Historical and forecast customer numbers—Tariff V Total**



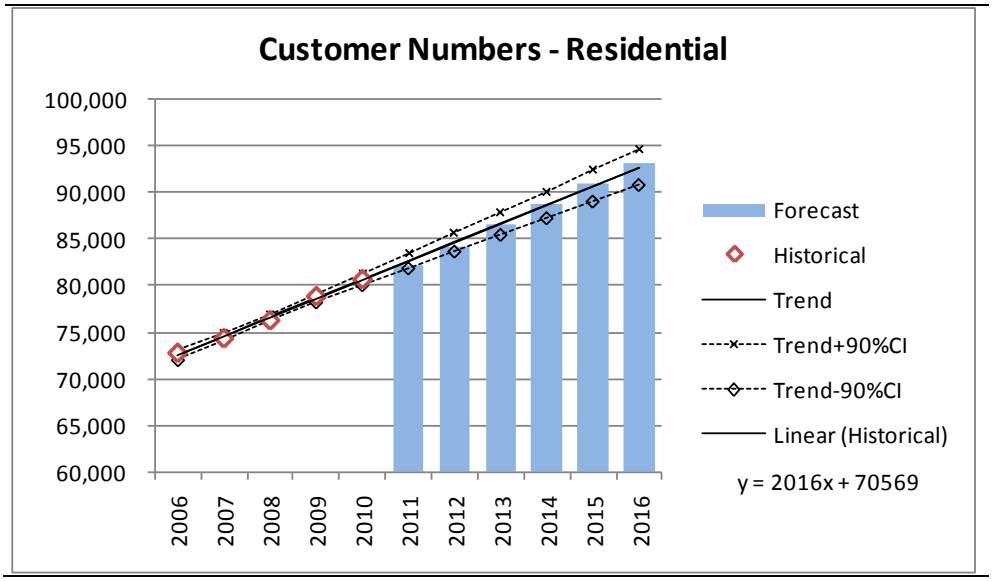
Data source: (NIEIR, 2010b), ACIL Tasman analysis

Overall the forecast rates of growth in customer numbers are statistically consistent with recent trends and do not appear to be unreasonable.

Figure 3 shows the corresponding data and forecast trends for residential customer numbers as a subset of the Tariff V customer class. The results are very close to those for the total Tariff V customer class—a wholly expected result given that residential customers account for more than 96 per cent of the Tariff V total customer numbers.

[1] See Appendix B for an explanation of the method of calculation of the 90 per cent confidence intervals.

Figure 3 **Historical and forecast customer numbers— Tariff V residential**



Data source: (NIEIR, 2010b), ACIL Tasman analysis

The NIEIR report identifies factors that could reasonably be expected to push growth in new residential customer connections to a higher rate:

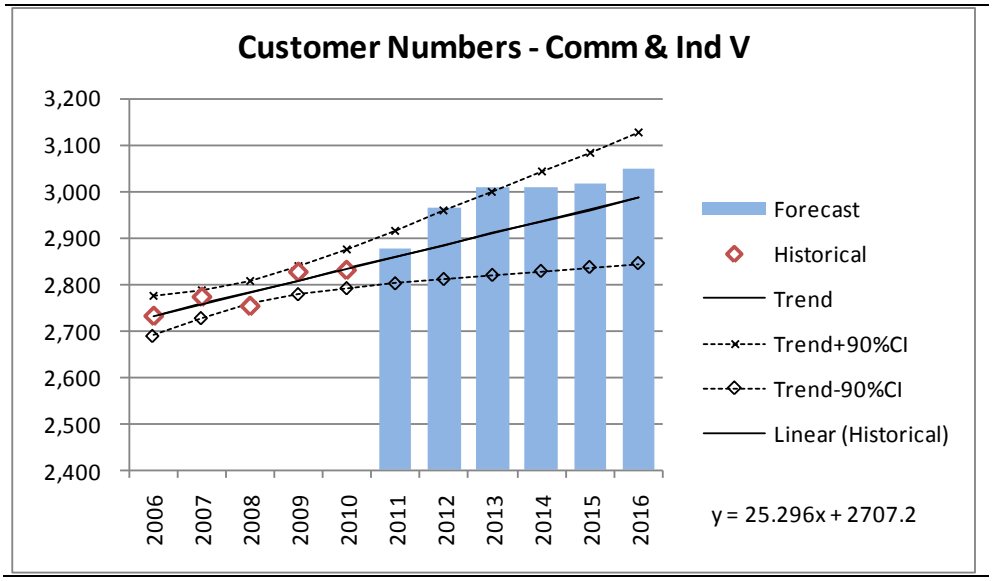
- Policies that tend to encourage installation of gas appliances rather than electric, but also tend to reduce average gas consumption by reducing the average energy use of new dwellings.
- The fact that under MEPS installation of new conventional electric resistance waters will be banned in all new and existing homes in gas reticulated areas from 2010, and in new flats and apartments in reticulated areas and established houses in non-gas reticulated areas from 2012.

Another factor that could be expected to increase the rate of growth for Tariff V customer is the gas marketing strategy to be undertaken by Envestra.

Again the forecast rates of growth in residential customer numbers are statistically consistent with recent trends and do not appear to be unreasonable.

Figure 4 shows the corresponding results for the Commercial and Industrial Tariff V customers.

Figure 4 **Historical and forecast customer numbers—Commercial & Industrial Tariff V**



Data source: (NIEIR, 2010b), ACIL Tasman analysis

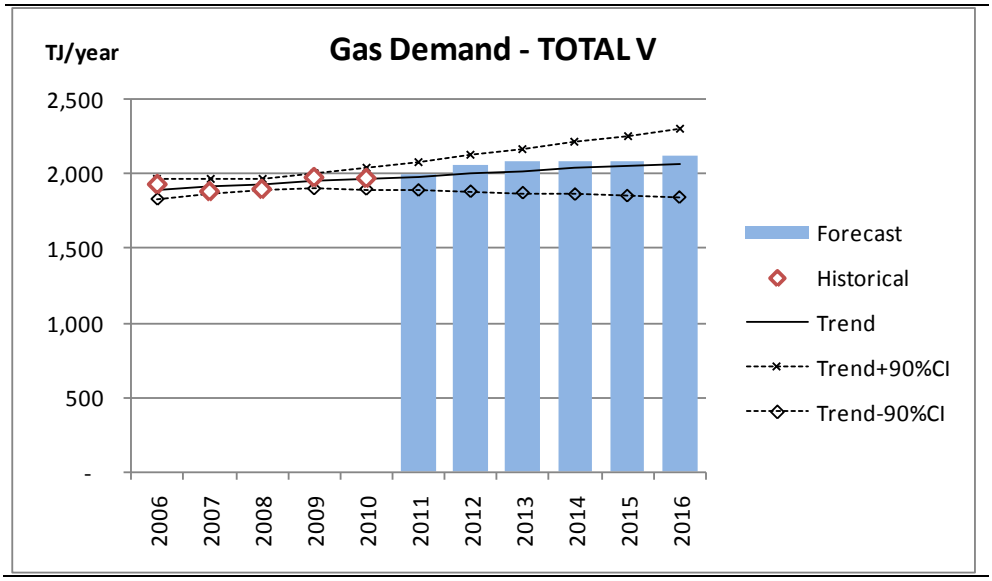
With a much smaller customer number set and greater sensitivity to economic cycles, the growth trend for small business customer numbers shows a weaker correlation and a correspondingly wider confidence interval around the extrapolated trend data. The forecast for small business Tariff V group customer numbers lie above the long-term trend but generally within the upper bound of the 90 per cent confidence interval.

The forecast rates of growth in customer numbers are statistically consistent with recent trends and do not appear to be unreasonable.

5.2.2 Tariff V Customer gas demand

The forecast of gas demand for the Tariff V Customer sector for Queensland as a whole is summarised and compared with historical actual consumption in Figure 5. The forecast demand is here compared to raw historical trends (that is, without weather normalisation) based on linear extrapolation. Because of Queensland's warm climate, there is virtually no space heating load and demand does not therefore vary significantly with seasonal temperatures. Accordingly, the demand forecasts are not weather normalised.

Figure 5 **Historical and forecast gas consumption — Tariff V customers**



Data source: (NIEIR, 2010b), ACIL Tasman analysis

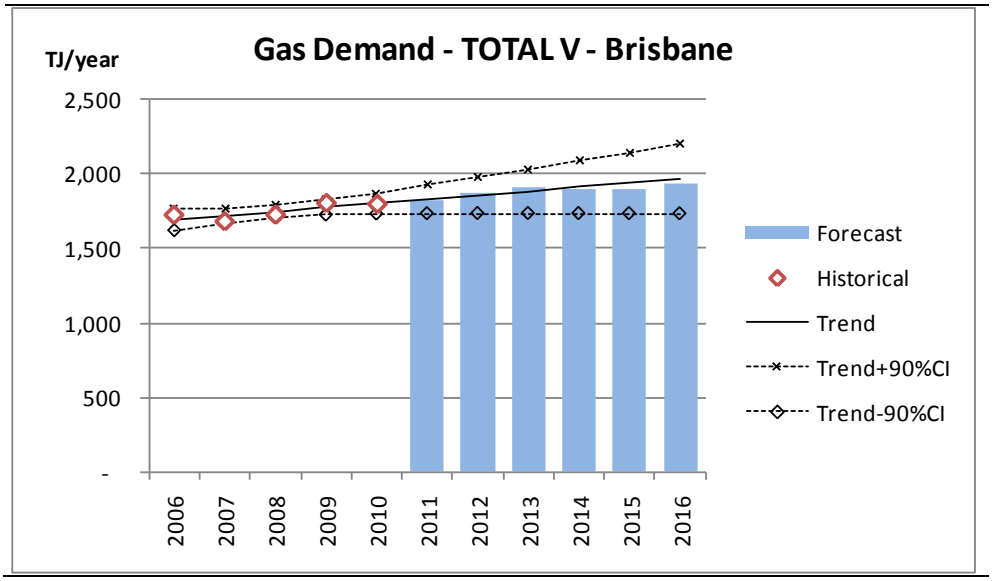
The forecast growth in total Tariff V gas consumption is statistically consistent with recent trends and does not appear to be unreasonable.

Tariff V Customer gas demand – Brisbane

Figure 6 shows the forecast of gas demand for the Tariff V Customer sector for the Brisbane region.

Again, the forecast demand is close to the historical trend and well within the 90% confidence interval. Accordingly, the forecast of gas consumption for the Brisbane region does not appear to be unreasonable.

Figure 6 **Historical and forecast demand— Tariff V customers, Brisbane**

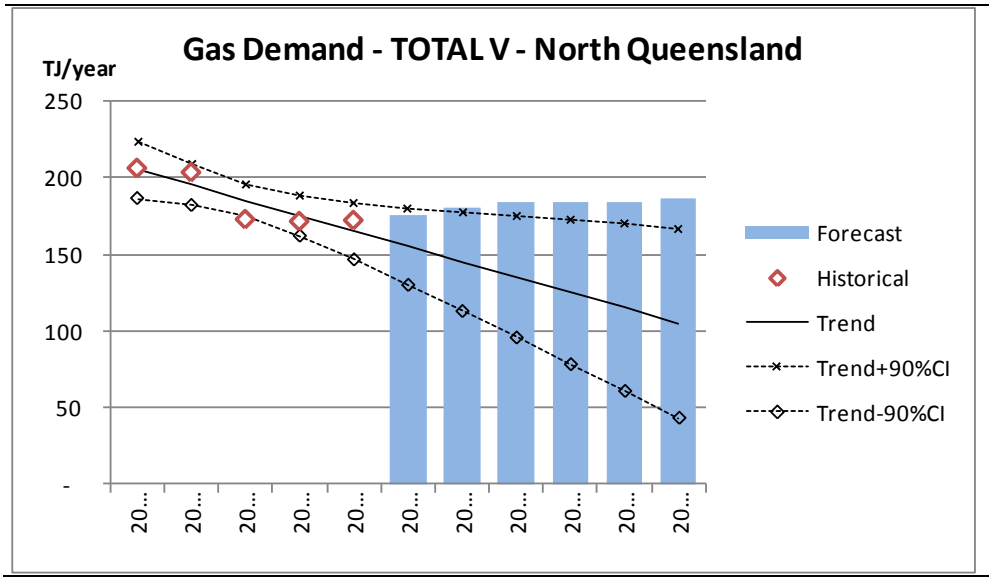


Data source: (NIEIR, 2010b), ACIL Tasman analysis

Tariff V Customer gas demand – North Queensland

Figure 7 shows the forecast of gas demand for the Tariff V Customer sector for the North Queensland region. The forecast demand is above the historical trend and slightly above the 90% confidence interval. However, the downward trend in the historical data appears to reflect the loss of a small number of substantial customers (around five net) in the 2007–08 year, with a corresponding step change in consumption of about 43 TJ. Gas demand for the past three years has been consistent at around 75 TJ/year and forecast demand is at or slightly above this level. Accordingly, the forecast of gas consumption for the North Queensland region does not appear to be unreasonable.

Figure 7 **Historical and forecast demand— Tariff V customers, North Queensland**

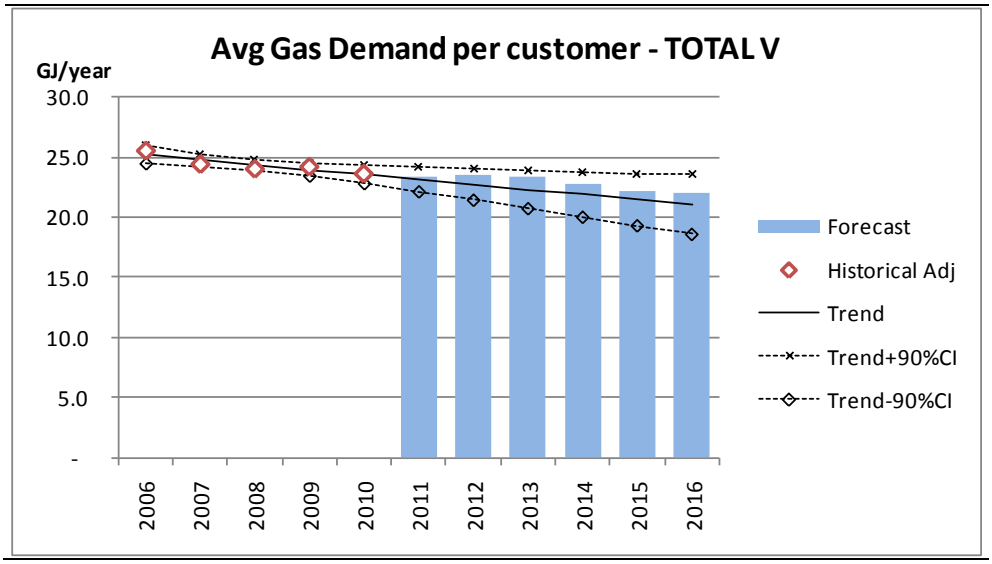


Data source: (NIEIR, 2010b), ACIL Tasman analysis

5.2.3 Tariff V average gas consumption

Assumptions regarding average gas consumption per customer for the Tariff V sector are critically important to the overall demand forecasts because the forecasts are generated by applying average gas consumption rates to the projected customer numbers in each demand segment. The implied average gas consumption per Customer in the Tariff V sector as a whole (derived from Tariff V demand and customer numbers) is shown in Figure 8.

Figure 8 **Actual vs forecast average gas consumption per Volume Customer**



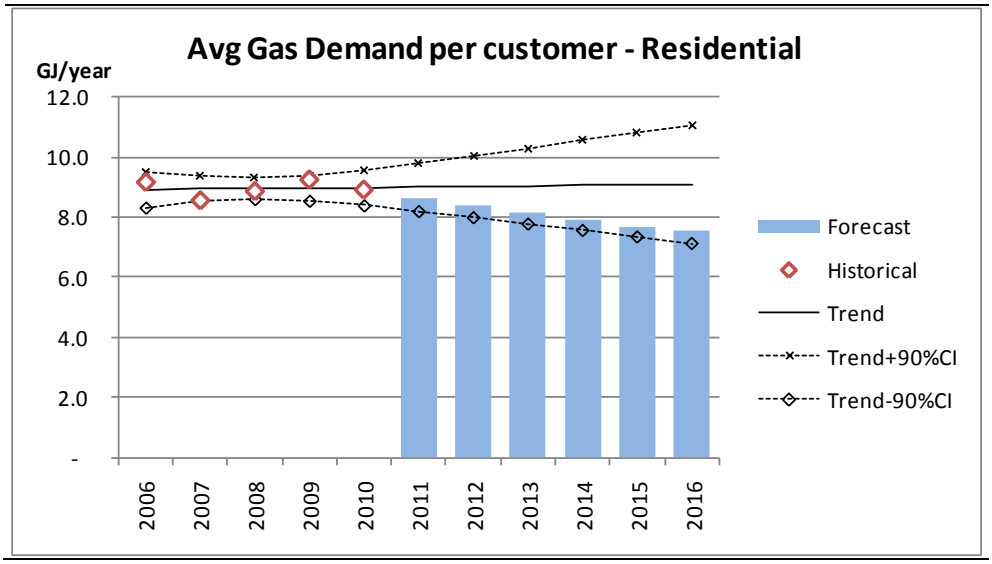
Data source: (NIEIR, 2010b), ACIL Tasman analysis

The forecast falls close to the trend line and well within the 90 per cent confidence interval around the historical trend based on the past five years of data. However, in order to assess the reasonableness of the assumptions regarding average gas consumption per customer in the Tariff V sector, it is necessary to consider separately the residential, small business commercial and small business industrial customer groups, since these groups are subject to different consumption drivers. The results of this more detailed analysis are discussed in the following sections.

Tariff V Residential average consumption

The forecast for average gas consumption by Residential customers is compared with historical data in Figure 9. The forecast based on the results presented in the NIEIR demand study lies below the historical trend which was virtually flat over the period 2006 to 2010. The NIEIR forecast of average consumption continues to decrease over time and lies close to the lower bound of the 90% confidence interval around the historical trend.

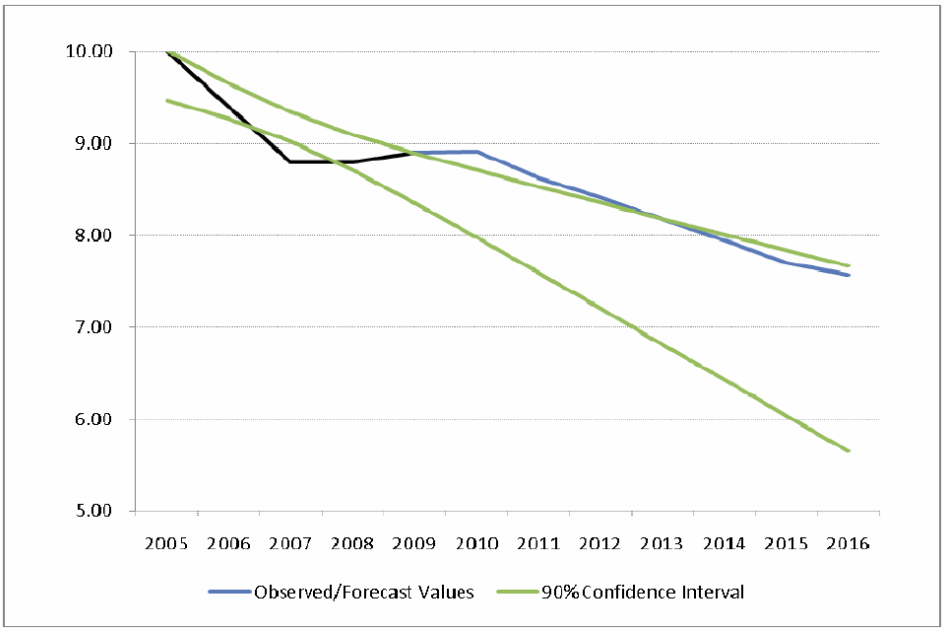
Figure 9 **Actual vs forecast average gas consumption per Volume Residential Customer**



Data source: (NIEIR, 2010b), ACIL Tasman analysis

By contrast, Envestra presents a chart (Graph 13.11, p.190 in the access arrangement information) that shows the forecast average gas use per customer being close to the upper bound of the 90% confidence interval around the historical trend, with the historical trend being steeply downward. This chart is reproduced as Figure 10. A similar representation of historical and forecast average residential gas use is presented in Figure E.3 of the NIEIR report (NIEIR, 2010b, p. iii)

Figure 10 **Queensland Average Residential GJ pa: Forecast vs 90% Confidence Interval**



Source: (Envestra, 2010, p. 190), Graph 13.11

A number of factors appear to have led to the significant differences between Figure 9 and Figure 10:

- Envestra has included the year ended June 2005 as a data point, with average consumption of 10.0 GJ/year, and has calculated the trend and confidence interval based on quoted average consumption figures from 2005 to 2009. By contrast, the ACIL Tasman analysis is based on the data presented in the NIEIR demand report. NIEIR presents detailed data only from year ended June 2006 on [see (NIEIR, 2010b), Tables 6.1 and 6.2]. ACIL Tasman has therefore calculated the trend and confidence interval based on consumption figures and customer numbers presented by NIEIR for years 2006 to 2010.
- The average consumption levels charted by Envestra for years 2006 and 2007 are consistent with information presented by NIEIR in Table 4.2 (NIEIR, 2010b, p. 28) but are inconsistent with—and significantly higher than—the average consumption levels calculated on the basis of the detailed customer numbers presented in the NIEIR demand report (Tables 6.1 and 6.2). Furthermore, they are not consistent with the average consumption data charted by Envestra in Graph 13.4 (Envestra, 2010, p. 177).

There are significant discrepancies between different sources on information on average residential consumption presented in the access arrangement information. The 2010 data point shown by Envestra in Graph 13.11 and NIEIR Figure E.3 has a value of approximately 8.9 GJ/year. This is the same as the average consumption calculated from the NIEIR data in Tables 6.1 and

6.2. However, it is significantly higher than the average residential consumption in 2010 of around 8.6 GJ/year shown by Envestra in Graph 13.4. *If the 8.9 GJ/year number is correct, then average residential gas usage has not been declining over the past four years, but has in fact been increasing slightly.*

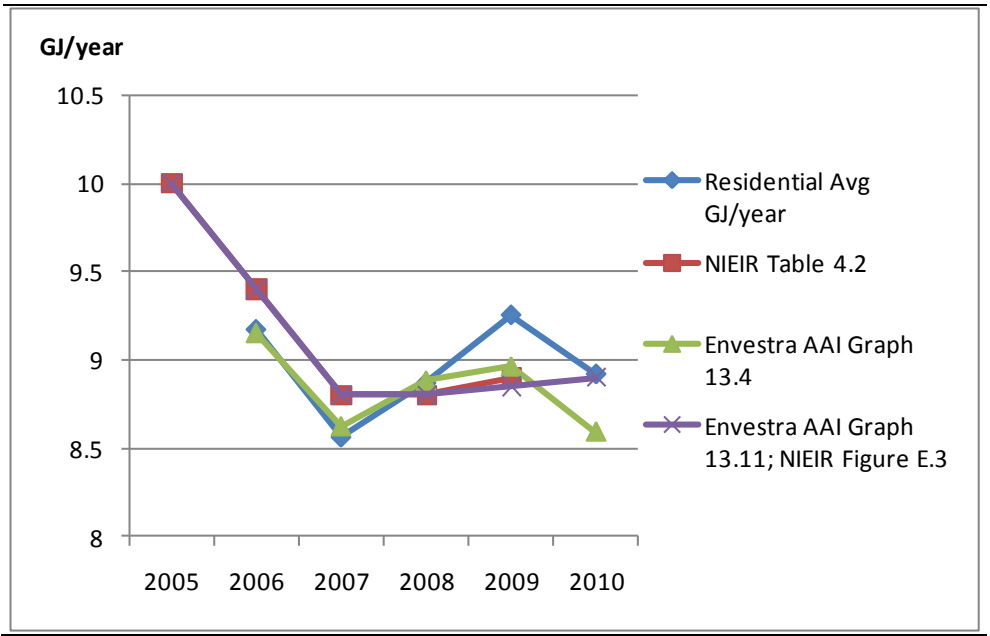
Figure 11 compares the average residential consumption rates calculated from the data presented in the NIEIR demand report (Tables 6.1 and 6.2) with the corresponding average consumption rates presented in Table 4.2 and Figure E.3 of the NIEIR report, and in Graph 13.4 and Graph 13.11 in the access arrangement information (Envestra, 2010, pp. 177,190).

Envestra was asked to explain the discrepancies and to advise the correct historical information to allow consistent calculation of average rates of consumption by Residential customers. Its response was as follows:

> "In addressing this issue, Envestra has found some inconsistencies in the recent history relating to Envestra's new billing system. This has arisen due to the incorrect classification of Tariff V customers as residential instead of commercial; however the total tariff V volume remains unchanged."

As a result, Envestra has undertaken to provide the AER with the correct/updated history and updated residential tariffs and volume forecasts.

Figure 11 **Comparison of historical average residential consumption estimates**

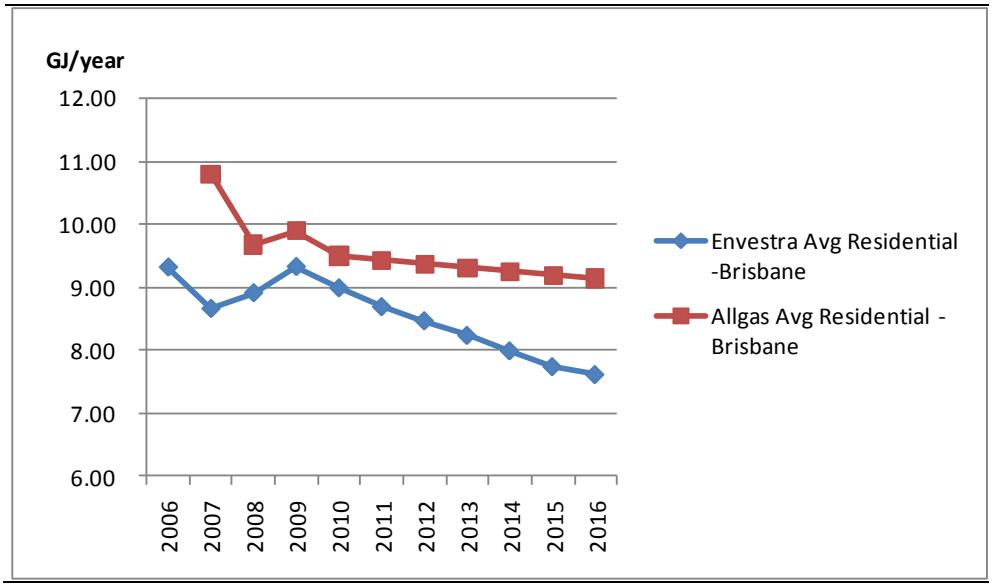


Data source: (Envestra, 2010), (NIEIR, 2010b), ACIL Tasman analysis

As a further check on the reasonableness of the Envestra forecast for average gas consumption in the residential sector, it is instructive to compare the Envestra forecast with that submitted by APT Allgas in its revised access

arrangement information. Figure 12 shows the comparison. Historically, consumption rates have been higher in the Allgas network. However, what is clear from the comparison is that Envestra is forecasting a much higher rate of decline in residential consumption over the forthcoming access arrangement period, with the average falling at an average 2.7% per year over the forecast period to around 7.6 GJ/year by 2016. This compares an average rate of decline of 0.6% per year to 9.1 GJ/ by 2016 forecast by APT Allgas.

Figure 12 **Comparison of historical and forecast average gas consumption, Brisbane residential customers, APT Allgas vs Envestra**



Source: (NIEIR, 2010b), (APA Group, 2010b), ACIL Tasman analysis

As shown in Figure 9, the forecast average rate of residential consumption falls within the 90% confidence interval around the historical trend (based on the numbers provided by NIEIR for years 2006 to 2010) and cannot therefore be regarded as statistically inconsistent with recent historical trends. However, it lies close to the lower bound of the 90% confidence interval around the trend line and reflects a much steeper rate of sustained decline in average consumption levels than that forecast by Allgas for the adjacent Brisbane South region. Notwithstanding the discrepancies between different sources of information on average residential consumption, all sources show that average consumption has risen since 2007. **Accordingly, the recent evidence does not point to a strong and sustained downward trend in average consumption.** While ACIL Tasman agrees that government policies aimed at water conservation and energy efficiency, together with ongoing improvements in gas appliance efficiency and competition from solar and heat pump water heaters are likely to lead to further reduction in average residential

consumption rates, we consider it likely that the rate of decline forecast by Envestra is overstated.

In seeking to identify a better forecasting basis, we note that Table 4.2 in the NIEIR report presents ten years of historical data on average residential consumption for the Envestra Queensland network up to 30 June 2009. This data shows an average rate of decline of 2.0% per year. Continuation of this rate of decline would see average residential consumption of 7.9 GJ/a by the end of the next access arrangement period in 2016, compared to the 7.6 GJ/a proposed by Envestra.

If, however, the average consumption for year 2006 to 2009 calculated from the NIEIR data in Tables 6.1 and 6.2 was to be confirmed, then the average rate of decline over the period 2000 to 2009 would fall to around 1.5% per year. Continuation of this rate of decline would see average residential consumption of 8.3 GJ/a by the end of the next access arrangement period in 2016, compared to the 7.6 GJ/a proposed by Envestra.

The resolution of the data inconsistencies referred to previously therefore has the potential to materially affect the calculated historical rate of decline in average residential consumption. Subject to consideration of the updated historical data and residential volume forecasts that Envestra has undertaken to provide the AER, ACIL Tasman considers that adoption of the historical rate of decline in average residential consumption, rather than the accelerated rate of decline proposed by Envestra, would result in the best forecast in the circumstances.

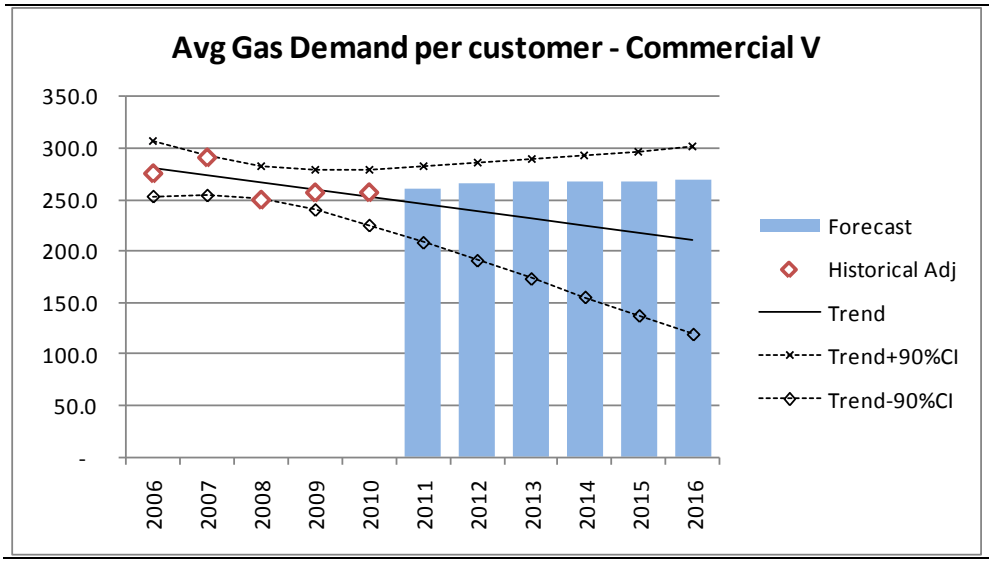
Tariff V Commercial and Industrial average consumption

The average rates of gas consumption for Commercial and Industrial Tariff V customers are shown in Figure 13 and Figure 14 respectively. In both cases, the forecast rates of consumption are consistent with historical trends, and lie well within the 90% confidence interval around the historical trends.

In particular, the average rates of gas consumption for these customer classes are very similar to the rates observed over the past three years.

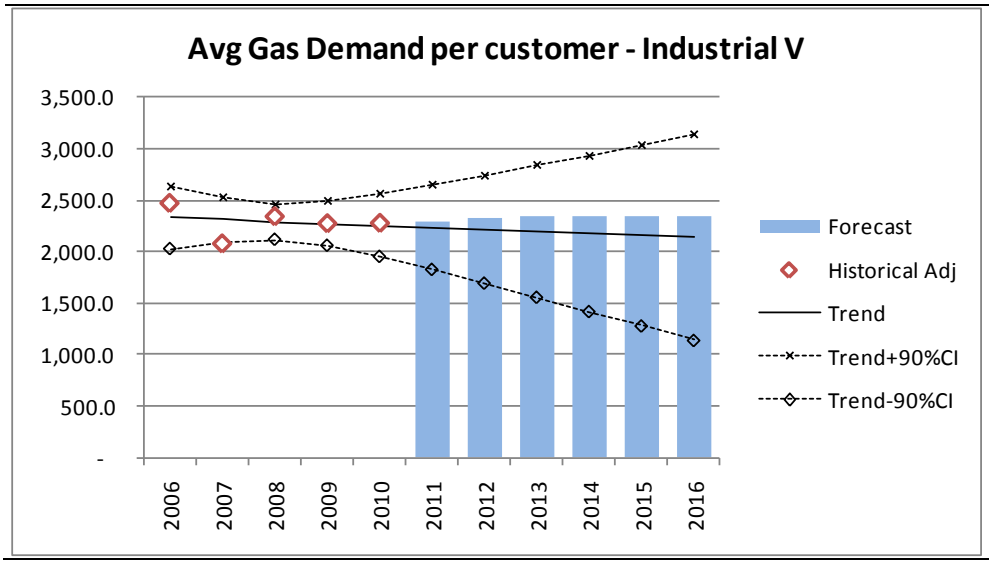
On this basis, ACIL Tasman considers that the forecast average rates of gas consumption for Commercial and Industrial Tariff V customers are reasonable.

Figure 13 **Actual vs forecast average gas consumption per Volume Commercial Customer**



Data source: (NIEIR, 2010b), ACIL Tasman analysis

Figure 14 **Actual vs forecast average gas consumption per Volume Industrial Customer**



Data source: (NIEIR, 2010b), ACIL Tasman analysis

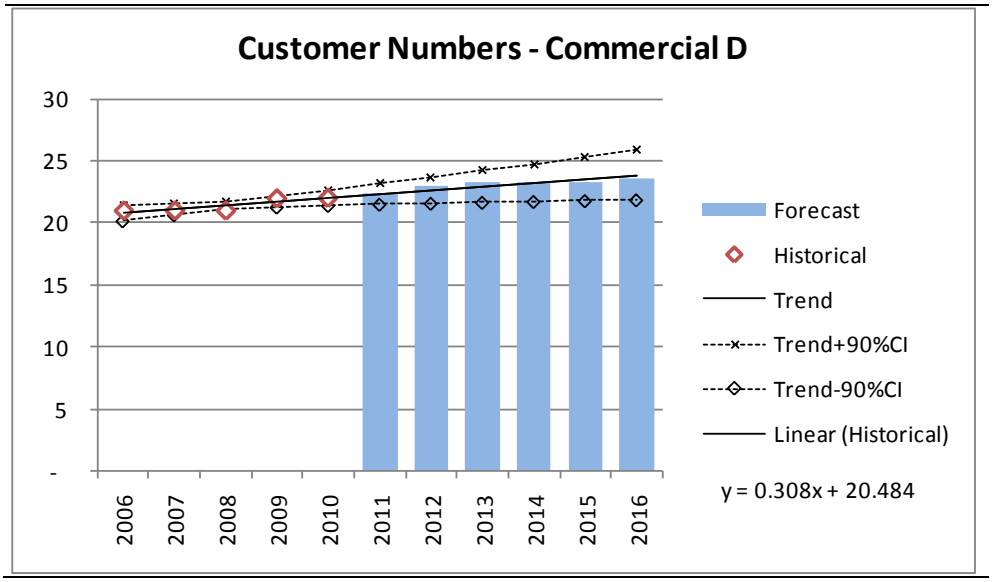
5.3 Tariff D customer forecasts

5.3.1 Tariff D customer numbers

The Tariff D customer class represents large gas users (>10TJ/year), and includes both commercial and industrial gas users.

Figure 15 shows the actual and forecast customer numbers for the Commercial customer class. As indicated, there are presently only 22 Tariff D Commercial customers and customer numbers in this class have shown very little change over the past five years. The number of Tariff D Commercial customers is forecast to grow to around 24 by the end of the next access arrangement period. The forecast is very close to the historical trend and well within the 90% confidence interval.

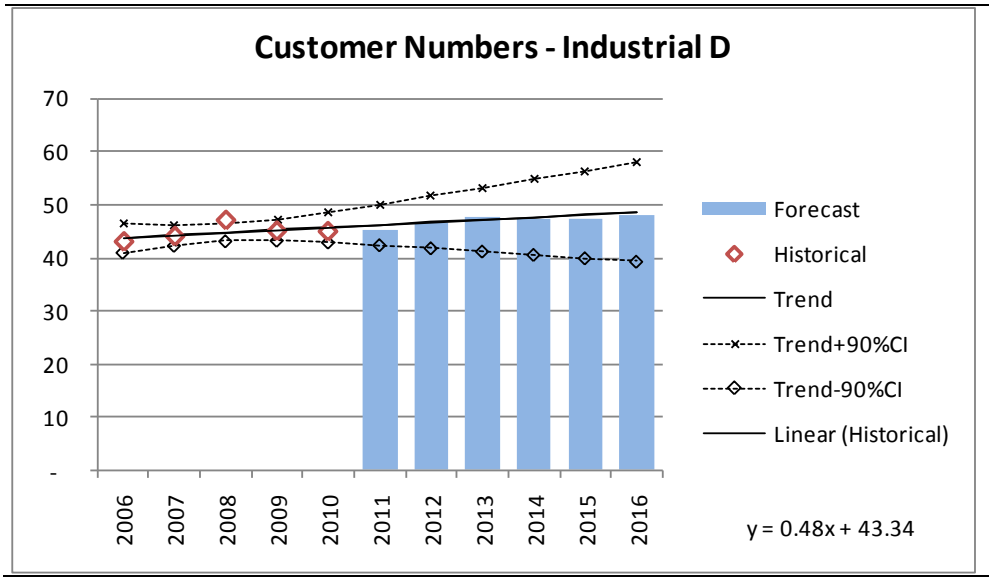
Figure 15 **Actual and forecast Tariff D Commercial customer numbers**



Data source: (NIEIR, 2010b), ACIL Tasman analysis

The corresponding actual forecast customer numbers for the Tariff D Industrial class are shown in Figure 16. There are presently 45 Tariff D Industrial customers; customer numbers in this class have ranged between 43 and 47 over the past five years. The number of Tariff D Industrial customers is forecast to grow to around 51 by the end of the next access arrangement period. Again, the forecast lies very close to the historical trend and well within the 90% confidence interval.

Figure 16 **Actual and forecast Tariff D Industrial customer numbers**

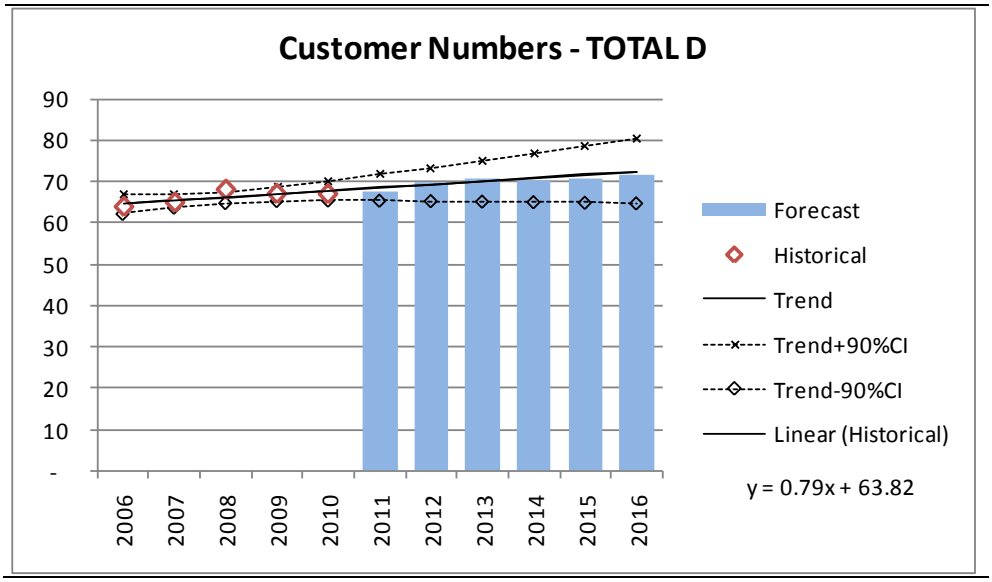


Data source: (NIEIR, 2010b), ACIL Tasman analysis

Give that the Commercial and Industrial Tariff D customer number forecasts are in line with historical trends, it is not surprising that the overall forecast of customer numbers in the Tariff D sector also lies very close to historical trend (Figure 17).

On this basis the forecasts of customer numbers in the Tariff D class, both in aggregate and for the Commercial and Industrial sectors individually, do not appear unreasonable.

Figure 17 **Actual and forecast Tariff D Aggregate customer numbers**

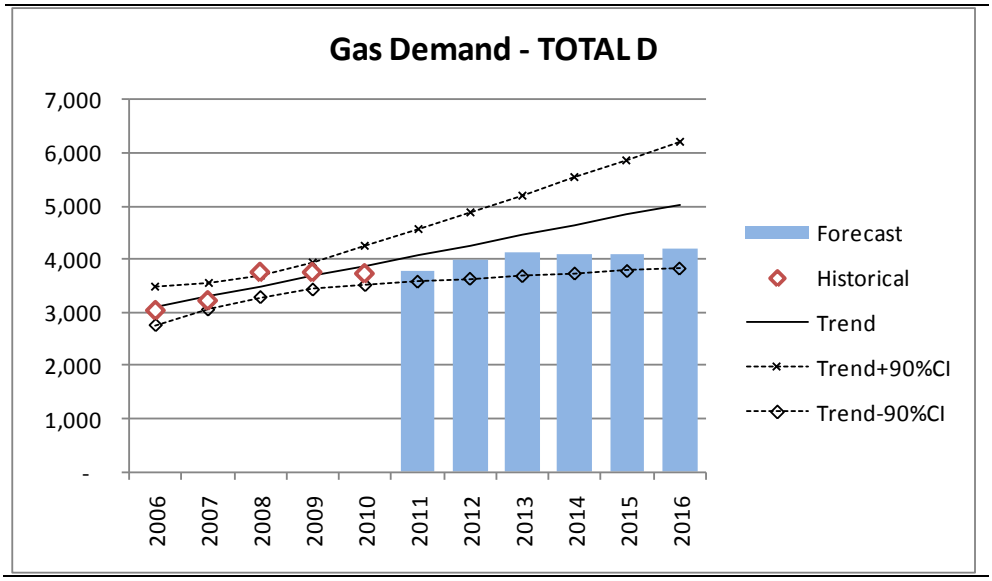


Data source: (NIEIR, 2010b), ACIL Tasman analysis

5.3.2 Tariff D gas demand

The demand forecasts for the Tariff D customer group in aggregate are shown in Figure 18. The forecast anticipates very mild growth in demand above current levels, reaching a little over 4,000 TJ/year. While falling below the historical trend, the forecast remains within the lower bound of the 90% confidence interval.

Figure 18 **Tariff D aggregate demand forecast (Commercial and Industrial)**



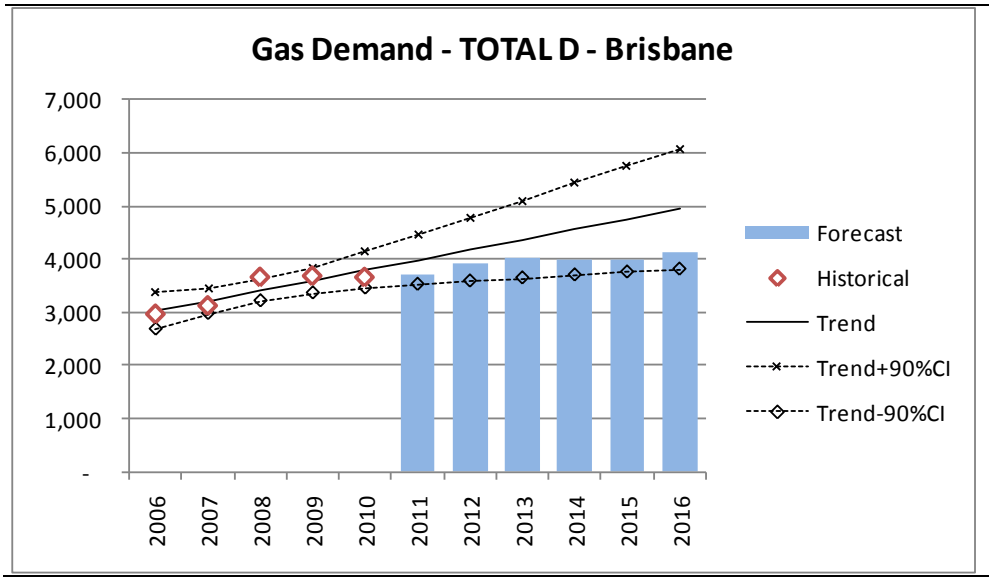
Data source: (NIEIR, 2010b), ACIL Tasman analysis

The following sections examined the forecasts of Tariff D Customer demand for the two separate regions, Brisbane and North Queensland.

Tariff D Customer gas demand – Brisbane

Figure 19 shows the forecast of gas demand for Tariff D customers in the Brisbane region. Again, the forecast anticipates very mild growth in demand above current levels, reaching just over 4,000 TJ/year. While falling below the historical trend, the forecast remains within the lower bound of the 90% confidence interval.

Figure 19 **Historical and forecast demand— Tariff D customers, Brisbane**

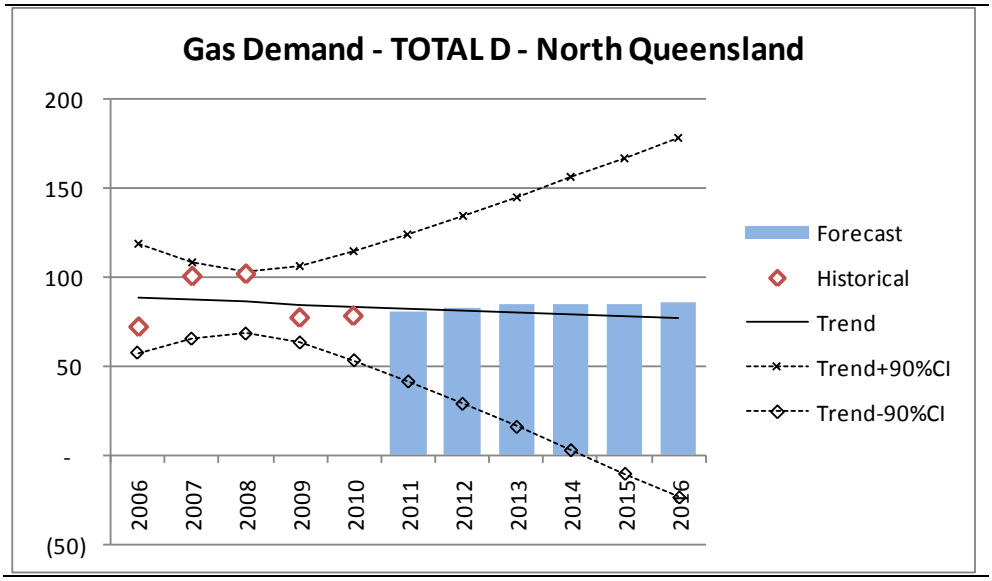


Data source: (NIEIR, 2010b), ACIL Tasman analysis

Tariff D Customer gas demand – North Queensland

Figure 20 shows the forecast gas demand for Tariff D customers in the North Queensland region. The forecast demand is very low – less than 100 TJ/year – and remains more or less in line with historical outcomes for the past two years. As a result, the forecast is close to the historical trend.

Figure 20 **Historical and forecast demand— Tariff D customers, North Queensland**



Data source: (NIEIR, 2010b), ACIL Tasman analysis

5.3.3 MDQ forecasts for Tariff D customers

Relationship between MDQ and gas demand

While it is important to consider the volume forecasts for Tariff D customers, it is the forecasts of Maximum Daily Quantity (MDQ) requirements that are most important for tariff setting. This is because the charges for Demand Customers are calculated on the basis of the system capacity (MDQ) used, rather than the physical quantity of gas delivered.

The relationship between gas demand and MDQ is complex. The ratio of average daily throughput to peak daily throughput (that is, the "load factor") varies widely from customer to customer. MDQ is directly related to peak daily requirements, rather than average daily requirements.

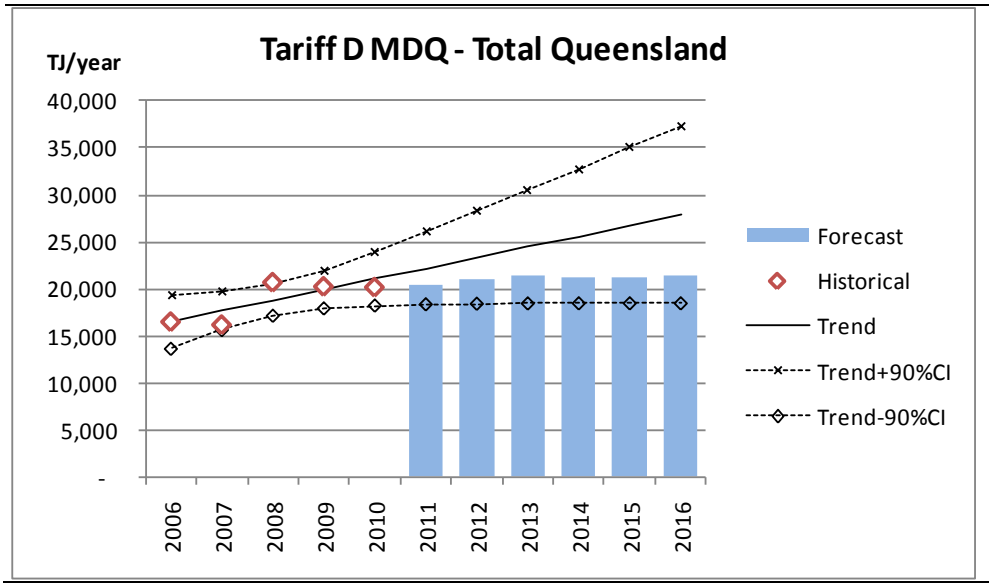
Hence the loss or gain of a demand customer has an impact on aggregate system MDQ requirements that is not necessarily proportional to the corresponding impact on total gas demand. A very low load factor customer such as a peaking electricity generator may have a large MDQ requirement, but may consume only a small quantity of gas over the course of a year.

The impact of changes in MDQ is further complicated by the fact that capacity is not uniform throughout the pipeline network. Hence the cost impact of adding or subtracting a customer with a given MDQ requirement may vary depending on where that requirement is located within the system.

MDQ history and forecast

Historical and forecast MDQ for the total Tariff D customer group is shown in Figure 21. The forecast of MDQ lies slightly above the historical trend, well within the bounds of the 90% confidence interval.

Figure 21 **Tariff D Customer Maximum Daily Quantity (MDQ)—TOTAL**

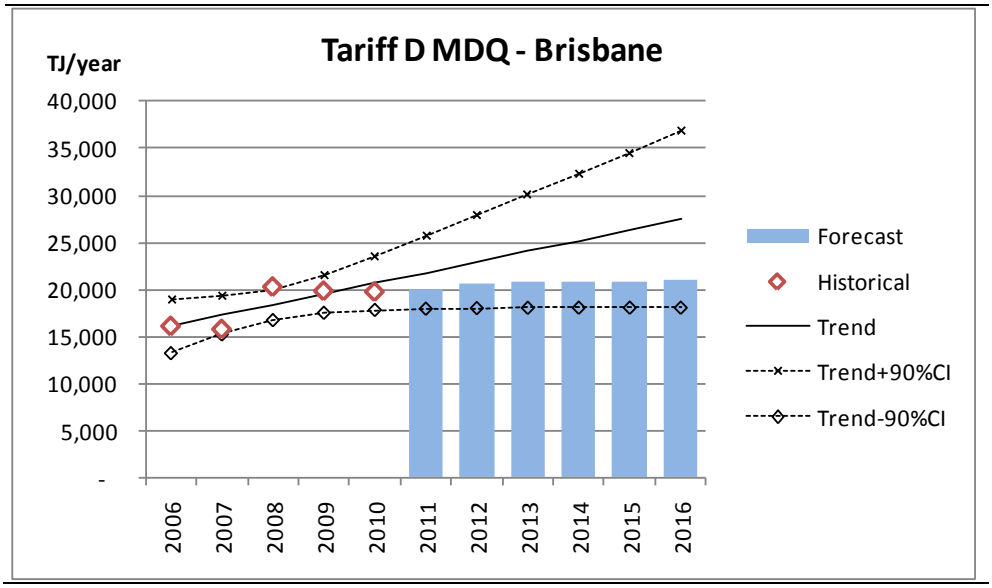


Data source: (NIEIR, 2010b), ACIL Tasman analysis

The historical data and forecasts for Queensland have been broken down into two regions: Brisbane and North Queensland. The corresponding forecasts are illustrated in the following charts.

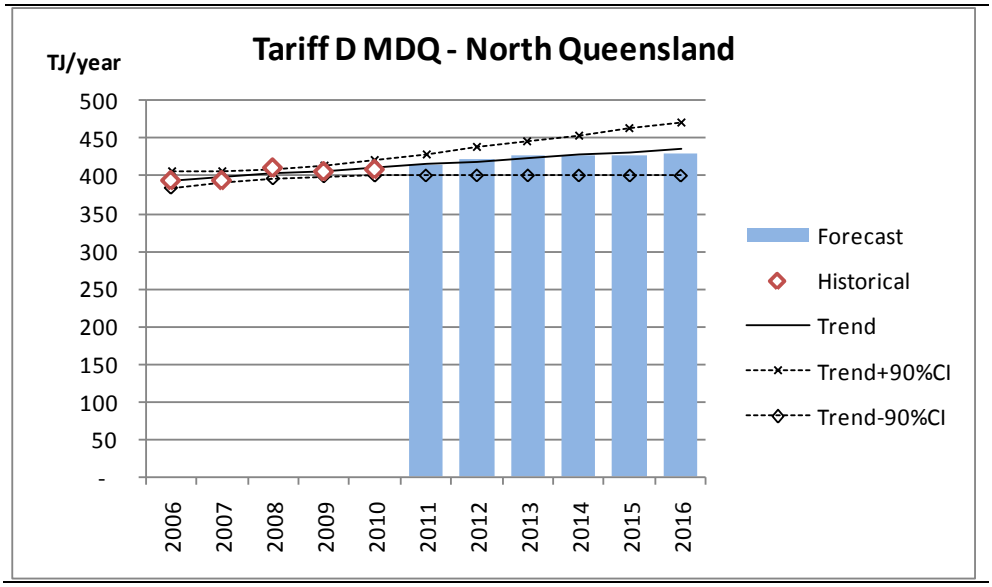
In the Brisbane region, forecast Tariff D MDQ is somewhat below the historical trend, but well within the 90% confidence interval and is consistent with MDQ utilisation over the past three years.

Figure 22 **Tariff D Maximum Daily Quantity (MDQ)—Brisbane**



Data source. (NIEIR, 2010b), ACIL Tasman analysis

Figure 23 **Tariff D Maximum daily Quantity (MDQ)—North Queensland**



Data source. (NIEIR, 2010b), ACIL Tasman analysis

In the North Queensland region, forecast Tariff D MDQ is very close to the historical trend, and again is consistent with MDQ utilisation over the past three years.

In light of the above analysis, ACIL Tasman considers the overall and regional forecasts of Tariff D Customer MDQ to be not unreasonable.

6 Conclusions

The demand forecasts presented by Envestra are based on analysis undertaken by NIEIR as reported in Attachment 13.1 to the access arrangement information (NIEIR, 2010b).

The forecasts in the NIEIR demand report have been prepared using a well-established and widely accepted methodology. In developing the demand forecasts, NIEIR has given consideration to the key drivers affecting future gas demand. Account has been taken of factors that might cause future gas demand growth to follow a different growth trajectory when compared to past experience. While we consider that the overall approach adopted by NIEIR is methodologically sound, the bases for assumptions regarding the quantitative impacts attributed to particular factors are generally not explained. The main risks to the forecast accuracy relate not to the methodology that has been followed, but to the assumptions regarding specific demand drivers and their impacts on demand. In this regard, the critical assumptions adopted by NIEIR include:

- the overall economic growth outlook in Queensland

- the impact of government policies and alternative technologies on gas demand and on average consumption per customer, particularly in the residential sector.

With regard to the economic growth outlook, NIEIR has adopted forecasts that are not inconsistent with recent Queensland Treasury projections and other independent sources.

The NIEIR report identifies a number of energy efficiency measures and policies on gas demand that have the potential to impact on gas demand. However, the bases for assumptions regarding the quantitative impacts attributed to particular policy interventions and other demand drivers are generally not explained.

We consider that the resultant forecasts are for the most part reasonable. The overall forecast rates of growth in customer numbers and gas demand in both the Tariff V and Tariff D sectors are statistically consistent with recent trends and do not appear to be unreasonable.

The most problematic aspect of the forecasts relates to average gas consumption in the residential sector. While the forecast average gas consumption per customer in the Tariff V market as a whole is close to the historical trend, average consumption in the residential sector is projected to fall throughout the forthcoming access arrangement period from 8.9 GJ/year in 2010 to 7.6 GJ/year by 2016.

The forecast average rate of residential consumption falls within the 90% confidence interval around the historical trend and cannot therefore be regarded as statistically inconsistent with recent historical trends. However, the forecast lies close to the lower bound of the 90% confidence interval (based on the numbers provided by NIEIR for years 2006 to 2010) and reflects a much steeper rate of sustained decline in average consumption levels than both the long run (ten year) historical trend and the corresponding forecast by Allgas for the adjacent Brisbane South region. Average residential consumption fell steeply between 2005 and 2007. However, it has since risen and was higher in 2009 than 2007. The recent evidence does not, therefore, point to a strong and sustained downward trend in average consumption. ACIL Tasman agrees that government policies aimed at water conservation and energy efficiency, together with ongoing improvements in gas appliance efficiency and competition from solar and heat pump water heaters are likely to lead to some further reduction in average residential consumption rates. However, we consider it likely that the rate of decline forecast by NIEIR, and reflected in the Envestra access arrangement information, is overstated and have therefore suggested use of the long-term historical trend as an alternative.

Subject to satisfactory resolution of this issue, we consider that the proposals by Envestra in relation to demand forecasts for the Queensland gas network business could be regarded as reasonable.

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A Curriculums Vitae

Following are brief curriculums vitae for the consulting team involved in the preparation of this report

Paul Balfe

Paul Balfe is an Executive Director of ACIL Tasman and has overall responsibility for ACIL Tasman's gas business. Paul has more than 30 years experience in the energy and resources sectors. Previously he held a number of senior executive positions in the Queensland Department of Minerals and Energy. He has a Masters in Business Administration and a degree in Science.

Paul is responsible for the development and commercialisation of ACIL Tasman's *GasMark* model and its application to strategic and policy analysis throughout Australia, New Zealand and in South East Asia. He provides a range of analytical and advisory services to companies, government agencies and industry associations, particularly in the gas, electricity and resources sector. He has expertise in gas, electricity, resources, mining, economic impact analysis and in the analysis of core risk management, safety and health.

He has advised government and corporate sector clients on matters relating to the coal, oil and gas industries, coal seam gas, oil shale, mining safety and health, environmental management and alternative and renewable energies. With qualifications in geology and business administration, his experience ranges across both technical and commercial aspects of project evaluation and development.

Paul has worked extensively on gas industry matters, particularly gas policy reform issues; gas market analysis; gas pipeline developments, acquisitions and disposals; and gas project commercial analysis. He has worked extensively in the Queensland coal seam gas industry as an adviser to both government and corporate sector clients on regulatory, technical, economic and commercial aspects of CSG development.

Owen Kelp

Owen Kelp is a Consultant with ACIL Tasman specialising in electricity and gas markets. Owen has worked extensively on energy industry matters and across a broad range of assignments including upstream conventional and coal seam methane economics; market demand, supply and price forecasting studies; strategic reviews; transmission and distribution networks (project evaluation, throughput forecasts, asset sales and due diligence work); project evaluation (financial modelling, market studies and economic benefits);

regulatory and policy change impact studies. Over the last eight years Owen has managed more than 50 energy industry assignments.

He has extensive modelling capability using various software packages and programming languages as well as practical experience with operations research methods including linear programming and optimisation. He also has a good theoretical knowledge of financial markets and instruments. Owen has been principally responsible for the development and maintenance of a number of ACIL Tasman energy market models, in particular:

GasMark Global – ACIL Tasman's global model for gas trade for both LNG and pipeline gas

GasMark – ACIL Tasman's regional model of the interconnected Australian gas market

GasMark New Zealand – supply demand model for the New Zealand system

PowerMark – detailed model of the National Electricity Market used for price forecasting and asset due diligence

PowerMark WA – detailed model of the Western Australian electricity market.

Owen holds a Bachelor of Business (Economics and Finance) from Queensland University of Technology and a Graduate Diploma of Applied Finance and Investment from the Financial Services Institute of Australasia (FINSIA).

B Establishment of Confidence Intervals around historical trend lines

The following explanation of the construction of confidence intervals is based on information provided in the manual for the Statistica software package.

> The confidence intervals for specific statistics (for example, means or regression lines) provide a range of values around the statistic where the "true" (population) statistic can be expected to be located (with a given level of certainty).
>
> The confidence intervals for the mean give us a range of values around the mean where we expect the "true" (population) mean is located (with a given level of certainty). Confidence intervals can be calculated for any p-level; for example, if the mean in a sample is 23, and the lower and upper limits of the p=.05 confidence interval are 19 and 27 respectively, then we can conclude that there is a 95 per cent probability that the population mean is greater than 19 and lower than 27. If the p-level is reduced to a smaller value, then the interval would become wider thereby increasing the "certainty" of the estimate, and vice versa. The width of the confidence interval depends on the sample size and on the variation of data values. The calculation of confidence intervals is based on the assumption that the variable is normally distributed in the population. This estimate may not be valid if this assumption is not met, unless the sample size is large, say n = 100 or more.

Confidence Intervals (CI's) have the form:

$$Est \pm t_{1-\frac{\alpha}{2},(n-2)} SE_{est}$$

For the CI around the y-estimate in the linear regression equation, the CI is given by:

$$CI = Est_y \pm t_{1-\frac{\alpha}{2},(n-2)} SE_{est}$$

Where $t_{1-\frac{\alpha}{2},(n-2)}$ is the inverse of the Student's t-distribution for confidence level α given that n is the number of data points (so that n-2 is the number of degrees of freedom in the distribution)

and

$$SE_{est} = SE_y \times \sqrt{\frac{1}{n} + \frac{(x_i - \bar{x})^2}{\sum (x_i - \bar{x})^2}}$$