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# Amadeus Gas Pipeline

## Access Arrangement Revision Proposal

## Submission

August 2015

# Contents

# Executive Summary

APT Pipelines (NT) Pty Limited's (APTNT) is required to submit proposed revisions to the full access arrangement applying to the Amadeus Gas Pipeline (AGP) by 4 August 2015.

The pipeline system consists of the mainline or system backbone and comprises four gas inlet stations (Palm Valley, Mereenie, Ban Ban Springs and Weddell), a compressor station (Warrego), one odorant station (Tylers Pass), eleven mainline valves, eleven scraper stations and fourteen offtakes. The AGP is approximately 1,629 kilometres in length, including the Mereenie spurline, Tennant Creek and Katherine laterals, and the Pine Creek outlet.

This submission provides supporting information for APTNT's proposed revisions of the access arrangement for the AGP to apply for five years from 1 July 2016. This submission accompanies APTNT's proposed revised Access Arrangement and Access Arrangement Information, and should be read in conjunction with those documents. This document also addresses relevant requirements of the Regulatory Information Notice under the National Gas Law (NGL) served on APTNT by the Australian Energy Regulator (AER) on 2 June 2015.

*Context for the review*

Very significant changes to this pipeline and its operating environment occurred towards the end of the first access arrangement period (2009/10 and 2010/11). These included the change in predominant gas source for the pipeline, transfer of full ownership of the pipeline to APA Group, and the renegotiation of the long term transportation agreement on the pipeline involving all firm capacity of the pipeline. The earlier access arrangement period (1 August 2011 to 30 June 2016) has involved the bedding down of many of these new arrangements, and a significant capital works program.

While these are significant operational changes for the pipeline, the underlying contractual/commercial arrangements for the pipeline, where firm capacity is fully committed to a foundation pipeline user, remains a constant since the pipeline was first built. This access arrangement period therefore reflects a transition to a renewed period of stable commercial and operating conditions, where most of the necessary integrity works for the pipeline are now complete, and the contractual arrangements for the pipeline are well established.

One potential area for change for the AGP during the access arrangement period is the possible connection to the south eastern gas market through the mooted North East Gas Interconnector (NEGI). APTNT expects to accommodate the potential connection of the NEGI to the AGP during the access arrangement period through the extensions and expansions policy set out in the prevailing Access Arrangement. Using the extensions

and expansion policy gives the AER appropriate oversight of the extension or expansion, while also addressing any uncertainty that may exist over future projects at the time of the regulatory decision.

*Demand*

Total gas demand on the AGP is expected to grow by 1.7 per cent per year over the access arrangement period. This forecast has been derived from the combined forecast of each delivery point on the pipeline, taking account of the specific demand characteristics of each delivery point.

Pipeline capacity increased with the connection of the Bonaparte Gas Pipeline and change in the flow of gas on the pipeline. Pipeline capacity is now expected to be 120TJ/day (notional value). Utilisation of capacity over the period is expected to grow from 59 per cent in 2016/17 to 63 per cent in 2020/21, while at the same time the full capacity of the pipeline is expected to be contracted on a firm basis to a single user on the pipeline.

*Capital expenditure in the earlier period*

Capital expenditure in the earlier access arrangement period was $44.8 million, compared with an AER approved amount of $23.4 million ($2015/16).

Key drivers for this difference were realised costs associated with the enhanced integrity program of works, compared with that approved by the AER. APTNT had sought to revise its forecast for these works following submission of its original proposal in December 2010, however the AER did not accept these revised forecasts in its final decision due (in part) to the timing of APTNT's advice during the process.

*Building Block revenue proposal*

APTNT's forecast capital and operating expenditure over the access arrangement period are set out in Table 0.1 and in chapter 6 and chapter 9 of this submission.

***Table 0.1 – Forecast capital and operating expenditures over the access arrangement period***

| $ '000 (2015/16) | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | Total |
|---|---|---|---|---|---|---|
| Capital expenditure | 20,341 | 2,546 | 2,265 | 2,339 | 2,434 | **29,924** |
| Operating expenditure | 11,925 | 12,905 | 13,859 | 11,808 | 12,299 | **62,797** |

Forecast **capital expenditure** for the access arrangement period is $29.9 million. APTNT's forecast capital expenditure is expected to decline in the access arrangement period in 2017/18 to a stable capital expenditure profile of between $2 million and $3 million per year. The expenditure spike in 2016/17 has contributions from two projects

that are continuing from the previous period: the Channel Island Bridge Project and Below Ground Station Recoating – stage 2. One further contributor to higher 2016/17 expenditure is the Building Modifications project.

Total forecast operating expenditure for the access arrangement period is $62.8 million. This amount has been derived by application of the base year methodology to 2014/15 expenditure. The only adjustment applied has been to take account of pigging expenditure, which represents a large and 'lumpy' operating expenditure, and is not suited to the base year methodology that assumes a relatively constant annual expenditure profile. It also includes debt raising costs.

Labour components of both capital and operating expenditure have been escalated using real cost escalators.

The allowed **rate of return** has been calculated as the weighted average of a return on equity and a return on debt, determined on a nominal vanilla basis. Consistent with the requirements of Rule 87, APTNT has had regard to the results of a range of recognised financial models in determining the return on equity. These models have produced an estimated cost of equity of 9.2 per cent. APTNT has also had regard to a number of approaches for determining the cost of debt, which has resulted in an estimated cost of debt of 7.7 per cent. Applying a 60 per cent gearing ratio results in a vanilla Weighted Average Cost of Capital (WACC) of 8.3 per cent.

Other elements of the proposal include:

- A capital base rolled forward in accordance with the roll forward model provided at Attachment B, yielding an opening capital base for the access arrangement period of $120.6 million ($nominal);
- A Tax Asset Base (TAB) derived using the opening TAB in the earlier access arrangement period, and rolling it forward using actual capital expenditure;
- Depreciation calculated by applying the remaining economic life of assets over the opening capital base value as at 1 July 2016, and forecast expenditure using straight line depreciation.

*Revenue requirement*

APTNT's proposed revenue requirement and X-factors are shown in Table 0.2. The revenue requirement is translated into a price path in a CPI-X format.

***Table 0.2 – Forecast revenue requirement and X-factors ($nominal)***

| $'000 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 |
|---|---|---|---|---|---|
| AGP Building block revenue requirement | 25,192 | 28,167 | 29,883 | 28,329 | 28,256 |
| Smoothed revenue requirement | 25,677 | 26,812 | 27,998 | 29,238 | 30,535 |
| X-factors | 0 | 0 | 0 | 0 | 0 |

APTNT proposes to retain the pipeline services offered under the earlier access arrangement, being a firm 'any direction' capacity based service, and two negotiated services, being an interruptible service and a negotiated service. The firm service specified as a Reference Service. The Reference tariff for the Firm service in 2016/17 is $0.6896/GJ of Delivery Point MDQ.

APTNT proposes only limited changes to the current non-price terms and conditions included in the access arrangement, as these were subject to comprehensive revision as part of the last review process, and are largely fit-for-purpose. Some revisions are proposed to the terms and conditions included with the access arrangement, to ensure ongoing alignment with APA Group's standard form contracting arrangements.

APTNT proposes a five year access arrangement period, with a review submission date falling four years after the start of the access arrangement period.

# Abbreviations

| | |
|---|---|
| AA | Access Arrangement |
| ABDP | Amadeus Basin to Darwin Pipeline |
| ABS | Australian Bureau of Statistics |
| AC | Alternate Current |
| ACCC | Australian Competition and Consumer Commission |
| ACN | Australian Company Number |
| AER | Australian Energy Regulator |
| AGP | Amadeus Gas Pipeline |
| AMP | Asset Management Plan |
| APA | APA Group |
| APTNT | APT Pipelines (NT) Pty Limited |
| AS | Australian Standard |
| CAPM | Capital Asset Pricing Model |
| CP | Cathodic Protection |
| CPI | Consumer Price Index |
| Cth | Commonwealth |
| DCVG | Direct Current Voltage Gradient |
| FEED | Front End Engineering and Design |
| GDP | Gross Domestic Product |
| GIS | Geospatial Information System |
| GJ | Gigajoule |
| IT | Information Technology |
| km | kilometres |
| KP | Kilometre Point |
| LNG | Liquefied Natural Gas |
| MAOP | Maximum Allowable Operating Pressure |
| MDQ | Maximum Daily Quantity |
| MRP | Market Risk Premium |
| MS | Meter Station |
| MS | Meter Station |
| Mt | Mount |

| | |
|---|---|
| National Gas Code | National Third Party Access Code for Natural Gas Pipeline Systems |
| NEGI | North East Gas Interconnector |
| NGL | National Gas Law |
| NGR | National Gas Rules |
| NT | Northern Territory |
| NT Gas | NT Gas Pty Limited |
| PMP | Pipeline Management Plan |
| PRS | Pressure Reduction Station |
| PTRM | Post Tax Revenue Model |
| PWC | Power and Water Corporation |
| RFM | Roll Forward Model |
| RIN | Regulatory Information Notice |
| RTU | Remote Terminal Unit |
| SA | South Australia |
| SCADA | Supervisory Control and Data Acquisition |
| TAB | Tax Asset Base |
| TJ | Terajoule |
| WACC | Weighted Average Cost of Capital |

# 1 Introduction

## 1.1 Purpose of this submission

This submission provides supporting information for APT Pipelines (NT) Pty Limited's (APTNT) proposed revisions to the Access Arrangement to the Amadeus Gas Pipeline (AGP) from 1 July 2016.[1]

In accordance with the requirements of section 132 of the National Gas Law (NGL) and section 43(1) of the National Gas Rules (NGR)[2], APTNT has provided to the Australian Energy Regulator (AER) with this submission:

- Revisions to the access arrangement applying in respect of the AGP; and
- An Access Arrangement Information document.

Together these documents make APTNT's access arrangement revision proposal.

## 1.2 Layout of this submission

Subsequent sections and chapters of this submission incorporate detailed information supporting the access arrangement proposal and access arrangement information, set out as follows:

- The remainder of this Chapter 1 outlines the history of the pipeline and describes the operations of the service provider and context for the access arrangement revision proposal;
- Chapter 2 specifies the services offered and non-price terms and conditions under the access arrangement;
- Chapter 3 discusses pipeline demand and utilisation during the earlier access arrangement period and forecast demand over the access arrangement period;
- Chapter 4 sets out capital expenditure governance processes, capital expenditure undertaken and to be undertaken during the earlier access arrangement period, and the justification and forecast cost of capital projects during the access arrangement period;
- Chapter 5 outlines the derivation of the opening capital base of the AGP from which a return on and of capital are calculated;

[1] Throughout this submission, the service provider is referred to consistently as APTNT. These references should be taken to include references to the former service provider, NT Gas, where relevant.

[2] Hereinafter, a reference to a Rule shall, unless otherwise specified, be understood to refer to a Rule of the National Gas Rules 2008 version 27.

- Chapter 6 explains the parameters of the capital asset pricing model proposed for calculation of the weighted average cost of capital for the rate of return during the access arrangement period;
- Chapter 7 explains the derivation of operating and maintenance costs;
- Chapter 8 calculates the total revenue to be derived from the pipeline;
- Chapter 9 explains the basis and derivation of the reference tariff, including cost allocation and the tariff variation mechanism; and
- Attachments contain explanatory and supporting material required by the Regulatory Information Notice or referred to in the text.

## 1.3 Requirements for access arrangement revision proposal

### 1.3.1 Information required by the National Gas Law and Rules

The NGL and NGR set out detailed requirements for information to be included in an access arrangement revision proposal and associated access arrangement information. Where relevant, these requirements are referenced throughout this submission. APTNT has also provided an Index at Attachment A of this submission which includes guidance on where requirements under the NGR can be found in the revision proposal.

### 1.3.2 Information required by Regulatory Information Notice

On 2 June 2015, the AER served on APTNT a Regulatory Information Notice (RIN) under Division 4 of Part 1 of Chapter 2 of the NGL. The RIN specifies information to be provided to the AER by APTNT in its access arrangement revision proposal, and the form of that information.

This submission, along with the access arrangement proposal and access arrangement information, provides information in satisfaction of the requirements placed on APTNT in the RIN.

The RIN also requires that APTNT submit to the AER an Index of Information outlining where the information to be provided under the RIN is contained in the access arrangement revision proposal. This Index of Information can be found at Attachment A to this submission.

### 1.3.3 Basis of information in the access arrangement revision proposal

Rule 73 states that:

(a) Financial information must be provided on:

(i) a nominal basis

(ii) a real basis

(iii) some other recognised basis for dealing with the effects of inflation.

(b) The basis on which financial information is provided must be stated in the access arrangement information.

(c) All financial information must be provided, and all calculations made, consistently on the same basis.

Unless otherwise stated, all information in the access arrangement revision proposal is provided in real 2015/16 dollars. Nominal values are brought to this basis using the Consumer Price Index (CPI) all groups, eight capital cities average June over June published by the Australian Bureau of Statistics (ABS) up to June 2015 (most recent CPI data available) and then using an annual forecast CPI of 2.5 per cent thereafter.

Forecast inflation for the access arrangement period for the financial modelling is 2.5 per cent.

Units used in the access arrangement revision proposal are noted throughout and described in the abbreviation list at page 9 of this submission.

The access arrangement revision proposal uses the convention established in the NGR of referring to the *access arrangement period*, being for the AGP the period in which the revised access arrangement will apply (proposed to be the period between 1 July 2016 and 30 June 2021), and the *earlier access arrangement period*, being the period 1 August 2011 to 30 June 2016.

## 1.4 Pipeline construction, ownership and regulatory history

### 1.4.1 Development and construction of the pipeline

In the mid-1960s natural gas was discovered at the Amadeus Basin, near Alice Springs, in both the Palm Valley and Mereenie fields. These discoveries, while significant, remained undeveloped due to the inaccessibility of markets for such remote reserves. In September 1983 gas for base load electricity generation was first produced and

delivered to the Power and Water Corporation (PWC)[3] at Alice Springs, 150 kilometres from the Palm Valley gas field[4].

In 1984 the Northern Territory (NT) Government began construction of a new coal fired power station on Channel Island some 42 kilometres from the city of Darwin. During the course of constructing the power station, the NT Government, after conducting a feasibility study of the gas reserves in the Amadeus Basin and assessing the economics of hauling natural gas to Darwin via pipeline, committed both the Channel Island and Katherine power stations to be fuelled by natural gas.

N.T. Gas Pty Limited (NT Gas) was formed from a consortium of companies to finance, construct, commission and operate the then called Amadeus Basin to Darwin Pipeline (ABDP). The pipeline was commissioned in December 1986 and first gas delivered to PWC in January 1987.

Between the commissioning of the AGP and the start of the earlier access arrangement period (August 2011) a number of lateral pipelines were constructed to interconnect with the AGP[5], including the:

- Cosmo Howley pipeline which was commissioned in 1988 and gas supplied to fuel the power station at the Cosmo Howley mine. In 2004/05 the power station ceased electricity generation. The Cosmo Howley pipeline was decommissioned in 2008;
- Elliott pipeline, which was commissioned in 1989 and gas supplied to fuel the power station at the Elliott township;
- Manton pipeline, which was commissioned in 1989 and gas supplied to fuel the temporary power station at Manton. The power station ceased electricity generation prior to 2001;
- McArthur River pipeline, which was commissioned in February 1995 and gas was supplied to fuel the power station at the McArthur River mine;
- Darwin City Gate to Berrimah pipeline, which was commissioned and gas supplied to commercial and industrial users in the Darwin environs in January 1996;
- Mt Todd pipeline, which was commissioned in October 1996 and gas supplied to fuel the power station at the Mount Todd mine. In November 1997 mining operations were suspended at the mine after the mine owner Pegasus Gold Australia Pty Limited became insolvent forcing the pipeline infrastructure out of service. The Mt Todd lateral is now idle;
- Weddell lateral, supplies gas to the Weddell Power Station. This point also became a potential supply point in 2009 with the construction of the Wickham Point Spurline,

[3] Then known as the Northern Territory Electricity Commission.
[4] Gas is delivered to Alice Springs through the Palm Valley to Alice Springs Pipeline, which is owned by Australian Gas Networks.
[5] Not all of these pipelines form part of the AGP for the purposes of this access arrangement.

which allows the delivery point to operate as emergency supply to the AGP if required, with gas coming from the Bayu Undan gas fields; and

- An additional supply point at Ban Ban Springs was added to the pipeline in 2008, bringing gas from the Blacktip Gas Field via the Bonaparte Gas Pipeline.

### 1.4.2 Ownership and operation of the pipeline

APA Group, through its subsidiary APTNT, became the sole owner of the AGP in mid-2011.

Since 1986, the Amadeus Gas Trust had leased the pipeline from a consortium of financial institutions, and NT Gas as trustee for the Amadeus Gas Trust, managed and operated the pipeline. APA held a 96 per cent interest in NT Gas and the Amadeus Gas Trust, and acquired the pipeline and associated assets at the end of the lease.

APTNT is both the owner and operator of the AGP. APTNT (ACN 075 733 336) is a legal entity registered under the Corporations Act 2001 of the Commonwealth.

### 1.4.3 Coverage and regulatory background of the pipeline

*Regulatory history*

In 1998, the relevant Commonwealth minister certified the *National Third Party Access Code for Natural Gas Pipeline Systems* (the National Gas Code) as an effective access regime for the state of South Australia (SA) under section 44N of the *then Trade Practices Act 1974* (Cth), effective for 15 years. The National Gas Code was made law in SA under the *Gas Pipeline Access (South Australia) Act 1997* (SA) and formed schedule 2 to that Act.

The National Gas Code was given application in the NT under the *Gas Pipeline Access (Northern Territory) Act 1998* (NT) and was separately certified for the NT by the relevant Commonwealth minister in October 2001 (effective for 15 years). The AGP was included in a schedule to the National Gas Code listing pipelines and networks covered from the commencement of the Code.

On 26 March 2003, the then regulator for gas transmission pipelines under the National Gas Code (other than in Western Australia), the Australian Competition and Consumer Commission (ACCC), approved the first access arrangement, intended to apply to the AGP for the period 1 July 2001 to 30 June 2011. The Access Arrangement established an Initial Capital Base of $228.5 million ($nominal) as at 1 July 2001, and approved accelerated depreciation for the pipeline over the access arrangement period to the residual value of the leased pipeline assets of $61.84 million ($nominal) in July 2011. This access arrangement continued to apply until 31 July 2011 (one month later than the intended revisions commencement date in the first access arrangement).

The earlier access arrangement was submitted under the NGL and NGR, which replaced the former Gas Pipelines Access law and National Gas Code in 2008. Consistent with the change legislation, the earlier access arrangement included significant revisions to reflect changes in law, rules and terminology.

*Late start date for the earlier access arrangement*

The earlier access arrangement covers the period 1 August 2011 to 30 June 2016.

It should be noted that the access arrangement approved to apply from 1 August 2011 was not adjusted in any way to reflect the later start date of the access arrangement. This means that approved capital and operating expenditure allowances for the earlier period, and total revenue, relate to the period 1 August 2011 to 30 June 2016.

Since 2011, there have been some changes to the NGR related mainly to the rules for setting the regulated cost of capital, however these do not warrant the same wholesale revision of the access arrangement as required in respect of the earlier access arrangement. Where relevant, new and revised rules, and their implications for the access arrangement revision process, are noted throughout this submission.

## 1.5 Pipeline overview and context for the access arrangement revision proposal

### 1.5.1 Pipeline system characteristics

The pipeline system consists of the mainline or system backbone and comprises four gas inlet stations (Palm Valley, Mereenie, Ban Ban Springs and Weddell), a compressor station (Warrego), one odorant station (Tylers Pass), eleven mainline valves, eleven scraper stations and fourteen offtakes. The AGP is approximately 1,629 kilometres in length, including the Mereenie spurline, Tennant Creek and Katherine laterals, and the Pine Creek outlet.

*Supply points*

The Palm Valley Joint Venture supplies the gas received at the Palm Valley inlet station from their gas treatment plant, while the Mereenie Joint Venture supplied gas received at the Mereenie inlet station from their gas treatment plant. An odorant plant is located at Tylers Pass where the Mereenie spurline joins the AGP.

The Weddell delivery point supplies gas to the Weddell Power Station near Darwin. The commissioning of the Wickham Point Spurline in 2009[6], connecting the Conoco Phillips Darwin Liquefied Natural Gas (LNG) facility with the Weddell lateral, means that this

[6] The Wickham Point spurline and Weddell lateral are not part of the covered pipeline.

delivery point can operate as emergency supply to the AGP if required, with gas coming from the Bayu Undan gas fields.

The Bonaparte Gas Pipeline[7] joins the AGP at Ban Ban Springs, bringing gas supplied by Eni Australia B.V. from the Blacktip gas field. Gas is received at the Ban Ban Springs inlet station from the onshore processing plant at Wadeye via the Bonaparte Gas Pipeline. Gas started to be supplied into the AGP at the Ban Ban Springs supply point in 2009.

*Delivery points and laterals*

The AGP has fourteen delivery points along its length that received gas during the earlier access arrangement period, connected to laterals serving various markets. The delivery points and laterals they service are set out in Table 1.1 below. The Townend Road delivery point is a new delivery point added during the earlier access arrangement period.

***Table 1.1 – Delivery points and laterals on the Amadeus Gas Pipeline***

| Delivery point | Lateral/Pipeline | Additional details |
|---|---|---|
| Alice Springs | Interconnect station to supply the Palm Valley to Alice Springs Lateral Pipeline* | |
| Tennant Creek | Tennant Creek Lateral Pipeline | |
| Elliott | Elliott Lateral Pipeline* | |
| Daly Waters | McArthur River Mine Lateral Pipeline* | |
| Mataranka | Mataranka Lateral Pipeline*. | Low pressure plastic |
| Katherine | Katherine Lateral Pipeline | |
| Mt Todd | Mount Todd Lateral Pipeline* | Suspended |
| Pine Creek | Pine Creek meter station | |
| Cosmo Howley | Cosmo Howley Lateral Pipeline* | Decommissioned in 2008 |
| Ban Ban Springs | Bonaparte Gas Pipeline* | Commissioned in 2008 |
| Townend Road | Third party connection asset* | Commissioned in May 2014 |
| Darwin City Gate | Darwin Distribution System* | High pressure steel and medium pressure plastic |
| Weddell | Weddell and Wickham Point Lateral Pipelines* | Commissioned in 2007 |
| Channel Island | Channel Island Lateral Pipeline | |

* Laterals/pipelines that do not form part of the covered pipeline

[7] The Bonaparte Gas Pipeline is not part of the covered pipeline

*Operation of the pipeline*

Operation of the pipeline system is continuously monitored and controlled from APA's Integrated Operations Centre in Brisbane. APTNT also retains the capability to monitor the pipeline from its base in Palmerston approximately 20 kilometres south of the Darwin central business district. The control centre was located in Palmerston prior to APA Group's Integrated Operations Centre being built.

The AGP was initially constructed with no compressor stations and could transport a maximum of 44 TJ/day. Initial parameters for the AGP made provision for an additional nine compressor stations to be constructed as natural gas demand increased. In 1995, a compressor station at Warrego (40 kilometres north of Tennant Creek) was commissioned.

During the earlier access arrangement period, APTNT undertook significant capital expenditure works to ensure that the pipeline could be operated as a bidirectional pipeline, including pigging of the pipeline. These works were required as a result of the change in predominate gas source on the pipeline from the Palm Valley and Mereenie gas fields near Alice Springs, to Ban Ban Springs, bringing gas from the Blacktip gas field via the Bonaparte Gas Pipeline.

A pipeline map can be found at Figure 1.1 and pipeline schematic at Figure 1.2.

***Figure 1.1 – Map of the Northern Territory Pipeline network***

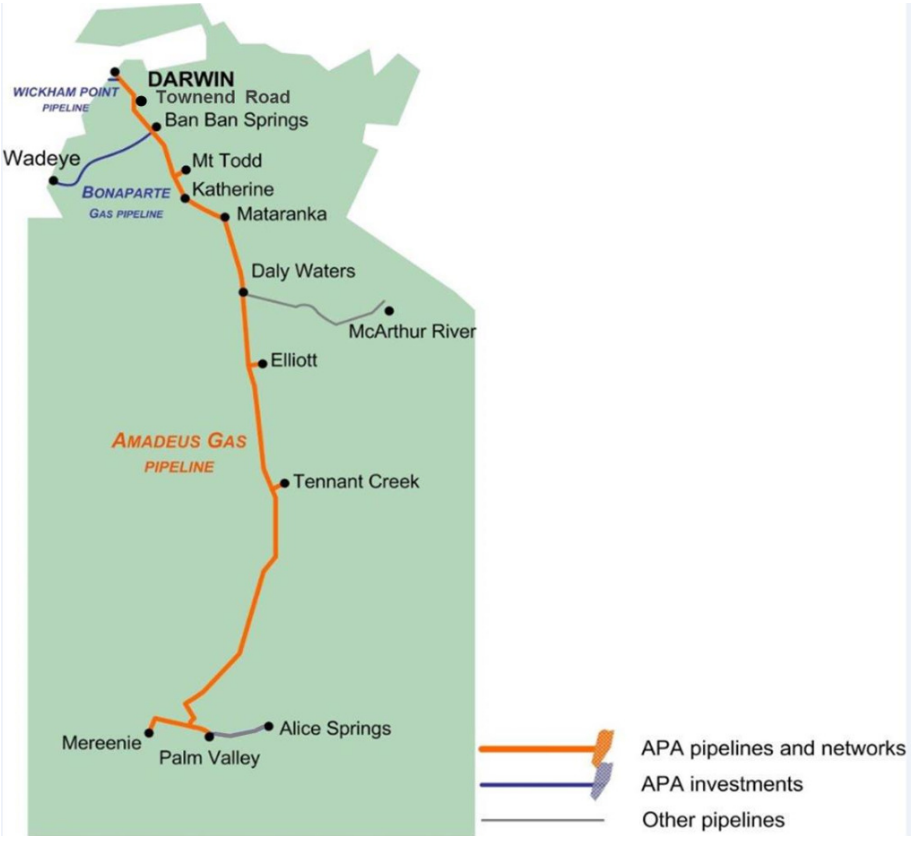
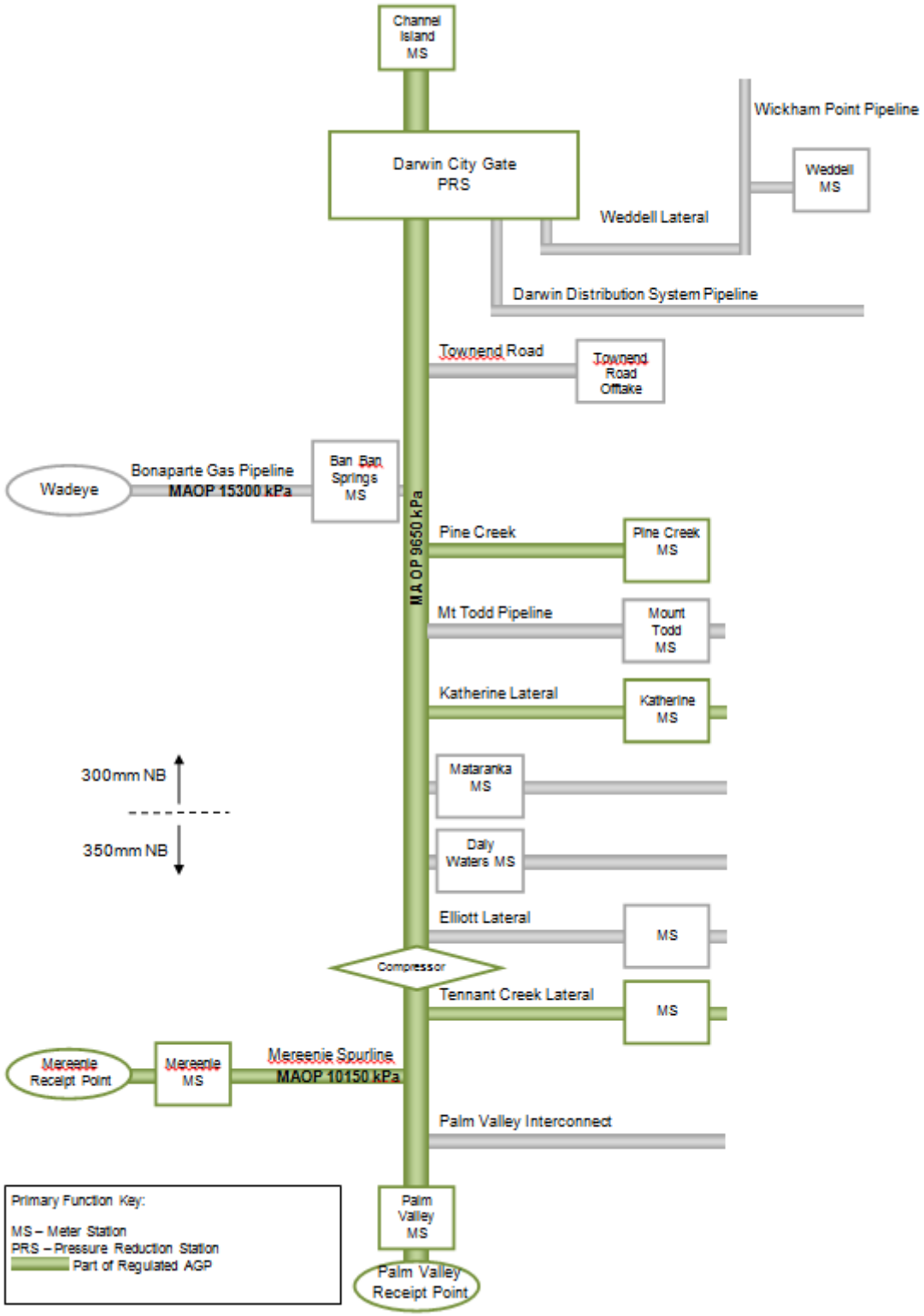


***Figure 1.2 – Amadeus Gas Pipeline schematic***



### 1.5.2 Operating Environment

The AGP's operating environment is unique for pipelines operating in Australia, and poses particular challenges for APTNT in ensuring the ongoing integrity of the pipeline and provision of pipeline services.

The AGP spans arid (in the south) and tropical (in the north) climates, characterised by climatic extremes brought about by the wet and dry seasons. APTNT's annual expenditure profile is highly seasonal and concentrated in the dry season, reflecting the limitations that the wet season places on works on the pipeline. In the wet season, parts of the pipeline become inaccessible by any means other than helicopter, and travel to other parts of the pipeline becomes difficult, unreliable and potentially unsafe.

Unpredictable changes in weather, and the very short period in which work on the pipeline can actually be conducted, also means that expected expenditure can be subject to uncontrollable and unexpected delays. This particularly impacts forecast expenditure *between* regulatory years, as the regulatory year starts in the middle of the dry season where the majority of work is being undertaken. A late dry season or early wet season can significantly impact when forecast expenditure is ultimately incurred.

These factors also impact APTNT's operating costs as travel requires special equipment, such as four wheel drives and helicopters, and restrictions in travel movements for work crews, such as dusk to dawn travel curfews due to the dangers of travel on outback roads in the early evening and at night due to kangaroos and cattle on the road.

The AGP is also extremely remote, which adds to the challenges of working on the pipeline. Work crews working in remote locations stay in local accommodation, which can be many kilometres from the pipeline. Night time travel restrictions can significantly curtail available works hours, adding to the time and costs of even routine work on the pipeline. The same remoteness makes the logistics of getting supplies and equipment to site very challenging, particularly in the wet season where roads, tracks and easements may be impassable.

Work crews working at remote sites are also a long way from medical assistance, and the dangers of working in extreme heat and sun limit working hours further to ensure health and safety.

The AGP spans earthquake prone areas, which means that sections of the pipeline must be inspected on a regular basis to ensure there has not been damage to the pipeline from tremors.

There has been very significant investment in the Northern Territory as a result of the mining boom and construction of new LNG export facilities. APTNT competes with these infrastructure projects for specialist and technical staff, and in many cases is not able to fill necessary staffing vacancies due to a general shortage in skilled labour in the

territory. This can also lead to delays in completing projects and overall higher staffing costs to secure sufficiently qualified workers.

These factors mean that APTNT's operations differ significantly from those of operators of other urban or rural pipelines, making meaningful comparison in the scope of works and costs very difficult. These factors mainly impact pipeline capital and operating costs, but non-system capital and operation expenditure is also plagued by logistical and supply issues, shortages in specialist and technical staff and contractors, and general staffing and recruitment issues associated with a remote location.

### 1.5.3 Context for this access arrangement period

*Period of transition during earlier access arrangement period*

Very significant changes to this pipeline and its operating environment occurred towards the end of the first access arrangement period (2009/10 and 2010/11). These included the change in predominant gas source for the pipeline and resultant change in pipeline flow direction and transfer of full ownership of the pipeline to APA Group, and the renegotiation of the long term transportation agreement on the pipeline involving all Firm capacity of the pipeline.

The earlier access arrangement period (1 August 2011 to 30 June 2016) has involved the bedding down of many of these new arrangements, including significant integrity capital works reflecting the revised economic life of the pipeline (derived from the new long term transportation agreement), and works required to accommodate the change in predominant pipeline flows.

*Move to more stable operating and commercial arrangements*

While these are significant operational changes for the pipeline, the underlying contractual/commercial arrangements for the pipeline, where firm capacity is fully committed to a foundation pipeline user, remains a constant since the pipeline was first built. This access arrangement period therefore reflects a transition to a renewed period of stable commercial and operating conditions, where most of the necessary integrity works for the pipeline are now complete, and the contractual arrangements for the pipeline are well established.

*Potential interconnection with south eastern gas market*

One potential area for change for the AGP during the access arrangement period is the potential for connection to the south eastern gas market through the mooted North East Gas Interconnector (NEGI).

APTNT expects to accommodate the potential connection of the NEGI to the AGP during the access arrangement period through the extensions and expansions policy set out in the prevailing Access Arrangement. APTNT believes that the extensions and

expansions policy can support these types of important developments, and is specifically designed to accommodate projects that emerge during an access arrangement period. Using the extensions and expansion policy gives the AER appropriate oversight of the extension or expansion, while also addressing any uncertainty that may exist over future projects at the time of the regulatory decision.

As discussed later in this submission, APTNT does not propose to change its extension and expansions policy approved by the AER in the earlier access arrangement period.

The prospects for this new connection are subject to considerable uncertainty, and will depend on available gas in the Northern Territory, and demand in south eastern markets through a competitive delivered gas price.

The NT Government is currently undertaking a public process to elicit proposals for building the interconnector, however there is very significant uncertainty both as to whether this project will proceed, and if it does proceed:

- The source of gas supply (which can come from southern fields such as the Palm Valley, Mereenie and Dingo gas fields, or from the northern Blacktip gas field, or fields between these points, or a combination of these points);
- The total gas demand to be served via the AGP to the NEGI;
- The degree to which gas supply and capacity will be provided under the existing contractual arrangements;
- The connection point for the NEGI, which currently involves at least two possible locations – either near Alice Springs or near Tennant Creek;
- The timing of the project, including when first gas would flow;
- The timing of gas demand and whether this will increase over time and the certainty over those volumes; and
- The scope of any capital expenditure that may be required on the AGP to accommodate any of the above supply and demand permutations.

None of these matters are known at the time of submitting this access arrangement proposal, and many may not be known in time for the draft or final decisions for the access arrangement. There is a significant risk that any forecasts made in relation to this project will be out of date or incorrect, and have the potential to undermine commercial arrangements for the new interconnector.

# 2 Services

The Rules require an access arrangement to:

- describe the pipeline services the service provider proposes to offer to provide by means of the pipeline[8];
- specify the reference services[9]; and
- specify for each reference service[10];
  - the reference tariff; and
  - the other terms and conditions on which the reference service will be provided.

This chapter describes the basis for proposing the services set out in the access arrangement, as well as proposed changes to non-tariff components in the access arrangement.

## 2.1 Pipeline services

A pipeline service is a service provided by means of the pipeline.[11] APTNT proposes to offer the following services on the AGP:

- Firm service – service for transport from any receipt points to any delivery points on the pipeline;
- Interruptible service – service for transport from any receipt points to any delivery points on the pipeline, where APTNT is entitled to cease receiving gas from, or delivering gas to, the user when pipeline capacity is constrained/curtailed, or to meet the capacity requirements of other users of the firm service;
- Negotiated service – service negotiated to meet the needs of a user which differ from those of the firm or interruptible service, including potential as available services.

These services are identical to those offered in the earlier access arrangement period.

Both the Firm and Interruptible services are 'non-directional' services, in that gas can enter the pipeline at any one (or more) of the four receipt points, and be delivered to one or more of the eleven active delivery points along the length of the pipeline.

APTNT considers that these services represent the scope of available services on the AGP.

[8] Rule 48(1)(b)
[9] Rule 48(1)(c)
[10] Rule 48(1)(d)
[11] National Gas Law section 2

### 2.1.1 Reference services

Reference services are a subset of pipeline services, and are those pipeline services that are likely to be sought by a significant part of the market.[12]

APTNT specifies the firm service as a reference service, as it considers that this service is sought by a significant part of the market. The firm service most closely corresponds with the service offered under the current foundation contract on the pipeline. Currently, 100 per cent of firm capacity is contracted on the pipeline. Over the earlier access arrangement period, in each year less than five per cent of gas was transported under arrangements other than a firm service, despite the availability of interruptible services in this time. The volume of interruptible service provided varies significantly across the earlier access arrangement period.

Under current contractual arrangements, the firm service is fully contracted under the long term arrangement and not expected to be available during the access arrangement period.

APTNT considers that firm capacity is likely to be preferentially sought by the majority of prospective users on the pipeline over an interruptible service. This means that the firm service is appropriately characterised as a reference service under the access arrangement.

### 2.1.2 Non-reference services

APTNT proposes to offer the interruptible service and the negotiated service as non-reference services in the access arrangement, consistent with the earlier access arrangement.

APTNT considers that these services are appropriately classified as non-reference services as currently there is only limited capacity contracted for gas delivery on the pipeline for either of these services. APTNT does not anticipate significant change to this situation through new connections or contracts accessing existing capacity over the forecast period.

The interruptible and the negotiated services cannot therefore be considered to be sought by a significant part of the market and therefore are not appropriately classed as reference services.

To the extent that prospective users seek transportation services on the AGP during the access arrangement period, it is expected that those users will preferentially seek any available firm capacity on the pipeline before seeking an interruptible service. This includes firm capacity potentially available through the foundation shipper. This reflects experience over the earlier access arrangement period where prospective users in the

[12] Rule 101(2)

first instance generally sought a firm transportation agreement, and only took a limited interruptible service as the firm service was not available.

## 2.2 Non-tariff components

### 2.2.1 Extensions and expansions

The extension and expansion policy applying to the AGP was significantly revised as part of the last access arrangement revision process. The revised extension and expansion arrangements now reflect those approved by the AER for other regulated assets across the country.[13]

APTNT has reviewed the extension and expansion arrangements applying in the earlier access arrangement period and considers that they remain appropriate. APTNT therefore does not propose any revisions to the extension and expansion arrangements, apart from a minor correction removing capitalising of a term that is not defined elsewhere in the access arrangement.

APTNT considers that the extension and expansion arrangements currently in place are suitable to support any changes to the regulated pipeline (for example, through expansion) required as a result of the interconnection of the AGP to the east coast gas market. In this event, incremental service provided by expansions will form part of the covered pipeline unless APTNT elects, and the AER agrees, that the incremental services should not form part of the covered pipeline. This provides the AER with regulatory oversight, as well as flexibility, over the future treatment of expanded capacity.

### 2.2.2 Capital redundancy

APTNT has revised the capital redundancy mechanism included in the earlier access arrangement to more accurately reflect the provisions in the NGR and other capital redundancy mechanisms recently approved by the AER.

The capital redundancy mechanism in the revised access arrangement is as follows:

> In accordance with Rule 85, the AER may review, and if necessary, adjust the Opening Capital Base at 1 July 2021 based on the following principles:
>
> (a) any assets that cease to contribute in any way to the delivery of Pipeline Service to Users shall be removed from the Capital Base; and
>
> (b) costs associated with a decline in the volume of sales of the Reference Service provided by means of the VTS will be shared between Service Provider and Users.

[13] For example the extensions and expansions policy in the current Roma Brisbane Pipeline Access Arrangement.

> Subject to the New Capital Expenditure criteria under Rule 79, if, after the reduction of the Capital Base by the value of assets identified as redundant, the assets later contribute to the delivery of the Reference Service (however described at the time), the assets will be treated as New Capital Expenditure (for the purposes of Rules 79, 81 and 84) equal to the value of the assets identified as redundant increased annually on a compounded basis by the weighted average cost of capital from the time the assets identified as redundant were removed from the Capital Base.

The principal changes involve the AER review process as is provided for under the approved APA GasNet access arrangement[14], as well as the inclusion of the requirement that assets cease to contribute *in any way* to the delivery of services, which mirrors the drafting in the National Gas Rules.[15]

### 2.2.3 Capacity trading

APTNT has not proposed any revisions to the capacity trading provisions in the access arrangements, other than to correct a minor grammatical error. These were substantially revised during the last revision process to align with the National Gas Rules.

### 2.2.4 Queuing

The queuing arrangements in the access arrangements provide for a simple first come first served queue. These provisions were updated during the last revision process to align with the National Gas Rules.

APTNT has revised some terms to refer to the defined terms in the access arrangement where appropriate.

### 2.2.5 Review of the access arrangement

Review submission and revision commencement dates

Rule 49 requires that a full access arrangement include a review submission date and a revision commencement date. APTNT proposes the following dates:

- Review submission date: 1 July 2020
- Revision commencement date: 1 July 2021

The proposed revision commencement date is five years after the last revision commencement date (1 July 2016). The proposed review submission date is one year prior to the proposed revision commencement date.

[14] APA GasNet Access Arrangement, effective 1 July 2013 to 31 December 2017, p 7
[15] Rule 85

APTNT notes that the AER must approve a proposal made in accordance with the 'general rule' under Rule 50(1)[16], which sets out a standard five year access arrangement period and a revision submission date 4 years after the start of the period. APTNT's proposal is consistent with this general rule, though it does consider that there may be scope to establish a longer access arrangement period (up to ten years) if the AER were willing to consider this approach.

The expected contractual and expenditure stability of this pipeline for the foreseeable future may mean that a longer period is consistent with the revenue and pricing principles (as required under Rule 50(4)).

### 2.2.6 Other changes to the earlier access arrangement

Further changes to the access arrangement are set out in Table 2.1 below.

***Table 2.1 – Overview of other revisions to the Access Arrangement***

| Access arrangement reference | Revision |
|---|---|
| Access Arrangement | |
| General | Reference Service now consistently referred to as the Firm Service for clarity |
| Section 1.4 | Minor revisions to align headings and references within the AA |
| Section 1.5 | Addition of reference to potential AA commencement under Rule 62 as provided for under the NGR |
| Section 1.6 | Revisions to the access arrangement discussed in section 2.2.5 |
| Section 2.1.1 | Revision to improve clarity over reference and non-reference services |
| Relocation of section 2.5 to 2.2 | Requests for service can relate to all pipeline services and therefore should be included in general provisions |
| Section 2.4.3 | Term for a Negotiated Service revised to remove restrictions included in the earlier AA |
| Section 3.1 | Description of process to set total revenue revised to more accurately reflect the provisions in the NGR |
| Section 3.5 | Update section to reflect start of the next AA in 2021 |
| Section 4.1 | Clarifies that the Reference Tariff applies to the Firm service and relates to the Firm MDQ |
| Section 4.3 | Clarifies that variances relate to each particular user, and not users generally<br>Clarifies that the Variance Allowance is a daily allowance |
| Section 4.7 | Revisions to the reference tariff variation mechanism discussed in chapter 11 |
| Section 4.8 | Update section to reflect start of the next AA in 2021 |
| Section 4.9 | Revisions to the capital redundancy mechanism discussed in section 2.2.2 |
| Section 5.3 | Correction of a minor grammatical error |
| Section 6 | Revision to the queuing requirements are set out in section 2.2.4 |
| Section 7 | Revisions to extensions and expansions set out in section 2.2.1 |
| Schedule 1 – Details | |

| | |
|---|---|
| Service Provider | Update to the Service Provider |
| Definitions | Now uses the defined term in the AA<br>Clarification that the Variance Allowance is a daily allowance |
| Notes | Revised to correct an inconsistency between the AA and the details and to update to reflect the start of the AA in 2016 |
| Payment Date | Revised to 14 days to correct inconsistency with the provisions in the terms and conditions in the earlier AA |
| Glossary | |
| Annual Reference Tariff Adjustment Formula | Definition deleted as term defined in body of AA |
| Bank Bill Rate | Inclusion of definition of the Bank Bill Rate in line with APA's standard transportation agreement. Alignment of this provision ensures consistency of treatment of late payments for multi-asset contracts. |
| Capacity | New definition to refer to the covered pipeline, and associated changes to the AA to refer to defined term (various) |
| Change in Control | Definition included to support new paragraph 92 (Assignment) |
| Confidential Information | Revision to make clear that referring to the Transportation Agreement |
| Consequential Loss | If User defaults, changes clarify that loss of revenue under other Transportation Agreements is direct loss to Service Provider |
| Contracted Capacity | Removal of a redundant term |
| Covered Pipeline | More clearly defines the pipeline to which the AA applies |
| Final Decision | Definition required under revisions to the Insurance Cap Event under section 4.7 |
| Gas Law | Removal of definition not used in the body of the document |
| Gas Specification | Updated definition to identify where specification can be accessed and to assure conformity with all applicable laws |
| Gross Negligence | Addition of definition as previously required by the AER in respect of the Roma Brisbane Pipeline AA and associated change to the AA to refer to defined term |
| Information Interface | Removal of jargon from definition |
| Net Financial Effect | Deletion of definition as not used in the AA document |
| Overrun Quantity | Revisions to reflect adjustment to overrun quantity with quantities are curtailed |
| Reference Service | Revisions for clarity that the Reference Service refers to the Firm Service |
| Reference Tariff Adjustment Mechanism | Definition not required as defined in the body of the AA |
| Interpretation | Revision to remove cross referencing error |
| Schedule 4 – Terms and Conditions | |
| Scheduling | Changes to reflect:<br>- the impact of capacity constraints on all or part of the pipeline apply to all scheduled quantities, not just firm quantities;<br>- scheduling order to make clearer the scheduling order – prior drafting was ambiguous in relation to scheduling order between 8(b) and 8(c); and<br>- an allowance for consistency with scheduling regimes on the APA network for multi-asset agreements. |
| Curtailment | Parallel changes to curtailment schedule to mirror changes to scheduling (clause 11) |
| Adjustment to Rates | Revisions to reflect the change in terminology for the Reference tariff variation |

| | |
|---|---|
| and Charges | mechanism |
| System use gas and linepack | Revisions to remove provisions only relevant to NSW<br>More clearly defines how APA will determine the quantity of System Use Gas User is required to provide and emphasises that allocation is to be made reasonably and equitably |
| Metering | Removal of installation from clause 35 as inconsistent with other provisions in clause whereby metering is the responsibility of the user |
| Possession of gas and responsibility | Correction to clause cross referencing |
| Title | Change to confirm that all pipeline gas is commingled<br>Removal of clauses only relevant to Western Australia |
| Billing and Payment | Change to Bank Bill Rate as source of interest charge calculation in line with APA's standard transportation agreement. Alignment of this provision ensures consistency of treatment of late payments for multi-asset contracts. |
| Limitation of Liability and Indemnity | Refers to new defined term for Gross Negligence in line with AER approved AA for the Roma Brisbane Pipeline<br>Liability cap remains at 10% of contract value, but is also capped at 2.5% in any one year |
| Force Majeure | Minor changes to clarify when Force Majeure can be claimed including when laterals owned by another APA entity are affected and where a user cannot take gas downstream of a Delivery Point |
| Assignment | Change of control provision included to ensure APA has visibility of the ownership structure of its users and the financial viability of such ownership structures where ultimate holding companies are not listed on a public securities exchange |

# 3 Regulatory Obligations

Compliance with regulatory obligations and requirements is one of the four factors listed under Rule 79(2)(c) for the justification of capital expenditure, and is embedded in the concepts of expenditure incurred by a prudent service provider and accepted good industry practice, which are requirements for both capital and operating expenditure under the Rules. This chapter provides an overview of relevant regulatory obligations applying to APTNT in its operations in the Northern Territory.

Compliance with regulatory obligations is a key driver of costs for the AGP in operation and maintenance of the pipeline. This section provides an overview of the main regulatory instruments and obligations applying to APTNT in its operations in NT, and which drive asset management plans and processes for the AGP. The details of regulatory requirements listed here are therefore referenced throughout this submission and in the supporting information provided to the AER in the access arrangement revision proposal. This chapter does not consider regulatory obligations arising from generic legislation such as the Corporations Act that applies to a wide spectrum of businesses across Australia.

## 3.1 National Regulatory Obligations

### 3.1.1 National Gas Law and National Gas Rules

The NGL includes powers for the AER to require information from service providers. For this access arrangement review process, the AER issued a RIN under section 48 of the NGL, requiring certain information in support of the access arrangement proposal.

The AER has not indicated whether it intends to issue annual RINs on APTNT in relation to the access arrangement. The issuing and completion of an annual RIN would represent a new obligation for APTNT and, depending on any associated auditing or other data validation requirements, could represent a significant additional cost to the business which is not reflected in historic costs.

APA considers that if the AER intends to issue annual RINs on APTNT, this should be flagged in the draft decision, and APTNT given opportunity to vary its proposal to include an operating expenditure step change event to reflect expected additional costs.

### 3.1.2 National Greenhouse and Energy Reporting 2007

The National Greenhouse and Energy Reporting Act 2007 requires that organisations triggering thresholds as defined by the Act report energy and emissions data. Thresholds relate to emissions of $C_{O2}$ equivalent, total amount of energy produced and total amount of energy consumed.

## 3.2 Northern Territory Regulatory Obligations

### 3.2.1 Energy Pipelines Act

The key instrument that gives APTNT authority to operate the AGP is *the Energy Pipelines Act* (NT).

The Energy Pipelines Act requires any person who constructs, alters or reconstructs a pipeline (or intends to), as well as any person who operates a pipeline, to hold a licence issued by the responsible minister under the Act.[17] A licence can impose conditions on the licence holder, including that the licence holder comply with specific standards set out in the licence.[18] The Act itself also requires that the licence holder comply with certain prescribed standards.[19]

The Act also includes obligations on the licence holder to restore agricultural land after construction of a pipeline, and establishes a series of environmental offences for land contamination brought about by an act or omission by a licence holder during the conduct of an operation authorised under the Act.[20]

The Minister may give directions to a licence holder on any matter in respect of which regulations may be made under the *Energy Pipelines Act*.

### 3.2.2 Energy Pipelines Regulations

The Energy Pipeline Regulations set out certain additional obligations on licence holders, as well as specify penalties and the form of applications.

A key obligation under the Regulations is that a licence holder develops a Pipeline Management Plan (PMP) for the construction and operation of a pipeline (as relevant). The PMP must be developed in accordance with the regulations, including requirements that the PMP include:

- A statement of the pipeline licence holder's strategic health and safety objectives for the design, construction, operation, modification and decommissioning of the pipeline[21];
- A comprehensive description of the pipeline including a description of:
  - the design for the pipeline, the route corridor in which the pipeline is to be constructed and the way in which the pipeline is to be constructed;

[17] Energy Pipelines Act, s. 12
[18] Energy Pipelines Act, s. 17
[19] Energy Pipelines Act, s. 34
[20] Energy Pipelines Act, Part VA
[21] Energy Pipelines Regulations, cl. 27

  - the compositions of energy-producing hydro-carbons that are to be conveyed through the pipeline when it is operating; and
  - the safe operating limits for conveying those mixtures through the pipeline[22];
- A comprehensive description of the pipeline management system including a description of:
  - the risk of significant pipeline accident events and other risks to the integrity of the pipeline associated with the design, construction, modification and decommissioning of the pipeline;
  - measures that have been, or will be, implemented to reduce the risks to levels that are as low as reasonably practicable;
  - the systems used to identify, evaluate and manage the risks and measures; and
  - the arrangements for monitoring, auditing and reviewing those systems[23];
- A description of the Australian Standards and international standards applied, or that will be applied, for the design, construction, operation, modification and decommissioning of the pipeline[24];
- Arrangements for record management and document availability[25]; and
- Arrangements for reporting to the Minister about the design, construction, operation, modification and decommissioning of the pipeline, at intervals agreed with the Minister, but at least once each year[26].

The PMP must be submitted to the NT Director of Energy for approval if significant changes to the PMP are made, as well as at least every five years. The Minister may also require a revision to the PMP. Under certain conditions set out in the Regulations, the Minister can refuse to approve a PMP, or withdraw consent to a PMP, which has the effect of withdrawing a licence to construct or operate a pipeline (as relevant).

### 3.2.3 AGP Pipeline licence

APTNT holds a licence in respect of the covered AGP, spurlines and laterals, as set out in Table 3.1.

[22] Energy Pipelines Regulations, cl. 28
[23] Energy Pipelines Regulations, cl. 29
[24] Energy Pipelines Regulations, cl. 30
[25] Energy Pipelines Regulations, cl. 31
[26] Energy Pipelines Regulations, cl. 32

***Table 3.1 – APTNT Pipeline Licence relevant to the covered pipeline***

| Pipeline name | Pipeline Licence | Expiry |
|---|---|---|
| Amadeus Basin to Darwin Gas Pipeline<br>Mereenie Field to Tylers Pass Spurline<br>Laterals:<br>Tennant Creek<br>Katherine<br>Pine Creek<br>Channel Island<br>Palm Valley Interconnect | 04 | 2032 |

## 3.3 Australian Standards and Codes

The following Australian Standards and Codes are referred to in relevant legislative instruments as mandatory or preferred standards and are therefore considered to be the primary codes of practice applicable to APTNT's activities:

- AS2885.1:2007 – Pipelines – Gas and Liquid Petroleum – Part 1 – Design and construction
- AS2885.2:2007 – Pipelines – Gas and Liquid Petroleum – Part 2 – Welding
- AS2885.3:2012 – Pipelines – Gas and Liquid Petroleum – Part 3 – Operations
- AS/NZS2832.1: 2015 – Cathodic Protection of Metals– Part 1 – Pipes and Cables
- API Specification 5L – American Petroleum Institute – Steel Pipe
- API Standard 6D – Specification for Pipeline and Piping Valves (24$^{th}$ Edition) July 2015
- APIA – Code of Environmental Practice
- AS4041:2006 – Pressure Piping
- MSS-SP44 – Specification for Flanges
- ASME B31.3 – Process Piping
- AS 3000:2000 – Electrical Installations (Wiring Rules)
- AS/NZS 3000:2007 – Standard for Wiring Rules
- AS 1210:2010 – Pressure Vessels
- AS 60079:2012 Explosive Atmospheres - Equipment
- ISO 31000 – Risk Management

Of these listed standards, AS2885.3 is the most important for the day-to-day operation of the pipeline. The AS2885 suite of Standards establishes requirements for the safe design, construction, inspection, testing, operation and maintenance of a land or

submarine pipeline constructed from steel pipe, and designed to transport gas or liquid petroleum.

AS2885.3 relates in particular to pipeline operations and integrity, and sets the base standards for integrity of the pipeline, including allowable limits for pipeline rupture risk management.

In general, AS2885 does not require that physical plant already in place be altered to comply with changes in the standard (and the standards it references), except where changes relate to areas of public safety in high consequence areas.

Existing plant is instead grandfathered unless there is an upgrade to an existing facility, in which case the upgrade would trigger a requirement to comply with the relevant revised standard as part of the project.

## 3.4 Regulatory reporting

APTNT has a number of regulatory reporting obligations to both the AER and the Northern Territory Government Director of Energy in relation to the AGP.

In November 2008, the AER issued a General Information Order under section 48 of the NGL applying to all service providers of covered pipeline services provided by a transmission pipeline. The Order requires APTNT, as the service provider of the covered AGP, to submit to the AER an annual compliance report responding to matters set out in the Order.

APTNT's pipeline licence contains a number of reporting requirements to the Director of Energy. APTNT must lodge in March and September of each year a status report on the activities undertaken to the AGP over the relevant period including:

- Incidents involving the Pipelines and potential safety problems;
- Environmental management activities undertaken or planned;
- Routine and non-routine maintenance activities undertaken or planned;
- Any inspection or other reports not previously submitted including results of coating surveys, cathodic protection system surveys, and integrity surveys; and
- Details of any measure taken or proposed as a consequence of such inspection or surveys.

APTNT must also advise the Director Energy as soon as practicable, and if serious within 24 hours, any particulars of:

- Uncontrolled escape or ignition of gas;
- Serious injury or death arising in connection with the operation, modification and decommissioning of the pipeline;

- Any incident involving the pipeline causing loss, destruction or damage to the asset; and
- Any incident involving a threat to the pipeline or a contravention of section 66 of the Act.

APTNT must also provide the Director of Energy a report on any of these incidents within 28 days of occurrence.

In addition APTNT, in compliance with the PMP and AS 2885.3, performs inspections and prepares reports to confirm and ensure pipeline integrity and confirm the validity of the threat assessments. These inspections or assessments include but are not limited to:

- Technical risk assessment reviews;
- Location class reviews;
- MAOP review;
- Cathodic Protection system surveys;
- In-line inspection tools inspections;
- Coating surveys;
- Right of Way inspections;
- Pressure reduction and over-pressure protection reviews;
- Emergency Management Manual reviews; and
- Operations and Maintenance plan reviews.

The Director of Energy is advised of the results of such inspections, reviews and technical assessments within 28 days of finalisation.

# 4 Pipeline asset management and planning

This chapter provides an overview of APTNT's long-term pipeline asset management strategy and direction, planning and governance processes and key documents.

## 4.1 Asset management policy and objectives

The purpose of the Asset Management Plan is to formulate management strategies and actions to ensure safe and reliable asset operation in order to meet legislative obligations for the intended life of the asset, while meeting APA Group's business objectives of maximising financial return, optimising lifecycle costs, relating maximum asset value and effective risk management.

### 4.1.1 Asset management policy and objectives

The AGP asset management policy and objectives provide the guiding principles and asset management philosophy for the operation of the pipeline as follows:

> The pipeline assets are operated and maintained to ensure an appropriate balance between the cost for asset maintenance, reliability and replacement against the risk and consequences of asset failure.

### 4.1.2 Risk management policy

Risk management is a key component of asset management. The AGP is operated within the overarching APA Group Risk Management Policy and framework.

Risk is inherent in all aspects of APA's business. The APA Risk Management Policy applies a consistent approach to the management of risks associated with all activities undertaken by APA.

The goal is to cost effectively manage risk through identification, assessment and active management and mitigation of potential outcomes. APA maintains a system of risk management appropriate to the level of risk considered acceptable by the APA Board, which is based on the international risk standard AS/NZS ISO 31000:2009 (Risk Management – Principles and Guidelines).

APA is committed to a culture where risks that could affect our shareholder value, employees, stakeholders, the community, the environment, our reputation, our operating assets, our financial and legal status, or prevent the achievement of our objectives are well managed. APA will manage such risks by:

- Complying with all applicable regulatory and legislative requirements;

- Educating and involving our employees and stakeholders in the process of risk management;
- Articulating the roles and responsibilities of the different controls and individuals within the risk management process;
- Prioritising risk management according to likelihood (probability) and the consequence (impact) of risks, with appropriate consideration of controls and their effectiveness;
- Developing action plans which assign responsibilities and accountabilities to minimise high level risks;
- Incorporating risk management into our strategic plans, project plans, budgets, overall decision making and operating philosophy;
- Undertaking regular reviews of the risk management processes to ensure continuous improvement; and
- Regularly considering and updating the Company's risk registers and risk profile, including the identification of new business activities and unusual circumstances which may present new risks.

APTNT operates in a potentially hazardous industry and recognises that this requires a rigorous and systematic approach to manage risk exposure. APTNT is committed to ensuring that an integrated risk management system is applied throughout the organisation, one that will specifically address the risks of the industry.

## 4.2 Planning process

The *Asset Management Plans and High Level Process Policy* provides the overarching guidance for the asset management planning process.

### 4.2.1 Asset management planning process

The Asset Management process is a continuous loop as depicted in the flowchart at Figure 4.1. The process is divided into four major phases:

- Issue identification

  Issues are identified from a range of sources including asset assessments, change management processes and commercial considerations. They are assessed and potential solutions evaluated in terms of cost benefit and technical quality.

- Scoping and prioritisation

  Funding proposals are developed based on the evaluation performed in issue Identification. Proposals are submitted for committee prioritisation and an options analysis is performed from a business perspective.

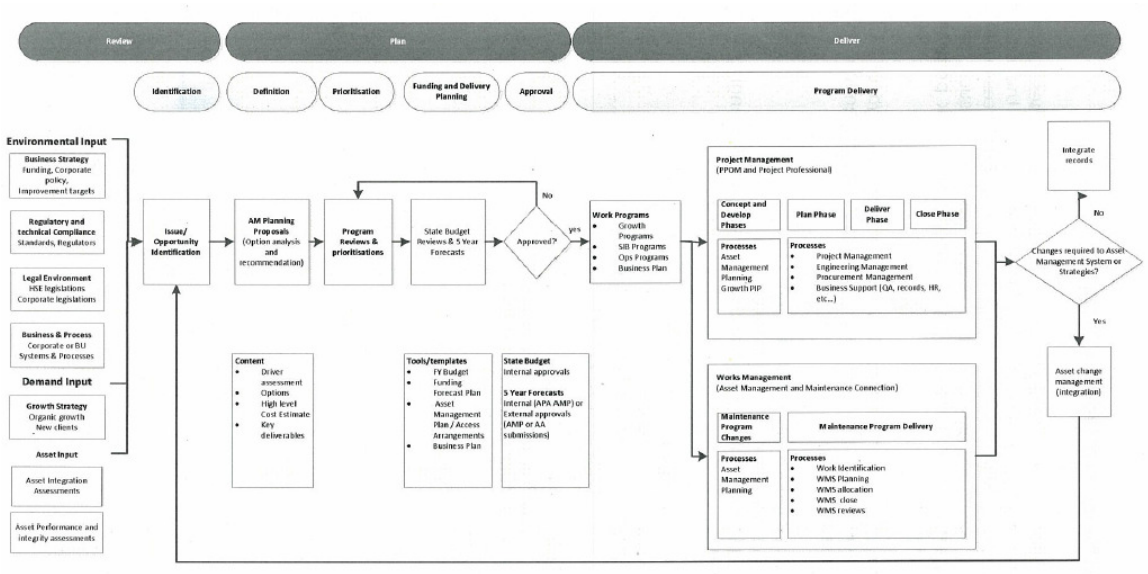
- Funding approval

  Final plans and associated budgets are submitted to the executive for national and strategic review and approval.

- Work program delivery

  Approved projects proceed through the five steps of the APA Project Management Framework.

***Figure 4.1 – Asset Management Process***




## 4.3 Key planning and asset management documents

APTNT has developed a number of planning documents to assist in the development and management of the pipeline, and to comply with relevant regulatory obligations. Key documents are:

- Asset Management Plan, including:
  - Lifecycle plan
- Pipeline Management Plan, including:
  - Safety and Operating Plan;
  - Environmental Management Plan; and
  - Records Management Plan.
- Emergency Plan

These are described in more detail below.

### 4.3.1 Asset Management Plan

The AGP Asset Management Plan (AMP) contains the rolling five year plan for non-routine capital and operating expenditure for the pipeline, with some longer term projects such as intelligent pigging programs included. The AMP is limited to pipeline facilities and does not cover other facilities such as buildings, computers, desks, vehicles, small plant and equipment. The AMP is reviewed and revised on an annual basis.

The Pipeline Licence, AS2885 and other mandatory or statutory Standards and Regulations form the basis of compliance requirements addressed in the AMP. Other capital and operating works are determined by operator experience, integrity considerations and risk assessment.

A key component of the AMP is the Lifecycle Plan, which addresses pipeline, station, rotating equipment, plant and easement condition, and associated expenditure requirements.

The AMP also includes detailed project descriptions and costings.

### 4.3.2 Pipeline Management Plan

The Energy Pipelines Regulations requires each licence holder to develop a Pipeline Management Plan (PMP) in accordance with the Regulations, the pipeline licence, and relevant ministerial directions. As APTNT holds several pipeline licences across the Northern Territory, and operates a number of pipelines for other licence holders, it has prepared a combined PMP in compliance with its obligations across a number of pipelines. The PMP therefore applies more broadly than the covered AGP, and also satisfies requirements for uncovered pipelines such as the Weddell and Wickham Point lateral pipelines.

APTNT has prepared the PMP for the operation, modification and decommissioning stages of each pipeline. The PMP documents measures to ensure the:

- Protection of the relevant pipelines and associated facilities;
- Safety of the public;
- Safety of personnel working on the relevant pipelines;
- Safety of contractors;
- Minimisation of environmental impacts; and
- Effective incident management.

APTNT maintains quality accreditation to AS/NZS ISO 9001 to achieve these objectives.

The PMP has been prepared in accordance with the requirements of the Energy Pipelines Regulations and the guidelines set by Australian Standard AS 2885.3 Pipelines – Gas and Liquid Petroleum Part 3: Operation and Maintenance.

Accordingly, as required in Division 2 Part 4 of the Regulations, the PMP includes the following matters:

- Description of safety policy;
- Description of the pipelines;
- Description of the management system;
- Description of standards; and
- Arrangements for reporting and document accessibility.

In addition, the PMP also caters for the requirements of AS 2885.3 clause 4.2, which includes the following matters:

- Description of organisation structure and responsibilities of key positions;
- Description of the pipeline system operation;
- Risk assessment in accordance with AS 2885.1 Pipelines – Gas and Liquid Petroleum Part 1: Design and Construction;
- Summary of operational and maintenance processes and procedures;
- Summary of the content of the emergency response plan;
- Summary of the records management plan; and
- Details of the audit schedule.

The overall structure of the PMP follows the outline of AS 2885.3 requirements.

### 4.3.3 Records management

APTNT has a Records Management Plan in place describing the methods used to properly identify, control, and store records that are necessary to safely operate and maintain the pipeline. These records may assist in determining the fitness of the pipeline at any stage of the pipeline operating life.

The Records Management Plan includes:

- Identification of records to be maintained in accordance with legislative, statutory and contractual requirements;
- Retention requirements for those records;
- An outline of the appropriate storage methods to preserve required records; and

- Record maintenance policies so that obsolete records and procedures are removed from circulation.

The Records Management Plan has also been prepared to satisfy requirements under AS2885.3 for:

- Design, construction and commissioning records;
- Operation and maintenance records; and
- Decommissioning records if facilities are decommissioned.

### 4.3.4 Emergency Plan

An Emergency Plan is implemented and maintained. It ensures that incident response is correctly coordinated by focusing upon the response structure and field control to:

- Ensure a consistent and coordinated approach by emergency response personnel to any emergency;
- Control and limit any effect that the emergency may have on people, property and environment;
- Ensure priority communication of critical emergency information to affected stakeholders;
- Provide a sound basis for the training and assessment of emergency response personnel; and
- Provide a means for reviewing and improving the response techniques.

Emergency Response Plans define the minimum response required for an emergency arising on all pipelines and associated pipeline facilities. The Emergency Response Plan is tested and updated annually.

## 4.4 Expenditure governance

### 4.4.1 Budgets and expenditure approval processes

APA Group's *Corporate Governance Statement* has been developed in accordance with the Corporate Governance Principles and Recommendations issued by the Australian Stock Exchange Corporate Governance Council in August 2007. The statement sets out the principles and framework to be followed by the APA Group Board and senior management for the management of the business in areas such as risk management, ethical and responsible decision making and management and oversight.

APA Group Board responsibilities are set out in the Board Charter. Focusing on areas of particular relevance to this access arrangement, the APA Group Board is responsible for ensuring that effective audit, risk management, compliance and control systems are in

place to protect APTNT's assets and to minimise the possibility of the business operating beyond legal requirements or beyond acceptable risk parameters. The APA Group Board is also responsible for monitoring compliance with regulatory requirements.

APA Group has in place detailed capital expenditure governance processes to ensure that projects undertaken are prudent, efficient and in line with the overall strategy.

The capital expenditure budget is developed as an outcome of the AMP and includes concept plans, implementation schedules for major projects, and high level cost estimates for all proposed capital expenditure projects.

Replacement and upgrade capital expenditure works (otherwise known as 'stay-in-business' (SIB) works) are included in the approved capital expenditure budget. Capital expenditure approval is required for all other capital projects and includes relevant information like identified needs, risk assessment, options considered, cost estimation, project justification and recommendation.

### 4.4.2 Allocation between regulated and non-regulated services

APTNT has a robust process in place for allocating its costs and revenue between regulated and non-regulated activities to ensure that there is no cross subsidisation between regulated and non-regulated activities.

All expenditures are directly coded to job numbers created for non-regulated activities. These expenditures are directly allocated to those non-regulated activities and are not included in the capital and operating expenditure discussed in the following sections. Every APTNT employee also completes a timesheet which must be submitted to their leader for approval on a weekly basis. These timesheets accurately record time spent on non-regulated activities and all such time is not included in recorded expenditure on regulated assets.

All capital expenditure is also directly allocated to the asset to which it relates based on actual capital spent.

# 5 Pipeline demand and utilisation

This chapter of the submission discusses pipeline demand and utilisation over the earlier access arrangement period, and provides a forecast of pipeline demand and utilisation over the access arrangement period.

## 5.1 Demand and utilisation during the earlier access arrangement period

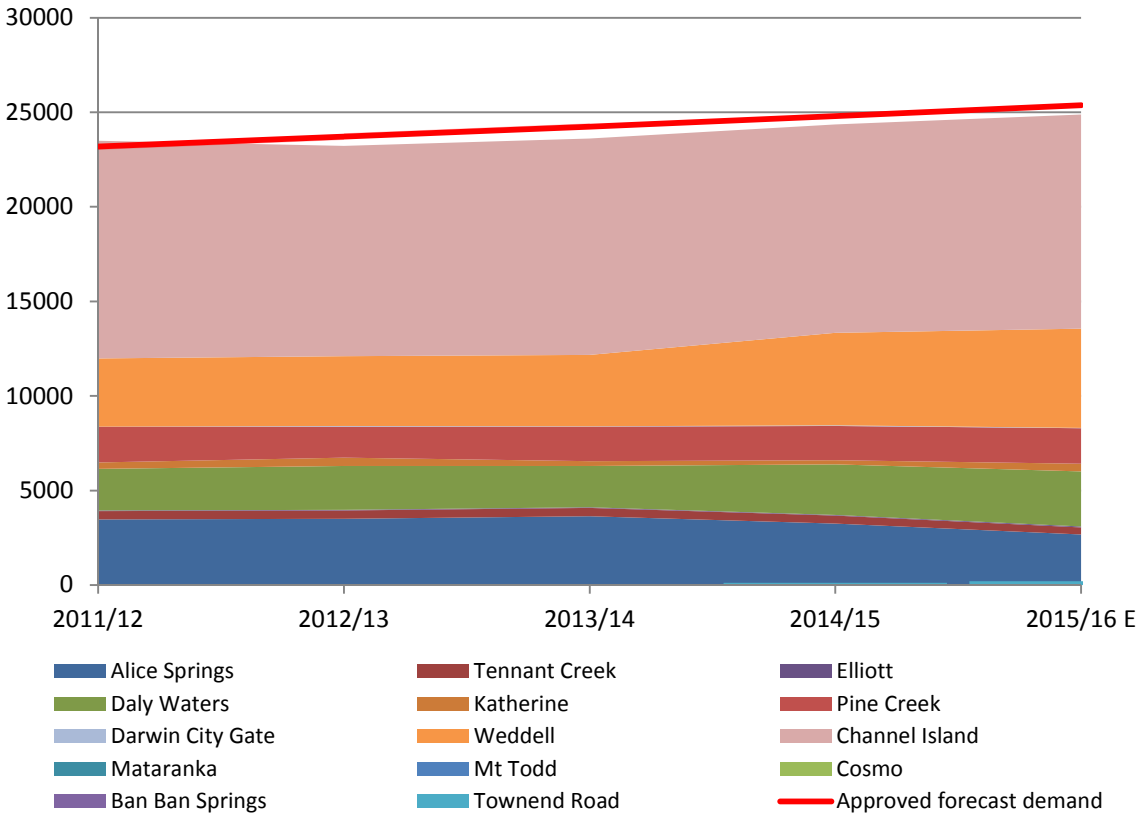
This section sets out usage of the pipeline over the earlier access arrangement period and discusses key drivers and trends for that usage.

### 5.1.1 Gas demand

*Total gas demand*

Total gas demand on the AGP by delivery point, compared to total forecast gas demand over the earlier access arrangement period, is shown in Figure 5.1 below.

***Figure 5.1 - Total gas demand over the earlier access arrangement period by delivery point compared to total forecast demand (GJ)***



This shows that total gas demand on the AGP was very close to forecast – within a range of 2 per cent of the forecast over the period.

*Demand by delivery point*

Table 5.1 shows actual and estimated minimum, maximum and average demand and volumes by delivery point over the earlier access arrangement period.

***Table 5.1 - Minimum, Maximum and average demand, and total volume by delivery point over the earlier access arrangement period***

| | | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16E |
|---|---|---|---|---|---|---|
| **Delivery point** | **Unit** | | | | | |
| Alice Springs | Min (TJ/d) | 6.1 | 5.8 | 6.7 | 6.1 | 6.3 |
| | Max (TJ/d) | 13.0 | 13.4 | 14.1 | 12.2 | 13.0 |
| | Average (TJ/d) | 9.5 | 9.6 | 10.0 | 8.9 | 7.3 |
| | Total (TJ/a) | 3465.6 | 3505.4 | 3642.3 | 3255.7 | 2673.5 |
| Tennant Creek | Min (TJ/d) | 0.6 | 0.5 | 0.6 | 0 | 0.5 |
| | Max (TJ/d) | 1.7 | 1.7 | 1.6 | 1.7 | 1.7 |
| | Average (TJ/d) | 1.2 | 1.2 | 1.2 | 1.1 | 1.0 |
| | Total (TJ/a) | 443.2 | 436.1 | 431.4 | 413.5 | 382 |
| Elliot | Min (TJ/d) | 0.07 | 0 | 0.07 | 0.07 | 0.07 |
| | Max (TJ/d) | 0.1 | 0.1 | 0.2 | 0.15 | 0.15 |
| | Average (TJ/d) | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| | Total (TJ/a) | 35 | 35.1 | 37.1 | 37.1 | 36.9 |
| Daly Waters | Min (TJ/d) | 2 | 0.9 | 1.4 | 1.5 | 1.5 |
| | Max (TJ/d) | 7.9 | 7 | 7.8 | 8.8 | 9.4 |
| | Average (TJ/d) | 6.0 | 6.3 | 6.0 | 7.3 | 8.0 |
| | Total (TJ/a) | 2203.2 | 2314.6 | 2190.5 | 2671.6 | 2915.8 |
| Mataranka | Min (TJ/d) | 0 | 0 | 0 | 0 | 0 |
| | Max (TJ/d) | 0 | 0 | 0 | 0 | 0 |
| | Average (TJ/d) | 0 | 0 | 0 | 0 | 0 |
| | Total (TJ/a) | 0 | 0 | 0 | 0 | 0 |
| Katherine | Min (TJ/d) | 0 | 0 | 0 | 0 | 0 |
| | Max (TJ/d) | 4 | 4.9 | 3.6 | 6.2 | 6.2 |
| | Average (TJ/d) | 0.9 | 1.2 | 0.7 | 0.6 | 1.1 |
| | Total (TJ/a) | 340.7 | 443.5 | 252.5 | 225.9 | 415.8 |
| Mt Todd | Min (TJ/d) | 0 | 0 | 0 | 0 | 0 |
| | Max (TJ/d) | 0 | 0 | 0 | 0 | 0 |
| | Average (TJ/d) | 0 | 0 | 0 | 0 | 0 |
| | Total (TJ/a) | 0 | 0 | 0 | 0 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Pine Creek | Min (TJ/d) | 1.0 | 0.0 | 0.7 | 2.2 | 0 |
| | Max (TJ/d) | 5.9 | 5.7 | 5.8 | 5.9 | 5.8 |
| | Average (TJ/d) | 5.2 | 4.5 | 5.0 | 5.0 | 5.1 |
| | Total (TJ/a) | 1885.7 | 1646.7 | 1820 | 1808.7 | 1864.4 |
| Cosmo | Min (TJ/d) | 0 | 0 | 0 | 0 | 0 |
| | Max (TJ/d) | 0 | 0 | 0 | 0 | 0 |
| | Average (TJ/d) | 0 | 0 | 0 | 0 | 0 |
| | Total (TJ/a) | 0 | 0 | 0 | 0 | 0 |
| Ban Ban Springs | Min (TJ/d) | 0 | 0 | 0 | 0 | 0 |
| | Max (TJ/d) | 0 | 0 | 0 | 0 | 0 |
| | Average (TJ/d) | 0 | 0 | 0 | 0 | 0 |
| | Total (TJ/a) | 0 | 0 | 0 | 0 | 0 |
| Townend Road[27] | Min (TJ/d) | - | - | 0 | 0 | 0.2 |
| | Max (TJ/d) | - | - | 0.045 | 0.7 | 1.30 |
| | Average (TJ/d) | - | - | 0.0 | 0.3 | 0.6 |
| | Total (TJ/a) | - | - | 0.1 | 124 | 202.8 |
| Darwin City Gate | Min (TJ/d) | 0.002 | 0.0 | 0.02 | 0.02 | 0.01 |
| | Max (TJ/d) | 0.1 | 0.2 | 0.3 | 0.2 | 0.2 |
| | Average (TJ/d) | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 |
| | Total (TJ/a) | 10.4 | 25.6 | 25.8 | 27.3 | 24.4 |
| Weddell | Min (TJ/d) | 0.0 | 0.0 | 0.0 | 2.4 | 0.0 |
| | Max (TJ/d) | 17.3 | 16.6 | 20.8 | 25.7 | 26 |
| | Average (TJ/d) | 9.9 | 10.1 | 10.3 | 13.4 | 14.4 |
| | Total (TJ/a) | 3595.9 | 3701.7 | 3773.1 | 4892.1 | 5249.2 |
| Channel Island | Min (TJ/d) | 16.7 | 17.8 | 16.3 | 15.2 | 15.2 |
| | Max (TJ/d) | 44.1 | 44.9 | 47.7 | 45.2 | 46 |
| | Average (TJ/d) | 31.6 | 30.5 | 31.3 | 30.2 | 31.0 |
| | Total (TJ/a) | 11520.1 | 11120 | 11439.8 | 11031.1 | 11323.2 |
| **Total volume** | **Total (TJ/a)** | **23499.8** | **23228.7** | **23612.6** | **24487.0** | **25088.0** |

As can be seen from the table, delivery points along the pipeline show different trends in demand and volumes. These trends largely relate to the principal end-use or purpose for gas delivered at that delivery point. For example, if gas delivered to a delivery point is used by a single or a small number of mines for electricity generation, then demand will reflect the success or otherwise of that mine over the period.

In contrast, if gas supplied is primarily used for electricity generation for domestic, commercial and small industrial consumption, then usage of gas is likely to follow trends

[27] New AGP delivery point from 2013/14

similar to that found in electricity network demand forecasts with demand drivers such as appliance use and efficiency, population growth and demographics, and weather being important. For these markets, an additional layer driving demand may also be step changes in electricity generation where older generating units are replaced by more efficient units, or generating units are added.

An additional delivery point was added to the pipeline over the earlier access arrangement period at Townend Road, supplying a commercial user. Deliveries started at this point in May 2014, with full supply reflected from 2014/15.

Table 5.2 describes each delivery point on the AGP by their primary gas usage characteristics, and provides a high level explanation for any specific trends in demand and volumes observed for those delivery points. Further details of drivers of demand are discussed in relation to demand forecasts, and are relevant to both the earlier access arrangement period and the access arrangement period.

***Table 5.2 - Gas usage characteristics and drivers of demand at each delivery point***

| Delivery Point | Usage characteristics |
|---|---|
| Alice Springs | Off take point to the Alice Springs pipeline that supplies gas for local electricity generation for domestic commercial and light industrial end uses. PWC has recently contracted a new source of gas from the small Dingo gas field near Alice Springs to supply a local electricity generator, displacing some load at the Alice Springs delivery point (Dingo gas supplying Alice Springs does not enter the AGP). This step change is reflected in demand at this delivery point from 2015/16. |
| Tennant Creek | Supplies gas for local electricity generation for domestic commercial and light industrial end uses, in addition to supplying some mining operations. Gas deliveries show a steady decrease related to a relatively stable population combined with a move to more efficient generating equipment. |
| Elliott | Supplies gas for local electricity generation for the local township with steady demand and no expected growth. |
| Daly Waters | Off take point for the pipeline to the Macarthur River Mine, which mines lead, silver and zinc. Demand is steady reflecting ongoing mining operations. |
| Mataranka | Currently no gas supplies to this delivery point and no forecast for new demand. |
| Katherine | Supplies gas for local electricity generation for domestic commercial and light industrial end uses. Generation units used as peaking supply for the Darwin/Katherine grid, leading to some fluctuation in usage over the period. |
| Mt Todd | Supplied gas to single mine operation. Mine ceased operation prior to start of the earlier access arrangement period and went into care and maintenance mode. |
| Pine Creek | Supplies gas to independent power plant to supply electricity to the local township and base load for the electricity transmission network. Steady demand reflecting role as a base load generator. |
| Cosmo Howley | Supplied gas to single mine operation. Prior to the start of the earlier access arrangement period and went into care and maintenance mode. Cosmo lateral decommissioned in 2008. |
| Ban Ban Springs | No gas supplies or contracts at this delivery point. Operated as a delivery point during commissioning of the Bonaparte Gas Pipeline in 2009. |
| Townend Road | A new delivery point that was commissioned in May 2014 and ramped up to full demand over 2014/15. This delivery point supplies a commercial user with a relatively flat demand forecast. |

| | |
|---|---|
| Darwin City Gate | Supplies gas to the Darwin distribution system for commercial and light industrial uses. |
| Weddell | Supplies gas for local electricity generation for domestic commercial and light industrial end uses. Shows a steady increase in demand reflecting increased reliance on this more efficient facility. |
| Channel Island | Supplies gas for local electricity generation for domestic commercial and light industrial end uses. Demand and volumes show a steady increase reflecting increased electricity generation demand. |

### 5.1.2 User numbers over the earlier access arrangement period

Table 5.3 shows user numbers by delivery point over the earlier access arrangement period. As discussed above, use of the pipeline is dominated by a single user, which is the only user providing gas to end users at a number of delivery points.

The lack of alternative users on the pipeline is a result of:

- the lack of available capacity over a long contracting period;
- the interruptible nature of gas contracts available; and
- the nature of the contracting parties, which were generally relatively itinerant, such as mining ventures.

These drivers largely remain in place over the access arrangement period.

***Table 5.3 - User numbers by delivery point over the earlier access arrangement period***

| Delivery points | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16E |
|---|---|---|---|---|---|
| Alice Springs | 1 | 1 | 1 | 1 | 1 |
| Tennant Creek | 1 | 1 | 1 | 1 | 1 |
| Elliott | 1 | 1 | 1 | 1 | 1 |
| Daly Waters | 2 | 2 | 2 | 2 | 1 |
| Mataranka | 0 | 0 | 0 | 0 | 0 |
| Katherine | 1 | 1 | 1 | 1 | 1 |
| Mt Todd | 0 | 0 | 0 | 0 | 0 |
| Pine Creek | 1 | 1 | 1 | 1 | 1 |
| Cosmo | 0 | 0 | 0 | 0 | 0 |
| Ban Ban Springs | 0 | 0 | 0 | 0 | 0 |
| Townend Road | - | - | 1 | 1 | 1 |
| Darwin City Gate | 2 | 1 | 1 | 1 | 1 |
| Weddell | 1 | 1 | 1 | 1 | 1 |
| Channel Island | 1 | 1 | 1 | 1 | 1 |

### 5.1.3 Pipeline capacity and utilisation over the earlier access arrangement period

*Pipeline capacity*

The capacity of the pipeline is impacted by both receipt point location and delivery point demand. This means that any calculation of AGP capacity must include assumptions related to the location of gas receipts and deliveries.

Table 5.4 below sets out pipeline capacity during the earlier access arrangement period using the receipt and delivery point demand configuration at the time.

***Table 5.4 - Pipeline capacity and utilisation over the earlier access arrangement period***

| | Units | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16E |
|---|---|---|---|---|---|---|
| Pipeline capacity | TJ/day | 119.7 | 119.7 | 119.7 | 119.7 | 119.7 |
| Average utilisation of pipeline capacity | % | 54 | 53 | 54 | 56 | 57 |

*Pipeline utilisation*

Utilisation in the earlier access arrangement period has been calculated using average delivery volumes for each year divided by the capacity of the pipeline. Utilisation is shown in Table 5.4.

## 5.2 Demand and utilisation forecasts

APTNT has prepared a forecast of total gas demand for the AGP over the access arrangement period, as well as forecasts for pipeline capacity and utilisation as required under the Rules.[28]

### 5.2.1 Gas demand forecast methodology

*Average demand*

APTNT has developed its forecast for each delivery point based on an analysis of:

- historic trends in gas volumes and maximum demand for each delivery point; and
- the drivers for gas demand for each delivery point.

These forecasts have then been checked against available information from the foundation shipper and other information on gas inputs into the pipeline to deliver both a bottom up and top down forecast for each delivery point and for the pipeline as a whole.

[28] Rule 72(1)(B)(d)

APTNT considers that its forecast is arrived at on a reasonable basis, and represents the best forecast or estimate possible in the circumstances.

*Maximum demand*

To forecast maximum demand for each delivery point, APTNT has adopted a number of approaches depending of the nature of demand at each point.

For Tennant Creek, Pine Creek and Elliott, APTNT has forecast maximum daily demand in line with gas requirements to fuel the maximum output of generators installed at these sites. Maximum demand for these sites does not grow over the period, as generation capacity is not expected to be increased at these sites.

For Townend Road, maximum demand is based on plant design, and is not expected to grow over the forecast period.

For Darwin City Gate, maximum daily demand is based on historical values without forecast growth, in line with the characteristics of load at this site.

A recent expansion at McArthur River Mine has increased the expected maximum demand at the Daly Waters delivery point from 2014/15, and is reflected in a step change in that year, without further forecast growth over the access arrangement period.

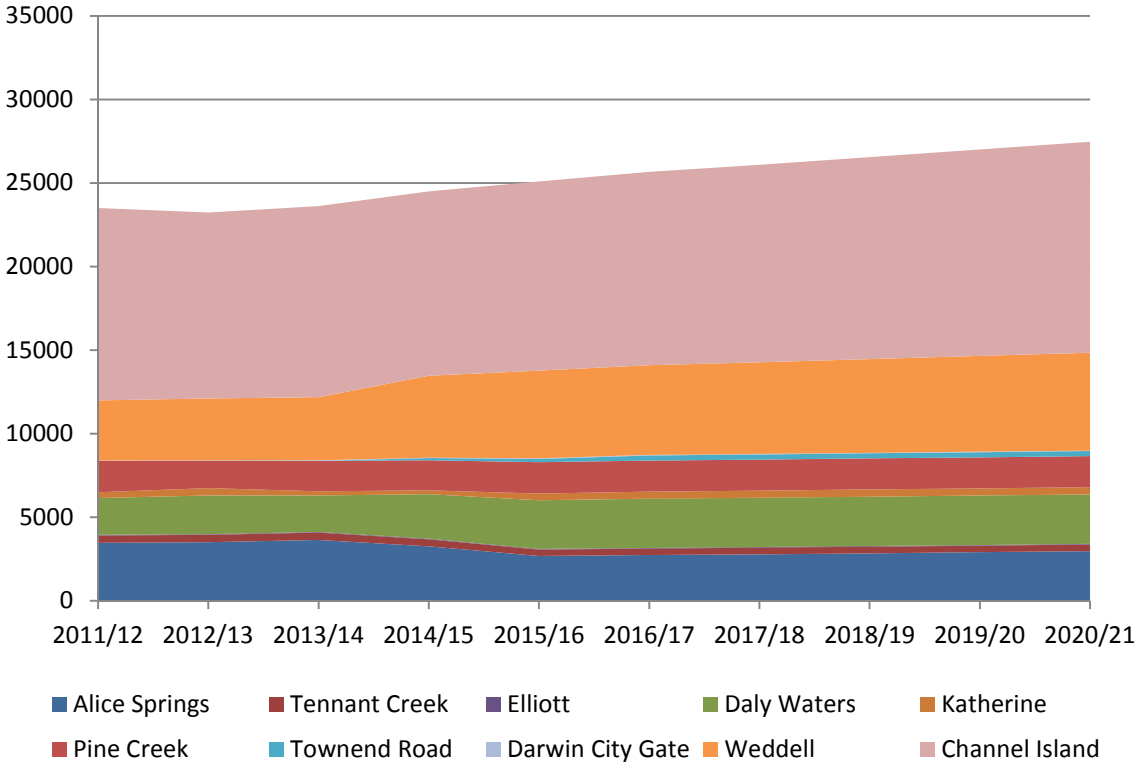
Maximum demand at the Katherine and Alice Springs delivery points has been derived based on historic observed demand, growing at the same rate as volumes over the access arrangement period. This is because generating capacity served is either unknown (Alice Springs) or the expected utilisation of the generating capacity does not provide a reasonable basis on which to estimate maximum demand for the access arrangement period. While the change in supply arrangements at Alice Springs have impacted forecast volumes, there is still potential for maximum daily quantities in line with historic trends.

For Weddell and Channel Island delivery points, APTNT has calculated maximum demand at the start of the period based on the observed historical maximums at each point. This demand is forecast to grow at the same rate as volumes for these points over the access arrangement period (2.2 per cent per annum).

### 5.2.2 Total gas demand

Total gas demand for the pipeline is forecast to grow by approximately 1.7 per cent per annum over the access arrangement period. This is shown graphically by delivery point in Figure 5.2 below.

***Figure 5.2 - Actual and forecast total gas demand over the access arrangement period (GJ)***




As discussed above, this forecast has been derived by developing a bottom up forecast for each delivery point, taking account of the unique characteristics of each delivery point that drive demand. This combined forecast is then checked against available demand information from the main shipper.

The forecast growth rate is in line with that observed over the earlier access arrangement period. Further detail on drivers of demand for each delivery point is set out in the following section.

### 5.2.3 Gas demand delivery point forecasts

Forecast minimum, maximum and average demand, and total volume by delivery point, is shown in Table 5.5 below.

***Table 5.5 - Minimum, maximum and average demand and total volume by delivery point over the access arrangement period***

| | | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 |
|---|---|---|---|---|---|---|
| **Delivery points** | **Unit** | | | | | |
| Alice Springs | Min (TJ/d) | 6.3 | 6.3 | 6.3 | 6.3 | 6.3 |
| | Max (TJ/d) | 14.0 | 14.3 | 14.6 | 14.9 | 15.2 |
| | Average (TJ/d) | 7.5 | 7.6 | 7.8 | 7.9 | 8.1 |
| | Total (TJ/a) | 2,730.0 | 2,780.0 | 2,840.0 | 2,900.0 | 2,960.0 |
| Tennant Creek | Min (TJ/d) | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| | Max (TJ/d) | 1.7 | 1.7 | 1.7 | 1.7 | 1.7 |
| | Average (TJ/d) | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 |
| | Total (TJ/a) | 386.0 | 390.0 | 394.0 | 398.0 | 402.0 |
| Elliott | Min (TJ/d) | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| | Max (TJ/d) | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| | Average (TJ/d) | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| | Total (TJ/a) | 37.0 | 37.0 | 37.0 | 37.0 | 37.0 |
| Daly Waters | Min (TJ/d) | 1.5 | 1.5 | 1.5 | 1.5 | 1.5 |
| | Max (TJ/d) | 9.4 | 9.4 | 9.4 | 9.4 | 9.4 |
| | Average (TJ/d) | 8.1 | 8.1 | 8.1 | 8.1 | 8.1 |
| | Total (TJ/a) | 2,956.5 | 2,956.5 | 2,956.5 | 2,956.5 | 2,956.5 |
| Mataranka | Min (TJ/d) | 0 | 0 | 0 | 0 | 0 |
| | Max (TJ/d) | 0 | 0 | 0 | 0 | 0 |
| | Average (TJ/d) | 0 | 0 | 0 | 0 | 0 |
| | Total (TJ/a) | 0 | 0 | 0 | 0 | 0 |
| Katherine | Min (TJ/d) | 0 | 0 | 0 | 0 | 0 |
| | Max (TJ/d) | 6.2 | 6.2 | 6.2 | 6.2 | 6.2 |
| | Average (TJ/d) | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| | Total (TJ/a) | 420.0 | 424.0 | 428.0 | 432.0 | 436.0 |
| Mt Todd | Min (TJ/d) | 0 | 0 | 0 | 0 | 0 |
| | Max (TJ/d) | 0 | 0 | 0 | 0 | 0 |
| | Average (TJ/d) | 0 | 0 | 0 | 0 | 0 |
| | Total (TJ/a) | 0 | 0 | 0 | 0 | 0 |
| Pine Creek | Min (TJ/d) | - | - | - | - | - |
| | Max (TJ/d) | 5.9 | 5.9 | 5.9 | 5.9 | 5.9 |
| | Average (TJ/d) | 5.1 | 5.1 | 5.1 | 5.1 | 5.1 |
| | Total (TJ/a) | 1,860.0 | 1,860.0 | 1,860.0 | 1,860.0 | 1,860.0 |
| Cosmo | Min (TJ/d) | 0 | 0 | 0 | 0 | 0 |
| | Max (TJ/d) | 0 | 0 | 0 | 0 | 0 |

| | | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 |
|---|---|---|---|---|---|---|
| | Average (TJ/d) | 0 | 0 | 0 | 0 | 0 |
| | Total (TJ/a) | 0 | 0 | 0 | 0 | 0 |
| Ban Ban Springs | Min (TJ/d) | 0 | 0 | 0 | 0 | 0 |
| | Max (TJ/d) | 0 | 0 | 0 | 0 | 0 |
| | Average (TJ/d) | 0 | 0 | 0 | 0 | 0 |
| | Total (TJ/a) | 0 | 0 | 0 | 0 | 0 |
| Townend Road | Min (TJ/d) | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| | Max (TJ/d) | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| | Average (TJ/d) | 0.9 | 0.9 | 0.9 | 0.9 | 0.9 |
| | Total (TJ/a) | 310.6 | 310.6 | 310.6 | 310.6 | 310.6 |
| Darwin City Gate | Min (TJ/d) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Max (TJ/d) | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| | Average (TJ/d) | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| | Total (TJ/a) | 24.4 | 24.4 | 24.4 | 24.4 | 24.4 |
| Weddell | Min (TJ/d) | 0 | 0 | 0 | 0 | 0 |
| | Max (TJ/d) | 27.0 | 27.6 | 28.2 | 28.8 | 29.5 |
| | Average (TJ/d) | 14.7 | 15.0 | 15.4 | 15.7 | 16.0 |
| | Total (TJ/a) | 5,365.0 | 5,483.0 | 5,604.0 | 5,727.0 | 5,853.0 |
| Channel Island | Min (TJ/d) | 15.2 | 15.2 | 15.2 | 15.2 | 15.2 |
| | Max (TJ/d) | 47.0 | 48.1 | 49.1 | 50.2 | 51.3 |
| | Average (TJ/d) | 31.7 | 32.4 | 33.1 | 33.8 | 34.6 |
| | Total (TJ/a) | 11,572.0 | 11,827.0 | 12,087.0 | 12,353.0 | 12,625.0 |
| **Total volume** | **Total (TJ/a)** | **25,661.5** | **26,092.5** | **26,541.5** | **26,998.5** | **27,464.5** |

Similar to the discussion of key trends behind actual demand in the earlier access arrangement period (see section 5.1.1), each delivery point exhibits different drivers that lead to different demand forecasts. Significant delivery points on the pipelines are described in the following sections.

*Alice Springs*

Gas delivered at Alice Springs is used for electricity generation for domestic, commercial and light industrial end uses.

As noted above, there was a step change in demand at the Alice Springs delivery point associated with a change in gas supply arrangements with the development of a downstream alternative gas source. This change impacted actual deliveries at this delivery point from 2015/16, and in also reflected in forecast demand at this point, which is lower that historic demand.

Alice Springs gas usage exhibits a seasonal load profile with highest demand in the summer months, corresponding with a cooling load. In recent years there has also been a winter load influence, which appears to be driving part of the load increase observed.

APTNT's forecast load growth for Alice Springs has been derived based on the historic demand, after adjusting for the step change in demand in 2015/16, to give a growth rate of 2 per cent per annum over the forecast period.

Maximum demand is also forecast to grow at the same rate as volumes over the period.

*Tennant Creek*

Similar to Alice Springs, gas delivered to Tennant Creek is used for electricity generation for domestic, commercial and light industrial end uses and exhibits a seasonal load profile, with a recognisable winter heating load.

The drivers of demand at this delivery point are very similar to Alice Springs. APTNT has derived its forecast for this delivery point based on recent trend growth of an average of 1 per cent per annum, using the customer's current forecast demand for this delivery point as the starting point for the forecast.

*Daly Waters*

Daly Waters is an offtake to the McArthur River Mine and exhibits a relatively steady load, with a step up in 2014/15 after an expansion at the mine. The expansion is also reflected in an increase in the expected maximum demand at this site from 2014/15.

APTNT does not forecast any further growth at this delivery point over the access arrangement period.

*Katherine/Darwin transmission system*

The Katherine, Pine Creek, Weddell and Channel Island delivery points exclusively supply gas for electricity generation for the Katherine/Darwin transmission system. It is therefore important to consider these delivery points essentially as part of a broader demand group, related to electricity generation in the north of NT. This system makes up approximately 75 per cent of demand on the pipeline in 2015/16.

There is different utilisation of each of these sites reflecting contractual arrangements and the relative generating efficiency of each site as follows:

- Pine Creek units contribute steady base load. Gas demand therefore does not change significantly over the period;
- Katherine units are largely used as peaking load, and therefore can have very volatile usage patterns;
- Channel Island units contributed steady base load, as well as some peaking load, however with the commissioning of more efficient generating units at Weddell in

2008/09-2010/11, older Channel Island units now contribute a lower proportion of total power generation for the region; and

- Weddell units, being used in base load generation in place of some Channel Island units.

This information has been used to derive a forecast for each delivery point contributing to the Katherine/Darwin transmission system as follows.

Pine Creek

Reflecting the historically very stable demand at this delivery point, APTNT forecasts demand at this point to remain stable with zero growth.

Katherine

To derive its volume forecast for Katherine, APTNT has assumed that the Katherine generating facilities continue to operate in line with their historical operation as a peaking facility. This assumption is consistent with information available to APTNT from the customer for 2015/16, provided as part of their short term demand forecasts. Using the volumes provided, APTNT has then forecast growth for this point based on average historic demand growth, of 1 per cent per annum.

Weddell

The forecast for Weddell delivery point reflects an increase in utilisation of these more efficient units and the displacement of gas load from Channel Island, with a forecast growth of 2.2 per cent per annum, reflecting the trend in total gas demand growth for the Darwin/Katherine transmission system over the earlier access arrangement period.

Channel Island

Channel Island is the dominant load for this pipeline, with 45 per cent of 2015/16 volumes for the pipeline delivered to this point.

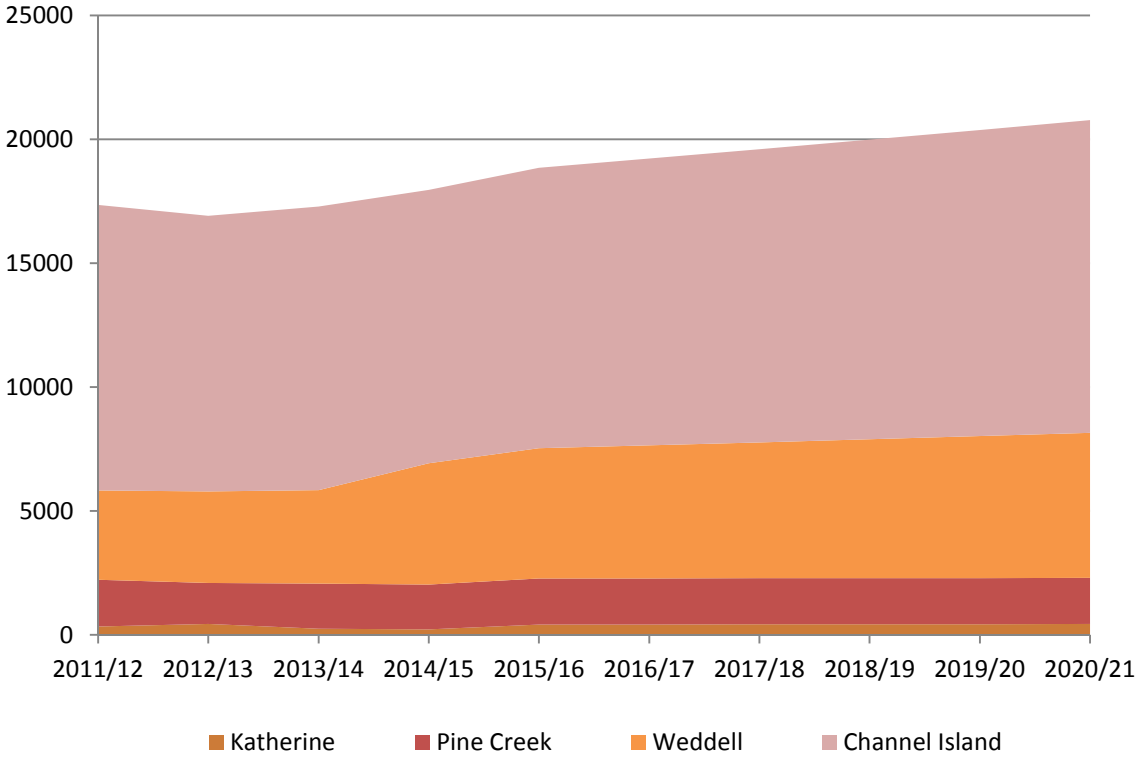
Additional generating units were installed at this site during the earlier access arrangement period, however these units have effectively displaced older less effective units at the site, leaving actual demand at this site relatively stable, with a forecast for steady growth in line with the trend in total gas demand growth for the Darwin/Katherine transmission system.

Total forecast Darwin/Katherine transmission system demand

Total forecast Darwin/Katherine transmission system demand is shown in Figure 5.3 below. In total, APTNT forecasts the Darwin/Katherine transmission system gas demand to grow by 2 per cent per annum, consistent with the growth rate for this system in the earlier access arrangement period.

APTNT considers that this forecast is arrived at on a reasonable basis, and represents the best forecast or estimate possible in the circumstances.

***Figure 5.3 - Forecast gas demand for the Darwin/Katherine transmission system by delivery point (GJ)***




*Total gas demand*

APTNT considers that its volume and demand forecasts included in this chapter are arrived at on a reasonable basis, and represent the best forecast or estimate possible in the circumstances. APTNT has utilised available up-to-date information to derive these forecasts, and has supported forecasts with the primary information referenced throughout the chapter.

### 5.2.4 Forecast user numbers

APTNT has forecast user numbers for each delivery point over the access arrangement period, as shown in Table 5.6 below. At active delivery points, there is only one contracted user, however at three of these points, the contracting user is not the foundation shipper.

As discussed above in relation to historic user numbers, users in addition to the foundation shipper have in the past only contracted over short periods of time, usually associated with:

- The limited availability of firm contracting arrangements; and
- The nature of the users, which are generally shorter term mining operations.

APTNT expects this trend to continue, as the drivers for shorter term contracts remain largely in place in the forecast period. Importantly, similar to the last period, the capacity of the pipeline is again expected to be fully contracted for the term of the access arrangement. This will limit APTNT's ability to offer firm haulage contracts, as discussed above in chapter 2.

While APTNT is currently marketing transportation services on the pipeline, at this stage there are no identified opportunities for additional supply of gas outside of the prevailing firm contract, and therefore no prospects of additional users on the pipeline.

In this context, APTNT has no basis for assuming that there will be additional users on the pipeline at any given delivery point, even if it is likely that at some stage over the access arrangement period additional users will contract to use the pipeline (as they did in the previous period).

***Table 5.6 - User numbers by delivery point over the access arrangement period***

| Delivery Points | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 |
|---|---|---|---|---|---|
| Alice Springs | 1 | 1 | 1 | 1 | 1 |
| Tennant Creek | 1 | 1 | 1 | 1 | 1 |
| Elliott | 1 | 1 | 1 | 1 | 1 |
| Daly Waters | 1 | 1 | 1 | 1 | 1 |
| Mataranka | 0 | 0 | 0 | 0 | 0 |
| Katherine | 1 | 1 | 1 | 1 | 1 |
| Mt Todd | 0 | 0 | 0 | 0 | 0 |
| Pine Creek | 1 | 1 | 1 | 1 | 1 |
| Cosmo | 0 | 0 | 0 | 0 | 0 |
| Ban Ban Springs | 0 | 0 | 0 | 0 | 0 |
| Townend Road | 1 | 1 | 1 | 1 | 1 |
| Darwin City Gate | 1 | 1 | 1 | 1 | 1 |
| Weddell | 1 | 1 | 1 | 1 | 1 |
| Channel Island | 1 | 1 | 1 | 1 | 1 |

### 5.2.5 Forecast capacity and utilisation

Forecast capacity has been determined after modelling the current aggregate contracted demands on the pipeline, and then simulating the additional quantity that can be delivered without breaching the physical and contractual constraints on the pipeline. The resulting pipeline capacity is set out in Table 5.7 below.

Utilisation of the pipeline has been calculated using forecast average delivery volumes for each year divided by the capacity of the pipeline. The estimate of non-coincident demand has been derived from recent flow data extrapolated for the forecast years with an annual growth rate matching forecast volume growth.

***Table 5.7 - Pipeline capacity and utilisation over the access arrangement period***

| | Units | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 |
|---|---|---|---|---|---|---|
| Pipeline capacity | TJ/day | 120 | 120 | 120 | 120 | 120 |
| Average utilisation of pipeline capacity | % | 59 | 60 | 61 | 62 | 63 |

# 6 Capital expenditure

This chapter provides summary information of capital expenditure undertaken in the earlier access arrangement period, and forecast capital expenditure for the access arrangement period.

A detailed discussion of completed and forecast capital expenditure projects is included in section 6.3. This includes comparisons (where relevant) to approved values, and provides explanations and justifications for actual and forecast capital expenditure by reference to the Rules. It also provides details of expenditure undertaken in the final year of the access arrangement period that preceded the earlier access arrangement period.

For the purposes of the access arrangement revision proposal APTNT classifies its capital expenditure according to driver as follows:

- *Expansion* capital expenditure, which is required to expand the capacity of the pipeline to meet demand both within the access arrangement period and beyond;
- *Replacement* capital expenditure, which is required to maintain the integrity of the pipeline and includes items such as replacement of instrumentation (for example metering, telemetry, remote terminal units), pipeline hardware (for example pipes, meter valves, regulators and fittings), site capital improvements (for example fencing and security), and specialised major spares; and
- *Non-system* capital expenditure, which relates to capital required for replacement of items such as office furniture and computer equipment.

These classifications are identical to those used in the earlier access arrangement period to ensure consistency when comparing actual expenditure against the forecasts used to derive tariffs in the earlier access arrangement period, and comparing past and future expenditure in this proposal.

APTNT does not use these classifications in its actual accounting and therefore some judgement has been applied in categorising historic and forecast expenditure into these classifications.

As noted above in section 1.4.3, the access arrangement period started on 1 August 2011. APTNT has presented capital expenditure data in this chapter in line with the access arrangement period. That is, actual recorded expenditure for 2010/11 relates to the period 1 July 2010 to 31 July 2011 (13 months), and actual recorded expenditure for 2011/12 reflected actual recorded expenditure for the period 1 August 2011 to 30 June 2012 (11 months).

The implications of the slightly later start to the access arrangement period are also discussed in respect of the capital base roll forward in section 7.1 below.

## 6.1 Rules governing conforming capital expenditure

Rule 79(1) specifies that capital expenditure:

> … must be such as would be incurred by a prudent service provider acting efficiently, in accordance with accepted good industry practice, to achieve the lowest sustainable cost of providing services. The capital expenditure must also be justifiable on a ground stated in subrule (2).

Rule 79(2) goes on to set out three main subrules for capital expenditure as follows:

> (a) the overall economic value of the expenditure is positive; or
>
> (b) the present value of the expected incremental revenue to be generated as a result of the expenditure exceeds the present value of the capital expenditure; or
>
> (c) the capital expenditure is necessary:
>
> > (i) to maintain and improve the safety of services; or
> >
> > (ii) to maintain the integrity of services; or
> >
> > (iii) to comply with a regulatory obligation or requirement; or
> >
> > (iv) to maintain the service provider's capacity to meet levels of demand for services existing at the time the capital expenditure is incurred (as distinct from projected demand that is dependent on an expansion of pipeline capacity)

The AER's discretion under this rule is limited such that the AER must not withhold its approval of capital expenditure if it is satisfied that it complies with the requirements of the law and is consistent with Rule 79. All forecasts and estimates must also comply with Rule 74.

## 6.2 Enhanced integrity works

### 6.2.1 Description of works

The capital expenditure forecast for the earlier access arrangement period was dominated by a series of projects termed enhanced integrity works, or 'special projects'.

These works were driven by integrity surveys of the pipeline, in particular from intelligent pigging, and Direct Current Voltage Gradient (DCVG) surveys. These surveys uncovered issues with the pipeline that APTNT considered, based on risk assessment using information available at the time, required rectification.

APTNT's enhanced integrity program was to be delivered in two parts:

- a short term period of relatively high expenditure to address immediate integrity concerns, to be delivered through a special project delivery structure in 2010/11 and 2011/12; and
- longer term increased expenditure (compared with historic norms), reflecting the new level of integrity expenditure required for this pipeline going forward.

### 6.2.2 Treatment of 'special projects' works in previous access arrangement decision

In the access arrangement revision proposal lodged in December 2010[29], APTNT proposed the majority of 'special projects' expenditure would be completed in 2010/11 (70 per cent), with remaining works scheduled for completion in 2011/12 (30 per cent). This meant that the forecast for special projects spanned two access arrangement periods.

Following submission of the revision proposal (but before the AER's draft decision), APTNT revised its forecast for the special projects, increasing the forecast expenditure for some projects, reduced it for others, and also moving some expenditure into the forecast access arrangement period, as APTNT was experiencing delays in reaching agreement with the primary contract holder on the scope and timing of the projects. APTNT advised the AER of these revisions both in response to specific questions on the capital expenditure program[30], and in a submission on the AER's Draft Decision.[31]

In its draft and final decisions, the AER did not accept APTNT revisions to the special project expenditure. In particular, the AER did not accept APTNT's proposed revisions to expenditure that were to occur in the forecast period (that is, after 1 July 2011).

In contrast, the AER's final decision states that it did accept APTNT's revised timings for projects, and adjusted forecast expenditure accordingly,[32] however this only partially appears to be reflected in the approved expenditure forecast. The AER also adjusted the estimated expenditure for 2010/11 to reflect APTNT's updated estimates for expenditure for the remainder of the year.

The outcome of the AER's decision was that the final approved allowance for special projects was 30 per cent below the amount proposed by APTNT in its December 2010 (original) proposal. This was despite the AER finding in its draft and final decisions that each project submitted by APTNT was prudent and efficient, and approving the forecast amounts for each project (before escalation).

[29] NT Gas 2010, *Amadeus Gas Pipeline Access Arrangement Revision Proposal Submission*, December, pp 63-78

[30] APTNT response to AER 2011, AER.NTGAS.15-18 – update on projects, 25 February

[31] APTNT 2011, *Amadeus Gas Pipeline revised 2011-16 Access Arrangement – project capital expenditure – Submission to the AER*, 24 June

[32] Australian Energy Regulator 2011, *NT Gas Access arrangement proposal for the Amadeus Gas Pipeline 1 August 2011-30 June 2016 Final Decision – Public*, July, p 42

That is, had APTNT not advised the AER of the revising timing and forecasts for expenditure for projects, it appears that the AER would have accepted the forecast including in the original proposal in full (except escalation).

The final approved amount was also 50 per cent below APTNT's revised proposal for the projects that it submitted based on information it received during the course of the access arrangement approval process, which the AER did not accept.

### 6.2.3 Presentation of 'special projects' works in this submission

APTNT has undertaken the works previously described as 'special projects' since 2010/11, and some of the individual projects are continuing into the forecast period (that is, past 2015/16).

In discussing these projects in this submission, APTNT will present capital expenditure for each project in each year that expenditure is incurred, which in some cases may span three separate regulatory periods. This will allow assessment of total project expenditure against AER approved forecasts for each project.

## 6.3 Details of capital expenditure projects

This section describes all material capital expenditure projects undertaken in the earlier access arrangement period, as well as those forecast for the access arrangement period. APTNT has used a materiality threshold of projects over $200,000 in describing these projects in this submission. This threshold covers 95 per cent of actual and forecast expenditure over the two periods.

Further detail on all forecast projects is included in the AMP, which is provided at Attachment A to this submission.

### 6.3.1 Expansion capital expenditure

*Katherine meter station upgrade*

APTNT proposed a single expansion project, being the Katherine Meter Station Upgrade project. This project was driven by a need to support an increase in the capacity of the Katherine generating facilities.

The APTNT proposal for the Katherine meter station upgrade was based on a FEED study completed in line with the customer's specifications. The outcome of the FEED was a project with forecast costs of $8.7 million ($2015/16). As a result of these high expected costs, the customer asked APTNT to put the project on hold.

APTNT subsequently advised the AER of the customer's decision to halt the expenditure, but advised that it expected to incur some further costs associated with the

project, however the scope of such works were unknown.[33] APTNT then revised its forecast of expenditure to reflect its incurred costs in relation to the FEED and other preparatory works, all of which were incurred in 2010/11 (the final year of the preceding period). The AER accepted the revised forecast and it was included in the opening capital base for the earlier access arrangement period.

The customer subsequently asked APTNT to build a new outlet to the Katherine meter station, with associated valve and pipework, to allow it to connect some new gas turbine units. The works also involved installation of the new main line valve actuator, and upgrade of the water bath heaters. APTNT understands that the customer undertook some works on its site, including gas conditioning, which is not included in APTNT's costs for the project.

As noted above, while additional works were expected, a lack of information on their eventual form meant that APTNT did not include a forecast of this expenditure in its earlier access arrangement proposal.

Total expenditure during the earlier access arrangement period for the reduced scope project was $0.8 million ($2015/16), incurred across 2012/13 and 2013/14.

The works increased the capacity of the Katherine meter station site as a result of the new outlet, and is justified under Rule 79(2)(b) as the incremental revenue to be generated from this expansion exceeds the present value of the capital expenditure.

*Noonamah offtake (Townend Road)*

In 2013/14, APTNT built an offtake to supply a new industrial customer. This offtake was not forecast in the earlier access arrangement.

The offtake included an actuated line valve and RTU to receive meter data from the connected facility. Expenditure of this project is set out in Table 6.1.

***Table 6.1 – Noonamah offtake –APTNT actual expenditure ($'000 2015/16)***

| Noonamah offtake | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16E | 2016/17F | Total |
|---|---|---|---|---|---|---|---|---|
| Actual expenditure | | | 7 | 555 | 56 | | | **618** |

The project added an additional delivery point, and is justified under Rule 79(2)(b) as the incremental revenue to be generated from this expansion exceeds the present value of the capital expenditure.

[33] APTNT response to AER 2011, AER.NTGAS.15-18 – update on projects, 25 February

### 6.3.2 Replacement capital expenditure

All projects in this category satisfy Rule 79(2)(c) as essential to maintain the safety and integrity of services, and to ensure continuing compliance with regulatory obligations, in particular those set out in AS2885.3. The AMP accompanying this submission includes references to specific requirements as relevant.

*Channel Island meter station upgrade*

The proposed for the Channel Island meter station upgrade was driven by a request to support an increase in the capacity of the Channel Island generating facilities with the addition of two new generating units.

Some of the work was undertaken by the customer, while APTNT provided site supervision of works including resources to attend design workshops, safety management studies composed of HAZOP studies and risk assessments, and labour and supervision for mechanical, civil and electrical works associated with the interconnection in the existing station. The customer subsequently transferred the customer funded portion of the asset to APTNT as a capital contribution. In line with the capital contributions approach in section 3.2 of the access arrangement, APTNT has recorded this as capital expenditure and as revenue. Total expenditure on this project is set out in Table 6.2 below.

Note that the AER approved forecast for this project was affected by the AER's regulatory treatment of the change in timing for this project. The need for this project, and the expected expenditure, was accepted by the AER as necessary and prudent. Changes in the timing for this project driven by PWC's project schedule meant that APTNT provided the AER with a revised forecast, with expenditure split between 2010/11 and 2011/12. While accepting the revision to actual expenditure in 2010/11, the AER did not accept the revision to the forecast amount, and instead applied a negative value in this period for this project. The drivers for this negative calculation were unexplained and have not been able to be replicated by APTNT.

***Table 6.2 - Channel Island meter station upgrade – AER approved and APTNT actual expenditure ($'000 2015/16)***

| Channel Island meter station upgrade | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16E | 2016/17F | Total |
|---|---|---|---|---|---|---|---|---|
| AER approved forecast | 350 | -104 | | | | | | **246** |
| Actual expenditure | 1,781 | 939 | 18 | | | | | **2,738** |

*Channel Island piggability project (Channel Island Bridge Project) (AMP item 15)*

A 12 kilometre spurline runs from Darwin City Gate to Channel Island Meter Station with approximately 800 metres of 8" heavy wall pipe installed on the bridge crossing towards the end of the section. This pipeline is critical to Darwin as it feeds major power generation facilities.

The 12 kilometre spurline is currently unpiggable with intelligent inline inspection tools due to the dual diameter construction. Thus, the levels of corrosion (leading to loss of wall thickness) are currently hard to quantify. Whilst other integrity assessment methods are utilised such as DCVG surveys, these methods can only detect potential areas of metal loss, compared to intelligent pigging that detects actual metal loss.

APTNT proposed a project to make the Channel Island spurline piggable by replacing the pipeline at the bridge crossing with 12" pipe to allow the entire section of pipe to be pigged as a single section. The project also included upgrades at the Darwin City Gate and the Channel Island meter station through the installation of pig launching and receiving facilities, a new filter and associated valving. Approved expenditure for the project expenditure was $7.5 million, to be incurred over 2010/11 and 2011/12.

Subsequent to this process, the customer asked APTNT to undertake a further FEED study to investigate three options to make the spurline piggable. The options were:

1. Replace the 8" section of the pipeline across the bridge with 12" pipeline in line with previous approved project scope;
2. Undertake underwater horizontal directional drilling to remove the need for a bridge crossing; and
3. Assess scope for a midway scraper station to provide for separate pigging of the 12" and 8" sections of the pipe.

The FEED showed that option 2 was the preferable option with similar costs to option 1 but without the future complication of the bridge crossing. PWC has agreed to this option in concept, but has asked for a further geotechnical survey to confirm that the drilling option is feasible.

The project is expected to start at the end of 2015/16, and span into the forecast period. Total actual and forecast costs for the project are presented in Table 6.3 below, and included some expenditure incurred in 2010/11 in relation to the initial project scope.

***Table 6.3 - Channel Island piggability project – AER approved and APTNT actual/forecast expenditure ($'000 2015/16)***

| Channel Island piggability project | 2010/ 11 | 2011/ 12 | 2012/ 13 | 2013/ 14 | 2014/ 15 | 2015/ 16E | 2016/ 17F | Total |
|---|---|---|---|---|---|---|---|---|
| AER approved forecast | 1,499 | 5,969 | | | | | | **7,468** |
| Expected/ forecast expenditure | 76 | | | 115 | 227 | 518 | 10,902 | **11,838** |

*Channel Island meter project*

The metering on the pipeline off-takes is generally by orifice meter. The accuracy of orifice meters can be relatively poor and they are sensitive to wear and fouling, and have a tendency to under-read should the plates become worn or even slightly contaminated. At best these meters would be +/- 1 per cent accurate, and experience suggests that +/- 2 per cent is a reasonable expectation with errors up to +/- 5 per cent possible.

APTNT does not consider this level of accuracy to be appropriate due to the volume of gas throughput, particularly where there are third party users on the pipeline. As ultrasonic metering is in place at Ban Ban Springs inlet station, the imbalance in the accuracy of fiscal metering will contribute to greater unaccounted for gas. Current technology (ultrasonic or coriolis metering) would improve accuracy to +/-0.1 per cent and increase reliability.

APTNT proposed the replacement of two existing orifice plate meters at Channel Island with Ultrasonic meters, with expenditure to be incurred in 2010/11. APTNT later sought to revise this forecast and the expenditure to the forecast period (to be incurred in 2011/12). While the AER accepted APTNT's downward revisions to the 2010/11 forecast, it did not accept the corresponding increase in forecast expenditure related to the change in timing for this project. The AER therefore did not approve any expenditure for this project. This project has not proceeded within the earlier access arrangement period. In the event that a significant third party user were to use the pipeline, then APTNT believes that installation of more accurate metering would be necessary.

*Replacement of Elliott heaters*

On 25 February 2011, and in response to the AER's draft decision, APTNT advised that it would not be proceeding with the Elliott heater replacement project within the earlier access arrangement period. Accordingly, APTNT has not incurred any expenditure on this project.

*Bidirectional pigging project*

The change in majority supply, from the Amadeus to the Blacktip gas field, has resulted in majority southbound flows on the AGP between Ban Ban Springs and Palm Valley. This has required the pipeline to be pigged in the reverse direction compared to pipeline

design. In addition, southbound flows are lower than required for effective metal-loss pigging. It has therefore been necessary to create a pressure/flow regime suitable for pigging.

The AER approved a total of $0.5 million ($2015/16) for this project to be incurred over 2010/11 and 2011/12. The original plan for this project was to use insertion sleeves to allow to the launch and retrieval of pigs without physical modification of the stations. This approach was suggested by the pigging vendor as a low cost solution.

Subsequent investigation by APTNT and discussions with other pipeline operators showed that the use of sleeves would be unsuitable for the configuration of the AGP, and APTNT's risk assessment concluded that the approach was not acceptable for the pipeline.

As a result, APTNT had to physically modify the stations to allow for bidirectional pigging. The project was completed in 2013/14 at a total cost of $5.1 million ($2015/16). The profile of expenditure is shown below in Table 6.4 below.

***Table 6.4 - Bidirectional pigging project – AER approved and APTNT actual expenditure ($'000 2015/16)***

| Bidirectional pigging project | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16E | 2016/17F | Total |
|---|---|---|---|---|---|---|---|---|
| AER approved forecast | 254 | 238 | | | | | | **493** |
| Actual expenditure | 99 | 872 | 3,857 | 311 | | | | **5,138** |

*Cathodic Protection (AMP items 12, 13 and 30)*

Impressed current Cathodic Protection (CP) is used on the AGP to prevent external corrosion. The CP system is one of only two ways the pipeline is protected from corrosion and it is fundamental to the longevity of the pipeline asset. The other protection is the coating which is known to be deteriorating and is the subject of the heat shrink sleeve replacement program.

APTNT completed the Cathodic Protection stage 2 project in line with the approved expenditure for this project, albeit with some delay in the project and deferral of expenditure from 2010/11 to the earlier access arrangement period. The profile of expenditure is shown in Table 6.5.

***Table 6.5 - Cathodic Protection stage 2 – AER approved and APTNT actual expenditure ($'000 2015/16)***

| Cathodic Protection stage 2 | 2010/ 11 | 2011/ 12 | 2012/ 13 | 2013/ 14 | 2014/ 15 | 2015/ 16E | 2016/ 17F | Total |
|---|---|---|---|---|---|---|---|---|
| AER approved forecast | 1,163 | 3,033 | | | | | | **4,196** |
| Actual expenditure | 237 | 419 | 3,562 | 158 | | | | **4,376** |

Work on the CP system was ongoing in the earlier access arrangement period. APA forecast (and the AER approved) some cathodic protection work as part of routine replacement capital expenditure. APA has not been able to completely reconcile the AER's calculation of approved capital expenditure in this category, however the approved routine cathodic expenditure allowance appears to be in the order of $1.0 million over the earlier access arrangement period. APA's routine expenditure over the earlier access arrangement period is in line with this forecast.

In the forecast period, APTNT forecasts a number of expenditures to maintain pipeline cathodic protection, including:

- Addition of a new CP site in each year of the forecast period. Note that expenditure in the earlier period included in routine replacement included preliminary works for an initial additional three sites involving cultural clearance, survey work and preliminary design, as this work can be time consuming;
- Replacement of two CP units in each year of the forecast period; and
- Replacement of CP ground beds through a planned replacement program.

Forecast expenditure for these works is shown Table 6.6 below.

***Table 6.6 – Cathodic Protection – Forecast expenditure ($'000 2015/16)***

| Cathodic Protection | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | Total |
|---|---|---|---|---|---|---|
| New CP sites | 349 | 364 | | 371 | | **1,084** |
| CP unit replacement | 29 | 29 | 29 | 29 | 29 | **145** |
| Replace CP ground beds | | 73 | | 75 | | **148** |

These significant CP works reflect the condition of the pipeline which has significant metal loss through corrosion. CP provides a line of defence against further corrosion, and is a cost effective way of managing metal loss on a pipeline. It is also important to recognise that as a pipeline ages, its drain on the CP system increases, creating the need for more investment in new sites and to upgrade sites.

*Hazardous area assessment and equipment replacement (AMP item 8)*

This project is required to ensure ongoing compliance with the *Energy Pipelines Act* and the AGP Pipeline Licence to comply with relevant Australian Standards, in particular AS3000 and AS60079. This project involves the following:

- The production of hazardous area drawings, that clearly identify the hazardous zones;
- Identification of assets identified as not consistent with requirements;
- The production of hazardous area dossiers that identify the equipment that is situated within the hazardous zones and the equipment's certificate of compliance to be in that location;
- Developing hazardous area inspection procedures and an inspection program; and
- Training personnel in hazardous area requirements.

Hazardous area dossiers have been prepared for all sites, including training of operational and engineering personnel.

Works on hazardous area equipment replacement is ongoing, with some expenditure expected 2015/16, and in the forecast period as set out in Table 6.7 below.

***Table 6.7 – Hazardous area assessment and equipment replacement – AER approved and APTNT actual and forecast expenditure ($'000 2015/16)***

| Hazardous area works | 2010/ 11 | 2011/ 12 | 2012/ 13 | 2013/ 14 | 2014/ 15 | 2015/ 16E | 2016/ 17F | 2017/ 18F | Total |
|---|---|---|---|---|---|---|---|---|---|
| AER approved forecast | 321 | 789 | | | | | | | **1,110** |
| Actual expenditure | 22 | 572 | 1 | | | 206 | 258 | 155 | **1,215** |

*Palm Valley slamshut and filter*

APTNT proposed the installation of a filter and slamshut at Palm Valley as part of the earlier access arrangement proposal.

The change in flow direction on the AGP, where gas now flows south to Palm Valley, created the need to install a filter at Palm Valley where none had been required previously. Filters remove dust from delivered gas that may be in gas received from the producer, or been picked up during transport in the pipeline. In particular, pigging operations (now conducted southbound) can reasonably be expected to cause disturbance in the pipeline that can raise dust into the gas stream.

At the time of proposal, APTNT had limited experience with the amount of dust that might be entrained in the gas stream during pigging with low gas speeds. This meant that it had limited ability to accurately forecast the level of dust expected to be delivered

at Palm Valley, and therefore the needs for filtration at the site. Additionally, the first section to be pigged (Tanami Road to Palm Valley) could not be pigged for the previous 15 years due to very low flow conditions and the level of dust build up during this period was uncertain.

The solution chosen by APTNT involved the use of a relocatable filtration system with temporary pipeline connections to be used only at the time of pigging. This solution was found to be preferable for two reasons. First, the Palm Valley site is very crowded and the pipework and civil works required for a permanent solution would be considerable.

Secondly, considerable modelling work was undertaken of the observed and forecast levels of dust at the site and these were found to be manageable, except when pigging the pipeline. This allowed for a relocatable solution to be adopted as full time filtration would not be required.

The profile of expenditure is shown in Table 6.8. Installation of the filtration system was delayed to coincide with the scheduled pigging operation as analysis showed that it was not required before this time.

The temporary filter was installed on the Palm Valley Interconnect in August 2014. Cleaning pigging commenced on the Tanami Road to Palm Valley section in September 2014. The pigging operation itself is treated as operating expenditure in line with the prevailing access arrangement decision.

***Table 6.8 - Palm Valley filtration project – AER approved and APTNT actual expenditure ($'000 2015/16)***

| Palm Valley filtration | 2010/ 11 | 2011/ 12 | 2012/ 13 | 2013/ 14 | 2014/ 15 | 2015/ 16E | 2016/ 17F | Total |
|---|---|---|---|---|---|---|---|---|
| AER approved forecast | 254 | 53 | | | | | | **307** |
| Actual expenditure | | | | 113 | 253 | | | **365** |

The remotely operated slam-shut valve was thought to be required to enable the pipeline outlet to the Palm Valley to Alice Springs pipeline to be isolated. This was considered necessary to prevent loss of inventory in the case of a downstream emergency. Investigations found that the interconnected Envestra (now Australian Gas Networks) pipeline has appropriate levels of over-pressure protection and rupture detection, making it unnecessary to also install a slamshut on the AGP. The slamshut portion of this project was therefore not pursued.

*Heat shrink sleeve replacement (AMP Item 3)*

The field joint coating across the butt weld areas of the pipeline have failed significantly, in many cases causing shielding of the pipe metal from the CP system. The result is corrosion in the vicinity of the field joints that occur at least every 18 metres.

On the basis of work by contracted specialist IONIK Consulting, APTNT committed to completing 100 repairs at heat shrink sleeves per year on a prioritised basis (largest defects first), to address estimates that over 1100 defects would require repair in the first ten years of the program.

The first year of the program was to be completed as part of the special projects delivery structure, with the remainder in routine replacement capex. Due to delays in timing of the special projects program, this delineation between special projects and routine expenditure is not useful for the presentation of the costs for this project. APTNT has therefore presented the total costs of this project in Table 6.9 below against APTNT's best estimate of the AER approved amounts for this project over the earlier period.

Note that this project extends into the forecast period in line with the previously advised ten-year program, and forecast costs are presented below in Table 6.10.

Since the original IONIK consultancy, APTNT are now using a new assessment technique to prioritise repairs. It is based on the remaining strength method, which the pigging vendor GE refers to as LAPA. This method is less conservative than the ASME B31G method that was utilised by IONIK. The LAPA analysis is allowed in AS 2885 and comes at additional expense, but usually results in fewer repairs. In recent years APTNT has been able to significantly reduce the number of repairs by utilising the LAPA analysis.

***Table 6.9 - Heat Shrink Sleeve Replacement– AER approved and APTNT actual expenditure ($'000 2015/16)***

| Heat Shrink Sleeve Replacement | 2010/ 11 | 2011/ 12 | 2012/ 13 | 2013/ 14 | 2014/ 15 | 2015/ 16E | Total |
|---|---|---|---|---|---|---|---|
| AER approved forecast | 445 | 675 | 541 | 541 | 541 | 541 | **3,282*** |
| Actual expenditure | 2 | 790 | 639 | 628 | 400 | | **2,459** |

* Note that the approved forecast amount is subject to considerable uncertainty as APA has not been able to replicate the AER's calculations in respect of approved routine replacement capex.

***Table 6.10 - Heat Shrink Sleeve Replacement – Forecast expenditure ($'000 2015/16)***

| Heat Shrink Sleeve Replacement | 2016/ 17 | 2017/ 18 | 2018/ 19 | 2019/ 20 | 2020/ 21 | Total |
|---|---|---|---|---|---|---|
| Forecast expenditure | 52 | 261 | 266 | 268 | 270 | **1,118** |

*Below ground station pipework recoating (AMP Item 1)*

During construction of the AGP, complex joints, valves and fittings were coated with coal tar enamel. The majority of stations on the pipeline have detectable coating defects identified during DCVG surveys, CP surveys and physical assessment. During an earlier project, spot samples of the coating within the scraper stations were conducted that

confirmed the coating defects exist in the coal tar enamel sections and at the heat shrink sleeves within the stations.

Where corrosion defects exist in buried pipe work with the heat shrink sleeves and with coal tar enamel, there is high potential for the development of shielding of the pipe steel from the CP system resulting in corrosion. None of this pipe work is able to be inspected through metal-loss pigging, and it is therefore necessary to excavate, inspect and repair each facility.

The original scope of this project involved recoating 37 stations on the AGP where coal tar was used, and replacing the coatings with modern epoxy.

APTNT revised its forecast prior to the AER's final decision to increase this project to $13.0 million. The AER did not accept the revised forecast, and instead approved an amount close to that proposed by APTNT in its original proposal.

APTNT subsequently divided the project into two stages, with the first stage involving nine stations. Expenditure incurred for this work is set out in Table 6.11 below.

***Table 6.11 - Belowground Station Pipework Recoating stage 1– AER approved and APTNT actual expenditure ($'000 2015/16)***

| Belowground Station Pipework Recoating stage 1 | 2010/ 11 | 2011/ 12 | 2012/ 13 | 2013/ 14 | 2014/ 15 | 2015/ 16E | Total |
|---|---|---|---|---|---|---|---|
| AER approved forecast | | 5,554 | | | | | **5,554** |
| Actual expenditure | 160 | 411 | 5,586 | 94 | | | **6,251** |

Due to having limited previous experience in belowground station work (both on the expected scope of costs, and their likely cost), APTNT conducted the first stage of this project using a rates-based sole source contract. With the knowledge gained in completing the initial sites, APTNT is conducting the remainder of this project through a fixed cost tender. This is expected to deliver cost efficiencies for the works on the remaining 25 stations.

Actual and forecast costs for the remainder of this project are set out in Table 6.12 below.

***Table 6.12 - Belowground Station Pipework Recoating stage 2 – estimated and forecast expenditure ($'000 2015/16)***

| Belowground Station Pipework Recoating stage 2 | 2012/ 13 | 2013/ 14 | 2014/ 15 | 2015/ 16E | 2016/ 17 | 2017/ 18 | Total |
|---|---|---|---|---|---|---|---|
| Estimated and forecast expenditure | | 32 | 504 | 9,128 | 3,525 | | **13,189** |

*Anchor Block repairs*

Each station has anchor blocks on either side of the pipework to stop pipeline movement within the station from heat based expansion and contraction and other sources of ground movement. The design of the anchor blocks is generally a welded ring on the pipeline that is cast with reinforced concrete.

DCVG surveys uncovered signs of coating defects within the anchor blocks at two sites – Newcastle Waters and Palm Valley. These findings were reinforced by observed drains on CP sites at the stations. A further survey found that 9 out of 14 stations with anchor blocks showed signs of coating defects within the anchor blocks and therefore the need to excavate each block, remove the reinforced concrete encasing the pipeline, address the coating defect and any associated metal loss, and then replace the anchor block.

This change in scope of the project (from 2 stations to 9) was the driver for the change in APTNT's revised forecast for this project provided to the AER during the revision process. While accepting the need for the project in its draft and final decisions, the AER did not approve any expenditure in its final decision, due to the change in timing of the project, which pushed expenditure into the forecast period and which was not adjusted by the AER.

APTNT conducted further engineering tests involving long range ultrasonic testing at each station by a contractor from Singapore with specialist equipment and knowledge in this testing. This work showed that there was no significant corrosion associated with the coating defects that were detected through DCVG.

Final APTNT expenditure on this project was $0.8 million, with the majority of expenditure incurred in 2012/13.

*Darwin City Gate oil vessel*

The hydrocarbon drop out at Darwin City Gate was significant during the 'early gas' period from the Bonaparte Gas Pipeline. At the time of the earlier proposal, it was unclear the degree of liquids that would be received at the station over the longer term.

While the AER accepted the need for this project and the prudency of the initially proposed expenditure, it did not approve any expenditure for this project, due to a change in timing of the project advised by APTNT during the review process.

The original oil vessel design for this site was a bespoke unit to address potentially high liquid levels at the site. Operational experience with Black-tip gas showed a relatively low liquids level, allowing APTNT to install a smaller standard tank. APTNT also replaced the oil vessel foundation, recoated underground pipework and installed cathodic protection, with total expenditure set out in Table 6.13 below.

***Table 6.13 – Darwin City Gate oil vessel –APTNT actual expenditure ($'000 2015/16)***

| DCG oil vessel | 2010/ 11 | 2011/ 12 | 2012/ 13 | 2013/ 14 | 2014/ 15 | 2015/ 16E | 2016/ 17F | Total |
|---|---|---|---|---|---|---|---|---|
| Actual expenditure | | | 16 | | 22 | | | **39** |

*Darwin City Gate moisture analyser & C9 gas chromatograph*

The gas chromatograph project involved replacement of an existing C6 gas chromatograph with a C9 unit, to allow for the detection of high end hydrocarbons that could drop out as condensate in the downstream processes.

The moisture analyser project involved replacement of an existing moisture analyser at Darwin City Gate with a new unit.

These projects were proposed separately, and the AER accepted the need for these projects, and the prudency of the initially proposed combined expenditure of $0.27 million ($2015/16). Due to a change in timing for these projects advised by APTNT during the review process, the AER did not ultimately approve any expenditure for either project.

Some of the work was undertaken by the customer, while APTNT provided site supervision of works including resources to attend design workshops, safety management studies composed of HAZOP studies and risk assessments, and labour and supervision for mechanical, civil and electrical works associated with the interconnection in the existing station.

These projects were completed by APTNT as a single project, and some synergies related to project management were achieved. The customer provided the gas chromatograph for installation, and subsequently transferred the asset to APTNT as a capital contribution. In line with the capital contributions approach in section 3.2 of the access arrangement, APTNT has recorded this as capital expenditure and as revenue.

Combined expenditure for the projects is set out in Table 6.14 below.

***Table 6.14 – Darwin City Gate moisture analyser and C9 gas chromatograph –APTNT actual expenditure ($'000 2015/16)***

| DCG moisture analyser and gas chromatograph | 2010/ 11 | 2011/ 12 | 2012/ 13 | 2013/ 14 | 2014/ 15 | 2015/ 16E | 2016/ 17F | Total |
|---|---|---|---|---|---|---|---|---|
| | 254 | 54 | | | | | | **308** |

*SCADA Bigpond Replacement and Clear SCADA (AMP item 11)*

APA Group uses many communications types including Satellite to monitor, operate and control the SCADA environment. The current services vary between service providers,

hardware deployed to site and adherence to security standards such as security and encryption.

Previously, some SCADA satellite services for the AGP were provided by Telstra Bigpond. Telstra had advised that APTNT would need to migrate to a different service due to the existing satellite service becoming unreliable. APA included $0.2 million in its routine capital expenditure allowance for this purpose.

APA primarily uses Ursys as a satellite provider for SCADA satellite services. APTNT took the opportunity to transfer to the APA standard SCADA service provider, which would offer efficiencies in relation to control room interoperability and asset management. The SCADA replacement project involved changing hardware at a number of sites, as well as an IP readdressing project.

The existing SCADA system is used to monitor, maintain and operate assets. This system is critical to being able to monitor the performance of assets and undertake initial diagnostics of asset faults should they occur.

APA Group's National SCADA Blueprint released in November 2009, recommended that all APA Group SCADA systems in operation across the country be migrated to ClearSCADA . This gradual migration to a common SCADA platform would mean that APA Group could access significant economies of scale in its SCADA operations and maintenance, and reduce key person and other risks associated with specialist SCADA knowledge requirements across the business. In particular, benefits were identified as arising from:

- A national scalable ClearSCADA licence and maintenance agreement for existing and future APA Group requirements;
- An APA SCADA Development Centre, with a goal of having 60 per cent of SCADA development across APA undertaken by in-house resources by 2012;
- National selection of a ClearSCADA vendor to provide external support and development;
- Associated development of an Enterprise Historian to capture all of APA Group's SCADA-related data and removal of all direct interfaces to SCADA (thereby improving SCADA security); and
- A standard Disaster Recovery architecture.

The transition of APTNT's SCADA system to the ClearSCADA system was undertaken between 2014/15 and 2015/16, replacing the existing Honeywell system, that was proving to have high maintenance and upgrade costs. This expenditure is set out in Table 6.15 below.

Implementation in Victoria, for the APA GasNet transmission system, proceeded on the basis of a forecast cost of $3.8 million. The replacement, and the proposed allocation of expenditure, were examined by the AER in the making of its September 2012 Draft

Decision on proposed revisions to the access arrangement for the Victorian transmission system. In its Draft Decision the AER stated that it "considers that APA GasNet's proposed SCADA system upgrade is prudent" and that:

> APA GasNet's proposed SCADA upgrade expenditure complies with the conforming capital expenditure criteria in r. 79 of the NGR and should therefore be included in the projected capital base under r. 78 of the NGR.[34]

The AER maintained this position in its March 2013 Final Decision on the proposed revisions to the Victorian transmission system.[35]

Expenditure on both of these projects is set out in Table 6.15 below.

***Table 6.15 – SCADA projects APTNT actual expenditure ($'000 2015/16)***

| SCADA projects | 2010/ 11 | 2011/ 12 | 2012/ 13 | 2013/ 14 | 2014/ 15 | 2015/ 16E | Total |
|---|---|---|---|---|---|---|---|
| SCADA Bigpond replacement | | | | 184 | 110 | | **294** |
| Clear SCADA | | | | | 71 | 764 | **834** |

In the earlier access arrangement period, APTNT forecast an annual allowance in its routine capital expenditure category for upgrades and updates to the SCADA system of $0.1 million per year. APTNT forecasts ongoing expenditure to update the new system, as set out in the IT Application Renewal Program forecast as part of Non-system capital expenditure.

*Single loop and Wizard controllers (AMP items 7 & 19)*

Single loop controllers control pressure or flow regulators at stations. The single loop controllers installed at a number of AGP sites were redundant, and APTNT could no longer source replacements. This project involves replacing the single loop controllers at four AGP sites (Darwin City Gate, Katherine, Pine Creek and Tennant Creek) with a design used commonly across APA assets.

A Wizard controller is a backup pneumatic controller for the single loop controller. A number of incidents across APA assets (in particular in Western Australia) where supply was interrupted, identified the need to have a back-up to the single loop controller at all stations. Two stations were identified as priorities, having either no backup controller, or having an old backup controller, and a new back-up controller was installed at each site (Tennant Creek and Pine Creek) during the earlier access arrangement period.

[34] Australian Energy Regulator, Access arrangement draft decision: APA GasNet Australia (Operations) Pty Ltd, 2013–17, September 2012, Part 2, p 82

[35] Australian Energy Regulator, Access arrangement final decision: APA GasNet Australia (Operations) Pty Ltd, 2013–17, March 2013, Part 1, p 23

A further program of work is scheduled for the forecast period, with two units replaced in 2016/17, and three further units replaced during the forecast period as shown in Table 6.16 below.

***Table 6.16 – Single loop and Wizard controllers - APTNT actual and forecast expenditure ($'000 2015/16)***

| Single loop and Wizard controllers | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | Total |
|---|---|---|---|---|---|---|---|---|
| Actual and forecast expenditure | 25 | 187 | 72 | | 26 | 11 | 26 | **347** |

*Site battery and 240V battery charger replacements (AMP items 5 & 6)*

Solar powered sites have a battery system to store energy. This power is used for communications, station monitoring and control and cathodic protection.

Mains powered sites have an uninterruptible power supply (UPS) to maintain station control and monitoring in the event that the site power fails. All meter stations have 240V battery chargers that are required for the UPS. If the UPS system cannot supply the required power, the site will automatically shut in as a safety precaution. Therefore, it is important that the UPS system is reliable so that a fail to supply or fail to take does not occur.

The life of the batteries is heavily influenced by temperature exposure.

The older generation of wet cell lead acid batteries used on solar powered sites had a life of between 10 to 15 years. These batteries have numerous safety related issues and have generally been superceded by gel cell lead acid batteries which have an estimated maximum life in hot conditions of between 7 to 10 years. The NiCd batteries used in the UPS systems are original equipment and have exceeded their design life of 25 years.

The 240 V chargers have historically undergone extensive refurbishments as components fail and they are now obsolete. Due to the criticality of this equipment and long lead times for some types of battery chargers, they need to be replaced prior to complete failure.

The site battery replacement program involves replacement of site batteries on both a reactive and proactive basis, dependent on the criticality of the site to system supply. The 240V battery charger replacement program involves prioritised proactive replacement of chargers to ensure maintenance of the UPS system.

Both projects span the current and forecast access arrangement periods, as set out in Table 6.17 below.

***Table 6.17 – Site battery and 240V battery charger replacements – estimated and expenditure ($'000 2015/16)***

| | 2014/15 | 2015/16 E | 2016/ 17 | 2017/ 18 | 2018/ 19 | 2019/ 20 | 2020/ 21 | Total |
|---|---|---|---|---|---|---|---|---|
| Site battery replacement | | 47 | 83 | 109 | 12 | 36 | | **288** |
| 240V charger replacement | 17 | 51 | 28 | 24 | 26 | | | **145** |

*AC mitigation (AMP item 14)*

The Channel Island Spurline and Katherine Lateral both parallel high voltage power lines. This may result in low frequency induction, earth potential rise, capacitive coupling and AC corrosion. Due to the installation of new high voltage power lines and increased loads on existing high voltage power lines, the possible harm to people and assets needs to be mitigated. Expected AC mitigation project works include:

- Installation of equipotential grading ring and AC mitigation test point at four locations on the Katherine Lateral;
- Installation of equipotential grading ring and AC mitigation test point at 33 locations on the AGP between KP 1476 and KP 1510; and
- Decommissioning of the ground beds (two off) at KP 1506 on the Channel Island Spurline.

Expenditure is limited to the earlier access arrangement period and is set out in Table 6.18 below.

***Table 6.18 – AC mitigation - APTNT actual expenditure ($'000 2015/16)***

| AC mitigation | 2010/ 11 | 2011/ 12 | 2012/ 13 | 2013/ 14 | 2014/ 15 | 2015/ 16E | Total |
|---|---|---|---|---|---|---|---|
| Actual expenditure | | | | | 34 | 207 | **242** |

*Mainline valve actuators replacement (AMP item 17)*

The Limitorque actuators on the DN300 and DN350 mainline valves are original equipment and are now obsolete as spare parts cannot be readily obtained.

The actuators are installed on all mainline valves located with scraper stations and at critical mid-section mainline valves. These actuators provide pipeline isolation and can be operated locally or remotely via SCADA. Therefore they are relied upon for pipeline isolation in the event of an emergency. AS 2885.1 requires that procedures are in place to be able to effectively isolate the pipeline remotely using mainline valves in a timely manner. The long lead time for the actuators means that they have to be replaced ahead of failure.

Two actuators have been purchased for Helling and Batchelor. A phased replacement of the remaining 10 actuators is proposed to commence in 2015, at the rate of two actuators every two years. Actual and forecast costs for this project are set out in Table 6.19 below.

***Table 6.19 – Replace mainline valve actuators - APTNT actual and forecast expenditure ($'000 2015/16)***

| Mainline valve actuator replacement | 2015/16E | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | Total |
|---|---|---|---|---|---|---|---|
| Actual and forecast expenditure | 146 | 92 | | 92 | | 89 | **419** |

*AGP routine replacement (AMP item 24)*

Stay in business capital items are purchased through the year and requested on an individual basis. The type of equipment purchased includes minor plant and equipment and materials used on the pipeline.

The AER included an allowance for routine replacement and non-system in each year of the earlier access arrangement period. These amounts included the continuation of the heat shrink sleeve replacement program (as a 10 year program) following the expected conclusion of the special project program of works, as well as allowances for cathodic protection and the transfer of satellite providers. As these amounts are already reported above in respect of these respective projects, Table 6.20 below shows the remainder of expenditure over the earlier access arrangement period in this category against APTNT's best estimate of the adjusted forecast for routine replacement and non-system works.

***Table 6.20 – Routine replacement and non-system expenditure ($'000 2015/16)***

| Routine replacement | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16E | Total |
|---|---|---|---|---|---|---|
| AER approved forecast | 576 | 636 | 847 | 585 | 784 | **3,428** |
| Actual and estimated expenditure | 215 | 285 | 332 | 204 | 250 | **1,287** |

Forecast routine replacement capital expenditure is set out in Table 6.21 below.

***Table 6.21 – Forecast routine replacement expenditure ($'000 2015/16)***

| | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | Total |
|---|---|---|---|---|---|---|
| Routine replacement | 256 | 263 | 269 | 276 | 283 | **1,348** |

*Gas chromatograph upgrades (AMP item 27)*

Gas chromatographs are used on pipeline systems to determine the chemical composition of the gas. This chemical composition is used for a number of purposes including:

- Calculation of the physical properties, for flow calculations and custody transfer for billing purposes.
- Determining the gas quality in accordance with gas transportation agreements and pipeline integrity requirements.

Gas chromatographs become obsolescent due to technology updates of both hardware and software. Older units become unserviceable as they are no longer supported by the vendor.

This program of works involves replacement of Gas chromatographs as they become unreliable or unserviceable. Gas chromatographs are an integral part of an operating pipeline and must have high levels of availability and accuracy so that they can be relied upon for billing and gas quality determination. It is a pipeline licence requirement and AS 2885.3 requirement to know the composition of the contents being conveyed in a pipeline. Forecast expenditure for this project is set out in Table 6.22 below.

***Table 6.22 – Gas Chromatograph upgrades - APTNT forecast expenditure ($'000 2015/16)***

| Gas Chromatograph upgrades | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | Total |
|---|---|---|---|---|---|---|
| Forecast expenditure | 205 | 205 | | | | **411** |

*Moisture analyser upgrades (AMP item 28)*

Moisture analysers are used on pipeline systems to accurately determine the amount of water present in the gas. The moisture content in the gas stream needs to be controlled for the following reasons:

- To prevent the formation of corrosive carbonic acid when water combines with carbon dioxide in the gas stream. This could result in internal corrosion of the pipeline; and
- To meet end user requirements as specified in the gas transportation agreement.

It is a pipeline licence requirement and AS2885.3 requirement to know the composition of the contents being conveyed in a pipeline.

This program of works involves replacement of moisture analysers before they become unreliable or unserviceable. Forecast expenditure for this project is set out in Table 6.23 below.

***Table 6.23 – Moisture analyser upgrades - APTNT forecast expenditure ($'000 2015/16)***

| Moisture analyser upgrades | 2016/ 17 | 2017/ 18 | 2018/ 19 | 2019/ 20 | 2020/ 21 | Total |
|---|---|---|---|---|---|---|
| Forecast expenditure | | | 103 | 103 | | **206** |

*Remote Terminal Unit replacement (AMP item 32)*

Remote terminal units (RTUs) are a microprocessor controlled device that interfaces field devices such as pressure transmitters, flow meters and valve actuators with the SCADA system. RTUs are therefore critical in the control and monitoring of gas pipeline facilities.

As RTUs are electronic equipment they have a finite life based on hardware and software requirements. With time, units may function adequately but are not well supported by the vendor. The typical design life for an RTU is approximately 10 to 15 years. It is a requirement of AS2885 to have reliable SCADA monitoring of the pipeline.

This program of works involves the replacement of RTUs before they become unreliable or unserviceable. APTNT expected to replace three to four RTUs per year on a rolling basis as set out in Table 6.24 below.

***Table 6.24 – RTU replacement - APTNT actual and forecast expenditure ($'000 2015/16)***

| RTU replacement | 2015/16E | 2016/ 17 | 2017/ 18 | 2018/ 19 | 2019/ 20 | 2020/ 21 | Total |
|---|---|---|---|---|---|---|---|
| Actual and forecast expenditure | 39 | 37 | 39 | 42 | 39 | 39 | **236** |

*Site hut upgrades (AMP item 33)*

The AGP has site huts at all meter stations and scraper stations. The site huts house electronic equipment that is used to monitor and control the pipeline such as RTUs, communications hardware and battery power systems. The site huts on the AGP are original equipment and require significant maintenance in order to prolong their life.

This program of works involves the upgrade of site huts to ensure the integrity of the equipment contained inside is not compromised. It is a requirement of the pipeline licence and AS 2885 to ensure that the pipeline can be appropriately monitored and controlled.

The site huts must be either refurbished or replaced to ensure that the electronic equipment inside still functions correctly in order to perform station monitoring and control. The complete replacement of the site huts is cost prohibitive due to the extensive fit out required to relocate all of the electronic equipment. A refurbishment program is proposed to extend the life of the huts as far as practicable including:

- Installation of a skillion roof

- Repainting
- Replacement of failed building components such as doors, flashings, trims etc.

Actual and forecast costs for this project involves performing minor structural works using internal resources, with approximately two sites budgeted for every year of the period as set out in Table 6.25 below. Sites will be prioritised based on condition and criticality.

***Table 6.25 – Site hut upgrades - APTNT actual and forecast expenditure ($'000 2015/16)***

| Site hut upgrades | 2015/16E | 2016/ 17 | 2017/ 18 | 2018/ 19 | 2019/ 20 | 2020/ 21 | Total |
|---|---|---|---|---|---|---|---|
| Actual and forecast expenditure | 39 | 20 | 40 | 39 | 42 | 40 | **221** |

*Solar panel replacement (AMP item 34)*

Solar power systems are used at AGP stations where mains power is not available. The majority of solar panels on the AGP are original equipment (30 years old) and over time the efficiency, reliability and capacity of the panels deceases. This results in the solar panels not being able to supply enough power to run the site and charge the backup battery system.

Electrical power is critical to ensure that control and monitoring of the stations can be performed and to apply cathodic protection to the pipeline. Some of the solar panels are mounted on the station hut roof or on elevated frames which presents working at heights issues.

This program of works involves replacement of solar panels at AGP stations prior to complete failure. Historic and forecast expenditure is based on replacing solar panels at two sites per year as set out in Table 6.26 below. Sites will be prioritised based on condition and criticality.

***Table 6.26 – Solar panel replacement - APTNT actual and forecast expenditure ($'000 2015/16)***

| Solar panel replacement | 2014 /15 | 2015/16 E | 2016/ 17 | 2017/ 18 | 2018/ 19 | 2019/ 20 | 2020/ 21 | Total |
|---|---|---|---|---|---|---|---|---|
| Actual and forecast expenditure | 33 | 37 | 26 | 37 | 27 | 21 | 25 | **207** |

*Water bath heater upgrades (AMP item 35)*

Water bath heaters are used to heat the gas at delivery stations to ensure that the delivery temperature is well above the dew point where liquids may form in the gas stream. It is a requirement of the gas transportation agreement not to deliver liquids, which can cause extensive damage to power generation equipment.

The water bath heaters are original equipment on the pipeline (30 years old), but have undergone a number of upgrades over the years. Upgrades can include:

- Burner control system
- Gas fuel system
- Process coils

Regular maintenance and inspections are performed in order to prolong the life of water bath heaters. This program of works involves major maintenance of water bath heaters to extend their life as far as economically feasible.

***Table 6.27 – Water bath heater upgrades ($'000 2015/16)***

| Water bath heater upgrades | 2016/ 17 | 2017/ 18 | 2018/ 19 | 2019/ 20 | 2020/ 21 | Total |
|---|---|---|---|---|---|---|
| Forecast expenditure | | | 320 | | 326 | **647** |

### 6.3.3 Non-system capital expenditure

*IT system capital expenditure*

Since the start of the earlier access arrangement, APA Group has been required to undertake significant expenditure in IT systems to meet the ongoing needs of the business. These upgrades have been necessary for the AGP, and a proportion of expenditure for these projects has been allocated accordingly. The allocation for most of these individual projects is well below the materiality threshold for capital expenditure (most allocations are below $0.07 million). Some of the more significant projects (either from a financial or operational perspective) are set out below.

- Portfolio and Project Operating Model

The PPOM project established a single portfolio and project management operating model across APA Group. This was achieved by having consistent and aligned methods across the organisation, supported by a tool that removes inefficiencies in project delivery and portfolio reporting. The foundations set by implementing the process and technology pieces helps develop APA Group project delivery competencies based on integrated with the Financial industry best practice in project/portfolio management. The PPOM project was part of the Financial Transformation Project to support a common set of financial project management tools within APA Group.

- Financial Transformation System

APA Group businesses have, over the years, utilised multiple finance systems and charts of accounts, reflecting numerous legacy systems. Until recently, APA Group had three different finance systems creating considerable complexity in managing financial reporting, analysis and controls. APA Group has undertaken a project to rationalise the

previous suite of finance systems to deliver ongoing savings to the APA Group businesses.

- APA Gas Grid (Project Colin or Energy Components)

The APA Gas Grid project comprises a number of functions which seek to transform APA Group's management of its gas assets. The project comprised of a new web-based customer interface to provide metering, billing and contractual information for users, a single nominations tool for transport of gas across multiple assets, customer invoicing capabilities and customer access to real time pipeline capacity information to support nominations.

Further work to the system in 2015/16 will upgrade and expand capabilities.

Expenditure associated with ongoing upgrades and updates to the APA Gas Grid system is included in forecast expenditure as part of the Application renewal program.

- Enterprise Asset Management

Effective and safe asset management is essential at APA for the maintenance of its energy assets. APA previously used six standalone maintenance systems across the Networks and Transmission businesses. The IT infrastructure (hardware and software) supporting each of these systems is also near the end of its serviceable life. The system used by Transmission was a comparatively simple 'stand-alone' system with substantially manual interfaces with APA's other management systems.

This project involved development and migration to a new enterprise side asset management system, supporting maintenance scheduling and recording of maintenance activities, inventory management and financial control. It also provides data to facilities analysis of equipment performance.

- Data Centre project

APA's internal data centres were inappropriate for APA's size and complexity. Recovery from an outage required manual steps that varied from system to system. The Data Centre Project delivered outsources data centres of a standard required by APA's size and complexity, highlight resilient and available infrastructure, and 'Infrastructure Platforms' to service the business and future projects.

Total expenditure over the earlier access arrangement period for IT projects is set out in Table 6.28.

***Table 6.28 – IT system capital expenditure - APTNT actual expenditure ($'000 2015/16)***

| IT system capital expenditure | 2010/11 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16E | Total |
|---|---|---|---|---|---|---|---|
| Actual expenditure | 427 | 99 | 794 | 871 | 1,497 | 1,121 | **4,808** |

APTNT also forecasts some expenditure in corporate level IT in the access arrangement period, as described below.

- IT infrastructure upgrades (IT AM03)

This project involves the periodic upgrade of APA's IT desktop and telephony systems to ensure they continue to support business needs. This will ensure that APA continues to maintain reliable, compliant and efficient business processes and systems and preserves the on-going integrity of the services.

Benefits include of this project include:

- Modernisation of the desktop, office and mobility platforms;
- Reduced exposure to system and security related vulnerabilities;
- New capability realisation including touch screen and stylus for mobility;
- Modern platform for leveraging new capabilities; and
- Collaboration application and services offerings.

Forecast expenditure on this project over the access arrangement period is set out in Table 6.29 below.

***Table 6.29 – IT infrastructure upgrades ($'000 2015/16)***

| IT infrastructure upgrades | 2015/16 | 2016/ 17 | 2017/ 18 | 2018/ 19 | 2019/ 20 | 2020/ 21 | Total |
|---|---|---|---|---|---|---|---|
| Actual and forecast expenditure | 172 | 58 | 116 | | | 60 | **404** |

- IT Application Renewal Program (IT AM02)

In order to ensure that business processes and IT application systems are efficient and effective, APA has undertaken a significant investment in a number of Business and Technology projects over the past few years.

During the earlier access arrangement period a number of major projects to nationalise and upgrade key application systems were implemented. These projects provided improved scalability, flexibility and reliability, including:

- National Works Management - Enterprise Asset Management;
- Telemetry System – Nationalising the Telemetry System (Clear SCADA);
- Historian Reporting – Nationalising the Historian Reporting System (OSi/Pi);
- Hydrocarbon accounting, billing, B2B integration – (APA Grid).

These projects deliver sustainable application systems and align business processes to ensure that APA's systems continue to meet current and future needs. APA proposes to continue its prudent investment in Business and Technology projects in order to maintain its integrity of services and to mitigate avoidable risks.

An application upgrade roadmap, based on a stay in business program of work, has been developed to ensure that these application systems are kept up-to-date. This upgrade program will:

- Ensure upgraded applications continue to provide required integrated functionality to support business processes;
- Manage alignment with other co-existing applications;
- Ensure validity of support requirements with technology vendors;
- Introduce appropriate new functionality; and
- Improve software performance and efficiency.

Generally an application upgrade will involve not only the application upgrade itself, but also upgrades to the underlying associated technology platform components, assessment, design and implementation of any changes to configuration, customisations and integrations associated with the upgrades and complete testing of all impacted end to end processes.

This project is required to perform upgrades on existing IT assets and does not involve their replacement.

Based on the application upgrade plan, the following APA IT systems will be upgraded over the access arrangement period:

- Hydrocarbon accounting and billing – Tieto, Energy Components (APA Grid)
- Historian System – Osisoft PI System
- Telemetry System - ClearSCADA
- Middleware – Microsoft BizTalk
- Dial Before You Dig – Mipela
- Field Data / Mobility Systems
- Geospatial Information System (GIS) – GE SmallWorld / ESRI
- Enterprise Asset Management – IBM, Maximo

Forecast expenditure on this project over the access arrangement period is set out in Table 6.29 below.

***Table 6.30 – IT application renewal program ($'000 2015/16)***

| IT application renewal program | 2015/16 | 2016/ 17 | 2017/ 18 | 2018/ 19 | 2019/ 20 | 2020/ 21 | Total |
|---|---|---|---|---|---|---|---|
| Actual and forecast expenditure | 603 | 631 | 609 | 643 | 624 | 655 | **3,765** |

*Motor Vehicles (AMP item 25)*

A fleet of vehicles are in service throughout the AGP system including light cars, utilities and 4WD trucks. The fleet is well maintained, regularly serviced and reflects a program of staggered renewal. Vehicles are purchased or replaced on an as required basis depending on personnel, project or operational requirements.

APTNT incurred motor vehicle expenditure in the earlier access arrangement period as set out in Table 6.31 below. This category was overlooked in APTNT's forecasts in 2010 and therefore there is no approved capital expenditure.

***Table 6.31 – Motor vehicles –APTNT actual expenditure ($'000 2015/16)***

| Motor vehicles | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16E | Total |
|---|---|---|---|---|---|---|
| Actual expenditure | 89 | 681 | 670 | 402 | 308 | **2,150** |

APTNT forecasts continuing expenditure on motor vehicles across the forecast period, as set out in Table 6.32 below.

***Table 6.32 – Motor vehicles – APTNT forecast expenditure ($2015/16)***

| Motor vehicles | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | Total |
|---|---|---|---|---|---|---|
| Forecast expenditure | 591 | 222 | 369 | 443 | 590 | **2,215** |

*Building modifications (AMP item 26)*

Upgrades are needed to the 28 plus year old office facility in Palmerston to accommodate the workforce, improve staff facilities, upgrade the building and ensure compliance with Australian Standards. In addition the need for additional warehouse/storage facilities and improved office space has been identified at the 27 Georgina Crescent facility.

The administrative office component is an APA Group owned building on Crown Land at 16 Georgina Crescent whilst the maintenance base currently occupies a leased facility at 27 Georgina Crescent , both in Yarrawonga.

The intent of this project is to identify a real estate solution that will provide sufficient space to accommodate all Darwin staff into a single facility, to improve site security, to increase seating capacity and better utilise the surplus land, to accommodate more shedding and plant and stores building on the current excess land.

Forecast expenditure on this project is set out in Table 6.33 below.

***Table 6.33 – Building modifications – APTNT forecast expenditure ($'000 2015/16)***

| Building modifications | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | Total |
|---|---|---|---|---|---|---|
| Forecast expenditure | 3,126 | | | | | **3,126** |

## 6.4 Capital expenditure over the earlier access arrangement period

### 6.4.1 Total capital expenditure by driver

Total capital expenditure by driver over the earlier access arrangement period is set out in Table 6.34.

***Table 6.34 – Capital expenditure by driver over the earlier access arrangement period ($2015/16)***

| $'000 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16E | Total |
|---|---|---|---|---|---|---|
| **AER Final Decision** | | | | | | |
| Expansion | 0 | 0 | 0 | 0 | 0 | **0** |
| Replacement | 16,871 | 1,575 | 1,264 | 1,236 | 1,221 | **22,167** |
| Non-system | 124 | 123 | 475 | 123 | 357 | **1,203** |
| **Total Forecast** | **16,995** | **1,698** | **1,739** | **1,360** | **1,578** | **23,369** |
| **Actual capital expenditure** | | | | | | |
| Expansion | 0 | 767 | 558 | 56 | 0 | **1,381** |
| Replacement | 4,329 | 14,600 | 2,170 | 2,252 | 12,460 | **35,812** |
| Non-system | 190 | 1,610 | 1,556 | 1,899 | 2,393 | **7,649** |
| **Total Actual** | **4,520** | **16,977** | **4,284** | **4,207** | **14,854** | **44,842** |
| **Variance between approved forecast and actual** | | | | | | |
| Expansion | 0 | 767 | 558 | 56 | 0 | **1,381** |
| Replacement | -12,542 | 13,026 | 906 | 1,016 | 11,240 | **13,646** |
| Non-system | 66 | 1,487 | 1,081 | 1,776 | 2,036 | **6,446** |
| **Total Variance** | **-12,476** | **15,280** | **2,545** | **2,848** | **13,276** | **21,472** |

APA's actual expenditure for the earlier access arrangement period was above that approved by the AER for the period. The reasons for this difference are described on a project by project basis in the preceding section.

### 6.4.2 Total capital expenditure by asset class

Total capital expenditure by asset class over the earlier access arrangement period is set out in Table 6.35.

***Table 6.35 – Capital expenditure by asset class over the earlier access arrangement period ($2015/16)***

| $'000 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 E | Total |
|---|---|---|---|---|---|---|
| Pipeline | 2,549 | 14,280 | 1,364 | 1,150 | 9,784 | **29,128** |
| Compression | 0 | 0 | 0 | 0 | 0 | **0** |
| Meter Station | 1,565 | 802 | 847 | 774 | 1,623 | **5,611** |
| SCADA & Communications | 0 | 0 | 184 | 181 | 2,889 | **3,253** |
| Operation & Management facilities | 405 | 1,895 | 1,889 | 2,103 | 558 | **6,850** |
| Building | 0 | 0 | 0 | 0 | 0 | **0** |
| **Total** | **4,520** | **16,977** | **4,284** | **4,207** | **14,854** | **44,842** |

## 6.5 Forecast capital expenditure

### 6.5.1 Overview and forecast methodology

Forecast capital expenditure over the access arrangement period is shown in Table 6.36 below. These forecasts have been derived through the application of planning process and asset management principles discussed in chapter 4 above, and comply with the requirements of Rule 79 for conforming capital expenditure, as discussed in relation to capital expenditure for each project (see detailed project description in AMP at Attachment C).

***Table 6.36 – Forecast capital expenditure by category over the access arrangement period ($2015/16)***

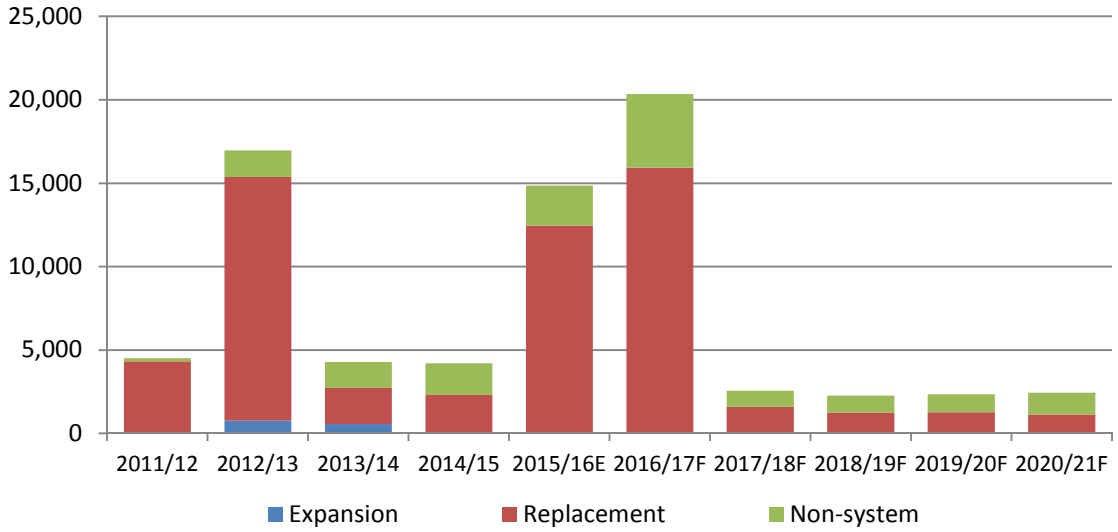
| $'000 | 2016/ 17 | 2017/ 18 | 2018/ 19 | 2019/ 20 | 2020/ 21 | Total |
|---|---|---|---|---|---|---|
| Expansion | - | - | - | - | - | **-** |
| Replacement | 15,935 | 1,600 | 1,253 | 1,271 | 1,129 | **21,188** |
| Non-system | 4,405 | 946 | 1,013 | 1,067 | 1,305 | **8,737** |
| **Total** | **20,341** | **2,546** | **2,265** | **2,339** | **2,434** | **29,924** |

APTNT's forecast capital expenditure is expected to decline in the access arrangement period in 2017/18 to a stable capital expenditure profile of between $2 million and $3 million per year. The expenditure spike in 2016/17 has contributions from two projects that are continuing from the previous period: the Channel Island Bridge Project and

Below Ground Station recoating – stage 2. One further contributor to higher 2016/17 expenditure is the Building Modifications project discussed in section 6.3.3 above.

The remainder of the period reflects a steady 'business as usual' replacement profile, which is significantly lower than historic expenditure levels. As discussed above, the earlier access arrangement period included significant integrity works, that are largely completed by 2017/18. The profile of actual capital expenditure over the earlier access arrangement period, and the forecast capital expenditure, is shown in Figure 6.1 below.

***Figure 6.1 – Capital expenditure trend over the earlier and forecast access arrangement periods ($'000 2015/16)***




APTNT considers that its forecast capital expenditure for the access arrangement period satisfies the requirements under Rule 79 that it be expenditure that would be incurred by a prudent service provider acting efficiently in accordance with accepted good industry practice to achieve the lowest sustainable cost of providing services, as required under Rule 79(1).

Forecast capital expenditure is not expected to be funded by parties other than APTNT.

*Forecast methodology*

Capital expenditure for the access arrangement period has been forecast using a zero-base approach, derived from known capital expenditure programs. The Asset Management Plan is a 5-year plan and includes all projects over that planning period. All projects with forecast expenditure above $200,000 described in section 6.3 above.

Outsourced labour components in forecast capital projects are escalated as appropriate by APTNT's forecast external labour escalator discussed further below.

There are no contingency allowances included in capital expenditure numbers. APTNT notes that there is a material risk that some estimates will be too low owing to

uncertainties in forecasting costs accurately, particularly in the later years of the access arrangement period. The unique operating environment in the NT also adds uncertainty in cost forecasting due to variable climatic conditions particularly in the wet season that can impact the scheduling of work, and the vast distances involved in transporting goods and labour to remote sites.

This cost risk means that there is a skewed likelihood towards costs being materially higher than forecast compared to the likelihood that costs will be lower. Despite these risks, APTNT considers that its forecast for capital expenditure is the best possible in the circumstances, and is consistent with the Rule 79 requirements for conforming capital expenditure. APTNT considers that any required reductions to this forecast would place it at material risk of not recovering its efficient costs in providing reference services, which would be contrary to the NGL revenue and pricing principles.

### 6.5.2 Real cost escalation

APTNT has not undertaken an economic study directed at forecasting real cost escalation for the forecast access arrangement period. Rather, it proposes to rely on existing NT-specific economic analysis that has already been subject to regulatory scrutiny.

APTNT considers that an analysis of real cost escalation in the Northern Territory must consider the unique attributes of the NT economy and the pressures applicable to that economy.

The Northern Territory Utilities Commission recently completed its review of the costs applicable to the PWC NT electricity assets. In the context of that review, PWC engaged Deloitte Access Economics to undertake a review and forecast labour cost escalators, and Sinclair Knight Merz to advise on forecast materials cost escalators.

Both studies referenced the boom in primary industry and natural resource development, which is causing strong competition for labour and other resources, which is placing upward pressure on costs.[36]

As Deloitte Access Economics noted:

> With the Northern Territory's resources boom now in full swing, the overall outlook is for strong wage growth in the near term as the resources boom puts upward pressure on wage negotiations both directly and indirectly. The utilities and professional services sectors are estimated to be currently experiencing wage growth in the order of one percentage point higher than the Territory average amid a period of strong demand from the resources sector – which competes with the utility sector for its workforce … that's

[36] See, for example, "Unions dig in over dispute with Gorgon", Australian Financial Review, 20 July 2015

> what happens when a $34 billion LNG project starts construction in an economy with an annual income of $19 billion.[37]

The Northern Territory Utilities Commission accepted, for the purposes of determining both the allowed capital and operating expenditure forecasts, the Deloitte Access Economics forecasts of real cost for labour cost increases, and the Sinclair Knight Merz forecasts of real material cost increases.[38]

APTNT proposes to rely on this regulator-approved finding of real cost escalation for the purposes of this submission.

*Real labour cost escalation*

The real labour cost escalation factors approved by the Northern Territory Utilities Commission are shown in Table 6.37 below.[39]

***Table 6.37 – Deloitte Access Economics real labour cost escalation factors***

| Year | 2015/16 | 2016/17 | 2017/18 | 2018/19 |
|---|---|---|---|---|
| Internal labour | 1.0% | 0.6% | 0.9% | 1.0% |
| External labour | 1.1% | 0.9% | 1.0% | 1.1% |

These real labour cost escalators have been applied for the purpose of determining both the capex and opex forecasts in this submission.

For the forecast years beyond the Deloitte Access Economics forecast, APTNT has applied the average of the approved real labour cost escalators, being 0.9 per cent per year.[40]

*Real material cost escalators*

The PWC submission to the Northern Territory Utilities Commission included a report from Sinclair Knight Merz which developed a quite granular forecast of real cost escalators to be applied to various types of projects forecast for the PWC electricity network. The Northern Territory Utilities Commission accepted the real cost escalators produced in the Sinclair Knight Merz report.[41]

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[37] Deloitte Access Economics, *Labour cost escalators in the Northern Territory*, 11 May 2013, p 1, Quoted in Power and Water Corporation, *Initial Regulatory Proposal* – September 2013, p 56

[38] NT Utilities Commission, *2014 Network Price Determination, Final Determination*, p 87

[39] Power and Water Corporation, *Initial Regulatory Proposal – September 2013*, p 58. Real cost escalation rates for 2013/14 and 2014/15 are not shown here

[40] Calculating an average over the 6 years reported by DAE, from 2013/14 to 2018/19, delivers an average of 1.2 per cent for internal labour and 0.9 per cent for external labour.

[41] NT Utilities Commission, *2014 Network Price Determination*, Final Determination, p 109

APTNT considers that this detailed forecast does not map well to the projects forecast for the AGP. Of the materials forecast by Sinclair Knight Merz, only steel is relevant to pipelines, and then only materially relevant where there is considerable forecast expansions through looping or pipeline extensions. Neither of these cases are relevant to the AGP capital expenditure forecast. APTNT therefore does not propose to apply a materials escalator to its capital expenditure forecast.

*Expansion capital expenditure*

In general, demand forecasts, in particular for peak demand (capacity and utilisation), are relevant to expansion capital expenditure. As described in chapter 5 in relation to demand and utilisation forecasts, APTNT does not anticipate demand to exceed the current capacity of the pipeline during the access arrangement period. As a result APTNT does not forecast any expansion conforming capital expenditure in the access arrangement period.

As noted by APTNT in section 1.5.3 of this submission, the mooted NEGI project could be built during the forecast period. Uncertainty over the scope, timing and other parameters of this project make it impossible to include in the capital expenditure forecasts for the pipeline at this time. APTNT proposes to address this interconnection, should it occur, through the extensions and expansions policy in the access arrangement, as is the case for any expansion that emerges within an access arrangement period.

*Replacement and non-system capital expenditure*

All projects in these categories satisfy Rule 79(2)(c) as essential to maintain the safety and integrity of services, and to ensure continuing compliance with regulatory obligations, in particular those set out in AS2885.3. The AMP accompanying this submission includes references to specific regulatory requirements as relevant.

### 6.5.3 Total capital expenditure by asset class

Total capital expenditure by asset class over the access arrangement period is set out in Table 6.38 below.

***Table 6.38 – Forecast capital expenditure by asset class over the access arrangement period ($2015/16)***

| $'000 | 2016/ 17 | 2017/ 18 | 2018/ 19 | 2019/ 20 | 2020/ 21 | Total |
|---|---|---|---|---|---|---|
| Pipeline | 14,479 | 261 | 266 | 268 | 270 | **15,545** |
| Compression | - | - | - | - | - | **-** |
| Meter Stations | 1,200 | 1,076 | 717 | 727 | 575 | **4,295** |
| SCADA & Communications | 689 | 725 | 643 | 624 | 714 | **3,396** |
| Operation & Management facilities | 847 | 484 | 639 | 719 | 874 | **3,563** |
| Building | 3,126 | - | - | - | - | **3,126** |
| **Total** | **20,341** | **2,546** | **2,265** | **2,339** | **2,434** | **29,924** |

### 6.5.4 Outsourced forecast capital expenditure

The AER RIN requires APTNT to submit information related to outsourced forecast capital expenditure that contributes in a material way to the provision of pipeline services. APTNT has very limited contracts currently in place for forecast capital expenditure. There are, however, some ongoing relationships with external providers that APTNT expects will continue in the access arrangement period. Details of these contracts and relationships are provided in confidential Attachment D.

APTNT has applied a materiality threshold of $50 000 in respect of reported outsourced arrangements.

# 7 Capital base

## 7.1 Opening capital base for the access arrangement period

### 7.1.1 Opening capital base for the earlier access arrangement period

The AER included an allowance for capital expenditure in 2010/11 of $5.7 million ($nominal).

As noted above in section 1.4.3, the earlier access arrangement period started later than anticipated – on 1 August 2011 instead of 1 July 2011, such that the forecast for 2010/11 effectively relates to the period 1 July 2010 to 31 July 2011.

Rule 77(2)(a) requires APTNT to establish the opening capital base at the commencement of the earlier access arrangement period. In line with the requirements of Rule 77(2)(a), APTNT has completed the roll forward of the capital base to 31 July 2011 using actual capital expenditure in the 13 month period between 1 July 2010 and 31 July 2011 of $4.1 million ($nominal).

*Changes to Rule 77(2)(a)*

Changes to Rule 77(2)(a) implemented in October 2014, provide for an adjustment associated with the 'benefit or penalty' associated with any difference between the estimated and actual capital expenditure for values included in the opening capital base established for the earlier access arrangement period.[42]

APTNT has calculated this benefit at $0.8 million ($nominal), which it has applied to the closing asset value at 30 June 2016 to give effect to the return of the benefit APTNT derived from this variation between estimate and actual expenditure.

### 7.1.2 Conforming capital expenditure during earlier access arrangement period

Conforming capital expenditure for the earlier access arrangement period is described in chapter 6 and is submitted in Table 6.34. As discussed in chapter 6, APTNT considers its capital expenditure in the earlier access arrangement period to be prudent and efficient. Significant expenditure was required within the period to address identified

[42] See from National Gas Rules version 22

integrity issues with the pipeline reflecting the age of the pipeline, and these works are now largely completed.

### 7.1.3 Amounts to be added to the capital base under rules 82, 84 and 86

Rule 82 addresses the treatment of capital contributions by users to capital expenditure. The effect of the rule is that capital expenditure, to the extent contributed by users, is not eligible for inclusion in the capital base unless a mechanism is proposed under sub-rule 82(3) to prevent the service provider from raising increased revenue as a result of the inclusion.

APTNT has included in its access arrangement at clause 3.2 a mechanism to ensure that it does not receive any benefit through increased Revenue from any User's contribution to the Capital Base.

Under the mechanism, capital contributions are treated as revenue in the year in which they are received. The forecast amount of capital contributions is then deducted from the total revenue requirement in determining the revenue requirement to be recovered through tariffs. Through this process, APTNT returns to customers, by way of lower tariffs, the full benefit associated with the return on and return of contributed capital. The up-front reduction in tariff revenue exactly equals, in present value terms, the return on and return of capital over the life of the capital investment.

APTNT received some capital contributions during the period, as discussed in respect of particular projects in section 6.3 above, and has added these amounts to the capital base in the relevant years.

Rule 84 relates to the formation of a speculative capital expenditure account, and how amounts included in a speculative capital expenditure account can be added to the capital base. APTNT does not currently have any expenditure in a speculative capital expenditure account, and did not roll any expenditure from a speculative capital expenditure account into the capital base during the earlier access arrangement period.

Further, APTNT did not undertake any non-conforming capital expenditure over the earlier access arrangement period that was recovered through a surcharge or that was added to a speculative capital expenditure account.

Rule 86 relates to the re-use of redundant assets, and how, after the reduction of the capital base by the value of assets identified as redundant, should the assets later contribute to the delivery of pipeline services, the value of those assets can be returned to the capital base. APTNT did not re-use any assets during the earlier access arrangement period that it had previously identified as redundant, and therefore does not forecast any amounts to be added to the capital base under this Rule.

### 7.1.4 Disposals

Disposals in the earlier access arrangement period are recorded in the financial models accompanying this submission and are shown in Table 7.1 below.

***Table 7.1 – Disposals in the earlier access arrangement period ($nominal)***

| $'000 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 |
|---|---|---|---|---|---|
| Disposals | 0 | 33 | 291 | 83 | 0 |

### 7.1.5 Depreciation over the earlier access arrangement period

The capital base has been rolled forward using the depreciation allowed by the AER in its 21 July 2011 Final Decision, as adjusted for outturn inflation, as shown in Table 7.2 and Table 7.3 below.

***Table 7.2 – AER forecast depreciation over the earlier access arrangement period ($nominal)***

| $'000 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 |
|---|---|---|---|---|---|
| Depreciation | -5,047 | -5,403 | -5,456 | -5,516 | -3,139 |

***Table 7.3 – Outturn depreciation and indexation over the earlier access arrangement period ($nominal)***

| $'000 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 |
|---|---|---|---|---|---|
| Depreciation | -5,047 | -5,403 | -5,456 | -5,516 | -3,139 |
| Indexation | 1,495 | 2,316 | 3,105 | 1,430 | 2,748 |
| Net Regulatory Depreciation | -3,552 | -3,087 | -2,351 | -4,086 | -391 |

### 7.1.6 Indexation of the capital base

As outlined above, the capital base has been indexed for outturn inflation, consistent with the AER's decision of 21 July 2011.

### 7.1.7 Capital base roll forward 2011/12 to 2015/16

The opening capital base for the access arrangement period is shown in Table 7.4. It should be noted that the opening capital base as at 1 August 2011 (the commencement of the prior Access Arrangement Period) is the closing capital base at 31 July 2011 (the end of the previous Access Arrangement Period), and that 2011/12 capital expenditure is for the 11 months from 1 August 2011 to 30 June 2012.

***Table 7.4 – Capital base roll forward 2011/12 to 2015/16 ($nominal)***

| $'000 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 |
|---|---|---|---|---|---|
| Opening capital base | 91,820 | 92,556 | 105,997 | 107,655 | 107,750 |
| Plus net conforming capex | 4,288 | 16,527 | 4,009 | 4,181 | 15,543 |
| Plus speculative capex | | | | | |
| Plus reused redundant assets | | | | | |
| Less depreciation | -5,047 | -5,403 | -5,456 | -5,516 | -3,139 |
| Plus indexation | 1,495 | 2,316 | 3,105 | 1,430 | 2,748 |
| Adjustment for previous period | | | | | -2,291 |
| **Closing capital base** | **92,556** | **105,997** | **107,655** | **107,750** | **120,611** |

The closing capital base as at 30 June 2016 reflects the application of the AER's Asset Base Roll Forward Model from the commencement of the earlier Access Arrangement Period (1 August 2011) to 30 June 2016. This necessarily includes a forecast of conforming capital expenditure for the 2015/16 year, which will be adjusted to reflect a best estimate of capital expenditure to 30 June 2016 in the revised Access Arrangement proposal.

APTNT has applied the forecast depreciation to roll forward the capital base. Through the application of the Roll Forward Model, the Buildings and Compression asset classes have been depreciated to zero. These asset classes remain open, at zero value. No value has been transferred to other asset classes.

## 7.2 Projected capital base for the access arrangement period

### 7.2.1 Opening capital base in 2016

The opening capital base as at 1 July 2016 reflects the closing capital base as at 30 June 2016 as discussed above.

### 7.2.2 Forecast capital expenditure

Forecast capital expenditure is addressed in section 6.5. In summary, forecast capital expenditure is shown in Table 7.5 below.

***Table 7.5 – Forecast capital expenditure over the access arrangement period ($2015/16)***

| $'000 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 |
|---|---|---|---|---|---|
| Capital expenditure | 20,341 | 2,546 | 2,265 | 2,339 | 2,434 |

### 7.2.3 Non-conforming capital expenditure

*Capital contributions*

APTNT does not forecast any non-conforming capital expenditure to be recovered through a capital contribution during the access arrangement period. APTNT has no contractual agreements with parties where capital contributions are made by users to new capital expenditure pursuant to Rule 82.

*Surcharges and speculative capital expenditure account*

APTNT does not forecast any non-conforming capital expenditure to be recovered through a surcharge during the access arrangement period.

APTNT does not currently have any expenditure in a speculative capital expenditure account, and does not forecast any expenditure during the access arrangement period that it intends to add to speculative capital expenditure account.

*Disposals*

APTNT does not forecast any disposals in the access arrangement period.

### 7.2.4 Depreciation over the access arrangement period

APTNT has not changed the standard asset lives from those approved by the AER at the last review. The remaining asset lives, as at 1 July 2016, for forecast depreciation purposes are as shown in Table 7.6 below.

***Table 7.6 – Remaining Economic Lives***

| Asset Class | Economic life (years) | Average Remaining Economic Life (years) |
|---|---|---|
| Transmission Pipeline | 80 | 59.9 |
| Compressor Stations:<br>Rotating Equipment<br>Station Facilities | N/A | N/A |
| Regulation and Metering Stations<br>Odorising Stations | 50 | 37.6 |
| SCADA | 15 | 11.4 |
| O&M Facilities | 10 | 4.6 |
| Buildings | N/A | N/A |

Applying these remaining lives to assets in service as at 1 July 2016, and the economic asset lives to new capital expenditure, yields the depreciation forecast shown in Table 7.7 below.

***Table 7.7 – Forecast straight line depreciation over the access arrangement period ($nominal)***

| $'000 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 |
|---|---|---|---|---|---|
| Forecast depreciation | 4,870 | 5,439 | 5,709 | 5,993 | 5,285 |

## 7.2.5 Indexation of the capital base

The capital base has been indexed to allow for forecast inflation over the access arrangement period. As discussed in section 1.3.3, the forecast inflation rate applied to the capital base is 2.5 per cent per year.

The forecast amount of indexation applied to the capital base is shown in Table 7.8 below.

***Table 7.8 – Forecast indexation of the capital base ($nominal)***

| $'000 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 |
|---|---|---|---|---|---|
| Indexation | 3,015 | 3,505 | 3,525 | 3,533 | 3,538 |

## 7.2.6 Projected capital base over the period

The projected capital base for the access arrangement period is shown in Table 7.9.

***Table 7.9 – Projected capital base for the access arrangement period ($nominal)***

| $'000 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 |
|---|---|---|---|---|---|
| Opening capital base | 120,611 | 140,186 | 141,001 | 141,324 | 141,518 |
| Plus indexation | 3,015 | 3,505 | 3,525 | 3,533 | 3,538 |
| Plus conforming capex | 21,431 | 2,749 | 2,508 | 2,654 | 2,831 |
| Less depreciation | 4,870 | 5,439 | 5,709 | 5,993 | 5,285 |
| Less forecast disposals | - | - | - | - | - |
| Less forecast redundant assets | - | - | - | - | - |
| **Closing capital base** | 140,186 | 141,001 | 141,324 | 141,518 | 142,601 |

## 7.2.7 Tax Asset Base

Rule 87A requires:

> The estimated cost of corporate income tax of a service provider for each regulatory year of an access arrangement period (ETCt) is to be estimated in accordance with the following formula:
>
> $ETC_t = (ETI_t \times r_t)(1 - \gamma)$

Where

| | |
|---|---|
| $ETI_t$ | is an estimate of the taxable income for that regulatory year that would be earned by a benchmark efficient entity as a result of the provision of reference services if such an entity, rather than the service provider, operated the business of the service provider; |
| $r_t$ | is the expected statutory income tax rate for that regulatory year as determined by the AER; and |
| $\gamma$ | is the value of imputation credits. |

In order to calculate the estimated cost of corporate income tax, it is necessary to establish the amount of tax depreciation that can be deducted from taxable revenue to determine the amount of tax payable. As tax depreciation is based on different depreciation rates than those used for statutory accounting or regulatory purposes, the value of the Tax Asset Base (TAB) is likely to be different at any given point in time than either the statutory or regulatory asset base. It is therefore necessary to establish a TAB for regulatory purposes.

APTNT has rolled forward the TAB in the earlier access arrangement period using the same principles as the normal asset base roll forward. That is, APTNT has applied the AER's Asset Base Roll Forward Model, adopting the opening TAB in the earlier access arrangement period, and rolled it forward using actual capital expenditure. As the TAB is not indexed, it was not necessary to update the roll forward for outturn CPI increases. The TAB roll forward is shown in Table 7.10, and the forecast TAB is shown in Table 7.11.

***Table 7.10 –Tax Asset Base as at 30 June 2016 ($nominal)***

| $'000 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16 |
|---|---|---|---|---|---|
| Opening TAB | 3,904 | 6,421 | 20,713 | 22,635 | 24,659 |
| Net additions | 4,116 | 15,798 | 3,824 | 4,020 | 14,854 |
| Tax Depreciation | -1,599 | -1,505 | -1,903 | -1,996 | -2,298 |
| Closing TAB | 6,421 | 20,713 | 22,635 | 24,659 | 37,215 |

***Table 7.11 –Forecast Tax Asset Base ($nominal)***

| $'000 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 |
|---|---|---|---|---|---|
| Opening TAB | 37,215 | 55,567 | 54,727 | 53,480 | 52,207 |
| Additions | 20,849 | 2,675 | 2,440 | 2,581 | 2,754 |
| Disposals | -2,497 | -3,515 | -3,686 | -3,854 | -4,035 |
| Tax Depreciation | 55,567 | 54,727 | 53,480 | 52,207 | 50,926 |
| Closing TAB | 37,215 | 55,567 | 54,727 | 53,480 | 52,207 |

The TAB is then applied to determine the corporate income tax allowance derived for the revenue model as indicated in Table 7.12.

***Table 7.12 –Income Tax Allowance ($nominal)***

| $'000 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 |
|---|---|---|---|---|---|
| Income Tax Allowance | 1,102 | 1,039 | 1,070 | 1,105 | 848 |

# 8 Rate of return and imputation credits

The return on the projected capital base included in the total revenue is to be determined as the product of a rate of return, the allowed rate of return, and the projected capital base at the beginning of each regulatory year of an access arrangement period.[43]

The way in which APTNT proposes to determine the allowed rate of return, guided by the AER's Rate of Return Guideline, is set out in this chapter of the submission.

The estimate of the return on equity used in determining the allowed rate of return is an estimate of gross return to equity investors. At least some investors receive, in addition to dividends on their investments, a rebate of tax paid on company profits in the form of the imputation or franking credits available under Australian taxation law. The estimate of the cost of corporate income tax included in total revenue is to be reduced to recognise the value of these imputation credits to equity investors.[44] The amount of this reduction is to be a fraction, γ, of the cost of tax, where γ is the value to be attributed to imputation credits. This chapter of the submission also sets out the way in which APTNT has estimated γ.

Sections 8.1 and 8.2 are preliminary. They note the assumptions which APTNT has made about gearing and about the credit rating of a benchmark efficient entity providing the reference service.

Section 8.3 sets out APTNT's approach to estimating the return on equity, and estimation of the return on debt is discussed in section 8.4.

APTNT shows, in section 8.5, that a nominal vanilla weighted average of the return on equity and the return on debt of 8.3 per cent is commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the service provider in respect of the provision of reference services. This weighted average of the return on equity and the return on debt is the proposed allowed rate of return for the AGP.

Rate of return implementation issues – annual updating of the return on debt and proposed averaging periods – are discussed in section 8.6.

APTNT's estimate of the value to be attributed to imputations credits – the fraction γ –is discussed in section 8.7. Section 8.7.1 summarises the estimation methods, financial models, market data and other evidence to be taken into account in estimating γ which are set out in the Rate of Return Guideline.[45] In section 8.7.2, APTNT assesses the

[43] Rule 87(1)
[44] Rule 87A
[45] Rule 87(14)

results obtained using those methods, models and data. APTNT's estimate of γ, 0.25, is discussed in section 8.7.3.

## 8.1 Gearing

The allowed rate of return of Rule 87 is to be the weighted average of a return on equity and a return on debt determined on a nominal vanilla basis.[46] In a weighted average determined on a nominal vanilla basis, the weight to be given to the return on equity should be the proportion of equity in the total capital of the benchmark efficient entity (which is assumed to be financed by equity and debt). The weight to be given to the return on debt – the gearing – should be the proportion of debt in the total capital of the benchmark efficient entity.

Section 4.3.2 of the Rate of Return Guideline advises that the gearing of the benchmark efficient entity for which the weighted average of the return on equity and the return on debt is to be determined is 0.6.

APTNT has therefore used gearing of 0.6 to calculate the nominal vanilla weighted average of returns on equity and debt which is to be the allowed rate of return for the AGP.

## 8.2 Credit Rating

Determination of a rate of return for a benchmark efficient entity with a degree of risk similar to that of the service provider in its provision of references services requires, among other things, a measure of credit risk.

Paragraph 6.3.3 of the Rate of Return Guideline proposes that this measure of credit risk be a credit rating of BBB+ from Standard and Poor's or the equivalent rating from another recognised rating agency. If financial data used to estimate the allowed rate of return do not reflect a credit rating of BBB+, or the equivalent, they are to be those which most closely approximate data for an entity with a BBB+ credit rating.

APTNT has therefore assumed a credit rating of BBB+ for the benchmark efficient entity. Where financial data to be used in estimating the rate of return are not available for entities with that credit rating, APTNT has used data for BBB rated entities.

## 8.3 Estimating the return on equity

The following subsections of this section of the submission set out APTNT's approach to estimating the return on equity.

[46] Rules 87(4)(a) and (b)

Section 8.3.1 notes the six steps to be taken in the process for estimating the return on equity set out in the Rate of Return Guideline.

The way in which APTNT has estimated a return on equity using the foundation model of the Rate of Return Guideline is explained in section 8.3.2.

Some issues of methodology are examined in section 8.3.3. The section concludes that none of the four financial models identified in the Rate of Return Guideline as being relevant to estimating the return on equity is clearly superior to any of the others. In these circumstances, an estimate of the return on equity which contributes to achievement of the allowed rate of return objective of Rule 87(3) can only be made by considering the estimates made using each of the four models.

Estimates of the return on equity made with each of the four relevant financial models are set out in section 8.3.4. The section concludes with a discussion of APTNT's proposed estimate of the return on equity to be used in establishing the allowed rate of return for the AGP. That estimate is 9.2 per cent.

### 8.3.1 Rate of Return Guideline: return on equity

Section 5 of the Rate of Return Guideline sets out the AER's preferred approach to estimating the return on equity. Six steps are to be taken to estimate a rate of return which should contribute to the achievement of the allowed rate of return objective, and which should therefore provide compensation to a service provider for a cost of equity which is commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk in reference service provision.

Steps 1 and 2 involve identification of relevant material and determination of the role of that material. Relevant material is material which may inform the estimate of the expected return on equity. Step 2 includes, in particular, identification of four quantitative financial models each of which may have a role in estimation of the return on equity. These four financial models are:

- the Sharpe-Lintner Capital Asset Pricing Model (Sharpe-Lintner CAPM);
- Black's Capital Asset Pricing Model (Black CAPM);
- the Dividend Growth Model;[47] and
- the Fama-French Three Factor Model.

The Rate of Return Guideline refers the Sharpe-Lintner CAPM as the "foundation model". The AER uses the Sharpe-Lintner CAPM as the starting point for estimating the expected return on equity.[48]

[47] APTNT uses the singular term Dividend Growth Model to refer to the class of financial models which can be used to estimate the return on equity as the discount rate which equates the present value of future dividends with the current share price.

In the procedure of the Rate of Return Guideline, the Black CAPM is not to be used directly to estimate the return on equity. It is to be used only to inform estimation of the equity beta to be used in applying the foundation model.

Similarly, the AER proposes that the Dividend Growth Model be used only to inform estimates of the market risk premium to be used in applying the foundation model. The Rate of Return Guideline proposes that it not to be used for the purpose of estimating the return on equity itself.

Although the Fama-French Three Factor Model is a relevant financial model, the Rate of Return Guideline advises that it has no role in estimating the return on equity.

Steps 3 to 6 of the Rate of Return Guideline specify how the foundation model, the Sharpe-Lintner CAPM, informed by the Black CAPM, the Dividend Growth Model, and other information, are to be applied.[49]

Step 3, "implement foundation model", notes the form of the Sharpe-Lintner CAPM, and determination of the values to be assigned to its input variables. Ranges may be assigned to input variable values, but probability distributions are not to be assigned to these ranges, and equal probabilities across ranges are not assumed. A range and point estimate for the expected return on equity are to be calculated using the ranges and point estimates for the input parameters of the Sharpe-Lintner CAPM.

Step 4 is to address the manner in which other information is to be used by assessing that information against the AER's assessment criteria. This step is to include consideration of directional and relative information, as well as ranges for other information, that will inform the making of a point estimate for the expected return on equity.

Step 5, "evaluate information set", requires evaluation of the full set of material that will inform, in some way, the estimation of the expected return on equity. The Rate of Return Guideline advises that evaluation is to include assessment of the foundation model range and point estimate alongside the other information from Step 4. In performing Step 5, regard may be had for patterns shown in the other information, and the strengths and limitations of the other information.

Step 6, "distil point estimate of the expected return on equity", leads to the final point estimate for the return on equity. The starting point for this final point estimate is the estimate from the foundation model, the Sharpe-Lintner CAPM. However, establishing the final return on equity estimate requires judgement exercised in respect of the analysis and evaluation of the other information undertaken in Step 5.

[48] Rate of Return Guideline, section 5.3.6, p 17

[49] The categories of "other information", and the role of that information, are listed in Table 5.2 on p 14 of the Rate of Return Guideline

The final estimate of the return on equity is to be either the value established by applying the Sharpe-Lintner CAPM, or a different value which is a multiple of 25 basis points. If the final estimate is the value established by applying the Sharpe-Lintner CAPM, it is to be rounded to one decimal place. This rounding will recognise the limited precision with which the expected return on equity can be estimated. If a different value is used, it is to be reported to two decimal places.

The Rate of Return Guideline notes that analysis in Step 5 should not suggest a final estimate of the expected return on equity outside the foundation model range.[50] If the analysis were to indicate a final estimate outside the range delivered through application of the Sharpe-Lintner CAPM, then:

- the values assigned to the input variables of the Sharpe-Lintner CAPM may be reconsidered; or
- the use of the Sharpe-Lintner CAPM as the foundation model may be reconsidered.

Ultimately, the estimate of the return on equity must contribute to the allowed rate of return objective.[51]

### 8.3.2 Applying the foundation model

APTNT has used the Sharpe-Lintner CAPM to estimate the return on equity in the way anticipated in the Rate of Return Guideline. The estimate obtained is reported in this section of the submission. It is not an estimate of the return on equity which could contribute to achievement of the allowed rate of return objective. An estimate of the return on equity made using the foundation model which might contribute to achievement of the objective can be made using estimates of the equity beta and the market risk premium which are higher than those proposed in the Rate of Return Guideline.

However, adjustment of the values of the inputs to the foundation model cannot correct for limitations inherent in the model itself. The question must still be asked – and is asked in subsequent sections – about whether the estimate of the return on equity obtained using the foundation model contributes to achievement of the allowed rate of return objective.

In accordance with the Rate of Return Guideline, estimation of the return on equity using the Sharpe-Lintner CAPM requires that values be assigned to three input variables.

[50] Rate of Return Guideline, p 17
[51] Ibid.

These are:

- the risk free rate of return;
- the equity beta; and
- the market risk premium.

*Risk free rate*

The risk free rate is the rate of return on a financial asset which is without risk. To estimate the risk free rate, a proxy for this riskless financial asset – the risk free asset – must be found from among the traded financial assets for which returns can be observed. The Rate of Return Guideline proposes that Australian Government securities with a term to maturity of 10 years be the proxy for the risk free asset. The risk free rate of return is then to be estimated from the yields on these securities.

When estimating the return on equity, regard must be had to prevailing conditions in the market for equity funds.[52] Recognition will be given to these prevailing conditions if, when applying the foundation model, the risk free rate is commensurate with prevailing conditions in financial markets at the commencement of the access arrangement period.

To remove the effects of "noise" from the estimate of the risk free rate, yields on Australian Government securities with the required term to maturity should be averaged over a period of between 10 consecutive business days and one year. To provide an estimate of the risk free rate which is commensurate with prevailing conditions in financial markets, this period should be as close as practicably possible to the commencement of the access arrangement period for which the allowed rate of return is being determined.

APTNT understands the reasons for choosing the averaging period as close as practicably possible to the commencement of the access arrangement period, and anticipates that the AER will estimate the risk free rate for an averaging period which is close to the time of its making a final decision on the AGP Access Arrangement revision proposal.

For preparation of the revisions proposal, a much earlier averaging period must necessarily be assumed. For the purpose of this revisions proposal, APTNT has estimated the risk free rate as the average of yields on Australian Government securities with terms to maturity of 10 years over the period of 20 consecutive business days ending 15 June 2015.

APTNT's estimate of the risk free rate of return is 2.93 per cent.

[52] Rule 87(7)

APTNT nominates the averaging period to be used for estimation of the risk free rate in the AER's final decision on the proposed revisions to the Access Arrangement for the AGP in confidential Attachment E.

*Equity beta*

The Rate of Return Guideline advises that the same point estimate and range for the equity beta are to apply across each of electricity transmission, electricity distribution, gas transmission and gas distribution. Beta is to be estimated from share price and other data for a set of Australian energy utility firms thought to be reasonably comparable to the benchmark efficient entity, and this leads to a range from 0.4 to 0.7.[53]

Other relevant information is to be used to select a point estimate from within this range. This other relevant information includes:

- empirical estimates for overseas energy networks; and
- the theoretical principles underpinning the Black CAPM.

When this other relevant information is taken into account, the Rate of Return Guideline advises that an equity beta point estimate of 0.7 is obtained.

*Market risk premium*

The Rate of Return Guideline proposes an estimate of 6.5 per cent for the market risk premium (MRP) to be used in the AER's implementation of the foundation model.

*Estimating the return on equity*

Using these estimates for the input variables ($r_f$ = 2.93 per cent, $\beta$ = 0.7, and MRP = 6.5 per cent), the foundation model – the Sharpe-Lintner CAPM – delivers an estimate of the return on equity of 7.48 per cent.

*Other information and its implications for application of the foundation model*

In its July 2011 Final Decision on proposed revisions to the Access Arrangement for the AGP, the AER stated that empirical work indicated an estimate of beta in the range 0.4 to 0.7. Consideration, then, the AER advised, needed to be given to other factors:

> . . . such as the need to achieve an outcome that is consistent with the national gas objective (NGO) – in particular, the need for efficient investment in natural gas services for the long-term interests of consumers of natural gas. The AER has also taken into account the revenue and pricing principles, the importance of regulatory stability and is also mindful it has recently considered an equity beta of 0.8 to be appropriate, if not overstated, for other gas businesses.[54]

[53] Rate of Return Guideline, p 15

[54] Australian Energy Regulator, *Final Decision Access arrangement proposal for the Amadeus Gas Pipeline*, July 2011, p 70

Taking into account the empirical evidence which was available at the time, and on the basis of its wider considerations – the importance of regulatory stability, the revenue and pricing principles of the National Gas Law, and the national gas objective – the AER concluded that a point estimate of the equity beta of 0.8 was appropriate, and would allow the service provider an opportunity to recover at least its efficient costs incurred in providing reference services and meeting regulatory requirements.[55]

Since 2011, there has not been a significant change in the empirical evidence supporting a range for the equity beta. As noted above, the Rate of Return Guideline continues to advise that the range for beta established by empirical analysis is 0.4 to 0.7. Furthermore, the circumstances of the AGP have not changed in any way which might require reassessment of relative riskiness. In consequence, a point estimate of 0.8 for the equity beta continues to be appropriate for use in the Sharpe-Lintner CAPM when estimating the return on equity for the AGP.

The Explanatory Statement accompanying the Rate of Return Guideline notes that the Sharpe-Lintner CAPM can be implemented using the difference between the expected return on the market portfolio and the risk free rate, as opposed to using a single point estimate of the market risk premium.[56] This implementation, using the difference between the expected return on the market portfolio and the risk free rate, is consistent with the derivation of the model from considerations of portfolio choice in conditions where a risk free asset is available to investors. Implementation using an independently estimated market risk premium is not consistent with the economic and finance principles from which the Sharpe-Lintner CAPM is derived.

The Sharpe-Lintner CAPM represents the expected return on a particular financial asset, $E(r_i)$, as:

$$E(r_i) = r_f + \beta_i \times [E(r_m) - r_f]$$

The first term on the right, $r_f$, is the return on the risk free asset available to investors. The term $r_f$ which appears in the expression $E(r_m) - r_f$ is the return on the same risk free asset. The value assigned to it should be the same as the value assigned to the first $r_f$ term in the equation representing the Sharpe-Lintner CAPM.

Independently estimating the market risk premium replaces the current rate of return on the risk free asset available to investors at the time of portfolio choice with a rate of return of uncertain provenance. Estimating the risk free rate as a long term average as part of estimating the market risk premium as a long term average of the difference between the return on the market portfolio and the return on a proxy for the risk free asset is conceptually unsound in the context of application of the Sharpe-Lintner

[55] Ibid.

[56] Australian Energy Regulator, *Explanatory Statement: Rate of Return Guideline*, December 2013, footnote 6, p 10

CAPM.[57] The model requires a current estimate of the return on the risk free asset. To make use of survey and other data which supposedly inform an estimate of the market risk premium, without consideration of the specific requirement of the Sharpe-Lintner CAPM for an estimate of the current risk free rate, amounts to obfuscation.

Appendix B of the Explanatory Statement accompanying the Rate of Return Guideline indicates a long term average nominal return on the market in the range 9.9 per cent to 12.7 per cent (after adjustment for the AER's estimate of the value to be attributed to imputation credits, γ = 0.5).[58] If, as APTNT contends in section 8.7.3 below, the correct estimate of γ is 0.25, then the corresponding range for the long term average nominal return on the market is 9.0 per cent to 11.6 per cent. If this range for the long term average return on the market is taken as an estimate of the range for the current expected return on the market, and the estimate of the risk free rate is currently 2.93 per cent, then the term $E(r_m) - r_f$ in the Sharpe-Lintner CAPM should have a value between 6.1 per cent and 8.7 per cent.

APTNT notes that the Western Australian Economic Regulation Authority has, in its June 2015 Final Decision on proposed revisions to the Access Arrangement for the ATCO Gas Australia distribution systems, required use of an estimate of the term $E(r_m) - r_f$ of the Sharpe-Lintner CAPM of 7.6 per cent.

An estimate of 6.5 per cent is close to the lower limit of the range of estimates for the term $E(r_m) - r_f$ when that term is interpreted consistently with assumptions made for derivation of the Sharpe-Lintner CAPM.

*Estimate of the return on equity made using the foundation model*

Application of the foundation model – the Sharpe-Lintner CAPM – using the input values of the Rate of Return Guideline yields an estimate of the return on equity of 7.48 per cent.

That estimate is made using an estimate of the equity beta of 0.7, and an estimate of the market risk premium of 6.5 per cent.

As noted above, econometric studies continue to indicate a range for beta of 0.4 to 0.7. Furthermore, circumstances have not changed since the AER found, in 2011, that an equity beta of 0.8 would allow the service provider using the AGP an opportunity to recover at least its efficient costs incurred in providing reference services, and meeting regulatory requirements, consistent with the requirements of the NGL. APTNT therefore concludes that using a beta of 0.8 leads to an estimate of the return on equity which could contribute to achievement of the allowed rate of return objective. An estimate of

[57] Estimating the market risk premium as a long term average of the difference between the return on the market portfolio and the return on a proxy for the risk free asset may have relevance in contexts other than application of the Sharpe-Lintner CAPM

[58] Australian Energy Regulator, *Explanatory Statement: Rate of Return Guideline (Appendices)*, December 2013, p 26

the return on equity made using a beta of 0.7 would not contribute to achievement of that objective.

APTNT concludes that, if the foundation model is used to estimate the return on equity, it should be used with the following estimates for the input variables of the model:

- risk free rate: $r_f$ = 2.93 per cent;
- equity beta: $\beta_i$ = 0.8; and
- $E(r_m)$: in the range 9.0 per cent to 11.6 per cent.

APTNT's estimate of the return on equity made using the Sharpe-Lintner CAPM is, then, in the range 7.8 per cent to 9.8 per cent.

APTNT notes that an estimate of the market risk premium of 6.5 per cent is at the low end of the range of estimates for the term $E(r_m) - r_f$ in the Sharpe-Lintner CAPM. It is significantly lower than the estimate of 7.6 per cent used by the Western Australian Economic Regulation Authority in its June 2015 final decision on revisions to the access arrangement for the gas distribution systems in the south west of Western Australia. Use of an estimate of 6.5 per cent for the market risk premium, as proposed in the Rate of Return Guideline, is likely to lead to an estimate of the return on equity which would not contribute to achievement of the allowed rate of return objective. Its use in total revenue and reference tariff determination would result in a relatively low tariff, leading to inefficiency because it would:

- provide APTNT with signal for under-investment in the AGP; and
- expose APTNT and users to the consequential economic costs and risks of over utilisation of the AGP.

The Rate of Return Guideline may refer to the Sharpe-Lintner CAPM as the "foundation model", but that model is only one of four financial models identified as being relevant to estimating the return on equity. In the next section of this submission, APTNT considers the AER's assessment of these models against the AER's assessment criteria. Each of the four models has strengths and limitations, and this precludes a finding that any one of them is superior to the others. In these circumstances, a point estimate of the return on equity made using the Sharpe-Lintner CAPM cannot, on its own, be taken to be an estimate of the return on equity which contributes to the allowed rate of return objective. It must be considered together with estimates made using the other three financial models.

### 8.3.3 Model assessment

The Rate of Return Guideline identifies the Sharpe-Lintner CAPM, the Black CAPM, the Dividend Growth Model, and Fama-French Three Factor Model as financial models relevant to estimating the return on equity.[59]

Relevant material identified in Step 1 of the AER's preferred approach to the return on equity is, the Rate of Return Guideline advises, to be assessed against the AER's assessment criteria.[60] These criteria are:

(1) estimation methods and financial models should be consistent with well accepted economic and finance principles and informed by sound empirical analysis and robust data;

(2) use of estimation methods, financial models, market data and other evidence should be consistent with the original purposes for which they were compiled, regard should be had to the limitations of those purposes, and simple rather than complex approaches should be promoted where appropriate;

(3) implementation should be in accordance with good practice, supported by robust, transparent and replicable analysis that is derived from available and credible datasets;

(4) models used to determine the return on equity (and the return on debt) should be quantitative, robust and not unduly sensitive to errors in inputs estimation, and modelling processes should avoid arbitrary filtering or adjustment of data which does not have a sound rationale;

(5) where market data and other information are used, this information should be credible and verifiable, comparable and timely, and clearly sourced; and

(6) estimation methods, financial models, market data and other evidence should be sufficiently flexible to allow changing market conditions and new information to be reflected in regulatory outcomes, as appropriate.[61]

The AER's application of these criteria – in particular, its focus on simple rather than complex models and methods, and a preference for the old and familiar – lead to an unbalanced hierarchy of the four financial models relevant to estimating of the return on equity:

- the Sharpe-Lintner CAPM is the "foundation model"; it is to be the starting point for estimating the return on equity.
- the Black CAPM is not to be used directly to estimate the return on equity; it is to be used only to inform estimation of the equity beta to be used in applying the foundation model;

[59] Ibid., p 13
[60] Ibid.
[61] Ibid., p 6

- the Dividend Growth Model is to be used to inform estimates of the market risk premium to be used in applying the foundation model; and
- the Fama-French Three Factor Model has no role in estimating the return on equity.

This use of criteria, not explicitly derived from the NGL and the NGR, to arrive at a hierarchy of models in which one model is the foundation model, and the others have very limited roles to play in estimating the return on equity, disregards the requirement of Rule 87(5) to have regard to relevant estimation methods, financial models, market data and other evidence in determining the allowed rate of return. Moreover, the criteria provide little to assist an assessment of whether particular models or methods can deliver estimates of the return on equity which can contribute to achievement of the allowed rate of return objective.

*Sharpe-Lintner CAPM*

The Sharpe-Lintner CAPM was a major advancement in financial theory in the mid-1960s when it was proposed, more or less simultaneously, by William Sharpe, John Lintner, Jan Mossin and others.[62] It was the first model in which the expected rate of return on a risky financial asset was explained as a capital market equilibrium rate of return.

The Sharpe-Lintner CAPM is derived from accepted economic and finance principles (criterion (1)). The model is applied using widely recognised techniques of empirical analysis, including widely used and replicable statistical methods for estimating the equity beta, and using well established data sets (criterion (3)).

Use of the Sharpe-Lintner CAPM in estimating the return on equity is entirely consistent with the original purpose for which the model was developed model (criterion (2)). The model is a static model of equilibrium pricing in a market for financial assets. It is relatively simple in comparison with more recent asset pricing models which have been derived in dynamic stochastic settings. Although the relative simplicity of the Sharpe-Lintner CAPM facilitates its application, that simplicity is a consequence of model derivation from a very restricted set of economic and finance principles.

The Sharpe-Lintner CAPM is a quantitative model (criterion (4)). It is not unduly sensitive to errors in input estimation, and its application does not usually require arbitrary filtering or adjustment of data (criterion (4)).

The Sharpe-Lintner CAPM has three input variables: the risk free rate of return, the equity beta, and the expected return on the market portfolio. Beta is assumed to be a

[62] The model was initially reported in the following published papers: William F. Sharpe (1964), "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk", Journal of Finance, 19(3): 425-442; John Lintner (1965), "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets", Review of Economics and Statistics, 47(1): 13-47; and Jan Mossin (1966), "Equilibrium in a Capital Asset Market", Econometrica, 34(4), 768-683

constant (the model offers no explanation for observed beta variation). Through the expected return on the market and, in particular, through the risk free rate, the model exhibits some flexibility for response to changing market conditions and new information (criterion (6)).

The Sharpe-Lintner CAPM appears, then, to satisfy the AER criteria for a model directly relevant to estimating the return on equity.

However, the consequences of model derivation from a restricted set of economic and finance principles must be recognised when applying the Sharpe-Lintner CAPM. An extensive technical literature, built up over five decades provides at least six reasons why an estimate of the return on equity made using the model is unlikely to achieve the allowed rate of return objective of Rule 87(3). These are:

- empirical research has shown that the Sharpe-Lintner CAPM does not provide good estimates of expected rates of return on financial assets;[63]
- the Sharpe-Lintner CAPM explains expected rates of return in terms of only one type of risk; the effects of other important types of risks, in particular, technological and regulatory risks, are excluded by the form of the model of choice from which the Sharpe-Lintner CAPM is derived;[64]
- the Sharpe-Lintner CAPM is essentially a static model; when the dynamics of investment behaviour are taken into account at least one more risk factor is required to explain asset prices;[65]

[63] See, for example, Rolf W. Banz (1981), "The Relationship Between return and Market value of Common Stocks", Journal of Financial Economics, 9: 3-18; Marc R. Reinganum (1982), "Misspecification of Capital Asset Pricing: Empirical Anomalies Based on Earnings' Yields and Market values", Journal of Financial Economics, 9: 19-46; Michael R. Gibbons (1982), "Multivariate Tests of Financial Models: A New Approach", Journal of Financial Economics, 10: 3-27; Robert F. Stambaugh (1982), "On the Exclusion of Assets from Tests of the Two Parameter Model: A Sensitivity Analysis", Journal of Financial Economics, 10: 237-268; Jay Shanken (1987), "Multivariate Proxies and Asset Pricing Relations: Living with the Roll Critique", Journal of Financial Economics, 18: 91-110; and Eugene F. Fama and Kenneth R. French (1992), "The Cross Section of Expected Stock Returns", Journal of Finance, 47(2): 427-465.

[64] That technological and other risks may be important in the explanation of asset prices is indicated by the growing number of pricing models developed within a general equilibrium framework incorporating production as well as exchange and consumption. See, for example, John H. Cochrane (1996), "A Cross-Sectional Test of an Investment-Based Asset Pricing Model", Journal of Political Economy, 104(3): 572-621; Urban J. Jermann (1998), "Asset pricing in production economies", Journal of Monetary Economics 41: 257-275; Joao F. Gomes, Leonid Kogan and Lu Zhang (2003), "Equilibrium Cross Section of Returns", Journal of Political Economy, 111(4): 693-732, Leonid Kogan (2004), "Asset prices and real investment", Journal of Financial Economics, 73: 411-431; and Joao F. Gomes, Leonid Kogan and Motohiro Yogo (2009), "Durability of Output and Expected Stock Returns", Journal of Political Economy, 117(5): 941-986.

[65] Robert Merton (1973). "An Intertemporal Capital Asset Pricing Model", Econometrica, 41(5): 867-887

- the Sharpe-Lintner CAPM does not take into account the effects of idiosyncratic risks on asset prices; the effects of these risks are assumed to be eliminated by portfolio diversification, but the required diversification is not supported by the evidence;[66]
- for derivation of the Sharpe-Lintner CAPM, investor expectations about investment opportunities and returns are assumed to be homogeneous; recent theoretical research, which examines the implications of the more reasonable view that investor expectations are heterogeneous, finds that optimal portfolios will not be well diversified, and idiosyncratic factors are important in explaining expected rates of return;[67] and
- dissatisfaction with the naïve psychological foundations of the rational actor framework of financial economics has led to the emergence of behavioural finance, which further challenges the adequacy of the Sharpe-Lintner CAPM as an explanation of the economic processes through which asset prices are generated.[68]

The Sharpe-Lintner CAPM may appear to satisfy the AER's assessment criteria, but there is doubt about whether it can, on its own, provide an estimate of the return on equity which can contribute to achievement of a rate of return which is commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the service provider in respect of the provision of reference services.

*Black CAPM*

The Black CAPM was developed in response to the fact that early empirical work showed that the Sharpe-Lintner CAPM did not provide a good fit to observed equity returns data. A number of the assumptions which must be made to derive the Sharpe-

[66] See, for example, John Y. Campbell, Martin Lettau, Burton G. Malkiel and Yexiao Xu (2001), "Have Individual Stocks Become More Volatile? An Empirical Exploration of Idiosyncratic Risk", Journal of Finance, 56(1): 1-43.

[67] See, for example, George M. Constantinides and Darrell Duffie (1996), "Asset Pricing with Heterogeneous Consumers", Journal of Political Economy 104(2): 219-240; John Y. Campbell, Martin Lettau, Burton G. Malkiel and Yexiao Xu (2001), "Have Individual Stocks Become More Volatile? An Empirical Exploration of Idiosyncratic Risk", Journal of Finance, 54(1): 1-43; Alon Brav, George M. Constantinides, Christopher C. Geczy (2002), "Asset Pricing with Heterogeneous Consumers and Limited Participation: Empirical Evidence", Journal of Political Economy, 110(4): 793-824; Fangjian Fu (2009), "Idiosyncratic Risk and the cross-section of expected stock returns", Journal of Financial Economics, 91: 24-37; Francis A. Longstaff (2009), "Portfolio Claustrophobia: Asset Pricing in Markets with Illiquid Assets", American Economic Review, 99(4): 1119-1144.

[68] Mark Machina (1987), "Choice Under Uncertainty: Problems Solved and Unsolved", Journal of Economic Perspectives, 1(1): 121-154, discusses problems with the standard behavioural assumption of expected utility maximisation. A brief history of behavioural finance and a review of the earlier literature is provided by Robert J Shiller (2003), "From Efficient Markets Theory to Behavioral Finance", Journal of Economic Perspectives, 17(1): 83-104.

Lintner CAPM – assumptions which, on their own or in other contexts, are accepted economic and finance principles – were identified as being possible causes of the empirical failure of the model. Fischer Black (among others) identified the assumption of unrestricted borrowing and lending at the risk free rate of return as being problematic, and derived an asset pricing model within the mean-variance framework within which the Sharpe-Lintner CAPM was derived without assuming the existence of a risk free asset.[69]

Black showed that when there is no risk free asset, and there is no riskless borrowing or lending, the expected return on any financial asset $i$, $E(r_i)$, is a linear function of $\beta_i$:

$$E(r_i) = E(r_z) + \beta_i \times [E(r_m) - E(r_z)]$$

This is the Black CAPM. $r_m$ is the return on the market portfolio, and $r_z$ is the return on a zero beta portfolio.

Black also showed that when there is a risk free asset available, but investors are not able to take short positions in that asset, $r_f < E(r_z) < E(r_m)$. In these circumstances:

- when beta is low, the expected return predicted by the Sharpe-Lintner CAPM is less than the expected return predicted by the Black CAPM; and
- when beta is high, the expected return predicted by the Sharpe-Lintner CAPM is greater than the expected return predicted by the Black CAPM.

This seemed to accord with the findings from work by Black, Jensen and Scholes using US share price data for the period 1926 to 1966. Black, Jensen and Scholes found that expected returns on portfolios of shares with low betas were consistently higher than the expected returns predicted by the Sharpe-Lintner CAPM, and expected returns on portfolios of shares with high betas were consistently lower than the expected returns predicted by the Sharpe-Lintner CAPM.[70]

Derivation of the Black CAPM from accepted economic and finance principles (criterion (1)) is acknowledged in the Explanatory Statement accompanying the Rate of Return Guideline.[71] However, the model is seen as being technical, and requiring complex econometric techniques for its application. In consequence, the AER doubts whether it is "fit for purpose" (criterion (2)). This is not the case. The model is a simple linear model of the same type and form as the Sharpe-Lintner CAPM. Like the Sharpe-Lintner CAPM, it was developed for the purpose of estimating rates of return on financial assets.

[69] Fisher Black (1972), "Capital Market Equilibrium with Restricted Borrowing", Journal of Business, 45(3): 444-455

[70] Fischer Black, Michael C Jensen and Myron Scholes (1972), "The Capital Asset Pricing Model: Some Empirical Tests", in Michael C Jensen (ed.), *Studies in the Theory of Capital Markets*, New York: Praeger

[71] Australian Energy Regulator, *Explanatory Statement: Rate of Return Guideline*, December 2013, Appendix A, p 17

The Black CAPM requires for its understanding little more analytical technique than is required for understanding the Sharpe-Lintner CAPM, and little more in the way of econometric methods and data sets than are required for application of the Sharpe-Lintner CAPM. This is clear from the standard textbook treatment of the model.[72]

The principal issues concerning the Black CAPM are, as the Explanatory Statement notes, its use of a return on a zero beta portfolio, and the requirement to estimate that return when the model is applied.

In the Black CAPM, the return on the zero beta portfolio (a portfolio of assets with a return which is not correlated with the return on the market portfolio) effectively replaces the risk free rate of return of the Sharpe-Lintner CAPM. The AER sees this use of a zero beta portfolio as adding to the complexity of the model. It does not. The idea of a zero beta portfolio is less complex – certainly less abstract – than the idea of a risk free asset, an asset with a return which does not vary over different states of the economy. The difficult concept of the risk free asset is rarely examined in the haste to identify that asset with a specific traded financial asset for the purpose of estimation of a risk free rate of return.

The main objection to use of the Black CAPM appears to be the difficulty of making suitable estimates of the return on the zero beta portfolio. On this point, the AER seems to have been guided by expert advice from Professor Michael McKenzie and Associate Professor Graham Partington:

> The problem in practice is estimating the return on the zero beta portfolio. This can be very sensitive to the choices made in its estimation as our prior work and the estimates of the consultants demonstrate.[73]

The Explanatory Statement which accompanies the Rate of Return Guideline advises:

> Expected returns on zero beta portfolios are not observable, and no generally accepted empirical measurement of the zero beta portfolio exists. As stated by, McKenzie and Partington 'there is no generally accepted empirical measurement of the zero beta return… because the empirical measurement of the zero beta return is neither simple, nor transparent'. Accordingly, the estimation of returns on a zero beta portfolio typically requires econometric analysis. Such analysis is neither simple nor transparent, and may lead to difficulties in determining robust updates to these estimates at the time of each determination. This also leads to concerns about data mining.[74]

The essence of this appears to be:

- the return on the zero beta portfolio is not directly observable;

[72] See John Y Campbell, Andrew W Lo and A Craig MacKinlay (1997), *The Econometrics of Financial Markets*, Princeton, New Jersey: Princeton University Press.

[73] Michael McKenzie and Graham Partington, *Report to the AER Part A: Return on Equity*, on behalf of The Securities Industry Research Centre of Asia-Pacific (SIRCA) Limited, October 2014, p 25

[74] Australian Energy Regulator, *Explanatory Statement: Rate of Return Guideline*, December 2013, Appendix A, p 16

- the return on the zero beta portfolio must therefore be estimated;
- estimating the return on the zero beta portfolio requires use of econometric methods;
- the use of those methods is neither simple nor transparent, and may lead to difficulties including concerns about data mining.

Certainly, the return on the zero beta portfolio is not directly observable. But then neither is the equity beta, which must also be estimated using econometric methods. If there is concern about the use of econometric methods being neither simple nor transparent, with the possibility of “data mining”, and that concern leads to the conclusion that the Black CAPM should have a limited role, then similar concerns and conclusions must arise about the Sharpe-Lintner CAPM, and about many other models which might be used to estimate the return on equity.

The implication of the argument against a substantial role for the Black CAPM is that the Dividend Growth Model, which usually does not require econometric estimation of its input values, is the only one of the four financial models identified as relevant which might be used to estimate the return on equity.

Appendix A to the Explanatory Statement advises that sensitivity to values assigned to the input variables of the Black CAPM – in particular, to the expected return on the market and the expected return on the zero beta portfolio – "represents a fundamental limitation of the model".[75] The Explanatory Statement claims that work by financial economists NERA to estimate the return on the zero beta portfolio demonstrates the Black CAPM is unsuitable for use. This is because "estimation of parameters for the Black CAPM is not sufficiently robust such that the model could be implemented in accordance with good practice". However, the Explanatory Statement is vague on what is meant by “robust”.

Robustness, at least as far as it can be characterised from the Explanatory Statement, may be important in the evaluation of data sets and estimation methods, but the way in which the AER uses the concept does little to assist in discriminating between financial models relevant to estimation of the return on equity. Qualitative models may not be robust, and the Sharpe-Lintner CAPM and the Dividend Growth Model are robust, but without a clear concept of robustness, these are no more than assertions. At best, the Explanatory Statement equates robustness with model sensitivity.[76]

But equating robustness with sensitivity does not help. Nowhere does the AER address the issue of whether estimation of the return on equity using the Black CAPM is sensitive

[75] Australian Energy Regulator, Explanatory Statement: Rate of Return Guideline, December 2013, Appendix A, p 17
[76] Ibid., p 29

to the values assigned to the model's input variables, and in particular to the value assigned to the return on the zero beta portfolio.[77]

In the discussion on criterion (2) (fitness for purpose), the Explanatory Statement notes:

> An important limitation of some of the information may be its past performance in forecasting returns or its robustness or sensitivity to assumptions. For example, dividend growth models can be quite sensitive to assumptions on growth in future earnings.[34] This factor is relevant to how the information from these models should be considered. Information that is considered less reliable may be considered qualitatively rather than quantitatively.[78]

The example provided in this paragraph – the Dividend Growth Model being quite sensitive to assumptions on growth in future dividends – illustrates the usual meaning of model sensitivity.

Sensitivity is the relative extent to which the value of the output of a model varies due to a specified variation of the value assigned to an input to that model.[79] Sensitivity is the issue of whether a small change made to the value of an model input variable results in a small change, or a large change, in model output, or in no change at all.

The following hypothetical example illustrates the concept. Model A and Model B are two financial models relevant to estimation of the return on equity. The output of Model A – the estimate of the return on equity obtained using the model – varies by 5 per cent for a 10 per cent variation in the value of input variable X. In the case of Model B, the output – the estimate of the return on equity – varies by 20 per cent for a 10 per cent variation in the value of the same input variable X. Model B is more sensitive than Model A to a variation in the value of the common input variable X.

Sensitivity is a characteristic of a model. It is conceptually and logically distinct from the way in which values are assigned to the input variables of the model. Model sensitivity is unrelated to uncertainty in the values to be assigned to model input variables. Uncertainty may lead to a wide range of possible values for an input variable, but model output may not be sensitive to that variation.

Both the Sharpe-Lintner CAPM and the Black CAPM have the form:

$$E(r_i) = E(r_x) + \beta_i \times [E(r_m) - E(r_x)]$$

In the case of the Sharpe-Lintner CAPM, $E(r_x)$ is the risk free rate of return; in the case of the Black CAPM it is the expected return on the zero beta portfolio.

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[77] Table A1 of Appendix A to the Explanatory Statement also asserts that the econometric derivation of input parameters leads to concerns about the potential for data mining. This assertion is not supported by the AER. It is not an assertion made in the technical literature on the model.

[78] Ibid., p 29

[79] Models with more than one input variable may have different sensitivities to the different inputs.

Using the values of the input variables in section 8.3.2 above and section 8.3.4 below, a 5 per cent variation in the risk free rate produces a variation of about 1.8 per cent in the rate of return estimate made using the Sharpe-Lintner CAPM. A 5 per cent variation in the return on the zero beta portfolio produces a variation of about 0.7 per cent in the rate of return estimate made using the Black CAPM. Neither variation is large, and neither model is particularly sensitive to a change in $E(r_x)$. The Black CAPM is less sensitive to a change in the rate of return on the zero beta portfolio than the Sharpe-Lintner CAPM is to a change in the risk free rate of return.

The Black CAPM, like the Sharpe-Lintner CAPM, has three input variables: the return on the zero beta portfolio, beta, and the expected return on the market portfolio. Beta is assumed to be constant; the model, like the Sharpe-Lintner CAPM, offers no explanation of beta variation. Like the Sharpe-Lintner CAPM, through the expected return on the market and the return on the market portfolio, the Black CAPM exhibits some flexibility in response to changing market conditions and new information (criterion (6)).

The Black CAPM was developed to address issues with the empirical performance of the Sharpe-Lintner CAPM. Like the Sharpe-Lintner CAPM, the Black CAPM appears to satisfy the AER's assessment criteria. The principal concern with use of the Black CAPM arises from the need to estimate the return on a zero beta portfolio. Making an estimate of that return requires econometric methods, but this permits the uncertainty in any estimate obtained to be made explicit. The work by NERA to which the Explanatory Statement refers, and recent work by SFG and CEG, all make explicit estimates of the return on the zero beta portfolio. Although there are differences between the estimates reflecting different data sets and methods, the Black CAPM is not especially sensitive to these differences. In the absence of a clearly superior alternative, there is no justification for rejecting direct estimation of the return on equity using the Black CAPM.

*Dividend Growth Model*

The present value to an equity investor, today (time 0), of the future dividends from investment in one share of the stock of a firm which is not expected to fail, is:

$$PV_0 = \frac{D_1}{(1+r_i)} + \frac{D_2}{(1+r_i)^2} + \ldots + \frac{D_n}{(1+r_i)^n} + \ldots$$

where:

- $D_j$ is the expected dividend on the share in year $j$, which is assumed to be paid at the end of year $j$; and
- $r_i$ is the investor's discount rate, which is the required rate of return on equity.

If dividends are expected to grow at a constant annual rate $g$, the present value of the expected future dividends is:

$$PV_0 = \frac{D_1}{(1+r_i)} + \frac{D_1 \times (1+g)}{(1+r_i)^2} + \ldots + \frac{D_1 \times (1+g)^{n-1}}{(1+r_i)^n} + \ldots = \frac{D_1}{r_i - g}$$

provided $g < r_i$.

The price the investor would be prepared to pay for the share today (at time 0) is, then:

$$p_0 = \frac{D_1}{r_i - g}$$

Today's share price, $p_0$, is set in the market for financial assets, so that, given the expected dividend in one year, $D_1$, and the dividend growth rate, $g$, the investor's required rate of return on equity is:

$$r_i = \frac{D_1}{p_0} + g$$

This is the simplest form of the Dividend Growth Model. More complex forms of the model allow for variations in the growth of dividends.

The Dividend Growth Model incorporates accepted economic and finance principles (criterion (1)): the rate of return is the rate at which equity investors discount expected future cash flows.

As Table A.1 of the Explanatory Statement notes, the Dividend Growth Model does not identify or provide a theory of the risk factors that explain equity returns. However, neither the Sharpe-Lintner CAPM nor the Black CAPM identifies or provides a theory of the risk factors that explain equity returns. They explain the prices of individual financial assets in terms of the prices of all financial assets.[80] Of the four financial models identified as relevant, only the Fama-French Three Factor Model introduces those risk factors.

The Dividend Growth Model is fit for purpose (criterion (2)). Its use in estimation of the return on equity is entirely consistent with the original purpose for which the model was developed. Furthermore, the Dividend Growth Model is a simple quantitative model (criterion (4)), which is easily implemented in accordance with good practice, in a transparent and replicable way (criterion (3)).

Table A.1 of Appendix A to the Explanatory Statement notes that the dividend growth rate is difficult to estimate and has a material impact on the estimate of the return on equity obtained using the Dividend Growth Model. This issue of sensitivity is of concern if the model is used to estimate equity returns for individual businesses, and leads the AER to conclude that the model should only be used to inform the estimate of the market risk premium required for application of the foundation model.

[80] See Lawrence H Summers (1985), "On Economics and Finance", Journal of Finance, 40(3), pp 633-635, and John Y Campbell (2000), "Asset Pricing at the Millennium", Journal of Finance, 55(4), pp 1515-1567.

The Explanatory Statement advises that, when used to estimate the return on equity of the benchmark efficient entity of Rule 87, the Dividend Growth Model leads to an implausible result.[81] Certainly, the AER's estimates made using a two-stage Dividend Growth Model show an average return on equity for an energy infrastructure business which has been consistently higher that the average return on the market for the period from September 2006 to June 2013.[82]

Does this use of the Dividend Growth Model to estimate equity returns for particular businesses fail the basic "sanity check" as the AER claims? The Dividend Growth Model fails, the AER maintains, because the systematic risk of infrastructure businesses is below the systematic risk of the market, implying that the return on equity for an energy infrastructure business should be below the return on the market. In support of this claim, the AER notes the view of Professor McKenzie and Associate Professor Partington that:

> . . . conceptual discussion clearly provides evidence to suggest that the theoretical beta of the benchmark firm is very low. While it is difficult to provide a point estimate of beta, based on these considerations, it is hard to think of an industry that is more insulated from the business cycle due to inelastic demand and a fixed component to their pricing structure. In this case, one would expect the beta to be among the lowest possible and this conclusion would apply equally irrespective as to whether the benchmark firm is a regulated energy network or a regulated gas transmission pipeline.[83]

This is speculation by Professor McKenzie and Associate Professor Partington. It is speculation made within the conceptual framework of the Sharpe-Lintner CAPM and, because it is speculation, it provides no evidence against the use of the Dividend Growth Model. Indeed, the result obtained using the Dividend Growth Model calls into question reasoning from the framework within which the Sharpe-Lintner CAPM is derived, and the model itself.

The Dividend Growth Model exhibits some ability to respond to changing market conditions and new information through changes in share prices and dividends (criterion (6)).

The Dividend Growth Model appears to satisfy most of the AER's assessment criteria. The principal concern with use of the model arises from potential difficulties with estimation of the dividend growth rate, and the implication that this may affect estimates of the return on equity obtained. However, these are issues which the AER does not explicitly examine.

The Dividend Growth Model is derived from a perspective on asset pricing which is different from the perspective underlying the Sharpe-Lintner CAPM, the Black CAPM and the Fama-French Three Factor Model (discussed below). The Sharpe-Lintner

[81] Australian Energy Regulator, *Explanatory Statement: Rate of Return Guideline*, December 2013, Appendix E, section E.3
[82] Ibid., Appendix E, Figure E.2, p 120
[83] Ibid., p 121

CAPM, the Black CAPM and the Fama-French Three Factor Model all explain the expected rate of return on a risky financial asset as a capital market equilibrium rate of return. In the Dividend Growth Model, the return on equity is the rate at which equity investors discount expected future cash flows. The model therefore requires approaches to the way in which its key input values are estimated which are different from the econometric approaches required for estimation of the key inputs to the Sharpe-Lintner CAPM, the Black CAPM and the Fama-French Three Factor Model.

In the absence of a clearly superior asset pricing model, these differences support consideration being given to estimates of the return on equity made using the Dividend Growth Model, particularly if the estimates obtained are considered together with estimates made using the other three financial models.

*Fama-French Three Factor Model*

The Rate of Return Guideline advises that the Fama-French Three Factor Model is a relevant financial model, but concludes that the model has no role to play in estimating the return on equity.

The principal reasons for this conclusion seem to be:

- the lack of clear theoretical foundations for the risk factors of the Fama-French Three Factor Model; and
- difficulties in estimating the factors, which lead to concerns about their stability and about the potential for "data mining" when applying the model.

These reasons for concluding that the model has no role to play should be examined within the context in which the Fama-French Three Factor Model was developed.

The Sharpe-Lintner CAPM was derived, in the mid-1960s, from a model of choice in which investors choose, at a point in time, portfolios of assets which yield returns one period later. This model of choice did not explicitly incorporate time, and yet time is fundamental to issues of investment and return.

In 1973, Robert Merton made the following assessment of the Sharpe-Lintner CAPM:

> Although the model has been the basis for more than one hundred academic papers and has had a significant impact on the non-academic financial community, it is still subject to theoretical and empirical criticism. Because the model assumes that investors choose their portfolios according to the Markowitz mean-variance criterion, it is subject to all the theoretical objections to this criterion, of which there are many.[84]

Merton's concerns about the Sharpe-Lintner CAPM apply equally to the Black CAPM, which was derived within the same mean-variance framework.

[84] Robert Merton (1973). "An Intertemporal Capital Asset Pricing Model", Econometrica, 41(5): 867-887

Merton sought to avoid the theoretical objections to the mean-variance framework by deriving a general form of the asset pricing relationship using the standard model of intertemporal choice from microeconomic theory. His use of intertemporal choice theory allowed another of the strong assumptions required for derivation of the Sharpe-Lintner CAPM and the Black CAPM – the assumption of a single time period – to be dropped, and opened the way to explicit consideration of the role of time in equilibrium asset pricing.

Merton showed that, in equilibrium, expected rates of return must compensate investors for bearing market risk (the key insight of the Sharpe-Lintner CAPM), and they must also compensate for the bearing of the risk of unfavourable shifts in the set of investment opportunities over time. If economic circumstances change over time, the explanation of the Sharpe-Lintner CAPM is inadequate, and a second risk factor is required to explain asset prices.

Subsequent application of Merton's method – the use of the standard model of intertemporal choice – has shifted the focus of asset pricing theory away from individual portfolio choice, to the macroeconomic factors which are the ultimate determinants of the risk premiums in asset prices.[85]

Intertemporal choice, which provides a dynamic stochastic approach to asset pricing, leads to the generic model:

$$p_t = E_t(m_{t+1}x_{t+1})$$

where $p_t$ is the equilibrium asset price at time $t$, $x_{t+1}$ is the uncertain payoff on the asset at time $t+1$, and $m_{t+1}$ is a stochastic discount factor.[86] This model expresses the simple idea that, in a competitive capital market, the equilibrium price of an asset is its expected discounted payoff, the expectation being formed at time t, the time at which a decision to purchase the asset is made.

The stochastic discount factor, $m_{t+1}$, is determined by the ratio of the marginal utility from the consumption of goods and services tomorrow (period $t+1$) to the marginal utility of consumption today (period t). It reveals a fundamental determinant of asset prices and, hence, of rates of return: the rate at which investors are willing to substitute consumption tomorrow for consumption today. This rate is, in turn, determined by the rate of growth in consumption between today and tomorrow. Asset prices and rates of return are, therefore, determined by expectations about consumption growth. This important result links asset prices to the state of the economy.

[85] See, for example, John H Cochrane (2005), *Asset Pricing*, revised ed., Princeton: Princeton University Press, and Sumru Altug and Pamela Labadie (2008), *Asset Pricing for Dynamic Economies*, Cambridge: Cambridge University Press

[86] Since the rate of return on the asset is $r_{t+1} = x_{t+1}/p_t - 1$, the model can be written in terms of the rate of return rather than the asset's price: $E_t(m_{t+1}(1 + r_{t+1})) = 1$

Relating the stochastic discount factor directly to consumption growth does not facilitate the development of asset pricing much beyond the rather abstract presentation above.[87] In these circumstances, more specific representations of the discount factor have been sought. In one line of research, the discount factor is modelled as a linear function of the economic factors, $f_i$, which determine consumption growth. The asset pricing equation then has the beta representation:

$$E_t(r) = a + b_1 \times \beta_{f1,r} + b_2 \times \beta_{f2,r} + \ldots + b_n \times \beta_{fn,r}$$

where $E_t(r)$ is the expected rate of return on an asset; $a$ is a constant; $b_i = \alpha \, x \, var(f_i)$, $\alpha$ a constant; and $\beta_{fi,\,r} = cov(f_i, r)/var(f_i)$.

These linear factor models have been an area of theoretical and empirical research in financial economics for at least two decades. A key issue for this research has been the question of what are the appropriate factors. Theoretical considerations, as outlined above, require that they be variables which can be explicitly related to investor marginal utility or consumption growth.

One such factor is the return on a portfolio of total wealth. Consumption is high when investor returns on a portfolio of all assets is high. This portfolio of all assets would comprise financial assets, real – tangible – assets, and intangible – but valuable – assets such as investments in human capital. If the number of factors is restricted to one, and that one factor is the return on a portfolio of total wealth ($r_w$), the beta representation of the basic asset pricing equation is:

$$E_t(r_{t+1}) = r_f + \beta_{w,r} \times \left[E(r_w) - r_f\right]$$

This is the conditional CAPM (the expected rate of return is conditional on the information available today). If further assumptions are made (for example, returns distributions are identically and independently multivariate normal), the conditioning can be removed, and the model reduces to the Sharpe-Lintner CAPM.

Restriction of the number of parameters to one – return on a portfolio of total wealth – is, however, arbitrary. Since the work of Merton in 1973, financial economists have recognised that multiple factors are required to explain equilibrium asset prices.

In the absence of clear theoretical guidance on what those factors should be, one line of research – extensively developed by Eugene Fama and Kenneth French – has pursued the empirical identification of relevant factors.[88]

Earlier asset pricing research had shown:

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[87] See John H Cochrane (2005), *Asset Pricing*, revised ed., Princeton: Princeton University Press, p 77

[88] An overview of their research program is provided in Eugene F Fama and Kenneth R French (2004), "The Capital Asset Pricing Model: Theory and Evidence", Journal of Economic Perspectives, 18(3), pp 25-46

- a size effect: low market value shares have higher returns than can be explained by the Sharpe-Lintner CAPM;
- a value effect: returns are predicted by ratios of market value to accounting measures such as earnings and book value of equity; and
- a momentum effect: shares with high returns during the past three to 12 months tend to have higher returns in the immediate future.

Fama and French proposed that these anomalies were interrelated and captured by a three-factor model of asset prices. The three factors were:

- the excess return on the market portfolio, $E(r_m) - r_f$;
- the difference between the return on a portfolio of small capitalization shares and a portfolio of large capitalization shares (SML); and
- the difference between the return on a portfolio of high book-to-market shares and the return on a portfolio of low book-to-market shares (HML).

The Fama-French Three Factor Model is:

$$E(r_i) = r_f + \beta_{rm} \times \left[E(r_m) - r_f\right] + s \times SMB + h \times HML$$

The empirical identification of the three factors ($E(r_m) - r_f$, $SMB$ and $HML$) by Fama and French has been described by some as "data mining". Indeed, Fama himself, has described the asset pricing model derived from intertemporal choice as a "fishing licence". But, as Cochrane notes, "you still can't fish without a licence".[89] Intertemporal choice may not impose much structure on empirical implementation, but it imposes some. It clearly establishes that that the marginal utility of wealth is critically important to asset price determination, and the constructs of empirical asset pricing must correlate with that marginal value. Cochrane points to momentum, which appears to explain asset prices.[90] Momentum has yet to obtain the status of a "factor" because, unlike the Fama-French size and value factors, there has been little or no reason to correlate momentum with a plausible measure of the marginal utility of wealth.

The Fama-French Three Factor Model is not lacking in theoretical foundations. Furthermore, the size and value factors are well established, albeit empirically rather than theoretically. The data set is the same as might be used for estimating the Sharpe-Lintner CAPM and the Black CAPM, and similar econometric techniques are used to estimate the betas of all three models.

Earlier studies (most of which are listed in Table A.2 of Appendix A to the Explanatory Statement) produced a range of estimates with some divergence of results. This is to be expected. Brailsford, Gaunt and O'Brien note:

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[89] John H Cochrane (2007), "Financial Markets and the Real Economy", in Rajnish Mehra (ed.), *Handbook of the Equity Risk Premium*, New York: Elsevier, p 243

[90] Ibid.

> While there has been some prior research using Australian data, this has been limited in depth and time series coverage by the availability of accounting data.
>
> While several previous studies have attempted to test the three-factor model in Australia, the results have been mixed and generally weak compared to the US findings. . . . These studies find that the three factor model explains returns better than the traditional capital asset pricing model, but the results are far from conclusive.[91]

Brailsford, Gaunt and O'Brien have shown that results from these earlier studies may have been affected by the method of portfolio construction employed:

> We show that in Australia, the traditional size sort leads to a very high proportion (around 95%) of total market capitalization being accounted for by stocks in just one size quintile. While the three smallest size quintiles make up just 1.5% of total market capitalization. In comparison, the largest stock size quintile in the US market comprises around 75% of total market capitalization, while the three smallest size quintiles in the US market still contain over 12% of total market capitalization. The large proportion of market value represented by just one size quintile in Australia is potentially problematic. It makes a meaningful comparison with benchmark studies difficult, and raises questions as to how much importance can be placed on an analysis where the majority of portfolios represent such an insignificant proportion of total market capitalization.[92]

Brailsford, Gaunt and O'Brien constructed a data set from ASX data and annual reports covering 98 per cent of all Australian listed companies over a period of 25 years from 1982 to 2006. Using this data set, and guided by their earlier work on portfolio construction, they construct a set of mimicking portfolios that were designed to capture size and book-to-market effects. Brailsford, Gaunt and O'Brien reported average premiums of -0.22 per cent for $SMB$, 0.76 per cent for $HML$ and 0.51 per cent for $E(r_m - r_f)$ (per month), and advised that these premiums were generally consistent with prior evidence and confirm a relatively high value premium ($HML$) in Australia.[93] They then tested these factors in both time series and cross section models, and showed that in all cases, the factors had significant positive exposures (betas).

Brailsford, Gaunt and O'Brien note:

> This is the first time that these factors have been consistently found to exhibit significant positive influences over Australian equity returns. In a series of comparative tests, the three-factor model is found to be consistently superior to the CAPM, although neither model can fully explain the time-series variation in portfolio returns.[94]

They conclude that their findings appear to settle the disputed question as to whether the value premium is a positive and significant factor in the Australian market, and

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[91] Tim Brailsford, Clive Gaunt and Michael A O'Brien (2012), "Size and book-to-market factors in Australia", Australian Journal of Management, 37(2), pp 261-262

[92] Tim Brailsford, Clive Gaunt and Michael A O'Brien (2012), "The investment value of the value premium", Pacific-Basin Finance Journal, 20, p 436

[93] Tim Brailsford, Clive Gaunt and Michael A O'Brien (2012), "Size and book-to-market factors in Australia", Australian Journal of Management, 37(2), p 279

[94] Ibid.

provide direction given the growing trend to utilize the three factor model in asset pricing tests and in practical strategies of portfolio formation in the funds management industry.[95]

With access to a relatively long data set for their work, Brailsford, Gaunt and O'Brien are able to report:

> The sample is constructed over a 25-year period from 1982 to 2006. Hence, the study provides a strong out-of-sample test of the [Fama-French three factor] model, directly addressing the criticism of data snooping.[96]

The stochastic intertemporal choice model which provides the theoretical foundation for the Fama-French Three Factor Model is a significant advancement on the static portfolio choice framework within which the Sharpe-Lintner CAPM and the Black CAPM are derived. Multiple factors, which correlate with changes in the marginal utility of wealth, are required to explain asset returns, but the stochastic intertemporal choice model does not explicitly identify those factors. At the present stage of development of asset pricing, those factors must be established empirically rather than theoretically. This is not uncommon practice in economics, in other social sciences, and in the physical sciences. It is not methodologically unsound.

Recent research supports use of the Fama-French Three Factor Model in the Australian context and demonstrates its superiority to the Sharpe-Lintner CAPM in estimating equity returns. That research also provides evidence that concerns about data mining in the implementation of the Fama-French Three Factor Model are unwarranted.

Again, in the absence of a clearly superior alternative, there is no justification for rejecting direct estimation of the return on equity using the Fama-French Three Factor Model and for not giving consideration to the estimates obtained, particularly if those estimates are considered together with estimates made using the other three financial models.

*Using financial models to estimate the return on equity*

The return on equity of the benchmark efficient entity of Rule 87 is not directly observable, and must be estimated using one or more financial models.

Rule 87(6) is clear: the return on equity is to be estimated such that it contributes to the achievement of the allowed rate of return objective. It is to be estimated such that it contributes to the achievement of a rate of return which is commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the service provider in respect of the provision of reference services.

[95] Ibid.

[96] Ibid., p 262

Furthermore, Rule 87(5) requires that, in determining the allowed rate of return, regard be had to relevant estimation methods, financial models, market data and other evidence.

Simple models and simple estimation methods might be preferred to more complex models and methods, but only if those simple models and methods can provide superior estimates of the return on equity. An inferior estimate from a simple model, or made using a simple estimation method, will not contribute to the achievement of the allowed rate of return objective. Conversely, greater model complexity and complexity in input parameter estimation are not reasons for model rejection. If a more complex model or estimation method is required to produce a result which better contributes to the allowed rate of return objective, then that more complex model or method must be employed.

Without further examination, the fact that the use of a particular financial model or method is wide-spread cannot be taken as indicative of the ability of that model or method to contribute to the achievement of a rate of return which is commensurate with the efficient financing costs of the benchmark efficient entity of Rule 87.

For example, the use of the Sharpe-Lintner CAPM in estimating equity returns has been justified by its wide-spread use by academics, market practitioners and other regulators. However, as APTNT has indicated above, academics have long moved beyond the Sharpe-Lintner CAPM in their work to understand asset prices. Market practitioners and regulators may continue to use the model, but the reasons for this do not lie in the model's superior ability to estimate equity returns. They lie in the way in which finance theory is taught. The derivation of the Sharpe-Lintner CAPM is accessible to undergraduate and MBA students with some training in elementary economics. The dynamic stochastic models which have replaced the Sharpe-Lintner CAPM require much more technical expertise. As Fama and French note:

> We continue to teach the CAPM as an introduction to the fundamental concepts of portfolio theory and asset pricing, to be built on by more complicated models like Merton's (1973) ICAPM. But we also warn students that despite its seductive simplicity, the CAPM's empirical problems probably invalidate its use in applications.[97]

Four financial models have been identified as relevant to estimation of the return on equity. None of these four models can, on its own, provide a definitive estimate of the return on equity required by Rule 87. There is currently no simple closed form model which, even approximately, explains most of the variation in equity returns, and such a model may be unattainable.

APTNT concludes:

- the Sharpe-Lintner CAPM is simple in form and simple to use but does not perform well empirically; the model explains little of the variation in equity returns limiting its

[97] Eugene F Fama and Kenneth R French (2004), "The Capital Asset Pricing Model: Theory and Evidence", Journal of Economic Perspectives, 18(3), p 44

usefulness in estimating the return on equity required by Rule 87 and precluding its being accorded the status of the "foundation model";

- the Black CAPM has a basis in economic and finance principles similar to that of the Sharpe-Lintner CAPM and performs better empirically; the questions which arise around estimation of the zero-beta return are typical of those which asked in applied economics and econometrics, and do not preclude direct application of the model;
- the Fama-French Three Factor Model represents a significant theoretical advancement over the Sharpe-Lintner CAPM and the Black CAPM, and performs better empirically than the Sharpe-Lintner CAPM, but there is uncertainty about the factors to be used although, again, this does not preclude direct application of the model; and
- the Dividend Growth Model provides direct estimates of the return on equity; it has a basis in economic and finance principles different from those which provide the foundations for the Sharpe-Lintner CAPM, the Black CAPM and the Fama-French Three Factor Model and, although the rate of growth of dividends may be difficult to estimate, this does not preclude direct application of the model.

The Rate of Return Guideline proposes that the Sharpe-Lintner CAPM be used as the foundation model for estimating the return on equity required when determining the allowed rate of return of Rule 87. This use of the model as a foundation model is sometimes justified by the view that:

> It takes a better theory to kill an existing theory, and we have yet to see a better theory. Therefore, we continue to use the CAPM while keeping a watchful eye on new research in the area.[98]

However, this view assumes that the Sharpe-Lintner CAPM is the current best available theory of asset pricing. It is not. To suggest that it is ignores the development of asset pricing theory in the fifty years since the model was first proposed. Both the theoretical and empirical work undertaken during those fifty years point to the Black CAPM and the Fama-French Three Factor Model being superior to the Sharpe-Lintner CAPM. The Black CAPM and the Fama-French Three Factor Model better estimate equity returns, but they are more difficult to apply.

The Rate of Return Guideline proposes that the empirical shortcomings of the Sharpe-Lintner CAPM be addressed by alternative implementations of the model.[99] These alternative implementations purportedly give recognition to other financial models and methods, but they are inherently arbitrary adjustments. The proposed use of the

[98] T Koller, M Goedhart and D Wessels (2005), *Valuation: Measuring and Managing the Value of Companies*, 4th edition, Wiley, page 324. Quoted by the Western Australian Economic Regulation Authority in its October 2014 Draft Decision on Proposed Revisions to the Access Arrangement for the Mid-West and South-West Gas Distribution System, Appendix 4, paragraph 4

[99] Australian Energy Regulator, *Explanatory Statement: Rate of Return Guideline*, December 2013, Appendix A, Table A.1, p 8

Sharpe-Lintner CAPM as the foundation model effectively disregards the requirement of Rule 87(5).

Moreover, it ignores the fact that asset pricing is an area of inquiry which has developed and is continuing to develop. The Dividend Growth Model, the Sharpe-Lintner CAPM, the Black CAPM and the Fama-French Three Factor Model all represent different stages in this development. Each of the four models – the Sharpe-Lintner CAPM, the Black CAPM, the Dividend Growth Model, and the Fama-French Three Factor Model – is, as the Rate of Return Guideline advises, relevant to estimating the return on equity. However, as is common in the social sciences, no one model has convincingly displaced its predecessors. In these circumstances, each of the four models should be used directly in estimating the return on equity required for determining the allowed rate of return of Rule 87.

Proposals have been made for the direct use of the four models by assignment of weights to each of the four estimates of return on equity which they produce, but any particular set of weights is difficult to justify. APTNT is of the view that, ultimately, weighting to produce a single return on equity outcome involves an unwarranted pretence of precision.

The value of multiple models which have different bases – different strengths and limitations – is that if they all deliver the same result, they allow that result to be advanced with greater confidence. This is sometimes called convergent validation.[100] Through the use of multiple models, factors which are neglected in a single model can be taken into account and, if "convergence" is demonstrated, the result can no longer be interpreted as a unique outcome arising from the use of a particular theoretical framework or single data set.

However, the results obtained from multiple models need not converge. Where there are divergent results, the reasons why this is the case must be examined and taken into account in reaching a conclusion on the phenomenon under investigation.

In these circumstances, each of the Sharpe-Lintner CAPM, the Black CAPM, the Dividend Growth Model, and the Fama-French Three Factor Model should be used directly to make a point estimate of the return on equity. The results should then be used in a considered way to arrive at the estimate of the return on equity required by Rule 87.

Using each of the four models to estimate the return on equity, rather than relying on the estimate from the Sharpe-Lintner CAPM (informed by the Black CAPM and the Dividend Growth Model), is a departure from the process proposed in the Rate of Return Guideline.

[100] See Todd D Jick (1979), "Mixing Qualitative and Quantitative Methods: Triangulation in Action", Administrative Science Quarterly, 24, pp 602-611

The way in which APTNT has used the four financial models to estimate the return on equity for the AGP is explained in the next section of this submission.

### 8.3.4 Estimates of the return on equity

APTNT's estimation of the return on equity using the AER's implementation of the Sharpe-Lintner CAPM was discussed in section 8.3.2 above. The estimate made was 7.48 per cent.

However, neither the estimate of the equity beta nor the estimate of the market risk premium used in making this estimate could lead to an estimate of the return on equity which could contribute to achievement of the allowed rate of return objective. APTNT concluded that, if the foundation model were to be used, it should be used with an estimate of the equity beta of 0.8 and an estimate of $E(r_m) - r_f$ in the range 6.1 per cent to 8.6 per cent. This would lead to an estimate of the return on equity in the range 7.8 per cent to 9.8 per cent.

In this section of the submission, APTNT sets out estimates of the return on equity made using the other three relevant financial models – the Black CAPM, the Dividend Growth Model and the Fama-French Three Factor Model.

The section concludes with a discussion of the results obtained, and APTNT's proposed estimate of the return on equity required by Rule 87.

*Black CAPM*

Estimation of the return on equity using the Black CAPM requires that values be assigned to its three input variables. These are:

- the return on the zero beta portfolio;
- the equity beta; and
- the return on the market portfolio.

Financial economists, SFG Consulting, have estimated the zero beta premium (the difference between the return on the zero beta portfolio and the risk free rate of return) to be 3.34 per cent.[101] Using an estimate of 2.93 per cent for the risk free rate (section 8.3.2 above), the corresponding estimate of the return on the zero beta portfolio is 6.27 per cent (= 3.34 per cent + 2.93 per cent).

An estimate of 0.8 is assigned to the Black CAPM equity beta. This value is consistent with the corresponding estimate used in the application of the Sharpe-Lintner CAPM.

[101] SFG Consulting, *Cost of equity in the Black Capital Asset Pricing Model Report for Jemena Gas Networks, ActewAGL, Networks NSW, Transend, Ergon and SA Power Network*, 22 May 2014

As discussed above, the return on the market portfolio is in the range 9.0 per cent to 11.6 per cent.

Using these estimate for the input variables ($E(r_z)$ = 6.27 per cent, $\beta$ = 0.8, $E(r_m)$ in the range 9.0 per cent to 11.6 per cent), the Black CAPM delivers a range for the estimate of the return on equity of 8.5 per cent to 10.5 per cent.

*Dividend Growth Model*

APTNT has not added to the collection of dividend growth models which now forms part of the body of material pertaining to Australian regulatory practice, but has taken a return on equity estimate from one of the recent studies which is now in the public domain.

Appendix E to the Explanatory Statement which accompanies the Rate of Return Guideline advises that the average of the Dividend Growth Model estimates of return on equity for five Australian energy infrastructure businesses is 14.7 per cent.[102] This estimate was made assuming long-term real growth in dividends at a rate 1.0 per cent below an expectation of long term GDP growth 3.0 per cent, and expected inflation of 2.5 per cent. It has been adjusted for the value of imputation credits using an estimate of the proportion of franked dividends of 0.75, and an estimate of the value of distributed imputation credits (theta) of 0.7.

If the estimate of the return on equity obtained from the AER's application of the Dividend Growth Model is adjusted for the value of imputation credits using the fraction γ proposed by APTNT in section 8.7.3 below, it reduces to 13.3 per cent.

This latter estimate is still high when compared with estimates made by CEG for the return on equity for the same energy infrastructure businesses. CEG has reported estimates of 12.2 per cent from a two-stage Dividend Growth Model, and 12.0 per cent from a three stage model.[103]

SFG Consulting has also estimated the return on equity for the energy infrastructure businesses using the Dividend Growth Model. SFG's most recent imputation-adjusted estimate, made for ATCO Gas Australia, is 10.8 per cent.[104] In making this estimate,

[102] Australian Energy Regulator, *Explanatory Statement: Rate of Return Guideline*, December 2013, Appendix E, p 122

[103] CEG (Competition Economists Group), *Estimating the cost of equity, equity beta and MRP*, January 2015, page 20. CEG's report is Attachment 7.03 to Ausgrid's revised regulatory proposal which was submitted to the AER on 20 January 2015

[104] SFG Consulting, *The required return on equity: Response to ATCO Gas Draft Decision*, 24 November 2014, page 73. SFG's report is Appendix 9.1 to ATCO Gas Australia's response to the Western Australian Economic Regulation Authority's October 2014 Draft Decision on proposed revisions to the Access Arrangement for the Mid-West and South West Gas Distribution Systems

SFG has used methods (including imputation adjustment made using an estimate of γ of 0.25) which were described in earlier reports to the AER.[105]

The Dividend Growth Model provides a relatively wide range – 10.8 per cent to 13.3 per cent – for an estimate of the return on equity for energy infrastructure businesses. The variation is at least partially explained by the fact that the estimates were made at different times, and APTNT has used the most recent estimate – 10.8 per cent made by SFG Consulting – in its estimation of the return on equity.

*Fama-French Three Factor Model*

As noted above, the expected return on equity, $E(r_i)$, from the Fama-French Three Factor Model is:

$$E(r_i) = r_f + beta_i \times \left[E(r_m) - r_f\right] + s_i \times SMB + h_i \times HML$$

Use of the model requires estimates for seven input variables:

- $r_f$ is the risk free rate;
- $beta_i$ is the market beta;
- $E(r_m) - r_f$ is the excess return on the market portfolio;
- $s_i$ is the size factor "beta";
- $SMB$ is the size factor;
- $h_i$ is the value factor "beta"; and
- $HML$ is the value factor.

APTNT has applied the model using its estimate of the risk free rate of 2.93, and SFG's estimate of the excess return on the market.

The beta factor for the market return, the size and value factor betas, and the size and value factors themselves, must all be estimated from share price and other data by expert econometricians. APTNT has used a suite of estimates recently made by SFG Consulting and which are now in the public domain.[106]

SFG has used data from listed companies in Australia and the United States of America when estimating values for the betas, and for the size and value factors. These estimated values are summarised in Table 8.1.

[105] SFG Consulting, *Alternative versions of the dividend discount model: and the implied cost of equity: Report for Jemena Gas Networks, ActewAGL, APA, Ergon, Networks NSW, Transend and TransGrid*, 15 May 2014

[106] SFG Consulting, *The Fama-French model: Report for Jemena Gas Networks, ActewAGL, Ergon, Transend, TransGrid, and SA PowerNetworks*, 13 May 2014

***Table 8.1 - SFG estimates of betas and factors for Fama-French Three Factor Model***

| Input variable | Australian data | U.S. data |
|---|---|---|
| Market return beta (beta) | 0.48 | 0.87 |
| Size factor beta (s) | 0.03 | -0.07 |
| Size factor (SMB) | -0.43% | 3.58% |
| Value factor beta (h) | 0.30 | 0.12 |
| Value factor (HML) | 9.97% | 4.81% |

APTNT has used the estimates in Table 8.1, together with the estimates in Table 8.2, to estimate the return on equity using the Fama-French Three Factor Model.

APTNT notes that the rate of return on the market portfolio shown in Table 8.2 has not been adjusted for any value which might to be attributed to the imputation credits available via Australian taxation law.

The resulting estimates of the return on equity, before and after adjustment for the value of imputation credits, are also shown in Table 8.2.

The adjustment for imputation credits has been made using the "Officer formula" with a value of 0.25 for the factor γ (see section 8.7.3 below).[107]

***Table 8.2 - Application of the Fama-French Three Factor Model***

| Input variable | | |
|---|---|---|
| Risk free rate ($r_f$) | 2.93% | |
| Market risk premium | 6.11% | |
| **Return on equity** | **Using Australian factor estimates** | **Using U.S. factor estimates** |
| No adjustment for imputation credits | 8.84% | 8.57% |
| Adjusted for the value of imputation credits | 9.79% | 9.49% |

SFG's factor estimates made using Australian data were made using data from a relatively small number of businesses. A larger data set was available for U.S. businesses. SFG therefore reported an estimate of the return on equity made using the Fama-French model which was a weighted average of the estimates made using Australian factor data and U.S. factor data.

[107] $r_e(without\ credits) = r_e\ (with\ credits) \times (1-T)/[1-T \times (1-\gamma)]$, where $T$ is the corporate tax rate

When SFG's weighting (24 per cent Australian data; 76 per cent U.S. data) are used, the weighted averages of the estimates of the return on equity shown in Table 8.2 are:

- without adjustment for imputation credits: 8.64 per cent;
- adjusted for the value of imputation credits: 9.56 per cent.

*Estimating the return on equity*

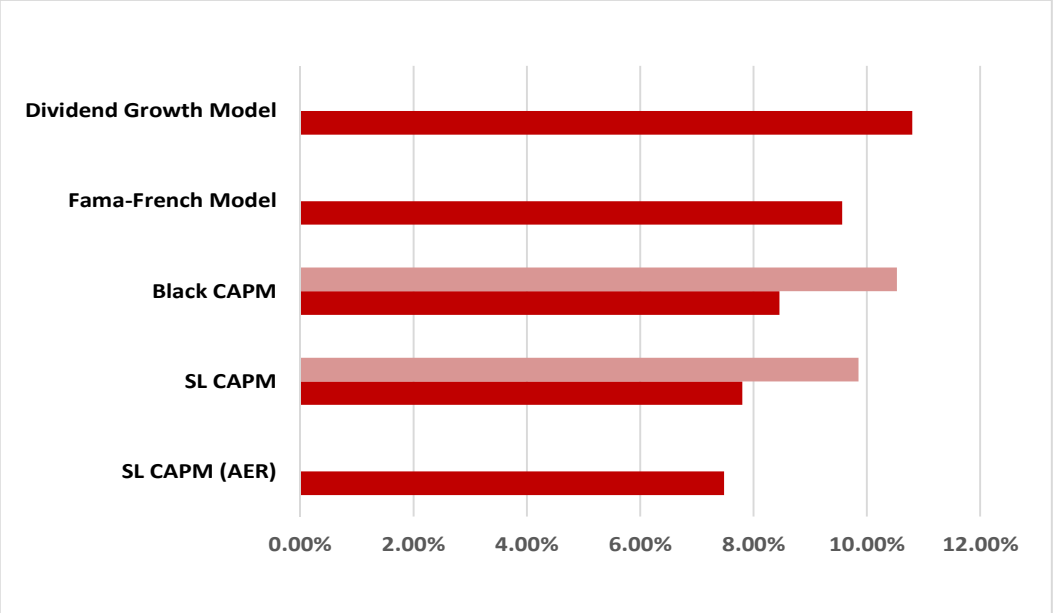
Four financial models have been identified as being relevant to estimating the return on equity of the benchmark efficient entity of Rule 87. These four models – the Sharpe-Lintner CAPM, the Black CAPM, the Dividend Growth Model, and the Fama-French Three Factor Model – deliver estimates of the return on equity which range from 7.48 per cent to 10.8 per cent.

Figure 8.1 shows the return on equity estimates from the four models.

There is no obvious convergence, but the estimates from the four models point to a return on equity exceeding 7.48 per cent. The estimate from the Dividend Growth Model suggests the return on equity may be as high as 10.8 per cent.

The differences between the estimates obtained reflect differences in assumptions underpinning the four models and their respective positions in the evolution of finance theory. They also reflect differences in the data from which model input variables were estimated.

***Figure 8.1 - Return on equity estimates***




The estimates made using the Sharpe-Lintner CAPM and the Dividend Growth Model, the earliest of the models in the evolution of finance theory, are, respectively, the lower and upper limits of the range of estimates.

The Black CAPM and the Fama-French Three Factor Model are more recent. They perform better empirically in equity return estimation than the Sharpe-Lintner CAPM. The Black CAPM indicates a return on equity in the range 8.5 per cent to 10.5 per cent the range being fixed by uncertainty in the estimate of the expected return on the market (9.0 per cent to 11.6 per cent). The Fama-French Three Factor Model indicates an estimate of the return on equity of around 9.6 per cent. This estimate has been made using an estimate of the market risk premium of 6.1 per cent, which is consistent with an estimate of the expected return on the market of 9.0 per cent. A higher estimate of the return on the market should lead to a higher estimate of the return on equity.

APTNT concludes that a reasonable point estimate of the return on equity is unlikely to be at either extremity of the range; it will fall within the range. When applied in the way APTNT proposes, the Sharpe-Lintner CAPM indicates an estimate in the range 7.8 per cent to 9.8 per cent. The Black CAPM and the Fama-French Three Factor Model point to this estimate being around 9.5 per cent. In light of the above considerations, APTNT has used as the single point estimate for the return on equity an estimate of 9.2 per cent, which is a simple average of the midpoint of the range for the Sharpe-Lintner CAPM and the estimate obtained using the Black CAPM and the Fama-French Three Factor Model.

APTNT's point estimate of the return on equity has been made having regard to four financial models which have been identified as being relevant to estimating the return on equity. It has been made using recent data from financial markets: in particular, regard has been had to prevailing conditions in the market for equity funds. The use of this point estimate can be expected to contribute to an allowed rate of return which is commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to APTNT in respect of the provision of the reference service using the AGP.

## 8.4 Estimating the return on debt

The way in which APTNT proposes that the return on debt be estimated for the purpose of determination of the allowed rate of return for the AGP is set out in this section of the submission.

Section 8.4.1 notes the method of return on debt estimation set out in the Rate of Return Guideline. In section 8.4.2 APTNT reports an estimate of the return on debt made using that method – a trailing average approach – and assesses the result. APTNT concludes that the trailing average estimate made in accordance with the Rate of Return Guideline does not satisfy the requirement of Rule 87(8) for an estimate of the return on debt which contributes to achievement of the allowed rate of return objective. An alternative – hybrid – approach is used, in section 8.4.3, to make an estimate of the return on debt which satisfies the requirement of the rule.

### 8.4.1 Rate of Return Guideline: return on debt

Estimation of the return on debt should, the Rate of Return Guideline advises, use a trailing average portfolio approach applied on a forward looking basis with:

- the length of the trailing average being 10 years;
- the same weight applied to each of the 10 terms of the trailing average (equal weighting); and
- annual updating of the trailing average within the access arrangement period.

This forward looking trailing average portfolio approach can be represented by the recursion formula:

$$ {}_{x}kd_{x+1} = \frac{1}{10}\sum_{t=1}^{10} {}_{x-10+t}R_{x+t} $$

where:

- ${}_{x}kd_{x+1}$ is the estimated rate of return on debt in regulatory year $x + 1$; and
- ${}_{x-10+t}R_{x+t}$ is the estimated rate of return on debt that was issued in year $x - 10 + t$ (and matures 10 years later, in year $x + t$).

A service provider first applying Rule 87 after November 2012 is to transition to the full trailing average over a period of 10 years commencing at the beginning of the first year of the next access arrangement period.

In the first year of the transition period, the rate of return on debt is to be estimated as the prevailing rate of return for that year. The Rate of Return Guideline requires, in effect, that the rate of return on debt be estimated using the "on-the-day" approach:

$$ {}_{0}kd_{1} = {}_{0}R_{1}, $$

where ${}_{0}R_{1}$ is the estimate of the rate of return on debt prevailing in year 1 made at time 0.

In the second year of the transition period, the rate of return on debt is to be estimated as:

$$ {}_{1}kd_{2} = 0.1 \times {}_{0}R_{1} + 0.9 \times {}_{1}R_{2} $$

where ${}_{1}R_{2}$ is the estimate of the rate of return on debt prevailing in year 2 made at time 1.

In subsequent years $x$ ($x = 3, 4, \ldots, 9$) during the transition period, the rate of return on debt is to be estimated as:

$$_{x}kd_{x+1} = 0.1 \times {}_{0}R_{1} + 0.2 \times {}_{1}R_{2} + \cdots + (1 - 0.1 \times x) \times {}_{x}R_{x+1}$$

where ${}_{x}R_{x+1}$ is the estimate of the rate of return on debt prevailing in year $x + 1$ made at time $x$.

The Rate of Return Guideline proposes that the rate of return on debt prevailing in year $x + 1$ be estimated at time $x$ as the sum of the risk free rate of return at time $x$ and a debt risk premium. In this estimation of the prevailing return on debt:

- published yields from an independent third party data service provider are to be used;
- a credit rating of BBB+ from Standard and Poor's (or the equivalent from another recognised rating agency) is to be assumed but, if the published yields are not those for issues with BBB+ credit ratings (or the equivalent), then the published yields are to be those which most closely approximate yields on issues with BBB+ credit ratings; and
- published yields for debt with a term to maturity of 10 years are to be used or, if the third party data service provider does not publish yields for maturities of exactly 10 years, the yields are to be extrapolated to a term of 10 years.

### 8.4.2 Estimating the return on debt: trailing average portfolio approach

The trailing average portfolio approach of the Rate of Return Guideline is applied assuming the benchmark efficient entity has a broad BBB credit rating (BBB+, BBB, BBB-), and issues debt with a term to maturity of 10 years.

The estimate of the return on debt can be made from yields on the broad BBB rated issues of Australian non-financial corporations, which have been published by the Reserve Bank of Australia (RBA), and adjusted to reflect the 10 years term to maturity assumption.

Assuming an averaging period of 20 business days ending on 15 June 2015, and applying the method set out in recent AER decisions, the estimate of the return on debt obtained is 5.29 per cent.[108]

Relative to yields on Australian Government securities with the same term to maturity (10 years), the debt risk premium in this estimate is 2.36 per cent.

This return on debt is effectively an “on-the-day” rate of return at or about 15 June 2015.

[108] Appendices A and B to Attachment 3 of the AER’s April 2015 Final Decision in the Directlink transmission revenue determination (2015-16 to 2019-20) set out the method.

It is not an estimate which contributes to achievement of a rate of return which is commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to the service provider in respect of the provision of reference services. Only by chance could an on-the-day rate be a measure of the return on debt for a benchmark efficient entity which finances using debt with a term to maturity of 10 years, and which staggers is refinancing to reduce the risk of not being able to refinance debt when it matures.

Although initial use of an on-the-day rate, with subsequent annual updating, may be parts of a transition to a trailing average estimate of the return on debt, the long period proposed for the transition precludes use of the approach. During the access arrangement period in which the trailing average approach of the Rate of Return Guideline is first implemented, the estimate made of the return on debt is unlikely to be a measure of the return on debt for a benchmark efficient entity which finances using debt with a term to maturity of 10 years, and which staggers is refinancing to reduce refinancing risk. During the access arrangement period in which the trailing average approach is first implemented, the estimate made of the return on debt will not – except by chance – contribute to achievement of the allowed rate of return objective of Rule 87(3).

### 8.4.3 Estimating the return on debt: backwards looking trailing average with hedging of interest rate risk (hybrid approach)

A better estimate of the return on debt – one which more accurately represents the likely financing practice of the benchmark efficient entity, and which is therefore commensurate with the efficient financing costs of that entity – is obtained using a backwards looking trailing average.

However, a simple backwards looking trailing average is unlikely to provide an appropriate estimate. The gas regulatory regime has been in place for over 10 years and, during that time, the AER has used an on-the-day estimate of the return on debt in the setting of reference tariffs. A benchmark efficient entity with the same scale and scope of operations as the service provider could be expected to have managed its interest rate risk during that time by hedging at least the base interest rate embedded in the allowed return on debt.

A backwards looking trailing average estimate of the return on debt can be made assuming a benchmark term to maturity of debt of 10 years and refinancing of one tenth of the debt portfolio each year. If the benchmark efficient entity were to fully hedge the base interest rate embedded in its return on debt it would:

- enter into a 10 years floating for fixed swap contract (pays floating, receives fixed) each time debt is refinanced; and
- enter into a 5 years fixed for floating swap contract (pays fixed, receives floating), for the entire debt portfolio, at the commencement of each regulatory period.

If these assumptions are made, the estimated return on debt is the sum of:

- the on-the-day 5 years swap rate; and
- a backwards looking trailing average of debt risk premiums (relative to the 10 years swap rate) for the current year and the preceding nine years.

*Debt risk premium*

Estimating the return on debt using a backwards looking trailing average requires a series of historical debt risk premiums. This series might be the monthly series of the credit spreads of Australian non-financial corporations which the RBA began publishing in December 2013 (and which extends back to January 2005), or it might be a similar series obtained from the Bloomberg service.

Although the AER has proposed use of an average of the two debt risk premium data series when estimating the return on debt, no clear rationale has been provided for combining them. The two series are different, even though they appear to have been derived from the same underlying set of issued bonds.

The RBA has published a comprehensive description of the methods it uses to compile its series of corporate bond spreads and yields, and others have been able to reproduce the results obtained by applying that method.[109]

The Bloomberg data are provided as part of a commercial financial information service, and the methods which underlie their compilation are not clear to users, and especially to those who might use the data for regulatory purposes.

The samples of bond issues which the RBA uses to estimate corporate bond spreads and yields are restricted to fixed rate bonds issued by Australian non-financial corporations raising at least A$100 million, or the equivalent in United States Dollars or Euros. The samples include issues with embedded options at longer maturities (bullet bonds, callable bonds, convertible and puttable bonds). Bond price data are sourced from the Bloomberg BVAL service, and may be supplemented with Bloomberg generic price data or prices from UBS. Credit spreads on foreign currency issues are hedged into Australian dollar equivalent spreads (foreign currency risk is completely hedged). The spreads are measured relative to swap rates, and to rates on Commonwealth Government bonds.

The RBA corporate bond spreads and yields are available for Australian non-financial corporations with BBB credit ratings. They are available for corporations with the broad BBB credit rating assumed for the benchmark efficient entity.

[109] Ivailo Arsov, Matthew Brooks and Mitch Kosev, "New Measures of Australian Corporate Credit Spreads", Reserve Bank of Australia Bulletin, December Quarter 2013, pp 15-16. APTNT understands that CEG (Competition Economists Group) has replicated the RBA credit spreads in work undertaken for service providers.

The RBA data are available for bond issues by Australian non-financial corporations with term to maturity of 10 years. They are available for corporations with the term to maturity of debt assumed for the benchmark efficient entity, although some extrapolation is usually required to obtain yield estimates for a term of exactly 10 years.

At the time of the first issue of its corporate bond spreads and yields series, the RBA advised:

> The paucity of Australian dollar-denominated issuance by NFCs, particularly at longer tenors, makes it impractical to estimate credit curves across a range of tenors solely from domestically issued bonds. Therefore, the sample includes bonds denominated both in Australian dollars and foreign currencies.[110]

The RBA data series are, then, for a sample which includes non-financial corporations which issue debt in offshore markets. The benchmark efficient entity is an entity which would not limit its debt raising to the domestic financial market, and the RBA's compilation of its data series takes into account the issue of debt in offshore markets.[111]

The RBA advises that its use of a Gaussian kernel to assigns a weight to every observation in the cross section depending on the distance of the observation's residual maturity from the target tenor according to a Gaussian (normal) distribution centred at the target tenor provides a robust method for estimation, capable of producing estimates even when the number of observations is relatively small.[112] Furthermore, the corporate credits spreads obtained are similar to the corresponding measures produced by the Bloomberg service prior to late 2008. After 2008, the RBA advises, its credit spreads diverge from the Bloomberg measures, particularly during the period 2009 to 2011 when the Bloomberg measures appear "counterintuitive".[113]

The RBA corporate bond spreads and yields series has significant advantages over the alternative:

- the method of construction is more transparent;
- the sample is larger due to the inclusion of bonds issued in foreign currencies; and

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[110] Ibid., p 17

[111] The AER noted in the explanatory statement accompanying its Rate of return Guideline:

> We observe that businesses are securing bank debt with an average term at issuance of 4.3 years, issuing Australian bonds with an average term of 9.7 years and offshore bonds of 9.7 years. We understand that the current domestic bond market is not liquid in Australia beyond an issuance of seven years. However, businesses appear to be issuing offshore to cover any lack of liquidity in the domestic market.

Australian Energy Regulator, *Explanatory Statement: Rate of Return Guideline*, December 2013, p 136

[112] Arsov, Brooks and Kosev, p 20

[113] Ibid., p 24

- the method is relatively robust, allowing for the estimation of spreads at longer maturities.[114]

APTNT has, therefore, used the RBA series in estimating the return on debt for the AGP.

*Estimating the return on debt as a backwards looking trailing average*

The average of the AFMA Interest Rate Swaps mid-rate for a term of 5 years over the period of 20 trading days to 15 June 2015 is 2.49 per cent. Using the RBA corporate bond spreads and yields series for BBB rated bonds, the average spread to swap for the months of May in the period 2006 to 2015, extrapolated to a term to maturity of 10 years, is 2.52 per cent. The estimate of the return on debt made as a backward looking trailing average with the embedded swap rate fully hedged is, then, 5.01 per cent (= 2.52 per cent + 2.49 per cent).

The benchmark efficient entity is, however, unlikely to have fully hedged the base rate embedded in its cost of debt. Debt risk premiums – credit spreads – on corporate debt have been inversely related to the base rate (measured as either the yield on Australian Government bonds with the same term to maturity, or as the corresponding swap rate) for at least three decades. In these circumstances, a part of any increase in the base rate will be "naturally hedged" by a corresponding reduction in the debt risk premium.

In view of the natural hedge afforded by the long term inverse relationship between the base rate and the debt risk premium, a service provider concerned with minimising its interest rate risk would not hedge all of its interest rate exposure.

CEG has examined the relevant data, and has determined that hedging of around one third of the base rate exposure arising from the setting, by the regulator, of on-the-day returns on debt during the last decade would minimise the interest rate risk of the benchmark efficient entity.[115]

A backwards looking trailing average of the return on debt, made using the yields on debt for the months of May from 2006 to 2015 reported in the RBA series for BBB rated issues with term of 10 years, and without allowance for hedging of the base rate, is 7.60 per cent.

The fully hedged return on debt estimate is, as above, 5.01 per cent.

If, as CEG advises, interest rate risk minimisation requires that only one third of the debt portfolio be hedged, the estimated return on debt is 6.74 per cent (= 0.33 x 5.01 per cent + 0.67 x 7.60 per cent).

[114] Ibid.
[115] CEG (Competition Economists Group), *Efficient use of interest rate swaps to manage interest rate risk*. June 2015, p 4

This is the estimated return on debt of the benchmark efficient entity.

In estimating the return on debt for the AGP, APTNT has departed from the Rate of Return Guideline by using a backward looking trailing average approach with partial hedging of interest rate risk.

APTNT notes that the AER has raised a number of concerns about the use of a backwards looking trailing average for estimating the return on debt.

Although its use would be reflective of past regulatory practice, implementation of a backwards looking approach would, the AER has noted, require high quality data on the debt risk premium, and these are not readily available.[116] This was the case when the Rate of Return Guideline was made and published (December 2013). It is no longer the case. Since December 2013 the RBA has published monthly credit spreads and yields for Australian non-financial corporations. The RBA series extends back to January 2005, and there is now some 10 years of credit spread and yield history available from an independent, knowledgeable and highly reputable source which can be used to make estimates of the return on debt.

The AER has also indicated that transitioning from the on-the-day approach with hedging can create a mismatch between the allowed return on debt and the efficient financing costs of a benchmark efficient entity over the life of its assets. This may, the AER contends, create windfall gains or losses to service providers or consumers, which should be avoided, so that economic regulatory decisions deliver outcomes based on efficiency considerations, rather than timing or chance. This is not correct. The AER has previously expected that, under an on-the-day approach, service providers would hedge at least the base rate component of the cost of debt. This may create gains or losses, but service provider hedging should now be factored into the way in which the return on debt is estimated. To do so properly represents the behaviour of benchmark efficient entity. To do otherwise would be arbitrary. To the extent that there are gains or losses, they are a consequence of the November 2012 changes to Rule 87 and cannot be assumed away by a purported concern for “efficiency”.

In adopting a backward looking trailing average approach, APTNT has assumed that a service provider seeking to minimise its interest rate risk would hedge the base rate component of the return on debt (but would be unable to hedge the debt risk premium). Again, APTNT has departed from the Rate of Return Guideline, but in a way that is partially consistent with the AER’s view of past regulatory practice. The AER has previously assumed that the base rate component of the return on debt would be fully hedged. APTNT assumes that the benchmark efficient entity’s interest rate risk exposure is minimised by partial hedging of the base rate.

[116] The AER has reiterated this view in its recent regulatory decisions (for example, in *Final Decision Directlink Transmission determination 2015-16 to 2019-20*, Attachment 3- rate of return, April 2014, p 66)

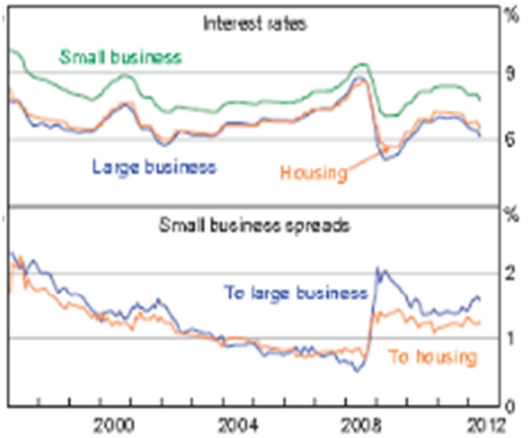
*Adjusting for size*

Both the trailing average return on debt estimation of the Rate of Return Guideline, and estimation as a backward looking trailing average as described by APTNT in the preceding paragraphs, assume that the benchmark efficient entity of Rule 87 is able to directly access financial markets through bond issues. This may be the case for an efficient service provider which has a large investment in the physical assets required for reference service provision, and which refinances its debt in tranches of around $100 million. However, it is not the case for the benchmark efficient entity with a similar degree of risk as that which applies to APTNT in respect of the provision of the reference service using the AGP.

APTNT's proposed opening capital base for the AGP (1 July 2016) is $120.6 million. With gearing of 0.6, the total debt requirement is $72.4 million. If this debt were refinanced annually, on a 10 year cycle, to reduce refinancing risk, the annual requirement would be less than $7.2 million. Even if the debt were refinanced less frequently, the financing requirement would still be relatively small. The benchmark efficient entity is, in these circumstances, not a large business; it is a small to medium sized enterprise. Unlike large corporations, it would be unable to directly access financial markets through bond issues, and would need to obtain its debt from financial intermediaries, principally the commercial banks.[117]

Size, and the need to access financial markets through intermediaries (rather than as the primary borrower), adds to the cost of debt. This is clearly shown in the graphs in Figure 8.2 and Figure 8.3.

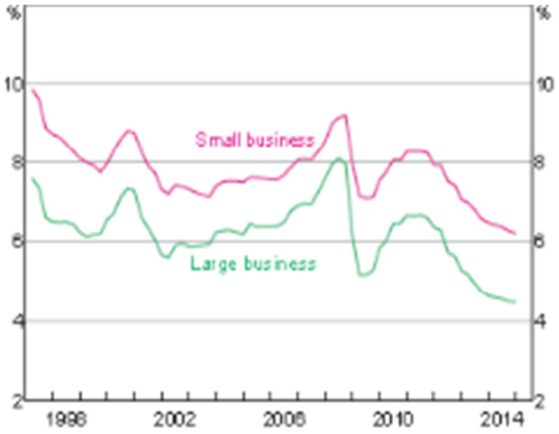
***Figure 8.2 - Business lending rates and spreads***




Source: Mihovil Matic, Adam Gorajek and Chris Stewart, "Small Business Funding in Australia", Reserve Bank of Australia, Small Business Finance Roundtable, May 2012, p 17

[117] Commonwealth of Australia, Financial System Inquiry Final Report, November 2014, p 15. Also, Mihovil Matic, Adam Gorajek and Chris Stewart, "Small Business Funding in Australia", Reserve Bank of Australia, Small Business Finance Roundtable, May 2012, p 16

***Figure 8.3 - Business lending rates***




Source: Reserve Bank of Australia, *Statement on Monetary Policy*, May 2015, p 54

The borrowing costs of small and medium sized enterprises are some 1.0 per cent to 2.0 per cent higher than the borrowing costs of large businesses.

The estimate of the return on debt which APTNT has made – 6.74 per cent – is an average of estimates of the returns which debt investors were likely to have required from a large business with a credit rating in the BBB range if it had raised debt over a historical period (10 years) prior to commencement of the access arrangement period and had partially hedged its interest rate exposures. The debt financing costs of a smaller entity – an entity of the same scale as the benchmark efficient provider of the AGP reference service – will be higher. APTNT has therefore estimated that those costs will be 1.0 per cent higher, and has estimated the return on debt to be 7.7 per cent.

By making an estimate of the return on debt in this way, APTNT has had regard to the financing practice a benchmark efficient entity would be expected to adopt. The estimate of the return on debt can, then, be expected to contribute to an allowed rate of return which is commensurate with the efficient financing costs of a benchmark efficient entity with a similar degree of risk as that which applies to APTNT in respect of the provision of the reference service using the AGP.

## 8.5 Proposed allowed rate of return

APTNT's estimates of the return on equity and the return on debt are, respectively, 9.2 per cent and 7.7 per cent. Use of each of these estimates in determining the allowed rate of return for the AGP contributes to achievement of the allowed rate of return objective for the reasons set out above.

APTNT has calculated a nominal vanilla weighted average of its estimates of the return on equity and the return on debt, with the estimates weighted using the gearing of the benchmark efficient entity. That weighted average, 8.3 per cent, is a rate of return commensurate with the efficient financing costs of a benchmark efficient entity with a

similar degree of risk as that which applies to the APTNT in respect of its provision of the reference service using the AGP.

APTNT therefore proposes an allowed rate of return of 8.3 per cent for the AGP.

## 8.6 Implementation issues

Two issues which arise in the implementation of the allowed rate of return are addressed in this section of the submission. They are:

- annual updating of the return on debt;
- the averaging period to be used when updating the return on debt estimate.

### 8.6.1 Annual updating

Rule 87(9)(b) permits the return on debt to be estimated using a method which results in that return, and the allowed rate of return, being different for different regulatory years in the access arrangement period.

APTNT intends that the estimate of the return on debt be updated annually throughout the access arrangement period.

If the return on debt is updated annually, then the total revenue is to be changed through the automatic application of a formula that is specified in the decision on the proposed revisions to the AGP Access Arrangement.[118]

The annual updating of the return on debt will effect a variation of the reference tariff for the AGP in each year of the access arrangement period. A full access arrangement must include a mechanism for variation of the reference tariff over the course of the access arrangement period, and APTNT has incorporated the variation of the reference tariff effected by annual updating of the return on debt into the reference tariff variation mechanism of the AGP Access Arrangement.

### 8.6.2 Averaging period

If the return on debt is updated annually, data must be collected and an estimate made close to the start of each regulatory year of the access arrangement period.

APTNT proposes an averaging period of 20 trading days for the AGP. APTNT has set out averaging periods for the period 2015-16 to 2019-20 in confidential Attachment E.

[118] Rule 87(12).

## 8.7 Value of imputation credits

APTNT's approach to estimating the value to be attributed to imputation credits – the fraction γ – is set out in the following subsections of this section of the submission.

Section 8.7.1 notes the approach to estimating γ proposed in the Rate of Return Guideline. An estimate made by applying that approach may not be, for the reasons set out in section 8.7.2, the best possible estimate. APTNT's estimate of γ is discussed in section 8.7.3. That estimate, 0.25, is an estimate arrived at on a reasonable basis, and represents the best estimate possible in the circumstances

### 8.7.1 Imputation credits in the Rate of Return Guideline

The Rate of Return Guideline advises:

- the value of imputation credits, the fraction γ (gamma), is to be estimated as a market wide parameter, and determined as the product of two components:
  - the distribution rate; and
  - the value of distributed credits;
- the distribution rate should be estimated using the cumulative payout ratio approach: statistics from the Australian Taxation Office should be used to calculate the proportion of imputation credits generated (via tax payments) that have been distributed by companies since the start of the imputation system; this leads to an estimate of 0.7 for the distribution rate;
- a body of relevant evidence should be used in estimating the value of distributed imputation credits; this evidence includes:
  - equity ownership statistics;
  - tax statistics;
  - implied market value studies; and
  - conceptual goalposts;
- regard is to be had to those approaches that:
  - accord with the interpretation of the value of distributed imputation credits parameter in the conceptual framework provided by Officer and Monkhouse;
  - are simpler and more transparent; and
  - produce reasonable estimates in light of empirical realities and conceptual considerations, namely, that most (but not all) investors are eligible to redeem imputation credits, and that eligible investors in possession of imputation credits have the incentive to redeem them.

The Rate of Return Guideline advises that this approach leads to an estimate of 0.7 for the value of distributed imputation credits, based on:

- greater weight being given to equity ownership statistics, which suggest an estimate of 0.7 to 0.8;
- weight being given to tax statistics, which suggest an estimate of 0.4 to 0.8;
- less weight being given to implied market value studies, which suggest an estimate of 0 to 0.5; and
- less weight being given to conceptual goalposts, which suggest an estimate of 0.8 to 1.0.

With an estimate of the distribution rate of 0.7, and an estimate of the value of distributed imputation credits of 0.7, this approach leads to an estimate for the value of imputation credits, the product of the distribution rate and the value of distributed imputation credits, of 0.5.

For the reasons set out in section 8.7.2 below, this estimate of γ cannot be regarded as an estimate arrived at on a reasonable basis, and does not represent the best estimate possible.[119] An alternative estimate, one which has been arrived at on a reasonable basis, and which, represents the best estimate possible in the circumstances, is discussed in section 8.7.3.

### 8.7.2 Estimate obtained in this way not the best estimate

Irrespective of whether it is estimated using multiple models (as above) or the foundation model of the Rate of Return Guideline, the estimate of the return on equity used in determining the total revenue is an estimate of a rate of return set within a market in which at least some investors can use imputation credits to reduce their personal tax liabilities.

In the scheme of the NGR, though, the return on equity itself is not to be adjusted to take into account the value of imputation credits to those investors. Instead, a gross return on equity is used to determine the return component of total revenue, and a deduction is made for the value of those credits. This deduction effectively reduces, in the context of establishing total revenue, the after corporate tax return which can be delivered to equity investors.

[119] It may, however, be within the range of values indicated by the evidence. See the expert report from Professor Stephen Gray: Frontier Economics, *An appropriate regulatory estimate of gamma: Report prepared for ActewAGL Distribution, AGN, APA, Ausnet Serivces, Citipower, Ergon, Energex, Jemena Electricity Networks, Powercor, SA Power Networks and United Energy*, June 2015, section 7.3

In subsequent references, this report, by Professor Gray, is referred to as: Gray, *An appropriate regulatory estimate of gamma*.

If a deduction is to be made in calculating total revenue so that, after receiving any imputation credits to which they might be entitled, equity investors are delivered the market rate of return on their investments, then a value must be attributed to those credits consistent with valuation processes in the equity market.

If the estimate of the value of imputation credits is not the best estimate possible – in particular, if the estimate is too high – then, other things being equal, the total revenue will not be sufficient to provide the return on equity component of the allowed rate of return of Rule 87. The service provider would not then be given a reasonable opportunity to recover at least the efficient costs it incurs in providing the reference services, and would be deprived of an important incentive for promotion of economic efficiency with respect to reference service provision. The reference tariff, and the outcome of charging that tariff, would not contribute to the promotion of investment in the pipeline, or to its efficient operation and use, for the long term interests of consumers of natural gas, as required by the national gas objective of section 23 of the NGL.

In accordance with the Officer and Monkhouse conceptual framework, γ is, as the Rate of Return Guideline notes, the product of:

- the distribution rate; and
- the value of distributed credits.

The distribution rate is the ratio of the face value of imputation credits distributed in a given period to the face value of imputation credits generated in that period. It is a measure of the relative volume of the credits available to equity investors.

If the deduction to be made for the value of imputation credits in the calculation of total revenue is to be such that equity investors have the prospect of receiving the market return on their investments, the value of distributed credits must be the market value of those credits relative to their face value.[120]

This interpretation of the "value of distributed credits" as the market value of those credits was the interpretation endorsed by the Australian Competition Tribunal in *Energex Limited (No. 5)*.[121]

The phrase "value of distributed credits" can be interpreted in another way: it can be interpreted as the proportion of distributed credits redeemed by equity investors. This proportion of credits redeemed is not a measure of the market value of distributed credits, although it may be a loose upper bound on that market value.[122] A very approximate value for γ could be obtained using the proportion of distributed credits redeemed as an upper limit on the market value of distributed credits.

[120] This is explained further Gray, *An appropriate regulatory estimate of gamma*, chapter 2
[121] Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9
[122] Gray, *An appropriate regulatory estimate of gamma*, section 2.10

The approach proposed in the Rate of Return Guideline requires that greater weight be given to equity ownership statistics in the estimation of the value of imputation credits, and that weight be given to tax statistics. Less weight is to be given to implied market value studies and to conceptual goal posts.

Equity ownership and tax statistics provide estimates of the proportion of distributed imputation credits redeemed by equity investors. The process of estimation using these statistics may be simple and transparent, but the result obtained is not in accord with the interpretation of the value of distributed credits in the conceptual framework of Officer and Monkhouse. The framework of Officer and Monkhouse requires a market value of distributed credits.[123] Furthermore, that process of estimation does not produce reasonable estimates in light of empirical realities and conceptual considerations. It produces estimates which are conceptually inappropriate for the purpose of estimating the value γ for the application of Rule 87A. They are at best loose upper bounds which should not be considered reasonable when properly made estimates of the market value of distributed imputation credits are available.

Similar issues would arise if conceptual goal posts were used to estimate the value of distributed imputation credits. Such "goal posts" might indicate broad bounds on the market value of distributed credits but would not themselves be estimates of that market value.[124]

The approach of the Rate of Return Guideline is to give less weight to market value studies when estimating the value of distributed imputation credits for the purpose of obtaining a value for γ. As was recognised by the Australian Competition Tribunal in *Energex Limited (No. 2)*, there are a number of conceptual and empirical issues associated with the dividend drop-off studies which have been used to make estimates of the market value of distributed credits. These could, however, be at least partially overcome with a newly-commissioned study that was "state of the art".[125]

The Competition Tribunal therefore directed the AER to commission Professor Stephen Gray, a principal of Strategic Finance Group (SFG Consulting), to undertake work which would provide the best possible estimates of the market value of distributed credits and gamma from a dividend drop-off study. Subsequently, in *Energex Limited (No. 5)*, the Tribunal advised that it was satisfied that SFG's March 2011 report was the best dividend drop-off study currently available for the purpose of estimating γ for the purposes of the NGR. Its estimate of a value of 0.35 for the value of distributed credits should, the Tribunal concluded, be accepted as the best estimate using this approach.[126]

The situation has not changed since 2011. SFG principal, Professor Stephen Gray, has updated the dividend drop-off study but reports (in his new role with Frontier Economics)

[123] Ibid., section 2.9
[124] Ibid., section 2.7
[125] Application by Energex Limited (No. 2) [2010] ACompT 7, paragraph 146
[126] Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9, paragraph 29

that he remains of the view that 0.35 is a conservative estimate of the market value of distributed imputation credits.[127]

Whether 0.35 is, or is not, a conservative estimate does not concern APTNT at this point (it is an issue considered later, in section 8.7.3). What is important is that there is a recognised and accepted method which can be, and has been, used to estimate the market value of distributed imputation credits. A properly made estimate of the market value of those credits can be, and has been, made for the purpose of estimating γ for calculation of the deduction from the cost of income tax when determining total revenue. In these circumstances, the procedure for estimating γ set out in the Rate of Return Guideline cannot lead to an estimate arrived at on a reasonable basis and which represents the best estimate possible in the circumstances. That procedure gives substantial weight to methods which can do no more than yield a rough approximation for γ using an incorrect construct – the proportion of credits redeemed – rather than the conceptually correct market value of those credits (being the concept required within the Officer and Monkhouse framework).

In the next section of this submission, APTNT sets out an alternative approach to estimating γ. This approach is one which leads to an estimate which has been arrived at on a reasonable basis, and which represents the best estimate possible in the circumstances.

### 8.7.3 APTNT's estimate of the value to be attributed to imputation credits

APTNT has estimated the value to be attributed to imputation credits – the fraction $\gamma$ – as the product of:

- the distribution rate; and
- the value of distributed credits.

This is the approach of the Rate of Return Guideline.

The distribution rate is a company-specific parameter because it depends on dividend payout policies which vary across companies according to their characteristics and circumstances. The value of distributed credits is a market-wide parameter because the value of a credit in the hands of an equity investor is independent of its source. This has the implication that the data source used when estimating the distribution rate need not be the same as the data source used when estimating the value of distributed credits.[128]

[127] Gray, *An appropriate regulatory estimate of gamma*, section 5.1
[128] Ibid., chapter 6

*Estimating the distribution rate*

APTNT has adopted an estimate of 0.70 for the distribution rate. This is the estimate proposed in the Rate of Return Guideline.

APTNT concurs with the view in the Rate of Return Guideline that an estimate of 0.70, made using statistics published by the Australian Taxation Office, is an estimate arrived at on a reasonable basis, and represents the best estimate possible in the circumstances.

APTNT notes that, since publication of the Rate of Return Guideline, the AER has made reference in its decisions to the views of:

- Associate Professor John Handley, that the estimate of the distribution rate should be made using only the credits generated and distributed by listed entities, resulting in a higher estimate of the distribution rate of 0.8; and
- Associate Professor Martin Lally, who considers that the best estimate of the distribution rate is 0.84, calculated using data for the 20 largest ASX-listed companies.

Each of these relatively high estimates for the distribution rate is an extreme, and cannot be taken as indicative of the position of the benchmark efficient entity of Rule 87 and Rule 87A. Neither estimate displaces the estimate of 0.70 for all companies, public and private, made from taxation statistics.[129]

*Estimating the value of distributed credits*

APTNT has used an estimate of 0.35 for the value of distributed credits.

This is the estimate of the market value of distributed imputation credits made by SFG in 2011, using a dividend drop-off study, which was accepted by the Australian Competition Tribunal in *Energex Limited (No.5)*.

In June 2015, Professor Gray, author of the SFG's 2011 report, advised that 0.35 continues to be a conservative estimate of the market value of distributed imputation credits.[130]

Professor Gray made clear, in his June 2015 advice, that estimates made before 2000, or made before the SFG 2011 study, do not support broadening the range of estimates for the market value distributed imputation credits.[131] Tax law changes, in 2000, pertaining to the refund of imputation credits, have meant that earlier estimates of the market value of the credits now have limited relevance. Earlier studies which provided estimates of the market value of imputation credits had a number of recognised

[129] Ibid., chapter 3
[130] Ibid., section 5.1
[131] Ibid., section 5.2

limitations. The design of the SFG study in 2011 addressed these limitations so that its estimate of market value (and estimates from subsequent updating of the 2011 study) displaced the estimates from earlier studies.

APTNT notes that, since 2011, the Western Australian Economic Regulation Authority (ERA) has undertaken its own dividend-drop off studies for the purpose of estimating the market value of distributed imputation credits.[132] ERA analysts, Vo, Gellard and Mero, report a range, 0.29 to 0.44, indicative of the market value of distributed credits being higher than estimated by Professor Gray. However, Vo, Gellard and Mero do not apply a "market return correction" to the data when estimating the dividend drop-off models from which they obtain their reported range. When Vo, Gellard and Mero apply the market return correction to their data, their estimate for the market value of distributed imputation credits is very similar to that of Professor Gray.

The making of the market return correction removes a non-random effect, an effect which cannot be properly accounted for by the error terms of a regression model, and thereby leads to a better defined (lower variance) estimate of the market value of distributed credits. Not to make the correction is unusual, and leads the ERA to an estimate which is not the best estimate possible in the circumstances.

Use of the market return correction is not the only empirical issue which arises when using dividend drop-off studies to estimate the market value of distributed imputation credits. A number of other issues have been raised – and responded to – in the past, but continue to be raised, in the debate on the estimation of γ for the application of Rule 87A. These issues, and the responses to each of them, are summarised in Professor Gray's June 2015 advice.[133] The issues which have been raised do not provide a basis for either:

- use of a conceptually unsound estimate of the value of distributed credits made as the proportion of credits redeemed; or
- rejecting the conceptually correct estimates of market value of the credits obtained from dividend drop-off studies.

APTNT contends that its estimate of the value of distributed credits, 0.35, is an estimate arrived at on a reasonable basis, and represents the best estimate possible in the circumstances. Its use is, however, a departure from the approach proposed in the Rate of Return Guideline.

[132] Duc Vo, Beauden Gellard, Stefan Mero (2013), "Estimating the Market Value of Franking Credits: Empirical Evidence from Australia", paper presented at 42nd Australian Conference of Economists, available at http://www.murdoch.edu.au/School-of-Management-and-Governance/Australian-Conference-of- Economists/.

[133] Gray, *An appropriate regulatory estimate of gamma*, sections 5.3 and 5.4

*APTNT's estimate of the value to be attributed to imputation credits*

The estimate of γ, the value to be attributed to imputation credits, which APTNT has used when estimating the cost of corporate income tax for the AGP in accordance with the requirements of Rule 87A is, therefore, 0.25 (= 0.70 x 0.35).

This estimate is made from estimates of the distribution rate (0.70) and the value of distributed imputation credits (0.35). Those estimates for the distribution rate and the value of distributed credits were arrived at on a reasonable basis, and represent the best estimates possible in the circumstances. Using their product to estimate γ is standard practice.[134] It is also in accordance with the Officer and Monkhouse framework for taking into account any value which might be attributed to imputation credits in the context of firm or project valuation.

The estimate of γ obtained, 0.25, is, then, itself an estimate arrived at on a reasonable basis, and represents the best estimate possible in the circumstances. The use of this estimate, which incorporates a market value of imputation credits, when calculating an estimate of the cost of corporate income tax in accordance with Rule 87A for the total revenue calculation, should provide APTNT with a reasonable opportunity to recover the efficient costs – including the efficient cost of equity financing – incurred in providing the reference service using the AGP. The reference tariff determined from that total revenue should contribute to the promotion of efficient investment in the pipeline, and to its efficient operation and use, for the long term interests of consumers of natural gas, as required by the National Gas Objective.

[134] Ibid., paragraph 151

# 9 Operating expenditure

This chapter sets out operating expenditure undertaken in the earlier access arrangement period and forecast operating expenditure for the access arrangement period, and provides explanations for actual and forecast operating expenditure by reference to the Rules.

## 9.1 Operating expenditure categories

As defined under Rule 69, operating expenditure for the purposes of price and revenue regulation under the Rules means:

> … operating, maintenance and other costs and expenditure of a non-capital nature incurred in providing pipeline services and includes expenditure incurred in increasing long-term demand for pipeline services and otherwise developing the market for pipeline services.

For the purposes of the access arrangement revision proposal APTNT classifies its operating expenditure in the following categories:

- *Operations and Maintenance*, which is direct expenditure associated with operating and maintaining the pipeline, pipeline right of way, pipeline facilities, compressor station, SCADA and communications systems and regulation, metering and gas measurement equipment. Other activities in this category include pipeline integrity management, pipeline facility upgrading and training for emergency response;
- *Overheads*, which includes expenditure relating to insurances, regulatory activities, compliance, support costs for personnel and training, legal, accounting, taxation, government levies, fees and charges and central head office costs; and
- *Sales and Marketing*, which includes expenditure relating to advertising and promotion of gas transportation services, investigation and feasibility studies for potential gas consuming projects, and commercial negotiations relating to gas transportation services.

These categories are identical to those used in the earlier access arrangement period to ensure consistency when comparing actual expenditure against the forecasts used to derive tariffs in the earlier access arrangement period, and comparing past and future expenditure in this proposal.

APTNT does not use these classifications in its actual accounting and therefore some judgement has been applied in categorising historic and forecast expenditure into these classifications.

## 9.2 Operating expenditure over the earlier access arrangement period

The operating expenditure allowed by the AER in the earlier access arrangement period is shown in Table 9.1 below. The AER's Final Decision accepted APTNT revised forecast for operating expenditure set out in the response to the AER's Draft Decision.[135]

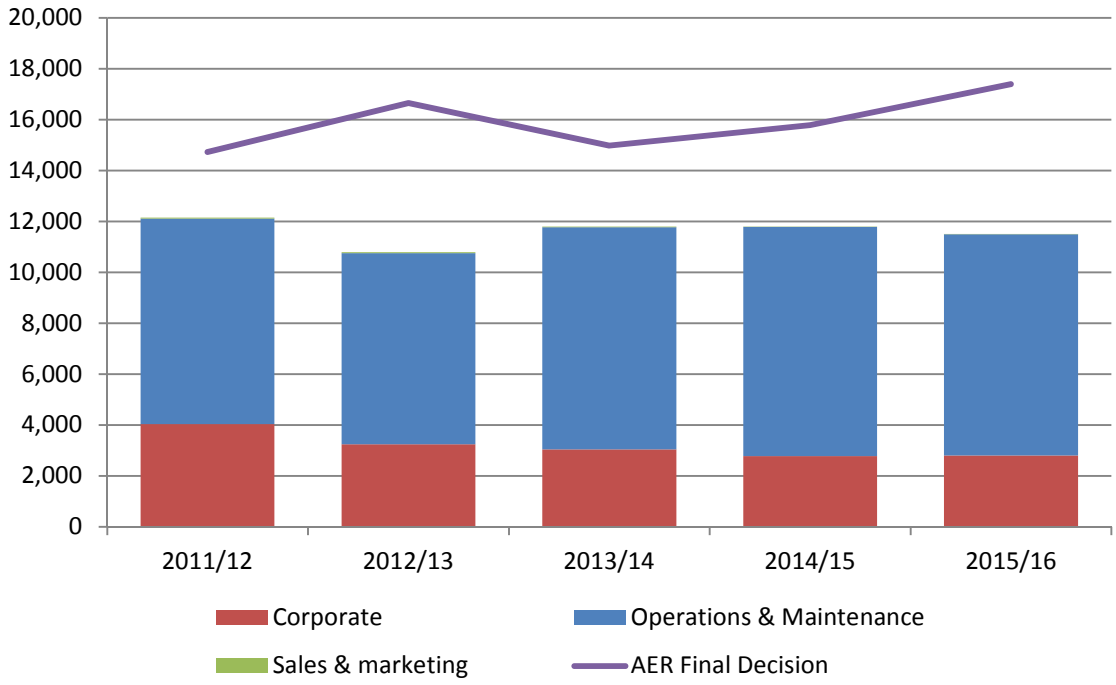
Table 9.1 also sets out actual and forecast operating expenditure incurred over the earlier access arrangement period, and compares incurred expenditure to that approved by the AER in its Final Decision in constant terms ($2015/16). This is shown graphically in Figure 9.1 below.

***Table 9.1 - Comparison of AER Final Decision and actual and estimated operating expenditure over the earlier access arrangement period ($2015/16)***

| $'000 | 2011/12 | 2012/13 | 2013/14 | 2014/15 | 2015/16E | Total |
|---|---|---|---|---|---|---|
| **AER Final Decision** | | | | | | |
| Operations & Maintenance | 9,791 | 11,648 | 9,935 | 9,976 | 12,281 | **53,630** |
| Overheads | 4,860 | 4,930 | 4,968 | 5,738 | 5,045 | **25,540** |
| Sales & Marketing | 69 | 69 | 69 | 69 | 69 | **345** |
| **Total Forecast** | **14,719** | **16,646** | **14,971** | **15,783** | **17,395** | **79,515** |
| **Actual operating expenditure** | | | | | | |
| Operations & Maintenance | 8,073 | 7,514 | 8,729 | 8,998 | 8,691 | **42,005** |
| Overheads | 4,031 | 3,238 | 3,035 | 2,778 | 2,797 | **15,879** |
| Sales & Marketing | 44 | 37 | 25 | 9 | 9 | **124** |
| **Total Actual** | **12,148** | **10,789** | **11,789** | **11,786** | **11,497** | **58,009** |
| **Variance between approved forecast and actual** | | | | | | |
| Operations & Maintenance | -1,718 | -4,133 | -1,206 | -978 | -3,590 | **-11,625** |
| Overheads | -828 | -1,692 | -1,933 | -2,959 | -2,248 | **-9,661** |
| Sales & Marketing | -25 | -32 | -44 | -60 | -60 | **-220** |
| **Total Variance** | **-2,571** | **-5,858** | **-3,183** | **-3,997** | **-5,898** | **-21,506** |

[135] AER 2011, *Final Decision*, p 103

***Figure 9.1 – Total operating expenditure comparison to forecast over the earlier access arrangement period ($'000 2015/16)***




APTNT's total operating expenditure over the earlier access arrangement period is expected to be $58.0 million. This is below the amount approved by the AER for the earlier access arrangement period. The drivers for these reductions are discussed in the following sections.

### 9.2.1 Operations and maintenance

Operation and Maintenance expenditure over the earlier access arrangement period was below forecast, as shown in Table 9.1. The main drivers for the lower than expected operations and maintenance expenditure were:

- Lower operations and maintenance labour costs associated with integration of the AGP into the APA Group ownership structure. These savings exceeded expectations at the time of the earlier submission;
- Increased efficiencies derived from business wide improvement initiatives such as consolidation of engineering and financial resources;
- Difficulties in finding suitably qualified staff in the tight NT labour market, meaning that some positions remained vacant for long periods and there is high turnover of staff in some positions;
- Unforeseen delays in undertaking pipeline pigging operations with the scheduled 2012/13 pigging activities undertaken largely across 2013/14 and 2014/15; and
- Deferral of forecast 2015/16 pigging activities to 2016/17.

With the exception of the deferred 2016/17 pigging costs (which occur after the forecast base year), these lower Operations and Maintenance costs flow through to the forecast period through a lower base year expenditure on which the forecast is derived.

### 9.2.2 Overheads

Overheads expenditure over the earlier access arrangement period was below forecast expenditure, as shown in Table 9.1. The main drivers for the lower than expected corporate expenditure were:

- Cost savings on local corporate costs that exceeded anticipated savings forecast in the APTNT revised proposal;
- Reduced allocation of head office corporate costs due to increased efficiencies derived from business wide improvement initiatives (such as Group IT projects), and economies of scale achieved across the national business; and
- Lower insurance costs, reflecting a general weakening of the insurance market since the last access arrangement decision.

These lower Overheads costs flow through to the forecast period through a lower base year expenditure on which the forecast is derived.

### 9.2.3 Sales and marketing

Sales and Marketing expenditure over the earlier access arrangement period was below forecast expenditure, as shown in Table 9.1.

The main cause for this lower expenditure is a general reduction in mining activity associated with lower international resource prices. These lower Sales and Marketing costs flow through to the forecast period through a lower base year expenditure on which the forecast is derived.

## 9.3 Forecast operating expenditure

### 9.3.1 Rules for operating expenditure

Rule 91 specifies that operating expenditure:

> … must be such as would be incurred by a prudent service provider acting efficiently, in accordance with accepted good industry practice, to achieve the lowest sustainable cost of operation.

The AER's discretion under this Rule is limited such that the AER must not withhold its approval of proposed operating expenditure if it is satisfied that the proposal complies

with the requirements of the law and is consistent with Rule 91. All forecasts and estimates must also comply with Rule 74.

APTNT has forecast its operating expenditure to ensure ongoing compliance with its regulatory obligations discussed in chapter 3, and in line with the planning and asset management processes and procedures set out in chapter 4. There are no contingency allowances included in the operating expenditure forecast. APTNT notes that there is a material risk that some estimates will be too low owing to uncertainties in forecasting costs accurately, particularly in the later years of the access arrangement period.

APTNT considers that its forecast operating expenditure is consistent with Rule 91 as being prudent and efficient expenditure. APTNT further considers that its forecast has been arrived at on a reasonable basis and is the best possible in the circumstances, in accordance with Rule 74.

### 9.3.2 Forecast methodology

APTNT has forecast its operating expenditure using a base year approach. The methodology to derive this forecast involves:

- Identification of an efficient base year and base year costs;
- Adjustment for step and scope changes including the removal from the base year of costs that are not indicative of future requirements and adding costs for new expenditures in future years not experienced in the past or embedded in the base year costs; and
- Escalation of costs for expected changes in input costs.

APTNT considers that the base year approach is appropriate for APTNT as it has displayed a stable profile of operating expenditure over recent years, and expects to maintain this profile into the foreseeable future. As discussed above in section 1.5.3, the commercial and operating environment for this pipeline has moved into a more stable period following the renegotiation of the primary long term contract on the pipeline in 2011, as well as the substantial completion of the enhanced integrity works program.

Therefore, APTNT believes that the base year approach will yield the best forecast or estimate possible in the circumstances, as it reflects the actual operating costs of the business. It should be noted that APTNT's operating costs are subject to commercial pressures to ensure lowest cost service delivery, in particular as a result of the long term contracting arrangements for the pipeline, which are not affected by the regulatory outcome.

### 9.3.3 2014/15 base year

APTNT has used its actual expenditure in 2014/15 as its base year for determining forecast operating expenditure over the access arrangement period. APTNT considers that this year is appropriate for this purpose as:

- It is the most recent completed regulatory year for expenditure and is therefore the most indicative of the current operating expenditure of the business; and
- It is in line with operating expenditure in previous years of the period.

APTNT is a wholly owned APA Group entity, and there are no operating or management contracts in place impacting forecast operating expenditure. For the avoidance of doubt, there are no related party margins included in historic or forecast expenditure impacting the base year or the operating expenditure forecast.

APTNT is subject to strong incentives to reduce its operating costs, including those in the base year, as its actual revenue for this asset is governed by a long term contract that is not linked to regulated outcomes. This means that APTNT faces continuous incentives to reduce its operating costs year-on-year for the life of its existing transportation contracts.

APTNT has applied one adjustment to the base year in respect of intelligent pigging. In line with the approach under the earlier access arrangement period, APTNT proposes to continue treating pigging costs as operating expenditure.

APTNT undertakes intelligent pigging on a 10 year cycle for most of its pipelines. Expenditure for this activity is relatively 'lumpy', and is not spread evenly over each year of the forecast period. As a result, intelligent pigging is a significant expenditure that is not suited to the base year forecasting approach (which assumes a relatively constant annual expenditure profile).

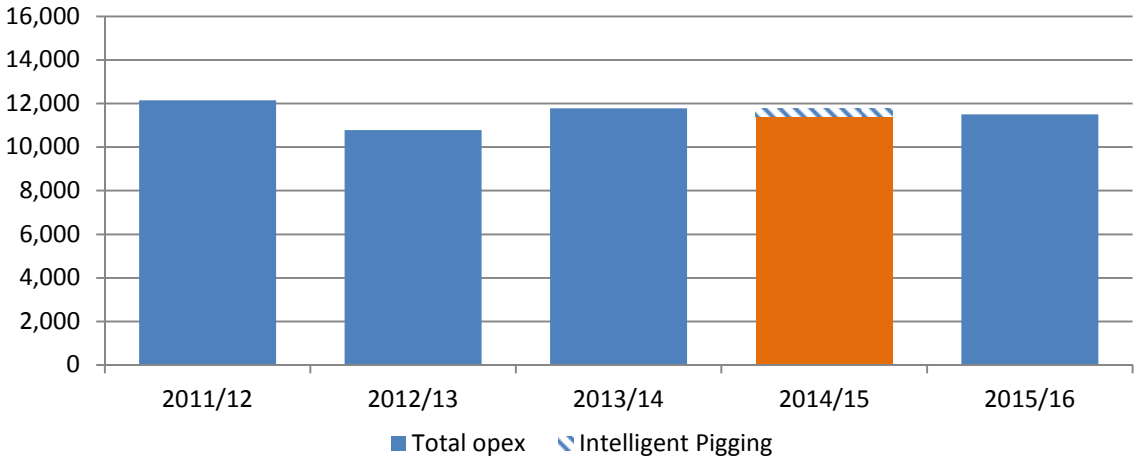
To address this issue, APTNT has adjusted the 2014/15 base year to remove expenditure for pigging undertaken in that year, and has then applied an adjustment to the forecast to reflect expected pigging costs in each year that this actively will be undertaken. The amounts of these adjustments are shown in Table 9.2 below.

***Table 9.2 – Adjustments to base year and forecast expenditure to account for intelligent pigging expenditure profile ($2015/16)***

| $'000 | 2014/15 | 2015/16 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 |
|---|---|---|---|---|---|---|---|
| Intelligent Pigging | -375 | 0 | 366 | 1,265 | 2,130 | 0 | 411 |

The resulting base year operating expenditure costs used for the purposes of forecasting operating expenditure is $11.4 million ($2015/16). This value is compared to actual (unadjusted) expenditure in the operating and maintenance category in the other years of the earlier access arrangement period as set out in Figure 9.2 below.

***Figure 9.2 – Adjusted base year 2014/15 operating expenditure compared to other years in the earlier access arrangement period ($'000 2015/16)***




## 9.3.4 Step and scope changes

APTNT has not identified any step or scope changes for the forecast years that are likely to impact operating expenditure. This includes expected changes to regulatory or other obligations that are not already reflected in the base year.

As noted by APTNT in section 3.1.1 above, APTNT's expenditure in the base year does not include an allowance for completing an annual RIN during the forecast access arrangement period. APTNT notes that the AER has previously sought to impose an annual RIN on other regulated pipelines within APA Group, but has not indicated that it intends to impose an annual RIN on AGP during the period. The issuing and completion of an annual RIN would represent a new obligation for APTNT and, depending on any associated auditing or other data validation requirements, could represent a significant additional cost to the business which is not reflected in historic costs.

APA considers that if the AER intends to issue annual RINs on APTNT, this should be flagged in the draft decision, and APTNT given opportunity to vary its proposal to include an operating expenditure step change event to reflect expected additional costs.

## 9.3.5 Escalation

*Real cost escalation*

APTNT has not undertaken an economic study directed at forecasting real cost escalation for the access arrangement period. Rather, it proposes to rely on existing NT-specific economic analysis that has already been subject to regulatory scrutiny.

APTNT considers that an analysis of real cost escalation in the Northern Territory must consider the unique attributes of the NT economy and the pressures applicable to that economy.

The Northern Territory Utilities Commission recently completed its review of the costs applicable to the NT's PWC electricity assets. In the context of that review, PWC engaged Deloitte Access Economics to undertake a review and forecast labour cost escalators, and Sinclair Knight Merz to advise on forecast materials cost escalators.

Both studies referenced the boom in primary industry and natural resource development, which is causing strong competition for labour and other resources, which is placing upward pressure on costs.

As Deloitte Access Economics noted:

> With the Northern Territory's resources boom now in full swing, the overall outlook is for strong wage growth in the near term as the resources boom puts upward pressure on wage negotiations both directly and indirectly. The utilities and professional services sectors are estimated to be currently experiencing wage growth in the order of one percentage point higher than the Territory average amid a period of strong demand from the resources sector – which competes with the utility sector for its workforce … that's what happens when a $34 billion LNG project starts construction in an economy with an annual income of $19 billion.[136]

The Northern Territory Utilities Commission accepted, for the purposes of determining both the allowed operating and capital expenditure forecasts, the Deloitte Access Economics forecasts of real cost for labour cost increases,[137] and the Sinclair Knight Merz forecasts of real material cost increases.[138]

APTNT proposes to rely on this regulator-approved finding of real cost escalation for the purposes of this submission.

The real labour cost escalation factors approved by the Northern Territory Utilities Commission are shown in Table 9.3 below.

***Table 9.3 – Deloitte Access Economics real labour cost escalation factors***

| Year | 2015/16 | 2016/17 | 2017/18 | 2018/19 |
|---|---|---|---|---|
| Internal labour | 1.0% | 0.6% | 0.9% | 1.0% |
| External labour | 1.1% | 0.9% | 1.0% | 1.1% |

These real labour cost escalators have been applied for the purpose of determining both the capital and operating expenditure forecasts in this submission.

[136] Deloitte Access Economics 2013, *Labour escalators in the Northern Territory*, p 1
[137] NT Utilities Commission 2014, *Network Price Determination, Final Determination*, p 87
[138] NT Utilities Commission 2014, *Network Price Determination, Final Determination*, p 109

For the forecast years beyond the Deloitte Access Economics forecast, APTNT has applied the composite average of the approved real labour cost escalators, being 1.1 per cent per year.[139]

The PWC submission to the Northern Territory Utilities Commission included a report from Sinclair Knight Merz which developed a quite granular forecast of real cost escalators to be applied to various types of projects forecast for the PWC electricity network. The Northern Territory Utilities Commission accepted the real cost escalators produced in the Sinclair Knight Merz report.[140]

APTNT considers that this detailed forecast does not map well to the projects forecast for the AGP. Of the materials forecast by Sinclair Knight Merz, only steel is relevant to pipelines, and then only materially relevant where there is considerable forecast expansions through looping or pipeline extensions. Neither of these cases are relevant to the AGP capital expenditure forecast. APTNT therefore does not propose to apply a materials escalator to its capital expenditure forecast.

### 9.3.6 Total operating expenditure

Total operating expenditure by category over the access arrangement period is set out in Table 9.4 below.

***Table 9.4 – Forecast operating expenditure over the access arrangement period ($2015/16)***

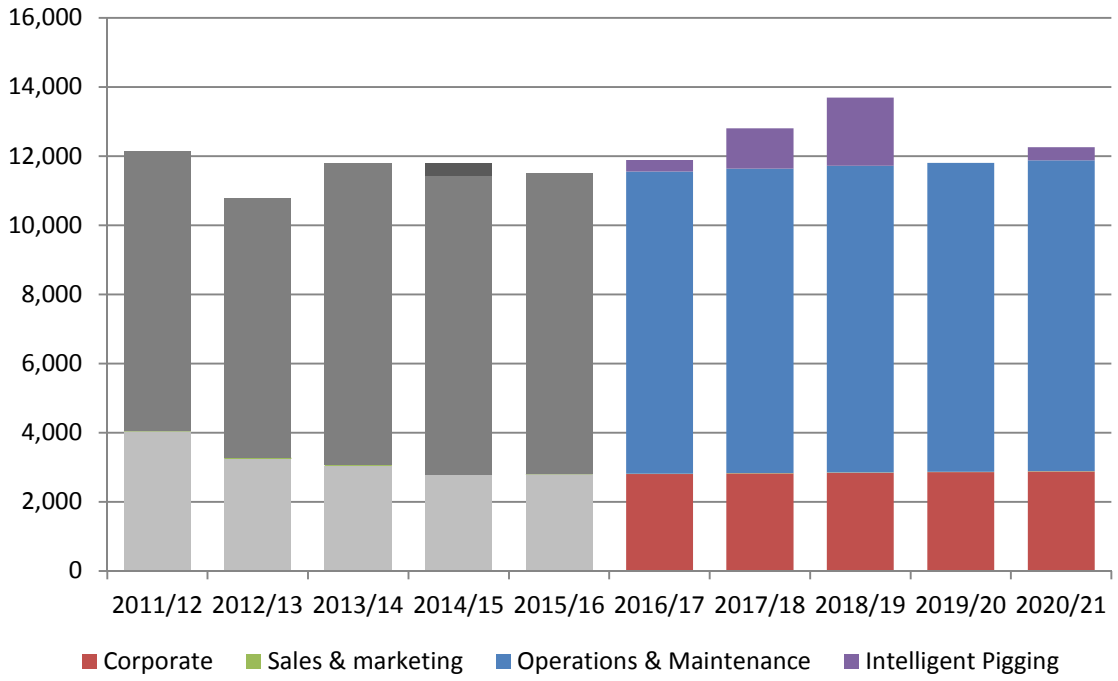
| $'000 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 | Total |
|---|---|---|---|---|---|---|
| Operations & Maintenance | 9,101 | 10,062 | 10,997 | 8,929 | 9,402 | **48,491** |
| Corporate | 2,808 | 2,825 | 2,844 | 2,862 | 2,879 | **14,219** |
| Sales & marketing | 9 | 9 | 9 | 9 | 9 | **47** |
| **Total Forecast** | **11,918** | **12,897** | **13,851** | **11,800** | **12,291** | **62,758** |

Operating expenditure for the access arrangement period compared to the earlier access arrangement period is shown in Figure 9.3 below. The corresponding categories in the earlier period are shown in greys.

[139] Calculating an average over the 6 years reported by Deloitte Access Economics, from 2013/14 to 2018/19, delivers an average of 1.2 per cent for internal labour and 0.9 per cent for external labour

[140] NT Utilities Commission, *2014 Network Price Determination*, Final Determination, p109

***Figure 9.3 – Operating expenditure over the earlier access arrangement period and access arrangement period ($'000 2015/16)***




As can be seen from the graph, total operating expenditure over the forecast period is in line with that in the earlier period, before adjusting for pigging expenditure. This reflects the largely recurring nature of operating expenditure.

APTNT considers that its forecast operating expenditure for the access arrangement period satisfies the requirements under Rule 91 that it be expenditure that would be incurred by a prudent service provider acting efficiently in accordance with accepted good industry practice to achieve the lowest sustainable cost of providing services.

Forecasts have been arrived at on a reasonable basis, using the best available information applying to the business and the pipeline.

## 9.4 Debt raising costs

APTNT has also included debt raising costs, calculated using the AER's Post Tax Revenue Model, in its total operating expenditure used to derive forecast revenue for the access arrangement period. Debt raising costs, as calculated under the PTRM, are set out in Table 9.5 below.

***Table 9.5 – Debt raising costs included in forecast revenue ($nominal)***

| $'000 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 |
|---|---|---|---|---|---|
| Debt raising costs | 7 | 8 | 8 | 8 | 8 |

## 9.5 Outsourced expenditure

The AER RIN requires APTNT to submit certain information related to outsourced forecast operating expenditure that contributes in a material way to the provision of pipeline services. APTNT has very limited contracts currently in place for forecast operating expenditure. There are, however, some ongoing relationships with external providers that APTNT expects will continue in the access arrangement period. Details of these contracts and relationships are provided in confidential Attachment D.

APTNT has applies a materiality threshold of $50 000 for this purpose.

# 10 Total revenue

Rule 76 requires the total revenue to be derived according to a building block approach. The considerations relevant to each of the building blocks are discussed in the relevant sections above. This section summarises those building blocks to present the total revenue requirement.

## 10.1 Return on capital

The required return on the capital base is discussed in chapter 8. The required return on the capital base is summarised in Table 10.1 below.

***Table 10.1 – Return on capital ($nominal)***

| $million | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 |
|---|---|---|---|---|---|
| Return on capital | 10,011 | 11,635 | 11,703 | 11,730 | 11,746 |

## 10.2 Regulatory depreciation

The forecast straight line depreciation over the access arrangement period is discussed in section 7.2.4. To calculate the amount of regulatory depreciation applicable to the revenue requirement, the amount of indexation of the capital base must be subtracted from the straight line depreciation. The indexation of the capital base is discussed in section 7.2.5.

Together, these two amounts combine to derive the forecast regulatory depreciation as shown in Table 10.2.

***Table 10.2 – Forecast depreciation over the access arrangement period ($nominal)***

| $'000 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 |
|---|---|---|---|---|---|
| Straight line depreciation | 4,870 | 5,439 | 5,709 | 5,993 | 5,285 |
| Indexation | 3,015 | 3,505 | 3,525 | 3,533 | 3,538 |
| Regulatory depreciation | 1,855 | 1,934 | 2,184 | 2,460 | 1,747 |

The depreciation schedule for establishing the opening capital base at 1 July 2021 will be based on forecast capital expenditure.

## 10.3 Corporate income tax

Rule 72(1)(h) requires the service provider to include an estimated cost of income tax calculated in accordance with Rule 87A. Rules 87A has been included in the Rules since the last access arrangement revision process, and states:

> (1) The estimated cost of corporate income tax of a service provider for each regulatory year of an access arrangement period (ETCt) is to be estimated in accordance with the following formula:
>
> $ETCt = (ETIt \times rt)(1 - \gamma)$
>
> Where
>
> ETIt is an estimate of the taxable income for that regulatory year that would be earned by a benchmark efficient entity as a result of the provision of reference services if such an entity, rather than the service provider, operated the business of the service provider;
>
> rt is the expected statutory income tax rate for that regulatory year as determined by the AER; and
>
> γ is the value of imputation credits.

For the purposes of this access arrangement, APTNT has historically adopted a post tax approach, in line with the requirements of the Rules. APTNTs corporate income tax allowance is set out in Table 10.3 below.

***Table 10.3 – Corporate income tax allowance ($nominal)***

| $'000 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 |
|---|---|---|---|---|---|
| Tax allowance | 1,102 | 1,039 | 1,070 | 1,105 | 848 |

## 10.4 Total revenue requirement

Combining these components as required under Rule 76 derives a total revenue requirement as shown in Table 10.4 below.

***Table 10.4 – Total revenue requirement ($nominal)***

| $'000 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 |
|---|---|---|---|---|---|
| Return on capital | 10,011 | 11,635 | 11,703 | 11,730 | 11,746 |
| Return of capital | 1,855 | 1,934 | 2,184 | 2,460 | 1,747 |
| Operating expenditure | 12,224 | 13,559 | 14,925 | 13,034 | 13,915 |
| Tax Allowance | 1,102 | 1,039 | 1,070 | 1,105 | 0,848 |
| **AGP Building Block Revenue requirement** | **25,192** | **28,167** | **29,883** | **28,329** | **28,256** |

The present value of this revenue requirement stream, discounted at the WACC of 8.3 per cent per cent, is $110.36 million.

## 10.5 Incentive mechanisms

There were no incentive mechanisms in the earlier access arrangement period that have ongoing application or administrative requirements in the access arrangement period.

Looking forward, the National Gas Access Regime, defined by the NGL and Rules, focuses on reference tariffs and is therefore fundamentally a “price cap” regime.

Under a price cap regime, the service provider has clear incentives to:

- reduce operating expenditure from approved forecast levels;
- defer or avoid capital expenditure relative to the approved forecast; and
- increase the utilisation of the pipeline.

Under the AER’s ‘revealed cost’ approach, the benefits of these actions are retained by the business until the next regulatory reset, at which time they form the foundations of cost and revenue forecasts for the following access arrangement period. The benefits arising from these activities are therefore delivered to Users in the access arrangement period following that in which the activities are undertaken.

Beyond the incentives encapsulated in the Rules, APTNT does not propose any incentive mechanism for the AGP.

# 11 Tariffs

This chapter explains the basis and derivation of pipeline tariffs, including the allocation of total revenue and costs to pipeline services and the reference tariff variation mechanism.

## 11.1 Revenue allocation

The total revenue requirements derived from the building block approach is shown in Table 11.1 below.

***Table 11.1 – Total revenue requirement ($nominal)***

| $'000 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 |
|---|---|---|---|---|---|
| AGP building block revenue requirement | 25,192 | 28,167 | 29,883 | 28,329 | 28,256 |

The present value of this revenue requirement stream, discounted at the WACC of 8.3 per cent per cent, is $110.36 million.

### 11.1.1 Revenue and cost allocation to services

Rule 93(2) requires costs to be allocated between reference and other services as follows:

(a) Costs directly attributable to reference services are to be allocated to those services;

(b) Costs directly attributable to pipeline services that are not reference services are to be allocated to those services; and

(c) Other costs are to be allocated between reference and other services on a basis (which must be consistent with the revenue and pricing principles) determined or approved by the AER.

Revenue is to be allocated between reference and other services in the same ratio in which costs are allocated between reference and other services.

APTNT proposes three pipeline services, one of which is also a reference service. APTNT must therefore allocate costs between these services based on the costs directly attributed to those services.

As set out in the chapter 5 above, there is currently one dominant user of the pipeline. This user takes a firm transportation service akin to the proposed reference service, and is currently contracted for the full firm capacity of the pipeline. To the extent that there are other users of the pipeline, these users take services that are different to the reference service (for example, interruptible services). These services made up less

than 5 per cent of gas volumes transported over the earlier access arrangement period, and varied considerably over the period. APTNT does not forecast any significant increase in demand for the interruptible or negotiated service during the access arrangement period. APTNT is not in any negotiations for the further provision of these services.

As non-firm services only represent a minor proportion of pipeline flows, APTNT does not currently incur material costs on the AGP associated with providing non-reference services. The main driver of costs for the pipeline are the infrastructure and operating expenditure required to support the gas flows associated with the prevailing firm contracting arrangements.

Similarly, APTNT does not forecast any additional users of non-reference services, and therefore does not forecast any costs to be allocated to these services. As a result, APTNT has allocated all costs and revenue to be recovered through the reference service. This is the same approach as applied during the earlier access arrangement period.

## 11.2 Reference tariff

### 11.2.1 Rules requirements

Rule 95(1) requires that a tariff for a reference service be developed:

(a) To generate from the provision of each reference service the portion of total revenue referable to that reference service; and

(b) As far as reasonably practicable consistently with paragraph (a), to generate from the user, or the class of users, to which the reference service is provided, the portion of total revenue referable to providing the reference service to the particular user or class of users.

As APTNT only proposes to offer one reference service, Rule 92(2), which relates to the allocation of revenue between reference services, does not apply.

Rule 95(2) requires that the portion of total revenue referable to providing a reference service to a particular user or class of users is determined as follows:

(a) costs directly attributable to supplying the user or class of users are to be allocated to the relevant user or class; and

(b) other costs are to be allocated between the user or class of users and other users or classes of users on a basis (which must be consistent with the revenue and pricing principles) determined or approved by the AER.

This is a limited discretion Rule.

### 11.2.2 Allocation to user classes

As outlined above, APTNT has allocated all revenue associated with the AGP to the reference service. APTNT considers that there is only one class of user on the pipeline, being users supplying mining or generating facilities within the NT.

The reference tariff structure proposed is unchanged from the earlier period, and is a simple capacity tariff based on firm Maximum Daily Quantities (MDQs) at each delivery point. This tariff allows APTNT to recover its revenue requirement from users of the pipeline in proportion to their capacity requirements, which matches the reference service which is an 'any direction' service from between any receipt and delivery point.

It can be expected that any potential additional users of the pipeline would also be in the same class as the principal user of the reference service as those users are not expected to give rise to specific costs (or avoid any specific costs) compared to the principal user of the reference service.

As a result, revenue associated with providing the reference service has been allocated to a single user class consistent with the requirement that direct and other costs associated with providing the reference service are allocated in accordance with the cost of providing the reference service to that class of user.

### 11.2.3 Revenue equalisation and X-factors

The revenue requirements as outlined in section 10.4 above varies by year according to differing operating and other requirements over the course of the access arrangement period. In order to present a smooth price path, Rule 92(2) requires a smoothed revenue path to be derived, in present value terms.

Applying a WACC of 8.3 per cent, the smoothed revenue requirements that would derive the same net present value of cash flows is outlined in Table 11.2 below.

***Table 11.2 – Smoothed revenue requirement ($nominal)***

| $'000 | 2016/17 | 2017/18 | 2018/19 | 2019/20 | 2020/21 |
|---|---|---|---|---|---|
| Smoothed revenue requirement | 25,677 | 26,812 | 27,998 | 29,238 | 30,535 |

The revenue path is then translated, reflecting changes in demand requirements, into a price path in a CPI-X format. This derives the unit price to apply in each year of the access arrangement period based on a defined starting point. The 2016/17 tariff that forms the starting point for the access arrangement period is $0.6896/GJ.

## 11.3 Reference tariff variation

The Tariff Variation Mechanism included in the revised access arrangement includes an annual element to update tariffs in respect to changes to CPI and to the return on debt, as well as a cost pass-through variation mechanism, which applies when a defined event occurs.

APTNT has proposed a reference tariff variation mechanism that is substantially the same as that in the earlier access arrangement period. APTNT has made the following minor changes:

- Minor variations to the introduction of section 4.7 of the access arrangement to make clear that the reference tariff mechanism is made up of two components: the Scheduled Reference Tariff Variation Mechanism, and the Cost Pass-through Reference Tariff Variation Mechanism;
- Changes to the description of the Scheduled Tariff Variation process to reflect that the tariff notification made 50 days before implementation is necessarily a draft notification, as key input data for the tariff calculation has not yet been released by the ABS. The subsequent submission of an updated tariff variation notice incorporating actual data reflects current practice in respect of the AGP access arrangement in notifying the AER of tariffs for the coming year;
- Revision to the definition of an Insurance cap event to align it with the drafting for this event required by the AER in respect of the APA GasNet access arrangement[141]; and
- Minor drafting changes to refer consistently to the *Firm Service* as the Reference Service, and to refer to the tariff *variation* mechanism instead of a tariff *adjustment* mechanism in line with the drafting under the NGR.

The Reference Tariff Variation Mechanism continues to permit variation of the base reference tariff (the Reference Tariff for Firm Service for the year 2016/17) in accordance with the change in inflation relative to base year inflation. The measure of inflation for tariff variation is the change in the CPI (weighted average, Eight capital Cities).

Two more substantive changes to the mechanism are:

- The inclusion of a mechanism for the annual updating of the return on debt; and
- The tariff variation process under Scheduled Reference Tariff Variation Mechanism.

These changes are discussed below.

[141] Australian Energy Regulator 2012, *APA GasNet Australia (Operations) Pty Ltd Access arrangement draft decision 2013-17 Part 2 Attachments*, September , p 326

### 11.3.1 Annual update of return on debt under the tariff variation mechanism

APTNT has incorporated into the tariff variation mechanism, a mechanism to give effect to the intra-period adjustment of the allowed rate of return proposed in the AER's Rate of Return Guideline.[142] The allowed rate of return is to be adjusted annually during the access arrangement period by updating the estimate of the return on debt which has been used in determining the rate of return.

As discussed in section 8.4 above, APTNT has adopted a backward looking trailing average approach to estimating the return on debt. That approach provides an estimate of the return on debt which better contributes to achievement of the allowed rate of return objective than an estimate made using the trailing average approach of the Rate of Return Guideline.

APTNT's proposed trailing average approach recognises that the benchmark efficient entity of Rule 87 will partially hedge its interest rate risk, leaving a part of that risk unhedged. In consequence, the trailing average which APTNT has used to estimate the return on debt comprises:

- an unhedged component, being a trailing average of the nominal yields on BBB rated bonds designated as having terms to maturity of 10 years; and
- a hedged component, being the current AFMA Interest Rate Swaps rate (BBSW) for a term of 10 years plus a trailing average of spreads to swap on BBB rated bonds designated as having terms to maturity of 10 years.

APTNT proposes that its trailing average estimate of the return on debt be updated, each year, for the year ahead. This requires:

- updating the unhedged component by updating the nominal yields on BBB rated bonds by deleting the earliest of those yields in the trailing average, and adding in to the trailing average the yield for the current year; and
- updating the hedged component by deleting the earliest of the spreads to swap in the trailing average of those spreads, and adding into the trailing average of spreads the spread to swap for the current year.

The return on debt for year n is to be updated using the formula:

$$URoRD_n = (1-H) \times \frac{1}{10} \times \sum_{t=n-10}^{n-1} y_t + H \times \left( BBSW_{n-1} + \frac{1}{10} \times \sum_{t=n-10}^{n-1} DRP_t \right)$$

where:

- $\boldsymbol{URoRD_n}$ is the updated return on debt for year n in the period 2017/18 to 2020/21;

[142] Rate of Return Guideline, section 4.3.3.

- $H$ is 0.33; it is the proportion of interest rate risk which is hedged;
- $y_t$ is the nominal yield, in March of year t, on BBB rated bonds designated as having terms to maturity of 10 years and issued by Australian non-financial corporations, as published by the Reserve Bank of Australia;
- $BBSW_{n-1}$ is the average of the mid-rates for AFMA Interest Rate Swaps for a term of 10 years, the average being calculated over APTNT's nominated, but confidential, averaging period for year n – 1; and
- $DRP_t$ is the spread to swap, in March of year t, on BBB rated bonds designated as having terms to maturity of 10 years and issued by Australian non-financial corporations, as published by the Reserve Bank of Australia.

When the return on debt for year n is updated in the version of the AER's Post-Tax Revenue Model (version 3) used to calculate the total revenue for the AGP, the X factors for year n and for future years are recalculated within the model. The tariff variation mechanism permits an adjustment to the base reference tariff (in addition to the adjustment for inflation noted above) using the recalculated X factors:

$$Reference\ Tariff_n = Reference\ Tariff_b \times \frac{CPI_n}{CPI_b} \times \prod_{j=1}^{n}(1 - X_j)$$

where:

$Reference\ Tariff_n$ is the Reference Tariff for the year n;

$n$ is the year in which the adjusted Reference Tariff is to be applied;

$Reference\ Tariff_b$ is the Reference Tariff for the Firm Service for the year 2016/17 specified in Schedule 1;

$CPI$ means the Consumer Price Index (weighted average, Eight Capital Cities) published quarterly by the Australian Statistician (and if the Australian Statistician ceases to publish the quarterly value of that Index, then CPI means the quarterly values of another Index which Service Provider reasonably determines most closely approximates that Index);

$CPI_n$ means the value of the CPI for the Quarter ended March 31 last published before the Adjustment Date for year n;

$CPI_b$ means the base CPI, being the CPI for the Quarter ended March 31 2016; and

$X_j$ is the X factor for year j from the Post-Tax Revenue Model.

$$\prod_{j=1}^{n}(1 - X_j)$$

is the product of factors $(1 - X_j)$ calculated as follows:

- for 2017/18, n = 1, and

$$\prod_{j=1}^{n}(1 - X_j) = 1 - X_{2017/18}$$

where $X_{2017/18}$ is the X factor for 2017/18 from the Post-Tax Revenue Model after updating the return on debt for 2017/18;

- for 2018/19, n = 2, and

$$\prod_{j=1}^{n}(1 - X_j) = (1 - X_{2017/18})(1 - X_{2018/19})$$

where $X_{2017/18}$ is the X factor for 2017/18 from the Post-Tax Revenue Model after updating the return on debt for 2017/18, and $X_{2018/19}$ is the X factor from the Post-Tax Revenue Model after updating the return on debt for 2018/19;

- for 2019/20, n = 3, and

$$\prod_{j=1}^{n}(1 - X_j) = (1 - X_{2017/18})(1 - X_{2018/19})(1 - X_{2019/20})$$

where $X_{2017/18}$ is the X factor for 2017/18 from the Post-Tax Revenue Model after updating the return on debt for 2017/18, $X_{2018/19}$ is the X factor from the Post-Tax Revenue Model after updating the return on debt for 2018/19; and $X_{2019/20}$ is the X factor for 2019/20 from the Post-Tax Revenue Model after updating the return on debt for 2019/20; and

- for 2020/21, n = 4, and

$$\prod_{j=1}^{n}(1 - X_j) = (1 - X_{2017/18})(1 - X_{2018/19})(1 - X_{2019/20})(1 - X_{2020/21})$$

where $X_{2017/18}$ is the X factor for 2017/18 from the Post-Tax Revenue Model after updating the return on debt for 2017/18, $X_{2018/19}$ is the X factor from the Post-Tax Revenue Model after updating the return on debt for 2018/19; $X_{2019/20}$ is the X factor for 2019/20 from the Post-Tax Revenue Model after updating the return on debt for 2019/20; and $X_{2020/21}$ is the X factor for 2020/21 from the Post-Tax Revenue Model after updating the return on debt for 2020/21.

As set out above, the Access Arrangement provides for the annual updating of the Reference Tariff to reflect both changes in CPI, and changes in the return on debt.

Two inputs are required to complete this update, March CPI and the March cost of debt for the relevant year.

### 11.3.2 Tariff variation process

APTNT considers that the current tariff variation mechanism, with the changes discussed in this section, meets the requirements of Rule 97. The process and timing for tariff variation notifications remain unchanged from the earlier period, which the AER has previously approved as providing adequate oversight for the AER for tariffs.

# Attachment A – Information required by the National Gas Rules and AER Regulatory Information Notice

## Index of Information

This index of information provides cross-references to the documents that make up APTNT's revised access arrangement proposal, providing the location of information submitted in compliance with the National Gas Rules or the AER Regulatory Information Notice.

***Table A.1 – Index of information***

| Source | Requirement | AA reference | AAI reference | Submission |
|---|---|---|---|---|
| RIN 1.1 | Provide the information required in each regulatory template in the Microsoft Excel workbook attached at Appendix A completed in accordance with this Notice. | | | Attachment B |
| RIN 1.5 | Provide any calculations used to convert real to nominal dollars or nominal to real dollars for the purposes of providing the information required under the RIN. | | | Supporting models Attachment B |
| RIN 1.10(a) | Provide information required in the regulatory templates in accordance with the instructions. | | | Attachment B |
| RIN 1.10(b) | Provide an index of information outlining the location of the information provided and the in regulatory templates (Attachment A). | | | Attachment A |
| NGR 48(1)(a) | Identity of the pipeline to which the access arrangement relates and a reference to a website at which a description of the pipeline can be inspected | 1.1 | 1.1 | 1.5.1 |
| NGR 48(1)(b) | Description of the pipeline services the service provider proposes to offer to provide by means of the pipeline | Part 2 and Schedule 3 | Part 10 | 2.1 |
| NGR 48(1)(c) | Specification of the reference services | Part 2 | Part 10 | 2.1.1 |
| NGR 48(1)(d)(i) | The reference tariff for each reference service | Schedule 1 | 10.4 | 11.2 |
| NGR 48(1)(d)(ii) | The other terms and conditions on which each reference service will be provided | Schedule 3 | | 2.2 |
| NGR 48(1)(e) | Queuing requirements | Part 6 | | 2.2.4 |
| NGR 48(1)(f) | Capacity trading requirements | Part 5 | | 2.2.3 |

| Source | Requirement | AA reference | AAI reference | Submission |
|---|---|---|---|---|
| NGR 48(1)(g) | Extension and expansion requirements | Part 7 | | 2.2.1 |
| NGR 48(1)(h) | Changing receipt and delivery points | Part 5 | | 2.2.3 |
| NGR 48(1)(i) | Review submission and revision commencement dates | 1.6 | | 2.2.5 |
| NGR 48(1)(j) | Review expiry date (if relevant) | | | |
| NGR 51 | Trigger events (if relevant) | NA | NA | NA |
| NGR 99 | Fixed principles | NA | NA | NA |
| NGR 73 | The basis on which financial information is provided must be stated and must use a recognised basis for dealing with inflation. All financial information must be provided on a basis that is consistent throughout the submission. | | | 1.3.3 |
| NGR 72(1)(a)(i) | Capital expenditure by asset class over the earlier access arrangement period | | 2.1 | 6.4.2 |
| RIN 1.6 | Provide an explanation should capital expenditure provided in the regulatory templates be materially different to information previously submitted to the AER such as via annually submitted RINs. | | | NA |
| RIN 1.7 | In the relevant regulatory template, report any change and the materiality of that change where any method of allocation under section 1.6 changes over time. | | | NA |
| RIN 1.8 | Where historical information provided in the regulatory templates has previously been reported to the AER:<br>(a) this information must reconcile with the previously provided information; or<br>(b) explain why the information does not reconcile with the previously provided information. | | | NA |
| RIN 1.9 | For each change identified in the response to section 1.8:<br>(a) explain the nature of and the reasons for the variation; and<br>(b) quantify the effect of the variation on the annual Regulatory Information Notice for the relevant regulatory year. | | | NA |
| NGR 72(1)(a)(ii) | Operating expenditure by category over the earlier access arrangement period | | 2.2 | 9.2 |
| RIN 1.6 | Provide an explanation should operating expenditure provided in the regulatory templates be materially different to information previously submitted to the AER such as via annually submitted RINs. | | | NA |

| Source | Requirement | AA reference | AAI reference | Submission |
|---|---|---|---|---|
| RIN 2.5.5.1(a) | Provide an outline and explanation of the change in operating expenditure categories between the earlier access arrangement period and the access arrangement period | | | 9.1 |
| NGR 72(1)(a)(iii) | Usage of the pipeline over the earlier access arrangement period, including | | | |
| NGR 72(1)(a)(iii)(A) | minimum and maximum demand for each receipt or delivery point | | 2.3 | 5.1.1 |
| NGR 72(1)(a)(iii)(B) | user numbers for each receipt or delivery point | | 2.3 | 5.1.2 |
| NGR 72(1)(b) | Derivation of the capital base and a demonstration of the increase or diminution over the previous access arrangement period | | 3.1 | 7.1 |
| NGR 72(1)(c)(i) | The projected capital base over the access arrangement period including a forecast of conforming capital expenditure for the period and the basis for the forecast | | 3.2.5 | 7.2 |
| RIN 4.1(a)(i) | Describe and explain the nature of material forecast capital expenditure proposed in each asset class or capital expenditure category. | | | 6.3 |
| RIN 4.1(a)(ii) | Identify and explain the materiality threshold used to determine material forecast capital expenditure. | | | 6.3 |
| RIN 4.1(a)(iii) | Identify the location of the proposed forecast capital expenditure. | | | 6.3 and Asset Management Plan (Attachment C) |
| RIN 4.1(a)(iv) | Provide:<br>(1) relevant internal decision making documents including but not limited to business cases, feasibility studies, forecast demand studies and internal reports and the date of board resolution/management decisions relating to approval of the forecast capital expenditure; and<br>(2) other internal or external documentation or models to justify the forecast conforming capital expenditure. | | | Asset Management Plan, Attachment B Attachment C |
| RIN 4.1(a)(v) | Explain whether the forecast conforming capital expenditure is to be funded by parties other than the asset owner. | | | 7.2.3 |
| RIN 4.1(a)(vi) | Provide details of contractual agreements with parties where capital contributions are made by users to new capital expenditure pursuant to Rule 82. | | | 7.2.3 |

| Source | Requirement | AA reference | AAI reference | Submission |
|---|---|---|---|---|
| RIN 4.1(a)(vii) | If Rule 79(2)(a) is relied on to justify new capital expenditure, provide:<br>(1) a quantitative analysis which demonstrates how the capital expenditure is justifiable under Rule 79(2)(a); and<br>(2) an outline of the nature and quantification of the economic value that directly accrues to the service provider, gas producer, users and end users to address Rule 79(3). | | | NA |
| RIN 4.1(a)(viii) | If Rule 79(2)(b) is relied on to justify new capital expenditure, provide a quantitative analysis that demonstrates the capital expenditure is justifiable under Rule 79(2)(b). | | | Attachment B |
| RIN 4.1(a)(ix) | If Rules 79(2)(c)(i)-79(2)(c)(iii) are relied on to justify new capital expenditure, as relevant:<br>(1) identify the statutory obligation or technical requirement and the relevant authority or body enforcing the obligation or requirement;<br>(2) explain how the forecast capital expenditure satisfies the relevant statutory obligation or technical requirement; and<br>(3) provide supporting technical or other external or internal reports about how the forecast capital expenditure complies with the relevant statutory obligation or technical requirement. | | | Chapter 3, 6.3 and Asset Management Plan |
| RIN 4.1(a)(x) | If Rule 79(2)(c)(iv) is relied on to justify new capital expenditure:<br>(1) quantify and explain the change in demand for existing services necessitating the new capital expenditure; and<br>(2) provide reports or other information and documentation that supports how the forecast capital expenditure will meet the increase in demand for existing services. | | | Attachment B |
| RIN 4.1(b)(i) | If the speculative capital expenditure account has increased at a rate different to the rate of return implicit in a reference tariff:<br>(1) identify the differences in rates; and<br>(2) explain why. | | | NA |
| RIN 4.1(b)(ii) | Identify any mechanism which applies to prevent the service provider from benefiting, through increased revenue, from capital contributions made by a user in the access arrangement period. | 3.2 | | 6.3 |
| NGR 85 | Capital redundancy mechanism | 4.9 | | 2.2.2 |
| NGR 85(3) | Policies for other mechanisms (cost sharing if demand falls) | 4.9 | | 2.2.2 |
| RIN 4.1(c)(i) | If a mechanism to remove redundant assets is not proposed, explain why with reference to the relevant rules. | | | NA |

| Source | Requirement | AA reference | AAI reference | Submission |
|---|---|---|---|---|
| RIN 4.1(c)(ii) | Provide an explanation for whether and how APTNT considers the requirements of s. 79 of the NGR are met for any amounts added to or deducted from the opening capital base:<br>(1) from the speculative capital expenditure account;<br>(2) for the reuse of redundant assets;<br>(3) for redundant assets. | | | NA |
| RIN 4.1(d)(i) | Identify each change to standard asset lives for existing asset classes from the previous determination. Explain the reason(s) for the change and provide relevant supporting information. | | 3.2.2 | NA |
| RIN 4.1(d)(ii) | For each proposed new asset class, explain the reason(s) for using these new asset classes and provide relevant supporting information on their proposed standard asset lives. | | | NA |
| RIN 4.1(d)(iii) | If existing asset classes from the previous determination are proposed to be removed and their residual values to be reallocated to other asset classes, explain the reason(s) for the change and provide relevant supporting information. This should include a demonstration of the materiality of the change on the forecast depreciation allowance. | | NA | NA |
| RIN 4.1(d)(iv) | Describe the method used to calculate the remaining asset lives for existing asset classes as at 1 July 2016 (the start of the forthcoming regulatory control period) and provide supporting calculations. | | 3.2.2 | Attachment B |
| NGR 72(1)(c)(ii) | The projected capital base over the access arrangement period including a forecast of depreciation for the period including a demonstration of how the forecast is derived on the basis of the proposed depreciation method | | Part 3 | 7.2 |
| NGR 72(1)(d) | A forecast of pipeline capacity and utilisation over the access arrangement period and the basis on which the forecast has been derived | | Part 4 | 5.2.5 |
| RIN 2.1 | Provide details of the key drivers behind the demand forecasts. | | | 5.1 and 5.2 |
| RIN 2.2 | Explain and outline the methodology that has been used to support the demand forecasts, including the key assumptions and inputs that have been used and how demand for pipeline services is differentiated. | | | 5.2 |
| RIN 2.3 | Explain how the demand forecasts have been used to develop the service provider's capital expenditure and operating expenditure forecasts. | | | 5.1 and 5.2 |

| Source | Requirement | AA reference | AAI reference | Submission |
|---|---|---|---|---|
| RIN 2.4 | Explain any trends of demand and volumes over the previous access arrangement period and current access arrangement period. | | | 5.1 and 5.2 |
| RIN 3.1 | Provide details of the key drivers behind the forecasts of pipeline capacity and utilisation. | | | 5.1.3 and 5.2.5 |
| RIN 3.2 | Explain and outline the methodology, including key assumptions and inputs used to prepare the forecasts of pipeline capacity and utilisation. | | | 5.1.3 and 5.2.5 |
| RIN 3.3 | Explain how the pipeline capacity and utilisation forecasts have been used to develop the service provider's capital expenditure and operating expenditure forecasts. | | | NA |
| RIN 3.4 | Explain any trends of pipeline capacity and utilisation over the earlier access arrangement period and current access arrangement period. | | | 5.1.3 and 5.2.5 |
| NGR 72(1)(e) | A forecast of operating expenditure over the access arrangement period and the basis on which the forecast has been derived | | Part 5 | 9.3 |
| RIN 4.4(a) | General information | | | |
| RIN 4.4(a)(i) | Provide an outline and explanation of the change in operating expenditure categories between the earlier access arrangement period and the access arrangement period | | | 9.1 |
| RIN 4.4(a)(ii) | Provide a description and explanation of the nature of material forecast operating expenditure in each operating expenditure category which:<br>(1) outlines changes to the operations of the pipeline from the earlier access arrangement period that have resulted in material changes to operating expenditure category and total operating expenditure in the access arrangement period; and<br>(2) identifies the materiality threshold used to determine the material forecast operating expenditure. | | | 9.3 |
| | Self insurance operating expenditure | | | |
| RIN 4.4(b)(i) | Provide the name and a description of the self insurance event. | | | NA |
| RIN 4.4(b)(ii) | Outline whether the event is in relation to a particular asset or class of assets and, if so, identify those assets. | | | NA |

| Source | Requirement | AA reference | AAI reference | Submission |
|---|---|---|---|---|
| RIN 4.4(b)(iii) | Provide the reasons for self insuring the event. If the event has not previously been self insured, reasons why it is now being proposed and how the risk of the event was previously accommodated in the access arrangement. If a proposed self insurance event was previously insured externally, details of existing or previous insurance policies and reasons why external insurance is not relevant in the access arrangement period. | | | NA |
| RIN 4.4(b)(iv) | Provide quotes obtained from external insurers for the proposed self insurance event. | | | NA |
| RIN 4.4(b)(v) | Provide details of how the premiums were calculated, including any underlying assumptions used to derive the premiums. | | | NA |
| RIN 4.4(b)(vi) | Provide any expert consultant's report relied on by the service provider in deriving the estimates. | | | NA |
| RIN 4.4(b)(vii) | Provide, details of existing or previous insurance policies and reasons why external insurance is not relevant in the access arrangement period if a proposed self insurance event was previously externally insured. | | | NA |
| RIN 4.4(b)(viii) | Provide a resolution (including the date of the resolution) of the service provider's decision making body to self insure the event(s). | | | NA |
| RIN 4.4(b)(ix) | Provide details of the administrative arrangements that:<br>(1) outline how the self insurance risk is to be reported if required under relevant accounting standards in the service provider's audited financial statements. This may include relevant documents that were prepared or submitted for ASIC or other relevant state or territory government authority<br>(2) outline the procedure for notification and information that will be provided to the AER when the self insurance event occurs. | | | NA |
| RIN 4.5 | For each service provided by another party that contributes in a material way to the provision of the pipeline service(s) and is included in forecast operating expenditure and capital expenditure, provide: | | | 6.5.4 and Attachment D |
| RIN 4.5(a) | the name of the external party and contract | | | Attachment D |
| RIN 4.5(b) | details of how the contract was awarded (for example, by competitive tender) | | | Attachment D |
| RIN 4.5(c) | details of fees and charges and a description of the goods or services provided | | | Attachment D |
| RIN 4.5(d) | the commencement date and term of the contract | | | Attachment D |
| RIN 4.5(e) | reasons why the functions were outsourced | | | Attachment D |

| Source | Requirement | AA reference | AAI reference | Submission |
|---|---|---|---|---|
| RIN 4.5(f) | details of the relationships with the party or parties named in 4.7(a) and the service provider including if a party to the contract is an associate of any of the service providers of the pipeline | | | Attachment D |
| RIN 4.5(g) | provide an explanation of the materiality measure used. | | | Attachment D |
| NGR 72(1)(f) | Key performance indicators used to support expenditure incurred over the access arrangement period | | Part 6 | |
| NGR 72(1)(g) | The proposed return on equity, return on debt and allowed rate of return, for each regulatory year of the access arrangement period, in accordance with Rule 87, including any departure from the methodologies set out in the rate of return guidelines and the reasons for that departure | | Part 7 | Chapter 8 |
| NGR 72(1)(ga) | The proposed formula (if any) that is to be applied in accordance with Rule 87(12) | | Part 7 | Chapter 8 |
| NGR 72(1)(h) | The estimated cost of corporate income tax calculated in accordance with Rule 87A, including the proposed value of imputation credits referred to in that rule | | Part 8 | 10.3 and Chapter 8 |
| RIN 4.2(a) | Explain and provide details of the proposed method for dealing with taxation and a demonstration of how the taxation is estimated. | | | 10.3 |
| NGR 72(1)(i) | The proposed carry-over of increments from any incentive mechanism that operated in the earlier access arrangement period | | | NA |
| RIN 4.3(a) | Existing incentive mechanism in the previous access arrangement period.<br>For each incentive mechanism which applied in the previous access arrangement period: | | | NA |
| RIN 4.3(a)(i) | provide an outline of how it operates; | | | NA |
| RIN 4.3(a)(ii) | explain the increments for efficiency gains and decrements for efficiency losses that have occurred in the previous access arrangement period and the relevant carryover amounts in the current access arrangement period; | | | NA |
| RIN 4.3(a)(iii) | provide relevant supporting analyses or reports. | | | NA |
| NGR 72(1)(l) | The service provider's rationale for any proposed incentive mechanism | | Part 11 | 10.5 |
| RIN 4.3(b) | Proposed incentive mechanism in the access arrangement period.<br>For each incentive mechanism proposed in the access arrangement period: | | | NA |
| RIN 4.3(b)(i) | provide an outline of how it operates; | | | NA |

| Source | Requirement | AA reference | AAI reference | Submission |
|---|---|---|---|---|
| RIN 4.3(b)(ii) | explain its rationale including how it is intended to encourage efficiency of the provision of services and is consistent with the revenue and pricing principles; | | | NA |
| RIN 4.3(b)(iii) | provide relevant supporting analyses or reports. | | | NA |
| NGR 72(1)(j) | The proposed approach to price-setting including: | | | |
| NGR 72(1)(j)(i) | the suggested basis of reference tariffs (including the method used to allocate costs and a demonstration of the relationship between costs and prices) and | | 10.3 | 11.1 |
| NGR 72(1)(j)(ii) | a description of any pricing principles employed but not otherwise disclosed under this rule. | | 10.3 | 11.1 |
| RIN 4.6(a) | Total revenue allocation | | | |
| RIN 4.6(a)(i) | Provide an outline of the nature of the allocation method used to allocate cost pools to reference and other services and provide analysis and information to support this allocation. | | | 11.1 and 11.2 |
| RIN 4.6(a)(ii) | If relevant, for rebateable services, provide a description of the mechanism that the service provider will use to apply an appropriate portion of the revenue generated from the sale of rebateable services to price rebates (or refunds) to users of reference services. | | | NA |
| RIN 4.6(b) | Tariffs- transmission pipelines<br>For each reference service and for each user or class of users for a reference service for transmission pipelines: | | | |
| RIN 4.6(b)(i) | outline the nature of:<br>(1) costs directly attributable to each reference service<br>(2) other costs that are attributable to reference services<br>(3) where relevant outline the costs directly attributable and other costs attributable for the user or class of users and other users or classes of users. | | | 11.1 and 11.2 |
| RIN 4.6(b)(ii) | explain and provide information about, the cost allocation method outlined in 4.8(a)(i). | | | 11.1 and 11.2 |
| NGR 72(1)(k) | The service provider's rationale for any proposed reference tariff variation mechanism | | 10.4 | 11.3 |
| RIN 4.6(c) | Tariff variation mechanism<br>For each tariff variation mechanism: | | | 11.3 |
| RIN 4.6(c)(i) | outline the proposed reference tariff variation mechanism and the basis for any parameters used in the mechanism | | | 11.3 |

| Source | Requirement | AA reference | AAI reference | Submission |
|---|---|---|---|---|
| RIN 4.6(c)(ii) | outline how the reference tariff mechanism gives the AER adequate oversight or powers of approval over variation of the reference tariff (Rule 97(4)). | | | 11.3 |
| RIN 4.6(d) | Cost pass through mechanism<br>For each cost pass through mechanism: | | | |
| RIN 4.6(d)(i) | define and describe each cost pass through event; | 4.7 | | 11.3 |
| RIN 4.6(d)(ii) | explain how each cost pass through event is relevant to a building block component in Rule 76 and is either foreseen or unforeseen and the costs of the event are uncontrollable and therefore cannot be included in forecasts for total revenue; | | | 11.3 |
| RIN 4.6(d)(iii) | outline how the cost pass through mechanism gives the AER adequate oversight or powers of approval over variation of the reference tariff (Rule 97(4)). | | | 11.3 |
| NGR 72(1)(m) | The total revenue to be derived from pipeline services for each regulatory year of the access arrangement period | | 10.3 | 11.2.3 |
| NGR 90(2) | Whether depreciation for the opening capital base is based on actual or forecast depreciation | 3.5 | | 10.2 |

# Attachment B – Models

B-1 Post Tax Revenue Model

B-2 Roll Forward Model

B-3 NPV analysis – Katherine Meter Station

B-4 NPV analysis - Townend Road

B-5 Completed RIN templates

B-6 Supporting model – Capital expenditure

B-7 Supporting model – Operating expenditure

# Attachment C – Supporting documents

C-1 Asset Management Plan

C-2 IT AM01 Applications Renewal Program

C-3 IT AM03 Infrastructure Renewal Program

# Attachment D – Outsourced expenditure

Confidential

Provided as a separate document

# Attachment E – Averaging Periods

Confidential

Provided as a separate document