ACIL ALLEN CONSULTING

REPORT TO
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REVIEW OF DEMAND FORECASTS FOR APA VTS

VICTORIAN GAS ACCESS ARRANGEMENT REVIEW FOR THE PERIOD 2018 – 2022

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

1.2 Scope and Approach

The Australian Energy Regulator (AER) has engaged ACIL Allen to provide independent advice on the demand forecasts contained in the access arrangement proposals submitted by the Victorian transmission and distribution businesses. The purpose of this advice is to assist the AER in deciding whether or not the demand forecasts meet the requirements of the NGR and therefore whether or not they should be approved.

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 Engagement

Under the terms of our engagement, ACIL Allen is required to provide advice on whether the demand forecasts for each business have been arrived at on a reasonable basis and whether they represent the best forecasts for demand in the circumstances.

More specifically, ACIL Allen is required to:

1. critically assess and advise on the businesses' arguments relating to the likely trend in demand forecasts over the regulatory period;
2. ask questions about the demand forecasts in the form of a written information request to the business, via AER staff;
3. where relevant, provide alternative demand forecasts. Provide reasons for this alternative approach and set out the methodology and assumptions for this alternate approach;

4. consider feedback from AER staff, including those with expertise in forecasting;
5. provide draft and final written advice;
6. respond to the businesses' response to the AER's draft decision and any questions/queries from the businesses.

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 requirements.
- 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 classes of customer for different reference services.

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

1. the adequacy of the overall approach and methodology
2. the reasonableness of the assumptions that have been used in applying the chosen methodology
3. the currency and accuracy of the data used
4. the account taken of key drivers of gas demand in each relevant customer sector
5. whether the methodology has been properly applied.

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

1.2.3 Data sources

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

- the National Gas Rules
- the Access Arrangement Information, Access Arrangement Submission and Regulatory Information Notice (RIN) submitted by APA VTS Australia, hereafter "APA" (APA VTS Australia, 2017a), (APA VTS Australia, 2017b)
- the gas-fired electricity demand forecast prepared for APA by Frontier Economics, hereafter "Frontier" (Frontier Economics, 2016)
- various specialist reports as detailed in the Bibliography.

1.2.4 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 the APA operations.

Chapter 4 describes the forecast methodology, assumptions and ascertains their suitability.

Chapter 5 sets out our conclusions regarding the acceptability of the forecasts, and actions that the AER could propose to improve upon the forecasts as submitted.

2 KEY FINDINGS

The APA transmission pipeline network performs the following functions:

- high pressure transportation of gas for delivery into the low-pressure gas distribution systems servicing the Victorian retail mass market (residential, commercial and industrial customers)
- delivery of gas to some (but not all) Victorian gas-fired power generators
- transfer of gas to and from the Iona Underground Gas Storage facility and the Dandenong LNG gas storage facility. These operations are critical to peak load management in the Victorian gas supply system
- cross-system transfers of gas to interstate markets via the NSW-Victoria Interconnect and VicHub.

Rather than prepare its own independent forecasts of residential and commercial (Tariff V) gas demand, or using the corresponding forecasts prepared by AEMO in the context of the National Gas Forecasting Report, APA has elected to rely on the final demand forecasts approved for the distribution businesses. APA argues that these forecasts provide the best measure of the Tariff-V load going forward.

With regard to gas use by industrial customers, APA proposes to use the AEMO forecasts for Tariff D demand, adopting the AEMO's "weak" forecast of Victorian industrial demand from the 2016 National Gas Forecasting Report,

The only service lines for which APA presents independent forecasts are, therefore:

- Gas-fired Power Generation (GPG)
- Transfer of gas into and out of storage at the Iona Underground Gas Storage ('Iona UGS') and Dandenong LNG facilities
- Interstate transfers of gas that involve movement of gas across the VTS.

2.1 Assessment of the forecasts

2.1.1 Residential and commercial demand

Because APA proposes to rely on the final (approved) forecasts of Tariff V residential and commercial demand prepared by the distribution businesses for the upcoming access arrangement period, we do not consider residential and commercial demand forecasts in this report.

2.1.2 Industrial demand

APA adopts the AEMO 'Weak' forecast for industrial demand from the 2016 National Gas Forecasting Report (NGFR). APA argues that the NGFR identifies a number of negative drivers for industrial gas demand (rising prices, tight supply) which "do not appear to have been reflected in [AEMO's] forecast of industrial gas demand" (APA VTS Australia, 2017b, p. 33).

AEMO's forecasts for Victorian industrial demand show an average annual decline over the period 2018 – 2022 of 1.3 per cent for the Neutral scenario and 1.9 per cent for the Weak scenario, both well below the actual rate of decline over the past two years.

Given the considerable uncertainties facing industrial gas users in Victoria, our view is that the AEMO Weak scenario is at least as likely to materialise as the Neutral scenario and there is no clear basis for requiring APA to adopt the higher forecast.

2.1.3 Gas-fired power generation

The VTS serves the following gas-fired generators:

- Newport
- Somerton
- Jeeralang A
- Jeeralang B
- Valley Power
- Laverton North

There are two large NEM-participant gas-fired generators located in Victoria that are not connected to or reliant on the VTS for gas delivery, namely Mortlake and Bairnsdale.

APA has adopted forecasts of gas demand for power generation prepared by Frontier Economics ('Frontier') for purposes of the access arrangement. Frontier has prepared forecasts both with and without assumed re-introduction of a carbon pricing mechanism.

We have considered alternative forecasts of gas consumption in generators connected to the VTS:

- **AEMO NGFR 2016.** The NGFR does not provide information that enables consumption by the VTS-connected generators to be separated from the total forecast. However AEMO has provided the AER, in confidence, with a disaggregation of the 2016 NGFR gas-consumption for power generation modelling results that has enabled us to identify the VTS-connected component of the forecast. The VTS-connected component of the AEMO NGFR forecast follows a generally similar path to the corresponding Frontier forecast and, like Frontier, falls to very low levels over the period 2020 to 2022.
- **AEMO VGRP 2017.** The 2017 VGPR forecast anticipates much higher levels of GPG consumption. It anticipates a spike in Victorian GPG consumption to around 18 to 20 PJ/a in 2017 and 2018 (in response to closure of Hazelwood), reverting to about 10 PJ/a by 2021.

On balance, we think that there are a number of factors that are likely to see GPG taking a relatively constrained peaking role in Victoria in the mid-term. These include increasing levels of renewable energy supported by the Renewable Energy Target (RET) and Victorian Renewable Energy Target (VRET) schemes; constrained gas supply and consequent rising gas prices, with the prospect of significant declines in gas production from the Bass Strait region within the next five years (as noted by AEMO in the VGPR 2017). While recent initiatives by the Australian government aimed at bolstering domestic gas supply by potentially restricting some LNG exports may help to ease these supply/price pressures, we think it unlikely that they will result in a return to abundant low-cost gas that would support strong growth in GPG consumption.

On this basis, ACIL Allen concludes that the modelling approach adopted by Frontier is sound. It results in gas consumption forecasts that are reasonably close to AEMO's forecasts prepared for the latest NGFR, but significantly below the AEMO forecasts prepared for planning purposes in the VGPR. The assumptions that underpin the Frontier modelling are reasonable and take into account recent market developments, including the closure of Hazelwood. In the absence of any major changes in the energy market environment that might necessitate changes to key assumptions prior to the final decision, we consider that the Frontier forecasts of VTS-connected GPG demand that have been adopted by APA are not unreasonable.

2.1.4 Interstate transfers and storage

VicHub

Based on historical performance, flows out of the VTS at VicHub are forecast to be approximately 2PJ a year. This corresponds with reported average historical volumes at VicHub of 5.7TJ/day in 2016 (2.1PJ). ACIL Allen considers this forecast to be reasonable.

Culcairn withdrawals

The forecast for withdrawals at Culcairn is based on expected total annual demand of 29.6 PJ/a made up of existing demand (prior to expansion in the current Access Arrangement period) and expected average utilisation across all shippers contributing to incremental demand using the expansion capacity from the Victoria – NSW Interconnector Expansion (VNIE) project.

Current base capacity is about 7.3 PJ/a. APA expects average utilisation of the incremental capacity added by the VNIE project to be approximately 40 per cent, consistent with the average utilisation of incremental capacity across 2015 and 2016. On this basis, total withdrawals at Culcairn are expected to be 29.6 PJ (about 81 TJ/day on average) from 2017 when the VNIE project is complete.

Origin Energy argued in a submission on the APA forecasts that the forecast for withdrawals at Culcairn is too low. It noted that Culcairn withdrawals over the first two months of 2017 averaged 97 TJ/day. Origin Energy indicated that it expects average flows through Culcairn into New South Wales to be in the order of 150 TJ/day 'once the full capacity of the NSW–Victoria Interconnect is made available'. In considering this submission we note that the average rate of withdrawal referred to by Origin Energy occurred over January and February 2017—peak summer months for gas-fired power generation in New South Wales. Over the first five months of 2017, withdrawals from the VTS at Culcairn averaged 74.7 TJ/day. Origin's contention regarding higher average flows once the full capacity of the VNIE becomes available implicitly assumes that average capacity utilisation levels will increase compared to historical levels. While this possibility cannot be discounted, no evidence has been presented to support this conclusion. On the other hand, ACIL Allen has observed a general decline in load factors (capacity utilisation) on transmission pipelines across eastern Australia as gas supply has become more "peaky".

On this basis, we consider that the APA forecast for Culcairn transfers is not unreasonable.

LNG storage refill

LNG refill forecast volumes match actual volumes in 2015 (about 2.1 PJ/a), which was APA's best estimate of future volumes available at the time.

Iona UGS refill

The APA Access Arrangement includes estimates of Iona UGS refill volumes that were estimated from AEMO's modelling of daily withdrawals into the Iona UGS facility set out in the 2016 Victorian Gas Planning Report (VGPR). Based on this information, APA estimated refill volumes rising from 13 PJ/a in 2017-18 to 14 PJ/a in 2018-19, and to 14.2 PJ/a in subsequent years of the access arrangement period.

A number of submissions argued that the APA Access Arrangement as originally submitted did not make sufficient provision for expansion of the South West Pipeline to allow increased rates of refill of the Iona Underground Gas Storage facility. Declining production from the Otway Basin at Port Campbell means that an increasing proportion of the gas required to refill Iona UGS in summer is being sourced from the Gippsland Basin and transported via the VTS. APA has submitted a supplementary proposal to the AER to bring forward construction of the Western Outer Ring Main (WORM) Project which would address these concerns by providing an alternative route for gas to flow between Port Campbell and the Northern and Gippsland regions, permitting higher refill rates for UGS, better line pack management including enhanced capacity to meet increased peak GPG demand, and increased security of supply in the event of Longford or Port Campbell outages.

The WORM Project would support increased levels of gas transportation through the VTS for injection into the Iona UGS facility. The latest AEMO VGPR, published in March 2017 shows significantly

higher withdrawals from the South West Pipeline into storage than were anticipated in the 2016 VGPR. Based on this new information, ACIL Allen estimates that refill volumes from the VTS will increase to 16.2 PJ/a in 2018-19, and to 15.4 PJ/a in subsequent years of the access arrangement period.

We propose that APA should be asked to provide revised forecasts of Iona UGS refill volumes, taking into account the new information contained in the AEMO 2017 VGPR.

3 SCOPE OF VTS OPERATIONS

3.1 Context of the VTS Operations

The VTS gas transmission system is the high-pressure gas pipeline system that transports natural gas from several production facilities to distribution points throughout Victoria. It represents the transmission component of the Victorian Wholesale Gas Market operated by the Australian Energy Market Operator (AEMO).

The VTS system has only limited direct connection to end-user customers. With the exception of a small number of gas production, industrial and gas-fired power generation (GPG) facilities that connect directly to the high-pressure pipeline network, the VTS system delivers gas to the mid-pressure and low-pressure distribution systems that are operated by Ausnet Services, Australian Gas Networks and Multinet. It is these distribution systems that provide the direct connection to most of the end-user gas customers in Victoria. These 'mass market' customers purchase their gas from energy retailers such as Origin Energy, Energy Australia, AGL and Simply Energy.

The VTS system is a key component of the Victorian Wholesale Gas Market which operates as a 'market carriage system', differing from other gas markets in Australia in terms of its physical and commercial arrangements. Elsewhere in Australia, gas is sold under 'contract carriage' arrangements under which wholesale gas buyers and sellers enter into bilateral contracts (typically long term) for both the sale and purchase of gas and for gas transmission rights. The 'market carriage' arrangements that apply in Victoria incorporate a number of important features that are different from the 'contract carriage' system. Shippers are not required to reserve capacity under long-term contracts in order to ship gas through the transmission system; they are charged only for the gas transmission capacity that they actually use.

AEMO operates a spot market into which market participants must bid gas supply and through which all gas imbalances are taken to be bought or sold. Subject to residual curtailment powers, AEMO schedules gas supply from market participants as accepted in the spot market sufficient to meet demand.

Under these arrangements, APA does not have contractual certainty, either on the term of gas supply to users or on minimum capacity payments from users at particular sites. APA is subject to greater gas demand volume risk because, unlike traditional gas transportation agreements that pay the pipeline owner for reserved firm capacity, the arrangements in Victoria mean that APA is basically paid only for services actually used. This also has implications for financing of system capital works because capacity-seekers do not have to enter into ship-or-pay arrangements for incremental capacity.

Payments to APA for the use of the transmission system are made under the terms of a 'Service Envelope Agreement' (SEA) with AEMO. The SEA is established under provision of the National Gas

Law and provides for "the control, operation, safety, security and reliability of the declared transmission system". Under the terms of the SEA, AEMO has operational control of APA VTS System Capacity (as defined in the National Gas Rules). Extension to or expansions of the VTS can affect the APA VTS System Capacity if they form part of the covered pipeline. While AEMO operates the APA VTS System, APA has a direct contractual arrangement with each shipper for the payment of transmission tariffs under what is called a Transmission Payment Deed.

3.2 The VTS System

The following description of the VTS system is drawn from APA's Access Arrangement Submission (APA VTS Australia, 2017b). The VTS comprises over 2,000 km of high pressure gas transmission pipelines located throughout Victoria. It supplies gas to the Melbourne metropolitan area and to a number of regional centres including Corio (near Geelong), Ballarat, Bendigo, Wodonga, Koonoomoo and Echuca.

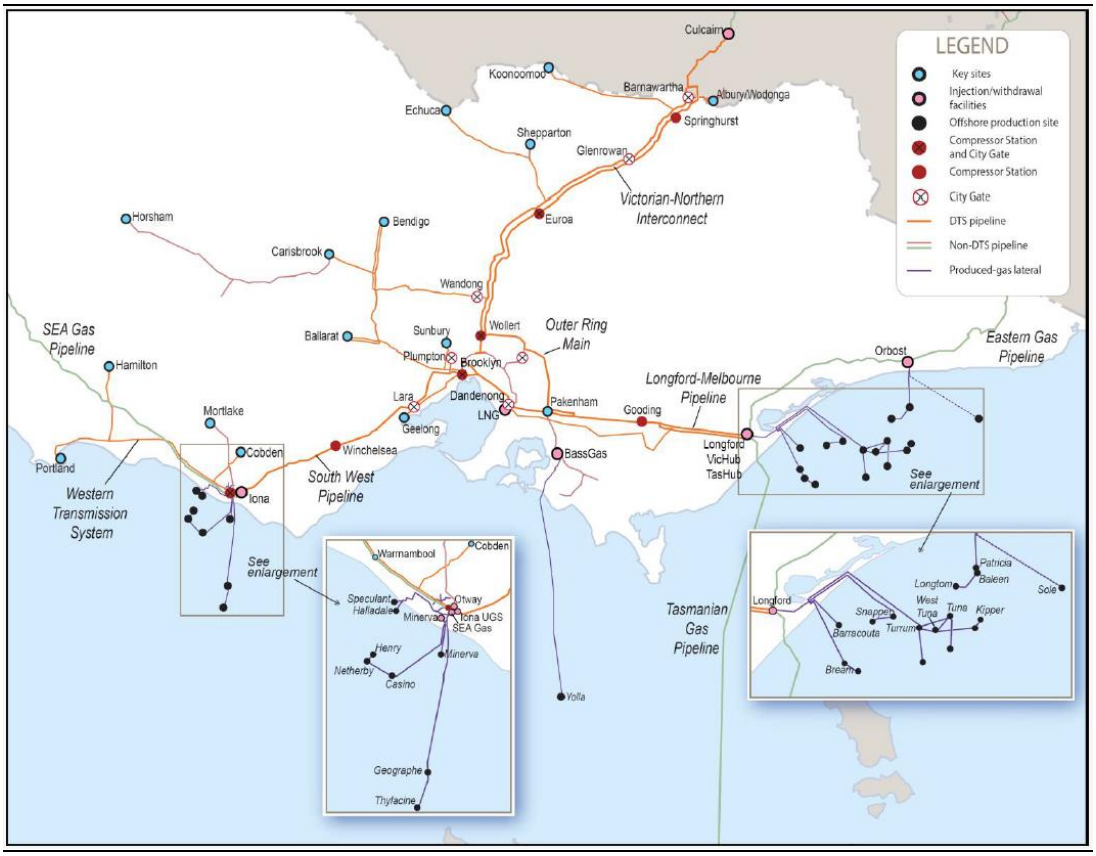
The Laverton North, Somerton, Valley Power (Loy Yang B), Jeeralang and Newport gas-fired power stations are all supplied directly from the VTS.

The main VTS pipelines and compression facilities include:

— Longford to Melbourne Pipeline (Longford-Dandenong-Wollert) with compression at Gooding.
— South West Pipeline (Port Campbell-Geelong-Brooklyn) with compression at Winchelsea and Brooklyn.
— Victorian Northern Interconnect (Wollert-Wodonga-Culcairn) with compression at Wollert, Euroa and Springhurst.
— Western Transmission System (WTS) (Iona-Portland) with compression at Iona.

The location of the VTS pipelines is shown in **Figure 3.1**.

FIGURE 3.1 MAP OF VICTORIAN TRANSMISSION SYSTEM



SOURCE: (AEMO, 2017)

Gas transmitted through the VTS is supplied primarily by Esso/BHPB and injected into the VTS at the Longford injection point. Some of the gas produced by Esso/BHPB at Longford is directed into the Eastern Gas Pipeline (Longford to Sydney, which also serves markets in eastern Victoria including the Bairnsdale power station) and the Tasmania Gas Pipeline; this gas does not use the VTS.

Other gas supplies into the VTS are sourced from the BassGas injection point at Pakenham and from the Iona injection points at Port Campbell. Gas is also supplied to the system through the Interconnect pipeline from NSW.

3.3 Recent extension and expansion

The VTS underwent significant growth in the earlier access arrangement period, triggered by the rapid increase in demand for gas on the east coast as a result of the new LNG facilities at Gladstone. This resulted in demand for increased capacity for gas sourced from Port Campbell, as well as demand for capacity for gas flows north into NSW at Culcairn. To meet this demand, some of which emerged during the earlier period, APA invested in new capacity on the South West Pipeline and the Wollert to Barnawartha pipeline through compression and looping respectively. Given this investment, APA does not expect to further invest in capacity for 'throughput' flows to Culcairn during the forecast period for gas.

3.4 Potential policy changes affecting operations of the VTS

The APA Access Arrangement Submission (APA VTS Australia, 2017b, p. 12) notes that there are a number of proposed changes to policy and market settings that could have significant implications for the VTS. These include a proposal to move the current market carriage Declared Wholesale Gas Market arrangements to a 'virtual hub' model, with contracted pipeline capacity at entry and exit points.

Given the uncertainty as to if and when any such policy changes will be brought into force, APA has proposed a new cost pass through event specifically related to the development of new market arrangements. The proposed event would capture costs incurred in the development and implementation of systems, processes and procedures made necessary by a decision to develop a new gas market structure in Victoria. Specifically, it allows for the pass through of prudent and efficient costs incurred for actions necessary to prepare for new market arrangements.

4 FORECAST METHODOLOGY AND ASSUMPTIONS

The VTS transports much of the gas used in Victoria by different types of end-user customers including:

- residential and commercial gas users
- industrial customers
- electricity generators.

It also fulfils a role (and receives revenue) for services that do not directly involve the end-use of gas in Victoria. These services include:

- Transfer of gas into and out of storage at the Iona UGS facility and the Dandenong LNG facility
- Interstate transfers of gas that involve movement of gas across the VTS.

Forecasts of gas moved through the VTS for use by mass market (residential, commercial and industrial) gas consumers should correspond to the comparable forecasts prepared for the upcoming access arrangement period by the three gas distribution businesses who will take gas from the VTS for delivery to those customers.

While the APA Access Arrangement Submission and Access Arrangement Information contain information germane to the forecasting of mass market gas demand (for example a discussion on weather effects on gas demand and trends in Effective Degree Days) such information is not, in fact, used to develop independent forecasts of mass market demand. Instead, APA has elected to rely on the final demand forecasts approved for the distribution businesses. In its response to AER Information Request #01, APA has indicated that:

"Consistent with the approach approved by the AER in the previous VTS Access Arrangement, APA VTS has deferred to the distribution business forecasts, and the AER's analysis and approval of those forecasts, as the best measure of the Tariff-V load going forward …

APA VTS expects that the load forecast in the AA revision submission would be updated to reflect the AER-approved distribution business forecasts."

With regard to gas use by industrial customers, APA proposes to adopt the AEMO 'climate adjusted' forecasts for Tariff D from the 2016 National Gas Forecasting Report.

The only service lines for which APA presents independent forecasts are, therefore:

- GPG
- Transfer of gas into and out of storage at the Iona UGS and Dandenong LNG facilities
- Interstate transfers of gas that involve movement of gas across the VTS.

As a result, our assessment of demand forecasts for APA is therefore limited to these three service lines.

4.1 Historical usage

The Access Arrangement Information (Section 2.3, pp. 6–7) covers historical pipeline usage, showing minimum, maximum and average demand by delivery point (Table 2.3) and by receipt point (Table 2.4). In the draft AAI as submitted, both Table 2.3 and Table 2.4 include labels for 'Average demand (AVG)' and 'Maximum demand (MAX)' that have been reversed (with the listed values for AVG demand in all cases higher than the listed values for MAX demand). In response to an Information Request, APA has confirmed that these errors will be corrected in the final AAI.

Section 4 (pp.13–16) address forecast network demand and utilisation.

4.2 The forecasts

4.2.1 Customer numbers

The Access Arrangement Information (Table 2.5, Table 4.1) indicates that there are currently 23 customers and that APA does not expect this number to change over the forecast period.

4.2.2 Network capacity and utilisation

The Access Arrangement Submission set out forecast network capacity and utilisation for the upcoming access arrangement period. These forecasts were subsequently updated in by APA in response to an AER information request. The updated information is shown below:

- Tables 3.2, 3.10: Capacity for flows toward Melbourne (ex Longford, South West Pipeline, NSW Interconnect) —ex Longford capacity is expected to increase from 990 TJ/d in 2017 to 1,030 TJ/d in 2018 and to remain at this level across the forecast period. For the SWP and NSW Interconnector forecast capacities remain at current (2017) levels of 429 TJ/d and 125 TJ/d respectively.
- Tables 3.3, 3.11: Capacity for flows away from Melbourne. For the NSW Interconnect and Western Transmission System capacity is forecast to remain unchanged at 201 TJ/d and 28 TJ/d respectively. For the South West Pipeline, westbound capacity is forecast to increase from 102 TJ/d in 2017 to 220 TJ/d in 2022 (following completion of the Western Outer Ring Main, or 'WORM', project to accommodate expanded Iona UGS injection capacity).

In terms of capacity utilisation, the Access Arrangement Submission and subsequent information request response set out changes in expected utilisation as follows:

- Tables 3.4 and 3.12: Utilisation of pipeline flows toward Melbourne—
  - flows on the Longford to Melbourne Pipeline will average 45.5 per cent (469 TJ/d) and will peak at 64.2 per cent (661 TJ/d) over the access arrangement period
  - flows on the South West Pipeline will average 16.4 per cent (68 to 71TJ/d) and will peak at 98.6 per cent (407 to 429 TJ/d) over the access arrangement period
  - flows on the NSW Interconnect will average 5.3 per cent (7 TJ/d) and will peak at 52.8 per cent (66 TJ/d) over the access arrangement period.
- Tables 3.5 and 3.13 Utilisation of pipeline flows away from Melbourne—
  - flows on the South West Pipeline will average 25.3 per cent (26 to 56 TJ/d) and will peak at 100 per cent (102 to 220 TJ/d) over the access arrangement period
  - flows on the Victorian Northern Interconnect will average 39.5 per cent (79 TJ/d) and will peak at 92.7 per cent (186 TJ/d) over the access arrangement period
  - flows on the Western Transmission System will average 35.9 per cent (10 TJ/d) and will peak at 57.3 per cent (16 TJ/d) over the access arrangement period.

The proposed capacity settings for the South West Pipeline have been increased in light of APA's supplementary proposal to bring forward construction of the WORM project. This matter is addressed in section 4.2.7.

4.2.3 Forecast demand summary

Table 4.6 of the AAI summarises the forecast maximum and average demand over the next AA period, divided into Tariffs V and D (combined), GPG, Culcairn, VicHub and UGS/LNG refill.

There is no discussion or explanation of these forecasts in the AAI—simply a summary of the results that are presented and discussed in the Access Arrangement Submission.

The demand forecast is **summarised** on summary pages 4 and 5 of the AAS. The main features are:

- Tariff V demand: "APA VTS expects to see these two factors [population growth and improving appliance efficiency] contribute to a relatively flat demand for the residential sector". In fact the chart on page 5 of the AAS shows a small step change in aggregate Tariff V demand at the beginning of the forecast period, down to less than 120 PJ/a (having been at or above 120 PJ/a on a weather-normalised basis for the previous 9 years), with a mild reduction over the AA period to about 115 PJ/a by 2022.
  - In light of APA's confirmed position that it intends to rely on the distribution business forecasts, and the AER's analysis and approval of those forecasts, as the best measure of the Tariff V load, it is not necessary to consider this forecast of Tariff V demand any further in this report.
- Tariff D (Large user) demand is projected to continue a downward trend, related to declining economic activity. That trend has been apparent since 2007. There appears to be a significant downward step change between 2016 (estimated actual) and 2017 (forecast). While not obviously out-of-line with the longer term downward trend and not necessarily unreasonable given recent developments in the gas market, this warrants further investigation (see section 4.2.5).

APA proposes to rely on the AEMO forecasts of industrial gas use set out in the current (2016) NGFR (AEMO, 2016). AEMO has aggregated forecast demand information from the distribution businesses for those industrial customers served from the distribution systems, together with demand forecasts from industrial customers served by direct connection to the VTS.

The AEMO industrial demand forecasts have been developed using a well-established methodology that involves econometric projections of gas use by smaller industrial customers and survey-based assessments of the future gas requirements of larger customers.

For the purposes of this submission, APA has applied the AEMO's "weak" forecast of industrial (Tariff D) demand from its 2016 NGFR. APA advises that its Tariff D forecast may be reviewed following the AER's draft decision to update for any industrial closures since this lodgement of this proposal.

GPG is forecast to show a short-term increase as a result of closure of Hazelwood brown coal station (scheduled 1H2017) but then dropping as more renewable generation enters the market in response to the Victorian Renewable Energy Target.

Gas transported through the VTS to interstate markets is expected to increase relative to historical levels.

4.2.4 Residential and commercial demand

As explained above, APA proposes to rely on the final (approved) forecasts of Tariff V residential and commercial demand prepared by the distribution businesses for the upcoming access arrangement period. Accordingly we do not give further consideration to residential and commercial demand forecasts in this report.

4.2.5 Industrial demand

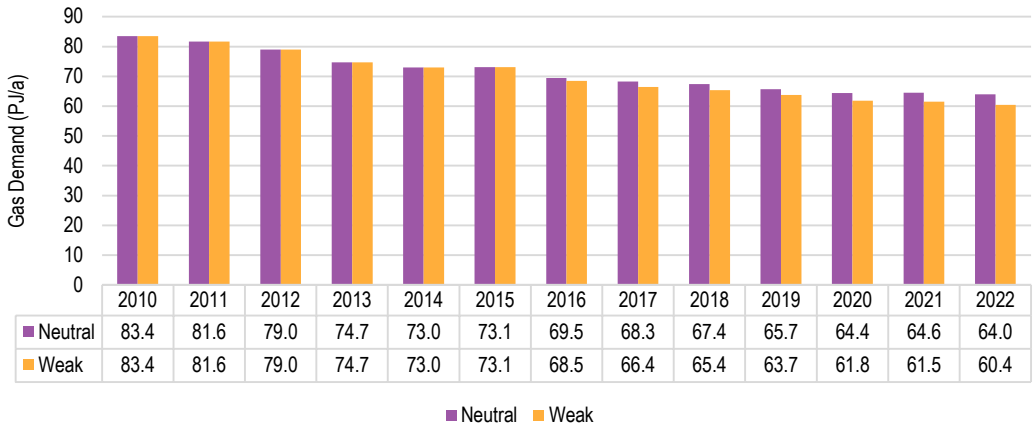
APA states that it has "applied the AEMO forecast of industrial (Tariff-D) demand from its 2016 National Gas Forecasting Report (NGFR)" but goes on to advise that it has adopted the AEMO 'Weak' forecast for industrial demand. APA considers that the 2016 NGFR identifies a number of negative drivers for industrial gas demand (rising prices, tight supply) which "do not appear to have been reflected in [AEMO's] forecast of industrial gas demand" (APA VTS Australia, 2017b, p. 33).

Assessment

Figure 4.1 compares the historical and forecast levels of industrial gas demand in Victoria under AEMO's Neutral and Weak scenarios, as presented in the 2016 NGFR. By the end of the access arrangement period in 2022, industrial demand under the Weak scenario is forecast to be 3.6 PJ/a or about 6 per cent lower than industrial demand under the Neutral scenario. Over the period 2010 to 2015, the data shows that industrial demand in Victoria fell by 10.4 PJ/a. We note that Tariff D industrial demand is highly asymmetrical, with a relatively small number of very large users accounting for a substantial portion of total industrial demand. There are a number of individual industrial gas consumers in Victoria with annual demand greater than 3.6 PJ/a[1]. A curtailment of operations by any one of these large consumers could result in a change in total industrial gas consumption greater than or equal to the difference between the Neutral and Weak scenario forecasts. APA reports that in 2015 and 2016 industrial demand has declined at an annual rate of between 4 and 5 per cent. AEMO's 2016 NGFR forecasts for Victorian industrial demand show an average annual decline over the period 2018 – 2022 of 1.3 per cent for the Neutral scenario and 1.9 per cent for the Weak scenario, both well below the actual rate of decline over the past two years.

Given the considerable uncertainties facing industrial gas users in Victoria, our view is that the AEMO Weak scenario is at least as likely to materialise as the Neutral scenario and there is no clear basis for requiring APA to adopt the higher forecast.

FIGURE 4.1 NGFR 2016: VICTORIA INDUSTRIAL GAS DEMAND, HISTORY & FORECAST— COMPARISON OF NEUTRAL AND WEAK SCENARIOS



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Neutral	83.4	81.6	79.0	74.7	73.0	73.1	69.5	68.3	67.4	65.7	64.4	64.6	64.0
Weak	83.4	81.6	79.0	74.7	73.0	73.1	68.5	66.4	65.4	63.7	61.8	61.5	60.4

SOURCE: (AEMO, 2016C)

4.2.6 Gas-fired power generation

The VTS serves the following gas-fired generators:

- Newport
- Somerton
- Jeeralang A
- Jeeralang B
- Valley Power
- Laverton North

There are two large NEM-participant gas-fired generators located in Victoria that are not connected to or reliant on the VTS for gas delivery, namely Mortlake and Bairnsdale.

[1] APA Access Arrangement Submission states that "There are about 400 gas customers who each take more than 10 TJ of gas demand annually. The largest customer takes between 6 and 7 PJ/year."

In recent times there have been a number of developments in the Victorian electricity market that have the potential to significantly affect levels of gas-fired power generation, including:

— The VRET under which the Victorian Government has committed to Victorian renewable energy generation targets of 25 per cent by 2020 and 40 per cent by 2025. These targets will be supported by a competitive reverse auction scheme. The scheme is designed to deliver up to 1,500 MW of new large-scale renewable energy capacity by 2020 and up to 5,400MW by 2025. This represents a major uplift on the existing and planned renewable energy investment required to meet the Australian government's Renewable Energy Target.

— Hazelwood closure in March 2017.

APA forecast: Frontier modelling

The AEMO modelling presented in the 2016 NGFR incorporates a proxy carbon price from 2020 onwards. APA argues that this is directly opposed to current government policy. APA therefore relies on a forecast of Victorian GPG prepared by Frontier, which does not assume any explicit carbon price over the period of the Access Arrangement. The Frontier report finds that:

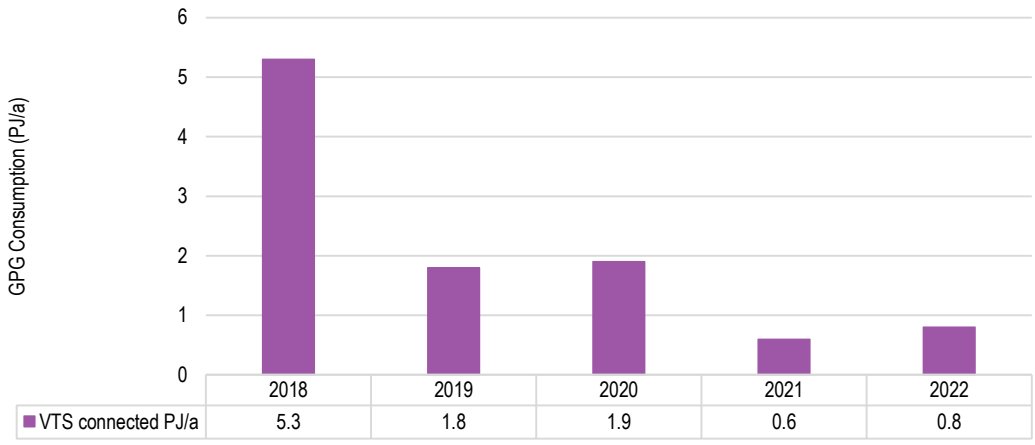
— GPG dispatch increases in the short term (2017–2018) in response to Hazelwood closure.

— GPG dispatch drops sharply in 2019, 2020 as a result of new renewable capacity driven by VRET.

— Newport (VTS) dispatches ahead of Mortlake (non-VTS) resulting in higher forecast VTS-connected demand than AEMO.

The APA forecast of VTS-connected GPG demand is shown in **Figure 4.2**

FIGURE 4.2 APA/FRONTIER FORECAST OF VTS-CONNECTED GPG CONSUMPTION



SOURCE: (APA VTS AUSTRALIA, 2017B)

The Frontier analysis is set out in APA supporting document C1 (Frontier Economics, 2016).

The Frontier report provides forecasts of gas use for power generation (GPG) in the Victorian market, specifically for gas plant on the regulated VTS. It also comments on the key differences between Frontier Economics' approach to modelling Victorian GPG demand relative to that undertaken by AEMO in its 2016 NGFR (December 2016), focusing on differences in assumptions regarding a cost on carbon.

Frontier used its proprietary electricity investment model WHIRLYGIG to model Victorian GPG performance over the forecast period. Frontier described the operational logic of its electricity market model as follows:

"WHIRLYGIG computes the least-cost mix of generation (output) and investment to meet demand, subject to meeting system reliability targets, renewable targets (for instance, the Large Scale Renewable Energy Target (LRET)), and a CO2 emissions trading scheme or carbon price.

WHIRLYGIG models all Australian electricity markets concurrently, hence Frontier is able to accurately forecast the market outcomes of nation-wide renewable energy policy, such as the LRET and the carbon price."

(Frontier Economics, 2016, p. 2)

Frontier identified the following key factors affecting GPG in Victoria:

- the demand/supply balance, in particular due to new wind entry, demand growth and the impact of closure of the Hazelwood coal-fired generator in 2017
- fuel prices, in particular for gas
- carbon prices (where applicable).

Frontier modelled two scenarios:

- The **Base Case: No Carbon Price** scenario reflects current Federal government policy, where no carbon price is introduced.
- The **With Carbon Price** scenario considers the possible implications if it is assumed a carbon price is used to support the introduction of an emissions target for the electricity sector.
  - Frontier's modelling assumes that the sector will meet the target (an input assumption) without reliance on international permit imports. Under this approach, the required carbon price to meet the emissions target is a model output, not a model input.

Other key assumptions incorporated into the Frontier modelling include:

- **Electricity demand:** AEMO National Electricity Forecasting Report (NEFR) Medium (or Neutral) 2016 (both scenarios). The AEMO Neutral scenario does not assume any major smelter closures (AEMO, 2016b, pp. 22-23) and therefore incorporates continued operation of the Portland smelter.
- **Gas price:** about $6/GJ (both scenarios). We consider this price is probably reasonable for existing long-term contracts but is likely to be below the cost of new long-term contracts. Spot prices in the Victorian market averaged about $6.50/GJ in 2016 but varied widely, from a minimum of $0.30/GJ up to more than $32/GJ. The effect of assuming higher wholesale prices would be, all else being equal, to reduce the levels of GPG gas consumption.
- **Renewable generation capital cost:** $2,349/kW wind (both scenarios) - we consider this assumption to be reasonable based on ACIL Allen's internal data on generation costs.
- **Carbon price:** sector target set to meet 28 per cent reduction on 2005 emission levels by 2030 (as per AEMO NGFR forecast)—"With Carbon Price" scenario only
- **LRET target:** 33 TWh by 2020, scheme end 2030. This is in accordance with the current LRET legislation.
- **VRET target:** about 1,800 MW to 2020 will contribute to LRET (not additional). About 3,600 MW *additional* renewables in Victoria 2021 to 2025 (both scenarios). This is in accordance with announced Victorian government policy.
- **Hazelwood:** Closure March 2017 (both scenarios). This has now occurred.

Modelling results

Impact of loss of Hazelwood

The closure of Hazelwood in March 2017 sees a drop in brown coal output of around 7.4TWh in 2017 (due to partial year closure) and 10TWh in 2018.

Initially, Victoria reverts from net exports to net imports in 2017-19, meaning that much of Hazelwood's output is replaced with increased generation from other regions. Reduced export/increased imports account for around 60 per cent of the reduction in Hazelwood output in 2017 and 2018. The net reduction in total Victorian generation post-Hazelwood retirement is 4.5TWh (2017) and 5.8TWh (2018).

In 2017, the remainder of Hazelwood's output is replaced by a mix of increased Victorian wind (~20 per cent of the Hazelwood reduction) and increased Victorian gas (~22 per cent). Wind increases from

3.9TWh to 5.3TWh in 2017, though further increases in wind output are limited only by constraints on the ability to physically build new wind plant. Gas increases from 0.2TWh to 1.8TWh in 2017.

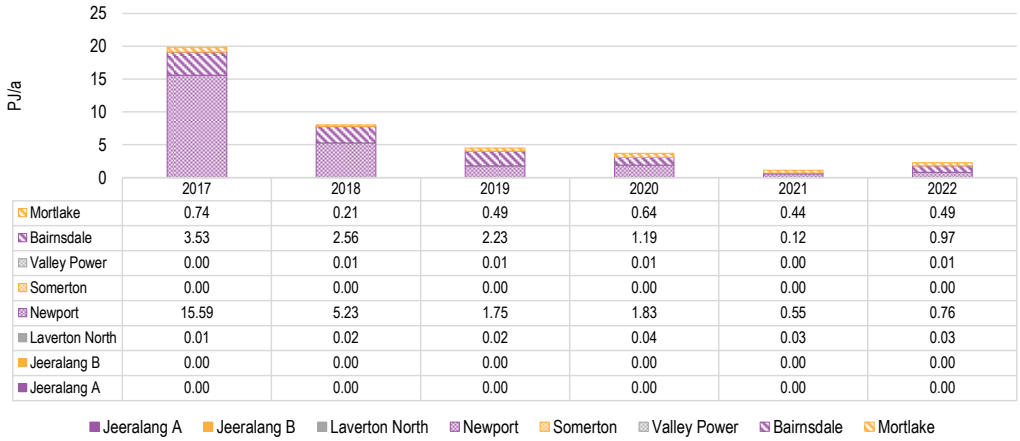
In 2018, Victorian wind is projected to grow due to the rising RET. In 2018, the increase in wind output takes up a larger share of the reduction in Hazelwood output (34 per cent). This displaces some of the increase in Victorian gas that initially occurs in 2017. By 2018, the increase in Victorian gas output is only 6 per cent of the reduction in Hazelwood dispatch.

This trend continues in 2019 and beyond: Victorian wind generation continues to grow to meet the RET (and VRET), and this further displaces some of the Victorian gas-fired generation and reduces imports from other regions. By 2020 Victoria is once again a net exporter and by 2022 the increase in Victorian wind output (relative to 2016 levels) is greater than the loss of Hazelwood output.

Gas use by generator

Figure 4.3 summarises Frontier's Base Case forecasts of gas use, by generator.

FIGURE 4.3 APA/FRONTIER GPG FORECAST BY GENERATOR, BASE CASE SCENARIO



	2017	2018	2019	2020	2021	2022
Mortlake	0.74	0.21	0.49	0.64	0.44	0.49
Bairnsdale	3.53	2.56	2.23	1.19	0.12	0.97
Valley Power	0.00	0.01	0.01	0.01	0.00	0.01
Somerton	0.00	0.00	0.00	0.00	0.00	0.00
Newport	15.59	5.23	1.75	1.83	0.55	0.76
Laverton North	0.01	0.02	0.02	0.04	0.03	0.03
Jeeralang B	0.00	0.00	0.00	0.00	0.00	0.00
Jeeralang A	0.00	0.00	0.00	0.00	0.00	0.00

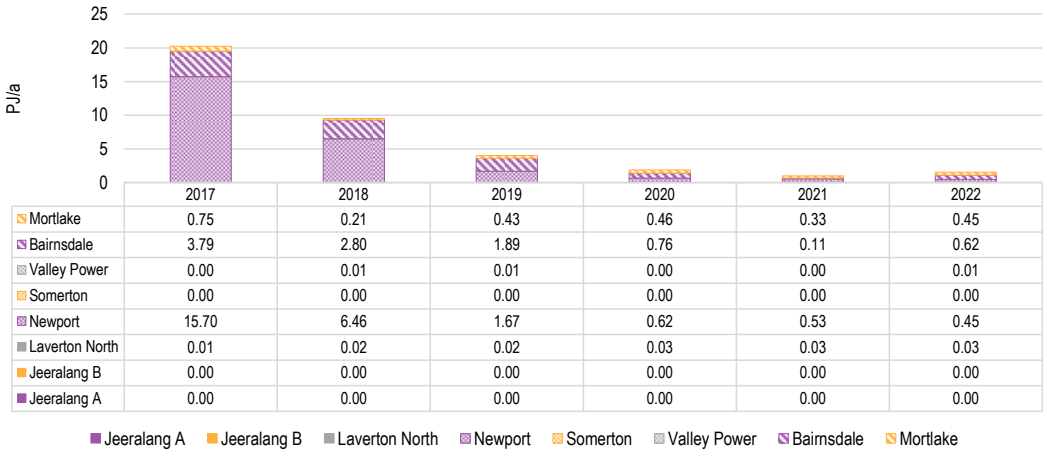
SOURCE: (FRONTIER ECONOMICS, 2016, P. 25)

Under Frontier's assumptions most gas is used in Newport (VTS-connected) and Bairnsdale (non-VTS). Mortlake has low levels of dispatch and the other Victorian GPG stations (Jeeralang A&B, Laverton North, Somerton and Valley Power) see little or no dispatch.

The Frontier report notes that in recent years, Mortlake (non-VTS) has provided more output than Newport (VTS-connected), largely due to lower historical gas prices. Frontier projects that it is more likely that Newport will dispatch more frequently than Mortlake, but notes that the nature of cost-based modelling makes it difficult to accurately reflect output from peaking gas plant because even a very small difference in cost assumptions (including efficiency, fuel prices, and operating costs) will mean that one plant will invariably dispatch ahead of another, whereas in reality they may dispatch at similar levels. As such, Frontier points out that its modelling may err in the direction of overstating Newport output at the expense of Mortlake. Analysis of actual generator dispatch to end April 2017 (post Hazelwood closure) suggests that Mortlake may dispatch more than Newport (see below).

The corresponding results for the **With Carbon Price** scenario are shown in **Figure 4.4**.

FIGURE 4.4 APA/FRONTIER GPG BY GENERATOR, WITH CARBON PRICE SCENARIO



	2017	2018	2019	2020	2021	2022
Mortlake	0.75	0.21	0.43	0.46	0.33	0.45
Bairnsdale	3.79	2.80	1.89	0.76	0.11	0.62
Valley Power	0.00	0.01	0.01	0.00	0.00	0.01
Somerton	0.00	0.00	0.00	0.00	0.00	0.00
Newport	15.70	6.46	1.67	0.62	0.53	0.45
Laverton North	0.01	0.02	0.02	0.03	0.03	0.03
Jeeralang B	0.00	0.00	0.00	0.00	0.00	0.00
Jeeralang A	0.00	0.00	0.00	0.00	0.00	0.00

SOURCE: (FRONTIER ECONOMICS, 2016, P. 34)

Frontier finds that, based on the assumptions above (including AEMO's 2016 NEFR Medium demand, Frontier's gas price forecasts, the inclusion of Hazelwood and Liddell retirements as announced, and the implementation of the proposed VRET) only a relatively low carbon price of between $19/t and $28/t CO_2e (real 2016) is required to achieve the 28 per cent abatement target.

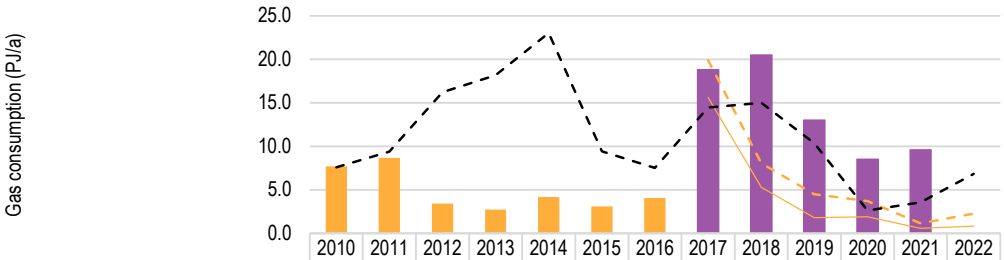
Given the relatively low carbon prices, the With Carbon Price scenario results are very similar to the No Carbon price scenario. Frontier forecasts growth in wind output (which is driven by the LRET and VRET, not carbon pricing) to be unchanged from the Base Case.

Alternative forecast: AEMO NGFR 2016

The AEMO National Gas Forecasting Report released in December 2016 (AEMO, 2016) provides an alternative forecast of total Victorian GPG. The NGFR does not provide information that enables consumption by the VTS-connected generators to be separated from the total forecast. However AEMO has provided the AER, in confidence, with a disaggregation of the 2016 NGFR gas-consumption for power generation modelling results that has enable us to identify the VTS-connected component of the forecast. Actual and forecast levels of total Victorian GPG as shown the 2016 NGFR are compared with the Frontier VGPR forecasts in **Figure 4.5**.

To preserve confidentiality, the VTS-connected component of the AEMO NGFR is not shown in **Figure 4.5**. However we have confirmed that it follows a generally similar path to the corresponding Frontier forecast and, like the Frontier forecast, falls to very low levels over the period 2020 to 2022.

FIGURE 4.5 VTS-CONNECTED GPG: HISTORY AND FORECAST COMPARISON



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Historical VTS	7.7	8.7	3.4	2.7	4.2	3.1	4.1						
VTS AEMO VGPR								18.8	20.5	13	8.5	9.6	
VTS Frontier								15.6	5.26	1.78	1.88	0.58	0.8
TOTAL GPG Frontier								19.87	8.03	4.5	3.71	1.14	2.26
TOTAL AEMO NGFR 2016	7.6	9.4	16.2	18.2	23.0	9.4	7.5	14.5	15.0	10.4	2.6	3.6	6.8

SOURCE: (AEMO, 2016), (AEMO, 2017), (FRONTIER ECONOMICS, 2016)

Alternative forecast: AEMO Victorian Gas Planning Report 2017

AEMO in its latest VGPR (AEMO, 2017) provides an alternative forecast of gas demand for power generation by stations connected to the VTS. The AEMO forecast does not address levels of generation from the non-VTS gas-fired generators in Victoria (Mortlake, Bairnsdale). It is therefore not directly comparable to the published AEMO NGFR 2016 forecast which relates to total Victorian GPG. It is, however, comparable to the Frontier VTS-connected forecast and to the VTS-connected disaggregation of the NGFR forecast (based on the confidential data provided by AEMO).

According to the VGPR forecast, GPG consumption on the VTS will increase from 4 PJ in 2016, to 19 PJ in 2017 and 21 PJ in 2018. AEMO explains that:

"This forecast is driven by the March 2017 closure of the coal-fired Hazelwood Power Station, and highlights the key role GPG is expected to play in balancing the output from intermittent renewable energy sources and playing a transitional role in the transformation of the generation mix towards a low carbon future."

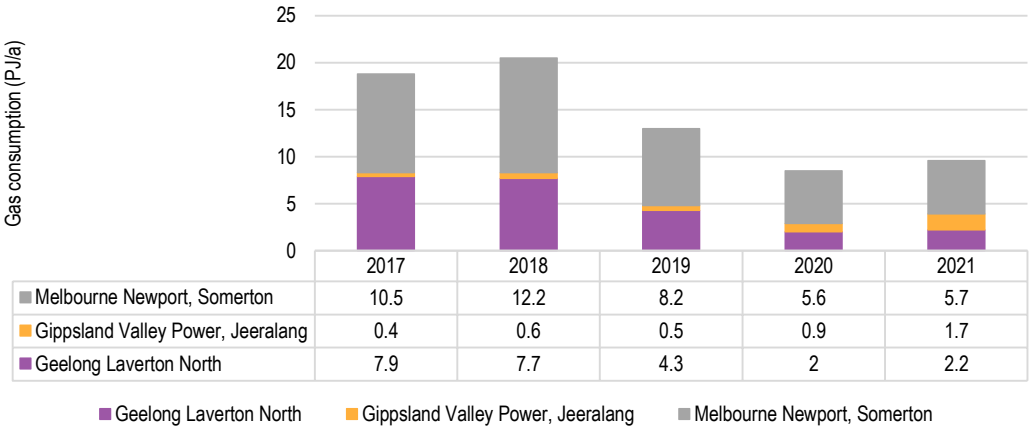
(AEMO, 2017, p. 21)

The AEMO VGPR forecast is expressed on a System Withdrawal Zone (SWZ) basis, rather than by generator. Figure 47 in the VGPR (AEMO, 2017, p. 101) shows the location of GPG power stations relative to System Withdrawal Zones. On this basis we have inferred that the AEMO forecasts for GPG correlate to individual stations as follows:

- Melbourne SWZ includes Newport and Somerton
- Geelong SWZ includes Laverton North
- Gippsland SWZ includes Valley Power (Loy Yang B) and Jeeralang A&B.

The AEMO forecast of VTS-connected GPG demand is summarised in **Figure 4.6**.

FIGURE 4.6 AEMO VTS-CONNECTED GPG FORECAST, VGPR 2017

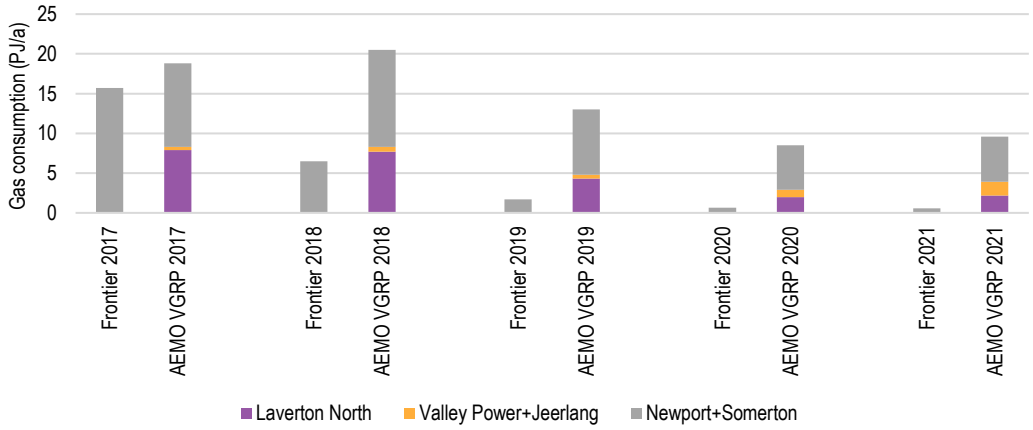


SOURCE: (AEMO, 2017, P. 22)

In its assessment of peak system demand (VGPR section 5.3.2, p.63) AEMO shows GPG demand by station on a 1-in-2 peak demand day. This analysis shows significant dispatch of a hypothetical "new open cycle gas turbine (OCGT) GPG unit in the Latrobe Valley to support electricity demand and back-up intermittent renewable generation". We understand that this new entrant generator was introduced on the basis of technical planning considerations to provide system support, but that other forms of system support (for example additional hydro capacity, battery storage) could fill a similar role. ACIL Allen's own electricity market modelling does not indicate any market need or justification for a new OCGT in Victoria within the timeframe covered by the VGPR, nor are we aware of any current commercial proposal to build such a plant.

To the extent that AEMO's assumed new entrant OCGT contributes to the GPG forecasts shown in **Figure 4.6** and **Figure 4.7** it would report to the Gippsland SWZ along with Valley Power and Jeeralang. Given the relatively small total forecast consumption for Gippsland SWZ, the contribution of the new entrant OCGT to overall GPG demand is assumed to be small.

FIGURE 4.7 COMPARISON OF FRONTIER AND AEMO FORECASTS



SOURCE:

As shown in **Figure 4.7**, the AEMO VGPR is forecasting much higher levels of total VTS-connected GPG demand than Frontier, particularly in the later part of the forecast period. Based on confidential information provided by AEMO, the VTS-connected component of AEMO's 2016 NGFR forecast is much closer to the Frontier values.

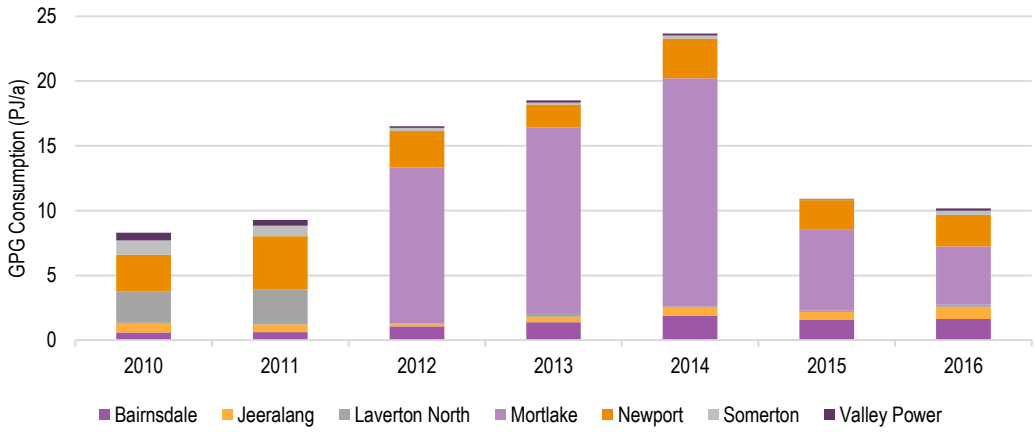
In order to form a view as to the reasonableness of these forecasts, we turn to an examination of historical dispatch levels, followed by a discussion of actual and anticipated responses to the closure of Hazelwood power station in March 2017.

Historical GPG dispatch

Figure 4.8 shows total historical Victorian GPG gas consumption over the period 2010 to 2016, calculated from actual plant dispatch data (as publicly reported by AEMO) and assumed plant heat rates.

Over the period 2012 to 2014 there was a strong increase in levels of Victorian GPG, driven mainly by high levels of dispatch from the Mortlake plant (non-VTS). Mortlake did not operate prior to 2011. The most likely explanation for the high dispatch of Mortlake over the 2011 – 2014 period was the ramp up of Origin's Queensland coal seam gas (CSG) production ahead of the commissioning of the first LNG train (QCLNG Train 1) plant at Gladstone leading to excess supply in Origin's gas supply portfolio. Following commissioning of the QCLNG Train 1 in December 2014, Origin was able to direct its excess CSG production into QCLNG.[2]

FIGURE 4.8 TOTAL VICTORIAN GPG GAS CONSUMPTION HISTORY BY PLANT, 2010 TO 2016

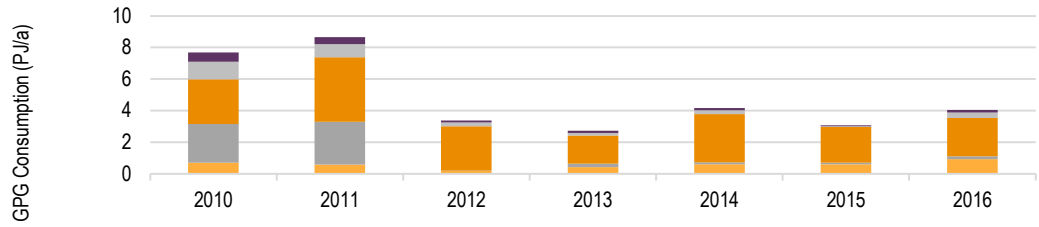


SOURCE: ACIL ALLEN ANALYSIS OF AEMO DATA

Figure 4.9 shows the corresponding historical gas consumption excluding the non-VTS connected generators Mortlake and Bairnsdale. Total VTS-connected gas consumption was around 8 to 9 PJ in the drought-affected years of 2010 and 2011, but then dropped to between 2 PJ/a and 4 PJ/a over the next 5 years. Newport accounted for the majority of this generation.

[2] Origin, as a member of the APLNG consortium, could direct its ramp-up CSG production into the QCLNG project prior to commissioning of APLNG Train 1 (in December 2015) because APLNG holds significant equity in a number of the QCLNG operated CSG fields in central and southern Queensland.

FIGURE 4.9 VTS-CONNECTED GPG GAS CONSUMPTION HISTORY BY PLANT, 2010 TO 2016



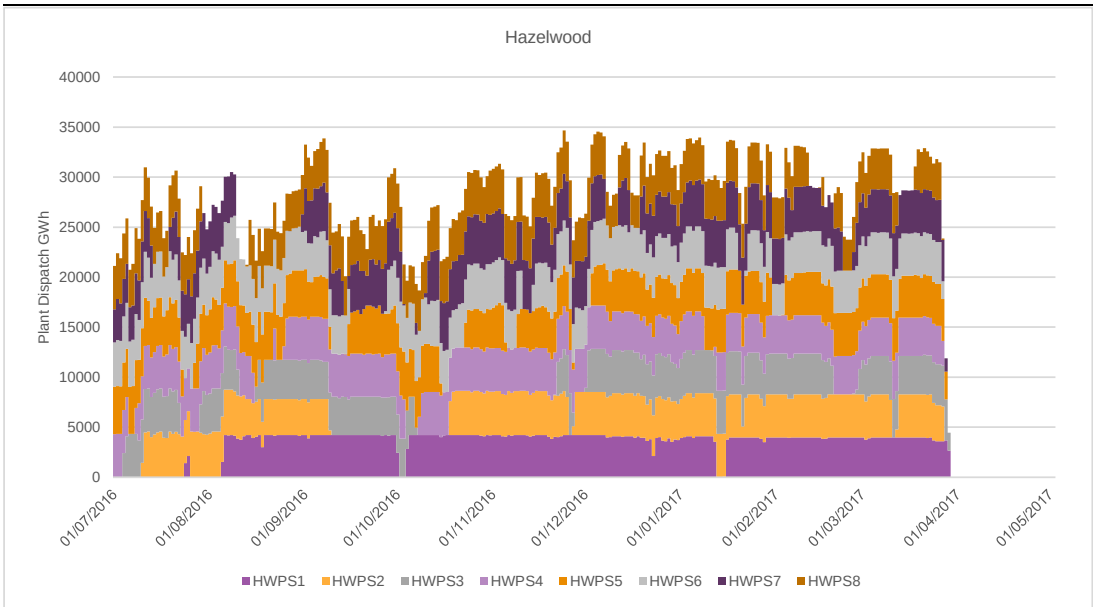
	2010	2011	2012	2013	2014	2015	2016
Valley Power	0.60	0.44	0.13	0.15	0.13	0.06	0.18
Somerton	1.10	0.83	0.24	0.16	0.26	0.04	0.33
Newport	2.84	4.08	2.81	1.77	3.04	2.25	2.43
Laverton North	2.44	2.72	0.03	0.23	0.12	0.11	0.18
Jeeralang	0.72	0.59	0.18	0.42	0.61	0.61	0.93

SOURCE: ACIL ALLEN ANALYSIS OF AEMO DATA

The above history is reasonably consistent with the patterns of generation evident in the Frontier forecast, which found that Newport would be the dominant VTS-connected generator, with Mortlake and Bairnsdale also contributing significantly. The AEMO VGPR forecast shows a major uplift in generation at Newport, but also finds greatly increased dispatch of Laverton North at levels around three times higher than this plant achieved in 2010 and 2011, and more than 20 times higher than its dispatch over the past five years.

The following analysis focusses on generator performance during the current financial year to date (ten months to end-April 2017). This covers the period either side of the closure of Hazelwood on 1 April 2017 which, as shown in **Figure 4.10**, happened fairly abruptly (rather than in a phased manner). GPG activity through January – March 2017 should therefore be interpreted as a response to 'normal' summer demand, rather than a lead-in to the Hazelwood closure.

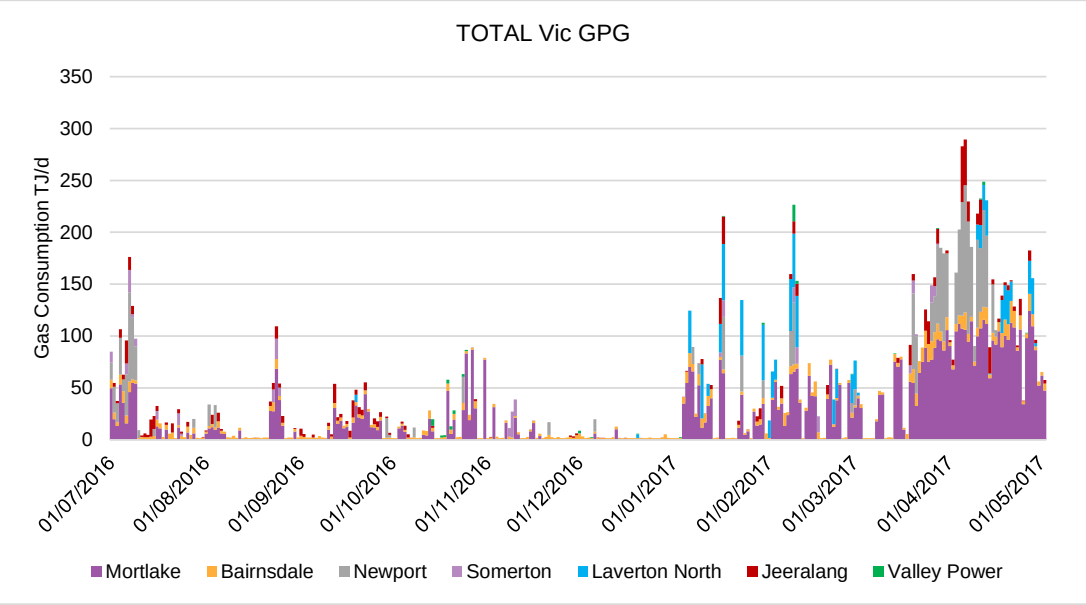
FIGURE 4.10 HAZELWOOD DISPATCH BY UNIT, FINANCIAL YEAR 2016-17



SOURCE: ACIL ALLEN ANALYSIS OF AEMO DATA

Figure 4.11 shows daily gas consumption, by plant, over the same period. It shows that large increases in GPG output following closure of Hazelwood came from Mortlake and Bairnsdale—both of which sit outside the VTS.

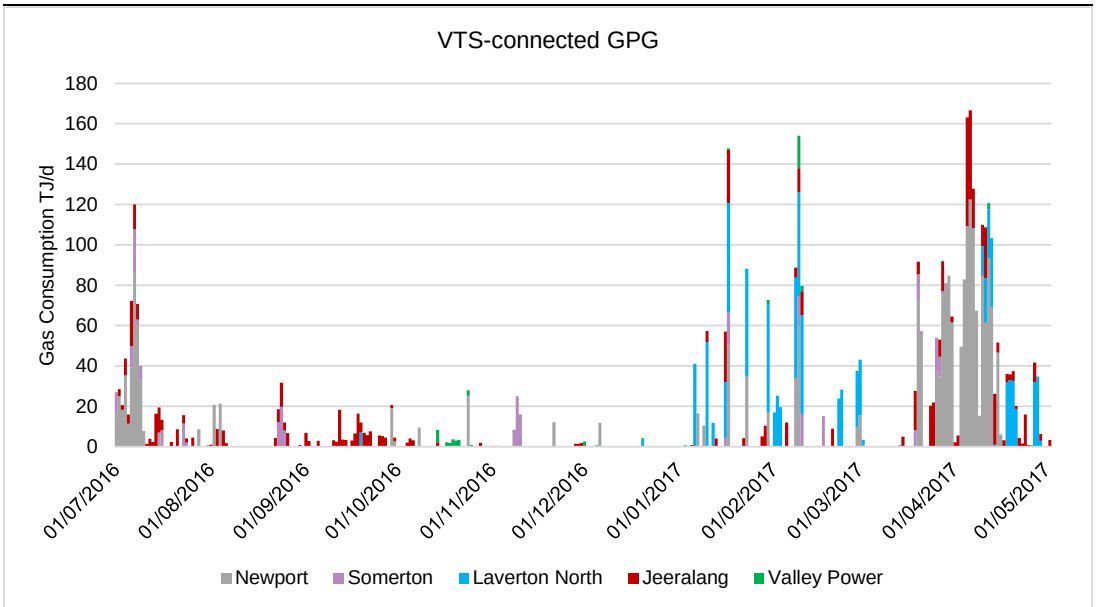
FIGURE 4.11 TOTAL VICTORIAN GPG CONSUMPTION BY PLANT, FY2016-17 (10 MONTHS)



SOURCE: ACIL ALLEN ANALYSIS OF AEMO DATA

Figure 4.12 shows the corresponding daily gas consumption for GPG plant connected to the VTS. It shows that in the first two weeks following Hazelwood closure Newport, and to a lesser extent Jeeralang and Laverton North, increased output. However, through the second half of April these plants cut back dispatch while Mortlake continued to dispatch at relatively high levels. The reduction in Newport dispatch may have been associated with plant maintenance.

FIGURE 4.12 VTS-CONNECTED GPG CONSUMPTION BY PLANT, FY2016-17 (10 MONTHS)



SOURCE: ACIL ALLEN ANALYSIS OF AEMO DATA

Total Victorian GPG consumption for the first ten months of FY2016–17 was about 13.1 PJ of which about 4.2 PJ came from VTS-connected plant. By way of comparison, the AEMO NGFR total Victorian GPG forecast was 20.4 PJ in 2016 and 18.2 PJ in 2017. The AEMO VGPR forecast was 18.8 PJ for the VTS-connected plant alone in 2017. If the level of VTS-connected dispatch remains at the levels seen in April following closure of Hazelwood, then calendar 2017 should see around 14.7 PJ of VTS-connected GPG. Frontier has forecast 15.7 PJ of VTS-connected GPG in 2017.

Conclusions regarding GPG demand forecasts

In comparing the Frontier GPG forecasts with those produced by AEMO for the NGFR (2016) and the VGPR (2017), it is apparent that there are large differences in the forecast levels of gas consumption for Victoria overall, and for the VTS-connected generators. The differences in the forecasts are much larger toward the end of the modelling periods (and therefore toward the end of the forthcoming access arrangement period).

The differences can be attributed to a range of alternative assumptions which, while plausible in each case and for the purposes for which the forecasts were prepared, lead to a wide range in the forecast total GPG consumption. This also reflects the rapidly changing nature of the Victorian and eastern Australian energy markets.

The VTS-connected component of the 2016 NGFR forecast anticipates a spike in consumption during 2017 and 2018, in response to closure of Hazelwood, followed by reversion to much lower levels generally in line with historical dispatch. Frontier also anticipate a spike in 2017, to around 15 PJ/a, but with a reversion to a little over 5 PJ/a in 2018, then declining to less than 1 PJ/a by 2021. These two forecasts are therefore reasonably well aligned.

The 2017 VGPR forecast on the other hand, anticipates much higher levels of consumption. It shows a spike in Victorian GPG consumption during 2017 and 2018, in response to closure of Hazelwood, to around 18 to 20 PJ/a, reverting to about 10 PJ/a by 2021.

The AEMO VGPR forecast sees GPG volumes rising by 2021 to around three times the average level of 3.5 PJ/a observed over the 5-year period 2012 to 2016, while the Frontier forecast sees GPG volumes falling to about one-third of the historical level.

All three forecasts have been prepared by experienced electricity market modellers using well established forecasting methods.

On balance, we think that there are a number of factors that are likely to see GPG taking a relatively constrained peaking role in Victoria in the mid-term. These include increasing levels of renewable energy supported by the RET and VRET schemes; constrained gas supply and consequent rising gas prices, with the prospect of significant declines in gas production from the Bass Strait region within the next five years (as noted by AEMO in the VGPR 2017). While recent initiatives by the Australian government aimed at bolstering domestic gas supply (by potentially restricting some LNG exports) may help to ease these supply/price pressures, we think it unlikely that they will result in a return to abundant low-cost gas that would support strong growth in GPG consumption.

On this basis, ACIL Allen concludes that the modelling approach adopted by Frontier is sound. It results in gas consumption forecasts that are reasonably close to AEMO's forecasts prepared for the latest NGFR, but significantly below the AEMO forecasts prepared for planning purposes in the VGPR. The assumptions that underpin the Frontier modelling were reasonable at the time of the forecast and in our view remain reasonable. In the absence of any major changes in the energy market environment that might necessitate changes to key assumptions prior to the final decision, we consider that the Frontier forecasts of VTS-connected GPG demand that have been adopted by APA are not unreasonable.

4.2.7 Interstate transfer and storage volumes

Table 3-9 of the AAS shows annual and peak demand forecast volumes for the access arrangement period, including volumes for:

— Culcairn (29.6 PJ/a; 57.53 TJ/d peak all years),

— VicHub (zero annual and peak all years)

— UGS/LNG refill (16.08 PJ/a 2018, rising to 16.28 PJ/a each subsequent year; zero contribution to peak).

The same information is presented in Table 4.6 of the AAI.

There is no discussion or justification in either document for these volume assumptions.

APA has confirmed (in response to Information Request IR001) that the labels for Average demand (AVG) and Maximum demand (MAX) in Tables 2.3 and 2.4 in the AAI have been reversed in all instances, with the listed values for AVG demand in all cases higher than the listed values for MAX demand. The following analysis has been made on the basis that the average withdrawal/receipt volumes are in fact those labelled as MAX.

The AAI (Table 2.3) shows that:

— **Culcairn exports** averaging 62.1 TJ/d were expected in 2016 (38.9 TJ/d actual average in 2015). The 2016 estimate is equivalent to 22.7 PJ/a.

— **VicHub exports** of 5.7 TJ/d were expected in 2016 (5.2 TJ/d actual average in 2015). The 2016 estimate is equivalent to 2.1 PJ/a.

— **Port Campbell exports** (Iona refill and SEA Gas) of 21.3 TJ/d were expected in 2016 (30.5 TJ/d actual average in 2015). The 2016 estimate is equivalent to 7.8 PJ/a.

The AAI (Table 2.4) shows that:

— **Culcairn receipts** averaging 8 TJ/d were expected in 2016 (8.7 TJ/d actual average in 2015). The 2016 estimate is equivalent to 2.9 PJ/a.
  – The net difference between expected withdrawals and receipts at Culcairn is therefore 22.7 – 2.9 = 19.8 PJ/a in 2016.

— **VicHub receipts** were not separately identified but were said to be included in Longford receipts.

— **Port Campbell receipts** (Iona and SEA Gas) of 81.1 TJ/d were expected in 2016 (134.5 TJ/d actual average in 2015). The 2016 estimate is equivalent to 29.6 PJ/a.
  – The net difference between expected withdrawals and receipts at Port Campbell was therefore 7.8 – 29.6 = negative 21.8 PJ/a in 2016 (that is, net receipts of 21.8 PJ at Port Campbell).

On the basis of these observations, an Information Request was raised with APA noting that there was no apparent correlation between the historical data on Culcairn & Port Campbell (UGS) withdrawals and receipts set out in the AAI and the forecast volumes for these services set out in the AAS. Information was sought on the basis for the withdrawal volume assumptions shown in Table 3-9 of the Access Arrangement Submission in relation to Culcairn, VicHub and UGS/LNG refill and their reconciliation with the historical data shown in Tables 2-3 and 2-4 of the Access Arrangement Information.

Information was sought as to why the forecast Culcairn annual withdrawal numbers are constant across the Access Arrangement period, given that APA is projecting significant increases in gas flows between the VTS and the NSW transmission system over the forecast period. (APA VTS Australia, 2017b, p. 225)

The information provided by APA in response to the Information Request is summarised in the following sections.

VicHub

The forecast of 0TJ of gas flows out of the VTS at VicHub matches the volumes included in the tariff model, which are used for tariff setting purposes.

The tariff model flows are set at 0TJ as these flows are difficult to forecast and are small (~2PJ/year). For tariff forecasting purposes, the difficulty arises from determining whether flows out of the system are cross system flows (therefore paying cross system tariffs), or are related to injections at Longford, which attract zero tariff. This issue was discussed in respect of the access arrangement approved by the AER for the 2013-17 access arrangement period. AER approved the zero forecasting approach for tariff purposes at VicHub, as set out in the AER's final decision for the 2013-17 access arrangement period, part 2, page 234.

Based on historical flows, it can be expected that flows out of the VTS at VicHub will be approximately 2PJ a year. This corresponds with reported average historic volumes at VicHub (AAI Table 2.3) of 5.7TJ/day in 2016 (2.1PJ).

ACIL Allen agrees that, on the basis of this information, the forecast in relation to flows through VicHub are reasonable.

Iona UGS and LNG refill

Table 3.9 of the Access Arrangement Submission combines volumes for Iona UGS and LNG storage. Individually, the forecasts for each are set out below. These values are also set out in the tariff model, and are those used to determine the tariffs.

TABLE 4.1 STORAGE REFILL VOLUMES

	2018	2019	2020	2021	2022
LNG refill (TJ/a)	2,080.8	2,080.8	2,080.8	2,080.8	2,080.8
Iona UGS refill (TJ/a)	14,000.0	14,200.0	14,200.0	14,200.0	14,200.0

SOURCE: APA RESPONSE TO INFORMATION REQUEST

LNG refill forecast volumes match actual volumes in 2015, which was APA best estimate of future volumes available at the time.

We agree that reliance on actual refill volumes from the most recent record period is appropriate. **We propose that, in order to incorporate the most up to date information into the forecast, APA should be required to update the LNG refill volume forecast based on actual volumes in 2016.**

The Iona UGS refill volumes were estimated from AEMO's modelling of daily withdrawals into the Iona UGS facility set out in Figure 9 of the 2016 VGPR. APA provided a calculation in the form of a spreadsheet file showing estimated withdrawals, and taking account of production plant shutdowns that further limit summer refill capacity. This set of calculations confirmed estimated refill volumes rising from 13 PJ/a in 2017-18 to 14 PJ/a in 2018-19, and to 14.2 PJ/a in subsequent years of the access arrangement period.

After filing the new Access Arrangement documents in January 2017, APA submitted a proposal to the AER to bring forward construction of the Western Outer Ring Main (WORM) Project. This project would provide an alternative route for gas to flow between Port Campbell and the Northern and Gippsland regions, permitting higher refilling rates for UGS, better line pack management including enhanced capacity to meet increased peak GPG demand, and increased security of supply in the event of Longford or Port Campbell outages.

It is outside the scope of this study to assess the merits of the proposal to include the WORM Project in the capital expenditure plans for the 2018 to 2022 access arrangement period. However, we note that a number of submissions in response to the draft access arrangement proposal argued that there would be a need for capacity expansion in the South West Pipeline system, to allow for increased rates of injection into storage at Iona during low-demand summer periods to ensure refill of expanded storage capacity. This need is driven by declining gas production in the Otway Basin region as a result of which more of the gas for refill of Iona UGS will need to be sourced from the Gippsland Basin and delivered to the storage site via the South West Pipeline (SWP).

If approved, the WORM Project should result in increased levels of gas transportation through the VTS for injection into the Iona UGS storage facility.[3] APA's supplementary capital expenditure submission argues that, while construction of the WORM increases capacity of the VTS, it does not drive additional volumes in relation to refill or GPG. We disagree. As APA has noted, declines in Port Campbell production in recent years has meant that 'additional gas volumes have been sourced from the VTS (largely from Longford) putting increasing pressure on capacity in the South West Pipeline to

[3] According to information supplied by APA to AER, Lochard Energy is proposing to increase UGS storage withdrawal capacity at Iona from 390TJ/day to 440TJ/day, and to increase injection capacity from 153TJ/day to 173TJ/day during 2017. Lochard has also indicated that it plans to further increase withdrawal capacity from 440TJ/day to 570TJ/day and refill capacity from 173TJ/day to 250 TJ/day by the end of 2019.

deliver those volumes'.[4] In other words, an increasing proportion of the total volume of gas held in the Iona UGS facility has been sourced from the Gippsland Basin and transported into storage via the VTS. That trend can be expected to continue, resulting in increased volumes of gas being transported into storage via the VTS.

This is confirmed in the latest AEMO VGPR published in March 2017. Figure 18 in that report corresponds to Figure 9 in the 2016 report, showing projected daily withdrawal quantities for the South West Pipeline over the outlook period. The new forecast shows significantly higher flows (up to a maximum of about 138 TJ/d compared to 108 TJ/d in the 2016 VGPR) thereby demonstrating an increased mismatch between anticipated capacity requirements and the current capacity limit on the SWP of around 104 TJ/d. Using values estimated from Figure 18 of the new VGPR, and adopting the same methodology used by APA, ACIL Allen estimates that refill volumes will increase to 16.2 PJ/a in 2018-19, and to 15.4 PJ/a in subsequent years of the access arrangement period.

We propose that APA should be asked to provide revised forecasts of Iona UGS refill volumes, taking into account the new information contained in the AEMO 2017 VGPR.

Culcairn transfers

In response to the AER's Information Request seeking clarification for the assumption that Culcairn transfers will remain steady at 29.6 PJ/a across the next access arrangement period, APA has advised that the forecast for withdrawals at Culcairn is based on expected total annual demand of 29.6 PJ/a made up of existing demand (prior to expansion in the current Access Arrangement period), and expected average utilisation across all shippers contributing to incremental demand.

The base throughput is derived from that accepted by the AER in the earlier access arrangement period as part of the calculations of demand for the original Gas to Culcairn project. Those calculations assumed a base level of throughput of 8PJ/year, with the maximum capacity at Culcairn of 46 TJ/day at the time.

Prior to commencing work on the VNIE project, Culcairn capacity was reduced to 42TJ/day (due to demand growth in Melbourne limiting the export capacity at Culcairn). APA therefore adjusted the base throughput assumption to reflect this reduction by taking 42/46 x 8PJ as the new base (~7.3PJ).

APA advised that it expects the average utilisation of the incremental Culcairn capacity to be approximately 40 per cent, consistent with the average utilisation of incremental capacity across 2015 and 2016. On this basis, incremental demand at Culcairn is expected to be 22.3PJ from 2017 (when the VNIE project will be complete). Adding this to the base capacity delivers a total of 29.6PJ/year from 2017.

The forecast utilisation of incremental capacity of 40 per cent reflects APA's understanding of the mixed uses for the capacity, which range from domestic and industrial demand, to opportunistic gas trading uses (taking advantage of opportunities to trade gas in and out of the DWGM).

APA is not expecting increased gas flows between the VTS and NSW transmission system in the forecast period. It is expected that increases in gas flows that have been experienced across the current access arrangement period will plateau in 2017, which is when the last tranche of new capacity will be completed delivering a total capacity of 200TJ/day.

As discussed in section 4.3.1, Origin Energy has argued that the APA forecast of average daily withdrawals of 80 TJ/day at Culcairn is understated, noting that Culcairn withdrawals over the first two months of 2017 averaged 97 TJ/day, at a time when the maximum withdrawal capacity was only 148 TJ/day. Origin Energy indicated that it expects average flows through Culcairn into New South Wales to be in the order of 150 TJ/day 'once the full capacity of the NSW–Victoria Interconnect is made available'.

The average rate of withdrawal referred to by Origin Energy occurred over January and February 2017—peak summer months for gas-fired power generation in New South Wales. Over the period 1 January to 28 May 2017, the average rate of northbound flow on the NSW–Victoria Interconnect (that is, withdrawals from the VTS at Culcairn) averaged 74.7 TJ/day[5]. Origin's contention regarding higher

[4] (APA VTS, 2017c, p. 10)
[5] Calculation by ACIL Allen using data published by AEMO on the Natural Gas Services Bulletin Board.

average flows once the full capacity of the Interconnect becomes available implicitly assumes that average capacity utilisation levels will increase compared to historical levels. While this possibility cannot be discounted, no evidence has been presented to support such a conclusion. On the other hand, ACIL Allen has observed a general decline in load factors (capacity utilisation) on transmission pipelines across eastern Australia as gas supply has become more "peaky".

On this basis, we consider that the APA forecast for Culcairn transfers is not unreasonable.

4.3 Issues raised in public submissions

4.3.1 Culcairn withdrawals

Origin Energy in its submission (Origin Energy, 2017) considered that the APA forecast of average daily withdrawals of 80 TJ/day at Culcairn appeared to be understated. Origin Energy pointed out that Culcairn withdrawals over the first two months of 2017 averaged 97 TJ/day, at a time when the maximum withdrawal capacity was only 148 TJ/day. Origin Energy states that it 'fully expects average flows through Culcairn into New South Wales to be in the order of 150 TJ/day once the full capacity of the NSW–Victoria Interconnect is made available'.

As discussed in the preceding section, the average rate of withdrawal referred to by Origin Energy occurred over peak summer months (January and February 2017). Over the period 1 January to 28 May 2017, the average rate of withdrawals at Culcairn averaged 74.7 TJ/day which is not inconsistent with the APA forecast. We have seen no evidence to support a conclusion that the average level of utilisation of the expanded capacity of the Interconnect will be higher than in the past.

4.3.2 Forecast use of gas for power generation

A number of submissions questioned the APA forecasts of gas use for power generation (GPG). For example, Origin Energy noted that 'The forecasts (developed by Frontier Economics) are generally lower than the AEMO 'weak VTS demand' scenario, principally post 2020.' (Origin Energy, 2017). The Consumer Challenge Panel (Consumer Challenge Panel, 2017) also commented on differences between the APA/Frontier and AEMO forecasts, and noted the importance of the forecasts as a driver of capital expenditure. AEMO (AEMO, 2017b) also noted that there have been some material changes in recent months impacting on GPG forecasts.

We have considered the various GPG forecasts in detail in section 4.2.6, and have concluded that the modelling approach adopted by Frontier is sound. It results in gas consumption forecasts that are reasonably close to AEMO's forecasts prepared for the latest NGFR, but significantly below the AEMO forecasts prepared for planning purposes in the VGPR.

4.3.3 Impacts of the Victorian Renewable Energy Target (VRET) Scheme

The Consumer Challenge Panel (Consumer Challenge Panel, 2017) noted that there are differences between APA forecasts and Victorian Government forecasts as to the longer term impact that VRET will have on demand forecasts.

The Frontier modelling assumptions explicitly include a VRET target of about 1,800 MW to 2020 which will be a contribution to the Australian Government RET scheme (not additional) plus a further 3,600 MW of additional renewables in Victoria from 2021 to 2025. This is in accordance with announced Victorian government policy.

We consider that the VRET Scheme has been appropriately taken into account in the Frontier modelling.

4.3.4 APA forecasts for Tariff V residential gas use

The Consumer Challenge Panel (Consumer Challenge Panel, 2017) questioned why APA has chosen to use distribution business forecasts as the basis for its forecasts for Tariff V residential gas use, rather than AEMO forecasts, stating that 'AEMO forecasts are more generally used as they are independent of any business.'

APA explains this choice as follows:

'APA VTS considers that these gas distribution businesses have the closest relationship with the customers they serve, and accordingly has adopted the distributors' forecasts for Tariff-V customers [for] the access arrangement period.'

(APA VTS Australia, 2017b, p. 31)

ACIL Allen considers that use of the distribution business forecasts (as amended following scrutiny by ourselves and AER) is reasonable and appropriate. The AEMO forecasts for the National Gas Forecasting Report are prepared in the context of a high-level forecast covering the whole of eastern and southern Australia. While AEMO draws on reasonably detailed information to prepare its forecasts of residential gas use, it does not have access to the same level of detailed data that is available to the distribution businesses and their advisors in relation to each of the specific businesses and its component parts. A further advantage of using the distribution business forecasts is that it should avoid any potential misalignment between the APA forecasts of residential gas use and the corresponding aggregate forecasts of the distribution businesses.

APA has used AEMO forecasts of gas consumption in the industrial sector, rather than the distribution businesses forecasts of Tariff D (Industrial) demand. We consider this to be appropriate because some large industrial consumers may be directly connected to the transmission system, in which case they would not be captured by the distribution business forecasts.

4.3.5 South West Pipeline capacity expansion

A number of submissions (for example (AEMO, 2017b), (Lochard Energy, 2017)) argued that the APA Access Arrangement as originally submitted did not make sufficient provision for expansion of the South West Pipeline to allow increased rates of refill of the Iona UGS facility.

Subsequent to filing the new Access Arrangement materials in January 2017, APA submitted a proposal to bring forward construction of the WORM project which would provide an alternative route for gas to flow between Port Campbell and the Northern and Gippsland regions, permitting higher refilling rates for UGS, better line pack management including enhanced capacity to meet increased peak GPG demand, and increased security of supply in the event of Longford or Port Campbell outages.

This proposal should address the concerns raised by AEMO, Lochard Energy and others in relation to capacity on the South West Pipeline.

5 CONCLUSIONS

The APA transmission pipeline network performs the following functions:

- high pressure transportation of gas for delivery into the low-pressure gas distribution systems servicing the Victorian retail mass market (residential, commercial and industrial customers)
- delivery of gas to some (but not all) Victorian gas-fired power generators
- transfer of gas to and from the Iona Underground Gas Storage facility and the Dandenong LNG gas storage facility which are critical to peak load management in the Victorian gas supply system
- cross-system transfers of gas to interstate markets via the NSW-Victoria Interconnect and VicHub.

Rather than prepare its own independent forecasts of residential and commercial (Tariff V) gas demand, or using the corresponding forecasts prepared by AEMO in the context of the National Gas Forecasting Report, APA has elected to rely on the final demand forecasts approved for the distribution businesses. APA argues that these forecasts provide the best measure of the Tariff V load going forward.

With regard to gas use by industrial customers, APA proposes to use the AEMO forecasts for Tariff D demand, adopting the AEMO's "weak" forecast of industrial demand from the 2016 National Gas Forecasting Report,

The only service lines for which APA presents independent forecasts are, therefore:

- GPG
- Transfer of gas into and out of storage at the Iona UGS and Dandenong LNG facilities
- Interstate transfers of gas that involve movement of gas across the VTS.

5.1 Assessment

5.1.1 Residential and commercial demand

Because APA proposes to rely on the final (approved) forecasts of Tariff V residential and commercial demand prepared by the distribution businesses for the upcoming access arrangement period, we do not consider residential and commercial demand forecasts in this report.

5.1.2 Industrial demand

APA adopts the AEMO 'Weak' forecast for industrial demand in light of the fact that the 2016 NGFR identifies a number of negative drivers for industrial gas demand (rising prices, tight supply) which 'do not appear to have been reflected in [AEMO's] forecast of industrial gas demand' (APA VTS Australia, 2017b, p. 33).

AEMO's 2016 NGFR forecasts for Victorian industrial demand show an average annual decline over the period 2018 – 2022 of 1.3 per cent for the Neutral scenario and 1.9 per cent for the Weak scenario, both well below the actual rate of decline over the past two years.

Given the considerable uncertainties facing industrial gas users in Victoria, our view is that the AEMO Weak scenario is at least as likely to materialise as the Neutral scenario and there is no clear basis for requiring APA to adopt the higher forecast.

5.1.3 Gas-fired power generation

The VTS serves the following gas-fired generators:

- Newport
- Somerton
- Jeeralang A
- Jeeralang B
- Valley Power
- Laverton North

There are two large NEM-participant gas-fired generators located in Victoria that are not connected to or reliant on the VTS for gas delivery, namely Mortlake and Bairnsdale.

APA has adopted forecasts of gas demand for power generation prepared by Frontier for purposes of the access arrangement. Frontier has prepared forecasts both with and without assumed re-introduction of a carbon pricing mechanism.

We have considered alternative forecasts of gas consumption in generators connected to the VTS:

- **AEMO NGFR 2016.** The NGFR does not provide information that enables consumption by the VTS-connected generators to be separated from the total forecast. However AEMO has provided the AER, in confidence, with a disaggregation of the 2016 NGFR gas-consumption for power generation modelling results that has enabled us to identify the VTS-connected component of the forecast. The VTS-connected component of the AEMO NGFR forecast follows a generally similar path to the corresponding Frontier forecast and, like Frontier, falls to very low levels over the period 2020 to 2022.
- **AEMO VGRP 2017.** The 2017 VGPR forecast anticipates much higher levels of consumption. It anticipates a spike in Victorian GPG consumption to around 18 to 20 PJ/a during 2017 and 2018, in response to closure of Hazelwood, reverting to about 10 PJ/a by 2021.

On balance, we think that there are a number of factors that are likely to see GPG taking a relatively constrained peaking role in Victoria in the mid-term. These include increasing levels of renewable energy supported by the RET and VRET schemes; constrained gas supply and consequent rising gas prices, with the prospect of significant declines in gas production from the Bass Strait region within the next five years (as noted by AEMO in the VGPR 2017). While recent initiatives by the Australian government aimed at bolstering domestic gas supply by potentially restricting some LNG exports may help to ease these supply/price pressures, we think it unlikely that they will result in a return to abundant low-cost gas that would support strong growth in GPG consumption.

On this basis, ACIL Allen concludes that the modelling approach adopted by Frontier is this sound. It results in gas consumption forecasts that are reasonably close to AEMO's forecasts prepared for the latest NGFR, but significantly below the AEMO forecasts prepared for planning purposes in the VGPR. The assumptions that underpin the Frontier modelling are reasonable and take into account recent market developments, including the closure of Hazelwood coal-fired power station. In the absence of any major changes in the energy market environment that might necessitate changes to key assumptions prior to the final decision, we consider that the Frontier forecasts of VTS-connected GPG demand that have been adopted by APA are not unreasonable.

5.1.4 Interstate transfers and storage

VicHub

Based on historical performance, flows out of the VTS at VicHub are forecast to be approximately 2PJ a year. This corresponds with reported average historical volumes at VicHub of 5.7TJ/day in 2016 (2.1PJ). ACIL Allen considers this forecast to be reasonable.

Culcairn withdrawals

The forecast for withdrawals at Culcairn is based on expected total annual demand of 29.6 PJ/a made up of existing demand (prior to expansion in the current Access Arrangement period) and expected average utilisation across all shippers contributing to incremental demand using the expansion capacity.

Current base capacity is about 7.3 PJ/a. APA expects average utilisation of the incremental Culcairn capacity added by the VNIE expansion project to be approximately 40 per cent, consistent with the average utilisation of incremental capacity across 2015 and 2016. On this basis, total withdrawals at Culcairn are expected to be 29.6 PJ (about 81 TJ/day on average) from 2017 when the VNIE project is complete.

Origin Energy argued in a submission on the APA forecasts that the forecast for withdrawals at Culcairn is too low. It noted that Culcairn withdrawals over the first two months of 2017 averaged 97 TJ/day. Origin Energy indicated that it expects average flows through Culcairn into New South Wales to be in the order of 150 TJ/day 'once the full capacity of the NSW–Victoria Interconnect is made available'. In considering this submission we note that the average rate of withdrawal referred to by Origin Energy occurred over January and February 2017—peak summer months for gas-fired power generation in New South Wales. Over the first five months of 2017, withdrawals from the VTS at Culcairn averaged 74.7 TJ/day. Origin's contention regarding higher average flows once the full capacity of the Interconnect becomes available implicitly assumes that average capacity utilisation levels will increase compared to historical levels. While this possibility cannot be discounted, no evidence has been presented to support this conclusion. On the other hand, ACIL Allen has observed a general decline in load factors (capacity utilisation) on transmission pipelines across eastern Australia as gas supply has become more "peaky".

On this basis, we consider that the APA forecast for Culcairn transfers is not unreasonable.

LNG storage refill

LNG refill forecast volumes match actual volumes in 2015 (about 2.1 PJ/a), which was APA's best estimate of future volumes available at the time.

Iona UGS refill

The APA Access Arrangement includes estimates of Iona UGS refill volumes that were estimated from AEMO's modelling of daily withdrawals into the Iona UGS facility set out in the 2016 Victorian Gas Planning Report (VGPR). Based on this information, APA estimated refill volumes rising from 13 PJ/a in 2017-18 to 14 PJ/a in 2018-19, and to 14.2 PJ/a in subsequent years of the access arrangement period.

A number of submissions argued that the APA Access Arrangement as originally submitted did not make sufficient provision for expansion of the South West Pipeline to allow increased rates of refill of the Iona Underground Gas Storage facility. Declining production from the Otway Basin at Port Campbell means that an increasing proportion of the gas required to refill Iona UGS in summer is being sourced from the Gippsland Basin and transported via the VTS. APA has submitted a supplementary proposal to the AER to bring forward construction of the WORM Project which should address these concerns.

The WORM Project would support increased levels of gas transportation through the VTS for injection into the Iona UGS storage facility. The latest AEMO VGPR, published in March 2017 shows significantly higher withdrawals from the South West Pipeline into storage than were anticipated in the 2016 VGPR. Based on this information, ACIL Allen estimates that refill volumes from the VTS will

increase to 16.2 PJ/a in 2018-19, and to 15.4 PJ/a in subsequent years of the access arrangement period.

We propose that APA should be asked to provide revised forecasts of Iona UGS refill volumes, taking into account the new information contained in the AEMO 2017 VGPR.

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