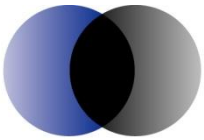
Review of Demand Forecasts for APA GasNet

Victorian Gas Access Arrangement Review for the period 2013 – 2017

Prepared for the Australian Energy Regulator

Final Report – 16 August 2012



ACIL Tasman

Economics Policy Strategy

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1 Introduction

1.1 Background

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 *National Gas Rules* (NGR) to be satisfied that the forecasts used in setting reference tariff(s) are arrived at on a reasonable basis and that they represent the best forecast or estimate possible in the circumstances.

1.2 Scope and Approach

The Australian Energy Regulator (AER) has engaged ACIL Tasman to provide independent advice through written reports on the demand forecasts contained in the access arrangement proposals submitted by the Victorian transmission and distribution businesses to assist it in its decision about whether to approve the access arrangement proposals.

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).

1.2.1 Requirements of the Terms of Reference

The Terms of Reference for the review of demand forecasts are set out in Appendix B. In summary, the Terms of Reference require ACIL Tasman to provide advice on whether the demand forecasts for each business have been arrived at on a reasonable basis and represent the best forecasts for demand in the circumstances.

More specifically, the Terms of Reference require ACIL Tasman to:

1. undertake a desktop review of the demand forecasts
2. formulate questions on areas where further information or clarification is required
3. analyse all material provided and prepare separate reports for each service provider, including recommendations on whether the demand forecasts

have been arrived at on a reasonable basis and represent the best forecasts for demand in the circumstances.

4. provide alternative forecasts if necessary (that is, if the review of the forecasts submitted by the service provider finds that they have not been arrived at on a reasonable basis and do not represent the best forecasts for demand in the circumstances).

1.2.2 Approach to the review

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.

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 a 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.

1.2.3 Data sources

In preparing this review, ACIL Tasman relied on the following data sources:

- The National Gas Rules
- The Access Arrangement Information (AAI) submitted by APA GasNet (APA GasNet, 2012a)
- The Access Arrangement Submission (AAS) submitted by APA GasNet (APA GasNet, 2012b)

- The demand forecast prepared by the National Institute for Economic and Industry Research (NIEIR) on behalf of the Australian Energy Market Operator (AEMO) and presented in the 2011 Gas Statement of Opportunities (AEMO, 2011)
- Various specialist reports as detailed in the Bibliography

1.3 Structure of the report

The remainder of this report is structured as follows:

Chapter 2 sets out the key findings of the report. To the extent that the review takes issue with particular elements of the forecast, it describes the nature of those concerns and recommends action to be taken to address those concerns.

Chapter 3 describes the scope of APA GasNet's operations.

Chapter 4 describes the forecast methodology and assumptions.

In Chapter 5 we consider whether the application of the methodologies and assumptions described in Chapter 4 has produced forecast results for the APA GasNet transmission system that are reasonable in light of historical patterns of demand as well as current and anticipated influences on retail gas demand in the distribution area.

Finally, in Chapter 6, we set out our conclusions regarding the acceptability of the forecasts, and the actions that the AER should require to address identified deficiencies in the forecasts as submitted.

2 Key Findings

2.1 The forecasting approach

The demand forecasts presented by APA GasNet are based on analysis undertaken by the National Institute of Economic and Industry Research (NIEIR) on behalf of the Australian Energy Market Operator (AEMO, 2011).

For the majority of the gas demand, APA GasNet has elected to use the forecasts prepared as part of AEMO's annual planning processes. APA GasNet has supplemented the AEMO forecasts with its own estimates of:

- interstate gas transfers
- storage refill volumes
- annual and peak day volumes associated with gas-fired power generators.

The AEMO demand forecasts were developed by using NIEIR's state and energy industry based projection models. The demand forecasts were prepared taking into account carbon prices in the Treasury Core Policy Scenario, with explicit carbon pricing starting from 1 July 2012.

ACIL Tasman's understanding of the NIEIR forecast methodology is based on the methodological description set out in the 2011 GSOO document, together with information on the methodology used by NIEIR to prepare gas demand forecasts for the next access arrangement period for the Multinet distribution system. According to Multinet, the approach adopted by NIEIR to develop the forecasts for Multinet essentially replicates the approach adopted in preparing the AEMO 2011 forecast (Multinet, 2012, p. 25).

NIEIR's forecasts are prepared using a mixture of model-generated results from a variety of models, data interrogation (that is, analysis of trends and patterns) and non-statistical information such as liaison with industry and government and user questionnaires. NIEIR takes into account estimates of the impacts of various government policies that are likely to affect gas demand.

It is clear, at least at a high level, that NIEIR's approach is comprehensive in terms of the range of factors that it seeks to take into account. Exactly how the various components of the forecast and their interactions have been dealt with; what weight has been given to particular market developments or policy changes in terms of impact on annual and peak demand; and how those weightings have been estimated is not always clear. The methodological explanations provided by NIEIR are typically generalized and "high level", making it difficult to verify the integrity of the modelling approach. However, on the basis of the information set out in the AEMO and the Multinet reports,

together with further explanation provided by NIEIR in response to questions from AER, we conclude that:

- The modelling approach adopted by NIEIR is sound in principle
- There is no obvious "better" approach to the modelling task
- The approach seeks to take into account most factors that might reasonably be expected to exert a significant influence on the demand for gas within residential, commercial and industrial customer groups
- If the influence of each of those factors has been appropriately estimated and the interactions between factors correctly represented, then the resulting forecasts should be reliable and should satisfy the requirements of rule 74 of the NGR that forecasts are arrived at on a reasonable basis and represent the best forecast or estimate possible in the circumstances.

We have reviewed the assumptions made by APA GasNet with regard to modifications to the AEMO/NIEIR forecasts to take account of interstate gas transfers, storage refill volumes and gas for power generation (GPG) and we consider that those assumptions are reasonable.

In particular, APA GasNet's assumptions regarding the level of new GPG in Victoria over the access arrangement period are broadly consistent with ACIL Tasman's current modelling of the National Electricity Market which shows no opportunity for new entrant gas-fired generating plant in Victoria prior to the end of 2017. This conclusion is reinforced by new electricity demand forecasts released by AEMO in June 2012 (AEMO, 2012b). These show significantly lower energy and peak demand in Victoria than previously forecast, further delaying the need for new entrant gas-fired generating plant.

APA GasNet has adjusted the AEMO peak day forecasts to take account of transfers, storage refill and GPG requirements. We consider that the adjustments made are reasonable.

2.2 Assessment of the forecasts

We have reviewed the forecasts themselves in order to test whether the modelling approach yields results that are reasonable, based on examination of historical observations and consideration of changing circumstances that may cause a move away from historical trends.

We conclude that the forecast for total system withdrawals on the VTS is not unreasonable.

We have compared the AEMO forecasts of annual system demand that have been adopted by APA GasNet (after adjustment for fuel and GPG located on the VTS) with the annual gas withdrawals forecast by the four distribution businesses. If the forecasts were perfectly aligned, we would expect the APA

GasNet forecast to exactly equal the sum total of the distribution business forecasts in each year. In fact the revised AEMO forecast is significantly higher than the sum total of the distribution business forecasts. The discrepancies may be explained, at least in part, by direct connection customers that bypass the distribution systems. It may also be that the AEMO forecasts, which have been prepared for system planning and reliability purposes, are inherently more conservative than the distribution business forecasts.

The most recent AEMO/NIEIR forecast show a substantial reduction in demand compared to the previous forecast, particularly in the large customer (Tariff D) sector. This is consistent with a large number of recent and announced plant closures and downsizings in the Victorian manufacturing sector. ACIL Tasman accepts that the numerous industrial plant closures, together with generally depressed conditions in the Victorian manufacturing sector, are likely to lead to losses of Tariff D gas demand and MHQ, with overall system demand showing little growth over the access arrangement period.

The forecast system daily peak demand is generally on historical trend and does not appear to be unreasonable.

3 Scope of APA GasNet operations

3.1 System description

APA GasNet operates the Victorian Declared Transmission System (VTS) which consists of 45 licensed high pressure pipelines and associated facilities supplying the Melbourne metropolitan area, country Victoria and supply to New South Wales and South Australia. The VTS also transports gas across the system and into NSW at Culcairn.

The VTS serves approximately 1.4 million residential consumers and 43,000 industrial and commercial users, with an average annual throughput in excess of 200 PJ per year. Most of the natural gas consumed in Victoria is transported through the VTS. Most gas consumers, however, are not directly connected to the VTS (and are therefore not customers of APA GasNet) but have connection to one of the low pressure gas distribution networks operated by Envestra, Multinet or SP AusNet.

The VTS primarily functions to transport gas from the Esso/BHP Billiton Longford gas treatment plant in south east Victoria (which processes gas from offshore Bass Strait gas fields), the Otway Basin gas fields and underground storage in southwest Victoria, and Bass Gas project facility at Lang Lang. Gas enters and exits the system in the west via the SeaGas connection point and

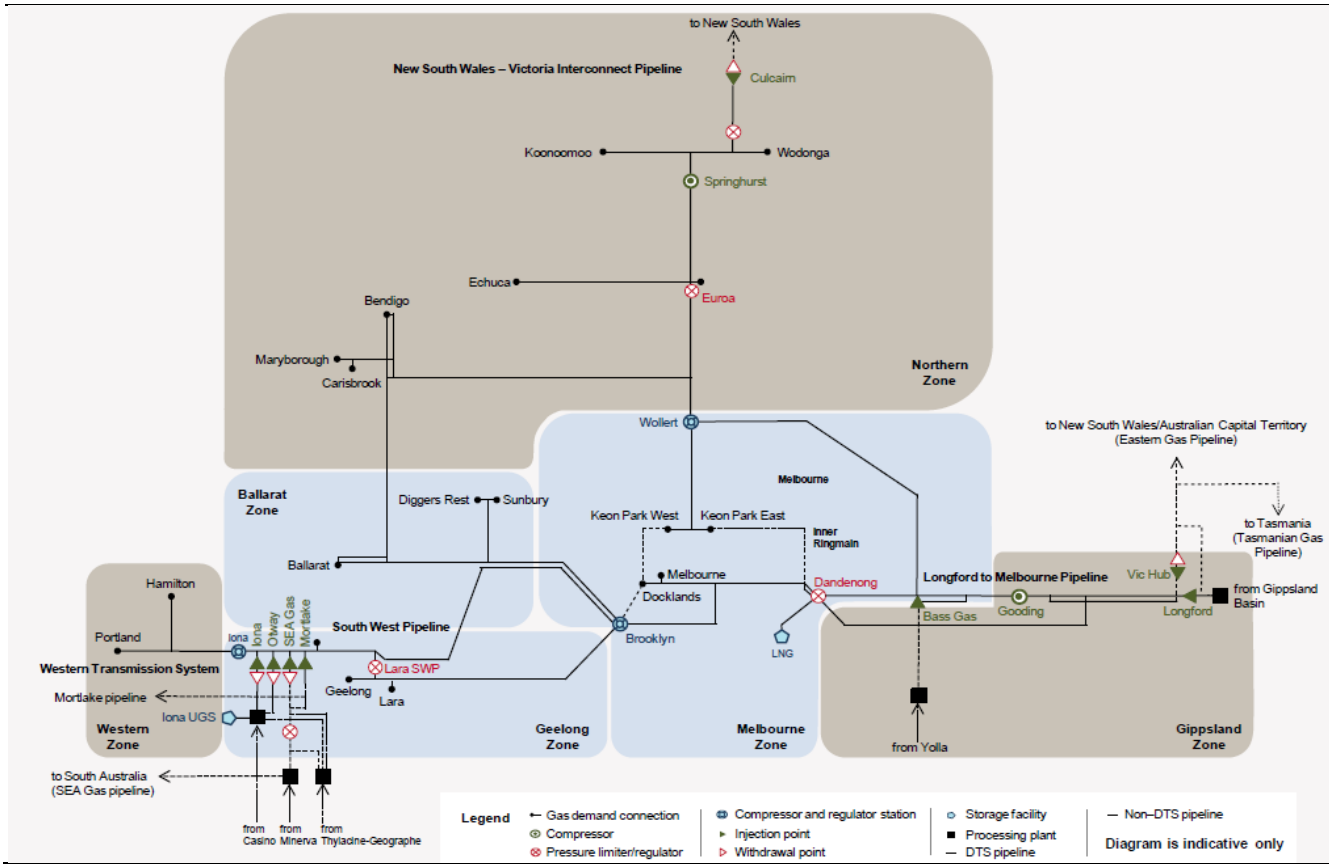
Western Underground Storage (WUGS) facility at Iona, to the north via the APA GasNet Northern Lateral Pipeline at Culcairn and to the East from Longford, VicHub, Bass Gas and the Dandenong LNG Storage Facility.

The VTS has a total length of 1,993 km comprising 45 pipelines of differing lengths, diameters, ages and construction materials. The pipeline is protected by pipeline coating (of various types and quality) and cathodic protection.

Pipeline assemblies include scraper assemblies (pig traps), mainline, isolating and branch valve assemblies. The system also incorporates compressor stations at Gooding, Brooklyn, Iona, Wollert, Euroa and Springhurst.

Figure 1 is a diagrammatic representation of the VTS.

Figure 1 **APA GasNet Victorian Declared Transmission System**



Source: (AEMO, 2011) Figure A1.1

3.2 Services and customers

APA GasNet provides a single Pipeline Service which is also the Reference Service. This is a bundled service called the Tariffed Transmission Service and comprises the transportation of gas in accordance with the *National Gas Rules* for a declared transmission system. This service is provided to the Australian

Energy Market Operator (AEMO) who is the only User of the pipeline under the *National Gas Law* definition.

This legal arrangement arises from the Market Carriage Model set out in the *National Gas Law and Rules*. Under these arrangements, AEMO operates the VTS.

Shippers (registered Market Participants of the Victorian Declared Wholesale Gas Market) access the Reference Service through AEMO in accordance with the *National Gas Law and Rules*. The only relationship between APA GasNet and Shippers is through the Transmission Payment Deed, key terms of which make up part of the access arrangement (Schedule F). APA GasNet does not provide any service directly to Shippers on the pipeline.

3.3 Historical customer numbers and gas demand

Because most gas consumers in Victoria connect to a low pressure distribution system rather than the high pressure system, the VTS has only a small number of customers (all serviced via AEMO as the sole User). These are either gas retailers (who purchase transport services on both transmission and distribution systems in order to be able to transport gas to their retail customers) or large industrial consumers and electricity generators that connect directly to the high pressure pipeline system. Historical customer numbers over the current access arrangement period are set out in Table 1.

Table 1 **APA GasNet—historical customer numbers**

Calendar Year	2008	2009	2010	2011	2012 (F)
Total customers	14	16	20	21	21

Data source: (APA GasNet, 2012a, p. 6)

Pipeline minimum, maximum and average demand figures over the earlier access arrangement period are set out in Table 2 below. These figures are based on actual demand for calendar years 2008 to 2011, and forecast demand for calendar year 2012.

Table 2 **APA GasNet—minimum, average and maximum demand (TJ/d) for the current access arrangement period**

Year ended 30 June	2008	2009	2010	2011	2012 (F)
Minimum	306	273	294	264	275
Average	675	645	648	651	655
Maximum	1,259	1,213	1,224	1,190	1,290

Data source: (APA GasNet, 2012a, p. 5)

4 Forecast methodology and assumptions

Under Rule 72 of the *National Gas Rules*, the Access Arrangement Information document accompanying an access arrangement must include to the extent practicable a forecast of pipeline capacity and utilisation. The APA GasNet Access Arrangement Revision Proposal Submission notes that:

> "As the VTS is a market carriage pipeline and operates as a meshed network with multiple injection points feeding a hub and spoke system, capacity is an ill-defined concept. The tariff calculations are based on annual and peak volumes, not capacity. APA GasNet can provide capacity and utilisation of individual pipelines within the system as defined under the National Gas Bulletin Board. The forecasts provided are those relevant to the tariff calculations." (APA GasNet, 2012b, p. 59)

For the majority of the gas demand, APA GasNet has elected to use the forecasts prepared as part of AEMO's annual planning processes. AEMO is required to prepare annual forecasts of gas demand and supply capabilities, each forecast covering a five year period. The AEMO planning documents (Victorian Annual Planning Report, Gas Statement of Opportunities) provide forecasts of general demand (that is, for the residential, industrial and commercial markets) and demand for gas-fired power generators. APA GasNet's Access Arrangement Submission indicates that it used the 2011 Gas Statement of Opportunities (2011 GSOO) for the majority of its forecast. However APA GasNet subsequently advised AER, in a response to a question regarding reconciliation of the 2011 GSOO forecasts with the access arrangement forecasts, that the forecast used by APA GasNet was not consistent with the AEMO 2011 GSOO Attachment but that instead the forecast reflected the AEMO Annual Planning Report from June 2011. This was the latest forecast available when tariff modelling for the access arrangement revision proposal began.

APA GasNet subsequently provided the AER with and updated version of the tariff model and all of the relevant tables, incorporating the latest available AEMO forecast. The analysis of the forecasts presented in this report reflects the updated modelling.

The AEMO forecasts do not address all gas flows through the VTS. For example, AEMO does not forecast gas flows from the VTS into connecting pipeline systems nor gas flows required to refill the storage facilities connected to the VTS (that is, the Iona UGS underground storage facility and the Dandenong LNG peak shaving facility). The AEMO forecasts include an allowance for system use gas required to fuel compressors and heaters in the system. APA GasNet provides its own forecast of Gas-fired Power Generation

(GPG) demand rather than use the AEMO forecast, for reasons explained below.

APA GasNet has therefore supplemented the AEMO forecasts with its own estimates of:

- interstate gas transfers
- storage refill volumes
- annual and peak day volumes associated with gas-fired power generators.

In order to evaluate the APA GasNet forecasts it is therefore necessary to consider the AEMO forecasts and the supplementary adjustments made by APA GasNet.

4.1 The AEMO forecasts

The National Gas Rules require that by 30 November each year, AEMO publishes a planning review covering the VTS. That review must assess the supply–demand outlook and the adequacy of gas system capacity, and provide additional information about maintenance plans, gas reserves, and gas pipeline developments. The Victorian Annual Planning Review satisfies those requirements, but with two exceptions. The latest gas demand and supply-capability forecasts, and information about liquefied natural gas (LNG) usage for the following winter period are delayed until actual VTS operational data from the most recent winter becomes available. In 2011 this information was published in the following two documents:

- 2011 GSOO, including Attachment A entitled Victorian Gas VTS Medium Term Outlook
- Victorian Gas System Adequacy for 2012, a document which is published only on the internet.

Only the first of these documents is relevant to the access arrangement period 2013 to 2017. Attachment A1 of the 2011 GSOO presents low, medium and high economic growth scenario forecasts for demand on the Victorian Declared Transmission System over the period to 2021.

4.1.1 Basis of the AEMO forecast

The AEMO demand forecasts are developed by the National Institute of Economic and Industry Research (NIEIR) using NIEIR's state and energy industry based projection models. The following summarises the methodology used for the latest forecasts, as described by AEMO (AEMO, 2011).

The gas demand forecasts were prepared for high, medium and low economic growth scenarios in conjunction with carbon prices in the core policy scenario modelled by Treasury in September 2011 (Treasury, 2011).

The economic forecasts were largely based on economic forecasts from KPMG prepared for AEMO in August 2011 (KPMG, 2011).

Forecasts were prepared for the overall VTS and for each System Withdrawal Zone (SWZ) for the following aspects of demand:

- annual system demand
- annual demand for GPG
- peak day system demand
- peak hour system demand.

The demand forecasts in Attachment A1 of the 2011 GSOO cover gas demand on the VTS only.

The forecasts of gas demand for GPG cover VTS-connected gas powered generators only. They exclude Victorian gas powered generators that are outside the VTS.

The forecasts incorporate an analysis of winter gas demand data up to 31 August 2011.

The demand forecasts were prepared based on carbon prices in the Treasury Core Policy Scenario, with explicit carbon pricing starting from 1 July 2012. These carbon price estimates were published by the Australian Treasury in September 2011 (Treasury, 2011).

Forecasting annual system demand

The annual system demand forecasts were generated from econometric models using key forecast economic inputs including:

- Victorian gross state product
- state industry output projections, and
- projections of state population, dwelling stocks, real household disposable income, gas and electricity prices and consumer price index.

Other factors taken into account when preparing the forecasts include:

- a survey of major industrial users on planned expansions or reductions including gas cogeneration
- market information obtained from media reports
- federal and state government energy policies, and

- standard weather conditions determined in accordance with the methodology set out in Attachment 2 of the 2009 Victorian Annual Planning Report Update (AEMO, 2009)

The econometric models generate annual demand forecasts for the industrial, commercial, and residential sectors, and for each major industry group as defined by the Australian and New Zealand Industry Classifications (ANZSIC). The forecasts were adjusted with demand variation information from the major gas customer survey and market information, and estimates of the impact of policies that might influence gas demand.

The annual system demand forecast by SWZ was generated by analysing historical Tariff D demand by industry sector and historical Tariff V demand to determine heating and non-heating loads in each SWZ.

Forecasting peak day system demand

The peak day system demand forecast was determined by applying load factors (defined as the ratio of average daily demand to peak daily demand) to the average daily demand, derived from the annual demand forecasts. Peak day forecasts were calculated for Tariff D and V separately. These forecasts were then added together to provide the VTS peak day system demand forecast.

Forecasting peak hour system demand

Historical data shows that winter peak day hourly demand peaks at around 8:00am and again at around 6:00pm, driven primarily by residential demand. This pattern is repeated across all SWZ.

The peak hour system demand forecasts for each SWZ were produced by applying the proportion of gas used in the peak hour on a selection of high demand days in the previous winter to the peak day forecasts. The growth rates were assumed to be the same as for the peak day forecasts.

Peak hour system demand forecasts were prepared for 1-in-2 and 1-in-20 peak day weather standards.

Industrial gas customer survey

In May 2011, NIEIR undertook a survey of 190 Victorian industrial and commercial gas customers. The survey sought information from the users regarding their recent and future gas demand in order to assess gas demand trends.

Of the 190 customers surveyed, 99 responded, including 14 of the top 20 gas consumers. The whole survey group consumed approximately 70 PJ of gas in

2010. The responding customers accounted for 71% of total gas consumption in the Tariff D segment in 2010.

Many survey respondents expressed some uncertainty regarding their responses. In developing the forecasts for Tariff D demand, NIEIR evaluated the 2011 survey information against the 2010 responses, other economic information, and publicly available information.

The survey found that:

- A number of industrial consumers intended to close or downsize by the end of 2012, leading to a decrease in demand in 2011 and 2012.
- Gas demand would increase in 2013 due to the operation of some cogeneration plants.

4.1.2 Analysis of NIEIR's modelling methodology

The approach adopted by NIEIR in developing the forecasts set out in the 2011 GSOO appears to be broadly consistent with common practice in developing gas demand forecasts: use appropriately weather-corrected historical data to establish relationships between gas demand and key economic measures that influence demand; adjust the forecasts to take account of new policy measures; incorporate known or anticipated changes affecting large (usually industrial) user demand.

NIEIR has considerable experience in preparing energy demand forecasts. However, in itself, the fact that NIEIR has this experience does not confirm that the forecasts represent best estimates arrived at on a reasonable basis (as required under the National Gas Rules). The description of the methodology used by NIEIR that is set out in the 2011 GSOO is too generalised to allow us to form a view whether the forecasts meet the requirements of the National Gas Rules.

In the course of providing advice to the AER on demand forecasts for the current Victorian Gas Access Arrangement Review, ACIL Tasman has reviewed the gas demand forecasts for the Multinet distribution system which were also prepared by NIEIR. According to Multinet, the approach adopted by NIEIR to develop the forecasts for Multinet essentially replicates the approach adopted in preparing the AEMO 2011 forecast (Multinet, 2012, p. 25). Therefore, the understanding of the NIEIR modelling methodology that ACIL Tasman has developed in the course of our detailed review of the Multinet demand forecasts should be applicable to the AEMO 2011 forecast relied on by APA GasNet. The following comments are based on ACIL Tasman's understanding of the NIEIR methodology gained principally through our review of the Multinet forecasts.

NIEIR's forecasts are prepared using a mixture of model-generated results from a variety of models, data interrogation (that is, analysis of trends and patterns) and non-statistical information such as liaison with industry and government and user questionnaires.

NIEIR forecasts gas demand for three classes of customers, namely:

1. Tariff D customers
2. Tariff V business customers (Small to medium enterprises)
3. Tariff V residential customers

Each of these three customer classes are treated differently in the forecasting approach.

Forecasting gas demand by large customers

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

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

Gas consumption forecasts for Tariff D were based on econometric models which link Victorian gas consumption by industry to real output growth by industry, real natural gas prices and weather conditions. The Tariff D forecasts were also partly determined by the results of a survey of major Tariff D customers.

Gas demand for embedded electricity generators is treated independently, with the forecasts adjusted (increased) to account for the anticipated demand of known new generators.

Small to medium enterprises (Tariff V Business)

Most businesses supplied NIEIR with four to five years of billing information for Tariff V customers. This information was disaggregated into residential class and business class.

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

NIEIR takes into account assumptions regarding changes in real gas price over time.

Residential customers

Broadly speaking, NIEIR's forecasts for residential customer usage are based on estimates of the average consumption per household and the projected number of households to be supplied. The average consumption estimates are disaggregated into existing customers and new connections.

Forecasts based on these two market segments are then adjusted to account for government policies that can be expected to impact on gas demand.

Weather normalisation

The need to take account of the impact of weather on gas demand has been noted, for example, by the Australian Energy Market Operator (AEMO) who in commenting on the Victorian gas distribution system noted that:

> "Understanding the factors that affect the consumption of gas is central in evaluating future energy demands. When temperatures are lower than normal, energy demand for residential heating increases. This strong relationship between gas demand and climate highlights the need to identify the weather conditions assumed when calculating forecast demand. In gas forecasts, the actual demand needs to be adjusted for weather before the underlying growth can be calculated. These weather adjustments can be simplified through the use of Effective Degree Day (EDD) variable." (AEMO, 2009, p. 55)

There are two basic approaches commonly used to adjust temperature data to take account of weather variations: Heating Degree Days (HDD) and Effective Degree Days (EDD).

The HDD approach uses a single measure of weather, namely temperature. HDD is calculated from meteorological data as the sum, over a year, of the negative differences[1] between the average temperature on each day and 18° Celsius.

The EDD approach preferred by AEMO is a composite index method based on the concept of Heating Degree Days (HDD) but also taking into account measures of average wind velocity, sunshine hours and seasonal variations in consumer propensity to use heating. The EDD approach in effect seeks to extend the HDD method by taking into account other weather-related

[1] If the average temperature on a particular day is greater than or equal to 18°C, then HDD for that day is zero.

parameters that may affect consumer behaviour in relation to gas consumption for space heating and water heating.

NIEIR's measure of weather for these purposes is EDD. However, NIEIR also takes account of Summer Degree Days (SDD) as well as EDD, at least in some of its forecasts of demand by residential customers. SDD is the sum of the daily differences between 'temperature' and a threshold. In calculating SDD, temperature is the mean of the daily maximum and minimum. The threshold is 18°C.

The rationale for using SDD in the model is that hot weather in summer can affect the level of gas demand. For instance, less gas is used for water heating in the warmer months.

NIEIR's SDD coefficients are negative and small (relative to the coefficients on EDD), implying that demand for gas is lower in warmer conditions. This is consistent with a declining use of gas for water heating in summer.

There are also dummy variables in NIEIR's model for weekend days (separately) which have negative coefficients, implying that, all else being equal, gas demand is lower on the weekend than during the week. This suggests that the weather analysis is based on combined residential and commercial data.

NIEIR takes the above regression results and a trend analysis of weather conditions to calculate the impact of warming. In doing this assumes that, in future, EDD will continue to decline at the historical rate of around 7.7 EDD each year and that SDD will increase at around 3.8 EDD each year.

ACIL Tasman analysed EDD data supplied by AEMO and found that between 1977 and 2010, EDD in Victoria declined at a rate of 7.75 EDD per year and that SDD over the same period increased by 3.83 SDD per year.

On this basis, we consider that NIEIR's assumptions regarding rate of EDD decline and SDD increase are consistent with historical trends.

APA GasNet approach to weather normalisation

APA GasNet's Access Arrangement Information shows at Table 4.4 that the forecast standard weather and sensitivity to changes in weather for the pipeline over the access arrangement period are assumed to be 1,309 EDD and 44.7 TJ/EDD respectively *for each year in the forecast period 2013 to 2017* (APA GasNet, 2012a, p. 16).

Adopting a constant EDD standard of 1,309 for the entire forecast period appears anomalous, given that it is well established that EDD has been declining at a rate of 7.7 EDD/year since the 1970s. On this basis, the trended EDD value of 1,309 in 2012 will have declined to around 1,270 in 2017.

Asked to comment on the basis for this assumption, APA GasNet advised (APA GasNet, 2012c) that it uses the AEMO forecasts for the base load which includes all of the weather dependent load, and that the forecast EDD is based on the AEMO Victorian EDD 2012 Weather Standards Review (AEMO, 2012b). AEMO states in that review (page 20, dot point 5) that it is using the 2012 value of 1,309 EDD/year *for the whole of the planning period*:

> "... the annual and peak day EDD standards for 2012 will be used for all of the five years in the planning period from 2012-2016. For system capacity planning, it has been AEMO's practice to use fixed peak day EDD standards. The use of a fixed peak day EDD standard for all the years in the planning period has the advantage of producing peak day forecasts standardised to consistent forecast weather conditions so that assessing the underlying growth in peak day demand due to other factors is clearer"

On this basis, APA GasNet's assumption of fixed EDD and weather sensitivity standards for each year of the access arrangement period is considered reasonable.

Price elasticity of demand

NIEIR has made assumptions regarding the price of gas over the forecast period. In the Multinet analysis NIEIR assumed that the delivered price of gas for a typical residential user would increase from $17.20 per GJ in 2012/13 to $18.90 per GJ in 2016/17.

In addition to gas price increases, ACIL Tasman expects that the price of electricity will also increase over the regulatory period as higher gas prices push up the cost of gas-fired generation. Higher electricity prices may also influence gas demand over the regulatory period through cross-price elasticity effects (for example, influencing consumer choices between gas and reverse cycle air conditioning for space heating).

Each of the relationships can be described using an elasticity. The price effect is summarised using the 'own price elasticity of demand for gas'. The substitution effect is summarised using the 'cross price elasticity of demand for gas'.[2]

The **own price elasticity of demand**, (commonly 'price elasticity') describes the relationship between the price of a good and the quantity of it that will be demanded. Being an elasticity it is expressed in percentage terms. For example a price elasticity of -1 suggests that for a one per cent increase (decrease) in price the quantity demanded will decrease (increase) by one per cent.

[2] The own price elasticity of demand is relevant to the estimated impact of the carbon price as well as to the impact of rising gas prices generally.

The price elasticity of demand is an important input into the forecasting process. Given the price increases forecast for the coming regulatory period, an overly high elasticity estimate would lead to gas demand forecasts being understated. NIEIR's assumptions regarding price elasticity for the AEMO forecasts are not stated. For the Multinet forecasts NIEIR assumed a price elasticity of demand for gas of -0.28. NIEIR has expressed the view that the assumption made for the Multinet forecast is conservative and that "*given the current environment of rising electricity and other fuel prices, it is quite possible that the elasticity could be double -0.28, or -0.56.*"[3] All else being equal, such an outcome would reduce gas consumption over the forthcoming access arrangement period below the levels forecast by NIEIR.

The value of -0.28 is also generally consistent with the AER's recent decision regarding Envestra's access arrangement in South Australia.

The **cross price elasticity of demand** summarises the relationship between the price of one good and the quantity demanded of another. In this case, the cross price elasticity of interest summarises the relationship between the price of electricity and the quantity of gas demanded.

Given that electricity and gas can be used similarly it would be reasonable to expect that they are substitutes (with a positive cross price elasticity of demand). The need to change appliances to allow substitution to occur suggests that the cross price elasticity of demand may become larger as it is measured over a longer time frame.

We understand that for the Multinet forecasts, NIEIR assumed that the cross price elasticity of demand between electricity and gas is zero. NIEIR has noted that in the short to medium term, appliance stocks are mainly fixed for existing customers, and that for new customers the average usage figures for new dwellings already include the implicit substitution of electricity for gas in small townhouses and multi unit dwellings. NIEIR also notes that business customers implicitly incorporate changes in price relativities with the inclusion of cogeneration assumptions from the survey.

Policy factors affecting the forecasts

Section A1.2 of the AEMO Forecast identifies eight policy measures implemented by the Victorian and Commonwealth Governments that will potentially impact demand for gas during the coming regulatory period:

- The Clean Energy Future (carbon pricing) plan – potentially affects all users

[3] NIEIR "Natural gas forecasts and customer number forecasts for the Multinet distribution region to 2021", p.68

- Energy Efficiency Opportunities Regulations – applies to large energy users only
- Minimum Energy Performance Standards – relevant mainly to residential and commercial consumers
- Mandatory Disclosure (*Energy Efficiency Disclosure Act 2010*) – relevant to residential and commercial consumers on sale or lease
- Federal Insulation Program – discontinued 2010 but has ongoing impact on demand for gas for space heating
- Renewable Energy Target – relevant mainly to residential and commercial consumers through switching to solar hot water
- Victorian Energy Efficiency Target (VEET) Phase Two – limited impact on gas demand
- 6-star building standards – relevant mainly to residential and commercial consumers with significant savings in gas space heating.

Multinet's forecasts were prepared by NIEIR with reference to a very similar list of policy measures though not all were quantified.

NIEIR's forecasts for Multinet are based on a price projection that, in turn, includes the impact that **carbon price** is expected to have on gas prices. This, together with its assumption regarding the own price elasticity of demand for gas quantifies the impact of the carbon tax on gas demand.

The **Renewable Energy Target** could be expected to influence demand for gas in two ways:

1. by providing an increased incentive to consumers to use solar water heaters, thus reducing demand for gas for water heating
2. by increasing the price of electricity, making gas less expensive and thus increasing gas demand (relative to a case in which there electricity prices remain constant). In practice, the extent and sign of this cross-elasticity effect will depend on relative price movements between gas and electricity.

NIEIR's forecasts for Multinet take account of the first of these effects but not the second. NIEIR's report to Multinet contains a statement to the effect that the Renewable Energy Target will have a "significant impact" on gas demand due to the "switch to gas boosted solar hot water in Victoria."[4]

NIEIR has informed ACIL Tasman that it was mindful of the additionality issue with solar hot water noting that RET (MRET) has been operating for a number of years now, and should be captured in the average usage for new customers. Also the 5 star standard introduced in July 2005, which mandated either a solar hot water system or a greywater plumbing system in new

[4] Multinet AAI, p199

dwellings caused a switch to gas boosted solar hot water in Victoria which is already accounted for in new customers usage. NIEIR has not allowed for any increase in solar hot water in existing dwellings, as there is limited data available; conversion from gas to solar in some existing dwellings would be expected to lower demand.

The **Energy Efficiency Opportunities** (EEO) Program requires large energy users to review their operations and identify potential energy saving projects. NIEIR considers that most of the impact of EEO is already accounted for in its models (through the industry based forecasts and through survey analysis).

Minimum Energy Performance Standards (MEPS) are an element of the broader National Framework on Energy Efficiency. In summary, MEPS prevents certain products from being sold in Australia unless they satisfy specific energy efficiency requirements. In the Multinet forecasts, NIEIR took the impact of MEPS for hot water heaters into account through its hot water model. It also took account of the possibility that MEPS would be introduced for gas space heaters and cookers, which are currently only required to carry an energy efficiency label.

Based on a response to a question from AER to Multinet, we understand that NIEIR's forecasts of residential gas demand were reduced by 0.19 GJ per household per year for new homes and 0.07 GJ per household per year for existing households to account for the MEPS for hot water heaters. These estimates were informed by the Regulatory Impact Statement for gas hot water heaters (Syneca Consulting, 2009). The savings for existing households are based on an average 10 GJ usage, with a ten percent improvement, discounted by the assumed asset life of 14 years. For new dwellings, the gradual phase in of MEPS reduces gas use in hot water by 2 percent per year. NIEIR has not factored in the additional shift to solar hot water, or the increase in penetration of energy efficient shower heads, both of which might be expected to further reduce average household gas demand.

In July 2009 COAG agreed to the **National Strategy on Energy Efficiency** (NSEE). Its objective was to accelerate energy efficiency improvements and deliver cost-effective energy efficiency gains across all sectors of the Australian economy. The likely impact of NSEE on gas demand is ambiguous because some measures under development would potentially reduce gas demand, while others would increase it through fuel switching (from electricity) in an attempt to reduce greenhouse gas emissions. In addition, at least some of the measures under development through NSEE were under development through the National Framework for Energy Efficiency (NFEE) before NSEE. In many cases it is unclear when, or whether, changes will actually occur.

In these circumstances ACIL Tasman considers it reasonable that NIEIR made no changes to the forecasts to account for NSEE.

One of the energy efficiency measures contemplated under NSEE (and previously under NFEE) is the **mandatory disclosure of energy performance of residential buildings**. The proposal is that owners of existing houses, flats and apartments would be required to provide energy, water and greenhouse performance information when they sell or lease their properties. The rationale is that this information would allow buyers and renters to make a better comparison between alternative properties. This policy measure is still in the development stage.

Mandatory disclosure of the energy performance of commercial buildings has been in place in Victoria since 2010. The impact of that program has not yet been reviewed, which makes it difficult to estimate its impact in future. In its report to Multinet, NIEIR points to a number of comments made by representatives of the commercial property industry to the effect that significant effort is currently underway to improve the energy performance of commercial buildings. We understand that this has been occurring for some time so, to some extent, it will be reflected in the historical data. For forecasting purposes the challenge is to identify the extent to which gas demand can be expected to diverge from the historical trend as a result of the ongoing improvement of energy efficiency of commercial buildings.

Our understanding is that the NIEIR forecasts were prepared on the assumption that mandatory disclosure of energy performance of residential and commercial buildings would not have an effect on gas consumption during the forthcoming regulatory period.

The **6-star building policy** is expected to see a significant reduction in gas demand in the residential sector. In 2009, the Council of Australian Governments (COAG) requested the Australian Building Codes Board to modify the Building Code of Australia (BCA) to require that all new homes and major renovations achieve a six-star energy efficiency rating (or equivalent). The necessary changes were included in BCA 2010 and subsequently enacted in State and Territory legislation[5].

In deciding to implement the 6-star energy efficiency requirement, COAG had regard to a Regulation Impact Statement (RIS) prepared by the Centre for

[5] The Victorian Government was reported to have reconsidered that commitment in early 2012 as part of a drive to reduce red-tape. However, in mid April 2012, the Premier of Victoria reaffirmed his Government's commitment to the mandatory 6-star energy efficiency rating.

International Economics (CIE).[6] In that RIS, CIE estimated that the introduction of the 6-star energy efficiency requirement would cause new Victorian houses to use approximately 6.5 GJ less gas than they would if the energy efficiency requirement remained at 5-star.

The demand forecasts produced by NIEIR for Multinet assume that from 2013 new homes will use 3.83 GJ/year less gas (on average) than they would use if the 6-star building standards had not been introduced. This is based on discounting the claimed gas savings from the 6-star standard by 50 percent to allow for rebound effects and non-compliance, and also took into account the apparent actual savings from 5-star scheme which was introduced in Victoria in 2005.

The **Victorian Energy Efficiency Target** (VEET) is a 'white certificate' scheme. Energy retailers, both electricity and gas, are required to acquit a certain number of Victorian Energy Efficiency Certificates (VEECs) each year. VEET commenced on 1 January 2009 with an annual target of 2.7 Mt CO_2-e to be abated each year until 2011. Commencing in 2012 the VEET Target was doubled to 5.4 Mt CO_2-e per annum.

In its report to Multinet, NIEIR notes that the majority (80 per cent) of VEECs created in 2009 were created by replacing incandescent lighting with compact fluorescent lamps and almost all of the remainder (16 per cent of the total) were created by activities associated with solar hot water. Further, NIEIR notes that the number of VEECs created by activities that would reduce gas use was about 20 per cent higher than the number created by activities that would increase gas use. Based on the Phase 1 of VEET activities, NIEIR estimates that VEET will reduce Victorian gas demand by 0.2 PJ per annum to 2014 (allowing for 30 per cent 'rebound, additionality, attribution and compliance').

4.1.3 Conclusions regarding the overall forecasting methodology

NIEIR methodology for the AEMO forecasts

NIEIR's methodology for forecasting gas demand in Victoria has been developed over more than a decade, and has been progressively elaborated in an attempt to take into account the many factors that influence gas demand in the various customer sectors. The forecasts prepared for AEMO and included in the GSOO reports are subject to detailed scrutiny by industry stakeholders.

It is clear, at least at a high level, that NIEIR's approach is comprehensive in terms of the range of factors that it seeks to take into account. Exactly how the

[6] CIE prepared the demand forecasts for SP AusNet.

various components of the forecast and their interactions have been dealt with; what weight has been given to particular market developments or policy changes in terms of impact on annual and peak demand; and how those weightings have been estimated is not always clear. The methodological explanations provided by NIEIR are typically generalized and "high level", making it difficult to verify the integrity of the modelling approach. However, on the basis of the information set out in the AEMO and Multinet reports, together with further explanation provided by NIEIR in response to questions from the AER, we can conclude that:

- The modelling approach adopted by NIEIR is sound in principle
- There is no obvious "better" approach to the modelling task
- The approach seeks to take into account most factors that might reasonably be expected to exert a significant influence on the demand for gas within residential, commercial and industrial customer groups
- If the influence of each of those factors has been appropriately estimated and the interactions between factors correctly represented, then the resulting forecasts should be reliable and should satisfy the requirements of rule 74 of the NGR that forecasts are arrived at on a reasonable basis and represent the best forecast or estimate possible in the circumstances.

4.1.4 APA GasNet adjustments to the AEMO forecasts

APA GasNet has supplemented the AEMO (NIEIR) forecasts with its own estimates of:

- interstate gas transfers
- storage refill volumes
- annual and peak day volumes associated with gas-fired power generators.

Interstate gas transfers

Historically, gas has been transferred from the VTS into other pipelines at Culcairn, VicHub and at the Iona and SEAGas interconnection points.

Transfers at VicHub have increased during the earlier access arrangement period from 0.1 PJ/year in 2008 to 2.4 PJ in 2011. APA GasNet attributes this increase to changes in operation of the VicHub connection point and opportunistic purchase of gas for transmission to Tasmania from the Victorian wholesale gas market. APA GasNet projects indicative volumes of 2.0 PJ/year going forward. **In light of recent history, ACIL Tasman considers this is a reasonable assumption.**

Transfers at the SEAGas interconnection point have generally been increasing over the earlier access arrangement period to 4.2 PJ/year in 2011. APA GasNet is not able to explain this increase, but notes that it has occurred as

production from the Minerva gas field has been declining. APA GasNet is forecasting no flows from the VTS through the SEA Gas connection point during the access arrangement period. APA GasNet acknowledges that this forecast may not eventuate but also notes that any gas flows that do occur at this connection point will be captured in the price control calculations and will be reflected in tariff rates from 2014 onwards. **ACIL Tasman does not have access to any other information that would allow a more reliable forecast of transfers at the SEAGas interconnection point.**

APA GasNet is unable to differentiate gas flows leaving the VTS at the Iona connection point between those being injected into the underground storage facility and those shipped to the SEA Gas pipeline. In accordance with prior ACCC decisions, all gas withdrawn from the VTS at the Iona connection point is designated as refill gas and is excluded from the standard tariff calculations.

APA GasNet notes that Culcairn transfers from the VTS to NSW increased from 4.5 PJ/year over the period 2008 to 2010 to 9.0 PJ/year in 2011. However, APA GasNet does not expect the level of transfers observed in 2011 to be maintained, because it considers that the 2011 outcome was due to "some one-off factors related to the increased use of the Uranquinty gas powered electricity generator as a result of electricity generation constraints arising from the Queensland floods and, later in the year, an accident at the Eraring plant" in NSW. APA GasNet notes that the winter transfer capacity on the Victoria – NSW Interconnector has increased from about 10 TJ/day to 28 TJ/day with the commissioning of Stage 1 of the Northern Expansion project. This capacity will further increase to about 38 TJ/day with the completion of Stage 2 (Euroa compressor station) in winter 2012. Outside the winter period, the completion of Stage 2 will allow transfer volumes up to about 83 TJ/day.

The Northern Expansion project proposed for the access arrangement period, consisting of partial looping of the Wollert to Barnawartha Pipeline will add a further 43TJ/day capacity for transfers to NSW at Culcairn throughout the year. In the access arrangement period, APA GasNet forecasts additional transfers to NSW at Culcairn of 45TJ/ day giving a total of 62 TJ/day.

APA GasNet has projected a transfer volume of 8.0 PJ for 2013 and 2014 and 17.0 PJ/annum from 2015 onwards, being the available transfer capacity flowing at a 55 per cent load factor.[7] Peak day flow at Culcairn is projected to be 17 TJ/d in 2013 and 2014, rising to 62 TJ/d from 2015.

[7] Note that on page 62, paragraph 3, of APA's access arrangement submission (APA GasNet, 2012b) it is stated that the "APA GasNet has projected a transfer volume of 6.5 PJ for 2013 and 2014 and 15.5 PJ/annum from 2015 onwards, being the available transfer capacity flowing at a 55 per cent load factor". APA GasNet has confirmed that this statement is

ACIL Tasman does not have access to any other information that would allow a more reliable forecast of transfers or peak day flows at Culcairn.

Storage refill volumes

There are two gas storage facilities connected to the VTS: the Western Underground Storage facility at Port Campbell (WUGS)—also known as the Iona Underground Storage Facility—and the Dandenong LNG Storage facility.

APA GasNet notes that the WUGS facility has a capacity of approximately 15 PJ, but that the connection point from the VTS to WUGS also services the SEA Gas Pipeline. APA GasNet has no means of differentiating between gas flows to either of these facilities. Flows through the Iona connection point, into storage or en route to the SEA Gas pipeline, reached a high of 18.3 PJ/a in 2004, but declined dramatically to 0.9 PJ/a in 2006. They have subsequently risen again to 8.6 PJ in 2011.

APA GasNet notes that the fluctuations are due to both seasonal variations in the use of storage gas resulting from warmer or colder weather in Victoria, and production variations in the Otway Basin gas fields. The latter have two effects on Iona withdrawals:

- more or less gas is withdrawn at Iona to supply South Australia via SEA Gas
- more or less gas from local gas fields is available to refill storage replacing gas withdrawn from the VTS at Iona.

Although it was originally expected that the storage could be filled with gas taken directly from the adjacent offshore fields with only minimal refill volumes taken from the VTS, this has not eventuated and it appears that most of the local gas supplies are otherwise committed. APA GasNet is therefore projecting volumes of 7.0 PJ/a for refill of the underground storage facility at Port Campbell.

The Dandenong LNG facility now services two demands, peak shaving and transport fuel. APA GasNet notes that there have been changes in the commercial and operating arrangements for the LNG facility, as a result of which operational gas flows through the LNG facility are expected to reduce from historical levels of about 1.5 PJ/a to much lower levels of about 0.2 PJ/a by the beginning of the access arrangement period. This reduction is due to changed operational procedures resulting from the recent APA Facilities Management agreement. Refill of the LNG facility for peak shaving is usually between 0.1 and 0.3 PJ/annum depending on peak winter days. Use of the

incorrect and that the correct projection of transfer volumes at Culcairn is as set out in Table 5.9 of the same document.

facility for heavy transport fuel is increasing and reached 0.5 PJ/annum in 2011. Aggregating these forecasted amounts, APA GasNet is projecting LNG refill of 1.0 PJ/a going forward.

ACIL Tasman does not have access to any other information that would allow more reliable forecasts of gas storage refill volumes at WUGS and LNG.

Annual and peak day volumes associated with gas-fired power generators

The AEMO forecast of GPG demand over the access arrangement period set out in the 2011 GSOO envisaged a significant increase in that demand especially in the last two years of the period (2016, 2017).

APA GasNet points out that the earlier AEMO forecast (in the 2011 Victorian Annual Planning Review) was based on an out-of-date carbon price path that has been superseded by the arrangements under the Clean Energy Futures (CEF) legislation. The carbon price values underpinning AEMO's GPG forecasts are significantly higher than the CEF legislation, under which Treasury modelling forecasts the carbon price will be $24.60 per tonne CO_2-e in 2016 and $25.60 in 2017 ($2010). This compares to values of approximately $40/t CO_2-e in this same period used in the AEMO modelling.

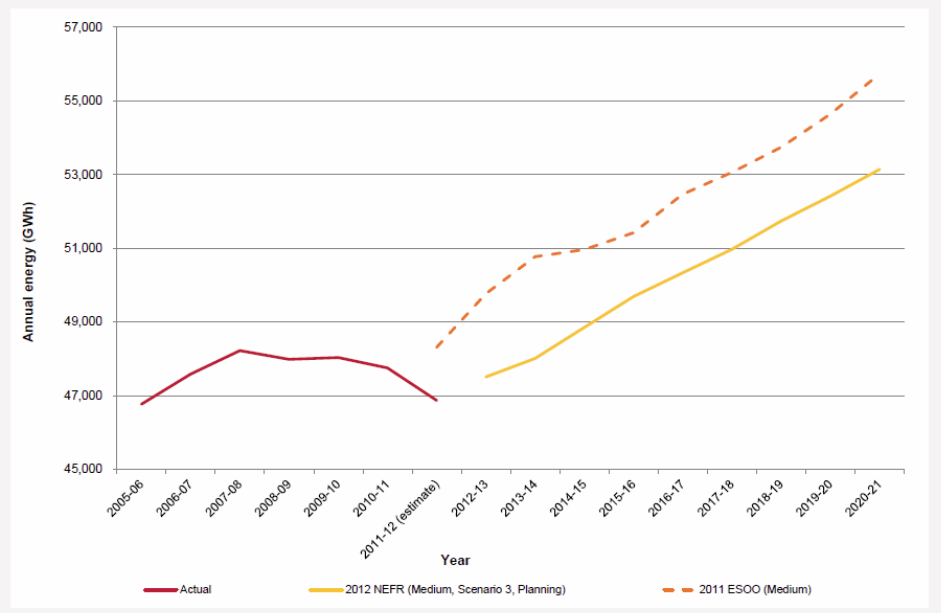
APA GasNet notes that Treasury modelling in the 'Strong Growth Low Pollution' paper (Treasury, 2011) issued in September 2011, using a carbon price consistent with the CEF package, shows that new base-load gas-fired generation in Victoria is not expected to arise during the access arrangement period.

APA GasNet therefore proposes to use a GPG demand forecast that is based on the AEMO mid-range forecast for 2012 with an annual growth in demand of 0.5 PJ/a in 2015 to 2017.

This is broadly consistent with ACIL Tasman's current modelling of the National Electricity Market which shows no opportunity for new entrant gas-fired generating plant in Victoria prior to the end of 2017. The modelling by ACIL Taman takes into account recent downgrades in forecast NEM electricity demand (energy and peak) issued by AEMO in June 2012 (AEMO, 2012b). These forecasts reflect strong uptake of renewable energy, and in particular the impact of small-scale renewables which have grown rapidly as a result of generous feed-in-tariff arrangements. Figure 2 is a reproduction of an AEMO chart which compares the forecast for Victorian electricity demand in the 2011 Electricity Statement of Opportunities (ESOO) the with the corresponding forecast in the 2012 National Electricity Forecasting Report (NEFR). The new AEMO energy forecast is about 2,000

GWh or 4 per cent lower than the previous forecast. AEMO's forecast of summer peak demand (50% POE) for Victoria has dropped around 9%, from 11,500 MW to 10,500 MW (AEMO, 2012b, page 8-11).

Figure 2 **Comparison of AEMO Victorian electricity demand forecasts, 2011 ESOO vs 2012 NEFR**



Source: (AEMO, 2012b)

The ACIL Tasman electricity market modelling assumes a carbon price that settles midway between the Treasury "Core Policy Scenario (Treasury, 2011) and the InterContinental Exchange (ICE) forward curve for Certified Emissions Reductions (CER) traded within Europe as part of the European carbon cap and trade arrangements (which can be used to meet liabilities under the CEF). The modelling also takes into account expected retirements of some brown coal-fired generating capacity in the Latrobe Valley under "contract for closure" arrangements. However this does not result in any new gas-fired CCGT plant entering the system until after the end of the 2013 to 2017 access arrangement period.

4.1.5 Peak Day forecasts

The tariff calculations for the VTS are based on actual flows, both annual and system peak day. The calculations based on peak day flow utilise the system peak flow (not the peak flows for each individual component of the system). AEMO provided a forecast of the 1:2 winter peak day for the general market in the 2011 Annual Planning Review. This forecast excludes transfers and refill.

APA GasNet has therefore adjusted the AEMO peak day forecasts to take account of transfers, storage refill and GPG requirements.

For the interstate markets, APA GasNet is assuming peak day transfers of 6 TJ/day at VicHub and 17 TJ/day rising to 62 TJ/day at Culcairn.

Storages are not expected to be filled on the peak day.

With respect to gas-fired power generation, APA GasNet notes that there is wide variation in the observed peak day, particularly given that the relevant peak day volume is coincident with the total system peak day. Based on historical analysis and previous statements from AEMO, APA GasNet is projecting a peak day contribution of 50 TJ/day from gas-fired power generation.

4.1.6 Supply volume forecasts

The APA GasNet tariff model also requires a forecast of gas injection volumes at each of the five injection points on the VTS. This information is required in order to determine flow paths and to allocate costs to the tariff withdrawal zones.

APA GasNet points out that there is no independent source of information that provides injection volume forecasts, and that gas supply is a competitive process whereby retailers and gas producers compete with each other to supply the demand for gas. In these circumstances, APA GasNet has derived the gas injection forecasts from a combination of historical data, known developments in the producing fields, and from the necessity to balance supply and demand each year.

Key elements of the APA GasNet supply volume forecasts are as follows:

- Injection volumes at Longford will grow from around 810 to 825 TJ/day over the access arrangement period.
- Port Campbell injections are projected to grow from 46.5 PJ/a to 64.2 PJ/a over the access arrangement period, with peak supply rising from 353 TJ/day to 398 TJ/day. On the peak day, the injection volume from Port Campbell is calculated as the balancing item after deducting the forecast peak day volumes from all other injection sources.
- The Yolla gas field in Bass Strait is projected to supply base load gas volumes of 14 PJ/a and a peak of 55 TJ/day (70 per cent load factor), in line with experience in recent years.
- Supply of gas from NSW at Culcairn are projected to be steady at 1 PJ/a, with a peak of 60 TJ/day (based on the fact that APA GasNet has AMDQ Credit Certificate contracts in place at Culcairn for 60 TJ/day).

- Supply of gas from the Dandenong LNG facility are projected to be steady at 0.3 PJ/a (slightly higher than historical averages), with a peak of 30 TJ/day.

4.1.7 Forecast user numbers

User numbers on the VTS are related to registration with AEMO to operate in the Victorian wholesale gas market. In the absence of other information, APA GasNet has assumed that the number of users of the VTS will remain constant over the access arrangement period. We consider this to be a reasonable assumption.

4.1.8 Forecast capacity and utilisation

Capacities of individual pipelines within the VTS vary depending on the direction of flow (toward Melbourne or away from Melbourne) and with the time of year. The forecast capacities for the main pipelines are based on current installed facilities plus known enhancements, including:

- Commissioning of a compressor station at Stonehaven in 2015, which will increase the capacity of the South West Pipeline from 353 TJ/day to 408 TJ/day in 2015 for flow toward Melbourne, and from 61 TJ/day to 190 TJ/day in 2015 for flow away from Melbourne.
- The Northern Expansion project which will increase the export capacity at Culcairn from 2015 to 81 TJ/day in winter and up to 126 TJ/day in summer.

Utilisation of the main pipelines is expected to increase over the access arrangement period largely because of the increased gas flows from the main injection zones at Longford and Port Campbell to Culcairn.

5 Assessment of the forecasts

In this chapter we review the forecasts themselves in order to test whether the modelling approach yields results that appear reasonable.

5.1 Use of trend extrapolation for forecast verification

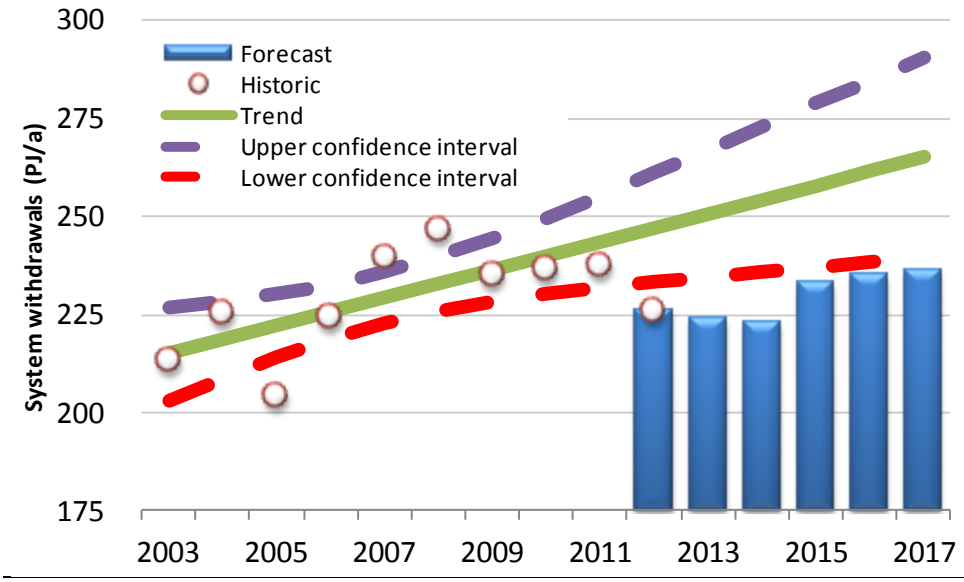
In the following analysis we have used historical trend analysis as a cross-check on the results generated using the AEMO/NIEIR forecasts, modified by APA GasNet to take account of transfers, storage refill and GPG demand. ACIL Tasman recognises that forecasting on the basis of extrapolation of historical 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 may prompt us to ask whether there are good reasons for the break in trend.

Note that the scale of the Y axis in the following charts has been chosen to allow the relationships between forecasts, historical trends and confidence intervals to be seen clearly. This has the effect of exaggerating the apparent extent of deviations from historical trends, when in fact the changes may be much less pronounced when viewed in absolute terms. Care should therefore be exercised in interpreting the charts.

5.2 Annual withdrawal forecasts

The forecast of annual withdrawals (including system gas, GPG, transfers and storage refill) is summarised and compared with raw (that is, not weather adjusted) historical withdrawal quantities in Figure 3.

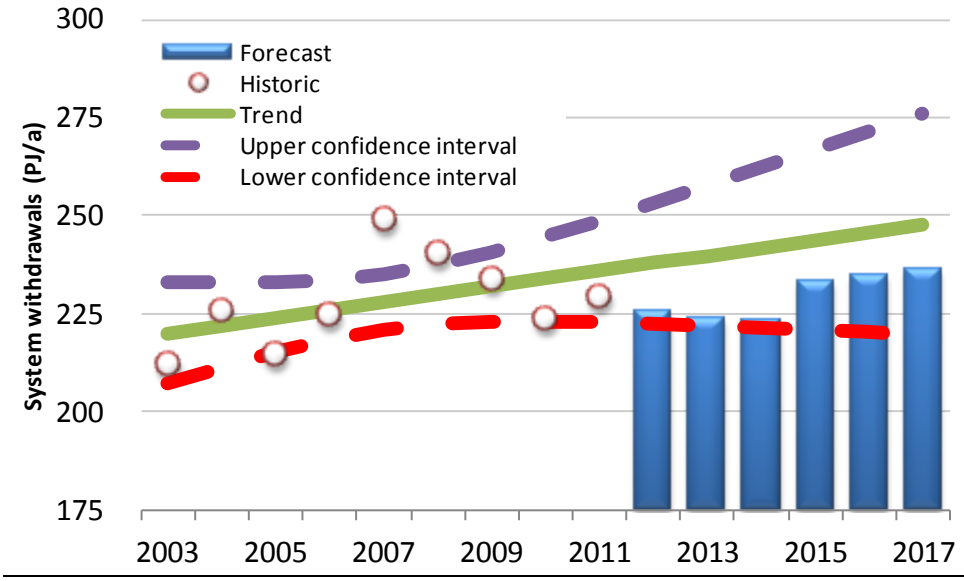
Figure 3 **Raw historical and forecast system withdrawals from the Victorian Transmission System**



Data source: Data source: (APA GasNet, 2012b); ACIL Tasman analysis

Figure 4 compares the weather adjusted historical withdrawal data with the forecast. ACIL Tasman has adjusted the raw historical data by assuming that aggregate demand on the APA GasNet system varies by 44.7TJ as for each EDD difference from "standard weather" (APA GasNet, 2012b, p. 51).

Figure 4 **Weather adjusted historical and forecast system withdrawals from the Victorian Transmission System**



Data source:(APA GasNet, 2012b); ACIL Tasman analysis

We make the following observations:

- The very high withdrawal volume in 2007 is anomalous, having been driven by drought conditions that resulted in abnormally high dispatch of Victorian gas-fired power stations. This situation persisted to a lesser degree in 2008.
  - In the absence of these abnormally high withdrawal years, the growth trend would be weaker and the range between the upper and lower confidence intervals narrower.
- The relatively low withdrawal forecasts in 2012, 2013 and 2014 are consistent with relatively weak demand expectations in the large industrial (Tariff D) sector over this period, including known plant closures, revealed in the Large Customer Survey.

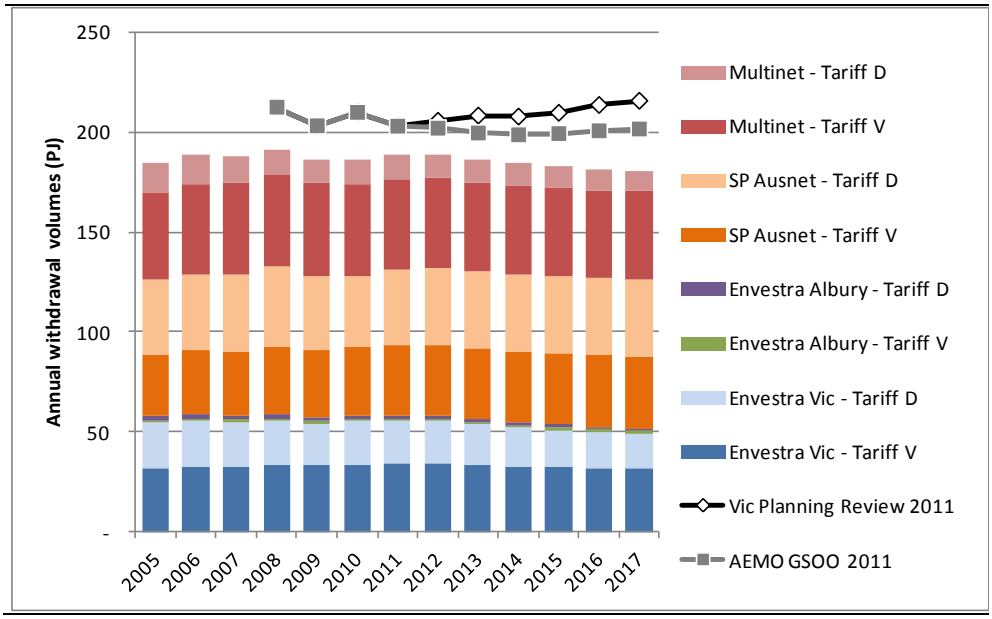
On this basis we consider that the forecasts for total system withdrawals on the VTS are not unreasonable.

5.3 Comparison with distribution business aggregate forecasts

The AEMO forecasts of system demand used by APA GasNet include gas used for compressor and system heating fuel, but exclude withdrawals for GPG and LNG storage and for export (at the Eastern Gas Pipeline, SEAGas / Iona, Lang Lang and Bass Gas. Distribution losses are implicitly included in the forecasts and transmission losses are negligible and are assumed to be zero. The resultant forecasts therefore represent forecasts of the annual gas withdrawals for the four distribution businesses, plus any gas used by industrial customers that are connected directly to the VTS. If the forecasts were perfectly aligned, we would expect the APA GasNet forecast to exactly equal the sum total of the distribution business forecasts in each year, except for gas used by industrial customers connected directly to the VTS.

Figure 5 compares APA GasNet's forecast of system demand based on the AEMO forecasts with the Envestra, Multinet and SP Ausnet forecasts of demand by tariff class.

Figure 5 **Comparison of APA GasNet and distribution business annual gas withdrawal forecasts**



Data sources: (APA GasNet, 2012b), (AEMO, 2011), (Envestra, 2012), (Multinet, 2012), (SP AusNet, 2012)

Two APA GasNet/AEMO forecast lines are shown. The black line with white diamond markers represents the AEMO forecast (excluding fuel and GPG) as reported by APA GasNet in Tables 5.1 and 5.9 of the access arrangement revision proposal submission (APA GasNet, 2012b). As APA GasNet has explained (APA GasNet Response to Information Request No.2 - Part 1. Confidential Response, 18 May 2012) this forecast was based on the AEMO forecasts set out in the 2011 Victorian Annual Planning Review which in turn drew on the demand forecasts set out in the 2010 VAPR Update released in November 2010. These forecasts were subsequently updated in the 2011 GSOO. The grey line with grey square markers represents the AEMO forecast based on the 2011 GSOO. APA GasNet has used this forecast in the revised version of its tariff model provided to the AER in July 2012.

As noted in the 2011 GSOO (AEMO, 2011, pp. A1-16), for the medium economic growth scenario cumulative demand over the period 2011 to 2020 is now forecast to be lower compared with the earlier forecast:

- for Tariff D, the new forecast is 11% lower
- for Tariff V, the new forecast is 2% lower
- for total system demand, the new forecast is 6% lower.

The substantial reduction in Tariff D forecast reflects manufacturing plant downsizing and closures identified in the Large Customer Survey and review of recent public announcements.

NIEIR's report for Multinet (NIEIR, 2011, p. 35) identifies a long list of recent and anticipated plant closures and downsizings in the Victorian manufacturing sector:

- South Pacific Types cease manufacturing at Somerton (2008)
- Huntsman Chemicals plant closures at West Footscray (2009–2010)
- Alcoa reduced production at Portland from 2009
- Amcor paper Alpington closure (end 2012)
- Austral Brick Cragieburn and Summerhill plant closures (2011)
- Bluescope Steel Western Port Hot Strip Mill closure (announced August 2011)
- CSR Viridian Dandenong & Ingleburn glass plant closure (announced September 2011)
- Coca-Cola Amatil SPC Ardmona food processing plant closure at Mooroopna (announced August 2011)
- Heinz food processing plant at Girgarre closure (announced January 2012)

ACIL Tasman accepts that the numerous industrial plant closures, together with generally depressed conditions in the Victorian manufacturing sector, are likely to lead to losses of Tariff D gas demand and MHQ, with overall system demand showing little growth over the access arrangement period.

In total, the revised forecast for non-GPG, non-export demand is some 8.7 PJ/a lower in 2013 and 14.1 PJ lower by 2017 when compared to the 2011 VAPR forecast

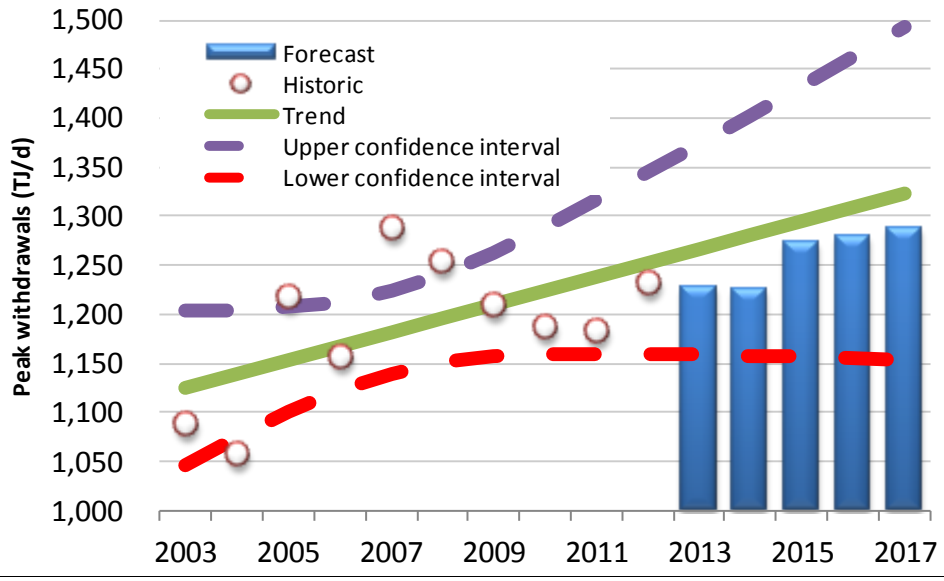
The revised forecast is 13.1 PJ higher than the sum total of the distribution business forecasts in 2013, rising to 20.9 PJ higher by 2017. The discrepancies may be explained, at least in part, by direct connection customers that bypass the distribution systems. ACIL Tasman does not have access to data on quantities of gas (if any) used by industrial customers that are connected directly to the VTS and has made no adjustment for such users. However, the fact that the historical data for the period 2008 to 2011 shows a similar "gap" between the APA/GasNet data and the aggregated demand for the distribution networks suggests that the difference is attributable to gas demand that bypasses the distribution networks but is not taken into account in the adjustments for exports, storage and gas for power generation.

5.4 Peak demand forecasts

Figure 6 shows historical and forecast peak demand on the VTS. This historical data has not been weather adjusted. Historical observations prior to 2008 are derived from VENCorp daily system withdrawal data and therefore include all contributions to peak system demand, including GPG and transfers.

This data is compared with historical total system peak demand data (2008 to 2012) set out in Table 5.1 of APA GasNet's access arrangement revision proposal submission (APA GasNet, 2012b) and forecast data (2013 to 2017) set out in the revised tariff model provided by APA GasNet to the AER in July 2012.

Figure 6 **Historical and forecast peak daily demand on the Declared Transmission System**



Data source: AEMO/VENCorp

As shown, there is considerable variation in the observed historical peak demand. This is presumably a function of fluctuations in peak demand associated with GPG (evident particularly in the high GPG demand years 2007 and 2008) as well as weather effects. As a result, the 90% confidence interval around the trend projection is broad. Nevertheless, the forecast system daily peak demand is generally close to historical trend. The step up in 2015 relates to the assumed increase in peak transfers into NSW via Culcairn, consistent with planned capacity expansion on the Interconnector. On this basis the peak demand forecast does not appear to be unreasonable.

6 Conclusions

The demand forecasts presented by APA GasNet are based on analysis undertaken by the National Institute of Economic and Industry Research (NIEIR) on behalf of the Australian Energy Market Operator (AEMO, 2011) as part of AEMO's annual planning processes.

The forecasting approach used by NIEIR is sound in principle; there is no obvious "better" approach to the modelling task.

We consider that NIEIR's forecasting approach takes into consideration most factors that might reasonably be expected to exert a significant influence on the demand for gas within residential, commercial and industrial customer groups. If the influence of each of those factors has been appropriately estimated and the interactions between factors correctly represented, then the resulting forecasts should be reliable and should satisfy the requirements of rule 74 of the NGR that forecasts are arrived at on a reasonable basis and represent the best forecast or estimate possible in the circumstances.

We have reviewed the assumptions made by APA GasNet with regard to modifications to the AEMO/NIEIR forecasts to take account of interstate gas transfers, storage refill volumes and gas for power generation (GPG) and we consider that those assumptions are reasonable.

In particular, APA GasNet's assumptions regarding the level of new gas for power generation (GPG) in Victoria are generally consistent with ACIL Tasman's current modelling of the National Electricity Market which shows no opportunity for new entrant gas-fired generating plant in Victoria prior to the end of 2017. This conclusion is reinforced by new electricity demand forecasts released by AEMO in June 2012 (AEMO, 2012b) which show significantly lower energy and peak demand in Victoria than previously forecast, further delaying the need for new entrant gas-fired generating plant.

APA GasNet has adjusted the AEMO peak day forecasts to take account of transfers, storage refill and GPG requirements. We consider that the adjustments made are reasonable.

The forecast for total system withdrawals on the VTS appears to be reasonable, taking into account the numerous industrial plant closures in recent times as well as the generally depressed conditions in the Victorian manufacturing sector. We accept that these factors are likely to lead to losses of Tariff D gas demand and MHQ, with overall system demand showing little growth over the access arrangement period.

The forecast system daily peak demand is generally on historical trend and does not appear to be unreasonable.

Finally we note that the revised AEMO forecast is significantly higher than the sum total of the distribution business forecasts (by between 6% and 8%). The discrepancies may be explained, at least in part, by direct connection customers that bypass the distribution systems.

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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.

Joel Etchells

Joel Etchells is a Consultant in ACIL Tasman's Brisbane office. Prior to joining ACIL Tasman Joel was employed by the Federal Treasury as a member of the International and Model Development Unit, within the Macroeconomic Modelling Division. In this role he was required to produce and analyse economic modelling results, including results from a variety of models. Joel used CGE models to forecast the impact of alternative climate change mitigation policies on the Australian economy and its major trading partners.

This involved examining the broad macroeconomic impacts of proposed polices, through to sector specific analysis within a CGE framework.

Since joining ACIL Tasman, Joel has used CGE modelling techniques to analyse the economic impact of variety of infrastructure/capital investments and economic policies; ranging from large natural resource development projects, through to an analysis of the impact of geospatial information for the Tasmanian economy. This work involved formulating and subsequently simulating economic shocks associated with a particular scenario as well as the qualitative analysis of the model output. He has also worked on gas access regulation in Victoria.

Joel has an Honours degree in economics from the University of Queensland and is currently completing a Bachelor of Applied Mathematics at the Queensland University of Technology. His honours year encompassed 12 months of postgraduate coursework and research with a major in econometrics, equipping him with the requisite skills to undertake a wide range of economic analysis.

Jeremy Tustin

Jeremy Tustin is a senior consultant in ACIL Tasman's Melbourne office. He has a degree in Economics from the University of Adelaide. His background is in economic regulation, in particular in the energy and water sectors, and competition and consumer protection.

Jeremy's energy background includes significant experience in greenhouse and renewable policy. He represented South Australia on the National Emissions Trading Taskforce, which was the joint taskforce of Australian States and Territories that was first to propose a cap and trade emissions trading system for Australia. In this area, Jeremy and his team developed and interpreted models of the impact an emissions trading scheme would have on South Australia and in developing a mechanism for offsets. Jeremy was also closely involved with the development of South Australia's solar feed-in law.

In relation to energy efficiency, Jeremy developed a reporting methodology for the South Australian Government's target to improve the energy efficiency of its buildings. He also coordinated interdepartmental activity in relation to that target, developed strategies to achieve it and prepared public reports on progress.

In his role with the Department of Treasury and Finance (SA), Jeremy advised the Treasurer on water policy, both rural and urban. He worked with the Office for Water Security to prepare Water for Good, South Australia's water security plan. In particular, Jeremy worked on the early stages of the design of

the future economic regulatory regime for the South Australian urban water sector. This included the decision to assign the regulator's role to the Commission. He also worked on a cost benefit analysis of a number of possible means of meeting South Australia's urban water demand.

Jeremy recently conducted (with others) the following projects:

- A review of the electricity sales, customer numbers and maximum demand forecasts submitted by the five Victorian electricity distribution businesses to the AER for the upcoming regulatory period (2011 to 2016).
- A review of the demand forecasts submitted to the Essential Services Commission of South Australia by SA Water
- A review of certain principles underpinning the Essential Services Commission of South Australia's upcoming determination of the standing contract price for gas in South Australia

Dr Leo Yanes

Leo Yanes is a Senior Consultant in ACIL Tasman's Brisbane Office. Dr Yanes has a strong background in quantitative economics, with an emphasis on econometrics, planning, valuation (discounted cash flows, cost-benefit analysis), quantitative risk analysis (Monte Carlo simulation, real options), and general equilibrium analysis.

Dr Yanes' modelling expertise encompasses supply chain modelling (including consolidated valuation using discounted cash flows, tax modelling and quantitative risk analysis), partial and general equilibrium models, input-output analysis and cost-benefit analysis.

Dr Yanes' regulatory and policy experience includes the following economic impact studies:

- Oil & gas sector expansion in Venezuela (PDVSA, Venezuela, 1994-1997)
- Santos GLNG project (Santos/Petronas/Total/KoGas, QLD, 2008)
- Australia-Pacific LNG project (Origin/ConocoPhillips, QLD, 2009)
- Impact to 2070 of the educational aspects of the National Reform Agenda, encompassing early childhood, schools and tertiary (Department of Education, Employment and Workplace Relations, ACT, 2010)

Dr Yanes has several years of econometrics training, most of it received at the London School of Economics (U.K.), were he completed the M.Sc. and Ph.D. in economics. His econometrics expertise includes non-parametric methods (Data Envelopment Analysis or D.E.A.), time series, cross-section and panel data studies, using classical econometrics. His experience in this field includes:

- Forecasting private mining exploration expenditure and mining production for NSW to 2025. These forecasts were based on time series and dynamic

panel data econometrics, and required forecasting the Reserve Bank of Australia's Commodity Price Index (for the NSW Geological Survey, 2010)

- A time series (co-integration) analysis of oil sector linkages in Venezuela, spanning 1950-1995 (for PDVSA, the National oil company of Venezuela, 1995)
- Forecasts for the Eastern Australia gas market to 2100. These forecasts were based on market growth projections (for Santos, 2009)

Dr Yanes' commercial/business planning experience includes project appraisal using discounted cash flow and long and short-run forecasting. He has built cash flow models for various oil & gas projects at Santos and PDVSA (the Venezuelan national oil company). Among these, Dr Yanes contributed to the construction of an integrated supply chain model for the Santos GLNG project, which encompasses all aspects of the production process, from a module forecasting gas and water flows through to LNG delivery.

As a lecturer at the School of Economics, University of Queensland (2002-2008), Dr Yanes taught and carried out research in industrial economics (monopoly, oligopoly & antitrust), mathematical economics, game theory, international trade, economic growth and firm structure. His research concentrated on analysing the impact of oligopolies on economic growth and international trade (in dynamic general equilibrium).

B Terms of Reference

The AER is seeking independent advice through written reports on the demand forecasts contained in the access arrangement proposals submitted by the Victorian transmission and distribution businesses to assist it in its decision about whether to approve the access arrangement proposals.

The consultant will be required to provide advice on whether the demand forecasts for each business have been arrived at on a reasonable basis and represent the best forecast for demand in the circumstances.

The review will require the consultant to undertake the following:

(i) a desktop review of demand forecasts and any relevant materials contained in the access arrangement proposals submitted by service providers

(ii) formulate a series of detailed questions on areas where it is considered that further information or clarification is required from the service providers to substantiate the demand forecasts

(iii) analyse all material provided and prepare separate reports for each service provider containing a list of issues identified from the review, and recommendations on whether the demand forecasts for each service provider have been arrived at on a reasonable basis and represent the best forecast for demand in the circumstances.

(iv) provide alternative forecasts of demand for the service providers if the consultant finds that the proposed demand forecasts have not been arrived on a reasonable basis and do not represent the best forecast for demand in the circumstances.

If requested by the AER the consultant will also:

(v) provide further advice on the revised access arrangement proposals from service providers scheduled to be submitted after the release of the AER's draft decisions.

The AER's decisions are subject to merits review by the Australian Competition Tribunal and judicial review by the Federal Court. The consultant's analysis and reports must be produced to a standard that is commensurate with scrutiny at that level. The consultant must describe in its written report the qualitative and/or quantitative methodologies applied in any calculation or formulae, the input values used or assumed, the rationale for any substituted values used or assumptions made and the conclusions reached in sufficient detail to support the AER in meeting its obligations under the relevant clauses of Part 9 of the NGR.

In addition to the draft and final reports, the consultant must provide supporting spreadsheets and analysis to ensure the AER can meet the requirements set out in Rules 59 and 62 of the NGR for the making and publication of decisions.

The consultant will be required to liaise with service providers and AER staff during the course of the access arrangement review. These consultations may include e-mail and telephone communications with AER staff and service providers.

C 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

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